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CITY OF COCKBURN
STRUCTURE PLAN
This Structure Plan was adopted by Council on 17.7.06
Signed
DIRECTOR OF PLANNING & DEVELOPMENT
File No. 9525
This Structure Plan was endorsed by the Western Australian Planning Commission on 8.9.06 with modifications
Signed
for Structure Plan
for DIRECTOR OF PLANNING & DEVELOPMENT

THE PLANNING GROUP

AUSTRALIAN MARINE COMPLEX – TECHNOLOGY PRECINCT

STRUCTURE PLAN

July 2006
Reference 705.072

Perth Melbourne Sydney Darwin Dunsborough
A member of The Urban Alliance

AUSTRALIAN MARINE COMPLEX - TECHNOLOGY PRECINCT

STRUCTURE PLAN

July 2006
Reference 705.072
Issue 5

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ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Cockburn Town Planning Scheme No. 3.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

08 September 2006

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015.*

Date of Expiry: **19 October 2030**

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Issue	**Date**	**Status**	**Prepared by**		**Approved by**	
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1	26.11.04	Draft	Matt Raymond		Peter Simpson	
2	6.12.04	Final	Matt Raymond		Peter Simpson	
3	9.5.05	Revised Final	Matt Raymond		Peter Simpson	
4	6.6.06	Amended Plan	Peter Simpson		David Caddy	
5	13.7.06	Revisions	Peter Simpson		David Caddy	

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CONTENTS

INTRODUCTION

This Structure Plan has been prepared in order to facilitate the subdivision, land use and development of the land that forms the Technology Precinct of the Australian Marine Complex at Cockburn Sound. The Technology Precinct forms one of four main precincts of the Australian Marine Complex.

This report has been prepared on behalf of LandCorp. LandCorp is the State Government's land and property development agency and has specific experience in the planning, project management and development of numerous major industrial projects throughout Australia.

This report has been prepared by a multi-disciplinary team of consultants including LandCorp, The Planning Group, Hassell Pty Ltd, Strategen and GHD with assistance from the Department of Planning and Infrastructure and the City of Cockburn.

BACKGROUND

The Australian Marine Complex (AMC) has been developed to facilitate and enhance the opportunities created by the clustering of the shipbuilding and marine-related, defence and resources industries.

The AMC comprises four adjoining precincts, which include the:

- Shipbuilding Precinct, including a Marine Support Facility;
- Support Industry Precinct;
- Fabrication Precinct, comprising a Common User facility and Fabricators Area; and
- Technology Precinct.

The AMC is located on the north-east sector of the Cockburn Sound approximately 23 kilometres south of Perth. The AMC is one of the most exciting maritime activity clusters in the Asian Pacific Region and has the financial backing of the Australian Federal Government and the Western Australian State Government.

Refer to **Figure 1 - Location Plan**

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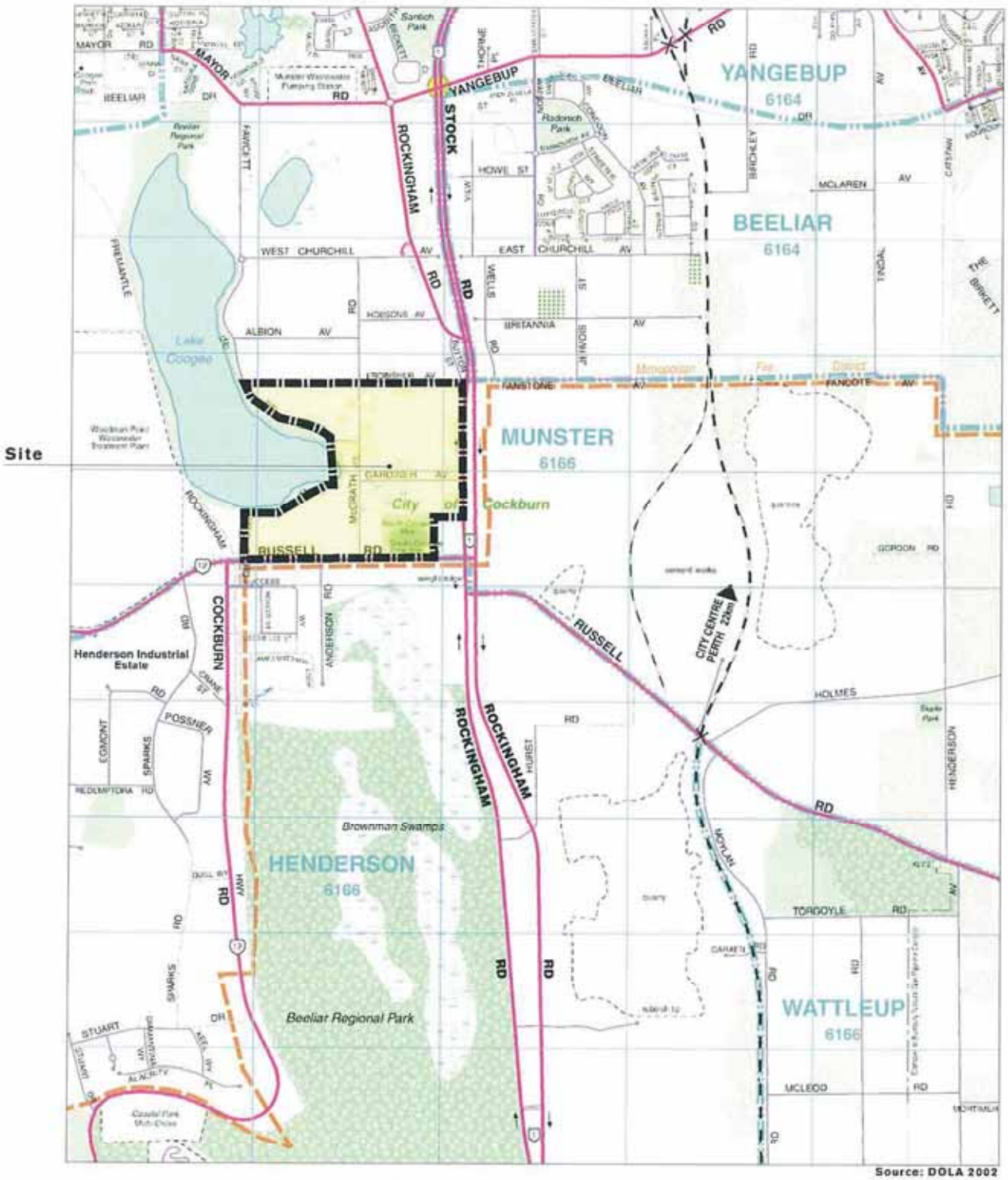

Figure No: 1

Title: **Location Plan**

Date: 27 April 2006 | Revision No: 1

Scale: Refer to Scale Bar | Job No: 706.072

Designer: M.R. | Drawn: S.L.

E Reference: Location Plan/b10

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STRUCTURE PLAN OBJECTIVE

The objective of this structure plan is to facilitate the subdivision, land use and development of the Technology Precinct of the Australian Marine Complex and to ensure the creation of an environmentally, socially and economically sustainable Precinct that has minimal adverse impacts on the adjacent Lake Coogee and associated wetlands.

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THE SUBJECT LAND

STUDY AREA AND SURROUNDS

The site is located approximately 9 kilometres from the Fremantle City Centre and is in relatively close proximity to the Woodman Point Recreations Reserve, Lake Coogee and the Beeliar Regional Park.

The Technology Precinct area (also referred to as the 'subject site') comprises a total area of approximately 49 hectares and is bounded by Frobisher Avenue to the north, Rockingham Road to the east, Russell Road to the south and Lake Coogee to the west.

The subject site is generally used for horticulture and associated dwellings and structures with approximately half of the land area not in active use.

Refer to **Figure 2 - Aerial Photo**

The land uses adjacent to and within the immediate surrounds include:

- The Water Corporation Wastewater Treatment Plant to the west;
- Henderson General Industrial Park to the south-west;
- The South Coogee Community Hall to the south;
- The South Coogee Primary School to the south;
- Cockburn Cement facility to the south-east;
- The residential suburb of Beeliar to the north-east;
- An urban area with horticultural activities to the north;
- Lake Coogee to the west;
- Beeliar Regional Park to the south, west and north-west.

Refer to **Figure 3 - Context Analysis**

LAND OWNERSHIP

The Technology Precinct area is comprised of 41 different lots ranging in area from 126 square metres to 8.0937 hectares. The land is owned by a number of different individuals with LandCorp being the largest landowner. Figure 4 indicates the current ownership of the land within the structure plan area.

The table below provides details of the land ownership, which is still in private ownership:

Lot	Street	Owner	Notes
36	Gardiner	Vjckoslav & Patricia May Jakovcevic	
45	Rockingham	N & V Di Lazzaro	
44	Rockingham	Roberto Di Lazzaro	
9	Rockingham	Roberto Di Lazzaro	
26	McGrath	Ante Oreb	
25	McGrath	Ante Oreb, May Foster, Frances Russel- Davison	
28	McGrath	Cockburn Cement Ltd	Under contract for sale to Landcorp

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Figure No: 3

Title: **Aerial Photo**

Date: 27 April 2004 Revision No: 1

Scale: Refer to Scale Bar Job No: 706.072

Designer: M.R. Drawn: L.C.

