

APPENDIX F4 Roxby Downs Draft Master Plan





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Figure 1.0 Existing Township

SCOPE

section one

The draft Master Plan for Roxby Downs is a framework for growth. Over the next five to ten years, as expansion at Olympic Dam unfolds, the population of the Town that services the mine will expand to up to 10,000 people. The purpose of the Master Plan is to provide the Vision for this Town of the future; to provide the Strategies necessary to achieve this Vision and the Guidelines required that would enable focused and timely activity to occur 'on the ground'. The Plan will help BHP Billiton, Roxby Downs Council, the community and developers build an expanded township that responds positively to its arid context and which makes Roxby Downs a wonderful living environment for its people.

The Plan envisages a Town that is both doubled in size and one which will still exist in 70 years time. By then Roxby Downs will be one of the oldest mining Towns in Australia and one of South Australia's principal rural communities.

The Plan is designed to be a working document. It is not a 'oneoff' commodity. Its ongoing success will depend on its flexibility to adapt to changing needs over time and on the degree of 'ownership' expressed by the people of Roxby – many of whom will come and go within the lifetime of the Plan.

It is necessary for a Plan such as this to convey the broad thrust of the proposed design approach. It is not intended to address every issue in detail. The Plan simply aims to provide guidance for design-related issues that are important to the future development of the place, and to ensure that development is responsive to the aspirations of the whole community.

It will help Roxby Downs fulfil its economic, environmental and social potential.



AIMS

The aim of the Master Plan is to be a design-based document. Where requirements are known (e.g. the numbers of residential buildings to be provided for) the Plan will make specific recommendations on both location and design. Where requirements are unknown or still under discussion the Plan will provide alternative strategies for location and design. The inclusion of a particular facility or component in this Plan does not automatically mean that such a feature will become reality.

The Master Plan provides

- An assessment of the existing social and environmental character of the township in the context of its historical development
- A response to Community input
- An agreed Vision
- An Urban Design Plan for the Roxby Downs Township
- Urban design recommendations for both the new Town elements and the existing urban area
- Civic area design
- Residential planning
- Open space design
- Landform treatment
- Access and movement
- Recreation and play
- Water sensitive urban design principles
- Built form
- Landscape
- Preliminary advice on the airport relocation
- Development of an Action Plan



REFERENCE DOCUMENTS

The following documents have played a key role in the development of the Plan:

- Kinhill Engineers Pty Ltd. 1986. Olympic Dam Expansion Project, Roxby Downs Township Geotechnical Report.
- Kinhill Engineers Pty Ltd. 1997. Olympic Dam Expansion Project. Environmental Impact Statement.
- Arup/HLA Envirosciences 2006. Olympic Dam EIS Project: Master Plan Consultation Report.
- Arup/HLA Envirosciences 2006. Roxby Downs Dune Survey.
- Planning SA & Government of South Australia 1999. Good Residential Design SA: A resource for planning, designing and developing neighbourhoods and homes.
- Essential Economics Pty Ltd. 2006. Roxby Downs Retail Economic Assessment.
- Roxby Downs Council. 2003. Roxby Downs (Municipality) Development Plan.
- Roxby Downs Council. 2005. Roxby Downs Community Plan.
- Planning SA Department of Transport and Urban Planning.
 2004 Designing out Crime: Design Solutions for Safer Neighbourhoods.

CONSULTATION

The community consultation approach for the Master Planning process is one component of an extensive Public Consultation Plan associated with the Environmental Impact Statement for the proposed expansion of Olympic Dam.

The objectives of the consultation are to:

- Inform about the Olympic Dam Development project, the EIS process and the Roxby Downs Master Plan
- Promote understanding of why consultation is occurring, what is involved, who is going to be consulted, what information is being sought and how this information will influence the decision making process
- Provide an opportunity for sharing of formation and interacting with the Roxby community so that views and concerns can be raised, documented and responded to
- Improve the planning process by guiding the design outcomes to be consistent with community expectations

The consultation process has involved the preparation of Information Sheets, the conducting of a Community Survey, articles in the Monitor Newspaper and an Inception Workshop with BHP Billiton, Roxby Downs Council, the EIS team and Arup/ HASSELL. A number of individual Focus Group meetings have also been undertaken with BHP Billiton staff, planning officers from Planning SA and key stakeholders in the Town.

The Focus Groups were designed to be:

- Interactive
- Productive
- Transparent
- Informative, and
- Enjoyable

Within the Town itself a total of 90 people attended the seven Focus Group sessions held in November 2005.

These results have formed one of the key building blocks in the development of the Master Plan proposals.

STEERING COMMITTEE

The Project Steering Committee included representatives of BHP Billiton, the EIS Team from ARUP HLA, Roxby Downs Council and Planning SA.

The Steering Committee was as follows:

BHP Billiton:

Dave ThomasJason SchellHerman KleynhansSteven GreenMick MillerGrant McClarenRichard YeelesRoxby Downs CouncilBill BoehmAlan Mayle (Consultant)Whyalla CouncilStewart PayneOlympic Dam EIS TeamDr. Michael RyanLisa Williams

The Project Team is as follows:

ARUP

Andy Marks (Project Director) Ian Davis (Civil Engineer) Vanessa Quirk (Civil Engineer) Peter Gillespie (Civil Engineer) Robert Stainforth (Traffic Planner) Jason Longland (Electrical Engineer)

HASSELL

Alun Chapman (Principal Urban Designer) Cassandra Chilton (Project Urban Designer and Associate Landscape Architect) Daniel Bennet (Associate Landscape Architect) Brenton Berman (Principal Planner) David Bills (Planner)

PEER GROUP

Dr. David Jones of Adelaide University Brian Mackay of Tonkin Consulting



APPLYING THE MASTER PLAN

The Master Plan document has been carefully developed so as to provide clear guidance for the future development of Roxby Downs, and is intended for a broad range of users. The Plan comprises the following sections:

- The Executive Summary (Section 2) provides a succinct summation of the principal proposals.
- The Existing Framework (Section 3) outlines the research and investigation that has been undertaken to date leading to the Constraints and Opportunities Plan (Section 4). This work, in combination with the results of the Public Consultation, has provided the basis from which the Vision, Strategies and Guidelines have been developed.
- The Vision (Section 5) presents the conceptual model from which the more detailed proposals have been developed.
- The Strategies, Goals, Actions and Design Guidelines (Section 6) illustrates the way forward both at the strategic and the detailed level.

The Master Plan will become the informing document for all future planning and design work to be undertaken in Roxby Downs.

ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT

Environmentally Sustainable Development aims to meet our existing needs without diminishing the worth of our natural resources for generations to come.

It demands a positive commitment from all to minimise the impact on the natural environment, minimise waste, use renewable energy resources and provide optimum solutions that will reduce long-term demands for energy.

BHP Billiton is one of the leading companies in Australia in its search for environmentally sustainable solutions. Its Sustainable Development Policy states that:

"We aspire to Zero Harm to people, our host communities and the environment and strive to achieve leading industry practice. Sound principles to govern safety, business conduct, social, environmental and economic activities are integral to the way we do business."

There are a number of techniques that can be employed to improve the sustainability of a place, including:

- Intelligent siting and locating of new developments
- Sensitive response to existing contextual characteristics
- Design of buildings to respond to climatic conditions and the natural features of a site
- Adoption of passive thermal design strategies
- Use of high-quality and durable materials appropriate to the setting
- Sourcing of building materials from renewable energy sources
- Responsible use and re-use of water
- Use of alternative energy sources
- Employment of indigenous plant material
- Reduced use of reflective surfaces
- Employment of environmentally sound land management practices
- Minimisation of waste
- Creation of well-defined, safe and vital communities that people will enjoy living in

EXECUTIVE SUMMARY

DESIGN BASE-LINE

Demographics

section two

- Design for a continuation of the existing demographic character of the Town, but allow for changes to this mix to occur over time
- Design for a Town of 10,000 people and a life span of 70 years
- Design for a new total permanent mine workforce of approximately 4,500 (long-term contractors and BHP Billiton employees)
- Assume an 50% residency rate of permanent employees within Roxby Downs
- Assume a Long Distance Commute workforce of 50% to reside in accommodation within Roxby Downs
- Allow for construction and short-term contractors to be accommodated outside of Roxby Downs
- Allow for additional growth in non-mine related residents
- Allow for a 5% vacancy rate to encourage healthier housing market

Sustainability

- Aim to create a sustainable township in line with BHP Billiton's Sustainable Development Policy
- Develop Roxby Downs as a leading example of Environmental Sustainable Urban Development
- Utilise the 'Good Residential Design' guide published by Planning SA as the basis for residential design

DESIGN PHILOSOPHY

- Acknowledge the significance and influence of the arid location
- Design for longevity and liveability
- Design to respect the environment

Culture

- Design for the people of Roxby Downs to enjoy
- Design to encourage people to stay longer in the Town
- Design to encourage older people to remain in the Town
- Celebrate the strong sporting culture of Roxby Downs
- Encourage people to actively use their streets
- Design for greater nighttime use
- Enhance the Town's credentials as a tourist destination
- Embrace new technologies that could enhance the liveability of the Town (e.g. to make Roxby Downs a 'Wireless' Town)
- Develop Roxby Downs as a UNESCO model for a 'Creative Town'

Design

- Up-grade the overall design quality of Roxby Downs
- Introduce good architectural design into the Town Core
- Create useable and attractive public open space

Movement

- Enhance the permeability of the Town
- Design for the pedestrian and cyclist as well as the car user



MASTER PLAN STRATEGIES

Town-Wide Urban Design Strategies

- Establish a concentric urban system for Roxby Downs with a single retail / civic / commercial / educational area at its core
- Limit the current expansion of the Town to within a 2km radius of the current centre of Richardson Place
- Design major roads to extend outwards from the Core, to allow for future expansion of the Town
- Locate small 'Local Centres', as needed, no closer than 1.5km from the Town Core, and no closer than 1km apart
- Scatter groups of accommodation for singles and couples units within the Town and no further than 1.5km from the centre, and aim for a variety of sizes to suit different requirements
- Introduce residential development to the west of Olympic Way
- Construct the remainder of the required housing concentrically around the Town
- Design the open space structure of the Town to echo the 'drifts' of the desert landscape

Civic Area Design Strategies

- Plan for a new early childhood services and primary school on the site of the existing Caravan Park No. 1.
- Plan for a new Police Station and Courthouse on the corner of Olympic Way and the extended Richardson Place
- Plan for the expansion of the Council and Government offices
- · Plan for the expansion for the existing hospital

Existing Retail Precinct

- Reinforce the existing retail precinct and extend these facilities towards Olympic Way by incorporating part of Burgoyne Place as an Extension of Richardson Place
- Introduce additional retail activity to the north side of Richardson Place, included potentially within the existing TAFE buildings
- Expand the TAFE facility to the north of the existing school
- Encourage restaurants at key locations along both sides of Richardson Place
- Plan for a new supermarket and associated specialty shops
- Plan for a new hotel / motel
- Plan for a potential increase in retail floorspace of 10,000m2 by 2013

RECREATIONAL AREA STRATEGIES

Town Core

- Design a new Town Park on the existing open ground to the rear of the swimming pool, and to the east of the existing Town Oval, with a new Town Plaza to connect the Park to Richardson Place
- Build a new Skate Park immediately adjacent to the Town Park, and close to Richardson Place
- Investigate covering the existing pool and/or heating to extend seasonal use
- Utilise the existing Town Oval as the main school oval

Development to the west of Olympic Way

- Provide for a new No. 1 Oval immediately to the west of Olympic Way, with a new No. 2 Oval alongside. This new Oval No.2 will have an additional role as a detention basin
- Provide for an integrated Sports and Community Club complex to the west of Olympic Way, on the site of the existing Golf Club building and linked to the No. 1 Oval
- Provide for lighting to the new No. 1 Oval
- Provide to re-locate the existing Social Club to this new joint facility
- Provide to re-locate the Bowling Club to the west of Olympic Way
- Provide for a new spectator viewing area overlooking the new No. 1 Oval
- Provide to install new Tennis Courts to the west of Olympic Way
- Provide additional netball courts

Regional

- Build a new cycleway running from Roxby Downs to Olympic Dam
- Site the new Race Course and Pony Club north of the existing Motor Sports facility
- Provide to create two new Regional Parks to the west and south-east of the township

RESIDENTIAL DESIGN STRATEGIES

Precincts

- Aim to achieve a set of distinct residential precincts within the new development areas, each with a strong individual identity
- Use the open space system to define the areas within which the new residential precincts will be developed
- Base the character of these new precincts on the compactness achieved within the 1980s residential development
- Maximise permeability and visibility for pedestrian and property safety and security
- Maximise passive surveillance of open space by residential development

Lot Design

- Utilise a traditional grid-based urban system for residential areas, to allow for greater permeability and legibility
- Orientate the majority of lots with their long axes running east-west
- Face residential lots towards the new Open Space System, where possible
- Align blocks (groupings of lots) to allow street views toward open space
- Design with a minimum broad acre residential lot size of 600m2 (30 metres x 20 metres)

Medium Density Design

- Introduce medium density residential apartments along the extension of Richardson Place towards Olympic Way
- Scatter other medium density residential development around the Town Core, but within a radius of 1km
- Maximise access for people with a disability in the medium density apartments near services and Town Core
- Locate low density unit developments throughout the town to acheive a mix of housing styles to accommodate a range of family sizes across the township

LANDSCAPE AND OPEN SPACE STRATEGIES

Open Space

- Create an Open Space System that reflects the existing character of the arid landscape (the 'Drifts')
- Utilise the existing dunes as the 'backbone' of this new Open Space System
- Design the Open Space System to act as wildlife corridors
- Utilise primarily indigenous plant material within the Open Space System
- Improve the existing open space systems, landscape and facilities

Streetscapes and Urban Parks

- Prepare a planting strategy for the whole Town, both new and old, and begin the growing-on of plant material
- Enact a Town-wide tree planting regime
- Plant introduced species used within the streetscapes, building surrounds and the Town Park
- Introduce avenue planting to all new streets and reinforce planting along existing streets to increase shade
- Utilise existing retention ponds as landscape features

Regional Parks

- Provide for the creation of two new Regional Parks, to the north-west and south-east of the Town
- Establish the new Regional Park to the south-east as a major example of arid landscapes



BUILT FORM

Richardson Place

- Introduce more interactive uses along Richardson Place
- Develop interactive facades along Richardson Place by replacing brick walls facing the street with glazing to the walls
- Orientate all new buildings towards the street
- Build two-storey buildings as the preferred new building form, along Richardson Place and its extension towards Olympic Way and promote the use of verandahs
- Make provision for outdoor dining to new buildings along Richardson Place
- Widen existing awnings to 5.5 metres, where possible
- Construct awnings of 5.5 metre width to all new public buildings

Materials

- Use colours and textures that are characteristic of the Town
- Utilise an accepted palette of materials and colours for any new buildings or landscape design
- Introduce a greater range of colour and vitality into the built form of Roxby Downs

Sustainability

- Design new built form with the principles of Sustainability as the primary focus
- Utilise an understanding of shading and thermal mass into building design to minimise energy use
- Provide wide eaves to all new buildings
- Provide a suite of housing design options, from which people can choose a home most suited to the needs of the Roxby Downs location

Fencing

- Prohibit any form of front fencing to residential homes
- Restrict side and back fences to a height of no more than 1.8 metres
- Encourage the use of permeable fencing for heat reduction and cross-ventilation

TRAFFIC AND PARKING

Road Design

- Emphasise pedestrian and cycle access as one of the main determinants of the design of the extended Town
- Extend Stuart Road and Aquila Boulevard to meet the By-Pass Road
- Introduce three to four new major road corridors to the west of Olympic Way
- Extend existing roads within the residential areas east of Olympic Way to meet new housing needs
- Provide for the new western roads corridors to act as 'floodways'
- Avoid long residential streets with aim to foster a low speed environment
- Maintain a minimum of 3 metre carriageway widths for each traffic direction
- Accommodate bus movements through residential collector roads

Intersection Design

- Create a new 'T' intersection between Burgoyne Street and Richardson Place, and designate this new stretch of road as part of Richardson Place
- Reduce the width of the extended Richardson Place and include a planted median strip (narrower than the existing)
- Investigate the introduction of traffic lights at the junction of the extended Richardson Place and Olympic Way
- Avoid cross intersections in new residential areas where possible
- Minimise the use of roundabouts, only to be used at strategic locations to manage traffic speeds or assist the turning of buses.

