5.8 ELECTRICITY SUPPLY

5.8.1 OVERVIEW

Olympic Dam's electricity requirements are currently met by two transmission lines:

- a 275 kV transmission line from Davenport delivers approximately 140 MVA of power to the site (this adequately meets the existing 125 MW maximum demand)
- a 132 kV transmission line off the national grid from Pimba, which is only used for stand-by capacity.

The construction and operation of the new open pit mine, metallurgical plant and associated infrastructure would result in a significant increase (i.e. about 650 MW) in the electricity demand for Olympic Dam. The major contributors to this would be the addition of electric shovels and additional primary crushers associated with the open pit, and the addition of infrastructure within the new metallurgical plant to process about six times more ore than at present.

The existing 275 kV transmission line has some spare capacity and would meet the additional demand in the first few years, but does not have enough capacity to deliver the total increase in electricity requirement, and alternative supply arrangements would be required.

The Draft EIS has assessed, and government approval is sought for each of the following three options:

- construction and operation of a new 275 kV transmission line with electricity coming from the NEM
- construction and operation of an on-site CCGT power station of around 600 MW capacity, utilising gas imported through the Moomba gas hub and delivered to site via a dedicated pipeline to be constructed on one of three proposed routes
- a hybrid solution that is a combination of the above two supply methods, allowing maximum operational flexibility.

In addition to these supply alternatives, it is proposed to install a cogeneration facility to recover the waste heat from the new acid plants and other on-site sources of steam. It is estimated that this facility could reliably generate between 100 MW in the early years and up to 250 MW when the operation is producing at full capacity. This plant would reduce the scheduled load demand.

Off-site infrastructure demand is expected to be around 130 MW, or around 765,000 MWh annually. Around 35 MW of this demand, representing the electricity demand for the desalination plant, would be obtained from renewable electricity sources (most likely to be wind power supplied through contract from the NEM).

Further, albeit small, reductions to the electricity demand may be achieved through solar energy for hot water systems for permanently occupied rooms at the Hiltaba Village, and potentially for the expanded residential areas of Roxby Downs. Table 5.36 summarises the additional on-site electricity demand for the proposed expansion.

The off-site infrastructure required to support the proposed expansion would also create additional electricity demand. This is described in Table 5.37.

5.8.2 CONTEXT

South Australia currently has a nameplate scheduled electricity generation capacity of around 3,994 MW of which 3,641 MW are fossil fuelled generators, the remaining being from scheduled wind generation. The breakdown of this capacity is provided in Table 5.38.

South Australia also has about 386 MW of non-scheduled wind electricity generating capacity (see Table 5.39).

In addition to the above, there are four power stations under construction, as shown in Table 5.40.

Table 5.36 Indicative electricity demand for the on-site infrastructure of the proposed expansion

Electrical loads	Proposed expansion maximum demand (MW)	Proposed expansion annual electricity consumption (GWh)
Open pit mine (including the MMIA)	95	283
New concentrator plant	300	2,365
New hydrometallurgical plant	40	315
Expanded smelter	3	24
Expanded refinery	12	95
New on-site administrative	4	18
Acid plant	42	331
Process infrastructure	20	158
Total additional electricity demand	**516**	**3,588**
Cogeneration electricity supply (at full capacity)	250	1,533
Net additional electricity requirement	**266**	**2,055**

Table 5.37 Indicative electricity demand for the off-site infrastructure

Electrical loads	Proposed expansion maximum demand (MW)	Proposed expansion annual electricity consumption (GWh)
Desalination plant	35	245
Water supply pipeline	22	154
Transmission line (losses)	7	61
Gas supply pipeline	0	0
Rail line	0	0
Pimba intermodal facility	3	16
Port – Darwin	5	26
Port – Outer Harbor	5	26
Landing facility	2	11
Airport	1	4
Roxby Downs and other off-site (e.g. Industrial Area)	42	184
Hiltaba Village	8	35
Total	**130**	**763**

Table 5.38 Current South Australian scheduled electricity generating capacity[1]

Operator	Power station	Station capacity (MW)	Plant type	Fuel
Infratil	Angaston	50	Reciprocating diesel	Distillate
International Power	Dry Creek	156	Gas turbine	Natural gas
TRU Energy	Hallett	192	Gas turbine	Natural gas/distillate
Origin Energy	Ladbroke Grove	86	Gas turbine	Natural gas
International Power	Mintaro	90	Gas turbine	Natural gas
NRG Flinders[2]	Northern	520	Steam	Coal
NRG Flinders[2]	Osborne	190	Cogeneration	Natural gas
International Power	Pelican Point	487	CCGT	Natural gas
NRG Flinders[2]	Playford	240	Steam	Coal
International Power	Port Lincoln	48	Gas turbine	Distillate
Origin Energy	Quarantine	224	Gas turbine	Natural gas
International Power	Snuggery	78	Gas turbine	Distillate
AGL	Torrens A	480	Steam	Natural gas
AGL	Torrens B	800	Steam	Natural gas/oil
AGL	Hallet Stage 1 (Brown Hill)	95	Wind turbines	Wind
Babcock & Brown	Lake Bonney Stage 2	159	Wind turbines	Wind
TrustPower	Snowtown Stage 1	99	Wind turbines	Wind

[1] Sourced from Electricity Supply Industry Planning Council Annual Planning Report 2008.
[2] Now Flinders Power, 100% owned and operated by Babcock & Brown Power.

Table 5.39 Current South Australian non-scheduled wind electricity generating capacity[1]

Registered party	Power station	Station capacity (MW)	Plant type
International Power	Canunda	46	Wind turbines
Hydro Tasmania/EHN	Cathedral Rocks	63	Wind turbines
Babcock & Brown	Lake Bonney Stage 1	81	Wind turbines
Transfield Services	Mount Millar	70	Wind turbines
Transfield Services	Starfish Hill	35	Wind turbines
AGL Hydro	Wattle Point	91	Wind turbines

[1] Sourced from Electricity Supply Industry Planning Council Annual Planning Report 2008.

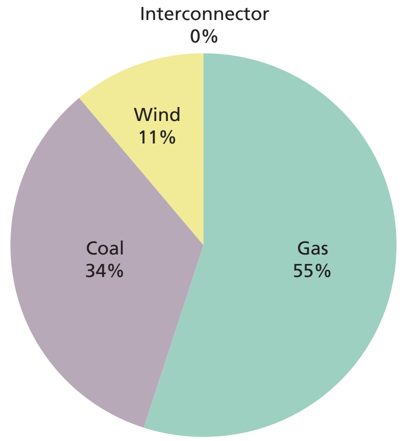
Table 5.40 South Australian electricity generation projects under construction or committed[1]

Developer	Power station	Station capacity (MW)	Plant type	Fuel
AGL	Hallett Stage 2 (Brown Hill)	71	Wind turbines	Wind
Pacific Hydro	Clements Gap	57	Wind turbines	Wind
Origin Energy	Quarantine Expansion	126	Open cycle gas turbine (OCGT)	Natural gas
TrustPower	Snowtown	98	Wind turbines	Wind

[1] Sourced from Electricity Supply Industry Planning Council Annual Planning Report 2008.

South Australia is connected to the rest of the NEM via Victoria by the Heywood and Murraylink interconnectors, which provide an import capacity of up to around 460 MW and 220 MW respectively.

In the 2007–08 financial year, electricity consumption for South Australia was about 13,700 GWh, including supply from the interconnector. Total supply, broken down by source, is shown in Figure 5.36.



Source: Electricity Supply Industry Planning Council Annual Planning Report 2008

Figure 5.36 South Australian electricity supply by source

The maximum demand of the existing Olympic Dam operation is 125 MW, and annual consumption is around 900 GWh (or about 7% of the South Australia's electricity consumption). The proposed expansion would require an increase in scheduled electricity supply of about 650 MW (maximum demand), resulting in an increase in annual electricity consumption of around 4,400 GWh. This demand would be reduced through the use of on-site cogeneration (250 MW). The required electricity load for the proposed expansion is therefore 400 MW. To provide operational security, however, installed electricity infrastructure would need to have the capacity to meet the majority of proposed expansion needs.

5.8.3 TRANSMISSION LINE – PORT AUGUSTA TO OLYMPIC DAM

Overview

An additional 275 kV electricity transmission line from Port Augusta may be constructed to meet, in whole or in part, the electricity demand for the expanded operation. The proposed line would be designed to meet the reasonably foreseeable demand for power at Olympic Dam and the Roxby Downs area, and also supply the OZ Minerals Prominent Hill development (estimated at about 50 MW). The proposed alignment of the electricity transmission line is shown in Figure 5.33, with cross-sections illustrated in Figure 5.34, a conceptual layout of the infrastructure corridor north of Woomera shown in Figure 5.37 and the key features listed in Table 5.41.

Table 5.41 Indicative major features of the proposed Port Augusta to Olympic Dam transmission line

Key features	Approximate data
Length (km)	270
Voltage (kV)	275
Maximum capacity (MW)	600
Average width of easement (m)	200–500
Average width of disturbance within the easement (m)	5
Type of tower construction	Free standing steel lattice
Number of towers	700
Number of circuits	2
Height of towers (m)	40
Height of transmission line above ground (m)	7.5–40
Number of temporary storage depots	10
Number of temporary cable winching sites	50
Separation distance to existing transmission lines (m)	30–170

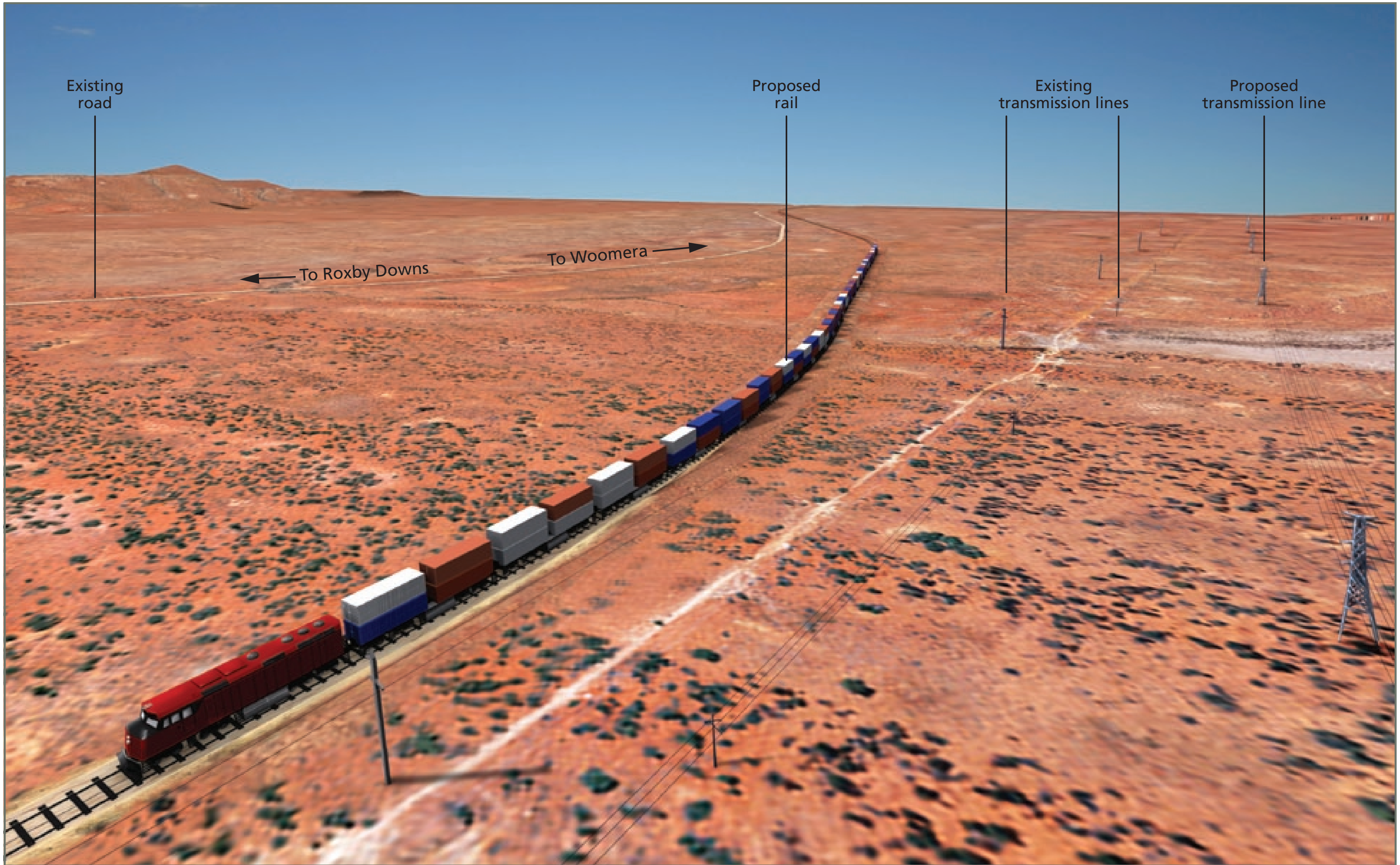


Figure 5.37 Conceptual layout of infrastructure corridors north of Woomera

The construction and operation of the proposed transmission line would result in additional demand for water, electricity and labour. These indicative major demands are provided in Table 5.42.

Construction phase

The construction of the 275 kV transmission line would be similar to the previous 275 kV line, except that freestanding lattice towers would be used in preference to guyed masts.

Construction method

An area of approximately 30 m x 40 m would be cleared to install the footings for pre-assembly and to erect each tower. The extent of clearing along the transmission line easement would be reduced to a central strip in the easement and average about 5 m in width, including the area cleared for centre line survey and structure pegging. An additional strip of around 5 m would be cleared for a construction and maintenance access track. Additional clearing for operational purposes is not required due to the low sparse vegetation in this arid area.

Either 'bored' or 'mass' concrete foundations would be used as footings to support each of the four tower legs. The footings would be about one metre in diameter for each leg, with each tower base covering a total area of about 10 m x 10 m. Concrete for the foundations would be supplied by a batching truck travelling between movable concrete batching plants.

Tower steel would be fabricated and galvanised off-site and delivered in bundles to each tower site for assembly and erection. The steel would be delivered on standard trucks with no heavy lift loads required. Sections of the tower would be assembled on-site and lifted into place by a mobile crane. Insulators and fittings would be attached to the tower and sheaves attached to the crossarms for the stringing.

To commence stringing for the conductors, steel draw wires would be run out on the ground from a moving vehicle and lifted into sheaves on the towers. Conductors would be pulled well clear of the ground and vegetation under tension using a winch. Tension would be maintained by braking apparatus located with the conductor drums. The conductors would be held in tension in the sheaves for up to two weeks for the wires to bed in before final adjustment, cutting and dead-ending at tension positions on suspension towers.

It is likely that a number of temporary stores depots, each of about one hectare, would be required along the corridor. The depots would house the temporary site offices, moveable concrete batching plants and concrete trucks. Additional small areas would be required every few kilometres for drum and winch sites for stringing conductors.

Clean-up and rehabilitation

The 5 m wide cleared stringing easement and the sites of the temporary facilities would be cleaned up and rehabilitated. Measures would include removing foreign material (i.e. construction material and waste), surface contouring where required, respreading topsoil and cleared vegetation.

Water supply during construction

Construction would require about 50 ML in total, principally to compact the foundations at tower sites, with smaller amounts required for dust suppression along the stringing easement. The water is likely to be sourced from about 10 groundwater wells along the alignment, some of which would be existing wells and others would be new wells. Water for domestic use and concrete manufacture would be sourced from the existing on-site desalination plant and the state potable water network.

Workforce accommodation

Approximately 90 people would be required for the construction of the electricity transmission line. Temporary facilities such as crib rooms and sanitary facilities would be provided at mobile construction depots and at the tower 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

Very little ongoing maintenance is required for the electricity transmission line. Access tracks to the transmission line towers would be retained for inspection and maintenance activities. Maintenance programs would typically involve two visual inspections per year for signs of unusual wear, corrosion or damage. Helicopter-based thermal imaging inspections would be undertaken annually. A more detailed inspection by vehicle would occur about every four years. Insulators would typically be replaced every 25 years.

Table 5.42 Indicative major demands for the proposed Port Augusta to Olympic Dam transmission line

Expansion requirement	Proposed expansion
Water demand during construction (ML)	50
Water demand during operation (GL per annum)	Negligible
Electricity consumption during operation (line losses) (GWh per annum)	61
Peak construction/shutdown workforce	90
Ongoing operational workforce	2
Total land disturbance (ha)	337

Vegetation under the transmission line would be allowed to grow and regenerate. Tree species that establish under the line would be trimmed or removed during routine maintenance only if they grew to a height that threatened the operation of the line or breached the relevant legislative limits.

5.8.4 TRANSMISSION LINE – CULTANA TO POINT LOWLY

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 and would have the capacity to meet the 35 MW demand from the proposed desalination plant.

Table 5.43 describes the indicative major features of the proposed Cultana to Point Lowly transmission line and Table 5.44 shows the indicative material demands.

The Cultana to Point Lowly transmission line would be constructed and operated as described above for the Port Augusta to Olympic Dam transmission line.

5.8.5 GAS-FIRED POWER STATION

Overview

As an alternative to, or in combination with, the electricity transmission line, a CCGT power station may be built on-site to generate electricity from natural gas piped from the Moomba gas hub.

The power station configuration would consist of three to four gas turbine generators with the energy in the hot exhaust gases recovered as steam to drive up to two steam turbine generators. This is known as a combined cycle configuration as it combines the gas turbine thermal cycle with the steam turbine thermal cycle.

The combination of the two cycles results in an efficient overall conversion of fuel to electricity. This efficiency results in low emissions of carbon dioxide per megawatt hour of electricity produced, leading to lower greenhouse gas emissions than the equivalent sized single cycle natural gas or coal-fired power station.

Context

As outlined in Section 5.8.2, the proposed expansion would require an increase in electricity supply of about 650 MW (maximum demand). To assist in meeting the additional electricity demand, a combined cycle gas turbine power station of about 600 MW capacity may be constructed.

CCGT power stations are a proven technology and such plants are currently operating in a number of locations throughout Australia and the world. Examples of similar facilities operating within Australia are in Figure 5.38.