E Reference: Aerial-A3.fh10

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metres

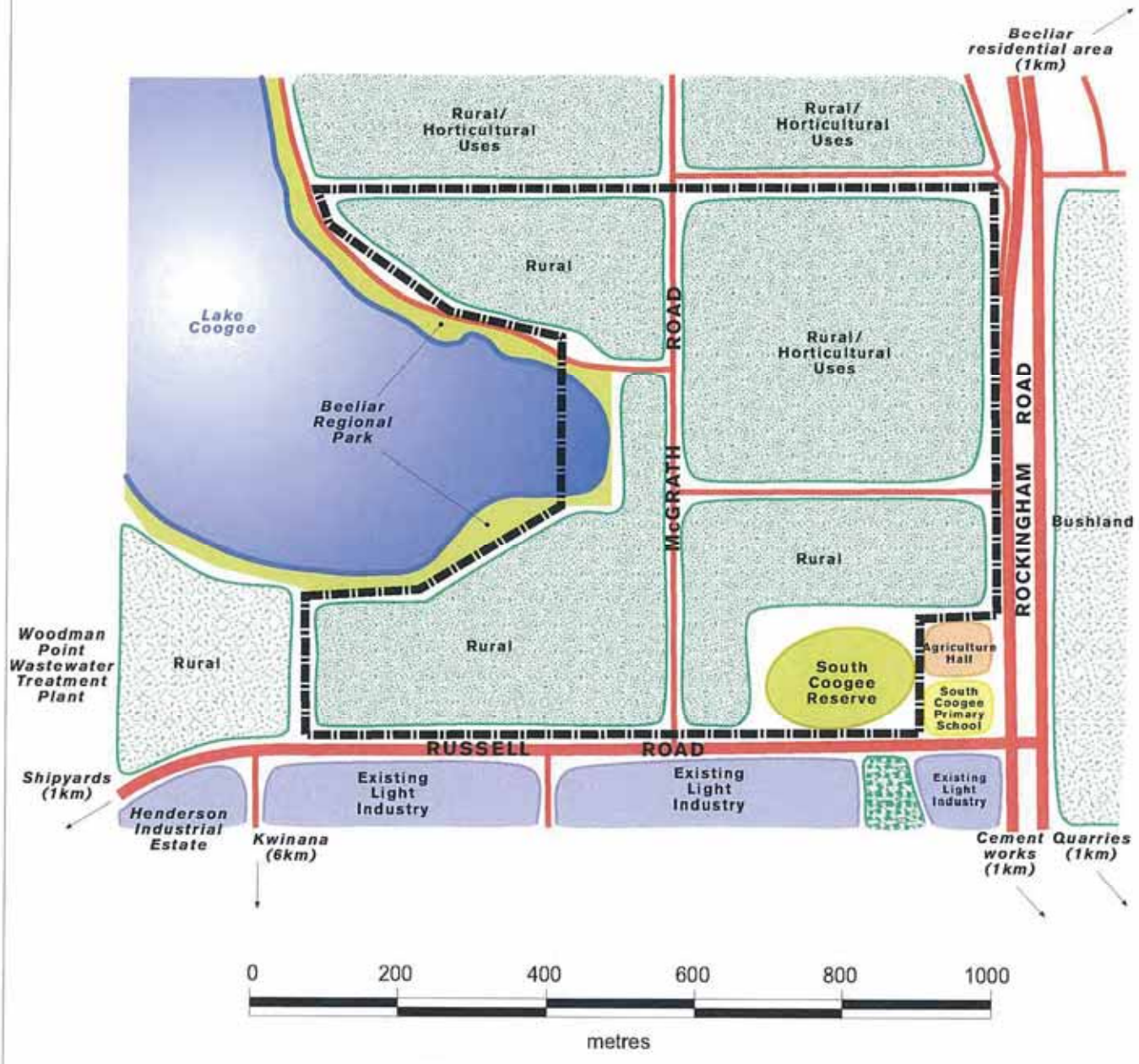

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Figure No: 3

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Title: Context Analysis

Date: 27 April 2006 Revision No: 1

Scale: Refer to Scale Bar Job No: 705.072

Designer: M.R. Drawn: S.L.

E Reference: Context-A3.fh10

This concept has been prepared for the purpose of meeting client specifications. This drawing does not constitute an invitation, agreement or contract for any part thereof of any kind whatsoever.

Although care has been taken in the completion of this document by The Planning Group WA Pty Ltd, all parties associated with the proposed property development disclaim any responsibility for any errors or omissions. The right is reserved to change the plan at any time.

Liability is expressly disclaimed by The Planning Group WA Pty Ltd for any loss or damage which may be sustained by any person acting on any visual impression gained from this drawing.

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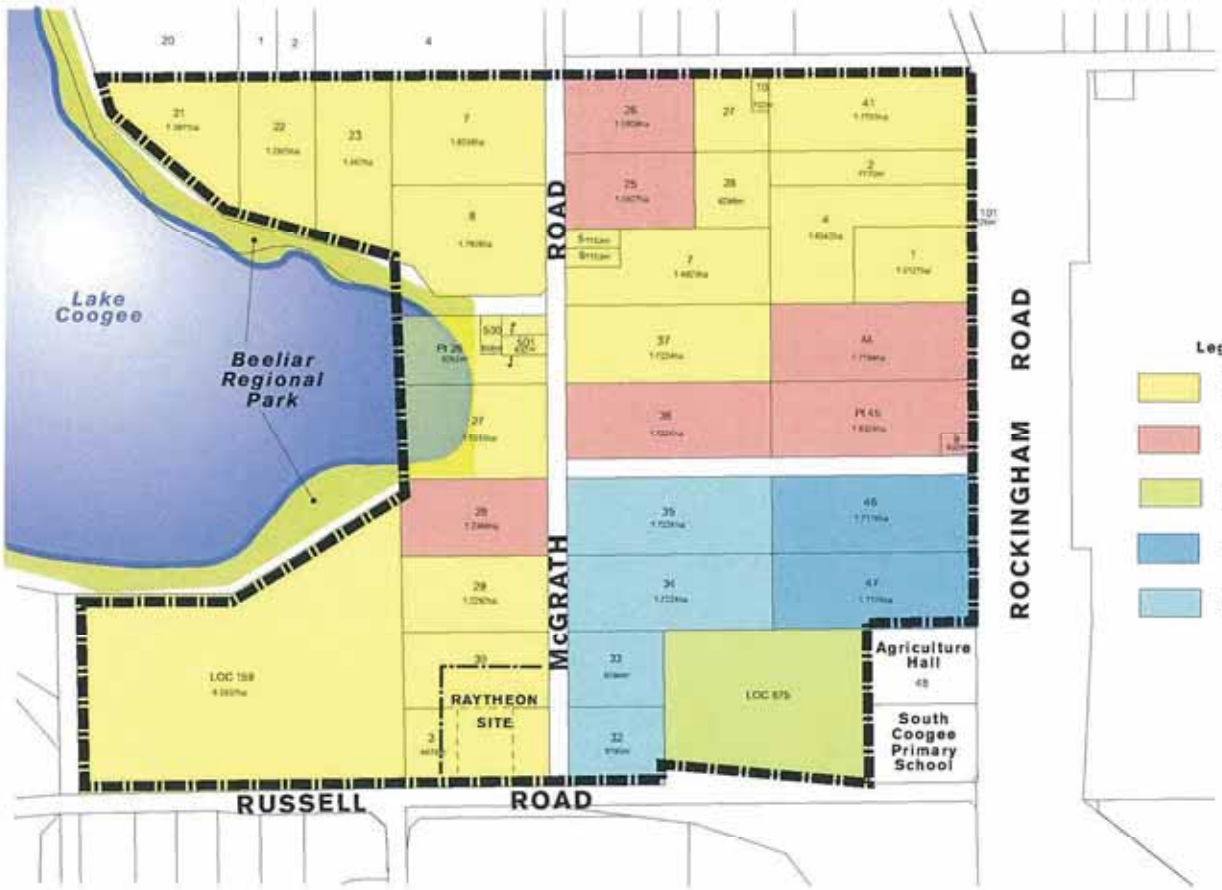

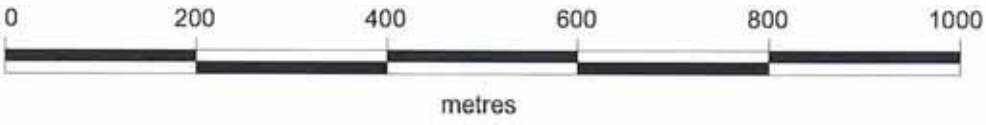

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Figure No: 4

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Title: **Land Ownership**

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SITE OPPORTUNITIES AND CONSTRAINTS

The subject site has a complex array of opportunities and constraints impacting on the development potential of the land.

The constraints include:

- Environmental considerations (buffers) associated with Lake Coogee (Conservation Category Wetland);
- A Bush Forever site;
- Remnant vegetation;
- European heritage;
- The location of an 'A' Class reserve within the site;
- The Cockburn Cement sand pipeline running along Gardiner Avenue;
- Cockburn Cement EPP Buffer;
- Wastewater Treatment Plant buffer;
- The location of existing infrastructure;
- Access from Rockingham Road;
- The interface between the proposed site and proposed residential uses to the north;
- The approval of the Raytheon development; and
- Landownership rationalisation.

While the site has a significant number of constraints which will impact on the land available for development, it does have opportunities that need to be taken into account, including:

- Opportunities for mixed use development outside of the buffer areas towards the northern portion of the site to provide a transition from the residential uses to the north to the proposed uses to the south;
- The relocation and or redevelopment of the South Coogee Reserve which is currently orientated incorrectly for the sporting uses which occur on the reserve;
- The ability to coordinate the relocation of the reserve with the City of Cockburn's future aspirations regarding the relocation and consolidation of other sporting facilities within the district;
- The ability to provide a sustainable precinct in terms of environmental protection and management;
- The ability to create a centre of leading marine research and technology within Australia;
- Maximising the topography of the site to achieve outlooks; and
- The ability to provide an interconnected traffic system through the road network, public transport and dual use paths.

The opportunities and constraints in association with the statutory controls over the site and the intent of the precinct guide the preparation of this structure plan. The above issues will be addressed individually and as overlays through this structure plan report to provide the basis on which the design has evolved from an area of land capable of development to a sustainable precinct that achieves environmental, social and community objectives.

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PLANNING FRAMEWORK

METROPOLITAN REGION SCHEME (MRS)

The subject land has two zonings and is affected by several reserves under the Metropolitan Region Scheme. The majority of the land is zoned Urban, however portions of Lots 7, 8 and 23 and the whole of lots 21 and 22 are zoned Urban Deferred. The western half of Lots 26 and 27 are reserved for Parks and Recreation while the eastern half is zoned Urban.

The current zoning is a result of a Metropolitan Region Scheme Amendment. The amendment was gazetted for final approval on 24 November 2000. The amendment was approved subject to:

- The preparation of an Environmental Management Plan (EMP) to protect the Conservation Category Wetland (CCW) on the site and Lake Coogee;
- The preparation of a Drainage and Nutrient Management Plan to ensure that the rate, quantity and quality of water leaving the development sites will not adversely impact the CCW. The plan is required to be submitted prior to the submission of an application for subdivision approval; and
- The preparation of a Site Contamination Management Plan. The plan is required to be submitted prior to the submission of an application for subdivision approval.

As indicated above, the EMP is required to be addressed during the preparation of the Structure Plan while the other plans are required to be prepared prior to the submission of an application for subdivision approval.

The EMP, Drainage and Nutrient Management Plan and Site Contamination Management Plan have been prepared by Strategen and approved by the Department of Environment.

With respect to the adjoining roads Rockingham Road and Russell Road are reserved as Primary Regional Roads.

The proposed use is consistent with the Urban and Urban Deferred zones of the Metropolitan Region Scheme.