Parking

- Avoid locating large areas of parking adjacent to main roads and major junctions
- Encourage residential housing development which provides for adequate off-street parking within residential properties. Investigate limited short term on-street visitor parking adjacent to precinct facilities
- Provide shade tree planting and incorporate Safer Design Principles to all existing and new car park areas
- Utilise the principles of Water Sensitive Urban Design when draining car park areas

Safety

- Design to provide for a safe walking and cycling environment
- Encourage the overlooking of pathways to give a better sense of safety through casual surveillance
- Provide lighting to all major pedestrian / cycle ways, both new and existing
- Design to allow for safe bicycle and pedestrian use by children
- Design the entrances to cycle ways to make them as safe and welcoming as possible
- Use concrete as the primary material for footpaths / cycle paths

Connectivity

- Utilise the new Open Space System to establish a more connective path system, focused on the Town Core with connectivity and neighbourhood parks
- Utilise existing desire lines as the basis for future route ways
- Enter precinct walking and cycling between residential communities

Location

- Locate new pathways on the tops of dunes, where possible
- Avoid locating pathways alongside major roads or create dedicated shared paths where necessary
- Design for better access to the Town Core
- Inter-connect all pathways within the existing Town, as far as possible
- Replace defective footpaths and build new ones where necessary
- Allow path access from residential areas to the new Regional Parks

WATER

Potable Water

- Establish mandatory installation of AAA water saving appliances and fittings in each new household e.g. flow regulator for showers, dual flush toilets to minimise potable water usage
- Upgrade existing infrastructure to cater for future growth
- Provide additional potable water storage and system capacity

Surface Water

- Value surface water as a resource
- Establish detention basins, in the form of parkland, near to housing precincts, to harvest and reclaim surface water for non-potable applications
- Convey surface water, collected from the new hard standing areas via conventional surface water networks to a nearby detention basin for storage and use
- Introduce Water Sensitive Urban Design elements to manage surface water run-off and facilitate pollutant removal, i.e. swale drains
- Designate flood plain zones and overland flow paths away from residential areas that have adequate capacity to cater for peak storm events

Waste Water

- Separate new waste water and new surface water drainage networks
- Upgrade the existing wastewater treatment system to cater for the new population. Reclaim treated waste water for irrigation of nearby public reserves, sports grounds, the golf course and Olympic Way landscaping.
- Construct overflow containment tanks adjacent to pumping stations and the existing clay-lined overflow ponds to adhere to current EPA guidelines and prevent sewage discharge into the environment



AIRPORT FACILITIES

- Locate a new airport east of Roxby Downs off the Andamooka Road
- The airport to have capacity and facilities to meet the BHP Billiton expanded mining operational requirements and the requirements of the expanded Roxby Downs community

Recycled Water

- Reclaim treated effluent from the new waste water treatment plant to reduce the demand on the potable water supply
- Distribute reclaimed water to select irrigation sites including public reserves, sports grounds, the golf course, and Olympic Way landscaping in the vicinity of the treatment plant

LANDFILL

Waste Management

- Maintain landfill in existing location
- Construct new landfill facility and transfer station within the existing site to cater for town demand

POWER

- Upgrade the substation for the growth in population
- Establish mandatory compliance for all new buildings with the energy limits to be imposed in BCA 2006
- Consider use of solar water heating to new buildings
- Provide appropriate shading and thermal mass in building design and construction to minimise energy usage
- Provide a standard suite of housing design options that addresses options in building orientation, shading and occupancy use
- Incorporate Planning SA's energy conservation measures into lot and building layouts



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INTRODUCTION

Responsible urban design should reflect the long-term needs and aspirations of the community and take into account the physical opportunities and constraints of the 'place'. The preparation of any successful Master Plan must therefore begin with an understanding of the existing physical context, the nature of the current urban form, the economic and social conditions that prevail, and how these may change into the future.

Roxby Downs is unique. Superimposed on an arid landscape, with its purpose to service the nearby Olympic Dam Mine, it has grown to accommodate a population of 4,500 people. It is a vital and expanding township that has an impressively strong community base. The Town has existed since 1987 when it was established under the Roxby Downs Indenture Agreement with the South Australian Government. At this time the Town Core with its retail, commercial and civic functions, was established, together with an area of residential housing mainly to the north and east of the Core. Further (mainly residential) expansion occurred in 1996 and 1998, to the south of the Core.

The following section looks at the existing framework of the Town and is based on a broad range of information and advice gleaned from the following sources:

Site Investigation

Desk-top study of aerial photographic material and background material Discussions with BHP Billiton, Roxby Downs Council officers and State planning representatives Public consultation

LOCATION AND LINKS

Roxby Downs is located in central South Australia, 600 kilometers to the north-west of Adelaide and 300 kilometers north of Port Augusta. It was first established in 1985 to service the Olympic Dam Mine, and was extended in the early 1990s to address mine expansion. Currently an underground mine, Olympic Dam will again experience a considerable influx of workers over the next six years as it introduces an open cut mine and expanded proposing facilities. The proposed expansion of Roxby Downs is a direct response to the needs of this growing workforce.

The main road access from the coast is via Olympic Way from Port Augusta, while the main Adelaide to Darwin rail line runs to the west of the Town. The Roxby Downs Airport is situated 6 kilometers to the north of the Town adjacent to the existing Camp 1, and direct flights from Adelaide now occur on a daily basis. As part of the expansion of Olympic Dam, the Airport will be relocated 14 kilometers east of the Town off the Andamooka Highway.

The closest towns to Roxby Downs are Woomera, which is located 70 kilometers to the south, and Andamooka, 30 kilometers to the east. Port Augusta is located 230 kilometres to the south. It is 540 kilometres to Adelaide.



Figure 3.1 Regional Infrastructure

	Major Road
	Minor Road
• • • • •	Track
	Railway Line
	Transition Line Corridor
	Water Supply Pipeline
ন	Airfield
	Towns

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LANDSCAPE AND ENVIRONMENT

Roxby Downs is situated in a unique arid landscape with strongly defined physical characteristics and a vibrant combination of rolling red sands, dark green White Cypress-pines and the silver of the saltbush undergrowth and Western Myall trees.

As a result of the prevailing northerly winds, the landscape immediately surrounding Roxby Downs is characterized by disconnected sand dune ridge lines running in an east-west direction and separated by inter-dune corridors and swales. The dune field is interspersed with stony tablelands and claypans.

Dune field vegetation is both colourful and varied. Slopes and ridges are well vegetated with White Cypress-pines and Mulgas, whereas the inter-dune areas support smaller shrubby Acacias, native wildflowers, saltbushes and the majestic Western Myall. However, there is considerable evidence of tree deaths amongst the Western Myalls, particularly to the west of Olympic Way.

The field survey undertaken to assess the ecological significance of the dunes in and surrounding Roxby Downs (Attachment E) found no dunes of high significance, with the majority of the dunes being of medium to low significance. The findings indicate all dunes retain native vegetation and generally have low levels of disturbance. There are some problems with litter, motorcycle tracks, weeds and erosion. The condition and appearance of the dunes would be improved through the implementation of weed control programs, revegetation and regular litter removal.

The significance of the larger environment in which Roxby Downs township is located, and the need for ongoing protection, management and restoration of regional arid ecosystems is reflected in local and State initiatives - notably the Arid Recovery, which is a reserve dedicated to arid zone conservation.

Implications for the Design Framework

The environment is the key to the future image and attraction of Roxby Downs. It is vitally important that the planning and design of the Town reflects its desert context and that it is based on sound principles of Environmental Sustainability. It is also essential that areas of ecological and environmental significance be protected.

The opportunity exists for the development of large regional parks for bushwalking etc.



Durre Fields and Sand Spreads



Sand Ridges



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RESIDENTIAL ANALYSIS

Most of the current workforce of 2,270 Olympic Dam workers lives in Roxby Downs, but the highly constrained housing market has meant that increasing numbers are commuting from Andamooka, Woomera and Port Augusta. Approximately 25% of the permanent workforce are working on a Long Distance Commute basis (otherwise known as LDC) either by fly-in/fly-out or drive-in/drive out. The existing OD operations are currently developing additional housing to address current defficencies in housing for existing operational employees.

The current housing issues that are pertinent to the development of the Master Plan are:

- There is a chronic housing shortage in Roxby Downs
- The shortage has resulted in inflated house prices and, in particular, inflated rents
- These high costs are especially problematic for young people and families
- There is an increasing need in the community for greater flexibility in housing provision. The current housing shortage means there is often a lack of suitable accommodation to match specific needs
- The lack of housing is beginning to influence staff turnover
- The perceived shortage of housing is becoming a deterrent to attracting suitable staff to work in the mine
- The current boom in the mining sector, particularly in, but not limited to, South Australia, means that workers are able to choose to move to where the facilities are perceived to be the best
- Lifestyle issues, particularly for younger people, are becoming more important when choosing places of employment and abode
- The poor quality of the existing Camp 1 accommodation is unacceptable to BHP Billiton
- The existing Camp 3 is of a higher standard but is still seen as being of a lesser standard than the market is offering elsewhere
- Caravan parks are not seen as viable long-term solutions to housing needs, particularly when they are occupying valuable land close to the Town Core

- It is socially preferable that long stay Camp residents employees be re-sited into the Town itself, particularly as an alternative to the sub-standard accommodation of Camp 1
- Camp 1 will be de-commissioned when the pit mine starts and the current short-term residents will be located in new short stay quarters (Hiltaba Village), while long-term residents employees will be relocated to new accomodation within Roxby Downs

In addition to these concerns it is felt that a substantial increase in Long Distance Commute proportions would impact adversely on the Town, creating a potential problems of:

- Lack of a relationship with the community
- Impermanence in the workforce, and
- Lack of a long-term lifestyle commitment

As a result, Long Distance Commute should not be seen as the mainstay for the majority of the workforce but, on the other hand, it should not be wholly discounted as it does allow a degree of flexibility for mine management.

Baseline Assessment

Over time, most changes that are likely to occur in a Town can only be approximated, as they are often slow to evolve, incremental in character and subject to a considerable number of outside variables. In Roxby Downs, however, there is a greater degree of certainty, as it has already been established as fact that the population of the Town will increase dramatically over the next few years, due to the proposed expansion of the mine at Olympic Dam.

Consequently it is possible to base the Master Plan for Roxby Downs on a number of specific and demographic and workforce related criteria resulting from this expansion of the mine. These include the:

- Demographic and socio-economic profile
- Community profile
- Current housing provision
- Workforce and population forecasts
- Accommodation forecasts

Demographic and Socio-Economic Profile

In May 2005, the population of Roxby Downs stood at 4,000. Of these, 1,800 were permanently resident workers, 400 were temporary resident workers, and 1,800 were family members or non-mine residents. It is estimated that at May 2006 the population stood at 4,500.

A high proportion of young families characterise the current population structure, with a significant number of people in the 18-39-age bracket, and a high average household size at 2.9 persons per household. There is also a significant proportion of the population under the age of 12 years, with a marked reduction in numbers of 12 to 18 year olds resident in the Town, reflecting worker's contractual arrangements. These include for older children to be boarded at senior school in Adelaide.

Community Profile

Roxby Downs is notable for a strong community spirit which is reflected in a high resident involvement in community activities and organised sport and recreation. Roxby Downs is unique in South Australia in that the Council operates under an Administrator and without a democratically elected body. As the Town grows and the responsibility of the Council becomes greater this situation is likely to require review, with the following issues coming to the fore:

- The potential change to a fully elected Council
- The need to increase the revenue base
- The opportunity to increase civic pride in Roxby Downs and move away from the notion that BHP Billiton or Council will provide for all of the Community's needs, in perpetuity

Nevertheless, Roxby Downs can be seen as a model for a strong and vital community. Despite the difficulties inherent in its location, its obvious isolation and its largely transient workforce, it has managed to develop into an extremely cohesive community with relatively few of the problems that many towns in outback Australia currently face.



Current Housing Provision

In May 2005, the Housing Profile for Residential Properties in Roxby Downs was as follows:

HOUSE TYPE	EXISTING PROPERTIES
1 Bed House	245 (20%)
2 Bed House	315 (25%)
3 bed House	415 (33%)
4 Bed House	275 (22%)
Total Properties (May 2005)	1,250

Note: Housing provision is constantly being updated and the above numbers are approximate only. The stated percentages, however, are a reasonable reflection of the current situation.

The Accommodation Profile for the Permanent Workforce, in May 2005, was as follows:

WORKFORCE	HOUSE TYPE	EXISTING
		PROPERTIES
Residential	Roxby Downs – 1 Bed House	180 (8%)
Workforce	Roxby Downs – 2 Bed house	230 (10%)
	Roxby Downs – 3 Bed House	335 (14%)
	Roxby downs – 4 Bed House	215 (9%)
	Roxby Downs (with other worker)	155 (7%)
	Camps	500 (22%)
	Andamooka	130 (6%)
	Woomera	25 (1%)
	Caravan	50 (2%)
	Subtotal	1,820 (79%)
Long Distance	Camps	500 (21%)
Commute		
Workforce		
	Subtotal	500 (21%)
Permanent	TOTAL	2,320
Workforce Total		
Properties (May		
2005)		

Note: Again, the percentages should be read as the more accurate representation of the current situation.

The list of non-Mine Related Properties in May 2005 was as follows:

HOUSE TYPE	EXISTING PROPERTIES	
Roxby Downs - residential	290	
Roxby Downs – non-residential	50	
Total Non-Mine Properties (May 2005)	340	

The emphasis on the 3-4-bedroom dwelling sitting in its large allotment is what one would expect for a demographic heavily weighted towards young families. Of interest, however, and peculiar to a mining town, is the large number of camp residents.

Workforce and Population Forecasts

BHP Billiton has supplied the following baseline material, upon which to formulate the workforce and population forecasts, and hence the Master Plan:

- The Master Plan should allow for a total population of 10,000 people by the year 2015
- Roxby Downs should have a life expectancy at least as long as the current projected life of Olympic Dam; that is, 70 years
- The new total permanent mine workforce will be in the vicinity of 4,500. This number includes both long-term contractors and BHP Billiton employees
- To maintain flexibility, the Master Plan will assume an 50% residency rate of permanent employees within Roxby Downs. This leaves a Long Distance Commute workforce of 50% to reside in single person units and apartments within Roxby Downs
- The Plan should allow for additional growth in non-mine related residents

In addition, temporary personnel associated with the construction of the mine and short-term employees will not be located in Roxby Downs and will be located a minimum of 5 kilometres from the Town. Also, it is generally accepted that the Plan should allow for a 5% vacancy rate in residential housing to encourage a healthier housing market than exists at present.



Accommodation Forecasts

Apart from the workforce and population forecasts outlined above, the following changing lifestyle needs should be taken into account in determining the future accommodation requirements:

- An increase in the range of accommodation and, in particular allowing greater flexibility to satisfy a variety of housing needs
- More single persons accommodation and accommodation for small households. This could include both self-contained units and apartments
- Locating medium density residential development close to the Town Core
- Improving the quality of accommodation and providing a greater range of facilities (e.g. home office, shop-top housing etc.)
- Greater access to, and views into, open space
- Designing with the principles of Environmentally Sustainable
 Development at the fore

The forecast for future accomodation needs will be determined on a as required basis.