5

Table 5.43 Indicative major features of the proposed Cultana to Point Lowly transmission line

Key features	Approximate data
Length (km)	25
Voltage (kV)	132
Maximum capacity (MW)	100
Average width of easement (m)	150
Average width of disturbance within the easement (m)	5
Type of tower construction	Free standing steel lattice
Number of towers	60
Number of circuits	2
Height of towers (m)	20–30
Height of transmission line above ground (m)	7.5–20
Number of temporary storage depots	Nil
Number of temporary cable winching sites	3

Table 5.44 Indicative major demands for the proposed Cultana to Point Lowly transmission line

Expansion requirement	Proposed expansion
Water demand during construction (GL)	Negligible
Water demand during operation (GL per annum)	Negligible
Electricity consumption during operation (line losses) (MWh per annum)	2,000
Peak construction/shutdown workforce	90
Ongoing operational workforce	Nil
Total land disturbance (ha)	13

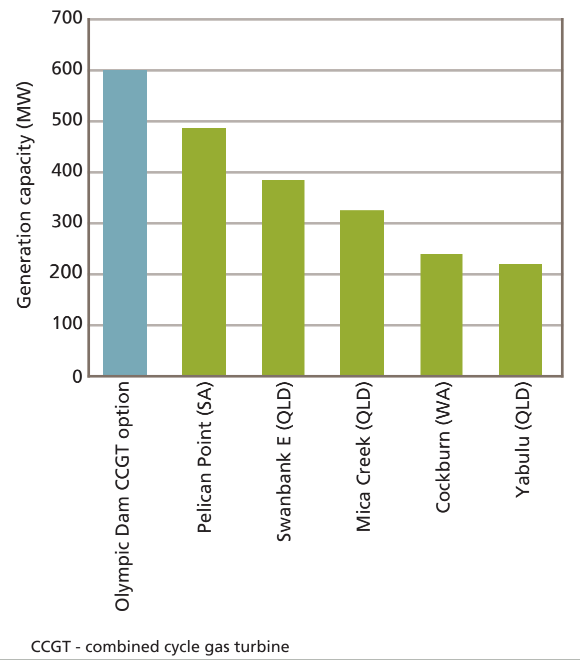


Figure 5.38 Electricity generation capacity of selected Australian combined cycle gas turbine power stations

Design

The final configuration and capacity of the power station would be determined through a tender process and commercial negotiation. For the purpose of the Draft EIS, project outputs have been calculated based on the use of three GE PG9171E or GT13E2 gas turbines plus one steam turbine. Other configurations may be possible depending on the tender responses, and it is possible that a smaller plant may be constructed as part of the hybrid solution.

A summary of the indicative major features of the power station is provided in Table 5.45.

Constructing and operating the proposed power station would result in additional demand for water, electricity and labour. These indicative major demands are provided in Table 5.46.

The main components of the power station are discussed below, with the indicative configuration shown in Figure 5.39.

Gas turbines

The gas turbines form the first part of the power generation process. The electrical output of the gas turbines represents approximately two-thirds of the power station output. Depending on the final selection of turbine vendor and configuration, the power station would consist of up to four gas turbines.

Table 5.45 Indicative major features of the proposed power station

Key features	Proposed expansion
Power station type	Combined cycle
Maximum electricity generation capacity (MW)	600
Annual generation capacity (GWh)	5,100
Fuel	Natural gas
Maximum gas demand (PJ/annum)	45
Number of gas turbines	3–4
Number of steam turbines	1–2
Number of exhaust stacks	2–4
Height of stacks (m)	35
Number of cooling towers	Nil
Average availability[1]	95%

[1] This refers to the percentage of time that the power station would be in operation. The remaining time consists of planned maintenance shutdowns.

Table 5.46 Indicative major demands for the proposed power station

Expansion requirement	Proposed expansion
Water demand during construction (ML)	200
Water demand during operation (GL per annum)	0.3
Electricity consumption during operation (GWh per annum)	60
Peak construction/shutdown workforce	900
Ongoing operational workforce	30
Area for temporary laydown pad (ha)	5
Area for CCGT plant (ha)	25
Total land disturbance (ha)	30

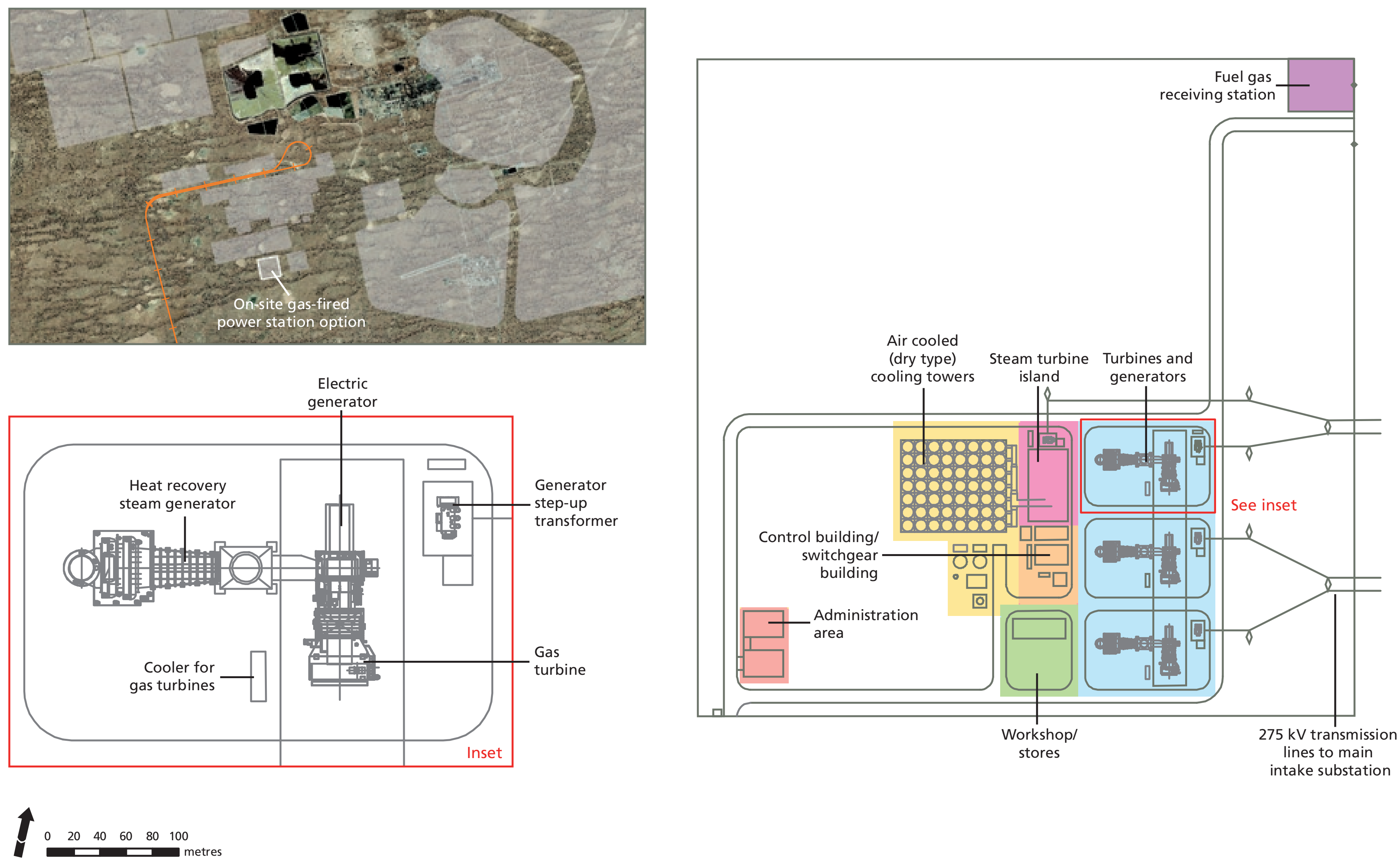


Figure 5.39 Indicative configuration of the on-site gas-fired power station option

In the gas turbines, air would first be compressed before entering a combustion chamber where it would be mixed with the gas and burned. The resulting high temperature and high velocity gas stream would be expanded through a turbine that would drive the air intake compressor and the electrical generators.

Heat recovery steam

The exhaust gases from the gas turbines would leave the turbines at around 500–600 °C. These would pass into a heat recovery steam generator (HRSG), consisting of a series of heat exchangers that would heat water to produce heated steam up to approximately 540 °C. The high pressure and high temperature steam would be used to drive a steam turbine.

Relatively small quantities of water would periodically be drained from the HRSG to prevent build up of impurities in the system. The re-circulating water system would be topped up with demineralised water from the on-site demineralised water plant.

The HRSG heat exchange surfaces would be arranged to extract as much energy as economically feasible from the gas turbine exhaust gases. The exhaust gases from the HRSG would be clean and low temperature, typically in the order of 100–120 °C, and vented to atmosphere. The height of the stacks would be a minimum of 35 m to clear the top of the HRSGs.

Steam turbines

The steam produced in the HRSGs would be delivered to the steam turbine. The steam turbine would expand the steam through a number of stages, converting the energy in the steam to electricity through the driven generator.

The steam exiting the turbine would be condensed in an air-cooled condenser operating under vacuum. The condensed water would be recovered and returned to the feed water system of the HRSG and reused for steam generation.

Electrical generators

The generators (one for each of the gas turbines and steam turbines) would turn mechanical energy into electrical energy using electromagnetic induction. The rotation of the gas and steam turbine shafts (from burning gas and using steam respectively) would subsequently turn the electrical generator rotors. These rotors would move an armature (essentially a bundle of metal wire) through a magnetic field to generate electricity.

Up to six generators would be installed in the proposed CCGT power station, depending on the number of gas and steam turbines installed.

High voltage system

Each of the generators (gas turbines and steam turbine) would be connected to individual generator transformers that would be directly connected to the new Olympic Dam main intake substation. Each generator transformer would convert the generation voltage of approximately 15 kV to 275 kV.

Each transformer would be located within a bund to contain cooling oil in the unlikely event of loss of oil during operation or maintenance.

Gas supply

The power station would be fuelled by natural gas from the Moomba gas hub, and delivered via a dedicated gas pipeline (see Section 5.8.6 for details).

Water requirements and supply

The power station would require water to make up steam system losses, gas turbine air inlet cooling during hot ambient conditions and general process and potable water. A preliminary annual raw water demand of approximately 300 ML is likely. Water would be sourced from the site process water storages and would pass through a treatment facility constructed within the CCGT plant. This would dose chemicals as necessary to the raw water to produce water suitable for use within the plant. A component of this would be a demineralisation plant that would produce high-quality water for use in specific applications.

Steam system

In order to prevent the build up of salts in the steam system, approximately 0.5% of the feed water flow to the HRSGs would be bled out of the system. The water bleed would be made up with demineralised water produced on-site. Water from the steam turbine condenser would be recycled to the HRSG feed water system. Steam system blowdown water would be recycled to the HRSGs through the raw water treatment system to minimise the raw water make up required.

Inlet air cooling

Gas turbine capacity is sensitive to inlet air temperature. To counter this effect the inlet air to the gas turbines would be cooled using an evaporative cooler. The cooler would use high-quality water to minimise the likelihood of contaminating the gas turbine compressor blades with salts from the water. The inlet cooling system would be effective at ambient air temperature greater than 15 °C. At lower ambient air temperatures the inlet evaporative cooling system would be turned off. Water consumption, when in use, varies as the ambient air temperature varies during the day. A storage tank would provide a buffer to smooth out the intra-day demand variations.

Construction phase

If required, construction of the power station would commence in about Year 4, with mechanical completion and pre-commissioning scheduled for late Year 6 (see Figure 5.7). The detailed design phase of the project would emphasise modularisation, pre-fabrication and pre-assembly in order to reduce the on-site labour required.

Construction method

Construction would generally follow four steps, as outlined in the following points:

- Site preparation – Vegetation would be cleared within the defined power station footprint, together with an area of land to be used as a temporary laydown facility. The necessary building platforms and hardstand areas would be established, and site drainage would be installed.
- Foundations – Foundations would be established for major plant items and buildings, using concrete batched on-site.
- Equipment installation and construction – Construction of the plant would involve assembling and installing equipment items that would be manufactured off-site. The heaviest and largest components would be assembled using heavy lift cranes.
- Plant commissioning – This step involves testing and commissioning equipment, in preparation for establishing the first commercial load.

Workforce accommodation

It is envisaged that during the construction phase personnel numbers would start at around 250 and build to a peak of approximately 900 people. Throughout the project, the construction workforce would average around 400 people. All personnel would be accommodated in either Roxby Village or Hiltaba Village.

Operation phase

Around 30 people would operate the CCGT plant once it was commissioned. Maintenance activities would be undertaken at regular intervals, resulting in around 5% downtime for the plant.

Chemical storage and use

Limited stocks of chemicals would be held on-site and used primarily for water treatment and cleaning (see Table 5.47). High-volume chemicals would be delivered to site in 'portafeed' containers suitable for direct connection to the plant. Where possible the transfer of chemicals between delivery vessels and site storage would be avoided. Chemical vessels in the plant and the warehouse would be located within bunded areas to contain spillages, should they occur.

The larger rotating machines and step-up transformers would contain large volumes of oil within self-contained circulating tanks. Typically, the turbine would have a circulating volume of 25,000–45,000 L and the generator transformers approximately 100,000 L. These machines would be bunded with collection sumps directed to oil–water separators before being directed to the area stormwater system to either be reclaimed to the new metallurgical plant or evaporated.

Waste management

Only minor volumes of wastewater and sewage would be generated. The wastes from the power station (mainly wastewaters and effluents) would be collected, stored and treated with other wastes on the Special Mining Lease (see Section 5.6).

5.8.6 GAS SUPPLY PIPELINE

Overview

The natural gas required to operate the CCGT plant would be delivered to Olympic Dam from the Moomba hub via a new gas pipeline. The natural gas supply may come from one or several of the major gas production wells connected to the Moomba hub (i.e. the Gippsland Basin in eastern Victoria; the Otway Basin in western Victoria; the coal bed methane fields in Queensland (see Figure 5.40)). Three alternative alignments from the Moomba hub are being considered (see Figure 5.3):

Table 5.47 Indicative power station reagent usage per annum and storage details

Description	Usage rate[1] (L)	Stored volume (L)	Chemical use[1]	Storage method
Sodium phosphate (3%)	30,000	10,000	Boiler feedwater pH control	Stored in a bunded tank
Ammonia (25%)	6,000	2,000	Boiler feedwater pH control	Stored in the on-site ammonia facility as a liquid in pressure vessels
Eliminox	5,000	2,000	Boiler feedwater oxygen scavenger	Stored in a bunded tank
Sulphuric acid (98%)	25,000	10,000	Demineraliser resin regeneration and neutralisation	Stored in a bunded tank
Sodium hydroxide (50%)	25,000	10,000	Demineraliser resin regeneration and neutralisation	Stored in a bunded tank
Sodium hypochlorite	5,000	2,000	Reverse osmosis cleaning	Stored in a bunded tank
Hydrogen (gas)	24 kNm³	4 kNm³	Generator cooling system	Stored in gas bottles as a liquid
Turbine oil	Negligible	4,000	Lubrication of turbines and pumps	Only minor make-up oil needs to be stored. The bulk is cleaned and reused
Miscellaneous oils and lubricants	2,000	500	General lubrication of pumps	Stored in drums in a bunded area
Diesel	n.a.	8,000	Fire pumps and emergency power	Stored in a bunded tank

[1] Final chemical use and quantities will depend on raw water quality, final plant capacity and plant configuration.

- Option 1: an alignment directly from Olympic Dam to Moomba (about 440 km)
- Option 2: an alignment from Olympic Dam to the existing compressor station on the Moomba to Adelaide gas pipeline (about 400 km)
- Option 3: an alignment from Olympic Dam to Moomba via the existing compressor station CS2 (about 560 km).

The proposed gas supply pipeline would run underground for the majority of its length, with a small section above ground at main line valves and scraper stations. Main line valves allow the pipeline sections to be isolated in the unlikely event that an emergency occurs. Scraper stations allow devices (known as 'pigs') to be inserted (and retrieved) to clean the internal sections of the pipe or to detect damage or metal loss within the pipe. Table 5.48 identifies the major features associated with the gas supply pipeline.

Constructing and operating the proposed gas pipeline would result in additional demand for water and labour. These indicative major demands are provided in Table 5.49.

Context

Australia has an extensive natural gas supply network that can service, directly or indirectly, the South Australian market (see Figure 5.40). Table 5.50 indicates the existing gas process infrastructure and its relationship to South Australia.

