

25.1 INTRODUCTION

The preceding chapters of the Draft EIS identified the predicted impacts and benefits of the expansion project, outlined management measures to reduce impacts and maximise benefits, and discussed and categorised residual impacts and residual benefits (defining those as likely to occur after the proposed management measures or commitments have been implemented). This chapter provides a consolidated list of these residual impacts and benefits and discusses their cumulative effects. It also collates those assessments of cumulative effects of the expanded operation (i.e. the existing operation plus the proposed expansion), and the cumulative effects of the Olympic Dam project and other major projects in the region of Olympic Dam and/or its associated infrastructure. In addition, this chapter provides an overview of how the proposed expansion addresses the guiding principles of ecologically sustainable development.

25.2 CUMULATIVE EFFECTS FROM THE PROPOSED EXPANSION

Table 25.1 shows the criteria used to categorise the residual impacts and benefits of the proposed expansion (see Chapter 1, Introduction, Section 1.6.2 and Figure 1.11 for details). These categories have been used for the purpose of ranking each of the issues assessed in the Draft EIS to guide future management attention, whereby further design modifications will be explored for high residual impacts and additional management measures will be investigated and adopted if practicable for moderate residual impacts (see Figures 25.1a to c). The consolidated list of the residual impacts and residual benefits is provided in Table 25.2.

Table 25.1 Criteria used to categorise residual impacts and residual benefits

Category	Residual impact		Residual benefit
	Where legislated criteria exist ¹	Where legislated criteria do not exist	Where legislated criteria do not exist
None/negligible	A change below detectable limits	No detectable impact	No detectable benefit
Low	An effect but within compliance limits/standards	Short-term impact ² to a common or local receiver ³	Short-term local benefit
Moderate	A short-term non-compliance ⁴	a) Short-term impact to a sensitive or state-wide receiver ⁵ b) Long-term ⁶ impact to a common or local receiver	a) Short-term state-wide benefit b) Long-term local benefit
High	A regular or consistent non-compliance	Long-term impact to a sensitive or state-wide receiver	Long-term state-wide benefit

¹ Includes listed flora and fauna species (including listed migratory birds).

² Short-term impact/benefit is a period of <3 years, corresponding with the maximum time to construct off-site infrastructure.

³ A common receiver is defined for the purpose of the Draft EIS as one that is not afforded additional protection under legislative Acts or Regulations and a local receiver is defined as one within the EIS Study Area.

⁴ Short-term non-compliance of a daily limit for air and noise and a period of <3 years for listed species.

⁵ A sensitive receiver is defined for the purpose of the Draft EIS as one that is afforded additional protection under a legislative Act or Regulation or a critical population group.

⁶ Long-term impact/benefit is a period of <3 years.

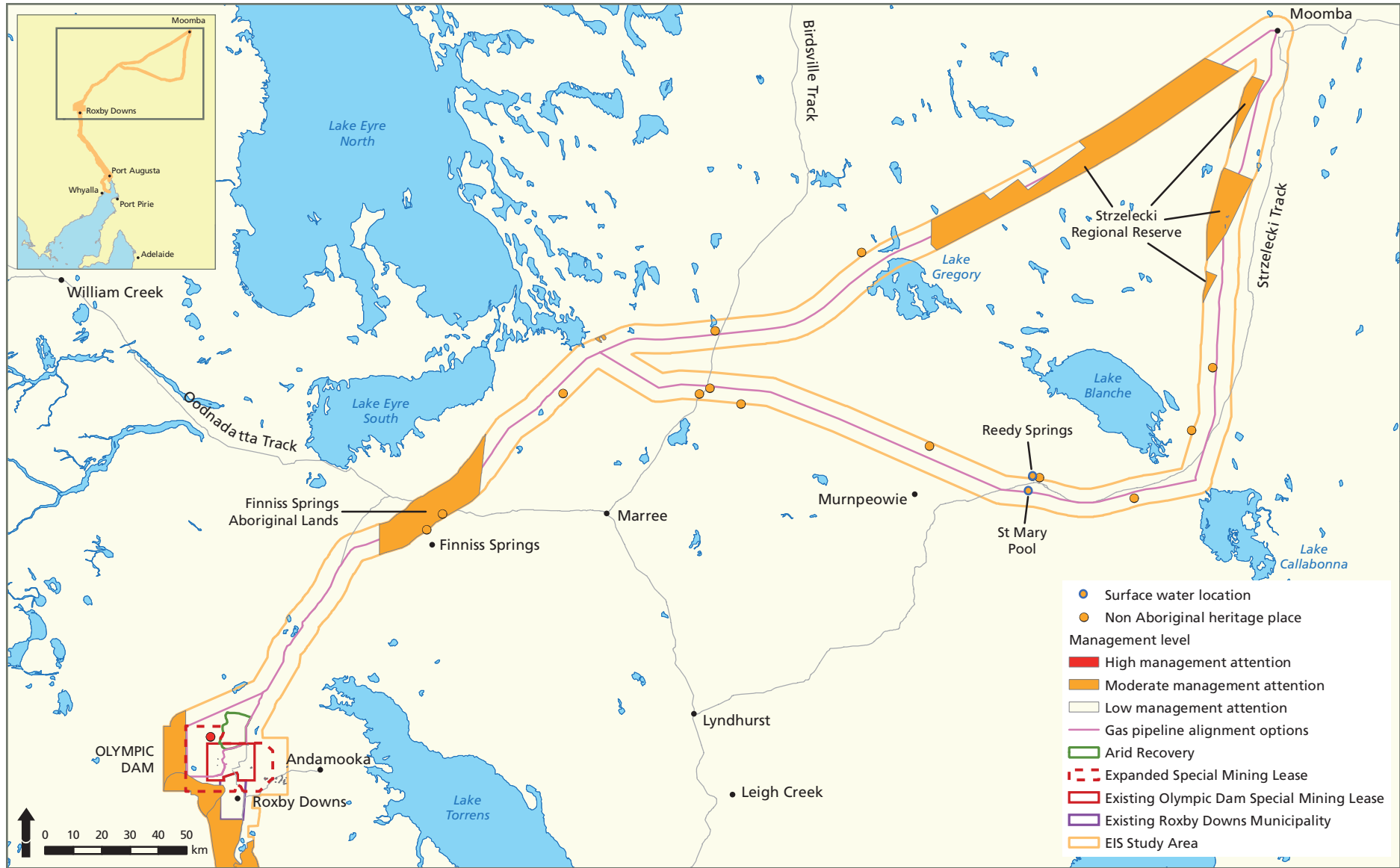


Figure 25.1a Management levels relevant to cumulative effects for the gas pipeline corridor options