It is assumed, at this stage, that the range of housing supplied to date will be maintained, however there will be a larger proportion of medium density housing constructed than in previous years to suit changing lifestyle needs.

Implications for the Design Framework

There is a current housing shortage, as well as a projected increase in demand that will need to be accommodated in future residential development.

There is adequate available land to develop to accommodate the expected future growth of the Town to a population of approximately 10,000.

Future township growth will be constrained by the Olympic Dam-Pimba Road to the east, dust and noise constraints to the north, and ecologically sensitive areas to the south and low land to the west.

BUILT FORM

Introduction

Richardson Place is the centre of commercial activity in Roxby Downs. It is over 70 metres wide and comprises a run of civic and cultural buildings along the northern edge and an opposing run of retail buildings along the southern edge, either side of a large (26 metre) grass median. Back from the main street can be found the supermarket, social club and hotel to the south, and a Cultural Precinct, Swimming Pool, TAFE, Area School and Library to the north. Additional civic and recreational facilities are located at the western end of Richardson Place and its junction with Burgoyne Street. Car parking is located either along the footpaths of Richardson Place, within the large median or off Burgoyne Street, adjacent to the Bowling Club.

Roxby Downs is unusual for a shopping centre in that the retail area, comprising a supermarket and specialty shops, is entirely confined to the southern side of the street (along with the Civic Offices and the Police Station).

There is no retail currently on the northern side, which is entirely given over to cultural and educational facilities. This has resulted in a far more active southern edge, with activity on the northern side confined to the entry to the Cultural Precinct and other community facilities and to the Library. Also, the disproportionate scale of the street means that the two sides are visually unrelated, and do not provide the feeling of enclosure that can be found in any typical country Town 'main street'. Also, the expanse of blank walls of the Community Hall and TAFE buildings along the northern street frontage heightens the lack of interaction by presenting a street edge with very little visual interest or variety to engage the pedestrian. However some attempt has been made to link the two sides via a covered walkway, which runs from the supermarket across the central median to the Cultural Precinct and Library. Buildings are all one storey in height, brick-faced, and of a relatively poor architectural standard, although the newly constructed entrance to the Cultural Precinct has introduced more sympathetic materials into the street (although the use of earth from outside the Roxby Downs area in the rammed earth walls is not condoned). Footpaths are of a poor standard, and are cluttered with a disparate collection of poorly designed and badly located street furniture, outdoor dining furniture and signs. Minimal awnings and patchy street tree planting contribute to a distinct lack of shade, making the street microclimate uncomfortably hot at times during the year.

The shopping strip is not active at night, with most after dark activity focusing on the Roxby Downs Tavern and Community Club, both of which are located off the main strip. Outdoor dining opportunities could be encouraged on Richardson Place to take advantage of more conducive evening temperatures. An improved standard of street lighting would further encourage nighttime activity.



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Civic

The Roxby Downs Council Offices and Police Station are located on the southern side of Richardson Place, between the retail precinct and the Hospital. On the northern side lies the Cultural Precinct, which comprises the Swimming Pool, Gymnasium, Area School, TAFE and Library. As with the retail facilities, the buildings are designed as a 'suite' with individual architectural character being down-played in order to present a 'unified' theme. The resultant architecture, however, is self-effacing and low-key and with none of the architectural merit often associated with Australian civic buildings on a main Town street.

Also, many of the uses within the buildings have grown incrementally and without obvious rationale. For example, the Council Offices are also home to the Monitor Newspaper and the Cultural Centre is home to Rox FM radio station, whilst being unable to offer badly needed meeting rooms for public use. There is also a need for a Youth Outreach Centre, a Volunteer Office, a Welcome Office, a Centre Link and an expansion of the Police Station. A useful addition to the Civic area would be a Performing Arts Centre as currently such activities are confined to the Gymnasium.

Implications for the Design Framework

The required expansion of the Council Offices and the need for additional meeting rooms and public facilities represents an opportunity to develop a purpose built Civic Centre that could include a range of mixed use community facilities such as meeting rooms, council offices, a performing arts space, child care facilities centre, newspaper offices and visitor information centre.

A new civic building could be a focus of the Town Centre and reflect the community's pride in Roxby Downs.

Retail

As shown in the Roxby Downs Retail Assessment, the population of the Town is characterised by a high proportion of young families, with a significant share of residents in the 18-39-age bracket, and a high average household size (2.9 persons per household). Residents have high levels of personal income, but there is relatively low workforce participation by females and a high proportion of single income families. Car dependency is high, and the car is the favoured transport option, even for relatively small journeys.

With a large population of young dependants, a key issue relates to the shopping and entertainment opportunities for this segment of the population. Anecdotal information suggests that teenage children have few opportunities for work, but have high allowances from their parents, and thus there is considerable potential to meet the demand for retail and entertainment opportunities.

There is also a very high proportion of young mothers, who are the main household members undertaking shopping – including grocery shopping. This suggests a shopping pattern which favours 'weekly' grocery shopping undertaken during the day, rather than on trips home from work (unlike more recent trends in metropolitan locations where both parents are working).

Retail Expenditure

Based on information derived from the Market Info Household Expenditure Model, which is based on a variety of data including the Household Expenditure Survey, ABS Census and National Accounts, residents in Roxby Downs have total available retail expenditure of approximately \$47m, which reflects an average per capita expenditure that is approximately 12% higher than the average for South Australia as a whole.

By 2013, total available retail expenditure is forecast to be approximately \$121m, based on an expanded population and with allowance for real growth in retail spending. Of this \$121million, \$54.9million will be on food, \$63.8million on nonfood and \$2.4million on services. With regard to the food related expenditure, an estimated \$17million is focused on food, liquor and groceries, which is the core market served by supermarket traders. The remaining expenditure on food includes spending on takeaway food, cafés and restaurants.

Retail Provision

Based on a floorspace audit undertaken in April 2006, total retail floorspace provision in Roxby Downs is estimated at approximately 6,580m2, of which an estimated 4,200m2 is located at the Roxby Downs Central Shopping Centre. The largest tenants include the Woolworth supermarket (2,200m2) and the Mitre 10 store (approximately 2,000m2). Non-retail tenants account for approximately 700m2 of floorspace, and comprise bank, credit unions, post office, real estate, etc.

Escape Spending

An estimated \$15.5m in retail expenditure currently escapes from Roxby Downs to other shopping locations such as Port Augusta, Adelaide, etc, and this represents approximately 33% of total available retail expenditure. Most of this escape spending is in non-food merchandise, as there is a relatively 'captured' market for food and services type retail facilities.

For example, escape spending is estimated at 7% of available spending on food shopping, and 16% of spending on retail services, while escape spending on non-food items is estimated at 58% of available spending.

Retail Potential

Assuming a total retail expenditure of \$121m by 2013, that the existing rate of escape spending is maintained, and that shops continue to generate approximately 85% of sales from non-permanent residents, visitors, etc, then total sales potential is estimated at approximately \$94m.

Based on typical industry trading levels, the total supportable floorspace would grow from the existing 6,580m2 to approximately 17,000m2 by 2013. This represents a growth of approximately 10,500m2 over the period.

It is important to note that not all of this retail development potential would be located in the Town Centre. For example, there may be potential for an additional provision of non-food merchandise that may include some homemaker-type stores (eg furniture, electrical). Some of this development potential may be accommodated out of Town, including along Olympic Way, in proximity to the industrial estate. Based on this, we estimate that the retail development potential in the Town Core may be in the order of approximately 8,000m2 to 9,000m2. Importantly, the Retail assessment shows that a second supermarket is likely to be supportable in the Town Centre, although further work needs to be undertaken in order to investigate when this facility would be viable. Preferably, this development would consist of an integrated centre comprising a supermarket plus associated specialty stores. This new development would therefore involve a total development of approximately 4,000 – 5,000m2.

There is also potential for a new Service Station to located within the Town.

Implications for the Design Framework

A better standard of retail presentation to the shops would lift the precinct.

Retail premises need to be developed on both sides of Richardson Place to encourage crossover shopping and activate both sides of the retail strip.

Wider awnings and street tree planting would add much needed shade and structure to the main street.

A unified paving treatment from a defined palette of high-quality materials should be implemented, as well as the introduction of high-quality street furniture, lighting and signage, to improve amenity and appearance.

The potential exists for a second supermarket. Opportunities for future expansion of commercial and retail establishments exist on vacant or under-utilised land west of Richardson Place on Burgoyne Street.



Community, Recreation, Education and Health

Roxby Downs has an extensive range of community, education and recreational facilities with good amenity in comparison to other South Australian country Towns of a similar size, while all of these facilities are conveniently located on and around Richardson Place. Currently, the Cultural Precinct and Leisure Centre acts as the community focus, with other facilities radiating off.

The recreation spine is located around the main Oval, which is in poor condition. The Oval was apparently hastily built and is in need of considerable re-grading and re-servicing. The area between the Oval and the School is an unstructured space of irrigated lawn, few trees and scattered tennis and netball courts. It acts as a spill over schools area, but gives the appearance of an underused paddock. The nearby car park is under-utilised and forms a visual barrier to the Oval from Richardson Place. It also occupies valuable public land that could be better used.

Implications for the Design Framework

There is a need for a wide range of additional sports facilities including a new Oval. The educational services capacity will need to increase as the

population grows

There should be an allowance for the potential expansion of health services facilities.

An opportunity exists to develop a consolidated Sports / Country Club with shared facilities on the site of the current Golf Club.

Tourism

A total of 35,000 people visit Roxby Downs as tourists every year, mostly on their way to Alice Springs, and the majority stay overnight. *Implications for the Design Framework There is a considerable potential to develop Roxby Downs as a major tourist destination.*

This could be limited to the potential for an increase in tourism at the mine, Andamooka and Woomera. New Regional Parks commendable development to act as focus destinations for tourists visiting the area.

Plan to expand visitor information centre to cater for expanded visitation.

Light Industrial

A small precinct of light industrial development is located off Olympic Way, north of Roxby Downs township, and includes the well utilised Service Station. Whilst these sites can sometimes be intrusive, the industrial precinct is well screened from the adjacent residential area on Axehead Road by a large dune.

Implications for the Design Framework

There is adequate room for expansion tof the light industrial development generally northward away from town. Street tree planting is needed to reduce dust and ameliorate the visual impact of bulky buildings typical of this use.



Residential

Residential housing in Roxby Downs can be divided into two main areas - the earlier northern residential area, constructed primarily in the 1980s and the residential area to the south and east, developed between 1997 and 1999. An additional 121 lots to the south east are currently under construction by the Olympic Dam Operations with a further 200 lots planned. There is also a smaller medium density development, known as 'The Dunes', to the south of the Town Core, two caravan parks located off Olympic Way and within I km of the Town Core and the BHP Billiton singleperson residential quarters at the junction of Olympic Way and Burgoyne Street.

The curvilinear road layout of collector loops and cul-de-sacs results in a mix of lot orientations, many in the less preferable north-south alignment.

The residential fabric consists mainly of single storey dwellings with double carports with a minimum of two-storey buildings. There are generally no front fences, although most properties have back fences, which are visually pronounced from within the retained dune system. The architectural styles vary in materials and quality, some models being more appropriate to the arid conditions than others.

While the Town's typology is generally consistent across the township there is a marked difference of street character between the earlier northern development and the southern expansion. The northern residential area's consistency and compactness, together with its attractive and well established tree planting, gives its streets a sheltered and welcoming atmosphere that is lacking in the southern expansion. The southern area has poorly defined precincts and a lack of established tree planting.

The caravan park on Pioneer Drive presents a poor image and occupies valuable land that is ideally located for other community and institutional uses including educational uses. The Myall Tree Caravan Park on Olympic Way is less problematic, but its interface with Olympic Way and Burgoyne Street needs to be improved with street tree planting and the possible removal of the outer fence.

Implications for the Design Framework

Future accommodation should be designed for the hot-arid climate using the principles set out in the Good Residential Design: SA. The Pioneer Street Caravan Park should be relocated in the future to free up land for other uses.

The current location of the buildings in the BHP Billiton singleperson residential quarters fronting Burgoyne Street could be a hindrance to the expansion of the commercial area.



Figure 3.3 Example of North Residential Area



Figure 3.4 Example of Southern Residential Area



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Landscape and Open Space

The vibrant red sand, existing mature Myall and WhiteImplications forCypress-pines and undulating topography of the dune ridgelinesShade planting isrunning in an east-west alignment, defines much of the landscapealong pathways.and identity of Roxby Downs, and within the Town a number ofThere is an oppordunes have been retained and incorporated into an Open Spaceopen space. ThisSystem for public use and access. In addition there are a limitedthe residential plnumber of designated open space areas for public use.safety and american setty and am

Unfortunately, in both the northern and southern residential developments many of the open spaces are bounded by the back fences of the residential developments resulting in a lack of surveillance and public 'ownership'. Subsequently there is the perception that the open spaces are unsafe, particularly at night. As a result, many of the dunes are becoming visibly degraded.

There are a number of well-used children's playgrounds. The play equipment is sheltered but could be improved with more integrated siting areas, footpaths and higher quality equipment. There is a minimal amount of scattered picnic seating and given the climate and exposed nature of the dunes these appear to be little used.

Formal open space in Roxby Downs is limited to the wide grassed median strip in Richardson Place, which currently functions as an event space for festivals and Lion's Park, which is an ill-defined leftover space suffering from a lack of visual permeability from the main street and shade planting. There is no developed Town Park to accommodate Town gatherings, picnicking or passive recreation, with residents of Roxby Downs travelling as far as Breen Park in Woomera for this type of amenity.

The water retention ponds located west of Olympic Way and adjacent to Burgoyne Street, Pioneer Drive and Axehead Road are undiscovered gems that support a surprisingly lush array of vegetation and bird life. Fencing could be removed and these ephemeral water bodies incorporated in public open space as a valuable ecological and recreational resource.

Implications for the Design Framework

Shade planting should be enhanced in all open spaces, particularly along pathways.

There is an opportunity to orientate all new developments towards open space. This will encourage a more interactive edge between the residential precincts and the public reserve, thus improving safety and amenity for all.

Revegetation and weed control programs could restore and rehabilitate existing dune vegetation.

Existing large trees – Western Myalls and White Cypress-pines should be retained and protected from the adverse effects of development where possible.

Areas of 'Low' ecological significance should be targeted for development.

An opportunity exists to develop a Town Park as a focus for Roxby Downs.

Natural landscape features, including topography, could be incorporated into the proposed expansion to assist in retaining the intrinsic character of the area.







Figure 3.5 Existing Open Space and Recreation



IMAGE AND IDENTITY

Marking the Entry Points

The marking of entry or gateway points into Roxby Downs is an important aspect in signalling 'arrival' and establishing a sense of place for residents and visitors alike. Recognising the key entry points and creating clear visual clues is important to establishing strong and welcoming gateways into the Town.

Olympic Way

The vehicular approach to Roxby Downs is via Olympic Way. However there is a distinct lack of arrival experience on this major road. The main entry points to the Town Centre, at both the north and south ends of Burgoyne Street have low-key signage and are undifferentiated in their urban design treatment from other minor feeder road exits. It is very unclear to the driver which of Burgoyne Street entrances is the main point of arrival.

There are no buildings facing Olympic Way south of Pioneer Drive. This emphasises the lack of perceived significance of Olympic Way as a major component of the Town fabric.