Table 5.48 Indicative major features of the proposed gas supply pipeline

Features	Proposed expansion
Predominantly buried or above ground pipe	Buried
Pipeline material	Steel
Length (km)	400–560
Average width of corridor/easement (m)	30
Average width of disturbance within the easement (m)	20–30
Length of sections above ground (m)	100
Volume of gas transported (PJ/a)	45
Diameter of pipeline (mm)	350–400
Depth of the excavated trench (m)	1.2–1.7
Average width of the excavated trench (m)	0.9
Total length of the trench open at any given time during construction (km)	up to 30
Depth to top of buried pipeline (m)	0.7–1.2
Depth to top of pipeline at road crossings (m)	1.2
Number of compressor stations	1
Distance between pipe stacking sites (km)	5

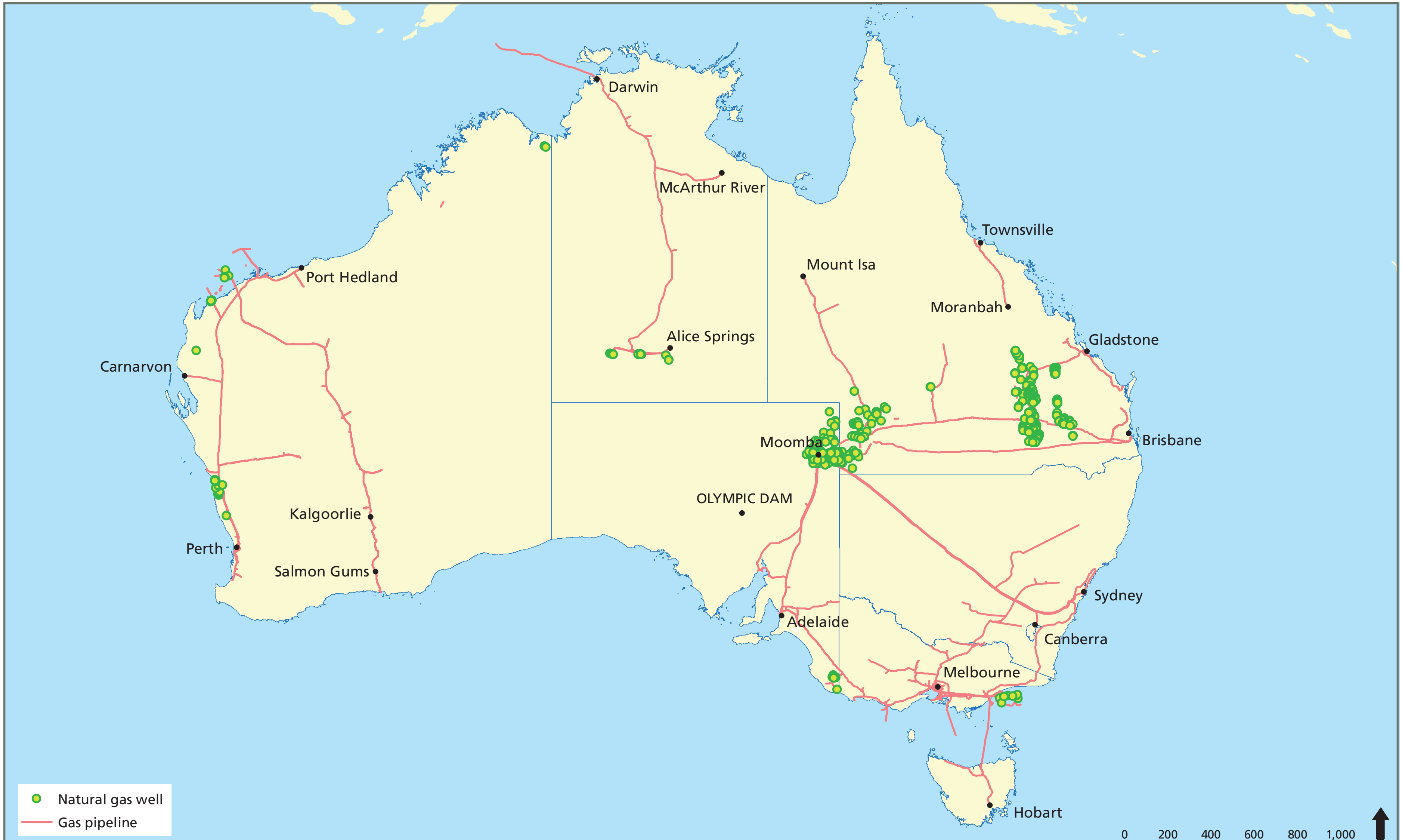
Table 5.49 Indicative major demands for the proposed gas supply pipeline

Expansion requirement	Proposed expansion
Water demand during construction (ML)	200
Water demand during operation (GL per annum)	Negligible
Electricity consumption during operation (MWh per annum)	Negligible
Peak construction/shutdown workforce	100
Ongoing operational workforce	2
Total land disturbance (ha)	1,342–1,686

Table 5.50 Gas processing infrastructure in relation to South Australia[1]

Plant	Operator	Estimated capacity (PJ/annum)	Relationship to South Australia
Moomba	Santos	180	Direct via the Moomba–Adelaide pipeline
Moomba gas storage	Santos	42	Direct via the Moomba–Adelaide pipeline
Longford	ExxonMobil	365–400	Indirect
Thylacine	Woodside	62	Direct via SEA Gas pipeline
Patricia Baleen	Santos	15–27	Indirect
Minerva	BHP Billiton	53	Direct via SEA Gas pipeline
Bass Gas	Origin Energy	21	Indirect
Iona Gas Processing and Storage	TRU Energy	60	Direct via SEA Gas pipeline

[1] Sourced from Electricity Supply Industry Planning Council Annual Planning Report 2007.



Source: Geoscience Australia 2006

Figure 5.40 Australian natural gas production and distribution network

Construction phase

Vegetation along the pipeline easement would be cleared and access tracks 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. Pre-coated steel pipe sections, about 18 m long, would be delivered directly to the pipeline easement for stringing to avoid storage and double handling. However, in some cases pipe may need to be stored temporarily in laydown areas (also called pipe stacking sites). These sites may occur every 5 km along the pipeline easement and would occupy an area of about 100 m x 50 m. Each site would be cleared, grubbed and levelled.

A wheel trencher, rocksaw or excavator would be used to dig the narrow trench in which the pipe would be buried. The length of trench open at any one time would generally be around 10–30 km depending on the soil types and the amount of rock through which the trench is to be excavated. Around 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. As with the water supply pipeline detailed previously, these may include open trenching, boring or directional drilling.

The pipeline sections would be laid out on the surface, bent to match the horizontal or vertical surface and then welded into strings about 0.5–1 km in length. The strings would then be lowered into the trench and the trench backfilled.

Disturbed areas would be cleaned up and rehabilitated. Foreign material (i.e. construction material and waste) would be removed. If required the surface would be contoured and excess material from the excavated trench, topsoil and cleared vegetation would be respread.

Marker posts with visible signs would be installed adjacent to the pipeline at distances in accordance with AS 2885 *Pipelines - Gas and Liquid Petroleum*. Pipe stacking sites would also be rehabilitated.

Testing and commissioning

The gas pipeline would be hydrostatically tested for strength and potential leaks in a similar manner to the water pipeline and in accordance with the requirements of AS 2885. Due to their typically smaller diameters, gas pipelines are commonly tested in longer lengths than those specified for the water pipeline (see Section 5.7.4); the exact length would be determined during the development of a testing and commissioning plan for the pipeline. Water for each new section could be drawn from the adjacent section that had been previously tested, with make-up water added to replace water lost through leakage. It is anticipated that approximately 20 ML of water would be required to complete the hydrostatic testing for the full pipeline length.

Following hydrostatic testing, the pipe would be emptied and dried. The first flush of water through the pipe would be screened before being discharged. Hydrotest water would be directed to the on-site process water storage for reuse within the existing metallurgical plant.

Above ground facilities

Above ground facilities for the pipeline would include mainline valves (MLVs), a scraper station, cathodic protection facilities (CPF) and marker signs. MLVs are used to isolate sections of the pipeline and typically occupy a cleared area of 250 m^2. CPF comprise buried anode beds located at intervals of approximately 100–150 km and above ground test points that are installed at 2–5 km intervals. The number and location of these items would be determined during the detailed design phase.

Water supply during construction

As noted above, construction of the gas supply pipeline and associated infrastructure would require about 20 ML of water, principally for hydrostatic testing of sections and dust suppression during construction. The majority of the water would either be sourced from wastewater recovered at the Moomba gas refinery (preferably), or sourced from Olympic Dam if the Moomba water could not be obtained efficiently. Additional dust suppression water would be drawn from purpose-drilled wells located in local saline aquifers.

Workforce accommodation

It is anticipated that up to 250 people would be required to construct the gas supply pipeline. Due to the mainly rural nature of the region and the limited townships along the proposed gas pipeline route, accommodation is not readily available and temporary camp sites would be required. While actual sites would be determined during detailed design and when the construction contractor was appointed, locations are usually dictated by the limit of travel distance for workers to reach the easement, which is normally around 70 km. Temporary facilities would be established at the camp sites, and solid wastes arising from their operation would be collected and disposed of in licenced waste disposal facilities, while wastewater would likely be treated via an on-site package treatment plant and treated effluent discharged to ground via irrigation for evaporation.

Operation phase

The pipeline would be buried for its entire length except for valve sites and scraper stations. Operating the pipeline would include regular monitoring to ensure there is no interference from third parties, that valves and the corrosion protection mechanisms are functioning, and to ensure that revegetation, erosion protection and weed management are being successfully implemented.

5.8.7 COGENERATION

Overview

Four sulphur-burning acid plants of around 3,500 t/d sulphuric acid producing capacity would be constructed to supply acid to the new hydrometallurgical plant. Significant waste heat is generated during the exothermic sulphur burning process. This would be captured and used to operate a steam turbine to produce electricity.

The capacity of the cogeneration plant would vary as the capacity of the acid plants was altered to match the throughput of material in the hydrometallurgical plant. The cogeneration plant would have a maximum capacity of around 250 MW, reducing the proposed electricity demand for the expansion to 400 MW.

Design

The output of the cogeneration plant would be stepped up from 11 kV to 132 kV and connected to the new metallurgical plant substation for distribution around the operation. The output from the cogeneration plant would reduce the draw in power from the main intake substation, reducing the demand on the NEM.

5.8.8 RENEWABLE

Opportunities to incorporate renewable electricity technologies are continuing to be investigated by BHP Billiton. The renewable electricity sources likely to be relevant to the proposed expansion are:

- geothermal (hot dry rocks), because of the potential to supply large amounts of baseload electricity and the relative proximity of the resources to Olympic Dam
- wind, because South Australia has significant wind generating capacity and the technology is relatively mature
- solar thermal, because of the high insolation levels near the Olympic Dam site
- solar photovoltaic, because of the roof area in Roxby Downs and Hiltaba Village and the relatively small domestic electricity loads.

A commitment to use renewable electricity to power the coastal desalination plant has been made. This would most likely be in the form of purchased wind energy contracted through the NEM. Additionally, solar hot water systems would be installed on new housing in Roxby Downs and on permanently occupied accommodation buildings (i.e. 2,000 rooms) in Hiltaba Village.

The investigations into incorporating renewable energy sources into the proposed expansion are described in greater detail in Chapter 13, Greenhouse Gas and Air Quality.

5.9 TRANSPORT

5.9.1 OVERVIEW

Constructing and operating the proposed expansion and associated infrastructure would necessitate an increase in the volume of materials being transported to Olympic Dam from both within Australia and from overseas. The increase in on-site metal production and the addition of concentrate as a product for export would also increase the volume of materials leaving Olympic Dam for destinations within Australia and overseas (see Table 5.51).

The existing operation currently imports and exports material from site via the existing South Australian road network and the local airport located at Olympic Dam Village. Some reagents and consumables are imported from overseas, arriving at the existing Port Adelaide port facility before being loaded onto trucks for delivery to site. Elemental sulphur prill is imported through Port Adelaide, where it is temporarily stored in the existing sulphur storage facility nearby before being loaded onto trucks for delivery to site. Other reagents and materials arrive from interstate, and are delivered to site by road.

Metals currently produced on-site are exported interstate and overseas in different ways. Refined copper cathode is back-loaded onto empty supply trucks and stored at the Port Adelaide port facility for export or interstate transport by road or rail. Uranium oxide is placed into drums inside containers at Olympic Dam and delivered by road to Port Adelaide, where it is loaded onto trains for export at established third party facilities at Port Adelaide and the Port of Darwin. Gold and silver bullion is loaded in small batches onto charter aircraft departing Olympic Dam and delivered directly to the Perth mint.

The proposed expansion would necessitate additions to, and an expansion of, the existing transport network to allow the required volumes of materials to be safely imported and exported from site. A new rail spur would be added between Pimba and Olympic Dam, connecting to the Defined Interstate Rail Network (DIRN). The use of rail would allow the import of greater volumes of sulphur from Adelaide and the export of concentrate via the Port of Darwin. A new facility would be constructed in Outer Harbor to facilitate the delivery of the sulphur, and a new facility would also be constructed at the Port of Darwin to store temporarily and to export concentrate.

Before the new rail spur is constructed, a road/rail intermodal facility would be constructed at Pimba. This would allow materials to move from Adelaide or interstate to Pimba using the existing rail network, before being offloaded and transferred onto trucks for delivery to Olympic Dam.

Table 5.51 Major commodity movements for the combined operation

Commodity	Quantities transported per annum
Sulphur (t)	1,800,000
Concentrate (t)	1,600,000
Diesel (kL)	429,000
Copper cathode (t)	350,000
Cement (t)	154,000
Fly ash (t)	173,000
Ammonium nitrate (t)	110,000
Sodium chloride (t)	73,000
General freight (to Olympic Dam) (t)	70,000
Uranium oxide (t)	17,000
Reagents (t)	12,800
Ammonia (t)	12,000

A landing facility would be constructed about 10 km south of Port Augusta to deliver large infrastructure sub-assemblies, which would be transported along a purpose built access corridor to the laydown facility on the outskirts of Port Augusta, a facility expanded from that used during the last Olympic Dam expansion. After the sub-assemblies have been constructed they would be transported to site along the existing Stuart Highway. Additional passing bays would be established along the highway to reduce the impact on local traffic.

Some changes to local traffic flow in and around Roxby Downs would also occur, including the relocation of the Olympic Way extension as it enters the operation, and the relocation of Borefield Road.

The existing Olympic Dam airport would be relocated to a site adjacent to Hiltaba Village and expanded to allow the use of jet aircraft, aiding the arrival and departure of the construction and operational workforce.

These new and modified modes of transport are discussed further in the following sections and the overall transport strategy is illustrated in Figure 5.41.

5.9.2 RAIL INFRASTRUCTURE

Overview

A new 105 km rail spur would be constructed between Pimba and Olympic Dam to connect the proposed expansion to the existing Defined Interstate Rail Network. Figure 5.35 illustrates the alignment and proximity of the rail line to the towns of Pimba, Woomera and Roxby Downs and Figure 5.37 provides a conceptual layout of the infrastructure corridor north of Woomera. A new rail terminal would be constructed at Olympic Dam to load and unload rail freight. Table 5.52 identifies the indicative major features of the proposed rail spur.

The construction and operation of the proposed rail spur would result in additional demand for energy and labour. These indicative major demands are provided in Table 5.53.

Context

Australia has an extensive rail freight network of approximately 45,000 km (see Figure 5.42) operated by a number of organisations. There are two rail links adjacent to the proposed expansion. These are the line between Adelaide and Perth (operated by the Australian Rail Track Corporation, ARTC) and the line between Tarcoola and Darwin (operated by FreightLink).

The existing rail line between Adelaide and Tarcoola (continuing on to Darwin or Perth) is suitable for trains of up to 1,800 m in length and loads up to 6.5 m in height, permitting double stacking (BITRE 2008). The same track restrictions remain from Tarcoola to Darwin and from Tarcoola to Kalgoorlie, where train length is restricted to 1,500 m.

There are three line segments between Adelaide and Tarcoola, and the volume of rail traffic in each segment changes as trains join the line from Sydney on their way to Perth, and others

Table 5.52 Indicative major features of the proposed rail spur

Features	Proposed expansion
Length (km)	105
Maximum width of corridor/easement (m)	150
Average width of disturbance within the easement (m)	30
Type of trains	Diesel electric
Use as a commuter train	No
Number of weekly train movements to Port of Darwin	14
Number of weekly train movements to Outer Harbor	28
Length of train (km)	1.4–1.8
Number of wagons	65–80
Maximum speed (km/h)	110

Table 5.53 Indicative major demands for the proposed rail spur and terminal

Expansion requirement	Proposed expansion
Water demand during construction (ML)	500
Water demand during operation (GL per annum)	Negligible
Electricity consumption during operation (MWh per annum)	Negligible
Diesel consumption during operation[1] (ML per annum)	36.5
Peak construction/shutdown workforce (including Pimba intermodal)	120
Ongoing operational workforce (including Pimba intermodal)	80
Total land disturbance (ha)[2]	444

[1] Diesel demand reflects indicative diesel required for all rail operations for the proposed expansion.
[2] Includes Pimba intermodal facility disturbance.

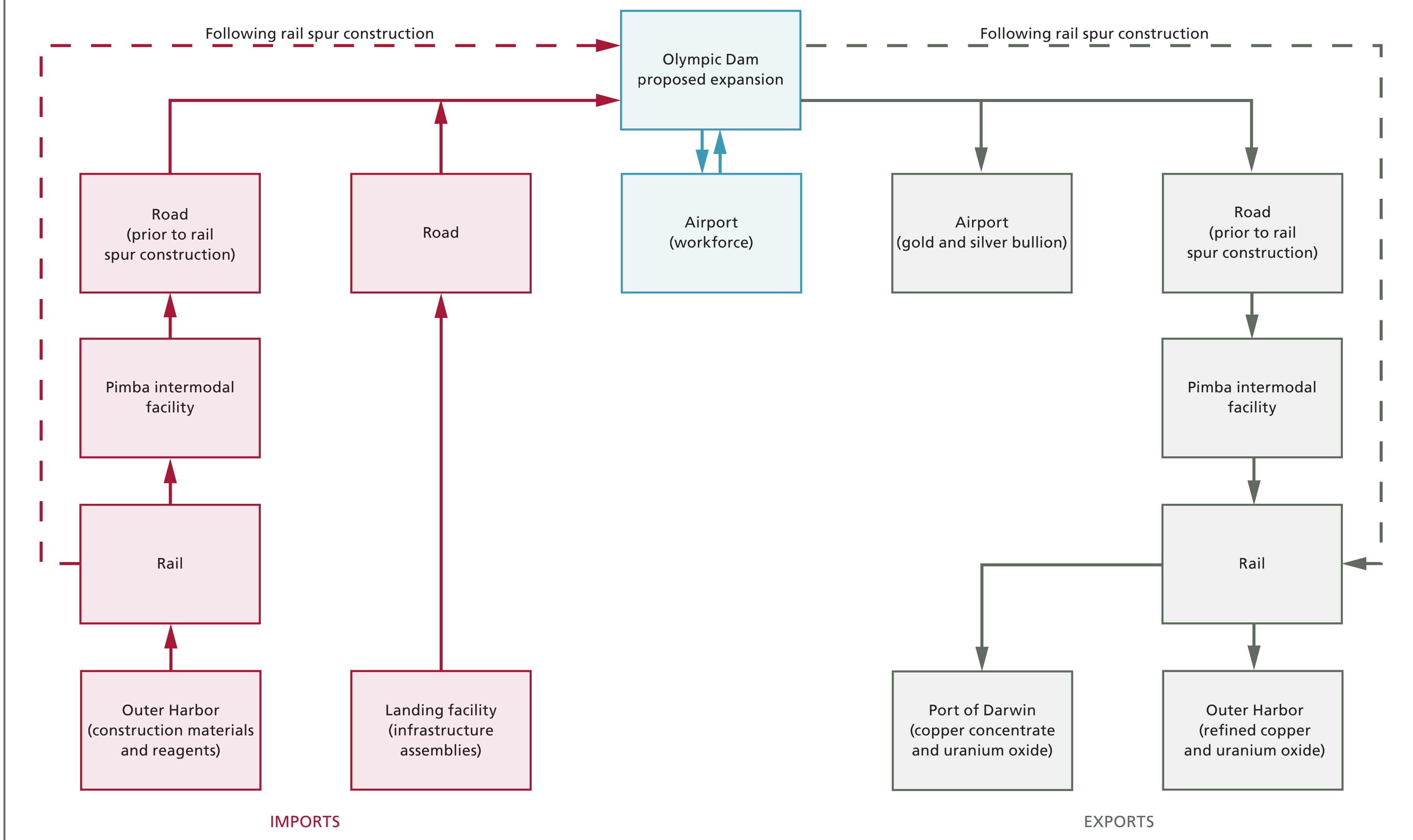


Figure 5.41 Proposed transportation strategy

Figure 5.42 Australian rail freight network

terminate in Spencer Junction (Port Augusta). The volume of existing rail traffic per segment is shown in Table 5.54.

