

Chapter 10

Land Use and Activity

10.1 Overview

The land use and activity assessment in this chapter considers the three site options located in the central–north South Australia.

The assessment considers the existing situation of human activity since European settlement, identifies the potential for this situation to change and evaluates possible impacts during the various stages of the national repository's life. The assessment is taken from a primarily non-Aboriginal cultural perspective; issues of indigenous culture, activity and values are addressed in Chapter 11.

The assessment of existing and potential future land use and activity is required in order to establish the extent to which:

- the proposed development might be incompatible with existing activities
- future developments might be incompatible with the proposal.

10.2 Site Planning

10.2.1 State Development Approvals

In most circumstances the *Development Act 1993* controls development and changes of land use throughout South Australia. However, in the case of the national repository, Planning SA, after obtaining Crown legal advice, has advised that no Development Application is required at the State level, as the facility would be constructed on Commonwealth land.

Environmental impact assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Section 1.2 of this document) and the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) licensing requirements (Section 3.3) satisfy the required land use assessment and approvals requirements for 'controlled activities' such as the waste repository.

Nevertheless, it is noted that the relevant Development Plan and zoning policy for this area present few limitations to the development of this type of facility, provided that environmental and conservation principles are addressed. On the other hand, the zoning does not limit the nature of activities and land uses that might be established in the region in the future.

10.2.2 Nature of the Operation and Facilities

The proposed national repository would have the following features (Sections 6.2 and 6.3):

- an appropriate access road
- security and feral animal-proof fencing
- disposal trenches and/or boreholes that would be filled and capped at the conclusion of each disposal campaign

- support facilities, including an operations building etc (Figure 6.5)
- possible other support infrastructure.

The site would be 1.5 x 1.5 km in size, and would largely comprise an undisturbed buffer zone with the disposal structures located in the central 100 x 100 m area of the site. The buffer zone would ensure that there is a space between the disposal structures and any other activity that may occur in the region.

With the construction of feral animal-proof boundary fences and the eradication of feral animals from within, there is potential for the buffer zone to become a native fauna and flora regeneration area (see Section 6.1.5 and 9.4–9.9).

The site of the repository facility and its associated buffer zone would be under the control of the Commonwealth which, in effect, prevents the establishment of other activities in the immediate vicinity and aims to prevent any unauthorised intrusion onto the repository site.

Operation Activity Levels

The level of activity associated with the proposed repository is likely to reach a peak at the construction stage and the following, initial, disposal phase. There would be some small additional activity arising from the establishment of monitoring programs, and from inspections by regulatory authorities and visitors.

Once the initial disposal of waste is completed, it is expected that the facility would generate only limited activity at times when the repository was opened for the disposal of waste, anticipated to be once every few years.

The level of activity at the repository site would probably be restricted to:

- occasional delivery of waste and other materials (during construction and infrequent disposal campaigns)
- on-site handling and disposal of waste (during infrequent disposal campaigns)
- maintenance, monitoring and security activity (between disposal campaigns)
- retrieval of waste if required.

Thus the level of activity directly related to the operation of the facility is likely to be relatively limited.

10.3 Visual and Landscape Considerations

10.3.1 Existing Landscape Character

The existing landscape character has both natural features (e.g. topography, vegetation and colours) and constructed features (e.g. buildings, infrastructure and signs). From the perspective of the viewer, which in the case of this project would be largely from a vehicle or road, the nature of the landscape can be described as an open, flat, gibber desert plain with few features dominating the landscape. It has a notable rich red colour interrupted on occasion by rolling, low-level sand dunes which support vegetation from shrubs to small trees. There are other more limited areas where the desert gives way to drainage lines, which have a more distinctive topography and support more substantial vegetation. The colours of the landscape can be striking, with rich red to yellow sands and the grey–green foliage of the vegetation.

The following observations are relevant to the specific selected sites.

Site 52a

This site (see Figures 9.3 and 9.4) is located within the Woomera Prohibited Area (WPA) and thus access to the area by the public is restricted. The flat plains of the gibber desert are the predominant natural feature, but some lakes break up this landscape, in particular the varied topography around Lake Hart. The landscape is also dotted with various items of Department of Defence (Defence) infrastructure, which is largely associated with its use as the WPA. These structures include a hangar, small offices, overhead lines, pipelines at ground level, roads and concrete remnants of structures.

The access road to the site is partly sealed and partly good all-weather gravel road (see Section 7.4 and Figure 7.2).

Those that experience this landscape are likely to be in the locality for Defence-related business, research or maintenance purposes, and pastoral activity.

Site 45a

Here, the gibber desert is the key feature (see Figures 9.3 and 9.4) but, unlike Site 52a, there is little evidence of constructed features (apart from fences and occasional station buildings). The access track is unsealed and some sections are in poor condition. The access track passes through a number of areas of high landscape value (e.g. sand dunes and vegetated drainage lines) some distance from the site.

Most people who experience this landscape are likely to be associated with local pastoral activity, off-road tourists and Aboriginal people.

Site 40a

This site is dominated by the limited features of the gibber desert plain (see Figures 9.3 and 9.4). The constructed features of the broad area are limited to fences and some ruins in the adjacent landscape. The current access road is an unsealed track and passes through some areas of landscape significance (sand dunes, views to The Pines area to the east and creeks (Figure 7.2)).

Most people who experience this landscape would be associated with the activities described for Site 45a.

10.3.2 Visible Elements of the Proposal

The key visible elements are likely to include (Figures 6.3 – 6.5):

- the access road
- during initial construction, and at subsequent disposal campaigns:
 - ▶ trenches or boreholes, which then would be covered and seen only as low relief earth mounds in between campaigns
 - ▶ sheds and buildings required to accommodate the various activities of the operation, in particular the operations building, conditioning facility and health physics facility
 - ▶ car and truck park areas
- security and feral animal-proof fencing.

The preferred colours, materials and specific design of these facilities have not been identified; however, it is expected that the facilities would be portable buildings for the office and similar facilities, and simple buildings of steel and corrugated iron construction for operational purposes (Section 6.4.2). It is intended that most of the buildings and other on-site infrastructure, apart from the security fencing and any brick buildings or permanent structures, would be removed from the relevant site between disposal operations.

10.4 Land Use and Demographics

10.4.1 Historic and Existing Land Use and Activity

The existing physical and biological environment has been described in detail in the previous chapters. An overview of land uses and attractions is contained in Figure 10.1. This environment establishes a context and certain parameters for human activity and land use. In general terms, the extent of post-European-settlement human activity in this region has been limited to key centres that are either located on transport routes or supporting mining, Defence or research activities. The only other settlements in the area are associated with large rangeland grazing properties; homesteads are sparsely scattered throughout the region.

The lack of obvious, easily accessible and usable water sources, limited transport and urban infrastructure, and the open desert environment have significantly limited human activity in this region since European settlement. Much of this activity, historically and currently, is confined primarily to:

- copper mining at Mount Gunson, copper–gold–silver–uranium mining at Olympic Dam, and opal fields at Andamooka and Coober Pedy
- rangeland grazing activities (primarily sheep and cattle)
- remote area tourism and research activity
- high technology Defence research and trials activity, and other uses of the WPA including those related to the aerospace industry, various types of research, the storage of radioactive waste and the detention of asylum seekers
- a number of townships or service centres and their associated living, recreational, tourism and business activities.

The very environmental conditions that limit human activity, and the relatively remote nature of the area, attracted the most notable activity in the region — the Woomera research and testing facility. The establishment of Woomera in the mid-1940s brought with it an extraordinary level of infrastructure and human activity. At its peak (around 1974) this township accommodated some 4000 people (compared with its present population of around 400). The level of activity associated with Woomera has fluctuated over time and this is likely to be a continuing feature of the town, although population levels are unlikely to reach the previous peak numbers.