Andamooka Road – Axehead Road Intersection

The Andamooka Road traverses open flats and glades of large Western Myall framed by dune ridgelines as it runs between Roxby Downs and the mining town of Andamooka. Although relatively underused at present, the relocation of the Airport and the new Short Stay Quarters to the west of Roxby Downs will mean that this road will become a far more important link into Roxby Downs, in future.

A stagger intersection at the Olympic Dam-Pimba Road connects to Axehead Road and the Town. There is considerable evidence that vehicles currently attempt this intersection at high speed, with tyre burnouts common.

Implications for the Design Framework

Olympic Way has the potential to be an attractive entrance to the Town by introducing structured landscape treatments, including avenue planting, leading up to and at major entry points and encouraging all new buildings to address the street. The Andamooka Road–Axehead Road intersection will become a major new entrance to Roxby Down, and issues such as traffic safety, signage and landscape treatment will need to be considered in detail.

Landmarks

Landmarks are important locational devices that denote key sites within a Town and enable people to orientate themselves and understand space. In the context of Roxby Downs there is a distinct lack of such significant landmarks. Currently, the most effective landmark is the Oasis Motel's central shade structure, which, due to its considerable height, is visible from both north and south of the Town Centre. Other visually dominant landmarks to be considered are the dunes themselves.

Implications for the Design Framework

Landmarks could be built at key sites such as at significant points of entry and along main streets, including the intersection of Olympic Way and Burgoyne Street/Richardson Place.



Signage

At present the signage around Roxby Downs is inadequate and inconsistent. Signs that are poorly designed or located detract from the visual experience of a place and can cause confusion. An overall signage strategy needs to be developed for Roxby Downs that addresses the following areas: entry signs, street signs, advertising signage, and interpretive signage for ecological education and signage for individual and commercial establishments.

The signage strategy should mark attractions, amenities and sites of interest in a clear unambiguous way to assist the visitor and local residents alike.

Implications for the Design Framework Legibility could be improved by adopting a consistent suite of signs with an emphasis on high-quality graphics and materials. Existing signage could be rationalised to reduce clutter and improve legibility.

Views

Visual access allows people to better understand the place in which they live. The visual experience of the distinctive colour, topographical form and vegetation of its surrounding arid environment is important to the identity of Roxby Downs. In a generally 'flat' landscape, the dune system creates the only points of elevation allowing for wonderful views across the Town, and out to the wider landscape. The dunes are also natural landmarks that appear as defining features on the horizon.

A number of dunes have been incorporated into the open space reserves of the township. Currently the majority of residential properties do not face out into the dunes, and the rear fences surrounding the dunes form a visual barrier to this amenity. Consequently, within the Town the dunes are often only seen at reserve entrances, or while on foot through the existing underdeveloped network of pathways.

As the Town expands there will be significant opportunities to capitalise on these important views to and from the dune ridgelines.

Implications for the Design Framework New development could be designed to acknowledge and maintain the visual importance of the arid landscape by providing as much visual access as possible. Dunes could be retained, where possible, as an intrinsic visual amenity of Roxby Downs. Paths could be located on the tops of dunes to provide opportunities for all to enjoy the views.



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MOVEMENT

Traffic and Parking

Road transport forms the prime mode of access to, from and within the Roxby Downs township. Existing development of the Roxby Downs Town Centre has occurred to the eastern side of Olympic Way.

The Town Centre main street, Richardson Place, is offset to the east from the crescent layout of Burgoyne Street which intersects and provides access for the Town to Olympic Way. Generally inter-dispersed residential precincts have been established to the north, east and south of the existing Town Centre presenting typically multi-directional curvilinear local road networks consisting of collector roads, loops and cul-de-sacs.

The curvilinear layout of the local road network results in difficult wayfinding and a lack of road hierarchy within the township. The road design in the residential areas is very wide, typically 8-12 metres, with a combination of upstand and modified kerbs.

The speeds are 50km/hr in all residential streets, but there is anecdotal evidence that suggests vehicles often travel at higher speeds. Narrowing the street pavement could assist in slowing down the traffic, together with the limitation of the street lengths.

There does not appear to be any current parking problems in the Town Centre. Whilst street parking in Richardson Place is well used, the main car park off Richardson Place appears to have spaces free on a regular basis. However, the lack of shade on Richardson Place and nearby car parks makes these spaces uncomfortably hot and exposed. These parking areas would be improved by the introduction of a greater degree of shade planting.

Parking is an issue in the residential areas with the high ownership of vehicles resulting in extensive on-street parking. In many streets, particularly in the south, parking on the verges has damaged street trees planting and irrigation systems. A considered approach to off-street parking should be developed with a range of verge treatments.

Implications for the Design Framework

Road pavement widths could be decreased whilst maintaining the width of road reserves .

A street tree planting strategy could be developed for the entire township to define arrival, road hierarchy, precinct character and provide shade.

Minimalise off-street parking to reduce pavement areas. Future expansion of the commercial area must also include for adequate public parking.



Cycling and Walking

There are relatively few significant pedestrian issues in Roxby Downs, as footpaths and crossings are clearly demarcated, throughout the Town. Despite the harsh climatic conditions there is evidence of high bicycle use, particularly for children attending local schools. Public Consultation has also indicated that cycling and walking are popular forms of exercise for adults.

A number of pedestrian and bicycle paths have been created throughout the open space areas and these provide varying degrees of connection to the Town Centre. The northern residential area has a fairly well established system; however the bitumen paths are in poor condition. The southern area has concrete paths, which are in better condition, but the legibility of the route is poor at locations.

Implications for the Design Framework

Pedestrian and cycle access could be emphasised as one of the main determinants of the new Town design. The existing pedestrian system could be improved by connecting missing links in the circulation system, upgrade path materials and implement an effective solar generated lighting system. Bicycle use could be promoted as an efficient and sustainable method of transport within Roxby Downs. A bicycle path to Olympic Dam could be introduced.
CONSTRAINTS AND OPPORTUNITIES

The Constraints and Opportunities Plan illustrates the following issues that are central to the development of the Master Plan:

Concentric versus Eccentric development

Constraints

section

- Current development skewed to the east of Olympic Way
- Potential need for a second Town Centre to the south if development continues eastwards
- Olympic Way is currently seen as a 'barrier'

Opportunities

- Still possible to develop the Town concentrically
- Concentric development allows maintenance of a single Town Centre
- Concentric development can minimise distances to the Town
 Core
- Developable land available to the west

Sense of Place

Constraints

- · Arid context has been under emphasied in the past
- The Town has been developed as a typical 'suburban' habitation – despite its uniqueness
- The Town is now inward looking

Opportunities

- The Town could respond more sensitively to its environment and 'look outward'
- A more sustainable approach could be adopted

Landform and Drainage

Constraints

- In the past the dune system was seen as a physical 'hindrance' to development
- The dunes are intermittent and unconnected
- The dunes run mainly east west, making north-south movement difficult
- Land to the west is lower lying, with some claypans
- Many of the dunes in the urban area are in poor condition
- · Ecologically significant Cane Grass Swamp to the south east

Opportunities

- · The dunes can be used as a 'positive' design element
- The individual dunes can be linked
- The dunes vary in their ecological value and development could acknowledge this
- Dunes within the urban area can be re-established
- Drainage issues can be resolved in the western area
- New roads can be used as drainage corridors to the west
- Provides a choice in travel, while also encouraging a healthier means of travel through the provision of walking and cycling paths

Connectivity

Constraints

- People prefer to walk on the tops of dunes but the dunes rarely link up
- North-south movement is difficult with east-west dunes
- · Few of the existing pedestrian and cycle paths link together
- Few pathways link back to the Town Core

Opportunities

- New development offers opportunities for linked systems leading back to the Town Core
- · Existing 'urban' dunes can be linked into the system
- New roads can be linked back to the single Town Core to minimise travel distances

Urban Design of the Town Core

Constraints

- The Town Core lacks strong identity
- The main street (Richardson Place) is a 'road off a road off a road' rather than the 'main' road
- The Town Core is difficult to find from the main access road of Olympic Way
- The Town Core design is typical of the stilted land-use planning undertaken in the 1980s.

Opportunities

- Richardson Place can be modified, and extended to meet Olympic Way
- Its legibility can be significantly enhanced
- The opportunity exists to introduce mixed-use (particularly residential uses) to create a more vibrant centre



CONSTRAINTS AND OPPORTUNITIES





Figure 4.0 Constraints and Opportunities Plan

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DESIGN PHILOSOPHY

The purpose of expanding the township of Roxby Downs is to accommodate a potential new mine workforce of approximately 4,500 people, which would include both long-term contractors and BHP Billiton employees. Current estimates suggest that the population of the Town could grow to 10,000 people as a consequence, and the Town could be viable for at least the next 70 years. It is assumed that the current demographic of young families would continue and that the need for mainly suburbantype housing would remain, with a predominance of 3-4 bedroom residences. There would also be a Long Distance Commuting workforce of around 50%, which would give a residency rate in Roxby Downs of 50% permanent employees.

The aim of the new housing provision would be to generate a 5% vacancy rate across the Town to encourage a healthier housing market than exists at present.

SUSTAINABILITY

The Vision takes BHP Billiton's Sustainable Development Policy as its founding Principle:

"We aspire to Zero Harm to People, our host communities and the environment and strive to achieve leading industry practice." (Sustainable Development Policy, BHP Billiton, 2005).

In addition to this baseline the following principles of sustainability have guided concept development:

Maximising the Sustainability Outcomes

Roxby Downs is a Town in the desert. As a township, it needs to have sustainability as its primary focus.

Minimising the Ecological Footprint

This involves keeping the Town as compact as possible to avoid the unnecessary disruption of any more land than is absolutely necessary.

Acknowledging and respecting the significance and influence of the arid location

Much of the development that has taken place in the past has concentrated on creating a suburban character to the Town, typical of much of the design of the 1980s and 1990s, and one that looks inward. The aim of this Master Plan will be to embrace the arid landscape in which the Town sits, with replanting of the dunes in the urban areas, and the promoting of the 'ownership' of the arid landscape by the people of Roxby.

The dune system is one of the Town's major assets. The Master Plan proposes a series of Open Space Areas that will link the dunes east-west across the Town and help to define its major urban precincts. Also, the majority (75%) of new buildings allotments will be orientated east west to maximise solar efficiency, while many of the newer houses will face directly into the arid landscape (25% as opposed to 7% in the past).

Maintaining a single Town Core

The least sustainable outcome for Roxby Downs would be to have a second core, situated to the south. This would create a doubling up of facilities and service provision for, what is, a relatively small town.

Designing to create a Town that the people of Roxby Downs will enjoy

Public consultation has been undertaken throughout the Master Plan process, to ascertain the current needs and aspirations of the existing residents of Roxby Downs. The results of this intensive study have helped guide the design process. In particular, the public has asked that the Master Plan should aim to:

- Design for liveability
- Encourage people to take up residency for longer periods
- Encourage older people to remain in the Town after retirement
- · Celebrate the strong sporting culture of the Town
- Enhance the Town's credentials as a tourist destination
- Acknowledge the unique arid environment

Minimising distances to the Town Core

In a Town where most journeys are done by car, it is essential to minimise distances travelled, in order to conserve energy and reduce exhaust emissions.

Promoting pedestrian and cycle access

Car journeys should be reduced, where possible, and greater emphasis given to the provision of pedestrian and cycle access. The children of the Town are already showing the way forward on this issue.

Beginning a programme of re-vegetation

It is time, with Roxby Downs, to give back something to the landscape from which the Town came. The 'urban dunes' will be re-vegetated as part of the establishment of the Open Space Corridors.

Reclaiming stormwater and treating waste water for nonpotable uses

The aim is to reduce demand on the potable water supply where possilbe.

Adhering to Water Sensitive Urban Design principles

"Managing the urban water cycle needs to be underpinned by key sustainability principles of water consumption, water re-cycling, waste minimisation and environmental protection. The integration of urban water cycle management with urban planning and design is known as Water Sensitive Urban Design". (Melbourne Water, Government of Victoria)

In addition to the fundamental issues of sustainability, the following urban design criteria should be satisfied:



URBAN DESIGN

Improving the existing urban structure of the Town

The existing Town has developed eastwards of Olympic Way and the Town Core. Further expansion to either the south or east will create an eccentric and unwieldy urban structure with the potential (and undesirable) requirement of a second Town Centre to the south. To avoid this unnecessary outcome, the Master Plan recommends that expansion also takes place to the west, to ensure that a manageable concentric urban framework can be achieved.

Enhancing the permeability throughout the Town, both for pedestrians and vehicular traffic

The best urban fabrics are those that allow ease of access throughout, so that people can to find their way around without hindrance; can memorise locations easily and are offered multiple choices to safely arrive at their proposed destination. Much of this permeability Roxby Downs already has, but there is still opportunity for enhancement. The new areas that will form the Town expansion will be designed to be as permeable as possible from the outset, utilising a grid system of streets and a hierarchical system of pathways. Street and footpath lighting will also be enhanced.

Actively Using the Streets of Roxby Downs

We will seek to encourage the people of Roxby Downs to more actively use their streets, particularly within the Town Core, consider walking or cycling rather than taking the car, and for there to be more night time activities focused on Richardson Place.

Improving the facilities within the Town Core

The results of the Public Consultation indicate that the people of Roxby Downs are generally happy with the type of facilities provided; but feel that these facilities are tired and over-stretched. The Master Plan proposes improvements to the existing facilities and the inclusion of new ones, especially within the Town Core and to the west of Olympic Way.

Up-grading its overall design quality

There are very few buildings within Roxby Downs that qualify as fine examples of architectural design, nor is the landscape treatment of the public realm of a universally high quality. The Master Plan recommends that improvements should be made in both these areas, especially within the Town Core.

Utilising the 'Good Residential Design' and 'Designing in an arid climate guide published by Planning SA as the basis for residential design

These guides will form the reference documents for the residential design

Embracing new technologies

The Master Plan advocates that Roxby Downs embraces new technologies to improve the liveability of the Town. These include making Roxby Downs a 'Wireless Town, where wireless broadband Internet access is available to all on demand.



Figure 5.0 **Concentric Expansion**

The existing Town has expanded eccentrically from Olympic Way, mainly to the east. In future, development will take place in a more sustainable concentric fashion.



Figure 5.1

Shared Pedestrian and Bicycle Network A new pedestrian and bicycle network will be integrated across the Town, linking existing pathways and creating new ones - all focused onto the Town Core with linkages to the proposed regional and neighbourhood parks. **VISION: LINKAGES**

VISION: COMPONENTS





Figure 5.2

New Major roads

New access roads will be designed to the west and south of the existing Town, which will allow easy and efficient movements back to the Town Core from the new residential areas.