A number of mining operations in the Northern Territory utilise the Tarcoola–Darwin rail line, resulting in an additional 24 weekly freight trains transporting goods and materials to the Port of Darwin, and a total of 34 weekly freight trains (FreightLink 2008). The proposed export of concentrate would add about 14 trains per week (one up and one back each day). Additional containerised uranium oxide would also be transported to the Port of Darwin via rail, although this would not require an increase in train movements.

Construction phase

Construction method

The rail alignment between Pimba and Olympic Dam would be surveyed and the easement cleared of vegetation as for the gas and water supply pipelines. The easement would be accessed primarily via stub roads from the existing Pimba to Roxby Downs road. An access track would also be required along the rail corridor within the rail easement. Access points for water tankers, plant and equipment would be required every 5–10 km, utilising existing tracks wherever possible.

The rail line would be constructed to withstand a 1-in-100-year ARI rainfall event (see Chapter 8, Meteorological Environment and Climate, for further details), and therefore would be constructed on average 1 m above natural ground level. Fill material would be sourced principally from an on-site civil crusher, which would crush rock to provide material fill. Additionally, some material would be sourced from re-used cut material and borrow pits along the alignment (see Section 5.9.4), with high-quality granular material for surface treatment of the formation sourced from Axehead Quarry (10 km from Olympic Dam and adjacent to the proposed alignment) and the Australian Rail Track Corporation (ARTC) quarry near Tarcoola.

Pre-cast concrete railway sleepers and steel rail would be manufactured off-site and delivered to a temporary laydown facility at the start of the rail line at Olympic Dam, or to the Pimba intermodal facility. The rail would be delivered to either the Port Augusta or Pimba yard in 27 m lengths, where it would be temporarily stockpiled before delivery by rail or road to the laying site. The proposed end-over-end rail line construction method for the 105 km rail spur would enable delivery by rail, which in turn would reduce the number of trucks transporting construction material on the road between Pimba and Olympic Dam. The lengths of track would be welded *in situ*.

A road-over-rail overpass would be constructed north of Woomera (see Figure 5.43) and is detailed in Section 5.9.4. Up to 130 drainage culverts would be installed along the rail line to minimise disruption to existing drainage patterns (see concept cross-section and plan in Appendix F2). Railway crossings with appropriate signage would be provided where the rail line crosses minor roads and access tracks to pastoral stations.

A rail terminal would be constructed at Olympic Dam for loading and unloading of import and export material. This would include large laydown facilities for materials handled by container handlers and loaders, and bulk loading facilities for loading the copper concentrate, and unloading and distributing sulphur and diesel.

All short-term use disturbed areas would be progressively cleaned up and rehabilitated when safe and practicable to do so. Measures would include removing foreign material (i.e. construction material and waste), surface contouring where required, respreading topsoil and cleared vegetation and seeding using appropriate local native species.

Water supply during construction

Approximately 500 ML of water would be required during the construction of the rail spur and new terminal. Low-quality water would be used for earthworks including embankment compaction and dust suppression during the transport and handling of mine rock. The water would likely be sourced from groundwater wells along the alignment. Potable water for concrete manufacture and the construction workforce would be obtained from the existing on-site desalination plant or from the State potable water network at Woomera, and would be transported to the construction site in water carts as required.

Workforce accommodation

The construction phase would require about 120 people and they would be accommodated within Hiltaba Village or in Woomera. Temporary facilities would be established at the work sites, and solid wastes arising from their operation would be collected and disposed of in licensed waste disposal facilities, while wastewater would likely be treated via an on-site package treatment plant and treated effluent discharged to ground via irrigation for evaporation.

Table 5.54 Existing freight train volumes between Adelaide, Perth and Darwin[1]

Line segment	Number of weekly freight trains
Adelaide to Crystal Brook	52
Crystal Brook to Spencer Junction (Port Augusta)	79
Spencer Junction to Tarcoola	62
Tarcoola to Perth	52
Tarcoola to Darwin	10

[1] Sourced from BITRE, Australian intercapital rail freight performance indicators 2006–07.

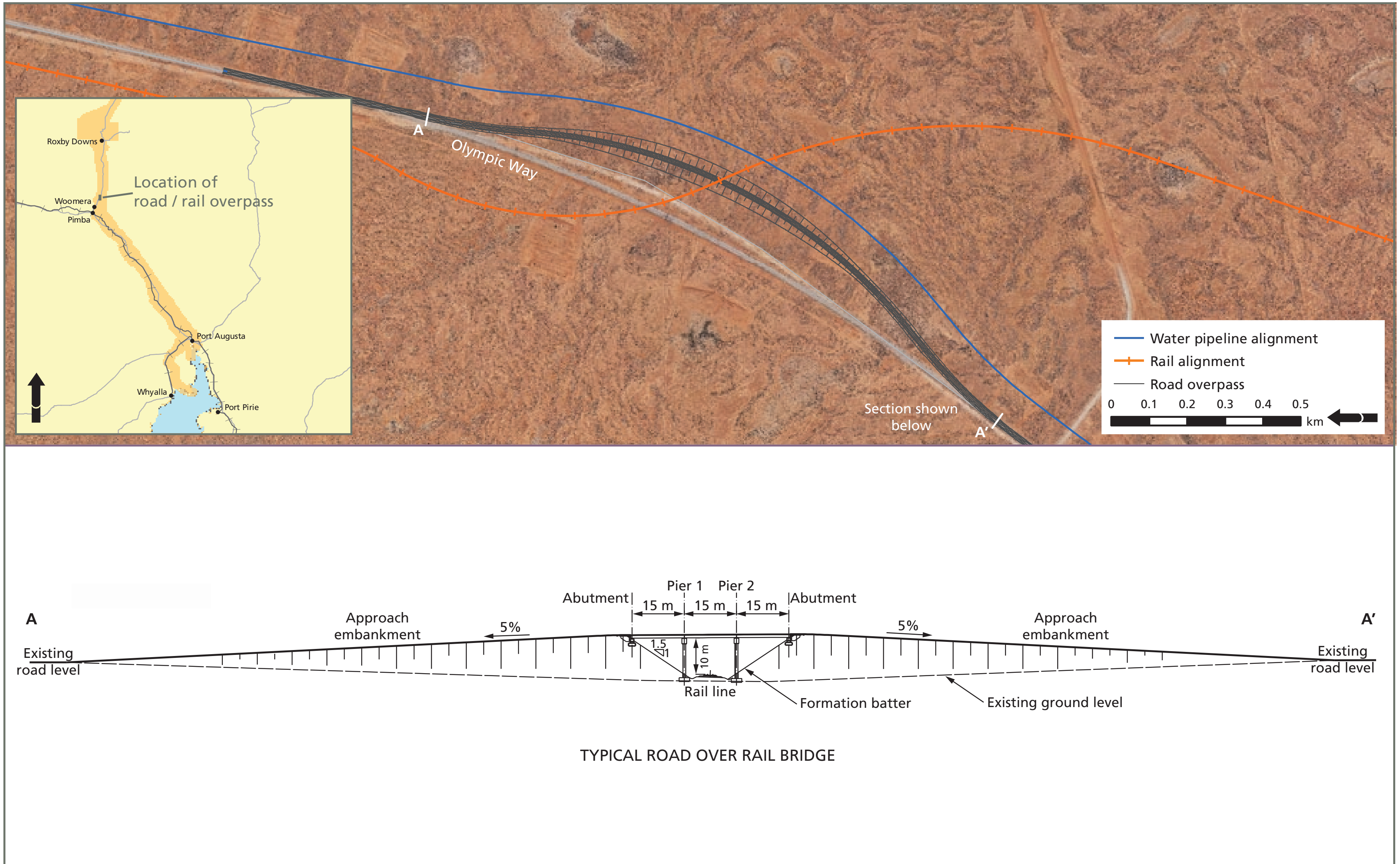


Figure 5.43 Road / rail overpass plan view and typical cross-section

Rail operation phase

Approximately 42 train movements per week are expected to be required following completion of the proposed expansion. These movements would comply with DIRN requirements for cargo size, axle weights, operating speeds and train lengths.

Of these movements, 28 would transport freight between Outer Harbor and Olympic Dam, and most of these would be to supply sulphur and diesel to the proposed expansion. The remaining 14 movements would be to transport concentrate and uranium oxide between Olympic Dam, Outer Harbor and the Port of Darwin.

Maintenance works during the operation phase of the rail line would be minimal, and include formation repair (particularly at culverts), rail tamping to correct track geometry, rail grinding to manage rail wear and replacing failed track and sleeper components.

5.9.3 PIMBA INTERMODAL FACILITY

Overview

An intermodal road/rail facility is proposed at Pimba before the rail spur to Olympic Dam is constructed to reduce the volumes of road traffic on the Stuart Highway (see Figure 5.44 and conceptual layout in Figure 5.45). Most non-oversized construction materials for the proposed expansion, and some reagents for the existing operation, would be transported by rail to the intermodal facility and would subsequently be transferred to road for delivery to site.

The Pimba intermodal facility would consist of a compacted crushed rock hardstand surface, a small office and amenities building and a small maintenance shed with a bunded fuel store for the on-site equipment. In addition to the existing rail sidings at Pimba, an extra 400 m of rail track would be constructed to service the intermodal facility.

Construction phase

Construction method

The proposed site would be surveyed and cleared of vegetation. A suitable foundation of compacted crushed rock would be established, using material sourced from the on-site civil crusher or the existing Axehead quarry in Roxby Downs. Portable buildings would be established at the facility, with a septic system installed to capture wastewater. The rail siding would be constructed in a manner similar to that described in Section 5.9.2.

Water supply during construction

About 20 ML of low-quality water would be required during construction for earth compaction and embankment construction. This would be sourced from local groundwater wells. The potable water requirements of the construction workforce and the ongoing operation are expected to be minimal, and would be sourced from the State potable water network.

Workforce accommodation

The construction phase requires approximately 80 people who would be accommodated within existing facilities at Woomera. Temporary facilities would be established at the work sites, and solid wastes arising from their operation would be collected and disposed of in licensed waste disposal facilities, while wastewater would likely be treated via an on-site package treatment plant and treated effluent discharged to ground via irrigation for evaporation.

Operation phase

The intermodal facility would be used to transfer loads from rail onto trucks during the proposed expansion construction period and during the initial stages of the operation phase, and may be used to back-load cathode copper being returned to Adelaide. Some short-term storage and laydown area would be provided for materials such as water pipes, other construction materials and pre-assemblies.

5.9.4 ROAD INFRASTRUCTURE

Overview

Constructing and operating the proposed expansion and associated infrastructure would change both the volume and type of road traffic currently using the existing regional road network.

The Pimba intermodal facility would reduce road traffic between Adelaide and Pimba. Following construction and commissioning of the rail spur to Olympic Dam, road traffic between Pimba and Olympic Dam would also be reduced (see Figure 5.46).

The landing facility and associated pre-assembly yard in Port Augusta would be used to import large assemblies, which would subsequently be transported by road to Olympic Dam. Additional passing bays would be constructed on the Stuart Highway and Olympic Way to minimise disruption to traffic from the movement of over-dimensional loads.

Additional roadworks in and around Roxby Downs would occur to manage the increase in traffic from residential growth.

The following sections detail the existing and proposed traffic volumes and the major modifications and additions to the existing road infrastructure required for the proposed expansion.

Figure 5.44 Indicative configuration of the proposed Pimba intermodal road/rail facility

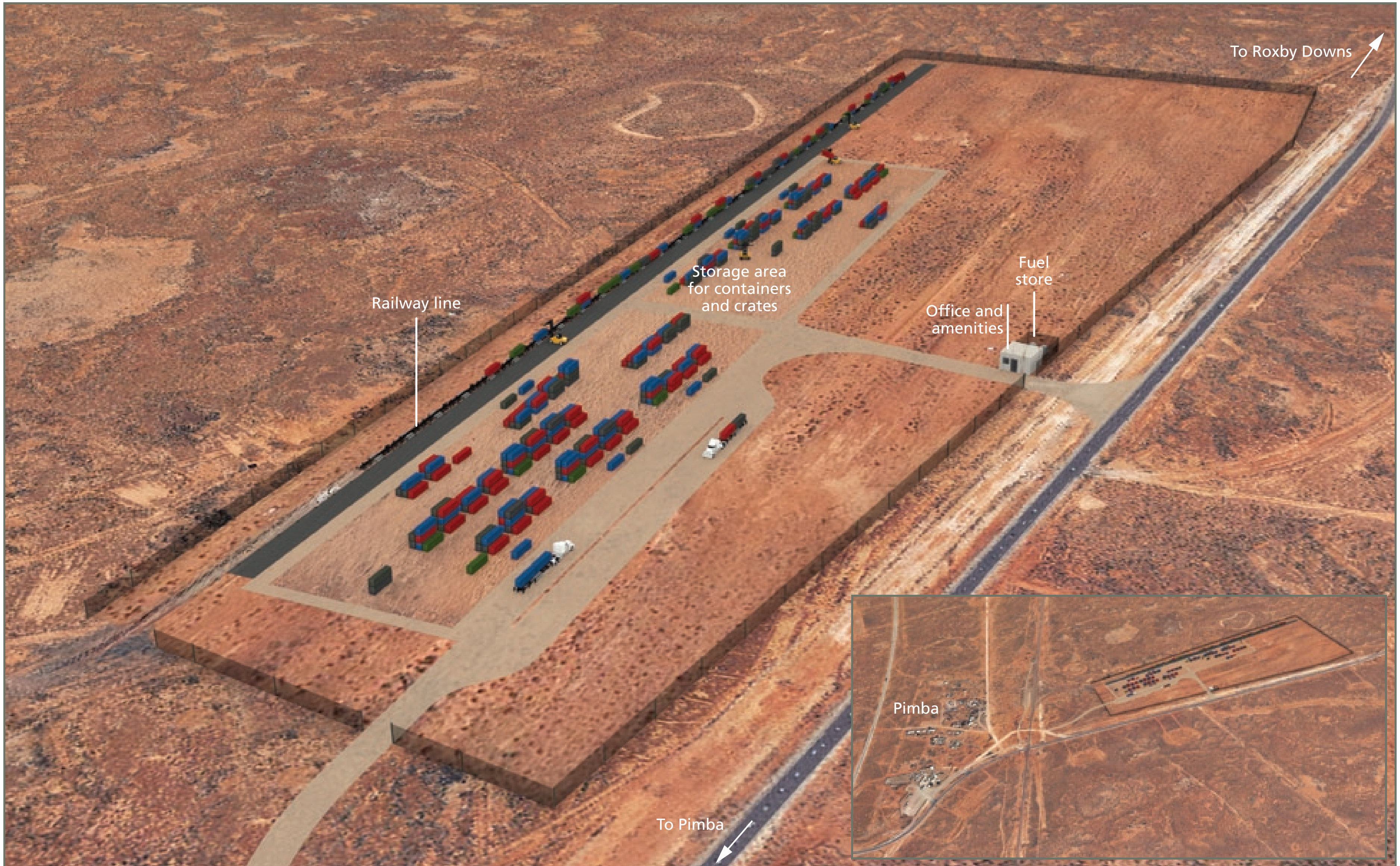


Figure 5.45 Conceptual layout of the proposed Pimba intermodal road/rail facility

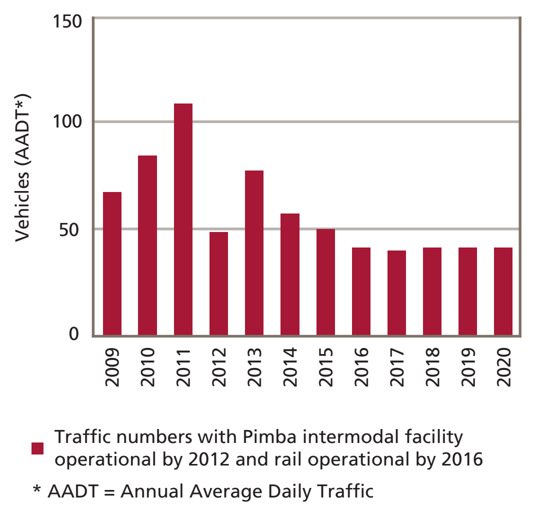


Figure 5.46 Traffic volumes on Stuart Highway with intermodal and rail

Context

The current traffic volumes along the three major traffic routes that may be affected by the proposed expansion are very low. Existing light and heavy vehicle numbers for these routes are provided in Table 5.55.

Road infrastructure design

Transport infrastructure within Roxby Downs

The following features are proposed in the Roxby Downs Draft Master Plan to meet the predicted transport infrastructure requirements (see Figure 5.47 and Section 5.10.2 for further information on the expanded Roxby Downs):

- Stuart Road and Aquila Boulevard would be extended to meet the heavy vehicle bypass
- four new distributor roads would potentially be constructed to serve new residential precincts west of Olympic Way
- two new distributor roads would connect Olympic Way to new residential precincts east of Olympic Way
- a new 'T' intersection would be constructed between Burgoyne Street and Richardson Place, and this new stretch of road would be designated as part of Richardson Place
- new traffic management measures would be implemented, including traffic control measures at the junction of the extended Richardson Place and Olympic Way, and further north of Roxby Downs at the junction of Olympic Way and the heavy vehicle bypass.

Relocation of Borefield Road

Portions of the existing Borefield Road would be relocated because it passes through the Olympic Dam SML where the proposed open pit and RSF would be located. Figure 5.5 shows the proposed alignment of the relocated Borefield Road. This relocation would increase travel time by an estimated 10–15 minutes when heading north to locations such as the entrance to Arid Recovery, groundwater wellfields, Marree and William Creek. The relocated road would remain unsealed. The re-alignment works would commence immediately following approval of the EIS, and the new alignment would be opened at the same time the existing alignment is closed to avoid disruption to traffic movement.