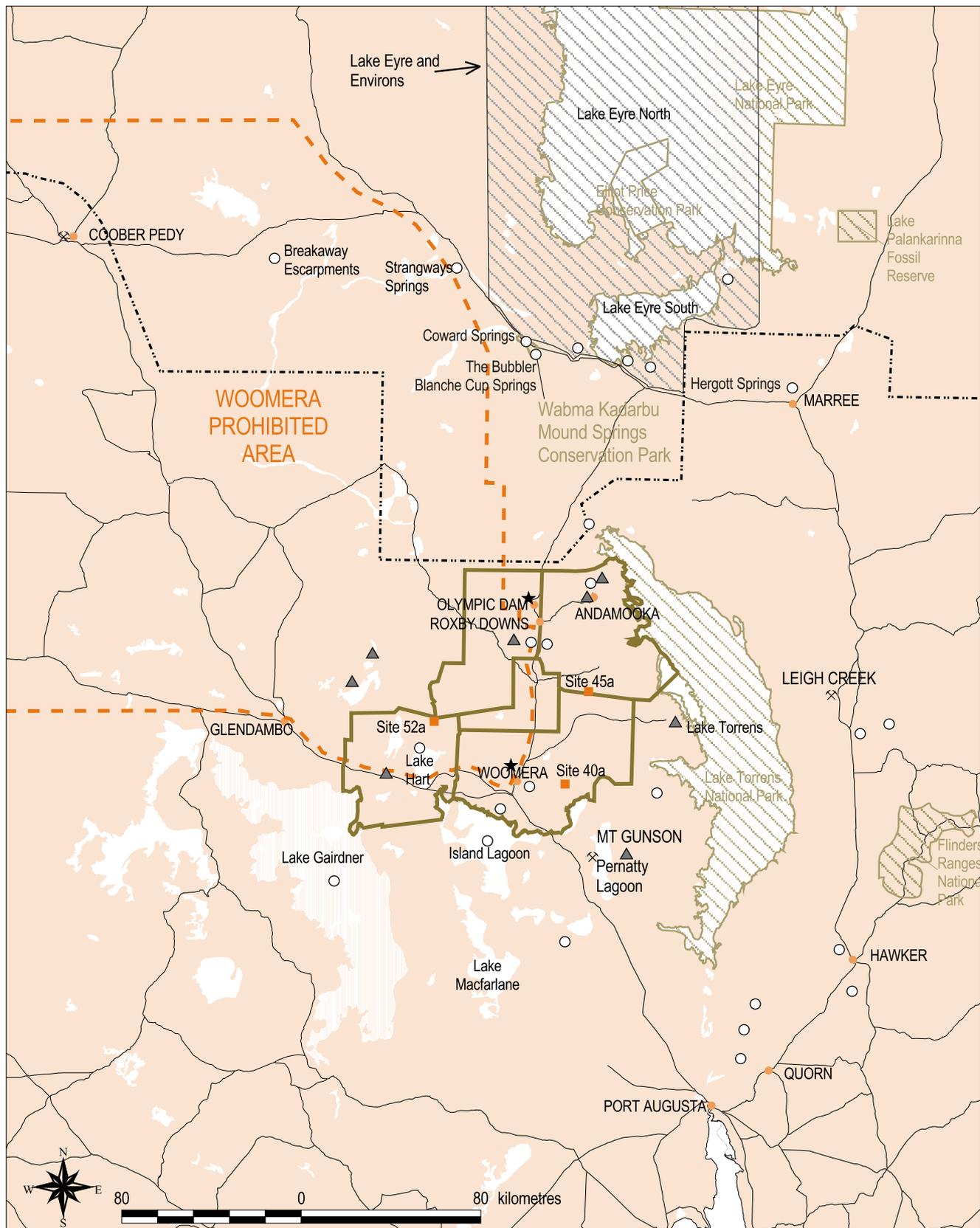
The other main centres of activity in the region include:

- Olympic Dam (copper–gold–silver–uranium mining and metallurgical operations) and its service centre Roxby Downs
- opal mining and the associated Andamooka township
- Pimba and Glendambo service centres for Stuart Highway travellers.

Beyond these centres of activity, there are a number of large pastoral properties, which primarily support dry land grazing and stock management.

The most significant population centres are located at Port Augusta to the south of the region (at the head of Spencer Gulf) and Coober Pedy, a well-known opal mining town, located to the northwest of the region on the Stuart Highway.

In the last few years this region has attracted regular protest and demonstration events, which are aimed at displaying opposition to nuclear activity and have been focused on Olympic Dam. In 2002, the focus was on the detention centre for asylum seekers near Woomera. These activities attract a number of participants who require camping facilities and sometimes other services (e.g. medical, police), and can also disrupt access and traffic conditions.



- Towns
- Potential repository sites
- Registered site of environmental, heritage or geological significance
- ⊗ Mines
- ★ Airports
- ▲ Aircraft landing facilities
- Woomera Prohibited Area
- - - Dog fence
- Pastoral lease boundaries (in vicinity of sites)
- Roads
- Salt lakes
- ▨ National parks and reserves
- ▧ Lake Eyre and environs

FIGURE 10.1
Land use and attractions

Activity by anti-uranium and anti-nuclear protestors has become part of a regular 'circuit' of demonstration events at other uranium mines, including Honeymoon and Beverley in the east of South Australia (northwest of Broken Hill) and at Ranger in the Northern Territory. The protests have caused minor disruption to activities at these operations, in particular to personnel access, and have also been associated with graffiti and other vandalism, trespass and property damage. Protestor activity is discussed further in Section 12.9.4.

In summary, the current land use and human activity in the region is confined to:

- a limited number of centres of settlement around mining and research facilities
- large scale rangeland grazing operations and associated, scattered homesteads
- Defence-related trials and activities and other uses of the WPA
- remote area tourism
- traffic and transport between centres of activity.

10.4.2 Current Demographics

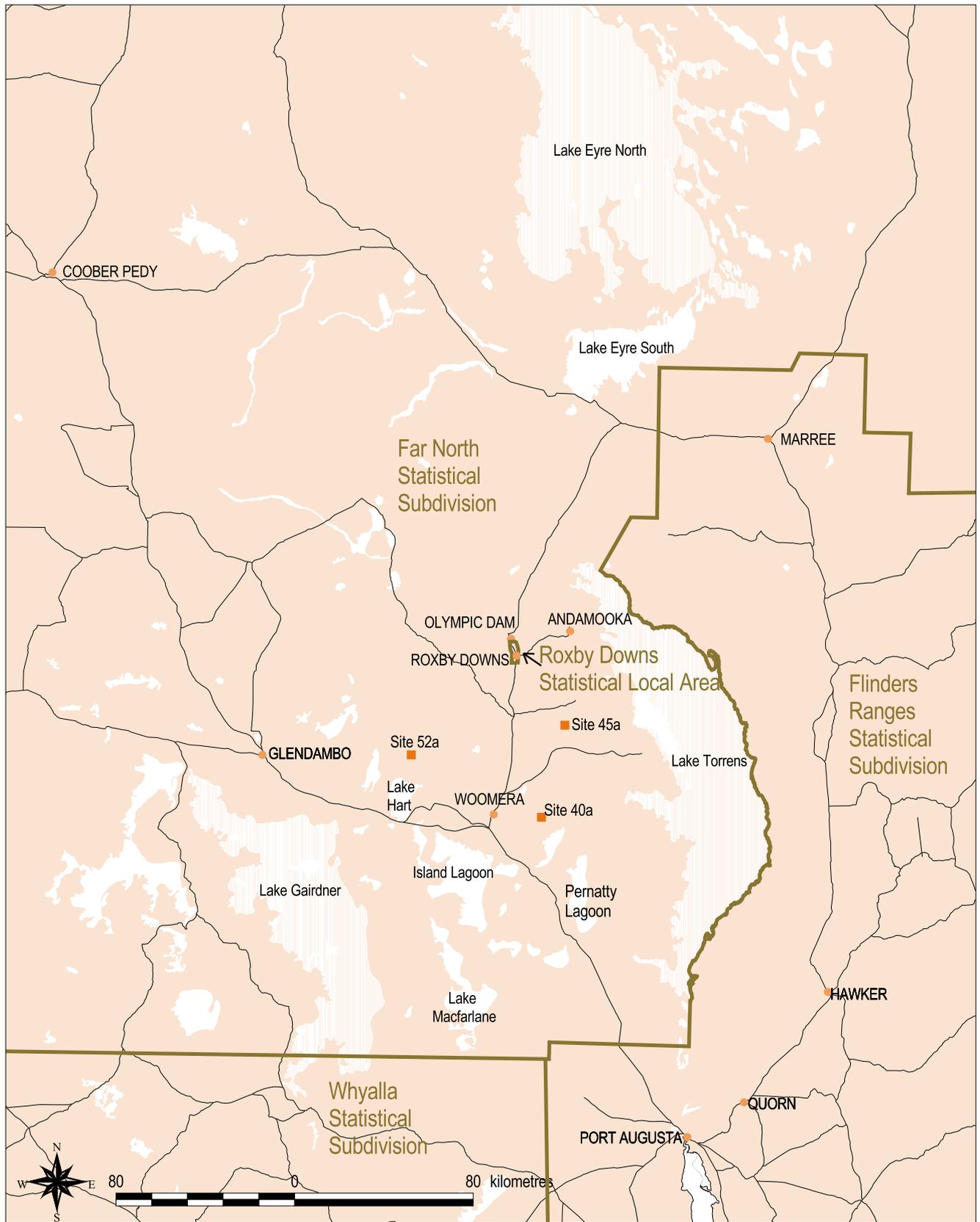
The Far North statistical subdivision (SSD) region is some 800,000 km² in area and makes up the bulk of the northern part of the State of South Australia (Figure 10.2). Overall, the Far North region of South Australia has one of the lowest populated densities in Australia, with a total recorded population of 10,693 (in 1996; Australian Bureau of Statistics 1999). In contrast, the Whyalla Local Government Area, to the south of the Far North SSD, has the largest regional population outside the Adelaide statistical division (SD) (Australian Bureau of Statistics 1999).