Town Components

Medium density housing will be located around the Town Core within a radius of 1km

Single Person's Accomodation will be distributed throughout the new residential areas but within 1.5km of the Town Core, with a variety of sizes and types to suit different requirements

Local Centres will be no closer than 1.5km to the Town Core and no closer than 1km apart

VISION: OPEN SPACE SYSTEM



Figure 5.4 Drifting landscape

The urban structure of the Town will be designed to echo the 'drifts' of the arid landscape

VISION: OPEN SPACE SYSTEM





Figure 5.5

The dunes should strongly influence the design of the New Town, and should not be viewed as barriers or 'left over spaces'

At present, the dunes 'drift' across the Town but are disconnected

Figure 5.6

In future, the dunes will be linked within an Open Space System that will form corridors of connectivity across the Town

The corridors of the Open Space System will then define the places where the new community can be built

VISION: RESIDENTIAL FRAMEWORK



Figure 5.7 This existing popular residential area in Roxby Downs will be used as a good example of precinct size and compactness, however lots need to be better orientated



Figure 5.8 This proposed new residential precinct layout emphasises permeability and good lot orientation. It also provides many lots and streets with direct views of open space, and eliminates fencing backing onto the dunes

VISION: RESIDENTIAL FRAMEWORK





Figure 5.9 Existing residential relationship to open space - back fences form a visual barrier and lack of surveillance increases percerption that these spaces are unsafe, particularly at night



Figure 5.10 Proposed residential relationship to open space - roads and dwellings enjoy views overlooking open space, paths are placed on the tops of dunes where it is possible to take advantage of the wide vistas available

VISION: CONCEPT DIAGRAM



Figure 5.11 The Concept Diagram illustrates a concentric expansion with a central commercial and recreational core radiating roads and pathways and an open space system drifting across the Town

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VISION

The vision for Roxby Downs is for the Town to expand in a way that maximises its potential for sound urban design, and minimises its impact on the environment, creates a place where people are happy to live and, in particular:

- Roxby Downs will celebrate its unique character as a 'Town of the Desert'
- The expanded Town will be designed as 'a place for families'
- A concentric urban system will be established for Roxby Downs with a single retail / civic / commercial / educational area at its core
- A pedestrian and bicycle friendly environment will be created with a well connected path system that links residential precincts and the Town Core. Encouraging healthier sustainable travel choices.
- New local paths and play areas will be located throughout the expansion
- Development will be introduced to the west of Olympic Way
- Major roads will be designed to 'radiate' outwards from the Core, to allow for future expansion of the Town
- Existing sporting facilities will be upgraded and new ones introduced
- The majority of new housing will be located within 2 kilometres of the Town Centre
- New housing precincts will be designed as 'connected communities'
- A total of 25% of new lots will face directly onto open space
- 75% of new streets will be orientated to allow views towards open space
- 75% of new lots will be aligned east-west to take advantage of northern light and to lessen the impact of the western sun
- Access for pedestrians, cyclists and car users will be improved throughout the Town
- Existing footpaths will be upgraded and new footpaths will be constructed, all linking back to the Town Centre
- Up to 10,000m2 of new retail space will be planned for by the year 2013
- New trees will be planted in both existing residential areas and the new housing precincts
- Design is aimed at providing a safe and secure environment through good engineering practice and encouraging casual

surveillance through use of space and the orientation of properties

- New streets will be designed to minimise off-steet parking; to have wide verges lined with avenue trees providing shade on either side
- Existing dunes will be incorporated within new Open Space Corridors (or 'Drifts') that will flow throughout the existing and proposed urban areas
- Important dunes within the existing and new urban areas will be targetted for revegetation
- Two new Regional Parks will be created to the north-west and south-east of the Town
- The Town's credentials as a major tourist destination will be enhanced
- Roxby Downs will become a 'Wireless' Town

A more 'sustainable' Town will be created by:

- Treating waste water for selected non-potable uses to reduce demand on the potable water supply
- Introducing Water Sensitive Urban Design elements sensitive to the natural environment (i.e. swales, detention basins) to manage stormwater run-off
- Reconfiguring existing waste water treatment lagoons to cater for proposed new population and to adhere to EPA requirement

DESIGN CONCEPT REGIONAL PLAN



Figure 5.12 Regional Plan indicating proposed Roxby Downs expansion and Olympic Dam Airport location

DESIGN CONCEPT LOCAL PLAN





Figure 5.13 Town Area Plan indicating proposed expansion with new locations for the Race Track and Pony Club, new bicycle track from Town to new Heavy Industrial Area and the two new regional parks

DESIGN CONCEPT DRAFT MASTER PLAN

Figure 5.14 Roxby Downs Draft Master Plan, 2006







Collector road planting





Town park planting

Avenue planting



Proposed caravan park



Extension to light industrial Stage 1





Recreation

Open space and path system



Low lying areas subject to innundation



Long Distance Commute Accommodation Village Bicycle Track Town to Heavy Industrial Area



SCALE 500 1000m 0 200

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TOWN CORE: CIVIC AND COMMUNITY

Goals

section

- Retain Richardson Place as the civic and community focus of Roxby Downs
- Ensure that all new civic functions are concentrated on Richardson Place

Actions

- Introduce new civic and community facilities amongst the existing retail development to provide greater variation and vitality
- Extend Richardson Place to meet Olympic Way by creating a new 'T' intersection at the existing junction with Burgoyne Street
- Extend the civic and community facilities along the new extension to Richardson Place
- Establish a new Primary School on the site of the Pioneer Drive Caravan Park
- Dedicate the existing No. 1 Oval to mainly schools use, and upgrade
- Construct a new Town Oval to the west of Olympic Way
- Construct a new No. 2 Oval alongside
- Provide a redeveloped Civic Centre and investigate the following uses:
 - Council Offices
 - Government Offices
 - Community newspaper "The Monitor"
 - Community radio "Rox FM"
 - Meeting Rooms
- Create a major water body as the focus of the western extension of Richardson Place
- Introduce a new Courthouse and Police Station to the west of Olympic Way incorporating the additional uses: Department of Correctional Services and the Legal Services Commission
- Provide a comprehensive Landscape Master Plan for all of the Civic and Community areas

TOWN CORE: COMMERCIAL AND RETAIL

Goals

- Create an attractive vibrant retail and commercial area focussed on Richardson Place
- Promote improvements to retail provision that will benefit existing and new residents and encourage visitors

Actions

- Introduce retail provision to the north side of Richardson
 Place
- Introduce high-density residential use between the existing retail area and Olympic Way
- Plan for a new supermarket to be constructed close to the existing retail area
- Develop two-storey mixed-use buildings along the extension of Richardson Place including ground floor retail and upper storey residential or commercial office space
- Introduce a new 30 room/3 star hotel at the corner of the extended Richardson Place and Olympic Way
- Provide a comprehensive Landscape Master Plan for all of the Commercial and Retail areas

- Plan for up to 10,000m² of new retail space by 2013
- Introduce a second supermarket and associated speciality stores to the Town
- Establish two-storey buildings as the main built form
- Use high-quality materials that are in keeping with the character of the arid landscape
- Articulate the facades of built form to create visual interest and variety
- Maximise activity at ground level
- Design retail and commercial premises to cater for equitable access in accordance with relevant Australian Standards
- Construct awnings of a minimum 5.5m width to all new buildings to provide visual interest and shade, and increase outdoor dining opportunities

- Aim to increase the width of existing awnings to 5.5m width where possible
- Avoid blank facades to street frontage, and consider the articulation of side and rear facades where visible from adjacent properties or public spaces
- Promote a consistent retail frontage by establishing an unvarying alignment for building setbacks as well as a signage policy to reduce clutter and irregularity
- Ensure that corner sites address both street frontages
- Align building facades parallel to the street and extend buildings to side property boundaries to reinforce existing street patterns
- Provide a context plan demonstrating how the building fits within the context of its new surroundings and how viewlines have been accommodated in all new development proposals
- Encourage a high standard of visual presentation to retail premises
- Encourage 'shop top' dwellings above retail as a desirable accommodation option which has proximity to most Town facilities and will provide a presence at night
- Introduce high-quality paving materials to all new footpaths, and upgrade existing to match
- Provide new street lighting, using attractive well-designed, energy efficient lighting fixtures
- Introduce new street tree planting to the central median strip and footpaths to present an attractive and unified appearance
- Provide safe and accessible pedestrian links from commercial and retail areas to car parks, public open spaces and residential areas. Cover, where possible
- Provide appropriate waste storage, recycling and loading facilities and locate them away from public views
- Screen all plant equipment, especially when located on roofs
- Maintain a consistent retail street frontage by avoiding residential or civic development at ground floor level





Figure 6.0 Roxby Downs Town Centre

LEGEND





- Council and Government Offices Note: The location could also be used for retail purposes should development opportunities arise.
- 3 Courthouse and Police Station including the following possible uses: Department of Correctional Services Legal Services Commission
- 4 Hotel /Motel
- 6 Potential expansion to Hospital
- 6 Mixed Use Development including possible commercial office space
- Country Club / Relocated Social Club / Multi-use Sports and Community Facility
- 8 Possible TAFE expansion



SCALE





Section AA - Richardson Street Extension to Olympic Way

RESIDENTIAL: DEVELOPMENT AND SUBDIVISION

Goals

- Aim to create a set of high-quality residential precincts, each with a strong individual identity
- Utilise a well defined open space system to outline the new residential precincts
- Base the new residential precincts on the compactness achieved in 'old' Roxby Downs
- Aim to achieve a density of approx. 11 lots per hectare

Actions

- Provide a comprehensive Landscape Master Plan for all new residential areas
- Orientate the majority of lots east-west, where possible
- Utilise a traditional grid-based system for residential areas, to allow for the greatest permeability and connectivity
- Face residential lots towards the open space system, where possible
- Align blocks to allow street views toward open space
- Design with a minimum broad acre residential lot size of 600m2

Provide the following average yield:

LOT SIZE

600-650m2	40%
650-700m2	40%
>700m2	20%

- Focus medium-density residential development around the Town Centre, but within a radius of 1km
- Introduce apartment living to the Town Core where appropriate
- Distribute single person's accommodation across new residential precincts, but within a radius of 1.5km from the Town Centre

- Design a suite of residential buildings that respond to and reflect the characteristics of the arid environment
- Ensure all new residential buildings are designed and developed to a high architectural standard incorporating ESD principles
- Protect and retain any significant existing trees on lots where possible, and design buildings around significant existing vegetation where possible
- Comply with Good Residential Design SA: A resource for planning, designing and developing neighbourhoods and homes (Edition 2), Planning SA, 2003 guidelines for residential buildings in hot-arid climates including the following:
 - designing dwellings with a long east-west axis
 - incorporating courtyards which are shaded by summer sun and contain vegetation
 - providing midday shade all year round but with some early morning solar penetration to external walls
 - maximising exposure to cooling breezes in verandahs and courtyards
 - constructing external walls to living areas and bedrooms with materials of high thermal mass and low thermal mass respectively
 - maximising the potential for internal cross ventilation
 - allowing for natural ventilation of roof spaces
 - providing verandahs and balconies
 - minimising east and west facing external windows or glass doors
 - providing shade structures over all windows and external doors
 - using light coloured external walls and light coloured and lightweight roofs
 - a minimum of 20% of lot area for private open spaces (where block is greater than 250m/2) or 35m/2 where the lot is less than 250m/2
 - locating private open space adjacent to and accessible from living/dining rooms if it is to serve as an outdoor extension of the dwelling
 - locating carports and garages to avoid dominating views of the dwelling from the street

STRATEGIES, GOALS, ACTIONS AND DESIGN GUIDELINES



- Ensure all new dwellings are designed and sited to take into account existing landform, and minimise earthworks where necessary by following the contours of the site with spilt levels
- Utilise high-quality, durable materials that are energy efficient and in keeping with the desert environment including concrete slab floors, rammed earth, cavity brick, stone, timber, steel, glass and aluminium
- Encourage contemporary architectural design that avoids period style features and decoration
- Locate air conditioner compressor units away from bedrooms and living rooms
- Maximise off-site fabrication
- Orientate the fronts of dwellings to overlook open space, wherever possible
- Face at least 20% of new lots directly onto some form of public open space
- Orientate the majority of new streets to allow views along the streets, toward open space
- Introduce two storey residential development where possible and in accordance with BHP Billiton requirements
- Provide improved access for pedestrians, cyclists and car users throughout the Town
- Construct new shared footpaths concrete, linking back to the Town Core
- Design new streets have wide verges and to be lined with avenue trees providing shade
- · Design streets to comply with current safety standards
- Introduce a minimum of one local Park per approximately 300 lots into each new residential precinct







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Section - elevation



Plan



Figure 6.4

Proposed Street Arrangement Section AA - Secondary residential road adjacent to public reserves - 13.5m road reserve

Figure 6.5

Proposed Street Arrangement Section BB - Secondary residential road - 16m road reserve

STRATEGIES: GOALS, ACTIONS & DESIGN GUIDELINES



Figure 6.6

Proposed Street Arrangement

Section CC - Residential collector road - 20m road reserve

Example of good mature street tree planting which provides shade and precinct character



Examples of building types that are energy efficient, designed for the desert environment, and utilise an a palette of high quality, durable materials including concrete slab floors, rammed earth, cavity brick, stone, timber, steel, glass and aluminium



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RESIDENTIAL: CARAVAN PARK

Goals

 Locate a new Caravan Park with hardstands for 300 caravans on the eastern edge of Roxby Downs, off Axehead Road

Actions

- Provide power and water to each hardstand
- Design and locate a reception building at the entrance to the new Caravan Park
- Provide car parking at the entrance
- Provide toilet and washing facilities
- Provide a comprehensive Landscape Master Plan for the new caravan park
- Preserve remnant vegetation, where possible
- Improve sustainability by:
 - Adoption of passive thermal design strategies
 - Sourcing of building materials from renewable energy sources
 - Responsible use and re-use of water
 - Use of alternative energy sources
 - Employment of indigenous plant material
 - Reduced use of reflective surfaces
 - Employment of environmentally sound land management practices
 - Minimisation of waste

- Provide midday shade all year round but with some early morning solar penetration, wherever possible
- Maximise exposure to cooling breexes
- Design for a variety of 'site' sizes
- Design each site to be a minimum of 80m2 in area
- Provide power and water to each site
- Provide suitable hard-standing to each site
- · Provide one principal point of access off the Axehead Road
- Provide a reception building, with associated turning facility and car parking to BHP Billiton approval
- Provide adequate toilet / ablution facilities to BHP Billiton
 approval
- · Provide suitable trees for shade to BHP Billiton approval

- Seal all access roads
- Provide new concrete shared footpaths throughout the Caravan Park
- Provide shade structures in select public areas
- Ensure all new buildings are designed and developed to a high architectural standard incorporating ESD principles
- Design all new buildings to respond to and reflect the characteristics of the arid environment
- Ensure all new buildings are designed and sited to take into account existing landform, and minimise earthworks where necessary by following the contours of the site with split levels
- Utilise high-quality, durable material that are energy efficient and in keeping with the desert environment
- Utilise contemporary architectural design that avoids period style features and decoration
- Design to minimise the need for fences around the perimeter of the facility, and internally

LIGHT INDUSTRIAL

Goals

- Locate and design an extension to the existing light industrial area on Olympic Way
- Provide well-planned light industrial zone that adequately services Roxby Downs

Actions

- Provide a well-planned light industrial zone that adequately services Roxby Downs
- Define the boundary of the light industrial zone and allow for expansion generally northward
- · Preserve remnant vegetation where possible
- Ensure light industrial development does not impact on residential amenity
- Ensure development is of a high standard of design which minimises environmental impact by installing appropriate measures to deal with runoff, waste and disposal.

Design Guidelines

- Encourage well-articulated industrial buildings to improve precinct appearance – use colour and avoid excessive signage
- Ensure that all light industrial development include a landscaped setback
- Encourage employee and visitor parking at the side and rear of building rather than at the front
- Screen all plant equipment, recycling and waste storage areas
- Introduce a high design standard for perimeter fencing to provide a cohesive street edge, and locate behind a landscaped strip
- Use indigenous plant material, where possible

HEAVY INDUSTRIAL AREA

Goals

 Locate and design new Heavy Industrial Area (HIA) to the north of Roby Downs between the town and the present Olympic Dam Village.