CITY OF COCKBURN DISTRICT ZONING SCHEME NO.3

The subject site is zoned Special Use (9) under the City of Cockburn Town Planning Scheme No. 3. The western half of Lots 26 and 27 remain reserved for Parks and Recreation.

The 'A' Class Reserve is currently zoned Urban under the MRS, but is a Reserve under TPS No. 3. A Scheme Amendment has been adopted by the City of Cockburn (awaiting approval) to rezone the land from a Reserve to Special Use (9).

The Special Use (9) Zone accommodates the Marine Industry Technology Precinct which is to include buildings for the purpose of:

- research and development;
- technological development;
- training and education of persons involved in marine technology and design, ship design, oil and gas exploration.

The subject land is identified under Schedule 11 (Development Areas) of Scheme No.3 as Development Area No.6 – Marine Industry Technology Park. The provisions under this Development Area reflect the objectives of the Special Use (9) Zone, which includes:

- The promotion of the purposes and functions of the Technology Development Act 1983;
- the encouragement of research and development;
- the encouragement of pleasant and efficient facilities;
- the consideration and improvement of appropriately located development within the zone;

- the safe movement of vehicular and pedestrian traffic;
- the protection of the amenity of areas adjacent to the zone;
- the implementation of uses only directly related to or incidental to ship design, ship building, ship repair, and marine engineering.

The Scheme identifies that prior to the Council considering a subdivision application or approving development a structure plan is required for the area. In accordance with the provisions of Scheme 3, a Structure Plan is to contain the following details:

- A map of the Structure Plan area;
- Site analysis map addressing landform, environmental values, hydrogeological conditions and Aboriginal and European heritage;
- A context analysis map relating the area to surrounding uses/activities;
- Proposals for proposed commercial centres, natural features to be retained, street block layouts, street networks including street types, transportation corridors, land uses including residential densities and estimates of population, schools and community facilities, parklands and urban water management areas; and
- A written report addressing the planning and policy framework for the area, site analysis, context analysis, integration with surrounding area, design rationale, traffic management, parkland provision and management, public utility proposals and the method of implementation.

Once the Structure Plan has been received by Council it is referred to the Western Australian Planning Commission (WAPC) prior to advertising. Within 60 days of Council receiving the Structure Plan, it should be advertised for a period of not less than 21 days. Council considers submissions and if it decides to adopt the Structure Plan, refers it to the WAPC for adoption.

STATEMENT OF PLANNING POLICY NO.4 -STATE INDUSTRIAL BUFFER POLICY

The purpose of the State Industrial Policy is to provide a consistent State-wide approach for the protection and long term security of industrial zones. The Policy also provides security for surrounding land uses.

The Policy identifies that in the case of industry such as technology parks, the impacts can usually be retained on site through the use of building setbacks and landscaping that form the buffer. The reason that the impacts can be retained on site through on site buffer areas is that technology parks are specialised uses for scientific and technological research and may include ancillary production and manufacturing activities. The development of technology parks consist of high quality buildings set in a landscaped setting and the uses generally do not affect the amenity of the location or the surrounding uses.

The proposed technology precinct at Munster is provided to service the marine industry with the uses proposed, and controlled through the Planning Scheme, being technology based. It is important to note that general industry uses are provided for in the adjoining Australian Marine Complex precincts and will therefore not be provided for in the technology precinct.

The policy identifies that on site buffers should be sufficient to address local amenity, through the use of development control requirements, such as setbacks and landscaping, to retain residual emissions within site boundaries. The Structure Plan provides for high quality buildings set in landscaped surrounds and can be controlled by the design guidelines which are required to be prepared in accordance with the Town Planning Scheme.

It is considered that the affects of the technology precinct can be retained on site through the appropriate siting of buildings within landscaped surrounds.

FREMANTLE-ROCKINGHAM INDUSTRIAL AREA REGIONAL STRATEGY

The Fremantle-Rockingham Industrial Regional Strategy (FRIARS) was prepared by the Western Australian Planning Commission to provide strategic land use planning directions for the Fremantle-Rockingham region for the next 20-25 years.

While the subject site was located within the study area, the strategy focused on the area to the east of Rockingham Road near Wattleup and Hope Valley. In the options presented the subject site remained for rural use.

The Strategy recognised that in the north-western part of the study area, a marine technology precinct had been planned (the subject site) to provide support industries for the Jervoise Bay marine industries. The Strategy further emphasised that the technology precinct is to be a high quality landscaped service industry area that will act as a buffer between general industrial uses and residential uses.

The results of the FRIARS study, as implemented by the Hope Valley Wattleup Redevelopment Act, made no recommendations for the subject area.

ENVIRONMENTAL PROTECTION (KWINANA) (ATMOSPHERIC WASTES) POLICY

The Environmental protection (Kwinana) (Atmospheric Wastes) Policy was prepared under the Environmental Protection Act 1986 to maintain an acceptable air quality around the Kwinana Industrial Area.

The Policy divides the area into three land use areas being, heavy industry, a buffer area for the heavy industry and land predominantly for rural and residential uses. The subject site is largely located with area B, which is the buffer area for the heavy industries, with the lots generally west of McGrath Road being located within area C.

The proposed structure plan, through the subdivision and development of land, will assist in achieving the outcomes of the policy as the development will involve removing the rural land uses and dwellings within the buffer area and replacing them with uses such as research and technology uses which are more appropriate for the buffer area than rural/ residential development.

ESTABLISHED BUFFER ZONES

The subject site is partially constrained by two buffers from neighbouring industries. The buffers are associated with the Cockburn Cement facility located to the east, and the Water Corporation Wastewater Treatment plant to the west of the subject site. The buffer zones would generally limit the ability to provide residential or rural/residential within the majority of the site. A small portion of land located near the intersection of Frobisher Avenue and McGrath Road lies outside of these two buffers.

Given that the site is proposed for Technology Industry, with Mixed Use located outside of the buffer area, the impacts of the buffer area are considered to be minimal.

DRAFT ENVIRONMENTAL PROTECTION (SWAN COASTAL PLAIN WETLANDS) POLICY 2004 (EPA)

The environmental protection policies (EPPs) prohibit environmental harm to any registered EPP wetland. Lake Coogee is a registered wetland under the EPPs. The requirements of wetland conservation can extend beyond a reserve or wetland boundaries, and that the implementation and maintenance of native vegetation around wetlands has a beneficial effect on water quality, and is essential for wetland fauna.

DRAFT STATEMENT OF PLANNING POLICY 2.8 - BUSHLAND POLICY FOR THE PERTH METROPOLITAN REGION

The subject site has been identified as a Bush Forever Site (site 261) which is described as Lake Coogee and adjacent bushland, Munster. The Bush Forever site includes the western half of Lots 26 and 27 McGrath Road which are currently reserved under the Metropolitan Region Scheme as parks and Recreation. Consequently given that the site is reserved for Parks and recreation it excludes the area from development.

HERITAGE CONSIDERATIONS

EUROPEAN HERITAGE

A search of the Heritage Council of Western Australia's Register and database revealed that there are no places within the subject site that are listed on the State Register. There are however several sites in the immediate area that are listed on the database and included on the City of Cockburn's Municipal Heritage Inventory. The properties include:

- Dadley House – 707 Rockingham Road, Munster
- Sawles House – Cnr Rockingham Road and Russell Road
- South Coogee Hall – Cnr Rockingham Road and Russell Road
- South Coogee Primary School - Cnr Rockingham Road and Russell Road

There is one site of heritage significance on the subject site, being Dadley House. The site is not listed by the Heritage Council but is included on the City of Cockburn's Municipal Heritage Inventory. There are no other sites of heritage significance within the subject site, however, both the inventory and the database identified that there are several sites of significance within close proximity to the site including the school and hall to the south east of the site.

The Municipal Heritage Inventory (MHI) identifies the dwelling as being built in approximately 1920-30 and is built of coarse-faced limestone blocks with quoins. There have been several additions to the dwelling and the dwelling has been identified as being a Management Category B site. The MHI recognises that there is some uncertainty about the places future given its location within the Technology Precinct.

Refer to **Figure 5 - Heritage.**

ABORIGINAL HERITAGE

A search of the Aboriginal Affairs Department's Register of Aboriginal Sites has revealed that there are two registered sites within close proximity to the Technology Precinct. The sites are identified as being near Lake Coogee.

The area west of Lake Coogee is known to have high cultural value to Aboriginal people. There is a listed mythological site between Cockburn Road and Lake Coogee (McDonald, Hales and Associates 2002) and a number of previously recorded archaeological sites (artefact scatters) located in the vicinity of the Woodman Point Wastewater Treatment Plant.

Research undertaken by McDonald Hales and Associates in 1997 and 1998 in connection with the Jervoise Bay infrastructure developments indicates that there is a potential for further archaeological sites to be located in the vicinity of Lake Coogee. Though some of the surface archaeological material may have been disturbed by non-Aboriginal developments there is still a potential for further material, including subsurface material, to be present in the area.

The Aboriginal Cultural Material Committee (ACMC) has recommended to the Minister for Indigenous Affairs that archaeological monitoring and mitigative research should be undertaken in respect of the Jervoise Bay development in recognition of the archaeological potential of the area.

ENVIRONMENTAL CONSIDERATIONS

CLIMATE

The Technology Precinct is located within the Perth Metropolitan Region in the southwest of Western Australia, which experiences a humid Mediterranean climate, with distinct seasons, characterised by cool wet winters and warm to hot dry summers. The long-term average annual rainfall is 870 mm with a pan evaporation of approximately 1500 mm. Perth receives more than 85% of its rain during May to October, with the remainder from thunderstorms and occasional cyclonic depressions in the warmer months.

Given that the subject site is located in proximity to the coast, strong sea breezes and other winds associated with the prevailing weather patterns are experienced. The prevailing winds tend to be from the north east during winter mornings and from the west during winter afternoons, while in the summer months the prevailing winds are from the east in the morning and the south west in the afternoon (Bureau of Meteorology, 2002). The dominant winds however tend to be the south west sea breezes experienced during summer afternoons.

TOPOGRAPHY AND PHYSIOGRAPHY

The Technology Precinct is located on the Swan Coastal Plain, which comprises Quaternary deposits overlying Tertiary, Mesozoic, and Palaeozoic sediments. The Precinct is within the gently undulating Spearwood dune system which generally has yellow sands over a Tamala limestone core. The Precinct and Lake Coogee are within an area of generally low lying land that is part of a north-south chain of swales and wetlands (the Beeliar or Cockburn wetlands) between the dunes. Local relief on the site ranges from 10 m AHD on the rises to below 2 m AHD for Lake Coogee and associated wetlands (WRC 1997).

Several roads including McGrath Road, Frobisher Avenue and Gardiner Avenue have been established in the area zoned for the precinct, which serviced the market gardens in the area, some of which are still operating.