The estimated Aboriginal population represents 29.2% of the total Far North SSD population, although only a small proportion of these people are located within non-Aboriginal townships. Apart from Aboriginal communities and pastoral stations, most people live in a small number of towns and settlements, the main ones comprising Woomera, Roxby Downs, Coober Pedy and Andamooka.

The demographic statistics highlight the significant diversity of the various communities within this region (Australian Bureau of Statistics 1999, 2001):

- Population growth rates range from relatively high, such as Roxby Downs at 2.4% (the fourth highest rate in the State), to negative rates in other centres.
- The history of erratic population growth rate reflects significant investment projects (e.g. the establishment of Olympic Dam and Roxby Downs, and subsequent expansion) and economic conditions.
- Unemployment rates range from 17.5% at Coober Pedy to 2.1% at Roxby Downs.
- The average income in Roxby Downs (\$51,391) and Whyalla (\$35,081) were above the State average (\$31,964) all other parts of regional South Australia had average incomes below the State average.
- The value of agricultural production is slightly higher than for the Adelaide SD but growth over time has only been marginal.
- Tourism statistics indicate a steady growth in numbers and average length of stay (currently 1.6 days).
- There are more males than females, but the proportion of young families is notably higher than the State average.

The total number of people in this region is relatively small, and significant changes in one location can affect the averages for the whole region. For example, the presence and nature of the Roxby Downs township and its population has a significant influence on average income, population growth rates and age structures for the region as a whole.



- Towns
- Potential repository sites
- ▬ ABS statistical divisions
- ▬ Roads
- ☑ Salt lakes

FIGURE 10.2

ABS statistical divisions

In more general terms, the projected population change is likely to range from slightly negative to slightly positive, although the region can swing from steady population trends to significant proportional changes, for example, with the establishment or closure of a mine, a research facility or a processing plant.

The demographic trends of the region largely depend on economic and investment factors, primarily driven by global trends. As such it is difficult to predict longer-term trends with any significant level of certainty.

10.4.3 Aircraft Landing Facilities

Generally, aircraft activity in this region is primarily focused on existing centres of activity. The only formal airfields of significance in the vicinity of the site options are located at the Olympic Dam Village (approximately 7 km north of the Roxby Downs township) and Woomera (approximately 5 km north of the township).

The Olympic Dam airfield is some 45 km from the nearest site option (45a) and the Woomera airfield is approximately 20 km from the nearest site option (40a). However, the direction of aircraft approach and take-off does not align with any of the site options. This, combined with the separation distances, suggests that there is a low risk of potential conflict.

The other landing grounds and helipads in the region tend to be focused on centres of activity but their use is less regular and less frequent. Formal landing grounds are located at:

- Andamooka
- Teatree Dam (8 km northeast of Andamooka)
- Chances Swamp (25 km southwest of Roxby Downs)
- Bosworth (80 km east of Woomera)
- Mount Gunson Mine (45 km southeast of Woomera)
- Wirramina (60 km west of Woomera).

Of these landing grounds, the closest is Mount Gunson, which is approximately 30 km southeast of Site 40a. Within the WPA, there is a disused landing ground, Evett's Field, about 10 km from Site 52a. A number of helipads are also located within the WPA but these are located at least 35–40 km from the nearest site option (52a).

10.4.4 The Woomera Prohibited Area

The WPA is located in the northwest pastoral area of South Australia and encloses a region of 127,800 km², representing about 13% of the State (Figure 10.1). Its southeastern corner is located approximately 450 km north-northwest of Adelaide. Several small parcels of land within the WPA, including the Defence Support Centre at Woomera and the Woomera Rangehead, are Commonwealth-owned land. About two-thirds of the land is State Crown land, covered by pastoral leases issued by South Australia. Currently, the area comprises 23 pastoral leases, which stock on average approximately 42,000 sheep and 30,000 cattle.

The area of Maralinga Tjarutja freehold land embraces most of the WPA west of 133° E. North of this area, a small portion of Pitjantjatjara freehold land extends into the WPA. Other civil land uses are largely confined to mining and mineral exploration.

Defence administers the WPA.

Within the WPA, Defence has nominated several areas as Defence practice areas where weapons practice and trials activities can be conducted. The primary practice areas are Lake Hart, the Woomera Instrumented Range (WIR) and, within the WIR, the Range E target area.

Lake Hart is located immediately to the south of the southeastern corner of the WIR. It is an air weapons range, used for testing live ordnance released from aircraft. The Lake Hart range is located approximately 15 km south of Site 52a.

The WIR is the most significant range with respect to the repository. It has a spatial extent of approximately 50 x 40 km orientated along the range centre line of 305 N degrees north (Figure 10.3). The Woomera Rangehead is located at the southeast corner of the WIR. Site 52a is located within the southwest corner of the WIR with the centre of the site located a little over 3000 m from the Range E target. The rangehead is Commonwealth land and the WIR is grazing land (i.e. supports non-Defence activity).

Legislation/Regulations

The WPA was first formally established in April 1949 under Regulation 5 of the Supply and Development (Long-Range Weapons) Regulations to facilitate the development of long range weapons jointly by the UK and Australia. The WPA was expanded as there was need for large range areas for missile testing, with the necessary gazettals being made under Regulation 90 (1) of the *Supply and Development Act 1939* (Cwlth). The Emu and Maralinga areas were included in the WPA in March 1953 and March 1955, respectively.

In September 1972 the WPA was reduced in area from about 267,000 km² to about 127,800 km². The reduction in size released the opal mining areas near Coober Pedy from the WPA. A further variation took place in September 1980, when an area within the eastern boundary was excised to facilitate development of the Olympic Dam mining venture and Roxby Downs township.

Following the disbanding of the then Department of Supply in the mid-1970s, responsibility for Woomera and the WPA passed to Defence. Amendments to the Defence Force Regulations in February 1976 included a new Regulation (DFR 35) enabling the Minister for Defence to declare a place to be a prohibited area.

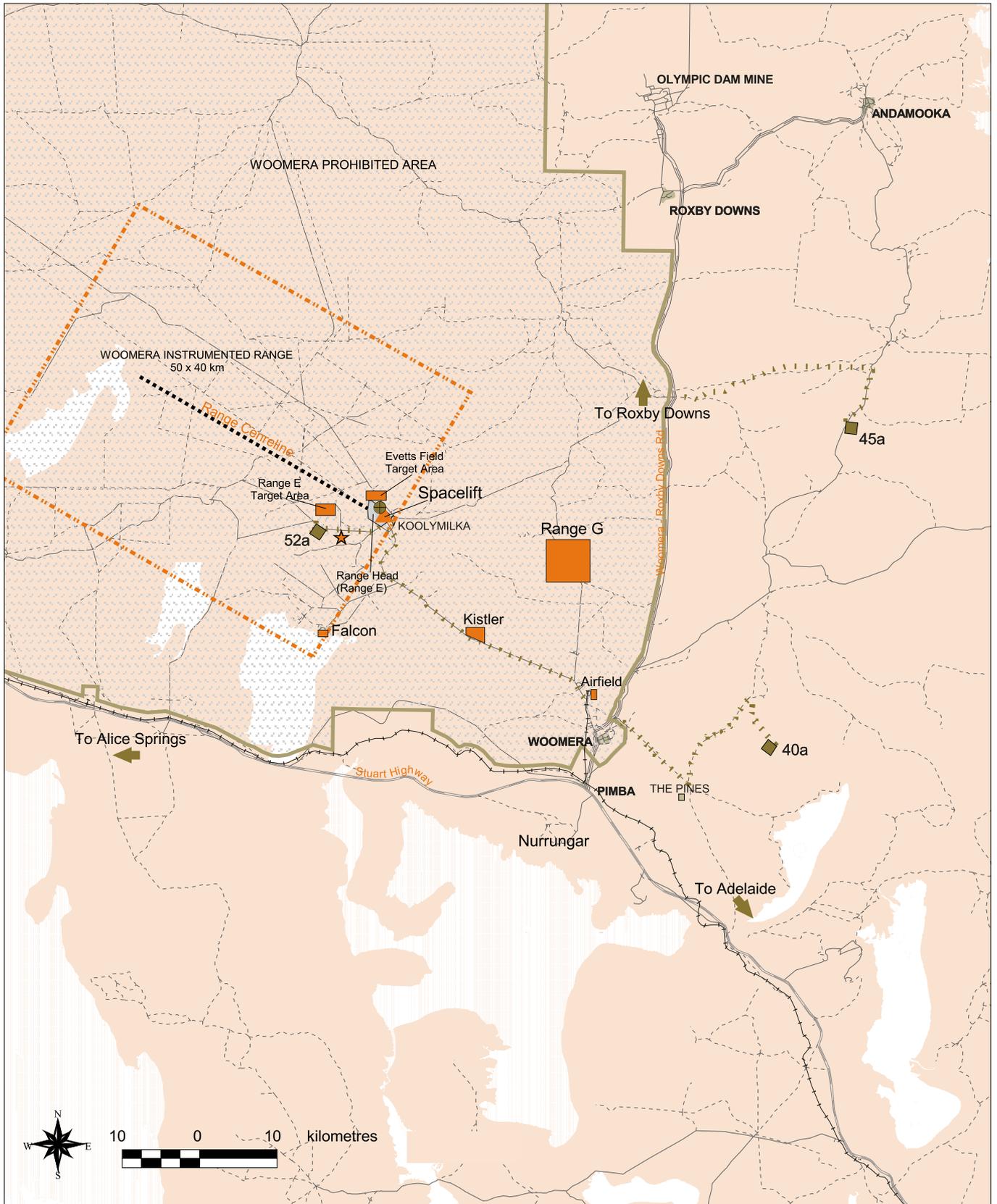
In 1978 the Minister declared the existing WPA to be a prohibited area under DFR 35:

1. the Minister may, by notice published in the Gazette, declare a place to be a prohibited area for the purposes of this regulation;
2. the Minister shall not declare a place to be a prohibited area unless:
 - a) it is an undertaking; or
 - b) it is a place which is necessary or expedient in the interests of the safety of defence of Australia:
 - (i) to carry out operations for the testing of war material;
 - (ii) that special precautions be taken to prevent the entry of unauthorised persons into that place.

Current and Planned Activities

The general function of the WPA is to provide Defence with a secure environment for the safe operation, development, testing, trialling and assessment of experimental or operational ordnance and delivery systems, and associated resources and material. In addition, the WPA is used for operational training and evaluation of elements of the Australian Defence Force.

As well as its uses for military activities, Defence policy is that the WPA be available for use by all elements of the Defence Organisation; non-Defence government, scientific and commercial organisations; and international military and non-Defence users. The area is particularly suitable for a wide range of non-Defence programs, especially those requiring stringent safety precautions and the unique attributes of the WPA (Department of Defence 2001).



- Repository waste sites
- Access roads
- Woomera prohibited area
- Salt lakes
- Towns/settlements
- Existing stores
- Bunker Intermediate level waste Launch Area 5
- Low level Fishermans Bend Soil
- Major road
- Sealed secondary road
- Minor road
- Track

FIGURE 10.3

Woomera prohibited area - uses

Over recent years there has been significant diversification at the WPA and it is used for various research projects, the storage of radioactive waste and the detention of asylum seekers. There are also various proposals to launch commercial satellites from the WPA. All activities within the WPA have been undertaken alongside the various military uses of the range, pastoral activities and habitation. Defence routinely incorporates the various uses in the overall management and use of the area.

A comprehensive Environmental Review (Woodward-Clyde 2000) covers the defence activities at the WPA.

Defence Trials

The Royal Australian Air Force (RAAF) is currently the primary Defence user of the WPA, and typically conducts one or two campaigns per year, each of 2–3 weeks duration.

The Aircraft Research and Development Unit (ARDU) of the RAAF conducts the following activities:

- aircraft operations concerned with navigation and sensor systems
- global positioning system (GPS) interference and signature measurement
- aircraft-launched weapons with trajectory measurements and impact scoring
- ground-launched weapons such as surface-to-air and surface-to-surface missiles
- ground tests involving ordnance detonation and other explosive testing.

The main category of ARDU activity that could impact on the repository is air-launched weapons, which commonly use the Range E target area. These weapons include:

- ballistic weapons (i.e. aerial bombs that are either dropped vertically or lobbed onto the target): even if not filled with high explosive (explosive filled weapons are not used on the WIR) the bombs weigh between 500–2000 pounds (about 230–910 kg)
- air to air weapons: these are not fired at ground targets and become a concern only if they lose control or miss the aerial target; they are relatively small weapons that have small warheads designed to inflict damage on airframes, for example the AIM9 Sidewinder has a warhead weighing only 9.8 kg including the fragmenting casing
- stand-off weapons: these are air-to-ground missiles designed to destroy major infrastructure targets — the largest are often referred to as ‘cruise missiles’; they can have a significant range (i.e. from tens to hundreds of kilometres) and can weigh in the vicinity of 1000 kg; however, these weapons are extremely expensive (often in the order of US\$1m) and are fired very rarely for test and evaluation, even by major users such as the US; they are also noted for their very sophisticated guidance systems which sometimes include television and imaging infra-red control (known as ‘man in the loop’).

The Australian Army conducts trials of the Rapier surface-to-air missile, parachute-training drops over Woomera Airfield, infantry exercises in the desert environment, environmental testing and other trials involving military equipment.

The Defence Science and Technology Organisation (DSTO) uses the WPA for various programs including trials of explosives and GPS jamming trials.

Other Uses

Trials (non-Department of Defence)

Various non-Defence trials have been undertaken on the WPA in recent years, including:

- NASA sounding rocket firings
- testing of Japanese rocket propellant

- flight trials for Japanese experimental aircraft
- UK Ministry of Defence anti-armour missile trials
- Australian Space Research Institute trials (rocket firings)
- Commercial trials by the chemical company ORICA, which has used the Lake Hart disposal area for the safe destruction of mining explosives and for the measurement of blast effects
- University of Queensland scramjet test flights.

Commercial Satellite Launching

The Commonwealth government has implemented a number of initiatives to encourage the commercial launch of satellites from Australian territory. It has enacted the *Space Activities Act 1998* to regulate commercial space launch operations in Australia. The Act aims to protect public safety and property during the conduct of launches. Broad approaches to protecting public life and property are adopted under the space-licensing regime.

In launching a rocket, the operator proposes a flight path designed to deliver the satellite (payload) to the owner's target position in space. In some cases the preferred flight path may include overflight of population centres or high value assets. The Space Activities Act requires that the Minister be satisfied as to the safety of the proposed launch along this flight path. Otherwise an alternative flight path needs to be proposed.

The proposed satellite launch activities are (see Figure 10.3):

- Kistler Aerospace Corporation
- Spacelift Australia Ltd
- Falcon Project.

Kistler

Kistler Aerospace Corporation has selected the WPA for the launch and recovery of a two-stage liquid fuel vehicle, which would be used to deploy communications and other satellites into low earth orbit. Kistler is progressing towards the finalisation of finances and is expected to begin construction of the launch pad when these are secured.

A site midway between Woomera Airfield and the Woomera Rangehead at Ashton Hill has been approved for construction. Launches would be in a north-northeasterly direction. The maximum number of launches is estimated to be no more than 25 per year.

Only Site 45a is within the Kistler safety zone.

Spacelift

Spacelift Australia Ltd has a proposal to launch light payloads into low earth orbit using Russian rockets, and is progressing towards finalising its finances. It originally intended to establish its facilities near Range E, but is now investigating a site north of Woomera Airfield, near Range G. When established, Spacelift intends launching along a set of trajectories between north-northwest and northeast with the specific trajectories dependent on customer requirements and safety considerations. The number of launches is estimated to be no more than 12 per year.

Spacelift's activities would not be expected to affect the preferred site or alternatives.

Falcon

The Falcon project is intending to establish facilities at Woomera, and plans to reactivate the launch pad 6a on the shores of Lake Hart, launching along a trajectory of approximately –55

and –10 degrees. Site 52a may be within the safety template. The status of the project is, however, unclear. The number of launches is estimated to be no more than 12 per year.

Radioactive Waste Storage on the WPA

A significant proportion of Australia's holdings of both low and intermediate level waste is currently stored in the WPA, close to Site 52a, and has been stored there since 1994–95 without incident.

More than half of the national holdings of low level and short-lived intermediate level radioactive waste are stored in a corrugated iron annexe attached to an aircraft hanger at the Rangehead, 10 km to the east of Site 52a and close to a target area (Figure 10.3). This material consists of contaminated soil, which originated from the clean-up of a site at Fishermans Bend, Victoria, and belongs to the CSIRO.