Actions

- Locate and define the boundary of the HIA to avoid dunes, remnant vegetation and clay pans where possible.
- Ensure development is of a high standard of design which minimises environmental impact by installing appropriate measures to deal with runoff, waste and disposal

Design Guidelines

- Encourage well-articulated industrial buildings to improve precinct appearance – use colour and avoid excessive signage
- Ensure that all heavy industrial development include a landscaped setback
- · Create a main entry road into the HIA
- · Use tree planting along internal roads and for screening
- Screen all plant equipment, recycling and waste storage areas
- Provide amenities for employees such as outdoor open space and café/restaurant
- Encourage employee and visitor parking at the side and rear of building rather than at the front
- · Use indigenous plant material, where possible

LANDSCAPE AND OPEN SPACE

Goals

- Undertake a comprehensive Landscape Master Plan for Roxby Downs
- Create a system of open space drifts that capture the eastwest dune ridgelines character of the arid landscape
- Create a new Town Park as the 'Heart' of the Town, close to Richardson Place Establish two new Regional Parks to the west and south-east as major examples of arid landscapes

Actions

- · Conserve as many ecologically important dunes as possible
- Utilise the dunes as the 'backbone' of the new Open Space
 System
- · Design the Open Space System to act as wildlife corridors
- Undertake an extensive street tree planting program with a selection of species appropriate to the arid climate



RECREATION

Goals

- Enact a Town-wide tree planting regime as soon as possible
- Introduce avenue planting to all new streets and reinforce planting along existing streets to increase shade
- Utilise existing retention ponds as landscape features

Design Guidelines

- Undertake ecological and heritage clearance surveys for all areas to be developed
- Utilise primarily indigenous plant material within the Open Space System, with introduced species used within the streetscapes, building surrounds and Town Park
- Use tree species to define precinct character and complement the width of the road reserve
- Ensure that dwellings in all new development are positioned to front directly onto access roads and open space areas to create 'ownership' of those spaces
- Discourage back or side fences that abut open spaces
- Make use of the existing and proposed water retention ponds and drainage lines in the development of open space networks
- · Provide and maintain walking and cycling paths
- Manage litter including the provision of rubbish bins
- Prepare a detailed design and management plan for the Regional Parks which specifies approaches to access, car parking, path systems, weed control and vegetation management, and interpretative signage
- Encourage the establishment of a local nursery to grow indigenous species of local provenance

- Establish a new Sports and Community complex west of Olympic Way to match BHP Billiton requirements
- Designate the existing Town Oval as the new School Oval
- Plan for the re-location of the Race Course and Pony Club north of the motor cross track, to be accessed form Olympic Way
- Design new tennis courts to the west of Olympic Way and adjacent to the new Sports and Recreational Club
- Expand netball facilities either to the west of Olympic Way in their current location

Actions

- Provide well-planned and connected sporting facilities to the west of Olympic Way that cater to the wide range of sporting and recreational interests of the residents of Roxby Downs
- Design all sports facilities to meet BHP Billiton requirements
- Preserve remnant vegetation in any expansion
- Provide a comprehensive landscape plan to all new recreational facilities

- Create an integrated Sports and Community Club complex to the west of Olympic Way, on the site of the existing Golf Club building and linked to the new No. 1 Oval
- Design a new No. 1 Oval immediately to the west of Olympic Way, with a new No. 2 Oval alongside. This new Oval will have an additional role as a detention basin
- Design the re-location of the existing social club to this new joint facility
- Design the new No. 1 Oval with a verandah to district sports standards for Australian Rules Football
- Develop the nearby No. 2 Oval to a lesser standard, to be used primarily for training
- Design for lighting to the new No. 1 Oval
- Design the re-location of the Bowling Club facility to the west of Olympic Way
- Provide for new tennis courts to the west of Olympic Way and adjacent to the new Sports and Community Club
- Provide for the new Race Course and Pony Club alongside Opal Road to match requirements as set out by BHP Billiton
- Utilise the existing Town Oval as the main School Oval
- Provide for new Netball Courts adjacent to the existing Gymnasium or west of Olympic Way

MOVEMENT

Vehicular Movement

Goals

- Introduce a new grid-based road system that provides maximum connectivity and permeability
- Design roads to face out onto open space to make views of the surrounding landscape an integral part of the experience of driving around Roxby Downs
- · Functional and sustainable design fit for use
- · Ensure a low speed residential environment

Actions

- Extend Stuart Road and Arcoona Street to meet the north-south By-Pass Road to the east of the Town
- Introduce three to four new major road corridors to the west of Olympic Way to accommodate new residential precincts
- Establish the new western collector roads corridors to act as "floodways"
- Extend existing roads within the residential areas east of Olympic Way to meet new housing needs
- Create a new "T" intersection between Burgoyne Street and Richardson Place
- Investigate the introduction of traffic lights at the junction of the extended Richardson Place and Olympic Way

Design Guidelines

- Maintain road reserve widths in keeping with the character of Roxby Downs, but aim to reduce road pavement widths
- Minimise road pavement areas whilst maintaining adequate carriageway widths for each direction of traffic
- Provide tree planting to all new roads
- Limit residential street lengths to ensure a low speed residential environment
- Accommodate refuse vehicles and bus turning movements within residential precincts

Parking

Goals

 Provide car parking that meets the current and future needs of Roxby Downs but achieves balance between extents of hard pavement and the need for structured and extensive street planting

Actions

- Ensure new retail, commercial and recreational developments provide adequate car parking
- Provide a designated and well signed area for bus parking
- Encourage residential housing development which provides for adequate off-street parking within residential properties. Allow for limited short term on-street visitor parking to occur without having significant impact on traffic flow

- Ensure all car parks are designed to conform with all relevant Australian Standards and Safer Design Guideline principles including vehicle and pedestrian accessibility, sight lines, lighting and disabled parking provisions
- Locate employee parking to the rear of retail and commercial properties
- Minimise the visual impact of car parks on public spaces and residential areas
- Ensure there is easy and direct access to public spaces and building entrances from disabled car spaces
- Provide extensive shade planting to all new car parks and introduce additional shade planting to existing car parks where possible
- Provide clear signage
- Separate loading and servicing access away from public car parking areas
- Minimise the number of vehicle crossings in pedestrian areas
- Investigate the use of permeable materials and utilise water sensitive urban design principles for car park areas
- Avoid locating large areas of parking adjacent to main roads and major junctions



Pedestrian and Cycle Movement

Goals

- Emphasise pedestrian and cycle access as one of the main determinants of the new Town design
- Encourage more people to walk and bicycle in Roxby downs
- Improve Town walking and bicycle movement opportunities by increasing safety and amenity
- Design for bicycle and pedestrian use by children
- Encourage overlooking of pathways to give a better sense of safety

Actions

- Utilise the Open Space System to establish a more connective path system, focused on the Town Core
- Inter-connect all pathways within the existing Town, as far as possible, to allow better access to the Town Core
- Locate new pathways on the top of dunes, as far as possible
- Construct a bicycle path from the Town to Olympic Dam Mine
- Allow path access to the new Regional Parks
- Utilise existing desire lines as the basis of future pedestrian/ bicycle pathways
- Inter-connect all pathways within the existing Town, where practicable
- Make the entrances to pedestrian/cycle pathways and all sections of these pathways as safe and welcoming as possible
- Provide lighting to all major new pedestrian/cycle pathways within the Town
- Improve or replace defective footpaths and build new ones where necessary
- Ensure footpaths and crossings within the township cater for the mobility impaired

- Provide adequate bicycle parking within commercial areas and adjacent to recreational facilities
- Shared pathways to be concrete
- Select a consistent solar powered light fixture and install along major open space pathways
- Provide adequate rest stops with seating and shading

EARTHWORKS

Existing Conditions

The area of the township and the proposed expansion lies within a region of east-west trending sand dunes up to 6m in height with sandy swales of near level profile between the dunes. The area to the west of Olympic Way is typically at a lower relative elevation than to the east and contains flat and rounded clay pans which tend to be flood-prone and have little vegetative cover.

Existing ground comprises sand or clay in varying relative composition underlain by limestone.

The 'Olympic Dam Project Roxby Downs Township Geotechnical Report' by Kinhill Stearns, July 1986, describes the existing geotechnical site conditions in detail.

The "comparator" residential zone bordered by Axehead Road to the north, Pioneer Drive to the south and Olympic Way to the west has cleared and flattened dune elements with some existing features of the natural landscape incorporated. Residential properties have been developed on both the swale and dune areas.

The newer development to the south of Stuart Road has limited the clearing of vegetation and dune elements. Residential properties were developed around natural features generally in the swale areas and not on dunes.

Implications

Goals

Earthworks modelling was undertaken within the Master Plan boundaries. The key objectives of the earthworks modelling were to:-

- Limit earth movement and achieve a cut and fill balance at each development phase to minimise the import of fill materials
- Limit the impact on existing topography and vegetation particularly that of high ecological significance
- Establish flood paths and zones away from developed areas
- Minimise deep trenching of gravity sewers where possible

Actions and Assumptions

- Natural land falls were incorporated into the earthworks model where possible. Proposed finished surface levels were specified with consideration for the design of utilities and 'floodways'
- Cut and fill volumes were established for each of the proposed residential precincts, the Caravan Park, Light Industrial Expansion, Charlton Road and the Heavy Industrial Area (refer Table 6.1). The earthwork model for each precinct was simplified in the following manner:
 - Major landscape features such as dunes were incorporated into earthwork design where practicable in order to minimise volumes of cut and fill whilst being sensitive to the existing topography (See Appendix F for Isopachyte (Cut & Fill Depth Contours) Concept Plan).
 - The canegrass swamp has been identified as a significant heritage site and remains unaffected by the proposed earthworks.
 - Borrow pits are proposed to accommodate the construction phasing and have been strategically located to suit the stormwater management strategy.
 - The earthwork model does not make allowance for housing foundations and underground services.
 - Construction cut and fill batters from finished surface level to existing surface was modelled as 1V:2H.

Table 6.1: Earthwork Volume Details

Precinct/Region	Solid Volumes (m ³)		Bulked Volumes (m ³)		Balance (m ³)	Topsoil Stripped
	Cut	Fill	Cut	Fill		Volume (m ³)
Camp 6 including self contained units	-179,500	200,900	-179,500	221,000	41,500	-14,400
Swale West of Precinct 1	-65,300	700	-65,300	800	-64,500	-1,900
Precinct 2	-174,200	215,600	-174,200	237,200	63,000	-18,000
Precinct 3	-125,000	251,400	-125,000	276,600	151,600	-20,400
3 Borrow Pit/Stormwater Reserve to the West - Shape and Depth Indicative						
only	-158,400		-158,400		-158,400	
Precinct 4	-239,600	128,400	-239,600	141,300	-98,300	-15,700
4 Stormwater Reserve and Potential						
Borrow Pit	-6,000		-6,000		-6,000	
Precinct 5	-307,700					
Precinct 6	-107,900	100,900	-107,900	111,000	3,100	
Precinct 7	-71,600	60,600	-71,600	66,700	-4,900	-8,300
Precinct 8	-231,600	159,400	-231,600	175,400	-56,200	-18,400
Light Indutrial Estate	-156,100	119,400	-156,100	131,400	-24,700	-11,300
Sporting Area to West of Olympic Way	-27,000	30,700				-3,900
Charlton Rd	-25,500	19,400	-25,500	21,400	-4,100	-4,600
Heavy Industrial Area	-495,300	437,200	-495,300	481,000	-14,300	-35,700
Pony Club/Racecourse	-173,300	151,900	-173,300	167,100	-6,200	-14,900
Caravan Park	-31,200	21,200	-31,200	23,400	-7,800	-3,100
Axehead Road Transition Housing	-40,600	28,600	-40,600	31,500	-9,100	-4,200
Total	-2,615,800	2,202,600	-2,615,800	2,423,600	-192,200	-216,400



STORMWATER DRAINAGE

Existing Conditions

The existing stormwater drainage network at Roxby Downs is made up of a combination of piped and open channel systems. The trunk network is predominantly piped, however, open channel median drains exists along sections of Olympic Way, Axehead Road, Stuart Road and throughout the southern sub division area. Minor collector roads and local access roads are used extensively throughout Roxby Downs as open channel flow paths which feed into the trunk network during peak storm events.

The network is designed for between 2 and 5 year Average Recurrence Interval (ARI) rainfall events in residential areas and up to 10 year ARI events in the northern industrial and central commercial areas. For peak rainfall events, up to 100 years ARI the pipe and swale system overflows onto the road network which is utilised as a 'floodway'.

The stormwater collected within the original northern section of Roxby Downs is directed into four ponds located predominantly on the western side of Olympic Way, details of which are shown in Table 6.2. The stormwater from the more recent southern subdivision is directed, via a combination of pipes and open earth channels, to a basin on the eastern side of Olympic Way where it ponds and is allowed to evaporate.

Roxby Downs has a low average rainfall of around 150mm/year, however, the rainfall events can be quite sporadic, of short duration and high intensity.

Pond	Pond Size	Area Drained	Method of Conveyance
	(m³)	(ha)	
С	2500	39	Olympic Way and Axehead open
			swales and pipe network
А	1350	68	Pipe network
В	900	41	Pipe network
G	500	79	Stuart Road swale and pipe network
			(east side of Olympic Way)

Table 6.2: Stormwater Pond Details

Refer to Appendix A for pond location.

The stormwater is then directed from these ponds into the adjacent sewerage pump stations. From the pump stations, stormwater is conveyed via the sewer rising main to the sewerage treatment lagoons. Stormwater not reclaimed via the sewer network is allowed to evaporate and seep into the ground.

STORMWATER DRAINAGE (CONT.)

Implications

The natural profile of the land dictates that stormwater will predominantly flow from east to west through the Town. The Master Plan proposes development within the natural valleys/ low points within the existing terrain and indeed near the existing ponds to the west of Olympic Way. It is essential to manage the stormwater run-off and ensure that there is no reduction in the hydraulic conveyance or reduction in the capacity for flood plain storage as a result of the Master Plan development. Therefore, it is essential to utilise existing, and form new detention basins for stormwater management.

The pipe and swale network along Stuart Road is at capacity and runoff from the Master Plan's eastern developments should be detained before entering the network.

The pipe and swale network along Axehead Road and through the industrial zone has not reached capacity. However, run-off from the northern development should still be limited or delayed before entering the network to avoid the need to upgrade the existing network.

The proposed Town Sports Precinct to the west of Olympic Way provides an area for stormwater detention if required.

Goals

- Value surface water as a resource and establish detention basins in the form of parkland nearby the new housing precincts to harvest and reclaim surface water for non-potable applications
- Convey surface water collected on new hard standing areas via a conventional surface water network to detention basins for storage and potential re-use
- Introduce Water Sensitive Urban Design elements to manage surface water run-off and facilitate in pollutant removal i.e. swale drains
- Designate flood plain zones and overland flow paths away from residential areas that have adequate capacity to cater for peak storm events

General Design Actions

 The proposed stormwater network reflects the local style of stormwater drainage conveyance, utilising the kerb and channel of minor collector roads and local access roads as open channel flow paths which feed into the trunk network consisting of pipes and swales. The pipe and swale network is designed to cater for 5 year ARI rainfall events in line with recommended South Australian standards

- Swale drains are used where possible as an alternative to underground piping in line with WSUD guidelines
- Development to the east of Olympic Way located in natural depressions requires additional earthworks and pipe/swale networks which prevent ponding and effectively convey stormwater from the local site out to the lower western depressions
- Detention basins in the eastern precincts are required to restrict flow into the existing stormwater network along Stuart Road, to minimise the impact on the existing networks.
 During peak rainfall events, greater than 10 years, stormwater shall overflow along existing road networks towards the west of the residential precincts
- Run-off storage basins/ponding areas used as ephemeral wetlands or vegetated infiltration areas, where possible
- No allowance has been made for stormwater treatment



Development Specific Actions:

Refer to Attachment A for details of the proposed stormwater network including basins locations and trunk pipe network.