Refer to **Figure 6 - Site Analysis.**

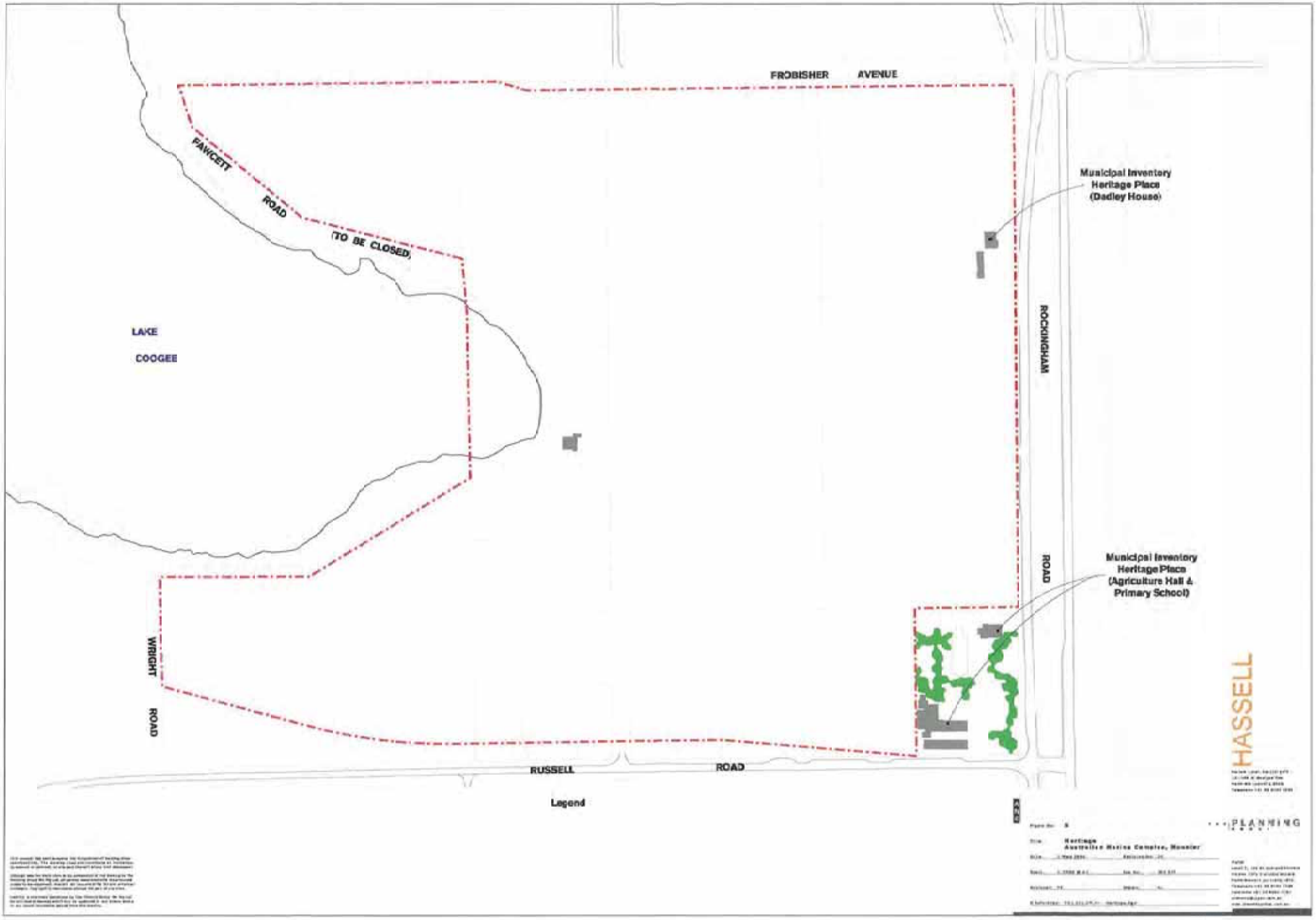
The maximum ground water table varies seasonally under this land but generally ranges from 6 metres below the surface in the most elevated parts of the site to equal or higher than the surface elevation within the Lake Coogee Basin.

SOILS

The soils of the Spearwood dunes range from yellow-brown siliceous sands with limestone at shallow depths near the western margins where the Technology Precinct is located, to bleached sand with yellow-brown B-horizons towards the east. The Spearwood sands of the dune system are Quaternary wind-driven deposits over Tamala limestone. The soils of the area are mostly sandy except in the lowest lying areas where silty swamp soils have formed near the wetlands. The base of Lake Coogee has a higher clay content than the other lakes. Possible, Lake Coogee was once the estuary of a river outlet that cut through the limestone ridge in the area (O'Brien 1993) and the clay deposits were laid down in the estuarine environment.

HYDROLOGY

The superficial aquifer is the shallow, unconfined aquifer that is connected to the lakes and wetlands of the region, including Lake Coogee. The superficial aquifer at the Technology Precinct is close to the surface, ranging from approximately 8 m below the highest ground to almost at the surface in lowlying areas (WRC 1997). The superficial aquifer reacts strongly to seasonal rainfall with a one to two month time-lag between rainfall and groundwater fluctuations.



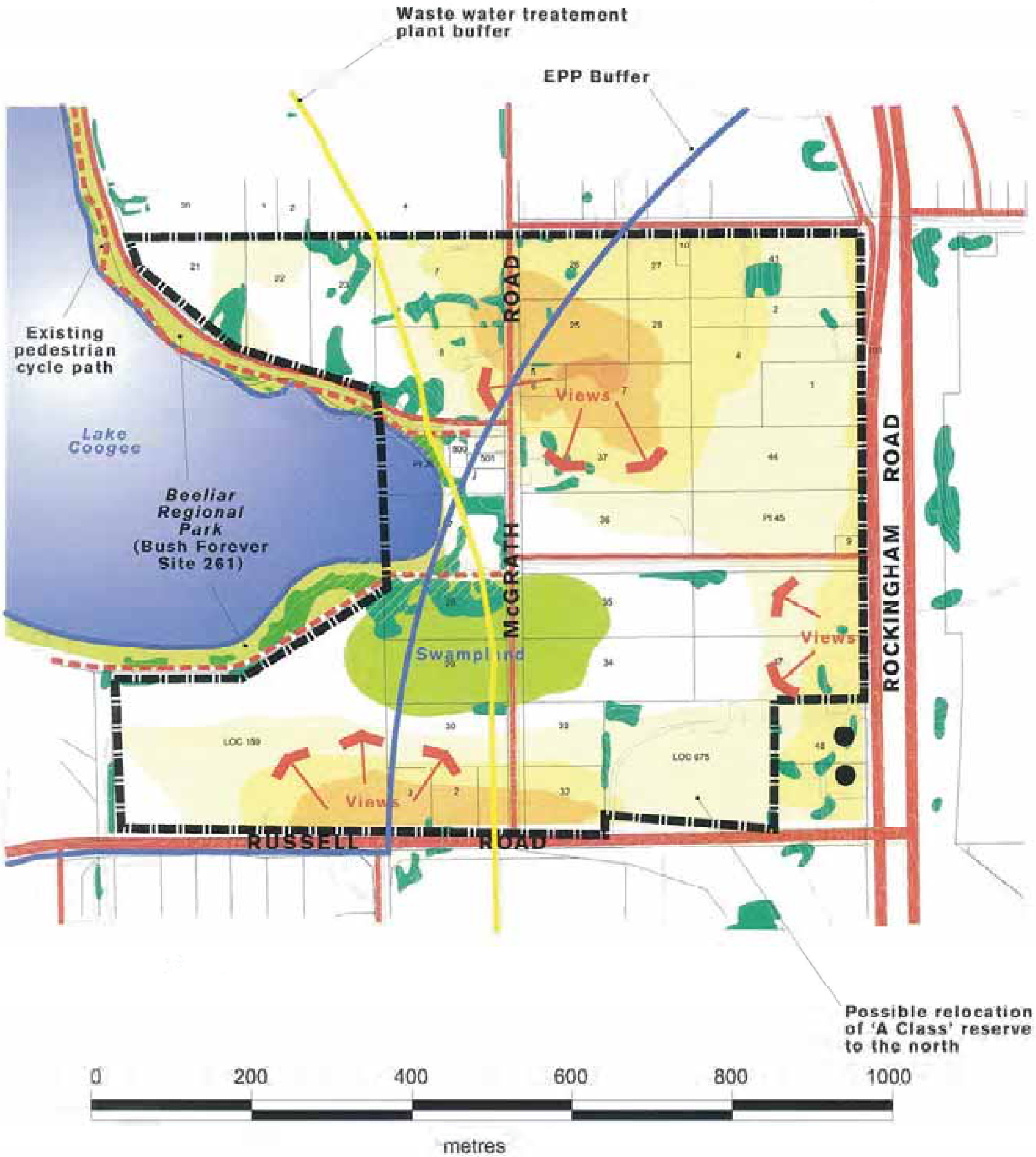


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Figure No: 6

Title: **Site Analysis**

Date: 27 April 2006 | Revision No: 1

Scale: Refer to Scale Bar | Job No: 763.072

Designer: M.B | Drawn: S.L.

E Reference: Site-A3.fh10

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NATURAL ENVIRONMENT

The Technology Precinct is located on the eastern boundary of Lake Coogee. Prior to European settlement, the area would have represented a transitional area between wetland and terrestrial upland ecological communities. The majority of habitat has however been historically cleared or severely degraded from agricultural or general human activity and only pockets of remnant vegetation remain.

Vegetation and Flora

The remnant vegetation is representative of the Cottesloe Complex–Central-South as mapped by Heddle et al. (1980). Approximately 36% of the original extent of this complex remains in the Perth Metropolitan Region with half of this (amounting to 18%) protected under Bush Forever. The adjacent Lake Coogee Reserve is also protected under Bush Forever. No significant flora have been recorded in the Lake Coogee Reserve (Government of Western Australia 2001).

A preliminary assessment of the vegetation on the site was undertaken by Biota (2004). Several areas of Tuart (Eucalyptus gomphocephala) woodland and paperbark (Melaleuca rhaphiophylla and Melaleuca cuticularis) woodland were rated as 'local conservation category 1' as they contain the main elements of the original native vegetation and are worthy of retention (Biota 2004). Weed invasion in the understorey has impacted these areas (fennel, pampas grass and castor oil plant) but active bushland management could improve vegetation condition and value. Most of the Tuart woodland areas exist in the northern section of the site, separated from Lake Coogee by Fawcett Rd. Three other category 1 sites exist in the south consisting of low-lying ground with paperbarks or woodlands of Tuarts.