This contaminated soil amounts to about 2010 m³ and is stored in 9276 drums of 207 L capacity (Section 4.1). The drums were moved safely from Sydney to the annexe between November 1994 and January 1995. The transfer required about 120 truck movements. The same number of truck movements is likely to be necessary to transfer the drums from the annexe to the repository.

Some 35 m³ of conditioned short and long-lived intermediate level waste is stored in a concrete bunker at Launch Area 5, which is 3 km to the south of Site 52a and within the WIR. The location is within 5000 m of the Range E target. This waste is the responsibility of Defence and was moved safely to the WPA from Sydney, in May 1995.

Radioactive waste is also located at the former Maralinga test site, buried in near-surface trenches.

Matters relevant to the siting of the national repository at the preferred site, Site 52a in the WPA, include the following:

- The 1.5 x 1.5 km (2.25 km² or 225 hectares) site required for the repository is insignificant compared with the size of the WPA (127,800 km²). Much of the site would be a large buffer zone with restricted access, with the repository trenches or boreholes located in a central 100 x 100 m area.
- Waste would be buried under at least 5 m of clean cover.
- After the initial campaign to dispose of accumulated waste, the repository would only be open to take waste for a limited time every few years (see Section 6.1.4). Otherwise the trenches would be covered and there would be no activity at the site, apart from monitoring and surveillance. The timing of disposal activities could be coordinated with Defence so as not to overlap with other uses of the range.
- As the WPA is an area of restricted public access, members of the general public would not be allowed near the repository site.
- Site 52a is the closest of the three sites to the building in which more than half of the national holding of low level and short-lived intermediate level radioactive waste is now stored. Thus the use of Site 52a for the repository would minimise the transport risks associated with moving the national holdings of waste to the facility.
- Defence's operational activities in the WIR since 1994 have taken place without any incident related to the existing radioactive waste stored in the WIR. The truck movements for transfer of the radioactive waste to the rangehead were harmonised with activities in the WPA, and operational activities since then have been able to take account of the two above-ground structures in which the waste is stored.

10.5 Planning Policy

The prediction of potential future activity in this part of South Australia is particularly difficult. The infrastructure, land tenure and climatic conditions are generally a major barrier for

additional, more intensive activities. However, technological advances and changes in global economic conditions and markets can prompt major investment in activities such as research and mining. In particular, there are a number of potentially significant mining project prospects in the region which, should they occur, could have major impacts on the level and nature of activity in the region.

This section provides an overview of the key development policy documents that provide insight into current expectations of future development. The nature and trends associated with the key land use types are also assessed.

10.5.1 South Australian Government Planning Strategy

A revised draft of the South Australian Government's *Planning strategy for the development of regional South Australia* (Planning SA 2001) was released in August 2001. This document is recognised by the South Australian *Development Act 1993* and has the role of providing broad strategic direction. While it has no direct influence on the assessment of specific development proposals, it does influence and guide future Development Plan and zoning policy.

The planning strategy divides the State into key regions. The Outback Planning and Development Area includes most of the northern region of the State and is the area of relevance to this proposal. The key strategies identified for the outback area focus on supporting economic development, conserving and managing natural resources; supporting existing communities; and providing improved infrastructure. The planning strategy fundamentally acknowledges the existing land use activities but the introduction of new land use activities is not specifically envisaged.

Mining, defence and aerospace activities (including their support industries) are considered the key areas for potential economic growth and future development. Tourism (based on adventure, four-wheel drive, heritage and Aboriginal culture themes) is also considered a potential growth area. The strategic emphasis for rangeland grazing is one of adjusting practices to achieve a greater level of sustainability.

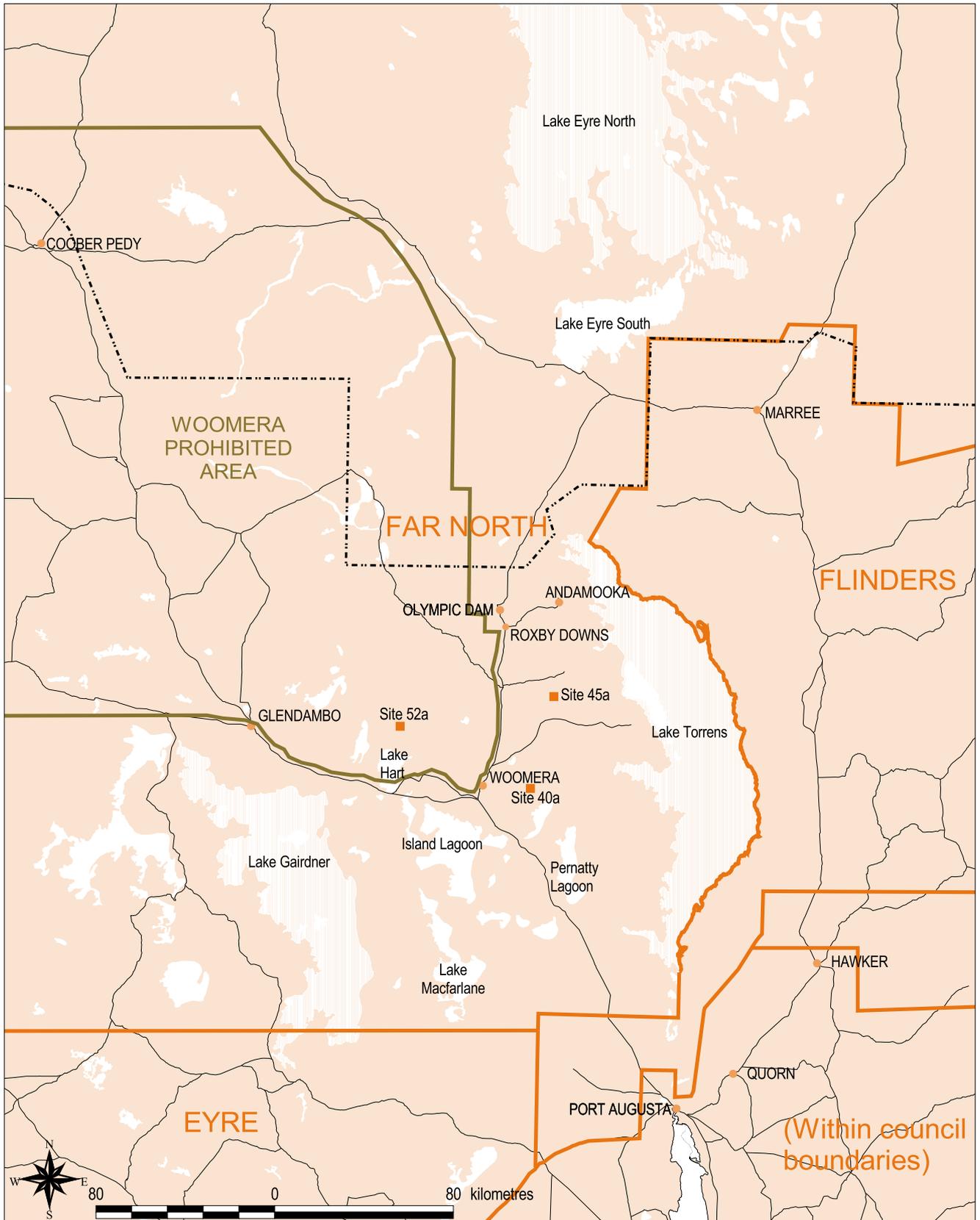
The potential for a radioactive waste repository is recognised in the planning strategy. The existence of a buffer zone on the repository site around the repository trenches and boreholes would ensure a safe distance between the facility and other activities that may be undertaken in the surrounding area.

In summary, the implications of the strategies on future development patterns and level of activity are likely to be as follows:

- Centres of development activity would be generally be limited to existing areas.
- Rangeland grazing activity is unlikely to become more intensive.
- Mining activity and associated support industries could establish in new areas (new ventures).
- Improved approaches to infrastructure and service delivery (water, energy, transport and communications) are unlikely to change significantly the existing patterns of settlement but should support community and business operating conditions.
- Improvement to infrastructure and services may encourage a greater level of remote area tourism (e.g. improved mobile phone service).

10.5.2 Development Plan and Zoning Policy

The relevant Development Plan provides an indication of the type and nature of land uses that are envisaged for the area. The 'Land Not Within A Council Area (Far North)' Development Plan applies to that area indicated in Figure 10.4.



- Towns
- Pastoral lease homestead
- Potential repository sites
- Out of council development plan boundaries
- Woomera Prohibited Area

- Dog fence
- Roads
- Salt lakes

FIGURE 10.4

Development plan areas

Given the recent release of the revised draft planning strategy for the region, it is expected that the Development Plan policies may eventually be amended to align with the intentions of the planning strategy.