Stormwater from the eastern development is discharged into a number of detention basins located upstream of the existing township drainage network. These basins allow for the existing stormwater drainage network within the town to be utilised without the need for upgrading of infrastructure. The existing stormwater drainage network will connect with the proposed stormwater network for the western development, which discharges to a series of retention basins to the west of the development area. The southern development areas will also discharge to the west of the proposed development area. Stormwater detention basins have been used at the boundary of the existing system and the western development and through the southern developments to manage the flows through development areas. Stormwater overflows are directed toward the west of the township with all existing and proposed properties protected from the 1 in 100 year stormwater event.

WASTE WATER AND RECYCLED WATER

Existing Conditions

Water is a valuable resource in Roxby Downs. Treated waste water and stormwater are commodities that help to reduce the demand on high-quality drinking water for non-potable applications. Sustainable planning and design that promotes reuse of waste water and stormwater to conserve potable water will be implemented.

Roxby Downs Council is the authority responsible for the waste water network within the Town. The existing main drainage features within the Master Plan boundary include:

- Waste water treatment lagoon system including primary ponds, secondary ponds, a storage pond and treated effluent return pump station
- Pump stations A, B, C, D, E, F and G and associated rising mains
- Treated effluent storage tanks located adjacent to the oval irrigation pump station along Olympic Way
- 3 No. stormwater collection and waste water overflow ponds adjacent to pump stations A, B and C west of Olympic Way
- Golf Course irrigation storage dam for reclaimed water (treated effluent and stormwater)

The existing waste water network serves a total development area of approximately 271ha and a population of approximately 4,000 people. The network is a conventional network that consists of four gravity trunk sewers that collect waste water from residential, commercial and industrial zones. The trunk sewers discharge into the main pump stations A, B, C and G located along Olympic Way. Pump station A is the final downstream station where all waste water is conveyed to and then pumped up to the treatment lagoons located west of Olympic Way.

At the lagoons combined waste water and stormwater effluent undergoes a natural process of primary and secondary treatment, using both aerobic and anaerobic processes. The effluent is stored in the lagoons for extended periods of time while a complex process involving bacteria, oxygen and UV light removes organic matter and micro-organisms from the water. After this process the treated effluent is reclaimed for the Golf Course and Sports Oval irrigation needs and is pumped to the storage tanks located adjacent to the oval pump station and the Golf Club storage dam.

Implications

The quality of reclaimed water is required to be Class B for the Golf Club and Sports Oval proposed applications. Class B water is appropriate for the proposed use with appropriate management The level of effluent treatment within the existing lagoons is highly variable, particularly after peak rainfall events, whereby an uncontrolled amount of stormwater discharges into the lagoons. This affects the reliability and consistency of treated effluent quality. The treatment lagoons are currently operating at capacity, and generally cannot cater for large volumes of stormwater inflow after peak rainfall events. In such circumstances, in addition to the reduction in treated effluent quality described above, untreated effluent is allowed to overflow into the adjacent landscape. This is not compliant with the Environment Protection Agency (EPA) regulations.

In the event of a power failure or pump equipment failure the emergency overflow relief pipe at pump stations A, B, C, D and E discharges into the environment. There is a level of containment of the overflow from pump stations A, B and C as it directed into nearby ponds, however, these ponds are unlined and hence promote land contamination. The discharge of untreated effluent into the environment does not comply with EPA regulations.

Overflow at pump station G is contained within a $91m^3$ tank, whilst overflow at pump station F is conveyed in a pipeline to pump station A.

Due to the arid climate, evaporation losses are high. This is an aspect of the treatment process, but effectively it also reduces the amount of treated water available for re-use.

All the above site and infrastructure constraints are addressed in our Master Plan goals and actions as outlined following.

Roxby Downs - Draft Master Plan Report, March 2008



Goals

The waste water drainage proposal is to upgrade the existing network to cater for the forecast population of 16,000 (includes the proposed Hiltaba Village). The Master Plan proposal recognises the amenity value of treated effluent in the urban environment.

The design objectives of the waste water drainage strategy are to:

- Upgrade the existing infrastructure to cater for future growth
- Improve the efficiency of the waste water treatment process
- Achieve a high level of certainty in the quantity and quality of treated effluent to be reused for non-potable applications
- Comply with current EPA regulations
- Limit untreated effluent discharge into the environment
- Reduce the demand on high-quality drinking water for selected non-potable uses
- Maximise utilisation of treated effluent and collected stormwater

Actions

In order to cater for future growth of the Town, and hence an increase in waste water flows, various elements of the existing drainage infrastructure are required to be upgraded, including the existing pump stations.

To contain waste water overflow in accordance with EPA regulations and allow for maintenance of the pump stations, it is proposed to construct an overflow containment/by-pass tank adjacent to the existing and new pump stations to provide six hour containment of the average dry weather waste water flows.

The existing overflow ponds at pump stations A, B and C will be upgraded and lined to comply with EPA regulations and to control untreated effluent discharge into the environment.

A key Master Plan strategy is to segregate the new waste water and new stormwater networks. This will reduce the demand on the existing waste water infrastructure and the frequency of untreated effluent overflows. This strategy will also improve the efficiency of the wastewater treatment process - refer Attachment B.

It is proposed to upgrade the existing lagoon waste water treatment system to have the capacity to:

- Cater for the forecast populations
- Achieve a high level of certainty in the quantity and quality of treated effluent to be re-used for non-potable applications
- Allow for an additional reticulation network to be installed to distribute treated waste water to selected irrigation sites including adjacent public reserves, sports grounds, the golf course and Olympic Way landscaping

Provision of a sewerage service for the Heavy Industrial Area is not feasible. It is proposed that the occupants of these lots will be responsible for their individual onsite disposal systems. Typically this would comprise of a septic tank and soakage trench system, although higher level users would have a package aeration systems and use treated effluent to irrigate private space.

POTABLE WATER

Existing Conditions

The existing potable water for the township of Roxby Downs is sourced from two bore fields in the Great Artesian Basin, approximately 200km northeast of Olympic Dam. From here, the water is pumped to a desalination plant at the mine operated by BHP Billiton for treatment.

Post treatment, the water is pumped from the potable storage tanks at the plant into the Town's 10ML storage reservoir, which is lined and covered. It is downstream of this point that the Roxby Downs Council take responsibility for the infrastructure.

A pump house adjacent to the storage reservoir containing six electric pumps (Grundfos LP 100-200/191) provides water supply at the required flow and pressure to the Town. Based on the available information it is understood that this pump system can provide the township with a flow of 180L/s at a pressure of 44m head.

Pressure fluctuations in the case of breakdowns could result in an interruption to the supply service. Hydropneumatic air vessels have been installed to manage pressure fluctuations and moderate pressures by maintaining system pressure in the situation where no pumps are operating.

A diesel standby pump capable of 90L/s is available in the case of power or electrical pump failure. A by-pass line and 0.3ML storage tank are available for use in the event of a main reservoir contamination or maintenance.

Implications

The proposed development will result in a significant increase in the potable water demand on the existing infrastructure leading to infrastructure upgrades.

Goals

A key objective for the Master Plan is to establish a reliable and sustainable water supply to support the forecast population of Roxby Downs. Water recycling is an important aspect of the Master Plan's water strategy to reduce the demand on high-quality drinking water for non-potable applications - refer Attachment C.

Actions

In order to conserve water it is proposed to install AAA water saving appliances in each new household for example flow regulators for showers and dual flush systems for toilets. These water saving appliances combined with the use of reclaimed water for irrigation of selected public sites are expected to result in a reduction in potable water demand.

An additional 90ML storage is proposed to be located north of the existing storage reservoir and a major upgrade of the adjacent pumping station is required to serve the forecast demand at sufficient pressure. This storage volume exceeds the current operating condition and allows for both unscheduled interruptions in water supply and malfunction of the desalination plant.


ELECTRICAL SERVICES

Existing Conditions

The main power supply to the township is via a 33kV overhead supply from main switch station/substation at the mine. The overhead line feeds both the existing camp and the current Roxby Downs Town. The zone substation at the Roxby Downs township has a current maximum output of 10MVA, with a reported maximum recorded demand of 6MVA.

The current electrical supply at the township zone substation is 33kV in and 11kV out for the township general high voltage reticulation.

The main high voltage reticulation around the current township is at 11kV and feeds various transformers serving the various loads in the township (i.e. residences, shopping centre and other ancillary service buildings).

These localised transformers distributed around the existing township vary in capacity to suit the loads served, however, in general, the residential portions of the township are serviced by 300kVA or 500kVA kiosk type transformer units.

Current Town supply requirements, as advised by Roxby Downs Council, are:

- The average maximum demand for the township is in the order of 4MVA typically, but can draw up to 6MVA in peak times (i.e. very hot weather with all Town air-conditioning units running at maximum capacity)
- There are occasional voltage fluctuations in terms of voltage spikes of up to 280V that occur during the mine operation time
- The Olympic Dam Village draws a maximum power demand of 3MVA
- Typically, the time period between 5pm to 8 pm of an evening is the peak electrical usage of the township. (i.e. cooling/ heating, TV/entertainment, cooking etc. all running at maximum)

Implications

Given the current capacity and current electrical demand usage estimates, initial assessment suggests that a total of 200 additional dwellings (or a significant commercial development) would be required to be added before the township zone substation would need to be upgraded in capacity.

This figure of 200 dwellings is based on the current average of 5kVA per dwelling maximum demand and no other energy management initiatives occurring (e.g. provision of solar hot water to current and new housing, thereby reducing the township overall reliance on electricity).

Goals

The key goals for the electrical services reticulation strategy for the Roxby Downs township are as follows:

- Upgrade or replace the zone substation to suit the anticipated growth in population and demand
- Provide new base electrical reticulation systems throughout the new areas of the Town and industrial areas
- Provide additional electrical supply capability to allow for furthur development of the existing Town Centre
- Provide new street lighting systems throughout the new areas of the township

Minimise energy usage in housing (and also more generally) by the following criteria:

- Establish mandatory compliance for all new buildings with the minimum energy limits to be imposed in the Building Code of Australia 2006
- Consider use of solar water heating to new buildings
- Provide appropriate shading and thermal mass in building design and construction to minimise energy usage
- Provide a standard suite of housing design options that addresses options in building orientation, shading and occupancy use
- Incorporate Planning SA's energy conservation measures into lot and building layouts

Actions

Base Electrical Infrastructure

Working with the intended Master Plan layout developed by HASSELL, Arup has developed an indicative scope of works and overall reticulation strategy to reflect what is required to service the new residential areas and anticipated increase in load in the main commercial centre of the Roxby Downs township.

The overall aim of the base electrical infrastructure is to provide a reliable and flexible system for the Roxby Downs township. Integration of the new electrical reticulation systems with the existing will result in an overall system that provides reliability typical to residential and commercial developments of a similar nature to that found in other townships.

Detailed studies will be required in future stages of the project to review the maximum loadings and balance of the existing electrical networks to ascertain the correct level of augmentation and correct integration points for the new electricity networks to link into the existing networks.

In order to cater for future growth of the Town, and hence an anticipated increase in electricity usage, various elements of the existing electrical infrastructure are required to be upgraded. Given the intended population increase, the existing township zone substation is intended to be upgraded, with additional space provision within the zone substation for a further future expansion.

Alterations to the overhead and underground reticulations systems to the existing areas of the township will be required to link into new areas and to rebalance the overall high voltage systems.

Additional new overhead and underground reticulation networks will be installed to distribute electricity to the new residential, recreational and commercial precincts.

Generally, overhead high voltage reticulation will be contained to major roadways such as Olympic Way with underground reticulation systems throughout the residential areas. Ground mounted kiosk type substations will be located within the residential areas for approximately every 60-70 lots (based on more developed load studies) and other substations will be integrated into the overall network to suit intended expansions into commercial and other central development. Low voltage reticulation will be provided to residential areas via underground reticulation systems.

Street lighting systems will be provided typically to match the existing street lighting systems in the current Roxby Downs township.

Housing

Although not a specific part of this study, one of the overall goals of the design of new housing types for Roxby Downs will be to maximise energy efficiency. The knock on effect of this drive for energy efficiency is the subsequent minimisation of the size (and therefore cost) of standard electrical reticulation systems that need to be provided to the new residential areas of the Roxby Downs township.

The goals and options therefore of further studies is to consider the design of housing and energy efficiency measures to be achieved throughout.

Renewable Energy

One of the goals for the electrical reticulation systems was to review the options for renewable technologies for possible integration into the overall township expansion.

At this time, an initial review has indicated that the following:

- Photovoltaic Cell Panels Per Residence (based on 500W): \$15,000 - 20,000 per house
- Micro Wind Turbines Per Residence (based on 500W): \$ 13,000 – 18,000 per house
- Central Wind Farm (in multiples of 1MW): Approximately \$3 million per MW.

The above suggests initially that neither PV installations (either per house or centrally) nor micro wind turbines per house will be viable options, as the cost per house and the output from each installation is not comparable to traditional electrical reticulation systems.

STRATEGIES: GOALS, ACTIONS & DESIGN GUIDELINES



Preliminary weather data gathered for Roxby Downs suggests that a central wind turbine farm could potentially be viable as the average wind speeds for the Roxby Downs areas may be suitable for some wind generation capability to augment the base electrical infrastructure.

If the option of a central wind farm is to be pursued further, consultation with specialist wind turbine suppliers and specialist studies must be carried out on issues such as wind profiles, topographical profiles, geotechnical studies and environmental impact assessments before a decision on the viability of the central wind farm can be ascertained properly.

The option (and cost) of central wind power generation would need to be analysed and compared to the potential savings of providing conventional electrical reticulation systems.

Irrespective of the above decisions, BHP Billiton would still have the option of purchasing "green" power from other external renewable energy providers as part of a drive to provide renewable energy content into the Roxby Downs township. A study would be required into the cost/benefit of options of purchasing "green" power for the whole Roxby Downs township.

ATTACHMENTS

ATTACHMENTS

Attachment A Extension of Existing Stormwater System

Attachment B Extension of Existing Waste Water System

Attachment C Extension of Existing Potable Water System

Attachment D Roxby Downs Dune Assessment

Attachment E Preliminary Proposed Lot Numbers

Attachment F Preliminary Proposed Lot Numbers



ATTACHMENT A EXTENSION OF EXISTING STORMWATER SYSTEM







ATTACHMENT C EXTENSION OF EXISTING POTABLE WATER SYSTEM



ATTACHMENT D ROXBY DOWNS DUNE ASSESSMENT

David Wiltshire Olympic Dam EIS HLA-Envirosciences / ARUP 76 Weymouth St Adelaide S.A.5000

1/3/2006

Roxby Downs Dune Survey

1. Introduction

Ecological Associates was engaged by HLA-Envirosciences/ARUP to assess the ecological significance of dunes within and surrounding the Roxby Downs township.

2. Method

A field survey was conducted on 27-28 February 2006. All dunes identified on a plan provided by HLA-Envirosciences/ARUP were surveyed. The location of dunes to the west of Olympic Way could not be accurately determined from the provided plans. AMG coordinates (Zone 53, GDA94 Datum) for the location of the surveyed dunes have been recorded for these dunes. The location of Dune 7 could not be accurately determined from the plans. Two dunes were surveyed in the approximate position of Dune 7 (labeled in this report as Dunes 7 and 7A). The dune south of Dune 21 was not labeled on the plan. This dune is labeled in this report as Dune 21A.

A list was compiled of all plant species present and notes were made on habitat features for fauna. Site condition was assessed using the criteria listed in Table 1. A score of one was assigned if one of these features was present. Where dunes comprised more than one site condition class each section was assessed separately.