Several other areas of vegetation were more severely degraded and rated as 'local conservation category 2'. In general, these areas have a scattered overstorey of native species (Melaleuca rhaphiophylla, Melaleuca cuticularis, Eucalyptus gomphocephala and Agonis flexuosa) and an exotic understorey. These areas may have value as a basis for landscaping or bush regeneration efforts (Biota 2004).

Fauna

No comprehensive fauna surveys have been carried out on the proposed Technology Precinct site. Biota (2004) commented that the denser shrublands and woodlands are likely to by utilised by avifauna. Little or no evidence of native ground fauna, including the Southern Brown Bandicoot (Isoodon obesulus fusciventer), was observed during the assessment. These observations were only preliminary but were consistent with expectations given the degraded nature of the vegetation, especially the understorey.

LAKE COOGEE

Lake Coogee is classed as a Conservation Category wetland in the Department of Environment Geomorphic wetland database (i.e. a wetland with a high level of ecological attributes and functions) and is part of the Beeliar Regional Park. The adjoining wetland areas within the proposed Technology Precinct are classed as Multiple Use (wetlands with few important ecological attributes and functions remaining) (Parsons Brinckerhoff 2004) due to the impacts of clearing, drainage and infilling at the site. Lake Coogee is protected under the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. This policy is designed to protect the environmental values of a selection of Swan Coastal Plain lakes and prohibits unauthorised filling, mining, effluent disposal and draining, into or out of the lake.

In the Beeliar Regional Park Draft Management Plan the lake has a Reserve Purpose of Recreation and is zoned for management for Conservation and Protection. The lake is used for local passive recreation and there is a dual use pathway around the eastern side of the lake. Lake Coogee is a shallow, eutrophic and highly saline lake (Bright 2002) that is the most saline wetland in the Spearwood Dune System. The lake has a catchment area of 421 ha. The lake is

semipermanent and interacts directly with the groundwater, being a discharge lake in summer and a throughflow lake in winter. However, the difference between the lake's water levels and the surrounding groundwater indicates that the clay base may impede groundwater lake interactions. Water levels fluctuate between approximately 0.8 metres AHD in late winter to 0.1 metres AHD in late summer (Bright 2002). The lake dries up on average every three to four years. Trends indicate that water levels in the lake may have risen in recent years; this is a concern for the remnant paperbarks around the lake (Bright 2002).

Regional groundwater flow is west from the Jandakot groundwater mound but flows are slow due to the low hydraulic gradient. The Technology Precinct is located on the western edge of the Jandakot Mound. There is also a small local groundwater mound, the Woodman Mound, located to the west of Lake Coogee. A salt water wedge underlies the area to the western edge of the Jandakot Mound and is thought to intercept the surface at Lake Coogee, contributing to its salinity (O'Brien 1993).

Nutrient levels and algal growth in Lake Coogee are lower than expected given the surrounding land use of intensive irrigated horticulture. Phosphorous levels are comparatively low which may be a limiting factor for algal growth (Parsons Brinckerhoff 2004). The low permeability of the lake's clay base may also limit the volume of polluted groundwater entering the lake.

The wetland values and functions of Lake Coogee and associated wetlands are described in more detail in Parsons Brinckerhoff (2004) and O'Brien (1993).

Refer to **Figure 7 - Environmental Constraints.**

ENVIRONMENTAL ASSESSMENT OF STRUCTURE PLAN

An environmental assessment of the structure plan has been undertaken by Strategen, and an Environmental Management Plan (EMP) for the development of the Technology Precinct prepared and approved. The EMP has been developed in order to meet the requirements of Condition 1 of Ministerial Statement 546 for the approval of the MRS rezoning for the Technology Precinct.

The purpose of the EMP is to provide a framework for planning and managing the development of the precinct such that, consistent with the Environmental Protection Authorities (EPA) objective for wetlands, the integrity, function and environmental values of wetland areas are maintained as per EPA (1999a).

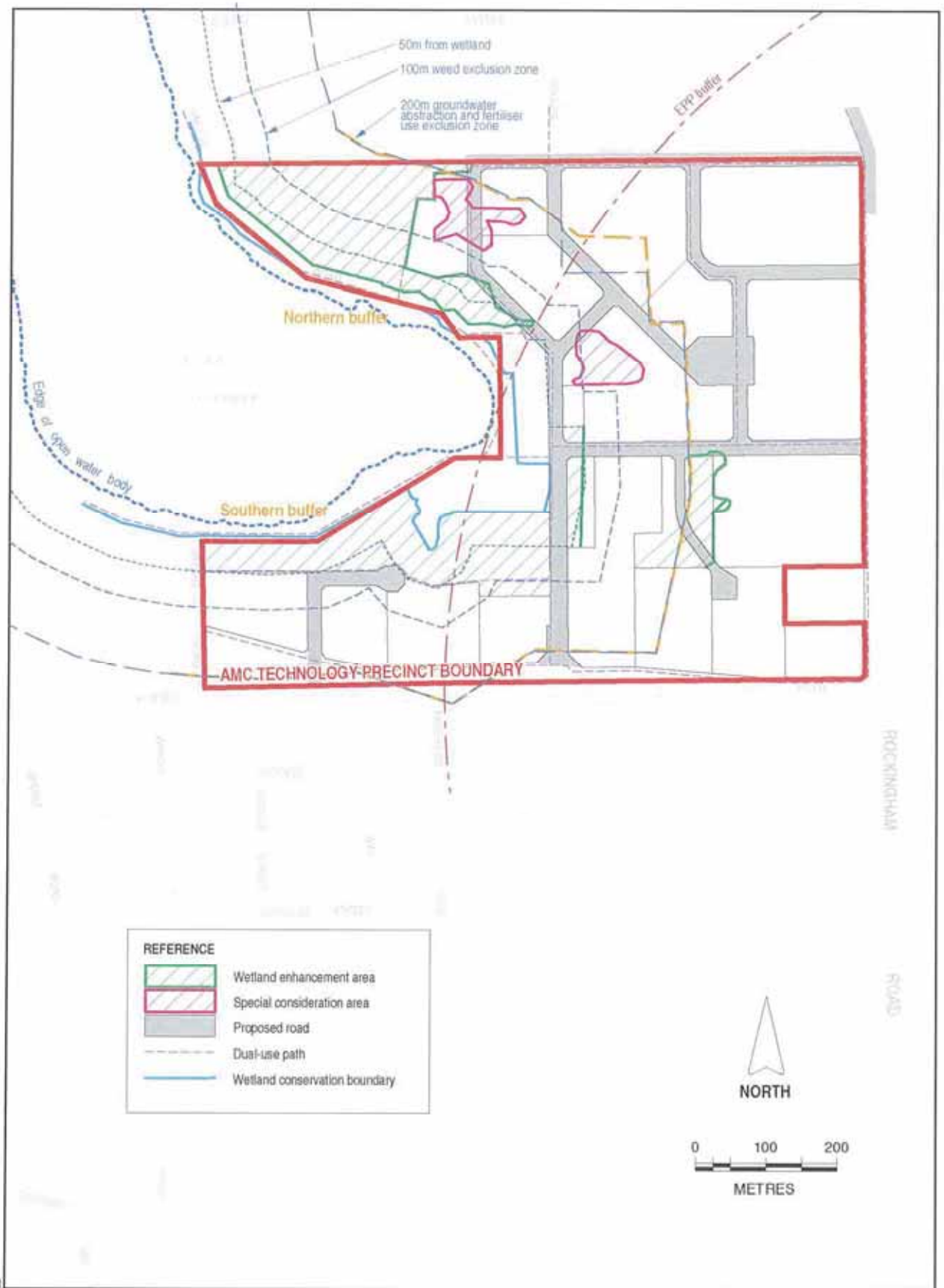
The EMP addresses management of on-site issues regarding construction and drainage, issues associated with the interface between the precincts and the adjacent regional park and the protection of the wetlands. Specifically the EMP addresses:

- The protection of wetland habitat of Lake Coogee and the provision of appropriate buffer between the lake and the Technology Precinct.
- The enhancement of wetland and upland habitat around Lake Coogee through rehabilitation works to restore degraded wetland and upland areas within the proposed buffer.
- Management of potential impacts of activities associated with constructing precinct infrastructure.

The EMP also describes the framework for implementing the plan, timing, maintenance issues, and broadly the roles and responsibilities for implementing the plan. The following section of the report comments on the design suitability of the structure plan and the implementation of appropriate environmental management practices in accordance with the EMP.

Stormwater Management

In order to meet the requirements of the Swan Coastal Plain Lakes EPP and the wetland management objectives for Lake Coogee, stormwater will not be allowed to directly enter the lake either during, or post, development of the Technology Precinct. Measures will be put in place to prevent large volumes of runoff from the precinct entering Lake Coogee or flooding