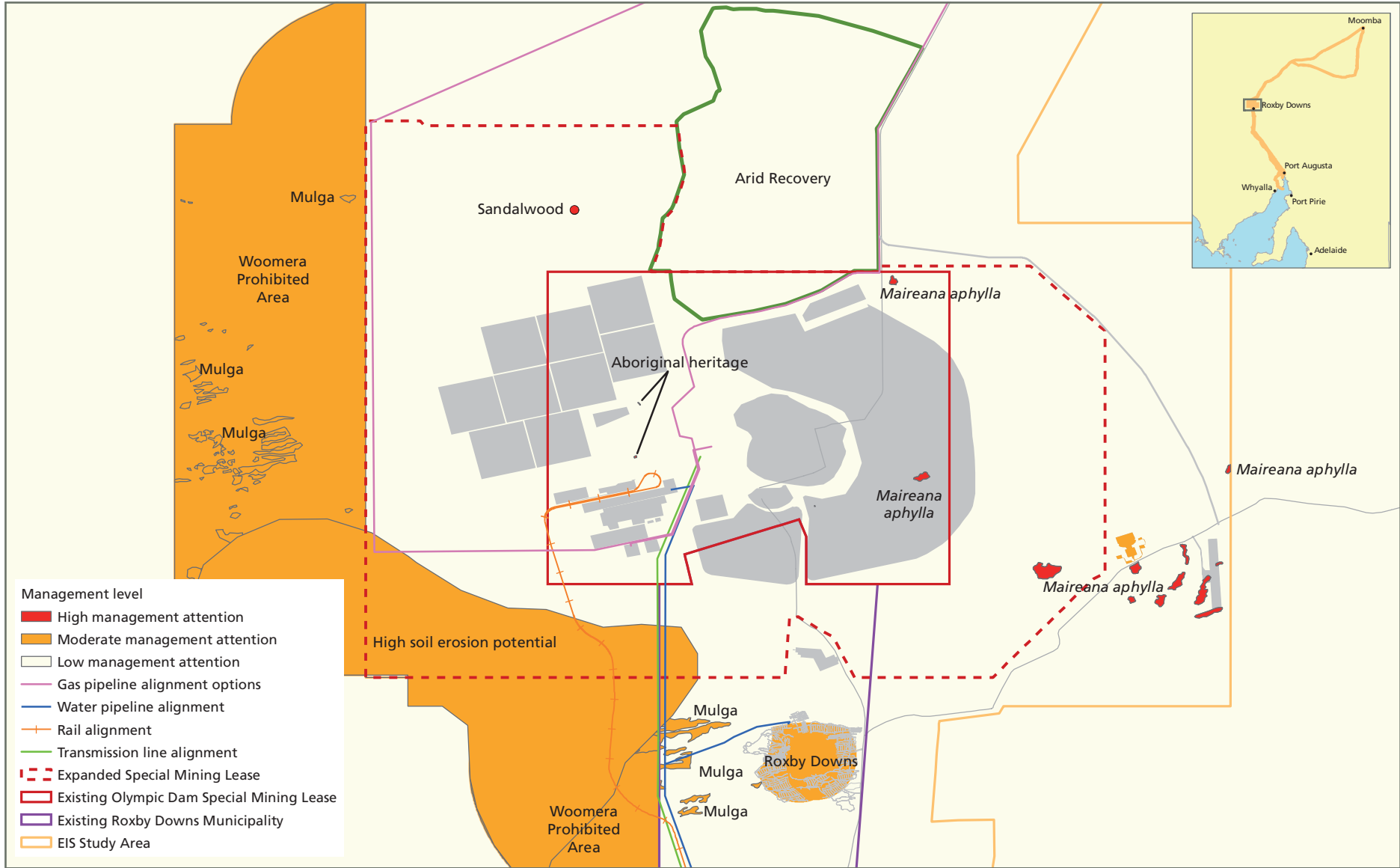


Figure 25.1b Management levels relevant to cumulative effects for Olympic Dam and Roxby Downs

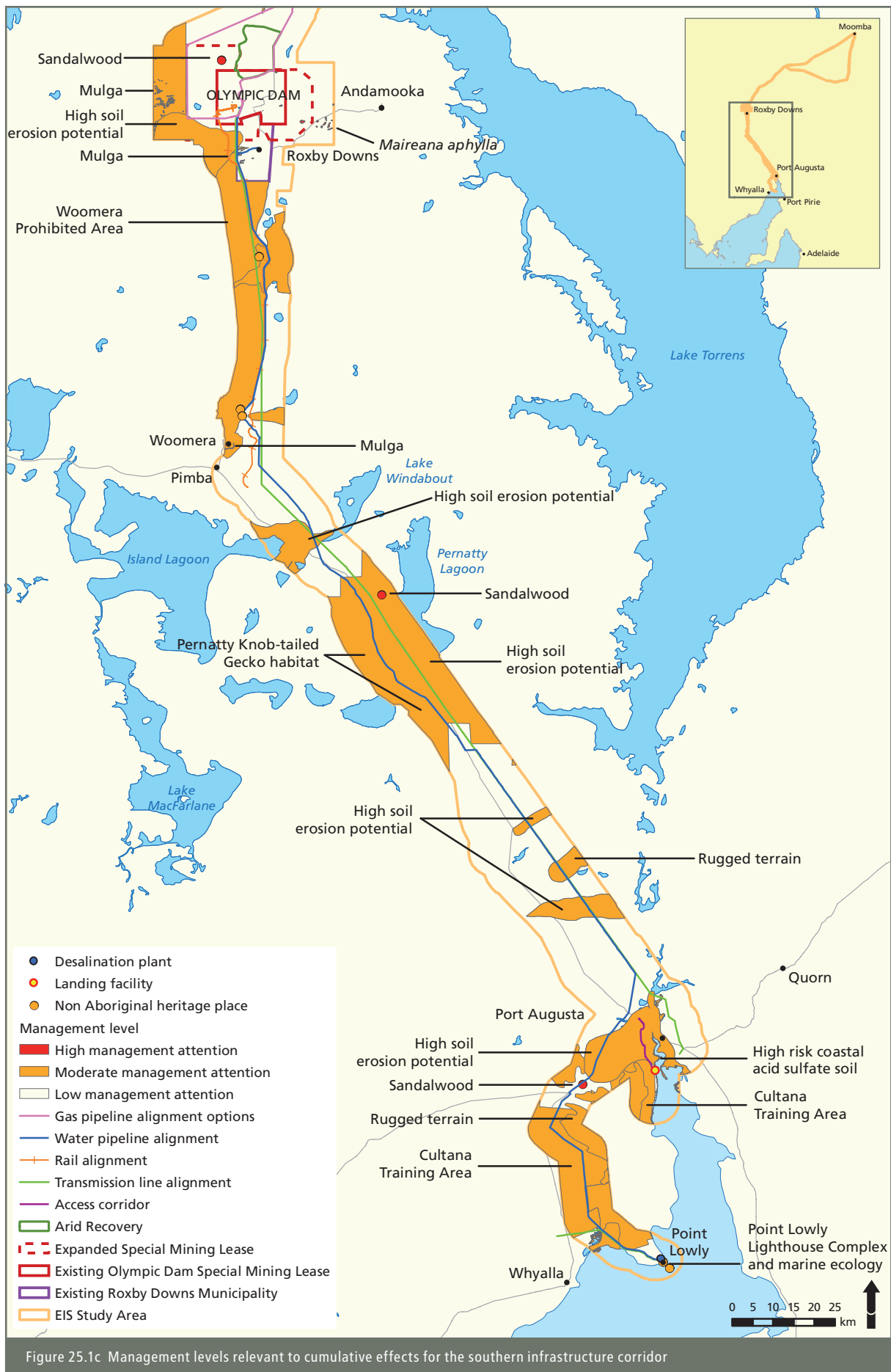


Figure 25.1c Management levels relevant to cumulative effects for the southern infrastructure corridor