Current policies within the Development Plan recognise the remote and diverse nature of this region as a whole. While the policies allow a wide range of forms of development, they also require recognition of environmental and conservation principles. The policies support tourism, mining and township development. Apart from some forms of advertising, no form of development is listed as either complying or non-complying.

Thus, provided a development can supply the infrastructure it requires and addresses environmental and conservation issues, there is little within the Development Plan to prevent any type of development occurring within any part of this region.

10.6 Future Activity Assessment

10.6.1 Access

There is good bitumen road access to the region running north from the Stuart Highway turnoff at Pimba including to Woomera, Roxby Downs and Andamooka from the Pimba turnoff. The Trans Australia Railway also passes through the region. Travel through the remainder of the region is limited by the quality of road infrastructure beyond these townships. Travel is generally restricted to the limited network of public roads and highways unless specific approval has been sought to access pastoral properties, Aboriginal lands and other reserve and restricted areas.

New road infrastructure, particularly that of a higher standard than the current off-road tracks, has the potential to increase the amount of movement through the area. However, it is unlikely to be established unless it is associated with a specific development or facility. On present indications, other than infrastructure required for the repository, other types of development that might require such infrastructure are likely to be confined to new mining operations.

Similarly, the establishment of new aircraft landing facilities is unlikely unless associated with a major new centre of activity such as a new mining operation.

10.6.2 Woomera

Defence maintains a program of activity at the Woomera facility within the WPA for a range of research and testing activities. The facility is also used by commercial organisations. As part of its operational responsibilities, the department maintains safety and exclusion zones and separation requirements to ensure that activity occurs in a safe manner, including controls over access and the nature of activity that can occur within the WPA.

The potential interaction between the repository if sited on Site 52a and Defence and other uses of the WPA is discussed further in Chapter 12.

10.6.3 Tourism

Tourism is a growing element of activity in the remote areas of Australia. Organised, commercial tours and the growth of off-road vehicle use has increased the ability of tourists to access remote and wilderness areas. This has led to an increase in the level of conflict between existing activities (particularly rangeland grazing and mining uses) and tourist activity. It has also created additional environmental management issues when tourists access sensitive and fragile areas.

The key attraction of remote area tourism is the notion of 'getting away from it all' and this type of tourism tends to involve:

- small groups of people
- unpredictable timing and duration of activity
- unpredictable destination estimates
- participants who may not be well trained or versed in the nature and sensitivities of the destination area
- misunderstandings about access rights and cultural practices.

Management and control of the impacts of this type of tourism is particularly difficult as the numbers of people involved, their destinations and level of knowledge are not known. The South Australian Pastoral Board has established a Public Access Coordinating Committee to further consider this issue. The committee includes representatives of the South Australian Government, SA Farmers Federation, the 4WD Association and the Conservation Council.

While not purely a 'tourism' activity, the protest and demonstration events staged at Olympic Dam and Woomera have similar impacts on community infrastructure to tourism. These activities brings 'visitors' to the area, who place pressure on accommodation, facilities and community services, and may discourage other tourists from visiting such areas. This type of activity is not expected to diminish in the near future.

10.6.4 Pastoral Activity

Rangeland grazing is the most extensive land use in the region, but the arid climate and low and erratic rainfall limit the intensity of this activity. A greater understanding and appreciation of land and resource management is also changing the nature of such activities. Inappropriate management practices in the past have affected the productivity of some areas, and international economic trends have further influenced the viability of some operations.

The nature of pastoral activity is now better understood and more easily controlled as there are relatively few individuals involved, their behaviour is more predictable and they are more likely to be receptive to sustainable management practices. Regional soil boards, such as the Kingoonya Soil Board (relevant to this region) advise pastoralists on land management practices.

10.6.5 Mining

The region is recognised as an area with high potential for mining activity. Operations such as Olympic Dam introduce a substantial level of new infrastructure and activity which is not restricted to mining operations alone but includes new communities (employees) service centres supporting industrial activities, transport and logistics activities, and associated infrastructure.

The establishment, expansion and timing of such ventures heavily depend on technological and global economic conditions, making predictions about future land use and activity very difficult.

Other potential mining projects in the area include: the Aulron Energy Ingomar project south of Coober Pedy, based on coal and iron ore; Dominion Mining Ltd's Challenger gold project southwest of Coober Pedy; Pima Mining NL's Andamooka Island prospect with copper-gold-uranium mineralisation (on the western side of Lake Torrens); Gunson Resources Ltd-Billiton Australia copper prospect near Mount Gunson; Grenfell Resources Ltd copper-gold prospect near Tarcoola; and Minotaur Resources Ltd copper-gold-uranium prospect near Mount Woods (between Olympic Dam and Coober Pedy).

10.7 Evaluation of Impacts and Risks

Australia's national repository would be a relatively small facility compared with the land required for other activities in the region. Disposal operations are expected to be conducted infrequently. Therefore, land use impacts would be expected to be small and primarily limited to the 'active' phases (i.e. during construction, operation and decommissioning).

Establishment of the repository would have minor positive impacts including:

- short-term local opportunities for employment and for the sale of goods and services, primarily during construction and operating campaigns
- possible up-grade of road infrastructure (only for Sites 40a and 45a)
- conservation benefits arising from regeneration of flora and fauna as a result of the exclusion of feral animals from the site
- visual impact as a result of the regeneration of flora.

Outside the region, there would be significant positive impacts arising from removing radioactive waste from temporary, non-purpose-built accommodation at many sites around Australia. Any possible hazard from the present storage activities would be eliminated when the sites were decommissioned. Once decommissioned, these sites would be available for uses more appropriate to their surrounding environments.

The main negative land use impacts associated with the proposal are relatively minor or of a short term duration and include:

- upgrading of existing road infrastructure (only for Sites 40a and 45a) which, if undertaken, would provide improved access to these areas
- activities associated with the construction and operation of the repository, such as the establishment of support facilities, and excavation and filling of disposal structures
- visual impact, primarily during construction and operating campaigns
- minor increases in traffic and pressure on local services during construction and operating campaigns
- minor effect on existing land uses at the repository site (including pastoral activities)
- potential to exacerbate the level of 'demonstration' activity and place pressure on local camping facilities and police resources.

It is not proposed to install power and water service infrastructure to the repository site (Section 6.3.6).

It has been argued that public perceptions about the facility would have negative impacts on the image of the region, which in turn would have a related negative economic impact. However, the transfer of radioactive waste for storage in the WPA in 1994–95 received considerable media coverage at the time, and the fact of its storage has been mentioned in the media and other public forums on many occasions since, as has the proposal to locate the repository in this region. In these circumstances, it is unlikely that construction of the repository would give rise to any new adverse impact on perceptions about the region or the regional economy.

The risk that a weapon or projectile from a Defence trial at the WIR might strike Site 52a is discussed in some detail below, and risk reduction measures are identified. The other sites are not subject to this class of risk.

Radiological risks are discussed separately, in Sections 12.5 and 12.8.

The other risks that need to be addressed relate to possible unauthorised intrusion and security breaches. Because of its location within the WPA, these risks would be lower at Site 52a than at either Site 40a or Site 45a.

The establishment of the repository would have minor positive impacts including:

- short-term local employment and purchase of goods and services
- possible up-grade of road infrastructure (local use).

10.7.1 Visual Impact

The nature of the visible elements of the national repository would comprise the security and feral-animal-proof fencing, and the operations and other buildings (Figures 6.2–6.3). During campaigns (which would be infrequent and undertaken over a relatively short period) there would be additional construction and earth moving equipment on site, and one or more trenches or boreholes could be open.

In between campaigns, the disposal trenches (or boreholes) would be covered and capped, and evident only as low mounds. As the disposal area would be a considerable distance from the perimeter fence, regenerated flora in the buffer zone would tend to hide (from the fence) any evidence of surface disturbance, apart from the access road.

Most if not all of the buildings and most other infrastructure, apart from fences, roads etc, would be removed from the repository site between campaigns (see Section 6.4.2). The size, scale, colours, materials and design styles of permanent buildings has yet to be decided. In this context the following assessment is relevant to the potential visual impact.

For Site 52a, the facilities, equipment and activities would not be dissimilar to other facilities, equipment and activities presently on the WPA and would be consistent with the existing landscape character. In addition, the restricted access would limit the numbers and types of people who might experience this landscape. Thus, assuming that appropriate colours and materials are used (e.g. non-reflective), the impact on the existing landscape would therefore be minimal, and this site is preferred for visual impact.