strategen

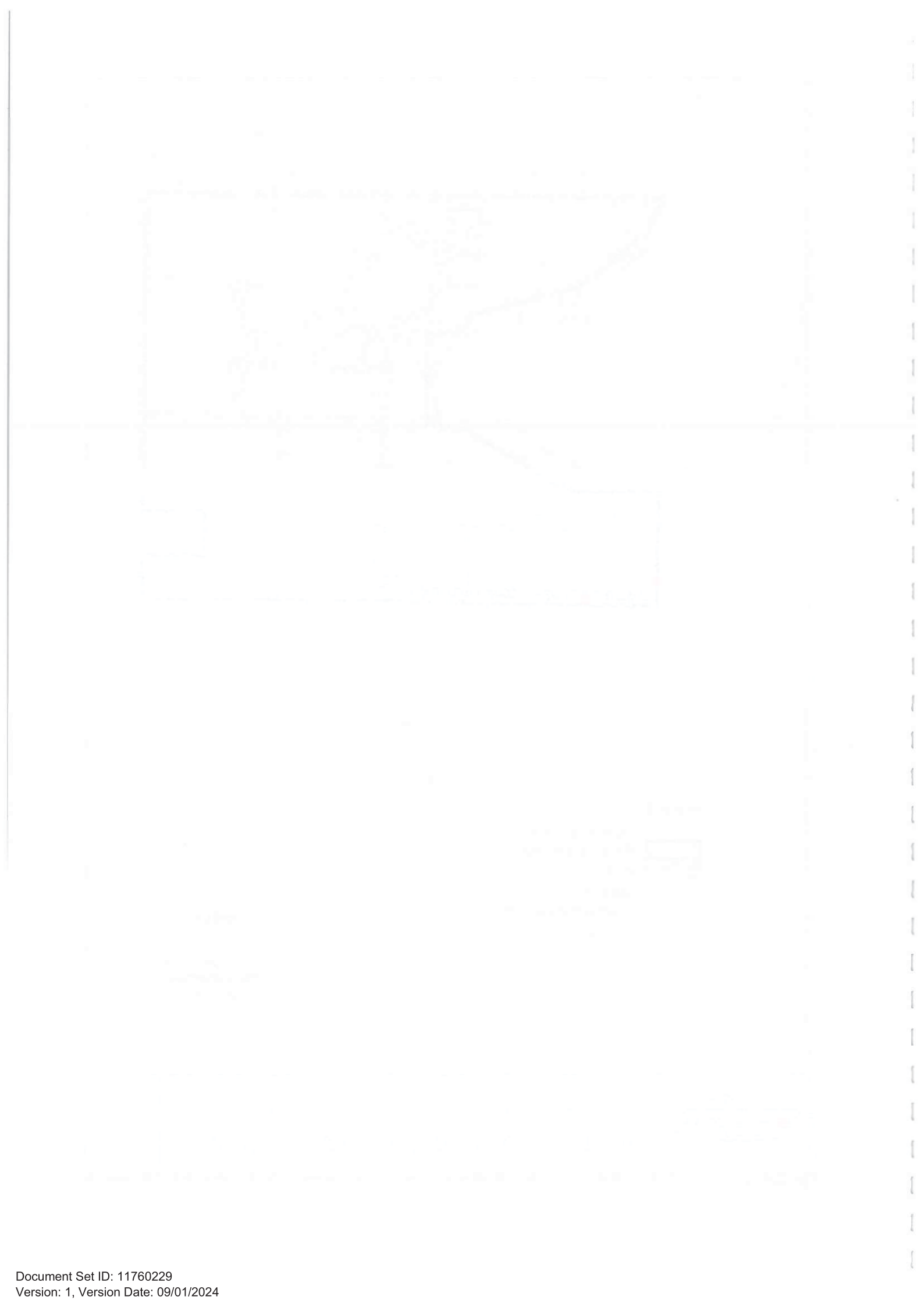
LandCorp

AUSTRALIAN MARINE COMPLEX - TECHNOLOGY PRECINCT

PROPOSED WETLAND BUFFER STRATEGY

Figure 7

ENVIRONMENTAL DWG 0421_Stage1_F7.dgn



in the multiple use wetland areas and to ensure net recharge before and after development are relatively similar. This is to be achieved through the application of Water Sensitive Urban Design (WSUD) techniques to slow, retain and treat stormwater within the precinct.

The harvesting of stormwater off building roofs for onsite industrial and/or irrigation reuse may further correct the future water balance of the site and is being investigated during the preparation of the Drainage and Nutrient Management Plan (DNMP).

The EMP asserts that prior to a subdivision application, LandCorp will prepare a Drainage and Nutrient Management Plan (DNMP) to describe the integrated road and drainage network and other environmental measures to be put in place to manage surface water runoff during the development and operation of the AMC Technology Precinct, and improve groundwater quality in the groundwater catchment south east of Lake Coogee.

The stormwater management plan is based on the principle of stormwater from each lot being kept and managed on site (in-situ infiltration) such that the precinct stormwater system is only required to handle runoff from roads in the precincts and overflow from lots in extreme storm events. Runoff occurring from higher rainfall events (1 in 5, 1 in 10 yr storm events or greater), beyond the capacity of the Lot, will need to be directed to infiltration basins within the POS inside the complex (not POS immediately adjacent to lake) or directed away from lake in existing stormwater drains (if present).

The establishment of native vegetation within the buffer and other areas will assist in restorating the hydrological balance near the lake.

Stormwater runoff has the potential to be generated from substantial rainfall events on the following surfaces/sources:

1. Roofs of buildings.
2. Landscaped verges, median strips and estate gardens/entry statement.
3. Roads.
4. Bitumised/concrete surfaces on developed lots (driveways, car parks and pavement).

Runoff from roofs and gardens represent low risk to surface and groundwater quality and would be treated separately to runoff from roads and bitumised surfaces, which can contain some contaminants, particularly following a first runoff event at the start of the winter seasons.

Buffers/Setbacks from Lake

LandCorp has voluntarily set aside several remnant wetland and fringing upland vegetation that are within the Multiple Purpose parts of the wetland in an attempt to address potential environmental concerns.

It is noted there is currently no formal buffer and little in the way of separation distance between the conservation category wetland and other land uses. Several occupied and unoccupied residencies exist on the edge of the wetland and derelict land previously used for market gardens abuts the wetland boundary. Land almost completely infested with weeds abuts Lake Coogee in this area and there are only small remnants of upland vegetation left in this area.

The Environmental Management Plan asserts that there is no apparent need for the recommended 200m buffer provision to protect water quality, as per the Water and Rivers Commission's Wetlands Buffer Guidelines. No industrial enterprises or other premises with potentially contaminating sources are permitted to establish on the subject site, as per the City of Cockburns Town Planning Scheme No.3 permitted use requirements.

The EMP determined that a 100 metre wide separation measure vegetated with perennial species would be appropriate between the Lake Coogee wetland function area and the proposed differing land uses. The 100 metre separation measure was recommended to protect Lake Coogee from several threatening processes:

- Habitat modification from traffic noise (100 m buffer recommended).
- Habitat modification from weed infestation (100 m buffer recommended).
- Inappropriate recreational uses (At least a 50 m separation measure would decrease pressure on wetland area).

It is evident that previous land use decisions prevent a 100 m separation measure filled only with perennial vegetation being achieved for a number of reasons:

- Most land within this distance has been cleared and is totally weed infested.
- McGrath Road runs immediately adjacent to the WFA. It is a major local road and is required for the operation of the Technology Precinct and to be easily accessible.
- Fawcett Road runs immediately adjacent through the WFA in one area.

However, the threatening processes of concern can be addressed to some extent through partial separation measures and modification of existing use:

- Traffic noise - LandCorp will modify Fawcett Road to a cul de sac.
- Weed infestation - LandCorp will conduct a weed eradication program within the proposed buffer enhancement area and prohibit use of non-native plants in landscaping within 100 m of conservation wetland.
- Inappropriate recreational use - As recommended, at least a 50 m separation measure has been provided for around the conservation category wetland and additional measures restricting access and enhancing wetland areas outside of the conservation category wetland area will decrease pressure on the Lake Coogee WFA from recreational pursuits.

Conclusion

Strategen Consultants have reviewed the current structure plan for the Australian Marine Complex Technology Precinct. The Structure Plan has been modified accordingly as a result of the recommendations of the Consultants reports.

TRAFFIC AND TRANSPORTATION CONSIDERATIONS

INTRODUCTION

This section of the report relates to traffic and transport planning for the Australian Marine Complex, Technology Precinct and presents information and recommendations for:

- Regional Road Planning;
- Site Access and Local Traffic Conditions;
- Bus Service Planning; and
- Pedestrian/Cycle Facilities Planning.

A traffic study has been undertaken by GHD Consultants in relation to the proposed Structure Plan, and is contained within Appendix 1 of this report.

REGIONAL ROAD NETWORK

Fremantle Eastern Bypass (FEB) and Roe Highway Stages 7 & 8

The proposed Fremantle Eastern Bypass has the potential to impact on the regional road network in the Munster and Henderson areas.

Road network planning in this part of the Perth Metropolitan area is undergoing significant change due to commitments by the current State Government to remove the FEB from the Metropolitan Region Scheme (MRS) and to review planning for Roe Highway Stages 7 & 8. Amendment No. 1055/33 to the Metropolitan Region Scheme which is currently out for public comment proposes the removal of the FEB reserve from the MRS.

Roe Highway Stage 8 comprises that section from the Kwinana Freeway to the FEB reserve. There is no MRS reservation for Roe Highway west of the FEB reserve. In order to progress planning of the road network, the State Government is undertaking a Freight Network Review and associated workshops on:

- Alternatives to the FEB; and Review of Roe Highway Stage 7 & Stage 8 options.

Once these initiatives are undertaken, the Department for Planning and Infrastructure and Main Roads Western Australia will be in a better position to address the planning implications for roads in the Munster and Henderson areas, including the regional roads Cockburn Road and Rockingham Road.

Fremantle-Rockingham Highway

It is possible that the Fremantle-Rockingham Highway will not be required now that the FEB is proposed to be removed from the network. In that case, Cockburn Road and Stock Road/ Rockingham Road will retain their role as regional roads within the regional road network. Under the previous planning (which included the FEB and Fremantle-Rockingham Highway), Cockburn Road will have been downgraded and control will have passed to local government from Main Roads Western Australia. Now, the ultimate design standard, planning responsibility and funding responsibility for Cockburn Road is uncertain and will need to be resolved as road network planning in the region proceeds.

EXISTING ROADS

Several roads exist within and around the subject site. Rockingham Road which is reserved as a Primary Regional Road under the City of Cockburn District Planning Scheme No. 3 (Scheme) runs north-south and abuts the eastern boundary of the site. Rockingham Road is part of the main road network for freight linking Fremantle with Rockingham.

Russell Road which is reserved as a Primary Regional Road under the Scheme runs east-west and abuts the southern boundary of the site. It currently serves as access to a number of industrial developments to the south and west linking Cockburn Road with Rockingham Road. Frobisher Avenue, McGrath Road, Gardiner Avenue and Fawcett Road are all local roads and serve as access routes to existing development in the site.

Existing Road Treatments

The intersection of Russell Road/Rockingham Road has recently been signalised and Russell Road has been upgraded to include channelisation, and turn pockets. There is a left turn pocket (signal controlled) in Rockingham Road south and two through lanes, right turn pocket in Rockingham Road north and two through lanes and left and right turn lanes in Russell Road.

Gardiner Avenue currently intersects with Rockingham Road and provides for left turn in and left turn out only. There is no left turn pocket, although there is an embayment just prior to the intersection.

Frobisher Avenue currently connects into Button Street at its eastern end. Button Street then connects to Old Rockingham Road at a point approximately 30m west of the Stock Road/ Rockingham Road unsignalised intersection.

An intersection with Fanstone Avenue exists opposite Frobisher Avenue and includes a right turn pocket in Rockingham Road. This intersection is located approximately 180m south of the Rockingham Road/Stock Road intersection.

The McGrath Road/Russell Road intersection is currently channelised and provides a left turn pocket approximately 60m long in Russell Road west, a painted right turn pocket approximately 60m long in Russell Road east and a left and right turn lane in McGrath Road.

Fawcett Road south of West Churchill Ave runs adjacent to Lake Coogee and provides a recreational route and includes a recreational cycle path along side the lake. The road reserve width is constrained along this route.