Table 25.2 Compilation of residual impacts and benefits

Section	Description of effect	Residual impact ¹	Residual benefit ¹
Environmental effects			
10.5.1	Soil erosion and the resulting sedimentation	Low	
10.5.2	Disturbance to acid sulfate soils leading to acidic run-off	Negligible to Low	
10.5.3	Collapsing and swelling soils	Negligible	
10.5.4	Soil contamination	Negligible to Low	
10.5.5	Disturbance to fossils	Negligible	
11.5.1	Change to drainage patterns	Negligible to Low	
11.5.1	Infiltration of stormwater into groundwater	Negligible	
11.5.2	Change to surface water quality	Negligible to Low	
11.5.4	Accumulation of water in the open pit	Moderate	
12.6.1	Changes to groundwater levels – regional aquifers	Moderate	
12.6.1	Changes to groundwater levels - GAB	None	
12.6.1	Changes to groundwater levels – saline wellfields	Low	
12.6.2	Effect on groundwater quality – seepage from TSF and RSF	Low to Moderate	
12.6.3	Groundwater drawdown effect on third parties – Stuart Shelf	None	
12.6.3	Groundwater drawdown effect on third parties – infrastructure corridors	Low	
13.2.5	Greenhouse gas emissions	High	
13.3.5	Predicted ground level dust concentrations around the SML – particulates emissions	Moderate	
13.3.5	Predicted ground level concentrations around the SML – other airborne emissions	Low	
14.5.2	Noise levels – around the SML	Low	
14.5.2	Noise levels – desalination plant	Low	
14.5.2	Noise levels – road traffic (Roxby Downs)	Moderate	
14.5.2	Noise levels – landing facility	Moderate	
14.5.2	Noise levels – Sulphur handling facility	Low	
14.5.2	Noise levels – relocated airport	Low	
14.5.2	Noise levels – transmission line, water supply and gas pipelines, rail line, Pimba intermodal and port facilities	Negligible	
14.5.2	Vibration – around the SML	Negligible	
14.5.2	Vibration – desalination plant	Low	
14.5.2	Vibration – rail	Negligible	
15.5.1	Vegetation clearance	Moderate	Moderate
15.5.2	Habitat fragmentation	Negligible to Low	
15.5.3	Listed ecological communities	Low	
15.5.4	Listed flora species	Negligible	
15.5.5	Listed fauna species	Negligible to Moderate	
15.5.7	TSF and wildlife, including threatened water birds	Negligible	Moderate
15.5.7	TSF and wildlife attracted to beach habitats	Moderate to High	
15.5.8	Potential ecological effects on groundwater dependent ecosystems	Negligible	
15.5.9	Emissions of dust and sulphur dioxide on fauna and flora	Moderate	Moderate
15.5.9	Radon emissions on fauna and flora	Negligible	
15.5.10	Emissions of noise and light on the reintroduced threatened fauna in the southern section of Arid Recovery	High	
15.5.11	Entrapment of fauna in the temporary water pipeline trench	Low	Moderate
15.5.11	Effect on birds from collision with the transmission line	Low	
15.5.11	Potential for introduction or spread of weeds	Low	
15.5.11	Potential for introduction or spread of vertebrate animal pests	Moderate	
15.5.11	Potential ecological effects from increased recreational activities around Roxby Downs	Moderate	
16.6.3	Water quality near the outfall at Point Lowly	tbc ²	
16.6.4	Accumulation of salt in Spencer Gulf	Negligible	

Table 25.2 Compilation of residual impacts and benefits (cont'd)

Section	Description of effect	Residual impact ¹	Residual benefit ¹
16.6.5	Potential ecological effect on marine ecosystem (within 100 m of the desalination plant return water outfall)	Moderate	
16.6.5	Potential ecological effect on marine ecosystem beyond 100 m of the outfall and within the 1:85 dilution contour, with a maximum extent 3.9 km along the direction of tidal flow to the south west or 2.1 km to the north-east of the outfall	Low	
16.6.5	Potential ecological effect on marine ecosystem beyond the 1:85 dilution contour	Negligible	
16.6.6	Effect of return water discharge on listed or otherwise significant species	Negligible to Moderate	
16.6.7	Effect of return water discharge on the Australian Giant Cuttlefish	Negligible	
16.6.8	Effect of return water discharge on Yellowtail Kingfish aquaculture in Fitzgerald Bay, macroalgal production in False Bay, Pacific Oyster farms in Franklin Harbor and Snapper near Point Lowly	Negligible	
16.6.8	Effect of return water discharge on Western King Prawn and species not individually tested (e.g. Blue Swimmer Crab), within 100 m of the outfall	Moderate	
16.6.8	Effect of return water discharge on species not individually tested (e.g. Blue Swimmer Crab) within the 1:85 dilution contour	Low	
16.6.8	Effect of return water discharge on commercial and recreational fisheries	Negligible	
16.6.9	Effect on stratification and deoxygenation	Negligible	
16.6.10	Effect on marine biota from impingement and entrainment from the desalination plant intake structure	Negligible	
16.6.11	Effect on marine ecology from construction operations – at desalination plant	Low	
16.6.12	Effect on marine ecology from construction operations – at landing facility	Negligible	
16.6.12	Effect on sediment movement from the landing facility	Negligible	
16.6.13	Effect on marine ecology from shipping operations and port activity	Negligible	
Cultural effects			
17.5.1	Potential impact on significant archaeological sites	Low	
17.5.2	Ongoing involvement of Aboriginal communities		High
17.5.4	Disturbance to archaeological sites	Moderate	
17.5.5	Potential disturbance to currently undiscovered sites	Low	
18.5.1	Potential disturbance to the Point Lowly Lighthouse Complex	Low	
18.5.2, 18.5.3	Potential disturbance to other sites of non-Aboriginal cultural heritage value	Negligible	
Social effects			
19.5.1	Labour supply	High	High
19.5.1	Business development		High
19.5.2	Crime and anti-social behaviour	Low	
19.5.3	Housing supply and affordability	Low	Moderate
19.5.5	Social character and well-being at Roxby Downs	Moderate	Moderate
19.5.6	Access and disturbance issues – effect of increase in road and rail traffic	Moderate	
19.5.6	Access and disturbance issues – landholders	Low	
19.5.6	Access and disturbance issues – energy supply	Negligible	
Economic effects			
21.4.1	The national, state, regional and local economies		High
21.4.2	Capital and labour resources		High
21.4.3	Potential effects on industry		High
21.4.4	Government revenues and expenditure		High
21.4.5	Contribution to South Australia's Strategic Plan		High
21.4.6	Effect on trade balances		High
Health and safety			
22.6.2	Open pit mining	Low	
22.6.3	Metallurgical plant expansion	Low	

Table 25.2 Compilation of residual impacts and benefits (cont'd)

Section	Description of effect	Residual impact ¹	Residual benefit ¹
22.6.5	Workforce exposure to radiation	Low	
22.6.6	Public exposure to radiation	Low	
22.6.7	Community health impacts from dust	Low	
22.6.9	General transport safety	Moderate	
22.6.10	Product transport safety	Low	

¹ Note that for those issues that have both a residual impact and benefit, this reflects a short-term impact and a longer-term residual benefit.

² To be determined once appropriate guidelines and mixing zone size have been provided by the SA EPA.

Table 25.2 shows that the residual impacts and benefits from the proposed expansion vary across the key sustainability pillars (i.e. environmental, social, cultural and economic).

The outcomes are:

- design modifications have successfully removed high residual impacts for all assessed issues except greenhouse gas emissions and for those that impact upon migratory species that may utilise the TSF beach areas, indirect impacts such as noise and light emissions to naturally extinct but reintroduced threatened fauna in the southern sections of Arid Recovery, and the drawdown of labour from other businesses
- the majority of environmental, cultural and short-term social effects would be managed to a negligible, low or moderate impact level
- the proposed expansion would have a moderate to high benefit for the social and economic environment at a local, state and national scale, and a high residual benefit for ongoing Aboriginal involvement.

A risk assessment of unplanned events has also been undertaken for the Draft EIS (see Chapter 26, Hazard and Risk, for details). This assessment included the compounding or cumulative effects that a fault or failure in one component of the project may have on another component and the resulting consequences. As per the process outlined in Section 1.6.2 of Chapter 1, Introduction, design modifications were made to ensure that no intolerable risks from cumulative events for the expansion project remained.