Table 1. Habitat features

Feature	Score 1	
Many large, mature trees		
Few-many large, mature trees	1	
Overstorey mostly intact and healthy	1	
Understorey mostly intact	1	
All plants healthy	1	
All or most plants healthy	1	
Recruitment of woody shrubs or trees	1	
High diversity of understorey or groundlayer species	1	
No perennial weeds present	1	
Low weed cover (<20%)	1	
Low-moderate weed cover (<50%)	1	
No litter present	1	
No evidence of disturbance	1	
No or low levels of disturbance	1	
Uncommon species present	1	
TOTAL	16	

Site condition classes were assigned as defined in Table 2.

Table 2. Site condition classes

Condition class	Score		
Excellent	14-16		
Good	11-13		
Moderate	8-10		
Poor	4-7		
Highly degraded	0-3		

Dunes were classified as high ecological significance if they provided habitat for threatened flora or fauna, comprised a plant association of conservation significance or the site condition score was excellent.

Dunes were classified as medium conservation significance if they supported many, large mature trees or the site condition score was moderate to good.

Dunes were classified as low conservation significance if the site condition score was poor to highly degraded.

3. Dune description

The vegetation of the surveyed dunes was relatively uniform. The dunes typically comprise a shrub layer of *Acacia ligulata*, *Dodonaea viscosa* spp. *angustissima* and one or more of the Mulga wattles (*Acacia aneura*, *A. ramulosa* and *A. brachstachya*). *Acacia aneura* sometimes forms a small tree and *A. ramulosa* and *A. brachstachya* are large shrubs. Approximately half of the dunes support White Cypress-pine (*Callitris glaucophylla*). On some dunes there are only one or two trees and other dunes support large stands of mature trees.

The small herbaceous shrubs, Sida ammophila, Hibiscus krichauffianus and Abutilon otocarpum were present on most dunes. Other common herbs were the daisies Chrysocephalum apiculatum, Polycalymma stuartii and Angianthus glabrata. The grasses, Aristida holathera and Enneapogon avenaceus, were present on almost all dunes. Other common grasses were Monochather paradoxa and Aristida contorta.

The herbaceous weed, *Brassica tournefourtii*, was present on all dunes and was typically patchy in occurrence. No perennial weeds were observed on any dunes and other weed species were uncommon.

No threatened species were found on any of the dunes. The surveyed dunes do not support any threatened plant communities. Dunes surrounded by urban development are not considered likely to support populations of threatened fauna. However all dunes provide suitable habitat for common bird and reptile species.

4. Assessment

The dunes are generally in good condition. None of the dunes are considered to be highly degraded and all support native plant communities with few signs of disturbance. Most dunes had a good cover of native shrubs, grasses and herbs. Bare areas were present on most dunes but this is typical of this vegetation type.

Weed cover is typically patchy and no dunes have a high weed cover. Litter is present although sparse in most of the dunes within the township and litter is commonly present along walking trails. Other litter has blown onto the dunes, most commonly from nearby building sites. There is some hard rubbish present in some dunes, which appears to have been used by children during play.

Although there are motorbike tracks on some dunes these are not extensive. Other vehicle traffic is not common. Foot tracks are the most common form of disturbance in dunes in the township but this is typically confined to a single track and has not resulted in any erosion. There are some blow outs on dune crests but these typically occur on dunes outside the township. Other erosion is associated with the construction of house sites around the periphery of dunes. Where established houses are adjacent to dunes, there is usually dense shrub growth adjacent to boundary fences which would restrict further erosion.

None of the surveyed dunes was classified as high ecological significance. Eight dunes were classified as low ecological significance (Table 3). The remainder of the dunes were classified as medium ecological significance (Table 3).



Table 3. Dune assessment

Ecological significance	Dune number	Condition score	Description
Low	13 East	4	East of Aquila Bvd. Acacia ligulata / Dodonaea viscosa shrubland on dune crest with Mulga on lower dune slopes. Shrub cover reduced. Some large dead <i>Dodonaea</i> but other shrubs healthy. Some hard rubbish and moderate cover of weeds. Disturbed where road has been cut through and shrub layer has not regenerated.
Low	20	6	(680016, 6618530) Mulga / <i>Dodonaea viscosa</i> shrubland with two <i>Callitris glaucophylla</i> . Adjacent to rubbish dump, a lot of blown in litter. Weed cover moderate to high.
Low	24	6	Acacia ligulata / Dodonaea viscosa / Mulga shrubland with two Callitris glaucophylla. Some eroded areas where new house blocks have been constructed. Some hard rubbish. Weed cover high in places.
Low	31	6	Acacia ligulata shrubland with Dodonaea viscosa. Adjacent to school. Lots of litter and foot tracks. Mulch has been laid to reduce erosion. Weed cover patchy and low where mulch has been placed. Some planted trees near the school.
Low	1 West	7	West of junction of Maireana Crt andTiliqua Cst. <i>Dodonaea viscosa</i> shrubland with <i>Acacia ligulata</i> . High weed cover adjacent to houses but weed cover reduced at centre of dune. Disturbed by motorbike track.
Low	5	7	Mulga shrubland with Acacia ligulata. There is large dead Acacia. Shrub cover is low. There is some hard rubbish and a high weed cover. Uncommon species present are <i>Eremophila glabra</i> and <i>Hakea</i> <i>leucoptera</i> .
Low	17	7	Acacia ligulata / Dodonaea viscosa shrubland with Mulga. A few Callitris glaucophylla. Shrub cover patchy with a lot of bare ground. Weed cover low. Some disturbance associated with vehicle tracks.
Low	28 south- west	7	Section north of Herbert St. Mulga / Acacia ligulata / Dodonaea viscosa shrubland. One mature Callitris glaucophylla that has been burnt. Some hard rubbish and minor foot tracks. Weeds patchy.
Medium	1	8	To 100 m west of Aquila Bvd. Acacia ligulata / Dodonaea viscosa shrubland with a few Callitris glaucophylla. Some patches with high weed density. A few foot tracks and motorbike tracks.
Medium	2	8	Acacia ligulata / Dodonaea viscosa shrubland on dune crest with Mulga on lower dune slopes and one large Callitris glaucophylla. Understorey mostly bare with low weed cover. Some vehicle tracks bur disturbance typically low.
Medium	7A	8	(380051, 6616814) Acacia ligulata / Dodonaea viscosa shrubland with a few Callitris glaucophylla. Moderate weed cover. Some disturbance by vehicles. Uncommon species Lycium australe present.
Medium	12	8	Acacia ligulata / Dodonaea viscosa shrubland on dune crest with Mulga and one Califiris glaucophylla. Disturbed where new hose blocks have been constructed on the northern side. Weed cover moderate but patchy. The uncommon Pittosporum angustifolium.
Medium	19	8	(680200,6618298) Many mature <i>Callitris glaucophylla</i> and Mulga. Disturbed adjacent to road with high weed cover and litter. Fewer weeds in fenced area to east of road. Uncommon species <i>Alectryon</i> <i>oleifolius</i> present.
Medium	21	8	(682664, 6618639) Open Acacia ligulata / Dodonaea viscosa shrubland with Mulga. Mulga generally in poor health. Weed cover low and confined mainly to the southern dune flank.

Ecological significance	Dune number	Condition score	Description
Medium	21A	8	(682738,6618463) <i>Acacia ligulata</i> shrubland. Some blown out bare areas. Weed cover moderate on southern dune flank. No disturbance.
Medium	26	8	Acacia ligulata / Dodonaea viscosa shrubland with a few Callitris glaucophylla. Some planted eucalypts near houses at eastern end. Disturbance by pedestrians. Some litter and blown in rubbish. Weed cover high in places but so is the cover of native daisies. Juvenile pines present.
Medium	34	8	(679505, 6617601) Open <i>Acacia ligulata</i> shrubland with a few <i>Callitris glaucophyla</i> . Some large dead shrubs but recruitment not adequate for replacement. Weed cover moderate.
Medium	35	8	(679701, 6617343) Mulga / <i>Dodonaea viscosa</i> shrubland with <i>Alectryon oleifolius</i> . High weed cover. Blow out on dune crest. Uncommon species <i>Alectryon oleifolius</i> and <i>Eremophila glabra</i> present.
Medium	3	(9)	This dune was not assessed but it is assumed to be similar to the adjacent Dune 4 (see below).
Medium	4	9	Mulga shrubland with Acacia ligulata and Dodonaea viscosa. Some dead shrubs but regenerating shrubs are present. Low disturbance. Wed cover moderate but patchy. The uncommon <i>Pittosporum</i> angustifolium is present.
Medium	9	9	(680032, 6616291) Many mature <i>Callitris glaucophylla</i> . Low shrub cover. Weed cover high in places. No signs of disturbance.
Medium	10A	9	(680628, 6615498) <i>Acacia ligulata / Dodonaea viscosa</i> shrubland. Juvenile <i>Dodonaea viscosa</i> abundant. Moderate weed cover. Some disturbance by motorbike track that runs along dune crest.
Medium	14	9	Mulga shrubland with Acacia ligulata and Dodonaea viscosa. Two mature Callitris glaucophylla. Moderate weed cover but low disturbance. More shrub cover at western end of dune. The uncommon Santalum lanceolatum and Ptilotus polystachyus var. polystachyus are present.
Medium	16	9	Acacia ligulata shrubland. Lots of bare ground with low weed cover and few signs of disturbance. Uncommon species Alectryon oleifolius present.
Medium	29	9	Mulga / Acacia ligulata shrubland. Some unhealthy Mulga but shrub recruitment is adequate. Weed cover patchy, high at eastern end. Minor footpath along dune crest. Uncommon species <i>Santalum</i> <i>Janceolatum</i> present.
Medium	30	9	Dodonaea viscosa shrubland with Mulga. Scattered mature <i>Callitris</i> glaucophylla. Blowouts on dune crests and disturbance by motorbikes. The uncommon <i>Eremophila glabr</i> a is present.
Medium	6	10	(680073,6617193) Mulga shrubland with stand of <i>Callitris glaucophylla</i> . Some blowouts on old vehicle tracks. Weed cover low to moderate. Uncommon species <i>Exocarpos aphyllus, Acacia oswaldii</i> and <i>Pittosporum angustifolium</i> present.
Medium	10	10	Many large mature <i>Callitris glaucophylla</i> with <i>Alectryon oleifolius</i> . Disturbed by motorbike track. Low cover of weeds. Large bare areas but few signs of disturbance.
Medium	13W	10	West of Aquila Bvd. <i>Acacia ligulata / Dodonaea viscosa</i> shrubland. Less disturbed than dune east of Aquila Bvd. Two large <i>Callitris</i> <i>glaucophylla</i> with several juveniles, several near the road. The uncommon <i>Santalum lanceolatum</i> is present.



Ecological significance	Dune number	Condition score	Description
Medium	15	10	Acacia ligulata shrubland with a few Callitris glaucophylla. Some blowouts on dune crest and disturbance by vehicles. Weed cover moderate. Uncommon species Pimelea microcephala and Eremophila glabra present.
Medium	27	10	Dune and swale area with storm water drain. Acacia ligulata shrubland on dune slope. Planted trees and shrubs in swale. High weed cover in patches in storm water drain. Numerous footpaths present.
Medium	28East	10	East of Anna Crt. Many mature <i>Callitris glaucophylla</i> with scattered <i>Acacia ligulata</i> and <i>Dodonaea viscosa</i> . Some dead pines but regenerating pines on dune crest. Weed cover patchy. Some disturbance by pedestrians. Planted trees and shrubs along walkway behind houses on Anna Crt and Torrens Crt.
Medium	7	11	(680077, 6617001) Open Mulga / Acacia ligulata shrubland with high grass cover. Low weed cover and no disturbance.
Medium	8	11	(680131, 6616630) Mulga / Acacia ligulata shrubland with scattered Callitris glaucophylla. Groundlayer dominated by grasses. Low weed cover and few signs of disturbance. Vehicle track bisects dune.
Medium	11	11	Acacia ligulata / Dodonaea viscosa shrubland with Mulga and Hakea leucoptera. A few Callitris glaucophylla present. Wed cover is patchy with highest weed densities near Aquila Bvd. Some litter present. Uncommon species present are Hakea leucoptera, Eremophila glabra and Ptilotus polystachyus var. polystachyus.
Medium	22	11	Many large, mature <i>Callitris glaucophylla</i> . Mulga shrubland with <i>Acacia ligulata</i> and <i>Dodonaea viscosa</i> . The uncommon <i>Eremophila</i> <i>glabra</i> and <i>Alectryon oleifolius</i> are present. Groundlayer dominated by weeds. Transmission line bisects dune.
Medium	23	11	Mulga shrubland with Acacia ligulata and Dodonaea viscosa. Some mature Callitris glaucophylla. The uncommon Eremophila longifolia is present. Moderate weed cover. Transmission line bisects dune.
Medium	25	11	Many large, mature <i>Callitris glaucophylla</i> . <i>Acacia ligulata / Dodonaea viscose</i> shrubland with Mulga. Some patches of weeds but cover generally low. Some litter present. The uncommon <i>Eremophila glabra</i> is present.
Medium	24	11	Acacia ligulata / Dodonaea viscosa shrubland with Mulga and two large mature Callitris glaucophylla. Some large weed patches. Some litter present, probably blown into the site. Vehicle tracks in places, site accessible by vehicle from Axehead Rd.
Medium	28 north- west	11	Section adjoining Gregory St. Many mature <i>Callitris glaucophylla</i> with Mulga, <i>Acacia ligulata</i> and <i>Dodonaea viscosa</i> . Less cover of Brassica but other weed species present. Some disturbance by foot traffic and some litter. Good shrub recruitment. Uncommon species <i>Myoporum acuminatum</i> present.
Medium	32	(11)	This dune was not assessed but is assumed to be similar to the nearby Dune 33 (see below). This dune supports many mature <i>Callitris</i> glaucophylla.
Medium	33	11	(680303,6617976) Callitris glaucophylla / Mulga woodland. Dune assessed occurs immediately north of sewage ponds. Weed cover patchy. Moderate disturbance with some blow outs. Uncommon species <i>Pittosporum angustifolium</i> present.
Medium	1 central	12	East of junction of Tiliqua Cst and Maireana Crt extending 150 m east. Many large, mature <i>Callitris glaucophylla</i> with <i>Acacia ligulata /</i> <i>Dodonaea viscosa</i> shrubland. High diversity of understorey species. Some bare areas with lose sand disturbed by motorbikes. Wed cover high adjacent to houses. Shrub recruitment evident. Uncommon species <i>Pittosporum angustifolium</i> and <i>Eremophila glabra</i> present.

Ecological significance	Dune number	Condition score	Description
Medium	18	12	(680231, 6618107) <i>Callitris glaucophylla /</i> Mulga woodland. Good cover of grass and high diversity of understorey species. Low weed cover and few signs of disturbance. Uncommon species present are <i>Acacia tetragonophylla</i> and <i>Alectryon oleifolius</i> .

5. Recommendations

All dunes within and surrounding the Roxby Downs township have retained their native vegetation and provide habitat for fauna. The dunes have low levels of disturbance and provide a distinctive character to the township layout.

Dunes with low ecological significance may be suitable for removal. Consideration should be made for providing areas where native vegetation is managed and protected to offset any native vegetation losses.

Dunes with a medium ecological significance are less suitable for removal. The condition of these dunes may be improved by weed control programs and litter removal which will improve their appearance and subsequently their appreciation by the community.

Dr Jane Prider

Senior Ecologist



ATTACHMENT E PRELIMINARY PROPOSED LOT NUMBERS





TOTAL NUMBER OF LOTS: Approximately 2881 (based on an approximate lot size of 675m2)

ROXBY DOWNS RESIDENTIAL LOT COUNT 16.01.07 SCALE 1:5000 @ 40

ATTACHMENT F ISOPACHYTE (CUT & FILL DEPTH CONTOURS) CONCEPT PLAN



Roxby Downs - Draft Master Plan Report, March 2008