EXISTING TRAFFIC VOLUMES

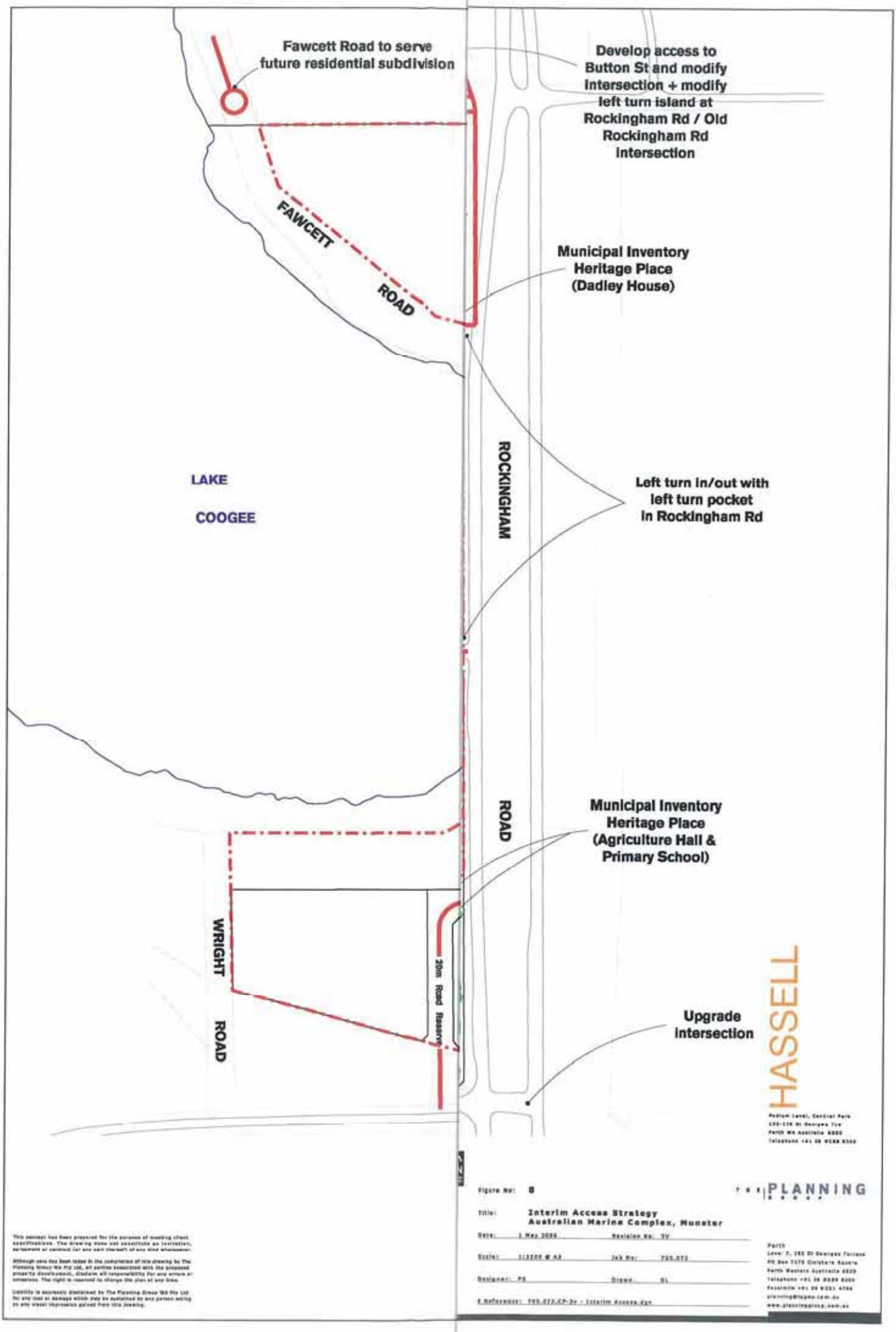
Figure 8 shows the Australian Marine Complex Technology Precinct development site access routes and the surrounding road network. The average weekday traffic count is summarised as follows:

Location	Average Weekday Traffic
Cockburn Road North of Russell Road	11,460 vpd (a)
Perimeter Road South of Russell Road	7,850 vpd (a)
Cockburn Road North of Rockingham Road	11,310 vpd (a)
Cockburn Road West of Russell Road	12,290 vpd (b)
Rockingham Road North of Russell Road	24399 vpd (c)
Rockingham Road South of Russell Road	25286 vpd (a)
Russell Road West of Rockingham Road	7264 vpd (a)

(a) Sept 2002, (b) Sept 2001, (c) Oct 2001 (Source Main Roads)

ANTICIPATED TRAFFIC VOLUMES

The traffic study undertaken by GHD consultants calculates that the Technology Precinct would have the potential to generate up to 1600vph (vehicles per hour) in the peak hour. This figure includes the school site in the southeast corner, but excludes any upgrades to the public transport that are planned to service the precinct. On this basis, the traffic volumes generated may be a little lower that predicted. The anticipated distribution of this traffic, based on the road layout and access to the surrounding network, is detailed within the Traffic Report attached in Appendix 1 of this report.



Interim Access Strategy

Access to the precinct will require appropriate measures to accommodate the predicted traffic generation for both the interim stage and when the future planned road upgrades are implemented. Following an assessment of the traffic generation from the proposed Technology Precinct, an analysis was undertaken for the access requirements of the precinct. It is evident that the existing intersection of Russell Road/McGrath Road will not accommodate the projected traffic volumes at full development of the Technology Precinct, and that traffic signals are required. It is recommended that interim upgrades be implemented as illustrated in Figure 8.

Main Roads WA has advised that they are not supportive of interim measures, which would be lost when the ultimate road works are undertaken. These long term road works as envisaged by Main Roads are outlined below.

- The grade separation of Russell Road/Rockingham Road intersection, Russell Road will align east-west rather than the existing staggered intersection.
- Construction of a new southbound carriageway on Rockingham Road, with the existing northbound carriageway becoming a service road.
- The grade separation of Beeliar Drive/Rockingham Road intersection.
- The upgrade of Russell Road, forming part of the Fremantle–Rockingham Highway Route. As part of this work Cockburn Road is planned to be realigned to the west of Lake Coogee. The route will be a Controlled Access Highway.

Main Roads have concerns specifically to the placement of traffic signal controlled access to Rockingham Road and the left in/out at the proposed east-west roads other than Gardiner Avenue. Despite these concerns, good access must be achieved for both the interim and long-term scenario. If not addressed, access is likely to be difficult at peak times which will result in congestion and safety issues.

Access Strategy

Based on the outcomes of the traffic study the following access strategy is recommended:

Stage 1

- Russell Road/McGrath Road:
  - Exclusive left turn lane from Russell Road west with 70 degree island , under give way control.
  - Localised widening to accommodate turning lanes appropriate to the design speed of Russell Road and one through lane in each direction.
  - Left and right turn lanes from McGrath Road
- Provide left in/out access to Rockingham Road at Gardiner Ave and at east-west access road to north with left turn lanes or acceleration lanes and deceleration lane at Gardiner Ave. For permeability to the site two east-west accesses are preferred.
- Bus access to the precinct is to be achieved via Russell Road for Stage 1 access.
- Cul de sac Fawcett Road just north of development.
- Upgrade Russell Road/Rockingham Road intersection to include a double right turn in Russell Road and left turns under give way control.
- Provide for a small bus facility in Transit Area, to include 4 bus stands near the Educational establishment.
- Provide access to Button Street and Old Rockingham Road. Access to the Technology Precinct development from the north would be highly desirable for both Stage 1 and the ultimate development. Analysis indicates that there would be benefit for the operation of the southern access points if this northern access were developed. In the first stage Button Street/Old Rockingham Road could operate to allow all movements with appropriate upgrade of the intersection. This will also be compatible with future planning.

- In order to improve the operation and safety of the Button Street/Old Rockingham Road intersection the following measures are recommended:
  - Traffic turning left from Rockingham Road into Old Rockingham Road do so at high speed due to the angle of the left turn island. This should be modified to 70 degrees and include give way signs. This will slow approaching traffic and improve safety at the Button Street intersection.
  - A right turn pocket should be provided in Old Rockingham Road to accommodate increased traffic turning right into Button Street to access the Technology Precinct.

Stage 2 (When Russell Road/Rockingham Road is upgraded and grade separated.)

When the ultimate road works are undertaken, access to Rockingham Road will be lost due to the construction of the new southbound carriageway east of the existing southbound carriageway and the northbound carriageway becoming a service road.

- Good access should be maintained to the north via Old Rockingham Road to the future Beeliar Drive interchange. This access should connect to the new service road (current northbound carriageway of Rockingham Road) which is accessed by the east-west access roads
- Opportunities for left in/out to Rockingham Road from the service road should also be pursued to maintain permeability to the precinct, it is apparent those opportunities are limited due to ramp requirements for the interchange and the difference in levels between the current northbound and southbound carriageways.
- Benefits of providing and maintaining the northern access include:
  - It provides ultimate access to the precinct from all directions via Beeliar Dr and Russell Road.
  - It allows buses to access the precinct from Rockingham Road north, for ultimate scenario.
  - It will allow access from the precinct to Beeliar Drive interchange.
  - No access through central residential area to north.
  - No additional impact to the Controlled Access Highway.
- The operation of the Russell Road/McGrath Road traffic signals should be reviewed and upgraded based on the prevailing traffic volumes. Analysis indicates that the initial geometry will not accommodate the likely year 2021 volumes. This intersection remains critical to providing good access to the Technology Precinct and should be carefully considered as part of the future upgrade of Russell Road.
- If good permeability is not achieved to the site as part of the long term planning, congestion is likely to occur for traffic accessing the precinct.
- Stakeholders should further consider access opportunities, compatible with future major road planning.

BUS SERVICES

Existing Services

Several bus routes currently operate along Rockingham Road (refer Figure 9), with bus stops located on either side within an embayment just north of Russell Road and just north of the Frobisher Ave alignment. Service frequency is very good at approximately every 15-30 minutes during weekday peak periods and approximately 30-60 minutes at other times.

Route 920 (Fremantle Train Station to Rockingham Bus Station) operates along Rockingham Road and is the main route servicing the area. The bus stop for this route is located near the Russell Road intersection. This service has a 15-30 minute frequency on weekdays and 30 minutes outside of working hours and on weekends.