25.3 CUMULATIVE EFFECTS FROM THE EXPANDED OPERATION

The assessment undertaken for the Draft EIS, while focused on the components of the proposed expansion, have also, where relevant, assessed the impact of the expanded operation (i.e. the existing operation plus the proposed expansion). Table 25.3 collates the relevant findings.

25.4 RELATIONSHIP TO OTHER MAJOR PROJECTS

The proposed Olympic Dam expansion may also have some effect on the demands and requirements of other projects in South Australia and the Northern Territory. The expansion has therefore been considered in relation to:

- other projects within the vicinity of Olympic Dam
- other projects within South Australia
- other projects within the Northern Territory.

The following does not provide an exhaustive list of the projects being planned or constructed within South Australia or the Northern Territory. Rather, it aims to discuss those major projects considered to be of most relevance to the expansion project. An overview of each project and its relevance to the proposed expansion is provided below, and the location of the projects within South Australia and the Northern Territory are shown on Figures 25.2 and 25.3, respectively.

25.4.1 PROJECTS IN THE VICINITY OF OLYMPIC DAM Prominent Hill – OZ Minerals copper and gold mine

The Prominent Hill project, about 130 km north-west of Olympic Dam, received South Australian Government approval in August 2006. The mine lease application area (MLA) is about 80 km², and within that, the footprint of the mine and infrastructure comprises approximately 13 km² (Enesar Consulting 2006). The major components are an open pit, integrated waste landform and linear service infrastructure (for water and electricity supply).

Construction started in late 2006 and the operation employs about 400 staff. Some of this workforce has been sourced via a training program targeting people from Coober Pedy, Port Augusta, Oodnadatta and other regional towns. Small on-site camps accommodate the permanent workforce. A construction village for 600 people is accommodating the short-term workforce. The life-of-mine is predicted to be 10 years.

The mine requires about 16 ML/d of water sourced from a wellfield in the Arckaringa Basin, which contains 12–18 wells. An additional demand for 5 ML/d of water during the construction phase is being supplied from local saline groundwater wells. Energy will be supplied via a 132 kV line connected to the South Australian grid at the Olympic Dam west substation, with a demand of 50 MW, consuming approximately 210 GWh per annum. The project has access to South Australia's road, rail, port and power infrastructure and concentrate will be exported via the Port of Darwin.

Prominent Hill is relevant to the proposed Olympic Dam expansion in relation to:

- increased energy demand from the state's electricity grid
- competing demand for labour
- additional greenhouse gas emissions and the challenge of meeting South Australia's reduction target
- potential reliance on Roxby Downs for the supply of goods, services, accommodation, support and emergency services.

Table 25.3 Cumulative effects of an expanded Olympic Dam operation

Impact assessment chapter	Issue	Cumulative effect
Groundwater	Extent of groundwater drawdown	The existing underground and the proposed open pit mining methods require removal of groundwater (i.e. depressurisation and dewatering) to operate safely and efficiently. The current operation dewater between 1.3–2.1 ML/d and the proposed open pit would require depressurisation drilling of 15 ML/d initially, reducing to around 5 ML/d within five years and for the ongoing operation and post closure. The groundwater drawdown from the proposed open pit would extend about 20 km to the north and about 45 km to the south. This would override the current groundwater drawdown effect from the existing underground operation (which extends up to 10 km).
	Groundwater mound beneath the tailings storage facilities	The existing TSF contribute around 0.5 to 1.5 ML/d to the groundwater, resulting in a groundwater mound beneath the TSF rising to the height of 65 m AHD (or 35 m below ground level). Current approvals require that groundwater levels do not rise above 80 m AHD (or 20 m below ground level). The proposed TSF would contribute an additional 3.2 ML/d to the groundwater. However, design of the new TSF would result in a considerable reduction in seepage rate per hectare and the height of the groundwater mound would remain at similar levels (65 m AHD) and therefore remain within compliance limits.
Air Quality	Particulates (i.e. dust)	The existing underground operation emits very little dust, and would therefore contribute very little to a cumulative effect. There is an existing on-site quarry to source material for backfilling the underground mining stopes. Some dust is generated from this quarry, however quarry operations would cease upon commencement of open pit mining as this would generate sufficient material to meet the demand for backfill within the existing mining operation.
	Other airborne emissions	Ground level concentrations of other airborne emissions (e.g. sulphur dioxide, oxides of nitrogen, carbon monoxide) from the existing operation are generally within compliance limits (the one-hour maximum average criterion for sulphur dioxide in the year 2000 and 2001 were exceeded, as a result of two bypass events in the acid plant). The proposed metallurgical plant would emit the same compounds in about the same specific concentrations as the existing plant, but at higher emission rates. The cumulative effect of emissions from the existing and proposed metallurgical plants has been assessed and would remain below applicable limits (see Figure 13.20a for details).
Noise and Vibration	Noise levels	Noise from the existing operation was not detectable at Roxby Downs during baseline noise surveys. Therefore, noise emissions from the existing operation would not contribute to a cumulative effect at Roxby Downs. Noise from local traffic and air conditioners within Roxby Downs would remain the most significant noise source in terms of impact to community amenity.
	Vibration levels	In the existing underground operation, a series of controlled blasts are used to break the ore within a stope and associated development drives, with the total volume of material blasted being about 12 Mtpa, largely consisting of ore with minor quantities of mine rock. The new open pit mining operation would blast in the order of 410 Mtpa of material, consisting of around 60 Mtpa ore and around 350 Mtpa mine rock. The vibration levels of the combined operations would not, however, extend beyond several hundred metres of the blasts and would not affect any third-parties.
Terrestrial Ecology	Vegetation clearance	The existing operation currently occupies a footprint of about 1,000 ha, and requires very little ongoing vegetation clearance (less than 10 ha per annum). The proposed expansion would increase the disturbance footprint over 40 years by about 17,000 ha. The vegetation associations over which the disturbance footprint occurs are widespread in the rangelands of South Australia. To place this in context, the cumulative footprint of the expanded operation over 40 years represents about 1.3% of the vegetation within the EIS Study Area (and thus the local environment).
	Listed migratory species	The existing operation affects listed migratory birds, with six listed migratory species having recorded mortalities from the current tailings retention system. The proposed expansion has implemented significant design modifications to reduce the expansion's impact through thickened tailings, covered central decant ponds and smaller covered balance ponds rather than open evaporation ponds. The water balance for the proposed expansion is such that more water would be evaporated from the increased area of TSF beaches than deposited, allowing for the acidic liquor within the existing TSF cells and evaporation ponds to be significantly reduced. This would have a significant benefit for the listed migratory species that utilise open water.

Table 25.3 Cumulative effects of an expanded Olympic Dam operation (cont'd)

Impact assessment chapter	Issue	Cumulative effect
Aboriginal Heritage	Involvement of Aboriginal communities	The existing operation is largely confined to the SML which is not subject to native title claims. The proposed expansion of the SML and associated infrastructure has facilitated ongoing and regular liaison with Aboriginal claimant groups and this has resulted in a coordinated agreement and signing of the Olympic Dam Agreement. This agreement is a positive outcome for the expanded operation and claimant groups.
Social Environment	Human services and planning	The basis of the assessment for the social environment has been to establish the current provision of human services at Roxby Downs and identify additional services to satisfy current and future needs. Delivering these future needs are largely the responsibility of the South Australian Government, in collaboration with BHP Billiton. Rather than contributing to a cumulative effect, the proposed expansion provides the opportunity to address current concerns and maximise social benefits for the affected communities.
Economic Environment	Contribution to the economy	The existing operation contributes approximately \$1.7 billion to the GSP of South Australia. The proposed expansion would increase activity within the local, regional and state economies as a result of capital investment, increased production and employment. The proposed expansion would have a substantial effect on the economy with a 30-year contribution of \$45.7 billion to GSP and \$22.6 billion to the GRP (Northern Statistical Division) in NVP terms above the BAU case.