Road overpass

As discussed in Section 5.9.3, a road overpass would be constructed approximately 15 km north of Woomera, where the proposed rail line would cross Olympic Way (see Figure 5.43 for location and details). The footprint for the road overpass would be in the order of 5 ha and it would be constructed immediately adjacent to the existing road (i.e. off-line) so as not to disrupt traffic movement.

Access corridor

A private access corridor of about 10 km in length and 15 m in width would be constructed between the landing facility and the Port Augusta pre-assembly yard on the north-western outskirts of Port Augusta then onto the Stuart Highway. This access corridor would be adjacent to Shack Road and to Defence's Cultana Training Area and then Kittel Street to the pre-assembly yard (see Figure 5.48).

The access corridor would be constructed of compacted crushed rock and gravel to establish an all-weather surface. Drainage features including culverts would be installed to prevent changes to existing drainage patterns.

Table 5.55 Existing road traffic volumes for major routes (AADT[1])

Route	Light vehicles	Bus	Heavy vehicles (Olympic Dam)	Heavy vehicles (others)
Princes Highway (between Adelaide and Port Augusta)	5,613	343	66	1,038
Stuart Highway (between Port Augusta and Pimba)	606	69	66	114
Olympic Way (between Pimba and Olympic Dam)	458	49	66	50

[1] Annualised average daily traffic.

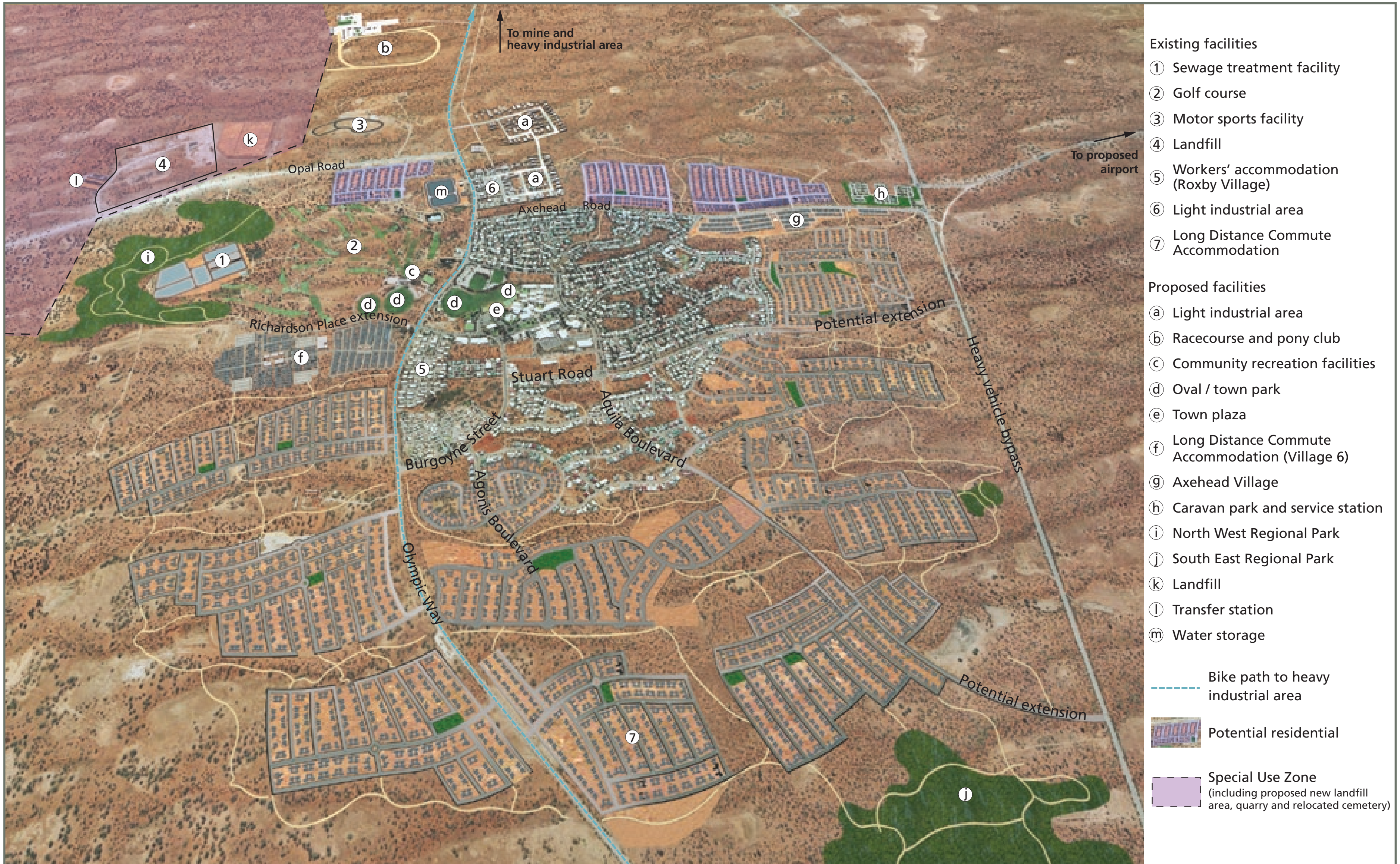


Figure 5.47 Conceptual features of the expanded Roxby Downs including new road infrastructure

Figure 5.48 Proposed alignment of access corridor and location of Port Augusta pre-assembly yard

Passing bays

Passing bays would be provided along the Stuart Highway north of Port Augusta and on Olympic Way (see Figure 5.33 for approximate locations) to allow the transport of over-dimensional loads from the pre-assembly yard at Port Augusta to Olympic Dam. The need for and specific locations of bays would be determined during detailed design, but bays would be spaced approximately 17 km apart. The bays would be approximately 30 m wide and 250 m long.

Nine bays would be constructed on the Stuart Highway between the Port Augusta pre-assembly yard and Pimba, covering approximately 7.5 ha. Six bays would be constructed between Pimba and Olympic Dam, covering approximately 4.5 ha. Amenity and snack facilities would be provided during over-dimensional load movements.

Miscellaneous roads within the SML

Other roads would be constructed within the SML. The most significant would be a new site entry roadway (including gatehouse), and various roads around the mine and metallurgical plant.

Construction phase

Construction method

The proposed roadways would be designed in such a way as to reduce and balance the amount of earthworks cut and fill required and, in the case of the passing bays, would be located in areas where they are most likely to be needed to ensure a maximum of 45 minutes delay due to road closure from pre-assembly convoys. The vegetation along these easements would be cleared, allowing compacted gravel to be laid.

Road signage, crash barriers and road surface markings would be added in accordance with legislative requirements.

The road overpass would be constructed of pre-cast concrete elements transported and assembled on-site. Bridge abutment material may be sourced either from nearby borrow pits or from mine rock from the pre-mining operations.

Borrow pits

Borrow pits would be required to provide crushed rock and granular material for road construction works. The material would be used in the gravel pavement areas for the passing bay network, and for the construction of the embankment for the rail line and Olympic Way overpass. The number and location of borrow pits would be determined during the detail design phase; however, it is anticipated that approximately 13 borrow pits (of 50 m x 50 m area) would be required for roadworks south of Pimba, and approximately 10 borrow pits (of 130 m x 130 m area) would be required for road and rail construction north of Pimba (see Figure 5.33).

Water supply during construction

The roadworks would use about 200 ML of low-quality water, sourced from local groundwater wells, primarily for earthworks including compaction and dust suppression. The use of potable water would be restricted to the manufacture of concrete for *in situ* cast aprons or other minor infrastructure if required, and minor usage for the construction workforce. The concrete elements of the road overpass and drainage culverts would be pre-cast in Adelaide or elsewhere.

Workforce accommodation

The road construction phase would require about 50 people who would be housed in either Hiltaba Village or Roxby Village (for roadworks in and around Roxby Downs), and Woomera and Port Augusta (for the rail overpass and the passing bays on the Stuart Highway).

Operation phase

The estimated changes in traffic volumes associated with the construction phase and the ongoing operation of the proposed expansion on each of the major routes are listed in Table 5.56. The potential for delays to the travelling public are addressed in Chapter 19, Social Environment, and the potential safety impacts of the change in traffic volumes and types is discussed in Chapter 22, Health and Safety. Maintenance of the roadways would continue to be managed by DTEI.

5.9.5 PORT INFRASTRUCTURE AND LANDING FACILITY

Overview

The proposed expansion would necessitate an increase in imported materials, in particular construction materials required during the development phases and, subsequently, reagents required during the operation phase. Simultaneously, an increase in products generated on-site would require additional export capacity. To meet the additional demand for

Table 5.56 Estimated change in daily traffic volumes as a result of the proposed expansion[1]

Route	Construction (year 2015)		Ongoing operation (year 2020)	
	Total vehicles (% change)	Heavy vehicles (% change)	Total vehicles (% change)	Heavy vehicles (% change)
Princes Highway (between Adelaide and Port Augusta)	–0.3	–1.9	–0.7	–4.5
Stuart Highway (between Port Augusta and Pimba)	105	12	70	–9
Olympic Way (between Pimba and Olympic Dam)	171	74	113	–15

[1] Changes in traffic volumes are relative to the BAU case, should the expansion not proceed.

import and export facilities, new port facilities would be constructed at the Port of Darwin and Outer Harbor and a barge landing facility would be constructed 10 km south of Port Augusta.

The indicative major features of the three new facilities are provided in Table 5.57.

The construction and operation of the proposed port facilities would result in additional demand for water, energy and labour (see Table 5.58).

Context

Details of existing shipping movements and import and export tonnage at the Port of Darwin and Port Adelaide (including Outer Harbor) are provided in Table 5.59.

Currently, the primary reagents used on-site that are imported by ship are elemental sulphur prill (approximately one shipment every six weeks) and sodium chlorate (shipments are spread across approximately 30 container ships per annum carrying other mixed cargo). Exports of refined copper cathode are bundled into standard containers or break-bulk shipments and are transported with other general freight, with about 250–300 ships leaving each year. Uranium oxide shipments are exported in shipping containers from Port Adelaide (Outer Harbor) and the Port of Darwin, in six to 12 ships each year.

Port of Darwin

Overview

The Port of Darwin, East Arm wharf, would be used to export uranium oxide and concentrate for the proposed expansion. Figure 5.49 shows a conceptual layout of the proposed Port of Darwin development for the export of concentrate. This would require the construction of new concentrate storage and loading facilities to be located in an area consistent with the proposed East Arm Master Plan. The total footprint required for the proposed facilities would depend on their ultimate location. The location and area of the preferred option is shown in Figure 5.50 and would be about 16 ha, comprising approximately:

- 12 ha for the rail loop and embankments
- 4 ha for the concentrate storage shed, office buildings and maintenance areas
- 0.2 ha for the rail unload and wash-down facility for the wagons.

Table 5.57 Indicative major features of the ports and landing facilities

Features	Port of Darwin	Outer Harbor	Landing facility
Mass of imports per annum (Mt)	Nil	2.2	n.a.
Mass of exports per annum (Mt)	1.6	0.4	Nil
Major materials imported	Nil	Sulphur and diesel	Construction assemblies
Major materials exported	Uranium oxide and concentrate	Uranium oxide and refined copper cathode	Nil
Number of shipping movements per annum	24–27	18–30	35
Types of vessels	Panamax	Panamax	Landing barges and roll-on, roll-off ships
Dredging of a navigational channel required?	No	No	No

Table 5.58 Indicative major demands for the proposed facilities

Expansion requirement	Port of Darwin	Outer Harbor	Landing facility
Water demand during construction (ML)	20	20	10
Water demand during operation (ML per annum)	2.5	1	Negligible
Electricity consumption during operation (MWh per annum)	26,000	26,000	11,000
Peak construction/shutdown workforce	50	50	100
Ongoing operational workforce	50	50	30
Total land disturbance (ha)	16	20	2

Table 5.59 Existing shipping movements and tonnages

Performance measure	Port of Darwin[1]	Port Adelaide[2]
Material imported (tpa)	820,000	4,870,000
Material exported (tpa)	650,000	2,250,000
Number of ship calls	4,717	1,122

[1] Sourced from Darwin Port Corporation 2006/2007 Annual Report.
[2] Sourced from Flinders Ports Annual Summary Report 2007.

Figure 5.49 Conceptual layout of the proposed Port of Darwin facility

Figure 5.50 Proposed location and indicative configuration of the Port of Darwin facilities

Design

The design elements of the proposed Port of Darwin facilities are described below.

Closed system

A closed transportation system would be implemented to transport, handle and load for export the concentrate because it contains low levels of uranium and triggers the requirement to be handled and transported as a radioactive substance. The insoluble concentrate would contain up to 2,000 ppm uranium compared to around 900,000 ppm in the uranium oxide (see Appendix E4 for details). As part of the closed system, rail wagons would be enclosed, as would the transfer from rail wagon to the concentrate storage shed at the East Arm facility. As well, the storage shed would be fitted with automatic doors, a negative pressure particulate filtration system, and water recycling systems would be used for washing the outside of the rail wagons after they had dumped their load. The closed system would extend to the ship loading activities and use enclosed conveyors, dedicated ships, and shipping only to designated discharge ports (although the latter is outside the scope of the EIS).

Rail operations

When operating at full capacity and exporting 1.6 Mtpa of concentrate to the Port of Darwin, a daily train service to the East Arm facility would be required. All wagon rolling stock would be clearly labelled and placarded in accordance with the requirements for the transport of radioactive material. Rail wagons would be effectively sealed with suitable covers, fitted in such a manner that there would be no escape of the concentrate under routine conditions of transport.

Upon arrival at the BHP Billiton East Arm facilities, the locomotives would be disconnected and diverted outside the rail unloading facility. Rail wagons would be moved through the unloading facility using a wagon indexer. The covers would be removed to discharge the concentrate and replaced again after it had been discharged.

The wagons would be unloaded inside an enclosed facility utilising a tippler operation which would discharge the concentrate into an underground bin/conveyor for movement to the storage facility. Automatic doors at either end of the unloading facility would raise and lower between each rail car.

The external surfaces of each rail wagon would be washed immediately after the unloading operation to remove dust particles. The water used to wash the rail wagons would be collected and treated to recover concentrate particles that may have attached to the wagon during unloading (i.e. tippling). The treated water would be contained in on-site storage tanks for reuse in subsequent wash cycles, and any collected solids would be placed on the concentrate stockpile for export. This would create a zero discharge system.

From time to time (preliminary estimates suggest about every four to six months), a proportion of the wash down water would be removed from the system, which would then be 'topped up' with replacement water. The removed water would be discharged into a holding tank or similar unit and railed back to Olympic Dam to be disposed of within the Olympic Dam TSF.

Preliminary estimates suggest that up to 0.6 megalitres (ML) would be required to wash the external surfaces of the train wagons. Depending on the method used to treat the wash down water (and thus the retention time to allow solids to separate), and the frequency of topping up the wash down water system, the annual water demand may be up to 2.5 ML.

Unloading station

The unloading (or dump) station would be a reinforced concrete structure, cast *in situ*, with the internal design incorporating lifting equipment, monorails and lift wells, as required. It would also provide sufficient space to enable maintenance and housekeeping functions.

Below ground, the dump station would include the following equipment:

- dump hopper
- belt feeder
- transfer to conveyor
- dust extraction bag house/ventilation system
- access stairs
- collection sump
- sump pump (slurry).

The rail wagons would be rotated to discharge their load (called tippling) into a hopper. A conveyor would move the discharged load onto a stockpile to await export.

Conveying and materials handling

All conveyor transfer points at Olympic Dam and East Arm would contain fully enclosed spoon chutes, with dust curtains at entry and exit points. Dust suppression mist sprays would be located within the skirts, after the loading point, and would cover the full width of the conveyed material.

The wharf conveyor would feed the ship loader via a travelling tripper. Once again, the conveyor would be enclosed with suitable protection over the longitudinal slot to allow the passage of the tail of the ship loader but not to provide a conduit for dust emissions under normal operating conditions. A nominal design capacity of 1,200 tpa would be used for the conveyors.

Concentrate storage shed

The storage shed would be a dry stockpile facility with a capacity of 90,000 t. The moisture content of the concentrate containing uranium would be maintained at 8–11%.

As part of the closed system, the concentrate storage shed at the East Arm facility would be a fully enclosed building fitted with automatic doors and systems for dust management and zero discharge water recycling. Ventilation equipment would include scrubbers, filtration and dust suppression. The shed would be fitted with a ventilation system to provide negative pressure and allow for the ventilation of concentrate stockpile emissions and particulate emissions produced by the reclaim equipment. The water used to wash the outside surfaces of the rail wagons would be collected and reused. Solids that settle from this water would be placed on the concentrate stockpile and, after several reuses, the water would ultimately be placed in a rail wagon for disposal at Olympic Dam. Concentrate would be reclaimed from the stockpiles and transferred to reclaim hoppers using front-end loaders, then transferred in an enclosed conveyor to the ship wharf loader.

Ship wharf loader

The existing East Arm wharf infrastructure has the capacity to cater for an additional ship loader. A dedicated wharf loader would be required to transfer the concentrate into the export vessel. The ship loader would be:

- a 1,200 tph travelling ship loader with rail spacing designed to match the existing East Arm rails
- loading into a Panamax-class vessel with 170 m hatch length
- fitted with appropriate spillage, wash down collection and dusting control devices.

Office buildings and maintenance area

Strict procedures and controls would be implemented to maintain separation between areas where the concentrate is handled and areas not exposed to the concentrate.

For example, wash down procedures as described above would be followed before equipment could be removed from the concentrate storage shed to separate repair or mainten-ance areas.

Security

BHP Billiton would collaborate with the Darwin Port Corporation and relevant regulatory authorities and agencies to develop and implement a site specific security management plan. The plan would include installing, monitoring and maintaining appropriate security measures around the proposed unloading, storage, and office and maintenance areas to prevent unauthorised access to the facilities. Such measures may include secure mesh fencing with razor wire, closed-circuit television and sensor movement detectors, alarm systems and 24-hour security patrols.

As the handling system of conveyors and transfer towers from the storage facility to ship loader is enclosed, all access points would be locked and secure at all times. Alarm systems and remote sensors would be fitted at access points and connected into the overall security control system for the facilities.