For the alternative sites, 40a and 45a, the landscape context is different. While there is some evidence of human activity in these areas, this tends to be limited in nature and scale (e.g. fence lines, and domestic and agricultural scale buildings). The proposed facilities, equipment and activities would be different from the existing pastoral activities, and would introduce a new visual element. In addition, there is a potential that a greater range of people could experience this landscape as access is not as restricted as in the WPA. It is possible to address the potential impact on the landscape using appropriate designs, colours and materials similar to other buildings commonly found in outback areas.

10.7.2 Access

There would be some impact on the transportation network in the region but, given the relatively small amount of activity during the construction, operation and closure phases, it is not expected that there would be any significant disruption of road traffic from activities relating to the repository. This is discussed in Chapter 7.

Given the limited road infrastructure within the region, a consideration would be the potential conflict between construction traffic and regional activity. The regional transport and traffic activity includes:

- access to shopping and medical centres (Whyalla, Port Augusta, Adelaide)
- freight transport (including road trains)
- tourist traffic (camping and off-road)
- business traffic (suppliers, contractors and service providers to the mining and research industries).

The construction phase has the potential for minor and short-term disruption of access arrangements for these remote areas, which depend on road access for a range of services and activities. However, owing to the relatively small scale of the construction activity, these issues are not considered to be significant.

The amount of operational traffic generated is described in Chapter 7. Overall, the traffic generated would not be significant, even during the first disposal campaign when the accumulated materials are transferred to the facility.

The use of Site 52a for the repository would minimise the transport distance, risks and any possible traffic disruption associated with moving the national holdings of waste to the repository. This is because Site 52a is the closest of the three sites to the building in which more than half of the national holdings of low level and short-lived intermediate level radioactive waste are now stored. The waste now stored in the WPA would be moved on roads not accessible to the public and which would be unlikely to any carry other traffic.

However, in the case of Sites 45a and 40a, the existing access roads would need to be upgraded (Section 7.4, Figure 7.2). The improved road infrastructure might improve accessibility to areas that were previously relatively protected from activity such as tourism and camping. Some areas along these routes are scenically attractive but also sensitive to human intrusion and activity. Such issues would not arise for Site 52a, where access to the WPA is already restricted.

In terms of domestic air traffic it is considered that the potential for conflict from a land use perspective is likely to be low. The limited level of air traffic, the landing and take-off directions of this traffic and the distances from the site options combine to limit the risk of potential conflict. However, of the three sites, 52a is generally the most remote from these facilities and Site 45a is the closest.

10.7.3 Site Suitability and Land Use

Based on the operational characteristics of the proposed facility alone, all three sites are suitable from a site planning perspective in that the proposal could be established at either the preferred or alternative sites provided that suitable buffers are established to address security, risk of intrusion and future land use activity concerns.

Current State zoning has little provision to limit the establishment of land uses and activities in the vicinity of the facility in the future. However, for the foreseeable future it is likely that pastoral activities would occur in the areas around the sites and, in the case of Site 52a, military and other uses of the WPA would also continue around the site. A further possibility is that a 'major project' (e.g. a mining venture) could be established in the region following the establishment of the proposed facility.

Given the size of the repository site, the impact on existing land use is expected to be minimal and, in relative terms, only a small amount of land would be removed from pastoral use. In addition, the site area and layout is such that a buffer has been included around the repository to ensure that the disposal trenches are suitably distant from both current and possible future land uses. The use of the buffer as a regeneration area is unlikely to conflict with other land use types.

From a practical, security and infrastructure perspective, Site 52a offers several site planning and other advantages over the two alternative sites:

- The level and standard of existing infrastructure is significantly higher.
- Its location within the WPA offers additional security advantages to address inadvertent or deliberate intrusion.
- It offers better existing access, which would significantly assist the construction stage.

- The use of Site 52a would avoid the significant road access consideration that would be required for the alternative sites.
- The longer-term land use activity is already subject to some control by the Commonwealth.
- Radioactive waste is already stored in the WPA.

10.7.4 Approaches, Programs and Procedures to Minimise Impacts

Various approaches could be adopted to minimise negative impacts of the national repository on the natural environment, existing land uses and the socio-economic environment. There may be some minor positive impacts from the siting of the facility.

Visual Environment

Minimising the structures left on the site between disposal campaigns would reduce minor visual impacts. In the case of Site 52a in particular, the structures on the site during disposal operations would not be dissimilar to the infrastructure already located on the WPA.

For Sites 45a and 40a, appropriate scale, design, colours and materials would be adopted, similar in character to typical 'outback' buildings, and this would assist to limit the visual impact.

At whichever site is selected, between campaigns, the growth of flora would tend to hide (from the fence) any evidence of surface disturbance apart from the access road.

Land Use

Potential impacts from the relatively small volume of traffic expected during construction and operation of the facility could be minimised by careful planning of activities. This would include consolidation of waste loads so that the number of trucks required is minimised.

Given the level of infrastructure already in existence in the vicinity of Site 52a, the siting of the repository at this location would minimise the need for the construction and upgrading of existing infrastructure such as roads.

To minimise the effect of construction and disposal operations on existing land use, the timing of these activities could be scheduled so as not to coincide with other uses of the WPA (in the case of Site 52a), or with particular pastoral activities such as lambing.

As for potential impact on diversification or expansion of military, aerospace or other use of the WPA, current activities on the WPA have co-existed with the storage of radioactive waste in above-ground facilities since 1994, without inhibiting activities aimed at diversification or expansion.

In comparison with present circumstances, the repository should, when operational, reduce concerns for diversification or expansion, because waste in the repository would be buried below ground, and the facility would pose a lesser hazard than the current storage arrangements.

Access

Access to the 1.5 x 1.5 km national repository site would be limited through appropriate security measures. Security fencing and other surveillance and monitoring would deter intrusion by people or relatively large animals.

Site 52a, within the WPA, would have in-built public access restrictions and other security coverage, and offer security advantages to the alternative sites.

In the case of Sites 45a and 40a, the upgraded road infrastructure could facilitate public access (e.g. tourists) to areas previously protected by the poor standard of these roads. Should either of Sites 45a or 40a be selected, measures would be adopted to minimise public access to the new roads by the use of locked gates, bollards, signage and fencing as deterrents.

10.7.5 Location of the Repository within the Woomera Instrumented Range

Location of the repository within the WIR presents a small risk that a weapon projectile fired at a target within the WIR, most particularly at the Range E target, could strike the repository site. Smaller, low velocity projectiles can be expected to fragment on impact with only limited ground penetration and are likely to damage only surface features or structures. However, larger or higher velocity weapons may strike with sufficient kinetic energy to penetrate the 5 m soil cover proposed for the repository (Section 6.2.5).

For an impact of this nature to represent a risk to human health or the environment, the impact would have to result in the release of radioactive material into the environment, including the surrounding or underlying ground, groundwater, vegetation or the atmosphere. The radiological risks of such an incident and release are discussed in Sections 12.5 and 12.8.

However, even if no radioactive material is released, the risk of impact of a weapon on the repository is an issue that should be considered.

Risk Assessment

A means of assessing the risk of such an occurrence is presented by *US Department of Defense Military Standard 882D, Standard Practice — System Safety, 1999* (MIL-STD-882D).

MIL-STD-882D provides a method of applying system safety that 'has proven effective in the management of environmental, safety and health mishap risks encountered during the development, test, production, use and disposal of Government systems, subsystems, equipment and facilities'. The MIL-STD 'provides a consistent means of evaluating identified risks. Mishap risk must be identified, evaluated and mitigated to a level acceptable (as defined by the system user or customer) to the appropriate authority and compliant with federal laws and regulations.'

MIL-STD-882D is recognised by the Australian Defence Force ADF as an appropriate basis for risk assessment and control. Defence aviation risk management principles require ARDU to ensure that risk assessment and control techniques based on MIL-STD-882D are promulgated and implemented in the planning and conduct of ARDU activities (Department of Defence, pers. comm. 2001). The methodology presented in MIL-STD-882D is similar to that used in *Australian Standard AS/NZS 4360/1999, Risk Management*, although different terminology is used. However, the US MIL-STD-882D is the standard directly applicable to ADF aviation risk management.

Methodology

An 'assessment of mishap risk' is made by 'assess[ing] the severity and probability of the risk associated with each identified hazard, i.e. determine the potential impact of the hazard on the personnel, facilities, equipment, operations, the public or environment, as well as on the system itself'. To aid in the achievement of the objective of system safety, mishap risks are characterised as to mishap severity and mishap probability.

Identifying the Risk

As discussed in preceding paragraphs, the risk to be assessed is the risk that a weapon fired at a target within the WIR would strike the repository site with sufficient force to penetrate at least 5 m into the ground, which is sufficient to breach the capping material above the radioactive waste. High explosives are not used on the WIR — the energy required to achieve soil penetration is therefore kinetic energy only, not explosive.