Flinders Project – Perilya zinc mine

The Flinders Project covers an area of 4,138 km² and comprises several high-grade zinc oxide prospects. The total mineral resources for the Flinders Project are estimated to be one million tonnes, of which almost 300,000 tonnes would contain zinc metal.

The Beltana zinc mine, which consists of a mining and on-site crushing program, is located about 150 km south-east of Olympic Dam and is the first phase of the Flinders Project. Mining operations commenced in March 2007.

The first shipments of intermediate grade ore were made in December 2007 (Perilya ASX and Media Release 24 January 2008). Ore shipments of high-grade zinc oxide are planned to involve direct shipment of the ore through Port Pirie to smelters in Asia. The ore is transported to Port Pirie by road.

The site is near existing road and rail infrastructure and, given its proximity to Leigh Creek, existing services and accommodation infrastructure are used.

The relevance of the Flinders Project to the proposed Olympic Dam expansion would be:

- increased demand for energy from the state's electricity grid
- additional traffic on existing transport routes.

25.4.2 RELEVANT PROJECTS IN SOUTH AUSTRALIA

Techport Australia and SEA 4000 ship building

The Osborne Maritime Precinct or 'Techport Australia' is to be developed as a maritime/naval shipbuilding precinct, incorporating industry and training facilities at Osborne on the LeFevre Peninsula (Port Adelaide). The 80 ha site will include a common user facility, a fabrication facility and a suppliers'

precinct as part of the development of the Royal Australian Navy's \$6 billion Air Warfare Destroyer program. The site will also include a Commercial/Education Precinct with a Maritime Skills Centre, the Air Warfare Destroyers' Systems Centre, offices and retail space. As part of the Osborne Maritime Precinct, a 10,000 tonne ship lift and transfer system will be constructed, as well as a wharf and a construction runway. Dredging of Port Adelaide River will be required.

Bulk earthworks commenced in July 2005. Construction of infrastructure began in 2006 and is anticipated to continue until 2009. The project is predicted to provide 3,000 direct and indirect jobs and be completed in 2017.

The relevance of these projects to the proposed Olympic Dam expansion is:

- competing demand for labour
- increased demand for energy from the state's electricity grid
- additional road traffic and transport at Port Adelaide.

Other Department of Defence projects

Projects planned for the RAAF Base Edinburgh (25 km north of Adelaide) are:

- AP-3C Orion upgrade – involves upgrading the capability of the RAAF AP-3C Orion maritime patrol and anti-submarine warfare aircraft. These aircraft are used primarily for maritime patrol, reconnaissance and anti-submarine warfare. The upgrade includes a major upgrade to the aircraft's combat systems, which includes integrating air-to-surface missiles, lightweight torpedo, electronic warfare self protection, electronic warfare support measures protection, and next generation communications.



Figure 25.2 Location of other recent or proposed major projects in South Australia

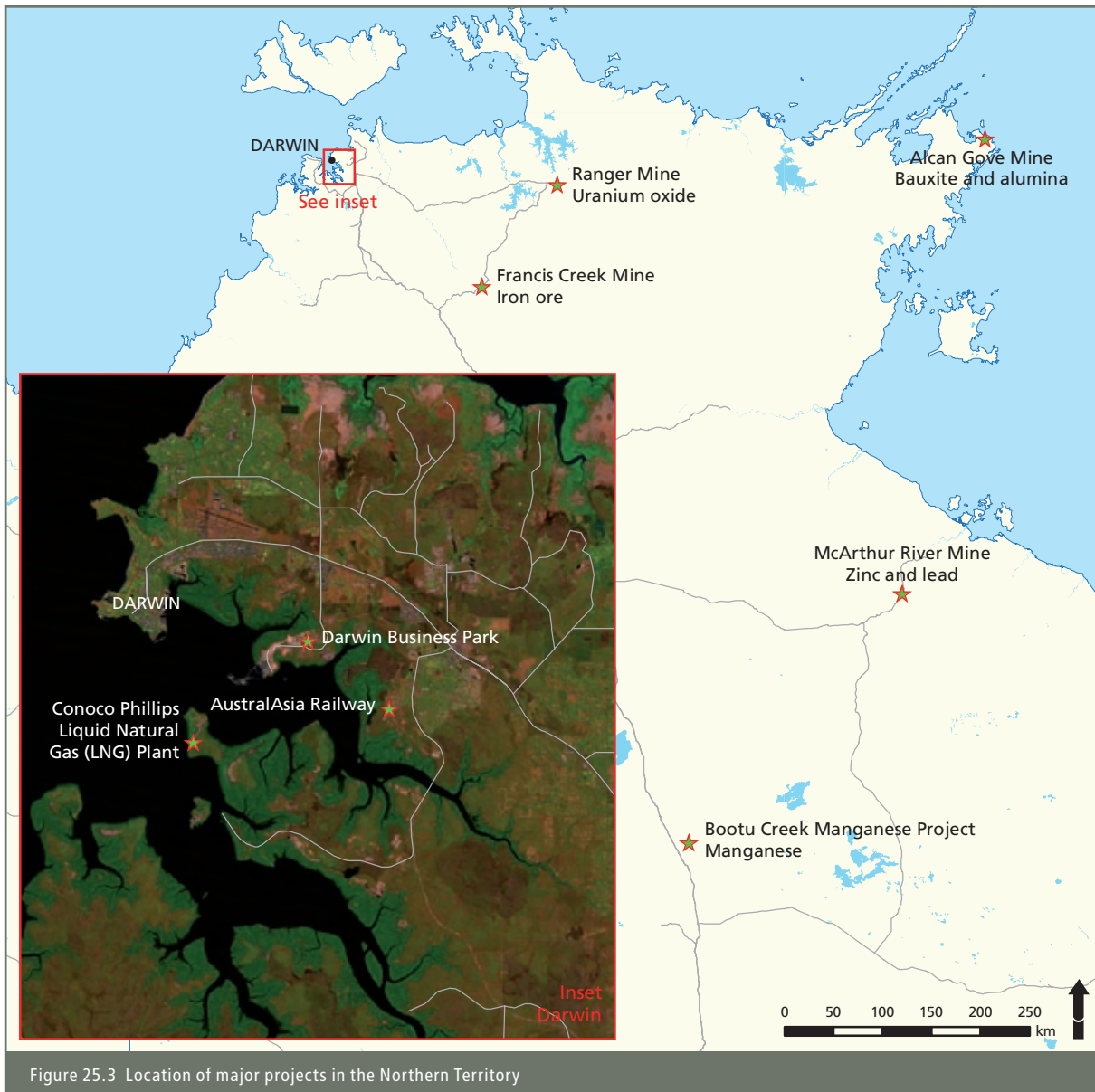


Figure 25.3 Location of major projects in the Northern Territory

- Project Air 7000 unmanned aerial vehicle systems – involves developing and introducing a long-endurance, multi-mission unmanned aerial system. These vehicles are being tested for surveillance capability.
- Further redevelopment of the base.

The Department of Defence would undertake the base redevelopment and Project AIR 7000 at an indicative cost of between \$100 million to \$130 million. Tenix Aerospace Division and Australian Aerospace are the proponents for the AP-3C Orion upgrade, which is expected to cost \$1 billion, employ 300 people, and be completed in 2015.