As the proposed facilities are within the Port of Darwin jurisdiction, the Australian Government maritime ports security program would also apply. All construction and operation employees would be required to possess and carry a Maritime Security Identification Card. Visitor access would be strictly controlled at all times and comply with both BHP Billiton and Port of Darwin requirements.

Construction phase

The concentrate storage shed and rail spur would be constructed to withstand flooding in a 1-in-100-year ARI rain event. This would include concrete perimeter bunding and require the facilities to be constructed to align with the existing height levels for East Arm facilities.

Infrastructure would be constructed to the necessary cyclone rating building standard codes and requirements for facilities, as stipulated by government regulations and the Darwin Port Corporation.

The construction phase would involve the following:

- civil works – bulk earthworks, access roads, road and rail structures, laying of rail track, security works, utilities and stormwater drainage controls
- buildings and structures – storage facilities, workshops, administration and support facilities and building services
- materials handling equipment – ship loaders, rail loaders and unloaders, conveyors and associated equipment
- procurement of major equipment – locomotives, rolling stock, front-end loaders and other required mobile or fixed plant and equipment
- integrated logistics support – maintenance arrangements, consumables, recruitment, training, administrative systems and permits and access requirements.

Water supply during construction

About 20 ML of low-quality water would be required during construction for earthworks. Additional high-quality water would be required for concrete manufacture and the construction workforce.

Workforce accommodation

It is anticipated that up to 50 people would be required to construct the concentrate storage and handling facilities and that these people would be accommodated in Darwin.

Operation phase

Based on the Panamax-class vessels loading approximately 60,000–65,000 t per call, it is anticipated that there would be approximately 24–27 calls per year to East Arm, or about one call every two weeks.

Loading time is expected to be about 50 hours per call, subject to berth requirements, tide and weather conditions (noting that loading would not occur during periods of heavy rainfall, storms, cyclone events or the like). Around 50 people would be required during the operation phase of the concentrate handling facility.

An increase in the export of uranium oxide would also occur via the Port of Darwin facilities. This material would continue to be packaged into 200 L drums and containerised. Containers would be transported from Olympic Dam via rail to a distribution facility at the Port of Darwin, prior to being moved onto the wharf for export (see Chapter 2, Existing Operation, for details). The amount of uranium oxide exported via the Port of Darwin would depend upon the availability of shipping there and at Port Adelaide.

Outer Harbor

Overview

Export of additional refined copper and potentially uranium oxide would occur via the existing Port Adelaide facilities.

The new hydrometallurgical plant would require sulphuric acid to extract copper and uranium from the additional ore produced from the open pit mine. About 1.7 Mtpa of elemental sulphur would be imported, which would exceed the capacity of the existing sulphur storage and handling facilities located at Port Adelaide, necessitating the construction of a new bulk sulphur offloading and storage facility at Outer Harbor (see Figure 5.51 for indicative location and infrastructure layout).

Depending on the exact location chosen, around 20 ha of land would be disturbed, comprising:

- 12 ha for the rail loop and embankments
- 4 ha for the sulphur storage shed, ancillary infrastructure of office buildings and maintenance areas
- 4 ha for the conveyor structure and wharf-side facilities.

Activities associated with Outer Harbor would operate in accordance with the *Harbours and Navigation Act 1993*.

Design

The design elements of the proposed sulphur handling facility are described below.

Ship wharf unloader

A screw unloader with a rated capacity of around 1,300 tph would be installed to remove sulphur from the ships. The screw unloader would be fitted with appropriate spillage, wash down collection and control devices, and would be suitable for unloading Panamax class ships.

Conveying and materials handling

All conveyor transfer points would contain fully enclosed spoon chutes, with dust curtains at entry and exit points. Dust suppression mist sprays would be located within the skirts after the loading point and would cover the full width of the conveyed material.

Figure 5.51 Indicative location and configuration of the Outer Harbor sulphur handling facility at Port Adelaide

5

Sulphur storage shed

The storage shed would be a dry stockpile facility with a capacity of 120,000 t. It would be a free-span portal frame shed, divided by a corrosion-treated concrete wall to create two 60,000 t stockpiles. Sulphur would be delivered to the stockpiles using an overhead tripper conveyor and a telescopic chute to reduce fall distances. The shed would contain a basic natural ventilation system and have a compacted crushed limestone floor.

Product would be reclaimed from the stockpiles using an automatic reclaim system feeding sulphur to an enclosed conveyor, rated at around 1,500 tph and capable of loading 58 rail wagons in less than three hours.

Rail operations

Transporting the 1.7 Mtpa of sulphur when the Olympic Dam expansion is operating at full capacity would require around one train per day. All wagon rolling stock would have appropriate signage and would be effectively sealed with suitable covers, fitted in such a manner that there would be no escape of the sulphur under routine conditions of transport.

Office buildings and maintenance area

Small office infrastructure would be established, including crib rooms and amenities. A maintenance area including an equipment laydown area would be set aside for routine maintenance to the stockpile management loaders and equipment.

Construction phase

The sulphur storage shed and rail loop would be constructed to withstand flooding in a 1-in-100-year ARI rain event. Infrastructure would be constructed to the necessary building standard codes and requirements for facilities, as stipulated by government regulations.

The construction phase would involve the following:

- civil works – bulk earthworks, access roads, road and rail structures, laying of rail track, security works, utilities and stormwater drainage controls
- buildings and structures – storage facilities, workshops, administration and support facilities and building services
- materials handling equipment – ship unloaders, rail loaders, conveyors and associated equipment
- procurement of major equipment – locomotives, rolling stock, front-end loaders and other required mobile or fixed plant and equipment
- integrated logistics support – maintenance arrangements, consumables, recruitment, training, administrative systems and permits and access requirements.

Water supply during construction

About 20 ML of low-quality water would be required during construction for earthworks. Additional high-quality water would be required for concrete manufacture and the construction workforce.

Workforce accommodation

It is anticipated that up to 50 people would be required to construct the sulphur handling facility and that these people would be accommodated in Adelaide.

Operation phase

Based on the Panamax vessels unloading approximately 60,000–65,000 t of sulphur per call, it is anticipated that there would be approximately 18–30 calls each year to Outer Harbor, or about one call every two weeks.

Loading time is expected to be about 50 hours per call, subject to berth requirements, tide and weather conditions. Around 50 people would be required when the sulphur handling facility was operating.

The existing intermodal facilities at Port Adelaide (Berth 25) would continue to be used by the expanded operation.

Landing facility

Overview

A landing facility would be established about 10 km south of Port Augusta to offload pre-assembled metallurgical plant and prefabricated infrastructure modules. This facility would consist of a piered jetty (200 m x 20 m), constructed using piles and concrete decking, with an underwater rock pad (80 m x 50 m) at the end of the pier to facilitate barge landings as shown to scale in Figure 5.52 and conceptually in Figure 5.53.

A quarantine laydown area of about 2 ha would be established adjacent to the landing facility, as per Australian Customs and Quarantine requirements, for temporary holding, inspection and clearance of modules before transportation to the pre-assembly yard on the outskirts of Port Augusta, and ultimately to Olympic Dam.

Activities associated with the landing facility would operate in accordance with the *Harbours and Navigation Act 1993*.

Construction phase

Construction method

Construction would commence with a survey of the site, followed by the clearance of vegetation. Rock fill obtained from cut-and-fill operations at the landing facility site and during construction of the access corridor would be used to establish a hardstand area and the underwater rock pad. Alternatively, should insufficient cut-and-fill material be available, mine rock would be transported from mining operations in the Middleback Ranges, or a borrow pit would be established in the vicinity of the landing site.

Precast concrete piles would be transported to site and driven as necessary, and the precast concrete decking would be positioned and secured to the piles. Berthing dolphins would be installed to secure the ships during unloading operations.

A small office facility with workforce amenities would be established at the edge of the hardstand area.

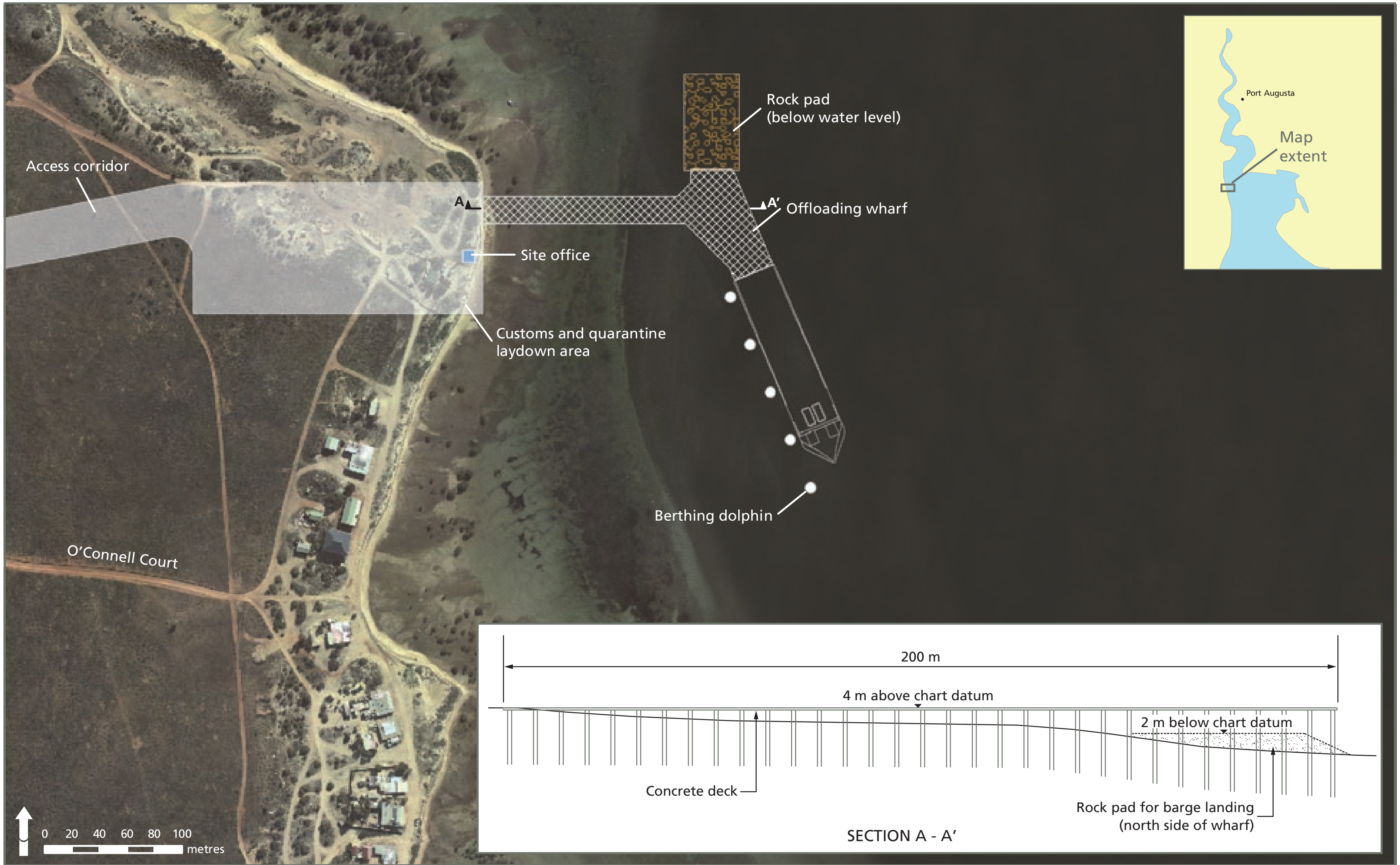


Figure 5.52 Indicative configuration of the proposed landing facility

Figure 5.53 Conceptual layout of proposed Port Augusta landing facility

Water supply during construction

About 5 ML of low-quality water would be required during earthworks, including hardstand compaction and dust suppression. Small volumes of potable water for *in situ* concrete manufacture and workforce needs would be required, and would be provided via water trucks.

Workforce accommodation

About 100 people would be involved in the construction of the landing facility and the associated access corridor. The workforce would be accommodated in Port Augusta.

Operation phase

The landing facility is expected to accommodate about one vessel every 11 days over seven years. The shipping operation would involve the mooring of heavy lift vessels in deep waters in Upper Spencer Gulf while smaller barges transferred the infrastructure modules from the vessel to the landing facility. Alternatively, vessels that could safely transit the existing channel would do so, and unload directly at the landing facility. Heavy lift vessels would arrive at the mooring site, on average every 11 days, and remain there for 2–3 days as the barges unloaded the cargo. This barging option, while not optimal for import efficiency, would avoid the need for dredging in the main channel. Barge unloading at the landing facility would occur during daylight hours, typically between 7 am and 7 pm. The landing facility would continue to be used during the operation phase on an infrequent basis to import equipment associated with ongoing replacement and maintenance. About 30 people would be required at the landing facility during the operation phase.

5.9.6 AIRPORT INFRASTRUCTURE

Overview

The proposed expansion would need a new airport with an expanded capacity to accommodate the transport of the larger workforce. The development of the open pit mine and associated RSF would necessitate the relocation of the existing Olympic Dam airport. The proposed expansion would require a larger workforce during both the construction and operational phases, and a larger proportion would fly-in and fly-out from other residential centres.

The existing Olympic Dam airport is about 6 km south of the mine and 10 km north of Roxby Downs (see Figure 5.5). The airline operator (Alliance Airlines) currently provides three to five scheduled return flights a day from Adelaide on weekdays, and one each day on Saturday and Sunday. The aircraft currently used for these services are 56-seat Focker F50 turboprops. In addition to transporting Olympic Dam employees, contractors and other passengers, there are small movements of freight through the current airport.

A new airport would be constructed about 17 km along the Andamooka Road, adjacent to the proposed Hiltaba Village. Closure and rehabilitation of the old airport would be limited to removing the major infrastructure components because the RSF would eventually cover the existing runway footprint. The indicative major features of the proposed airport are listed in Table 5.60 and a conceptual layout shown in Figure 5.54.

Table 5.60 Key features of the proposed airport

Key features	Proposed
Length of runway (m)	2,400
Width of runway/strip (m)	45–150
Orientation of runway	North/south
Capacity of carpark (bays)	230
Transit time from Adelaide (mins)	45–60
Seating capacity in departure lounge (persons)	150
Night flight capability	Yes

Constructing and operating the proposed airport would result in additional demands for water, energy and labour. These indicative major demands are provided in Table 5.61.

Table 5.61 Indicative major demands for the proposed airport

Expansion requirement	Proposed airport
Water demand during construction (ML)	20
Water demand during operation (ML per annum)	0.6
Electricity consumption during operation (MWh per annum)	4,000
Peak construction/shutdown workforce	50
Ongoing operational workforce	10
Total land disturbance (ha)	45

Design

The new airport would support both day and night flights. The curfew on flights in and out of Adelaide airport between 11 pm and 6 am would constrain the flight times at Olympic Dam airport, although flights from airports other than Adelaide would occur.

An all-weather runway would be designed to accommodate aircraft up to Code 4C class, such as the Boeing 737–800 or Airbus A320, each of which has a seating capacity of about 170. No control tower would be established, and the existing Olympic Dam common traffic advisory frequency (CTAF) procedures would apply within five nautical miles of the airport. The Melbourne Centre Flight Support Service would direct flights outside of the CTAF.

The terminal area would occupy approximately 2 ha. The terminal building would have solar panels on the roof to meet the bulk of the required electricity demand, however, it would still have a power line from Hiltaba Village to supply the balance as required. It would also have polished concrete floors, exterior walls of insulated metal-clad panelling with plasterboard internal walls, and reverse cycle ducted air-conditioning with an economy cycle to allow full flush fresh air supply. The physical dimensions of the airport runway, aprons and terminal building would comply with CASA Manual of Standards 139–Aerodromes.

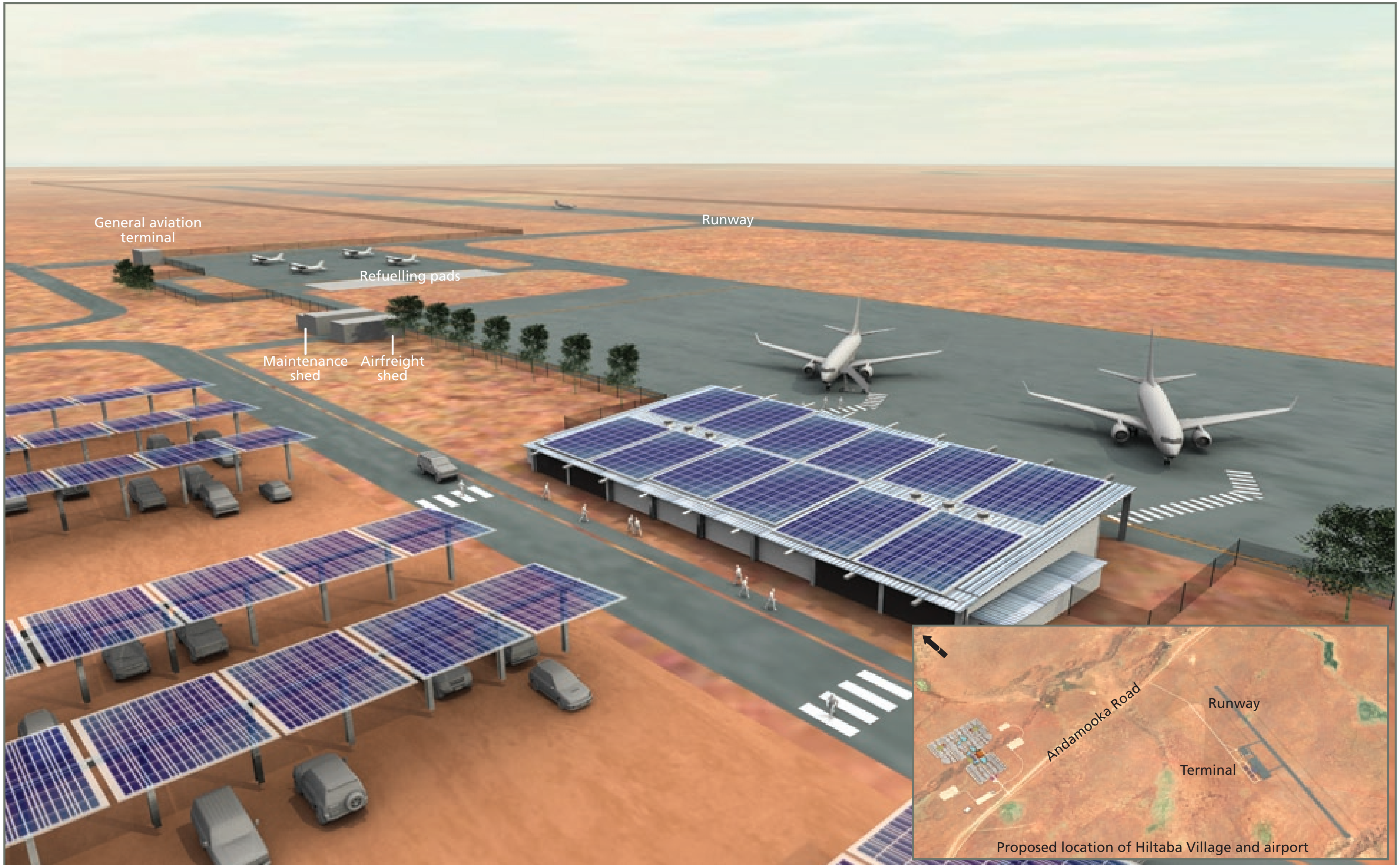


Figure 5.54 Conceptual layout of the proposed airport

The new airport would use non-precision GPS approaches, which would result in a lower cut-off point for the runway approach, thus lessening the risk of aircraft diversion due to low cloud or poor visibility. A full array of runway/taxiway lighting, illuminated wind indicators, apron and obstruction lighting would be installed for night-time flights. Additional features of the new airport would include:

- disabled access
- check-in desks and car rental desks
- baggage collection facilities in the arrival hall
- security screening areas.