Analysing the Risk

Mishap Probability

The likelihood being assessed is that of an impact of a weapon with sufficient impact energy to penetrate the soil covering the repository to a depth of 5 m. These weapons are taken to be large bombs and missiles in excess of 250 kg impact mass.

Defence advises that there are on average 60 weapons firings per year that could potentially strike the repository. These are weapons for which the firing template, that is the area within which the weapon may fall if it veers off course, overlaps Site 52a. These weapons are predominantly fired at the Range E target, which is located just over 3000 m from the centre of Site 52a.

Defence advises that, of the 60 weapons releases discussed above, 42 have the potential to penetrate to a depth of 5 m.

However, it is also understood that many of the heavier mass weapons fired at the Range E Target are cluster bombs.

While cluster bombs may weigh up to 500 kg in total, they are a cylindrical clamshell casing that contains 200 or more small bomblets each generally less than 1.5 kg in weight. The weapon is designed so that the clamshell casing splits open in the air and releases the bomblets, which are not massive enough to penetrate the depth to the repository cover. If the weapon casing failed to open in the air, the entire weapon may strike the ground. However, it is likely that the casing would shatter on impact, without significant penetration.

The risk assessment that follows has been based on the firing of 42 weapons per year that have the potential to penetrate to a depth of 5m, without an allowance for use of cluster bombs. This provides for a conservative risk assessment.

Methods of Calculating Likelihood

A method of calculating likelihood of impact is to note that the weapons safety templates used by Defence are based on a probability of an impact from an individual weapon release of 1×10^{-6} at the template boundary, increasing to approach unity at the target point. Information provided by Defence for weapons releases at the Range E target area indicates that the repository is located in an area where the risk is 1×10^{-6} . It is therefore reasonable to assume that the probability of an individual weapon release striking the repository site is 1×10^{-6} .

Based on 42 releases per year of weapons with potential to penetrate to a depth of 5 m, the resultant annual likelihood of an impact in the vicinity of the template boundary can therefore be calculated as $42 \times 1 \times 10^{-6} = 4.2 \times 10^{-5}$ per year.

An alternative method is that used in Section 12.5 in the assessment of radiological risks. This method makes the conservative assumption that each weapon has an equal probability of landing in any given square metre of the WPA. It is further assumed that any strike within 100 m of the central repository area of 100×100 m (0.01 km^2) would cause disruption to the wastes, that is the total area that could be possibly affected is approximately 0.09 km^2 . The ratio of this to the total WPA is therefore multiplied by the number of releases of weapons

potentially disruptive to the repository, resulting in a figure for weapon impact of 3.0×10^{-5} per year. This method also includes the possibility of an aircraft crash and calculates the probability of a military aircraft crash on the site, based on UK data, at 7.0×10^{-8} per year.

Mishap Probability Level

The mishap probability levels are presented in Table 10.1.

Based on the figures discussed above the mishap probability for an impact of a weapon that could penetrate to a depth of 5 m can be assigned a level of D Remote, as the probability is assessed as being between 10^{-3} and 10^{-6} . The risk level rating does not vary whether the central part of the repository site is evaluated or whether the entire 1.5 x 1.5 km site is assessed.

TABLE 10.1 Mishap probability levels

Description	Level	Specific individual item	Fleet or inventory
Frequent	A	Likely to occur often in the life of an item, with an occurrence greater than 10^{-1} in that life.	Continuously experienced
Probable	B	Will occur several times in the life of an item, with a probability of occurrence less than 10^{-1} but greater than 10^{-2} in that life	Will occur frequently
Occasional	C	Likely to occur some time in the life of an item, with a probability of occurrence less than 10^{-2} but greater than 10^{-3} in that life	Will occur several times
Remote	D	Unlikely but possible to occur some time in the life of an item, with a probability of occurrence less than 10^{-3} but greater than 10^{-6} in that life	Unlikely, but can reasonably be expected to occur
Improbable	E	So unlikely it can be assumed occurrence may not be experienced, with a probability of occurrence of less than 10^{-6}	Unlikely to occur, but possible

Source: MIL-STD-882D

Mishap Severity

Mishap severity categories are presented in Table 10.2.

TABLE 10.2 Mishap severity categories

Description	Category	Criteria
Catastrophic	I	Could result in death, permanent total disability, loss exceeding US \$1 million, or irreversible severe environmental damage that violates law or regulation
Critical	II	Could result in permanent partial disability, injuries or occupational illness that may result in the hospitalisation of at least three people, loss exceeding US \$200,000 but less than US \$1 million, or reversible environmental damage causing a violation of law or regulation.
Marginal	III	Could result in injury or occupational illness resulting in one or more lost work days, loss exceeding US \$10,000 but less than US \$200,000, or mitigatable environmental damage without violation of law or regulation where restoration activities can be accomplished
Negligible	IV	Could result in injury or illness not resulting in a lost work day, loss exceeding US \$2,000 but less than US \$10,000, or minimal environmental damage not violating law or regulation

Source: MIL-STD-882D

As discussed in Chapter 12, the human health and environmental risks (the first criterion) posed by a release of radioactive material from the repository are remote and the chance of causing death or injury is low. In injury or illness terms, therefore, the severity can be classified as Negligible.

The second criterion relates to the financial cost of the mishap. For the repository operator, the financial cost of an impact on the repository would include the cost of clean-up and repair of any breach of the repository cover. Given the nature of the repository and the remote human health and environmental risks posed by a release of radioactive material from the repository, it is unlikely that the costs of rectification would be substantial. While a cost figure for this was not estimated, a severity classification of Marginal was considered appropriate.

An impact on the repository could cause delays to Defence operations at the WIR while an investigation into the cause and consequences of the incident is conducted. However, the actual costs incurred would depend on the nature of the mishap, the type of weapon being tested and the point in the testing program at which the mishap occurred. Further, it is likely that Defence would incur these delay costs in any event, as any mishap of this nature would require investigation irrespective of whether the repository was struck.

The third criterion relates to environmental damage. The repository would be licensed by ARPANSA in accordance with Commonwealth laws and regulations (see Sections 3.2 and 3.3). As discussed in Chapter 12, remediation and mitigation treatments could be applied if a weapon of concern penetrated the repository. This would imply a category of Marginal.

Looking at a balanced definition of severity across all relevant criteria, it was considered that the most appropriate categorisation overall is Marginal.

Risk Assessment

The risk assessment matrix is presented in Table 10.3 and the consequent risk category in Table 10.4.

TABLE 10.3 Risk assessment matrix

	Catastrophic	Critical	Marginal	Negligible
Frequent	1	3	7	13
Probable	2	5	9	16
Occasional	4	6	11	18
Remote	8	10	14	19
Improbable	12	15	17	20

Source: MIL-STD-882D

TABLE 10.4 Risk category definition

Mishap risk assessment value	Risk category
1–5	High
6–9	Serious
10–17	Medium
18–20	Low

Source: MIL-STD-882D

With a mishap probability of Remote and a mishap severity of Marginal, the risk category is Medium. Activities in this category are permissible in accordance with military risk assessment protocols, and Medium is the second lowest risk category presented by MIL-STD-882D.

Mishap Risk Mitigation

MIL-STD-882D then requires that potential mishap risk mitigation alternatives be identified. A number of alternatives exist, including:

- engineering and constructing the cover material to the waste to increase its resistance to penetration
- altering the orientation or lines of approach to the Range E target area to further decrease the probability of a weapon strike on the repository
- reviewing all new weapon system templates to determine whether templates can be developed that place the repository at minimum risk of impact.

Residual Risk

The residual risk is defined by MIL-STD-882D as the risk that remains after all planned mishap risk mitigation or management measures have been implemented.

The residual risk is categorised by MIL-STD-882D in Table 10.5.

TABLE 10.5 Residual risk categories

Category probability	Catastrophic	Critical	Marginal	Negligible
Frequent	High	High	Serious	Serious
Probable	High	High	Serious	Low
Occasional	High	Serious	Low	Low
Remote	Serious	Low	Low	Low
Improbable	Serious	Low	Low	Low

The implementation of mishap risk mitigation alternatives would reduce the risk category. For a risk probability of Remote and a severity category of Marginal, the residual risk is categorised as Low. Thus the operations at the WIR can be conducted at low residual risk, provided that the planning and management of operations takes into account the presence of the repository.

Existing Defence Waste

It was noted in earlier discussion that short-lived and long-lived intermediate level waste belonging to the Department of Defence was moved to the WPA in 1995 and that the waste has been stored since then in an above-ground structure at Launch Area 5, some 5000 m from the Range E target. Site 52a is some 3000 m from the target. Since the time of the transfer, Defence's operational activities have been able to take account of the structure and location in which the waste is stored.