The relevance of the projects at RAAF Base Edinburgh to the proposed Olympic Dam expansion relates to:

- the further contribution to the State's long-term economic stability
- a minor effect on labour supply demand.

Honeymoon Uranium Deposit – Uranium One/Southern Cross Resources

The Honeymoon uranium deposit is about 385 km south-east of Olympic Dam. The Mining and Rehabilitation Program (MARP) was approved in January 2008 (including construction of the wellfield, process plant and related infrastructure). However, in May 2008 the company announced suspension of development in order to allow evaluation of opportunities for the project.

Southern Cross Resources also holds leases at Billaroo West, 80 km north-west of Honeymoon. The ore body at Billaroo West is spread over 21 ha and the mine will use an *in situ* method of leaching to extract the uranium. The mine will require an operational workforce of approximately 50 people, primarily supplied from the local area, but on-site accommodation would be available.

The Honeymoon mine is not anticipated to contribute cumulative effects to the proposed Olympic Dam expansion although it would contribute to the State's economy and supplement the supply of uranium oxide to the market. However, this has minimal implications for Olympic Dam given the small tonnages involved at Honeymoon and the large world demand for uranium oxide (see Chapter 3, Project Justification).

Port Adelaide waterfront redevelopment – Port Adelaide

The Land Management Corporation/Newport Quays are redeveloping 50 ha of former industrial land around the inner harbour of Port Adelaide. The works include constructing 2,000 residential dwellings, accommodating 3,000–4,000 people, as well as mixed-use precincts for commercial and retail space and marinas. The redevelopment would temporarily employ about 4,000 people at a construction cost of \$900 million.

The relevance of the redevelopment at Port Adelaide to the proposed Olympic Dam expansion relates to:

- competing labour demand
- increased demand for energy from the state's electricity grid
- a further positive contribution to South Australia's economy
- potential additional road traffic and transport near the BHP Billiton facilities at Port Adelaide and proposed facilities at Outer Harbor
- increased residential development in the wider Port Adelaide area.

Port Adelaide Shipping Channel and the Port River Expressway

The Port Adelaide Shipping Channel Project, which was completed in 2007, involved deepening the main shipping channel at Outer Harbor by an extra 2 m to 14.2 m, as well as extending the channel into St Vincent Gulf from a length of 9 km to 11.7 km. The upgrade enables fully laden Panamax-class vessels to enter Port Adelaide. Further development of the port, including the installation of a bulk loader based at Port Adelaide, occurred in 2007.

The Port River Expressway will provide new road and rail connections across the Port River, linking the industrial areas and transport and distribution facilities at Port Adelaide.

The Port Adelaide works and the Port River Expressway relate to the proposed Olympic Dam expansion by:

- providing a shipping channel and bulk loading capacity to enable access and efficient loading and unloading of larger ships at Outer Harbor, and therefore fewer ship movements for Olympic Dam imports and exports
- improving traffic flow for road and rail in the Outer Harbor area
- further contributing to South Australia's economy.

Desalination plant at Port Stanvac

This is a proposed desalination plant located at Port Stanvac which would use reverse osmosis technology to produce 150 ML/d (approximately 50 GL per annum) with the potential for capacity upgrade to 300 ML/d with further expansion. The project has a capital value of approximately \$1.1 billion.

The relevance of the proposed Port Stanvac desalination plant is:

- a minor effect on labour supply demand
- increased demand for energy from the state's electricity grid
- further demonstration from the South Australian Government of its commitment to reduce reliance on water pumped from the River Murray.

Proposed developments near Point Lowly

The South Australian Government Department for Transport, Energy and Infrastructure is planning to make available 500 ha of industrial-zoned land near Point Lowly. The land has been earmarked for the following development proposals:

- a bulk commodity facility and associated jetty – includes a harbor capable of berthing Cape-sized vessels and associated facilities for the bulk export of commodities, primarily iron ore from South Australian mines, together with a rail link to the national rail network
- fuel refinery – Port Bonython Fuels Pty Ltd is investigating an 80 million litre tank farm to receive, store and distribute imported diesel fuel
- Clean Seas Pty Ltd and the City of Whyalla are investigating an expansion of facilities to accommodate a growth in the aquaculture industry in Fitzgerald Bay.

These projects would not affect the land availability or operation of BHP Billiton's proposed desalination plant at Point Lowly. However, they are relevant to the proposed Olympic Dam expansion through the following points:

- potential for increased community concern regarding the industrialisation of the area
- competing labour demand during the construction phase of the proposed desalination plant
- further contributors to South Australia's economy.

Other mines

Other mining projects to be expanded or developed in South Australia include:

- the Challenger gold mine in the north-west of South Australia is increasing gold production towards one million ounces per annum
- OneSteel is progressing with an upgrade of its Middleback Ranges iron ore mine and steel works facility in Whyalla
- Tech Cominco is continuing exploration of the RMG Services find at Carrapateena
- approval of further expansion at the Beverley *in situ* uranium mine in the State's north was announced in August 2008

- Iluka has discovered a significant heavy mineral sands deposit in the Eucla Basin, in the Far West of South Australia
- IMX Resources is currently finalising feasibility studies on its Cain Hill deposit 55km South of Coober Pedy
- five gas fields and two oil deposits have been discovered in the off-shore Otway Basin in the South East of South Australia and gas is being supplied to local domestic markets.

These projects are relevant to the proposed Olympic Dam expansion through the following points:

- competing labour demand
- competing water and energy requirements
- further contribution to South Australia's economy.

25.4.3 PROJECTS WITHIN THE NORTHERN TERRITORY

Over the past nine years, economic development in the Northern Territory has been strong, most notably in the off-shore oil and gas sectors, the resources sector and defence. An overview of relevant projects is provided below, and the location of the projects is shown on Figure 25.3.

Darwin Business Park

Adjacent to the East Arm facilities, a 1,700 ha greenfield site encompasses 130 ha set aside for the Darwin Business Park and large tracts of industrially-zoned land designated for additional port-related export-based industries. The Land Development Corporation (LDC), a corporation of the Northern Territory Government, has as its primary focus the development and management of the industrial estate at East Arm, referred to as the Darwin Business Park. The Darwin Business Park provides direct links with berth, rail and road services for:

- cold storage facilities
- food processing and packaging
- pre-retail preparation facilities
- light assembly and manufacturing
- pick and pack distribution.

There are several large Australian companies which have established operations in the Darwin Business Park, including:

- Toll Holding's major distribution and consolidation centre
- Vopak's Darwin Industry Fuel Terminal
- Natural Fuel/Babcock & Brown biodiesel production facility.

New investments proposed or under way within the Darwin Business Park include:

- Gwelo Developments 7,000 m² distribution facility for the import of building products from Asia
- Top Class Fruit Supply warehouse/cold storage facility for importing and exporting of Northern Territory produce to Australian capital cities and Asian markets

- Amcor packaging warehouse
- Dawson's Diesel Services 2 ha warehouse for the repairs and maintenance of mining equipment, imported and re-exported over the East Arm wharf
- Metcash (Independent Grocers) warehouse/distribution facility
- Extended Toll facilities
- Shaw's Darwin Transport facilities
- Glimmer Pty Ltd industrial development
- Andarwin Pty Ltd distribution and warehouse development.

AustralAsia Railway

The AustralAsia Railway provides rail line haul services for Australia's central freight corridor. The AustralAsia Railway, operated by FreightLink, connects southern Australian markets and resource based industries with direct railway connections to Darwin's deep-water berth and intermodal facilities at East Arm. The AustralAsia Railway provides (FreightLink 2007):

- a bulk minerals transport to support the fast developing mining industries located along the Adelaide–Darwin rail corridor, with new opportunities also emerging to channel mine products through both Darwin and Adelaide-based ports
- transport of bulk liquids (primarily petroleum products)
- logistics for the Australian Defence Forces (ADF) for the deployment of military resources for training exercises and the positioning of equipment and supplies for general operations
- general logistics, providing all weather transport for a wide range of supplies and equipment.