The runway would have a north/south orientation, and would therefore be aligned with the prevailing winds. In contrast, the current runway is oriented east/west and has, in the past, encountered excessive cross winds that have forced flight diversions.

Construction phase

Construction method

Construction would commence with a survey and vegetation clearing as necessary. Cut and fill operations would be required to ensure the runway is level, and additional rockfill would be sourced from mine rock produced from the open pit if required.

The airport would be constructed to withstand flooding in a 1-in-100-year ARI rain event. The pavements would have a design life of 20 years.

Water supply during construction

About 20 ML of low-quality water would be required during the construction of the new runway and terminal area. This would be sourced from local groundwater wells. Potable water for the construction workforce and concrete manufacture would be obtained from the on-site desalination plant and transported to the airport site in water trucks.

Workforce accommodation

A construction workforce of about 50 people would be required for the construction of the airport. These would be accommodated in either Hiltaba Village or Olympic Village, depending on the timing of the construction.

Airport operation phase

Flight schedules

Flight schedules are yet to be determined. However, day and night flights are likely. Scheduled flights would comply with curfew times at the origin and destination.

Airport security

The Department of Infrastructure, Transport, Regional Development and Local Government has jurisdiction over aviation security, and the new Olympic Dam airport would fall within the criteria for establishing a security program as required by the *Aviation Transport Security Act 2004* and/or regulations current at the time of operation (see Chapter 6, Legislative Framework).

Water supply during operation

Potable water would be supplied from the pipeline to Hiltaba Village. Peak water demand would be about 0.2 ML/d for domestic use. The water supply to the airport would have a peak capacity of about 0.6 ML/d, with the additional capacity provided in the event of fire.

5.10 WORKFORCE AND ACCOMMODATION

5.10.1 WORKFORCE

Overview

The construction and operation of the proposed expansion and associated infrastructure would require an increase in the size of the workforce, particularly during the construction phase, which would continue for some 11 years as the open pit mine production increased and other infrastructure was expanded to suit.

The following sections summarise the on-site and off-site workforce demand as identified throughout the previous sections of this chapter. Chapter 19, Social Environment, discusses the potential sources of labour and details the potential social issues associated with this.

Workforce demand

Summaries of the on-site and off-site workforce requirements during the construction and operation phases are presented in Tables 5.62 and 5.63. These are presented in greater detail in Chapter 19, Social Environment.

Table 5.62 Indicative on-site infrastructure workforce profile for the proposed expansion

Infrastructure element	Peak construction workforce	Operational workforce
Open pit mine	3,000	2,500
Metallurgical plant	3,000	1,000
On-site desalination plant	n.a.	20
CCGT power station	900 (included in above)	30
Administration	n.a.	470
Total	**6,000**	**4,000**

Table 5.63 Indicative off-site infrastructure workforce profile

Infrastructure element	Peak construction workforce	Operational workforce
Coastal desalination plant	400	30
Water supply pipeline	100	Included in above
Gas supply pipeline	100	2
Transmission line	90	2
Rail infrastructure	120	80[1]
Pimba intermodal facility	Included in above	Included in above
Ports – Darwin	50	50
Ports – Outer Harbor	50	50
Landing facility	100	30[2]
Airport infrastructure	50	10
Hiltaba Village	300	120
Total	**1,260[3]**	**370**

[1] Included rail locomotive crew.
[2] When operational (3 days per 11 days).
[3] Maximum number provided as some construction may occur concurrently.

5.10.2 ACCOMMODATION

Overview

The requirement for more labour for the proposed expansion means more accommodation and services would be required in the Roxby Downs region. It is proposed to achieve this through an expansion of Roxby Downs township and the construction of additional accommodation facilities in and around Roxby Downs to accommodate the population associated with the construction phase. Also, some members of the workforce would commute from other residential centres. Figure 5.55 illustrates the overall strategy with regards to accommodation.

The locations of Hiltaba Village and Camp 2 are shown on Figure 5.5 and the locations of Axehead Village and Village 6 are provided in Figure 5.47. Table 5.64 provides a summary of the population change over time. Greater detail regarding population projections over time is provided in Chapter 19, Social Environment.

The increase in accommodation facilities would result in an increase in demand for water and electricity during construction and operation phases (see Table 5.65).

The accommodation infrastructure is detailed further in the following sections.

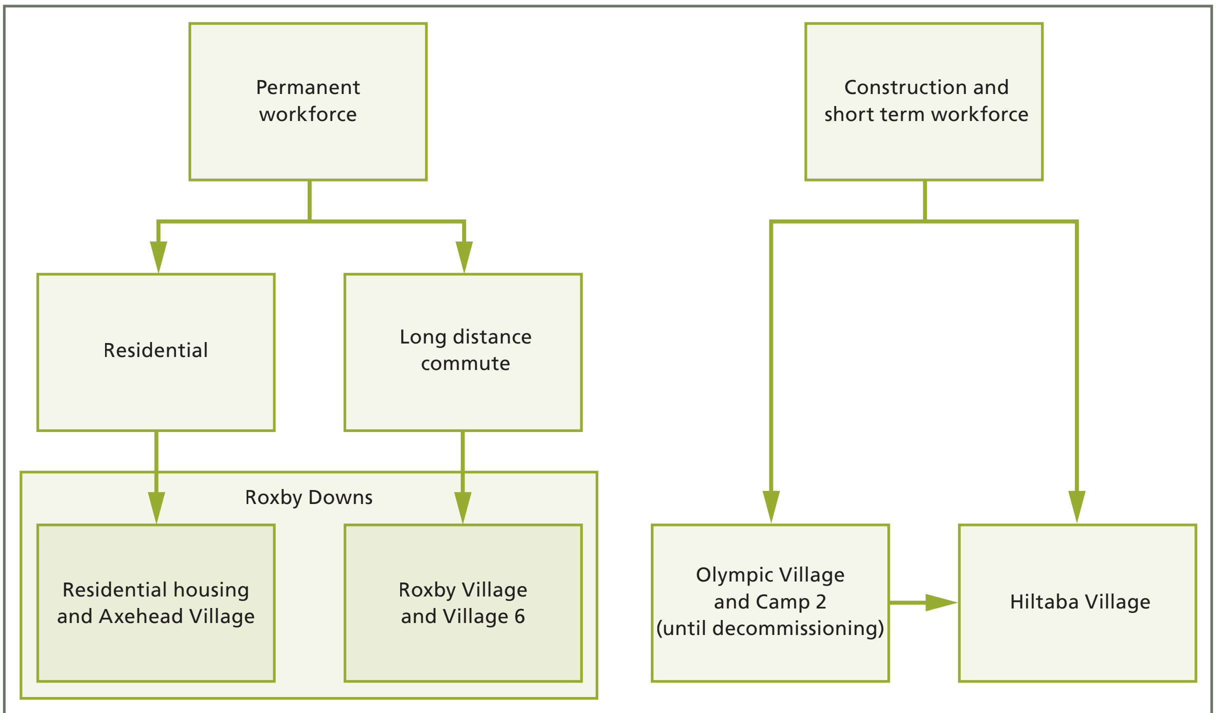


Figure 5.55 Proposed accommodation strategy

Table 5.64 Indicative workforce accommodation type profile for the expanded operation

Accommodation type	Peak population (FTE) by year			
	2010	2015	2020	2025
Permanent residential	50	1,350	1,900	2,000
Permanent long distance commute	50	1,350	1,900	2,000
Construction and short-term	1,500	5,900	2,300	0

Table 5.65 Indicative major demands for the proposed accommodation facilities

Expansion requirement	Roxby Downs[1]	Camp 2	Hiltaba Village
Water demand during construction (ML)	200	20	300
Water demand during operation (GL per annum)	1.8	0.002	0.8
Electricity consumption during operation (MWh per annum)	184,000	2,000	35,000
Peak construction/shutdown workforce	n.a.	50	300
Ongoing operational workforce	n.a.	10	120
Total land disturbance (ha)	465	10	60

[1] Roxby Downs data includes the existing infrastructure, Roxby Village, Axehead Village and Village 6 demands.

Permanent residential – Roxby Downs

The permanent residential workforce would be accommodated in an expanded Roxby Downs. The details of the proposed expansion are provided below.

Overview

The new open pit mine and the associated new metallurgical plant would see Roxby Downs grow up to an estimated 10,000 people. The predicted increase has been investigated and reported through the development of the Roxby Downs Draft Master Plan. The Draft Master Plan provides a framework for managing this growth over the next 10 to 20 years. The Draft Master Plan provides a guide for design-related issues affecting development and has been developed in consultation with Roxby Downs Council, relevant South Australian Government agencies, the existing Roxby Downs community and Olympic Dam workforce (see Appendix F4 for the Draft Master Plan).

The key features of the plan are provided in the following sections and illustrated in Figures 5.47 and 5.56. The Draft Master Plan (the supporting document to the Roxby Downs Development Plan Amendment) is on public exhibition, along with the Draft EIS. Comments on the Draft Master Plan will be taken into consideration as part of finalising the Master Plan and amending the Roxby Downs Development Plan.

A new transition-housing village, called Axehead Village because of its location on Axehead Road, would be established in Roxby Downs. This facility would have one, two and three bedroom self-contained houses, and would accommodate newly-started permanent residential employees and their families while they looked for permanent accommodation within Roxby Downs. The houses within Axehead Village would be similar in design to those detailed in the Draft Master Plan.

Context

Roxby Downs is about 14 km south of Olympic Dam, about 30 km west of Andamooka, 80 km north of Woomera and about 560 km by road north-north-west of Adelaide (see Figure 5.4). It was established in 1988 to accommodate workers and service providers for the Olympic Dam mining and processing operation.

The township currently has a population of about 4,500 people, including the permanent workforce, service providers, long-term contractors and their families. A small number of short-term contractors are also accommodated in Roxby Downs (at Roxby Village), although most are accommodated in the existing Olympic Village, 10 km north of Roxby Downs township.

Design

Sustainability

The following measures to promote sustainability were guiding principles in the development of the Roxby Downs Draft Master Plan:

- the installation of water saving appliances and fittings would be mandatory in all new households
- retention basins would be established in parklands to enable harvesting and reclaiming of stormwater for non-potable applications
- the principles of water sensitive urban design would apply
- treated effluent would be reclaimed from the new wastewater treatment plant for beneficial reuse to reduce the demand on the potable water supply
- renewable energy sources for the town would be investigated in conjunction with state and local government, focusing on domestic photovoltaic cells and/or purchasing renewable energy from electricity generators connected to the NEM

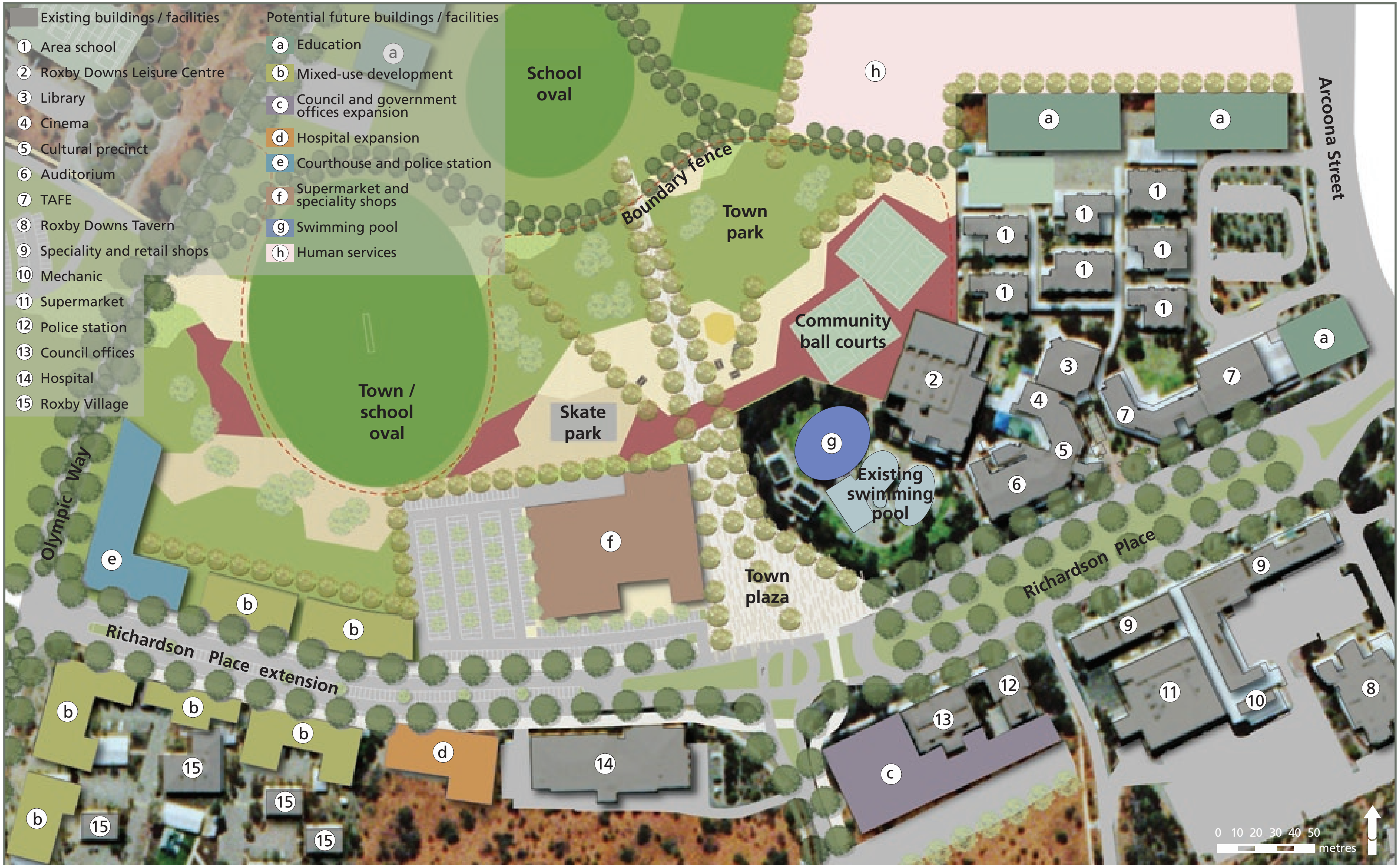


Figure 5.56 Proposed town centre for the expanded Roxby Downs

- solar water heating would be required for all new residential buildings and it would be mandatory for all new buildings to comply with the energy limits to be imposed by the Building Code of Australia 2008
- Department of Planning and Local Government's energy conservation measures would be incorporated into land and building layouts
- an understanding of shading and solar orientation would be incorporated into building design to minimise energy use, including the provision of wide eaves to new buildings
- urban development would be targeted to those areas identified as having lower ecological significance (as defined through an ecological survey of the wider Roxby Downs area: see Appendix F4).

Residential requirements

The following features are included within the Draft Master Plan to meet residential requirements:

- planning for the construction of over 2,500 new residential houses
- a range of average lot size yields of 350–450 m^2 (10%), 600–650 m^2 (35%), 650–700 m^2 (35%) and >750 m^2 (20%)
- two-storey, apartment living to be encouraged above retail and commercial ground floor uses, between the existing retail precinct and Olympic Way
- a new caravan park to be established for about 300 caravans on the eastern edge of town, off Axehead Road.

Civic and community infrastructure

The following features are included within the Draft Master Plan to provide for civic and community infrastructure requirements:

- a new open space system would be developed to strengthen a more connected township, focused on the town core connected to neighbourhood parks
- provision for a community centre that may include a range of mixed use community facilities, such as meeting rooms, council offices, a performing arts space, childcare centre, newspaper offices and a visitor information centre
- provision for a new primary school and early childhood services centre on the site of the Pioneer Drive caravan park
- provision for the Roxby Downs oval to be relocated to a site west of Olympic Way so that the existing oval could become the school oval
- provision for a new courthouse and police station at the intersection of Olympic Way and Richardson Place
- upgraded sport facilities, including a new sports and recreation complex west of Olympic Way
- provision for the racecourse and pony club to be relocated north of the existing motocross track
- provision for expanding the hospital and health services.

Commercial and retail

The following features are included within the Draft Master Plan to allow private sector development to meet the predicted commercial and retail demand:

- provision for expansion of the retail premises on both sides of Richardson Place, including provision for a second supermarket
- provision for the establishment of a new hotel/motel at the corner of the extended Richardson Place and Olympic Way
- provision for the expansion of the existing light industrial area north of Roxby Downs
- provision for the establishment of a new heavy industrial area to the north of Roxby Downs.

Construction phase

Construction method

The growth of Roxby Downs would occur gradually over the 11 years of the construction phase of the proposed expansion. It would initially involve surveying housing allotments, roadways and other infrastructure and progressively clearing vegetation and levelling land as required. Underground telecommunications, electricity, gas, water and wastewater services would be installed prior to building construction. Building materials and modular building units would be transported to site via rail to the Pimba intermodal facility, or on trucks from Adelaide, and houses and retail premises would be constructed on-site.