Frances Creek Mine – Iron Ore

Frances Creek Mine, located near Pine Creek on the Stuart Highway, approximately 190 km south of Darwin, is the primary project for Territory Resources Limited (Territory Resources). Territory Resources Frances Creek Mine is expected to produce around 1.5 million tonnes of bulk iron ore increasing to 3 Mtpa in 2009 (Territory Resources Ltd 2007). The mine is located 15 km from the Alice Springs to Darwin railway line, giving the operation a direct link to the Port of Darwin.

Bootu Creek Manganese Project – Manganese

Bootu Creek Mine, owned by OM Holdings Limited and operated by Bootu Creek Resources Pty Ltd, commenced production of manganese during the second quarter of 2006. Bootu Creek is expected to produce around 550,000 tpa of manganese ore and has further exploration potential from the 1,750 km² tenement holdings which will extend the mine's operating life and increase production (OM Holdings 2006). The manganese ore is transported 60 km by road to the Muckaty rail siding where it is loaded into wagons (purpose-built hoppers) for the 822 km rail trip to the Port of Darwin.

Alcan Gove Mine – Bauxite and Alumina

Alcan Gove Bauxite Mine and aluminium refinery is located in Nhulunbuy on the Gove Peninsula, Northern Territory. Alcan mines bauxite and refines it into alumina which is supplied globally for the creation of aluminium and other products. Alcan Gove recently completed a US\$2.3 billion capital expansion of the Gove alumina refinery. Construction of the refinery began in November 2004 and was completed early in 2007. At the peak of construction, the workforce reached 1,700 people. When fully commissioned, the increase in alumina production will be from 2–3.8 Mtpa. Alcan is a major manufacturer and exporter, making significant economic and social contributions to the communities within the Arnhem Land Region, the Northern Territory and Australia.

McArthur River Mine – Zinc and Lead

In October 2006 McArthur River Mine received approval to convert its underground zinc-lead mine into a 200 m deep open pit operation to allow for an additional 25 years of production. Once the mine has been converted to an open pit mine, it will generate approximately \$328 million a year and will have a production capacity of over 400,000 tpa of bulk concentrates.

Ranger Mine – Uranium Oxide

Energy Resources Australia (ERA) owns and operates Ranger Uranium Mine at Jabiru, Northern Territory. Mining of uranium oxide is planned to be completed in 2012 and processing of the material will continue until 2020. Currently the mine has over 300 employees and produces 5,000 tonnes of uranium oxide on an annual basis.

Conoco Philips Liquid Natural Gas (LNG) Plant

Darwin has become Australia's second major international gas hub with the newly commissioned \$1.75 billion Darwin LNG Plant. The first tanker of liquid natural gas embarked from Darwin Harbour in February 2006. The LNG Plant produces 3.2 Mtpa via a 500 km pipeline to the Bayu-Undan gas field in the Timor Sea. The LNG plant increased Northern Territory exports by \$450 million per annum.

The Bayu-Undan gas field is operated by Conoco Philips Australia and has recoverable reserves of more than 3.4 trillion cubic feet of natural gas and approximately 400 million barrels of liquid hydrocarbons (LPG and condensate).

Major Defence Projects

Defence presence in the Northern Territory has doubled since the early 1990s. The number of Defence personnel and their families increased from 6,200 in June 1992 to over 13,000 in June 2008 (NT Treasury 2008).

Defence-related contracts play a major role in the economy for Northern Territory-based businesses. The Defence Support Division in the Department of Business, Economic and Regional Development identifies opportunities to expand defence-related businesses and activities throughout the territory.

25.4.4 CUMULATIVE EFFECTS IN CONSIDERATION OF OTHER PROJECTS

Cumulative effects associated with the Port of Darwin relate principally to BHP Billiton gaining access to port land and facilities in light of the growing demand for the port, rather than the Olympic Dam expansion contributing to cumulative effects on the Darwin community. The proposed expansion would however contribute to increasing ship movements through Darwin Harbour (adding approximately 24–27 per year).

The following sections discuss potential effects of other projects on the proposed Olympic Dam expansion and relate principally to labour demand, energy and accommodation requirements, and the general economic effect they would have on South Australia.

Labour demand

As discussed in Chapter 19, Social Environment, resourcing the proposed Olympic Dam expansion would be a challenge for BHP Billiton. Forecasts of demand for labour in the minerals resources sector show significant increases in all states, and a doubling in South Australia over the 10-year period from 2005–2015. This figure has been estimated to be as high as 70,000 people by 2015. While this would reduce unemployment in South Australia, and in Upper Spencer Gulf region in particular, it also has consequences associated with recruitment and training and the drawdown of workers away from other areas of employment.

Various recruitment strategies are identified in Chapter 19 to meet the needs of BHP Billiton and the government as a whole. The labour supply requirements identified for the projects above are well understood by BHP Billiton, the South Australian Government and industry, and recruitment strategies and initiatives will continue to be developed and implemented. The recruitment challenge posed by the combination of the proposed Olympic Dam expansion and the additional South Australian projects is significant, and is being addressed.

Energy supply

In isolation, and in the event that a hybrid electricity solution of grid electricity and an on-site gas-fired power plant was not adopted, the proposed Olympic Dam expansion would place sufficient pressure on South Australia's baseload electricity supply to warrant the need for expanded or new facilities. The combination of the proposed expansion and the additional projects provides even greater opportunities for the electricity generation market to meet this baseload requirement.

Initial responses from electricity suppliers to meet BHP Billiton's additional demand have been overwhelming, with numerous suppliers wanting to provide the required electricity.

Accommodation and services in Roxby Downs

The proposed Roxby Downs Draft Master Plan incorporates the provision of services and accommodation to meet the needs of the proposed Olympic Dam expansion. It also provides for a

5% vacancy rate in accommodation, which is predicted to assist affordability of accommodation.

The mine operation at Prominent Hill and the Flinders Project are not expected to place significant additional demands on the human services infrastructure proposed for Roxby Downs. As identified in Chapter 19, Social Environment, BHP Billiton, in collaboration with the South Australian Government, would monitor developments in the northern region and assess the implications for Roxby Downs and neighbouring townships and communities through the Social Management Plan.

Economics

The proposed Olympic Dam expansion would result in a significant economic benefit for the Northern Statistical Division, South Australia and Australia. Modelled scenarios show net present value increases from the current operation of \$22.6 billion (Northern Statistical Division GRP), \$45.7 billion GSP and \$18.7 billion GDP above the business as usual case over the 30 year modelled period.

The economic impact of other proposed projects would further contribute to sustained economic growth for South Australia.

25.5 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

The principles of Ecologically Sustainable Development (ESD) have been integrated into the decision making process during the selection of project alternatives, and have been used to guide the various technical studies undertaken for the Draft EIS, as well as the development of the project design. The concept of ESD has evolved over the past three decades and is now embedded in Commonwealth, State and Territory legislation which requires the consideration of ESD in the environmental assessment phase of a project.

There are five key concepts included in the principles of ESD, being:

- Long-term and short-term economic, environmental, social and equitable considerations – namely that the principles of ESD require the effective integration of environmental considerations and resources in decision making which may include the consideration of ecosystems; people; communities; natural and physical resources; the qualities and characteristics of locations, places and areas; and the social, economic and cultural aspects of these things in the present and future.
- The precautionary principle - which reinforces the need to take risk and uncertainty into account. The precautionary principle is the principle that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage. The function of the precautionary principle is to shift the burden of proof to require a proponent to address the threat of serious or irreversible damage, notwithstanding that there is scientific uncertainty about the threat. In the application of

the precautionary principle, the measures adopted should be proportionate to the potential threat.

- Inter-generational equity - being the concept that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
- Conservation of biological diversity and ecological integrity – where biological diversity, or 'biodiversity', is considered to be the number, relative abundance, and genetic diversity of organisms from all habitats (including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part) and includes diversity within species and between species, as well as diversity of ecosystems and may be assessed in terms of ecological health.
- Improved valuation, pricing and incentive mechanisms – such that if the real value of natural resources is incorporated into the cost of using those resources, it is more likely that these resources will be used in a sustainable manner, adequately managed and not wasted.

BHP Billiton's support of the principles of ESD is evident in the existing environmental initiatives in respect of Olympic Dam and other BHP Billiton projects. The BHP Billiton Group Sustainable Development Policy, Charter, Health Safety Environment and Community Management Standards, Code to Business Conduct and Climate Change Position articulate its ongoing commitment to environmental responsibility and sustainable development.

The proposed expansion has incorporated the consideration of the five principles of ESD together with the issue of climate change and greenhouse effect as discussed below.

Long-term and short-term economic, environmental, social and equitable considerations

The assessment of the expansion project has examined potential environmental, social, cultural and economic impacts and has identified, as appropriate, mitigation measures to manage residual impacts through each phase of the expansion (i.e. construction, operation and decommissioning). Accordingly, the possible short-term and long-term impacts, benefits and risks associated with the expansion have been considered and presented within a clear, transparent and repeatable framework (see Chapter 1, Introduction, Section 1.6.2 for details).

Further to the findings presented throughout the Draft EIS, the proposed expansion would improve the overall natural resource efficiency of the Olympic Dam operation. For the purpose of the Draft EIS, natural resource efficiency refers to maximising the effective use of electricity, energy, water and waste materials in order to reduce potential environmental impacts. The outcomes of the project design in this regard are presented below.

Electricity and energy

Electricity consumption for the expanded operation would increase as a result of the new open pit mine and increased ore throughput in the new metallurgical plant. Measured as a function of the ore throughput, the existing specific electricity consumption is around 93 kWh per tonne of ore milled. Following the proposed expansion, the electricity efficiency would increase by around 25%, to 73 kWh per tonne of ore milled. Similarly for energy, the existing operation has a greenhouse gas intensity (indicative of the specific energy consumed by the operation) of around 105 kg of carbon dioxide equivalent (CO₂-e) per tonne of ore milled. This would reduce to around 50 kg of CO₂-e per tonne of ore milled following completion of the proposed expansion to full operational capacity, an increase in efficiency of around 52% (see Chapter 13, Air Quality, for further details regarding energy consumption and CO₂-e emissions).

Water

Water demand for the expanded operation would be greater than for the existing operation as a result of the greater ore throughput. Changes to the metallurgical circuit would be made to maximise reuse of liquor reclaimed from the TSF and saline water extracted from the mine depressurisation activities. In particular, an increase in the flotation tailings solids concentration to 70%, compared to 65% for the existing operation, through the use of higher efficiency thickeners following the flotation process, would result in a decrease in water demand from the coastal desalination plant of around 9.5 ML/d (approximately 3.45 GL per annum) (note the percentages provided for thickening in this part of the metallurgical process are different to the percentages of the tailings on deposition; see Chapter 5, Description of Proposed Expansion, Section 5.5.4 for details).

The existing specific water use is around 1.2 kL per tonne of ore milled. This would reduce following the proposed expansion to around 0.98 kL per tonne of ore milled for the combined operations, a reduction in specific water use of around 18%.

Waste

Details regarding the reuse of mine rock from the proposed open pit are provided in Chapter 5, Section 5.4.7. General waste management is discussed in Chapter 5, Section 5.6, which details the principles of waste management to be adopted for the proposed expansion, including an increase in the relative volumes of materials to be reused and recycled. The existing operation generates about 4,160 tpa of general wastes, up to 32% of which are recycled. The proposed expansion would generate a further 11,400 tpa of general wastes, a significant reduction when measured as a function of the tonnes of ore milled (0.5 kg per tonne of ore milled for the existing operation versus around 0.2 kg per tonne of ore milled for the combined expanded operation).

The precautionary principle

The proposed expansion has been assessed utilising many years of site specific and regional baseline environmental studies and the results of long-term monitoring programs. Additional studies have been carried out to complement this information in the context of the proposed expansion and to identify available and relevant scientific information. The assessment of the proposed expansion has been based on a sound understanding of the interaction between the various components of the expansion project and the receiving environment. Wherever significant impact or risk to the environment has been identified, BHP Billiton has identified measures that may be implemented to manage and minimise this potential harm. A range of measures has been adopted as components of the project design to minimise the potential for either serious or irreversible damage to the environment.

Inter-generational equity

The goal of inter-generational equity is underpinned in the BHP Billiton Group's governing corporate standards and has been addressed in the expansion project through the assessment of potential social impacts (see Chapter 19, Social Environment), the development of monitoring initiatives and management measures designed to mitigate potential for harm to the environment, consultation with the local and broader community (see Chapter 7, Stakeholder Consultation and Engagement), and the investigation and assessment of cultural and heritage values (see Chapter 17, Aboriginal Cultural Heritage, and Chapter 18, Non-Aboriginal Cultural Heritage). Measures such as environmental offsets and the creation of new infrastructure provide legacy benefits to the present and future generations.

Conservation of biological diversity and ecological integrity

Chapter 15, Terrestrial Environment, details the existing ecology, the proposed location and extent of vegetation clearance associated with the expansion, the effects of this clearance, and related management and compensatory measures. Chapter 16, Marine Environment, details the existing marine environment, the potential impacts of the construction and operation of the desalination plant and port facilities, and the proposed management measures. The expansion project addresses the conservation of biodiversity and ecological integrity by proposing a comprehensive environmental management framework based on a sound understanding of the existing environment and the interaction of the various project elements.

Improved valuation, pricing and incentive mechanisms

The economic assessment of the expansion project (see Chapter 21, Economic Assessment) incorporated environmental values. The identification and adoption of mitigation strategies and measures (including design modifications) to minimise the potential for harm to the environment as integral components of the expansion project incorporates the cost of those measures into the total project cost, enabling the value and

price of environmental resources (and their protection) to be more accurately reflected.

Climate change and greenhouse effect

The greenhouse gas assessment of the proposed expansion (see Chapter 13, Greenhouse Gas and Air Quality) includes Scope 1 emissions (direct project emissions), Scope 2 emissions (indirect emissions from the consumption of purchased electricity), and Scope 3 emissions (transport related emissions) within Australia. Peak greenhouse gas emissions estimated for the proposed expansion are 4.7 Mtpa CO₂-e (with a reportable component of 3.3 Mtpa as per the National Greenhouse and Energy Reporting (Measurement) Determination 2008).

For the purpose of providing context to global emissions, the abatement potential of the uranium oxide produced at Olympic Dam has been estimated. At full operating capacity, the expanded operation would produce up to 19,000 tpa of uranium oxide, which when used in nuclear power plants by customer countries would produce about 756,000 GWh of electricity. If for example this was used to substitute electricity supplied by typical fuel mixes in Australia, China and the United States of America, it would reduce direct greenhouse gas emissions by 615 Mtpa, 687 Mtpa and 438 Mtpa of carbon dioxide equivalents, respectively. This compares to Australia's total 2006 carbon emissions of 575 Mt of carbon dioxide equivalents.