Water supply during construction

About 200 ML of low-quality water would be required for the construction activities associated with the growth of Roxby Downs, including earthworks and dust suppression. This would be sourced from local groundwater wells. Higher-quality water would be required for concrete manufacture and workforce amenities; this would be sourced from the existing on-site desalination plant as required.

Operation phase

Community and social services

Details of the services that may be required within Roxby Downs are discussed in Chapter 19, Social Environment.

Water supply during operation

Potable water would continue to be supplied to Roxby Downs via the existing on-site desalination plant, until the coastal desalination plant had been commissioned. Depending on the quality of water produced by this plant, water would either be pumped directly to the Roxby Downs potable water storage ponds for distribution around town, or be pumped to site, where a portion would be passed through the on-site desalination plant before being directed back to Roxby Downs. It is estimated that around 5 ML/d would be needed for the expanded township.

Telecommunications

The existing township network, consisting of a mix of optical fibre and copper connections, would be expanded to ensure there would be no decrease in services across the township. It is likely that new residences would be connected with dedicated optical fibre connections. The existing copper infrastructure would be augmented with additional optical fibre connections so that internet speeds in existing homes would be much the same as the new homes. In addition, wireless broadband may be made available as appropriate, either through establishing WiFi nodes, or through the Australian Government's WiMax wide area broadband service.

'Fibre to the node' connections to retail, commercial, leisure and government businesses in the town core would be available as a part of Telstra's ongoing program of increasing capacity to meet demand. The light industrial area of Roxby Downs is currently serviced by copper cable.

At the time of writing, Telstra is the only provider offering 3G mobile services in the Roxby Downs region; other carriers are limited to 2G and 2.5G. It is envisaged that when other carriers roll out their 3G services they would utilise the existing site sharing practice, thereby limiting the number of communication bases and masts required.

General and industrial waste management

It is expected that, at least initially, disposal to landfill would play a principal role in managing the additional solid wastes. The expansion is expected to increase municipal solid wastes to about 50,000 m^3 per annum and a total of around 42,000 m^3 of construction wastes would be created in the first few years.

New waste landfill cells would be constructed at the existing Opal Road facility, which, at the time of writing, had approximately three years of service remaining at current waste deposition rates.

It is proposed that the landfill facility would have three new landfill sections as shown in Figure 5.57, specifically:

- a new municipal landfill cell (about 5.6 ha)
- a waste and recycling transfer station (about 1.5 ha)
- a non-putrescibles landfill cell (about 3.8 ha).

The municipal landfill site would need to accommodate at least 2 million m^3 over a 40-year life at the estimated waste generation rates. The proposed landfill would be constructed, operated and closed in compliance with the EPA Guidelines for Environmental Management of Landfills. Development, operation and closure would occur in discrete cells, each with a life of about five years.

The proposed transfer station would be used to segregate recyclable material, which would be transferred via rail containers to Adelaide for recycling, maximising both the recovery of resources and the design life of the municipal landfill.

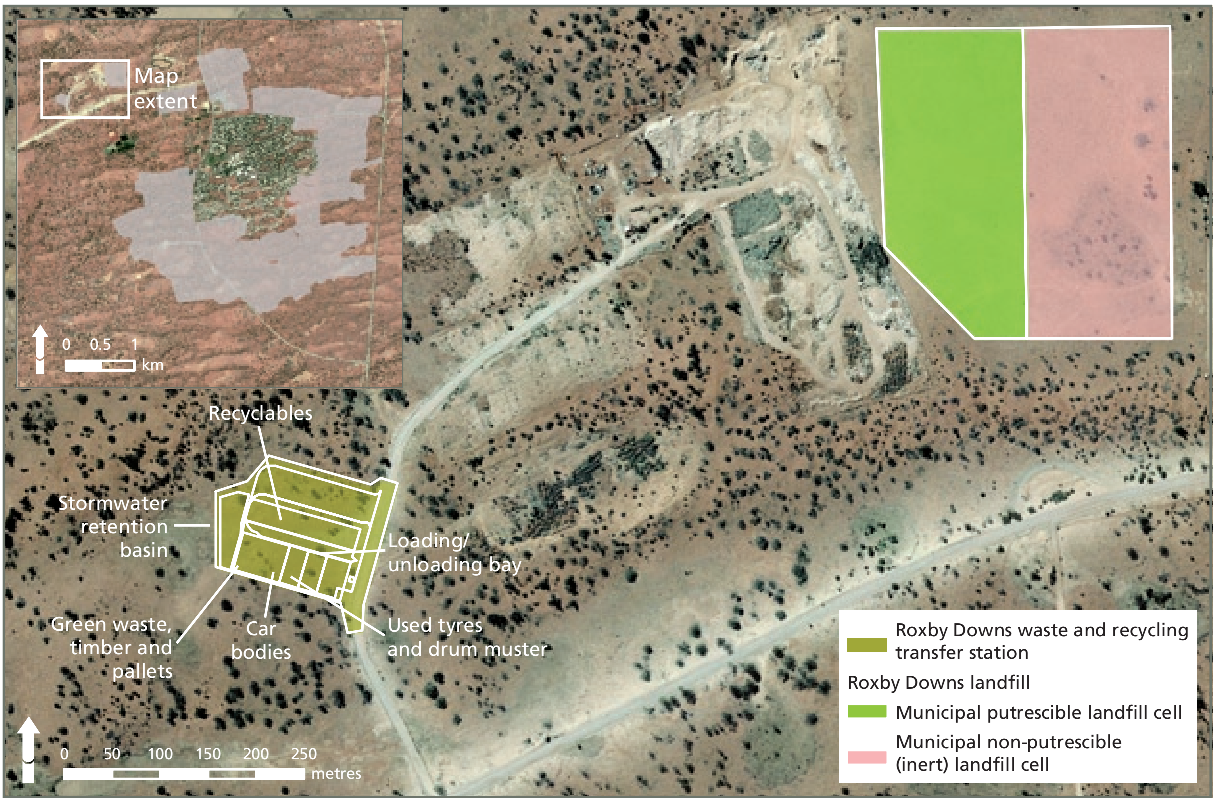


Figure 5.57 Indicative configuration of the proposed Roxby Downs waste management facilities

The landfill for non-putrescibles would be an unlined facility designed to accommodate waste generated as a result of construction and demolition activities external to the mining lease.

Sewage management

An upgrade and expansion of the existing wastewater treatment system is proposed, which would be developed in stages to service both Roxby Downs and the proposed Hiltaba Village. Predicted daily flow rates for the new treatment facility would average about 2.9 ML/d with a peak of about 5.9 ML/d.

The proposed wastewater treatment system would include an HDPE-lined aeration lagoon of about 12.5 ML/d capacity and a settling/sludge lagoon system of about 20.5 ML capacity. The wastewater from Roxby Downs and Hiltaba Village would then undergo tertiary treatment, consisting of disinfection and filtration. The sludge from filtration would be periodically removed and disposed of at a licensed landfill facility. The system would be designed for the combined peak population of Roxby Downs and Hiltaba Village, and also be capable of operating efficiently with a smaller population as the peak construction workforce declined. The facility would be located at least 400 m from the nearest proposed residence, exceeding SA EPA requirements (see Figure 5.47 for location). Treated wastewater from the storage lagoons would be reticulated to public and government open space areas to irrigate landscapes and sports facilities, including the golf course, community and school ovals, civic gardens, hospital grounds and streetscape plantings.

Permanent long distance commute – Roxby Village and Village 6

A proportion of the proposed permanent workforce (up to 50%) would reside in areas other than the Roxby Downs region, and would be employed on a drive-in drive-out or fly-in fly-out basis. It is expected that about 60% of the LDC workforce would reside in the Upper Spencer Gulf region, around 30% would commute from elsewhere in South Australia, and around 10% would travel to site from interstate. While on-site, the permanent LDC workforce would reside in one of two accommodation facilities (either Roxby Village or Village 6) (see Figure 5.47).

Roxby Village would not be expanded, and would remain at around 800 single ensuite rooms. A new Village 6 would be established to the west of Roxby Village, which would be divided into two types of accommodation. About 1,300 camp-style rooms similar to those at Roxby Village (i.e. around 16 m^2 in floor area with a single bed and an ensuite) would be established. A range of facilities similar to Roxby Village would also be provided, including a gym, mess facilities, a tavern and other entertainment infrastructure. In addition to the camp-style rooms, about 500 self-contained cabins would be built. These would be around 30 m^2 in floor area, and would feature a separate bedroom, living room and kitchen.

Construction and short-term workforce – Olympic Village, Camp 2 and Hiltaba Village

The workforce required during the construction phase of the proposed expansion, together with the short-term workforce required for routine plant maintenance shutdowns, would be accommodated within the existing Olympic Village, a redeveloped Camp 2 and the proposed Hiltaba Village (see Figure 5.5 for locations).

Olympic Village

Olympic Village currently accommodates around 1,365 people. There are plans under the existing operation to expand it to around 2,865 rooms with a corresponding increase in the capacity of the existing facilities, including the mess and wet mess, gym and other entertainment facilities. No further expansion of Olympic Village would be undertaken for the proposed expansion.

To minimise potential exposure to dust and noise impacts during the development of the open pit mine and the associated RSF, residents at Olympic Village will be relocated to Hiltaba Village. It is estimated this would occur in Year 2 or 3 of the expanded operation. The existing rooms and facilities would be decommissioned and either relocated to Hiltaba Village or sold to a third party. The area would not be rehabilitated because it would eventually be covered by the RSF.

Camp 2

Camp 2, located about 200 m south of Olympic Village, would be redeveloped to accommodate around 250 pre-mine contractors. This camp would be entirely self-contained and require construction of a mess, a tavern, laundry and office facilities. An all-weather road would be established to service the camp, and electricity and telecommunications infrastructure would be connected.

About 45 kL/day of potable water would be required for laundry and amenities at the camp. Wastewater would be pumped to the Olympic Village wastewater treatment plant for treatment and disposal.

Later, Camp 2 would be decommissioned at the same time as Olympic Village; Camp 2 is also within the footprint of the ultimate RSF.

Hiltaba Village

Overview

The main proposed workers' village (Hiltaba Village) would be located approximately 17 km east of Roxby Downs along the Andamooka Road, near the proposed new airport (see Figures 5.5 and 5.58). Construction of Hiltaba Village would begin immediately after approval of the EIS and it would be occupied as accommodation areas are completed.
Hiltaba Village would accommodate a workforce during the construction phase averaging 6,000 people, and up to 10,000 people during peak construction activity. Areas of the village would be decommissioned after the peak of the construction period, but be able to be recommissioned to meet future needs.

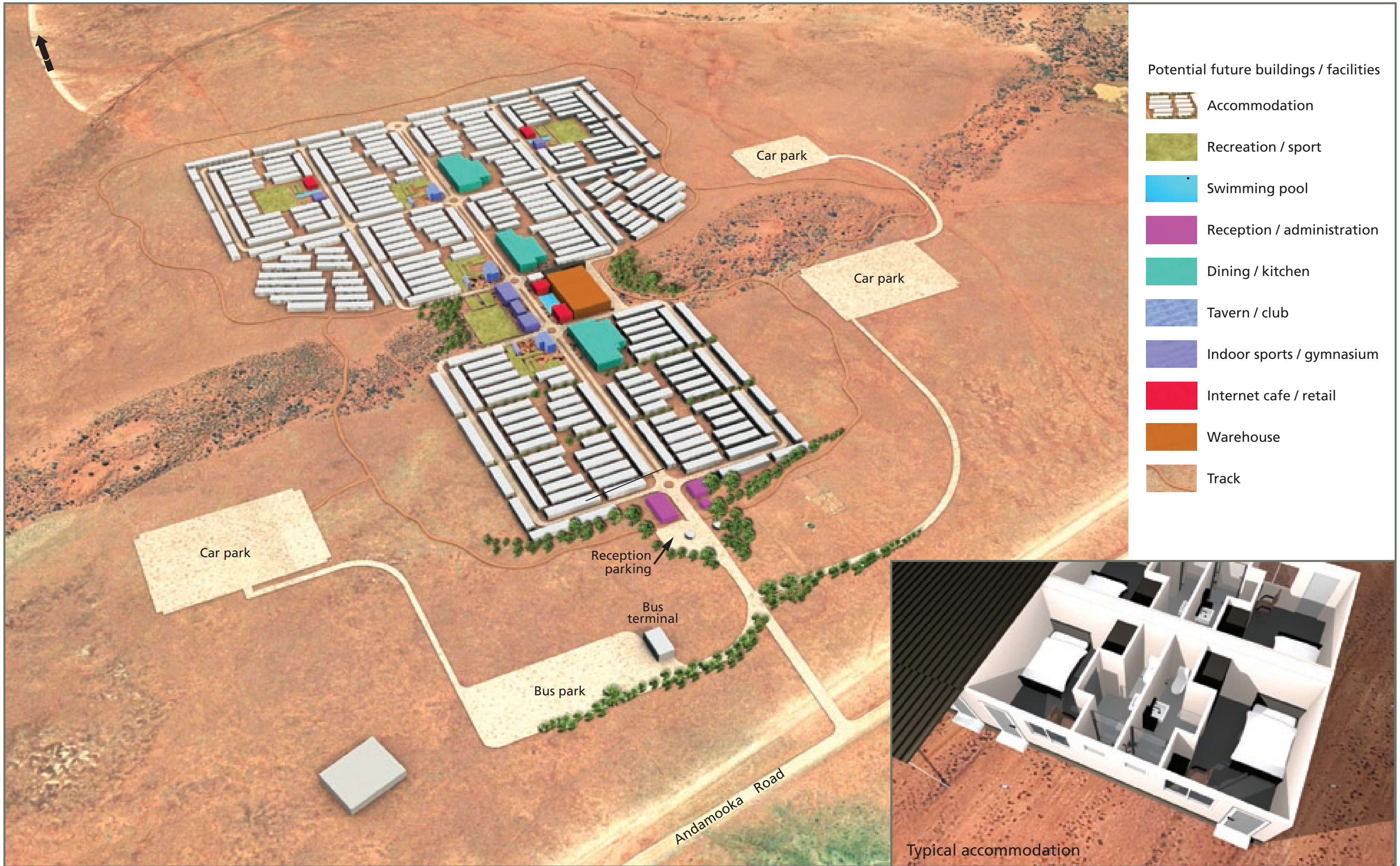


Figure 5.58 Conceptual layout of Hiltaba Village

The average capacity would be reduced to about 2,000 short-term workers (with a peak of 3,000).

A workforce commuter bus service would be established to link the airport, Hiltaba Village and the main work sites (for example, the new metallurgical plant or the Roxby Downs expansion) during both the construction phase and the ongoing operation.

Construction phase

Construction method

Hiltaba Village would be built in stages as the construction workforce expanded and would be decommissioned in stages as it contracted. This would provide maximum flexibility and efficiency in accommodating wide-ranging numbers of short-term contract workers. The village would be provided with amenities and facilities in modular precincts for about 3,000 persons, and each module would be fully self-contained (see Figure 5.58). Ensuite accommodation units would be provided, together with kitchens, a tavern and laundry and recreational facilities.

Water supply during construction

About 300 ML of low-quality water would be required for the construction of Hiltaba Village. This would be sourced from local groundwater wells and used for earthworks and dust suppression. Potable water would be required for the manufacture of concrete and would be sourced from the on-site desalination plant. It would be brought to site initially via the Andamooka water supply line or a temporary water supply line and ultimately through a permanent potable water supply pipeline from Roxby Downs.

Workforce accommodation

Workers would be accommodated either in temporary on-site facilities at the Hiltaba Village location, or in Olympic Village or Roxby Village until Hiltaba Village accommodation is available. Waste materials generated would be collected and disposed of to the existing Roxby Downs waste management facility. Wastewater would be treated and disposed of to landscaping pending a wastewater main connected to the Roxby Downs wastewater treatment plant.

Operation phase

As the construction activities and short-term workforce numbers reduced, a significant number of the units at the Hiltaba Village would become redundant. The redundant units may be sold and removed, and the disturbed area would be rehabilitated and revegetated as appropriate. The remaining units would provide short-term accommodation for maintenance and shutdown workers.

Water supply during operation

Potable water would be sourced from the GAB (within approvals) and treated on-site via desalination until the coastal desalination plant was operational. Water would be pumped from Roxby Downs via a dedicated pipeline to storage at Hiltaba Village, which would have sufficient capacity to provide for the airport and Andamooka. Peak water demand would be about 2 ML/d for domestic use. The system would have sufficient capacity to meet peak water demands and fire safety needs.

The existing water supply pipeline to Andamooka would be disconnected and reconnected to the Hiltaba Village supply reservoir at Hiltaba Village.

Telecommunications

A high capacity underground optical fibre connection would be provided to Hiltaba Village for voice and broadband data services. The fibre may also be used to deliver cable television services to the village. Distribution of services to each room may use voice-over-internet and television-over-internet distribution.

Off-site infrastructure accommodation

In addition to the accommodation provided at Hiltaba Village, short-term accommodation would be required for over 1,000 workers building the off-site infrastructure components of the project. The majority of this accommodation would be in existing short-stay accommodation in Port Augusta, Whyalla and Woomera, although it is anticipated that some accommodation camps would be established along the more remote infrastructure corridors, such as the gas pipeline corridor options. Where required, these would be located adjacent to proposed laydown/setdown areas to minimise the vegetation disturbance footprint. The off-site workforce accommodation profile is summarised in Table 5.66.

Table 5.66 Indicative off-site infrastructure accommodation profile

Accommodation centre	Peak construction workforce	Operational workforce
Woomera	260	80
Port Augusta	100	30
Whyalla	500	30
Darwin	50	50
Adelaide	50	50
Temporary accommodation camps	100[1]	Nil

[1] Up to four temporary camps would be established on the preferred gas pipeline route between Olympic Dam and Moomba.

Heavy industrial area

The existing heavy industrial area at Olympic Dam Village (consisting of about 20 contractor site operations leases) would be relocated as a part of the proposed expansion, as the open pit and RSF expanded over time. The heavy industrial area would be relocated to a new area approximately 3 km south of the existing Charlton Road estate (see location overview in Figure 5.5 and detail in Figure 5.59). This area would be serviced by feeds from the existing transmission line, water supply pipeline and telecommunications infrastructure running between Roxby Downs and the Olympic Dam operation. On-site wastewater treatment would be provided at each allotment.

Figure 5.59 Layout of the proposed Heavy Industrial Area