Route 116 (Booragoon Bus Station to Rockingham Bus Station) operates along Rockingham Road. The bus stop for this route is located near the Russell Road intersection. This service has a 60-90 minute frequency on weekdays and 3 hour on weekends. The PTA advise that Route 116 is a remnant of a once busy and well patronized service which has been gradually superseded when other routes in the network were improved over the years. It now has a

very low service level aimed at catering for a quite small clientele whose travel patterns are not adequately catered for by other routes. It is envisaged that it will be discontinued when the bus route network is heavily revised for the start of the new train service between Perth and Rockingham in late 2006, if not before. This will ultimately leave the high frequency 920 service as the primary public transport link for the Technology Precinct (TP) area.

Possible New Services

The Australian Marine Complex Technology Precinct structure plan has been designed to cater for possible bus service additions as indicated in Figure 9. It is envisaged that the existing public transport route would be altered to pass through the Technology Precinct using Russell and McGrath Roads, plus West Churchill Avenue.

Transperth predicts that there will be other bus routes serving the Technical Precinct. A secondary route operating along Hamilton, Mayor and Fawcett Roads, plus West Churchill Avenue and McGrath Road is also proposed in the 2007 Network Plan. This would terminate at a small purpose built Transit Square facility near the education and training (TAFE) site in the Technology Precinct. Some of these buses will continue on, servicing other parts of the Precinct to cater for worker travel and for TAFE students undertaking work experience or research projects.

An existing secondary route which currently terminates near Santich Park in Munster (and links that suburb with Spearwood, Hamilton Hill and Fremantle) is also likely to be extended to the Technology Precinct. This extension would utilise West Churchill Avenue and McGrath Road.

Transperth also indicated that a bus route may be established to link Cockburn Central, the Technology Precinct and other AMC precincts, once the South West Metro Railway is established in 2006/07. This route would travel (in part) via Beeliar Drive, Rockingham Road, West Churchill Avenue and McGrath Road.

PEDESTRIAN/CYCLIST FACILITIES

Existing Shared Paths

A shared path currently exists which runs from West Churchill Avenue, along Fawcett Road around Lake Coogee to Wright Road. The shared path is located on the west side of Fawcett Road but has a connection to McGrath Road.

Refer to **Figure 10 – Pedestrian/Cyclist Facilities.**

New Shared Paths

The Australian Marine Complex development will have shared paths (dual use paths) in accordance with the City of Cockburns Network Strategy, as indicated in Figure 10 and described below:

- Western side of the Rockingham Road reserve between Russell Road and past Frobisher Avenue to the north.
- East-west on the southern side of Frobisher Avenue.
- Western side of McGrath Road north of Frobisher Avenue.
- Extension of existing path on western side of McGrath Road to Frobisher Avenue.
- Southern side of Gardiner Avenue between Rockingham Road and Lake Coogee.
- Western side of newly created north-south internal road running between Gardiner Avenue and Frobisher Avenue.
- McGrath Road Path (N-S path within the McGrath Road road reserve between Russell Road and Frobisher Avenue).

SERVICE AND INFRASTRUCTURE CONSIDERATIONS

INTRODUCTION

This section highlights the services and infrastructure requirements of the Australian Marine Complex Technology Precinct, and has been compiled based on the following terms of reference:

- Base plans obtained from the various infrastructure agencies of Western Australia showing cadastral boundaries, contours, sewerage and water services; and
- Preliminary discussions with the City of Cockburn regarding issues relating to roadworks and drainage requirements for the development.

SITE WORKS

Preparatory works will include the following:

- Demolition of selected existing buildings, outbuildings, slabs structures, remnant improvements, and bitumen paved areas;
- Removal of fencing and other improvements as necessary, however, retaining as many existing and significant trees and vegetation as possible, where filling operations do not require disturbance of the ground;
- Removal of and deleterious materials and below ground facilities, tanks and remnant infrastructure; and
- Land filling either with imported earth or cut to fill on site. Topsoil will be stripped prior to earthworks, stored and re-used at completion of works to assist with stabilisation and regeneration of vegetation.

The development will comprise high quality industrial and office buildings. Carefully considered landscape treatments to both road verges, major entries and selected lots will be an important feature of the marketing strategy of the development.

ROADWORKS

All internal roadworks will be generally designed and constructed in accordance with the requirements and standards of the City of Cockburn as appropriate to the regulatory control requirement of the individual roads and hierarchy requirements. Roadworks may vary from traditional kerbed and asphalted pavements but will only be incorporated with local authority approval. Roads will also be enhanced by integrated landscape treatments in keeping with a selected theme. All entrance roads into the development will be subject to intersection treatments, and may include refuge islands and high level treatments to accord with the "streetscape concepts" and in accordance with local authority requirements. In order to achieve a legible road hierarchy within the development, the following carriageway widths are planned within the development:

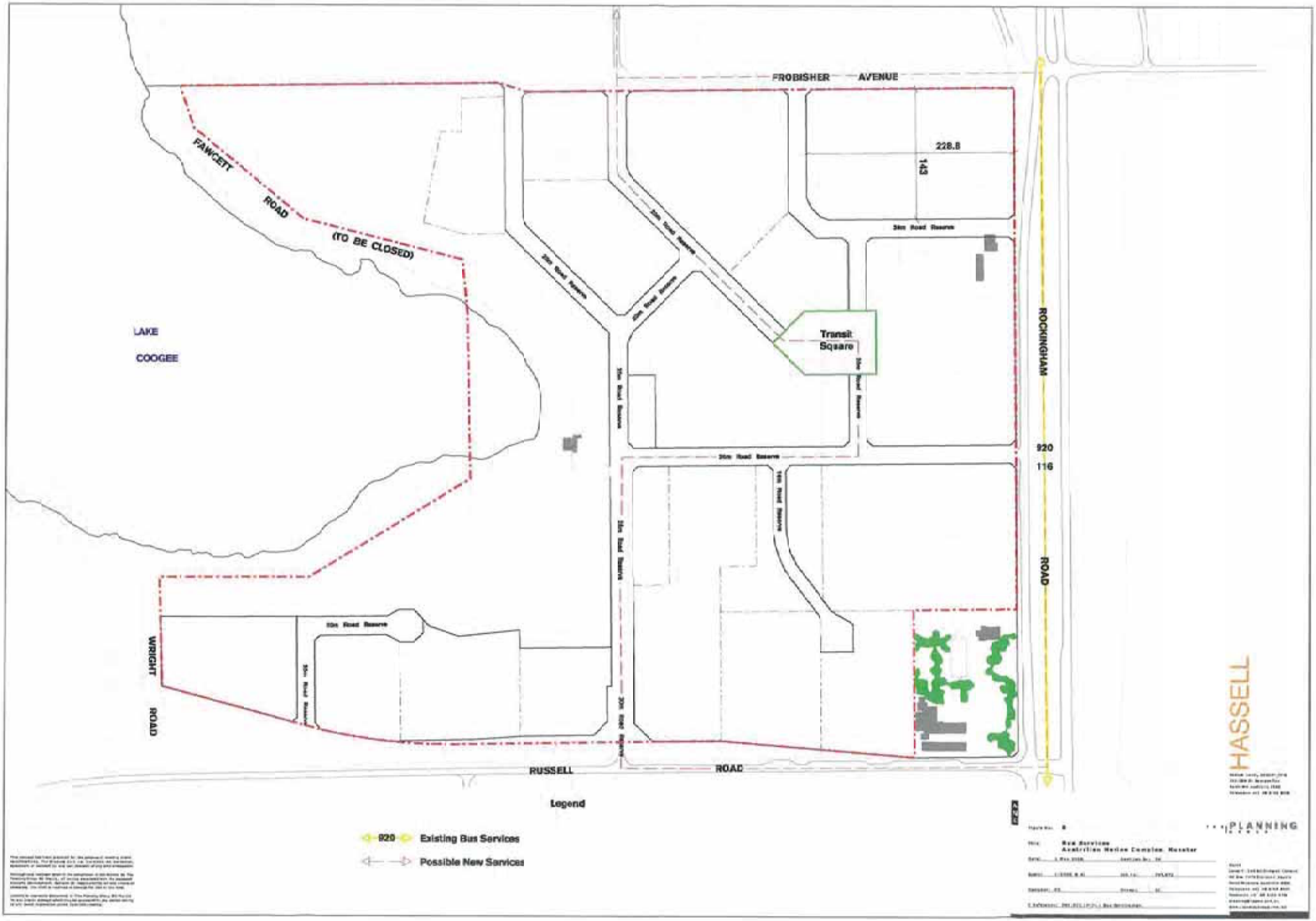
- Main distributor roads 25m reserve with boulevard treatment and/or single pavements with min 10 m wide seal; and
- Minor distributor roads 20m reserve with 9m seal width.

The above reserve widths are also designed to accommodate the relevant services corridors required to provide reticulated essential services to the development.

STORMWATER DRAINAGE

General

Previous discussions with the City of Cockburn have indicated that stormwater drainage will be required to be disposed of on-site through soakage where possible. Appropriate water management practices will be implemented to ensure that stormwater is disposed of in accordance with the City of Cockburn design standards.



Stormwater collection disposal strategies will vary according to development category however the standard principles will generally be applied. The developer has emphasised the need for water sensitive design principles to be adopted where possible. An intention of the development is to limit lot flow into the piped Council controlled drainage system by requiring absorption of runoff within the lots.

A stormwater drainage system capturing surface flow from the subdivision and directing it away from the Lake is required to prevent stormwater contamination of the lake. However, if redirection is not practicable, appropriate land uses will need to be located in the sensitive areas and control measures implemented to prevent contaminated runoff reaching the lake.

The stormwater management plan will be discussed with the City of Cockburn and the Waters and Rivers Commission during the final drainage design.

SEWER RETICULATION

The development will require reticulated sewerage as a condition of subdivision. The area is at present not serviced with Water Corporation sewerage, however, a gravity reticulation system for the area is proposed to be serviced by a sewerage pumping station to be constructed in Gardiner Avenue. Waste water from this station will be pumped northwards along McGrath Road to connect to the existing Water Corporation sewerage system in the area. Investigations will be made to determine the viability of a vacuum sewerage system for the area, and of the possibility of utilising the existing sewerage pressure main in McGrath Road.

All developed lots will therefore be served by a conventional gravity sewer system with the majority of the reticulation sewers located within road reserves. The internal sewer reticulation will be designed in accordance with the Water Authority Sewerage Manual. Standard Water Corporation sewerage headworks charges are expected to be levied on the development.

WATER RETICULATION

It is anticipated that new development will be able to connect to the water reticulation network which currently exists in the area.

Current water reticulation services exist in the Rockingham Road, Russell Road and McGrath Road road reserves. It is envisaged that these will be upgraded to allow for connections to service the area. All internal water reticulation pipework will be designed and constructed to the standards and requirements of the Water Corporation. Standard Water Corporation headworks charges are expected to be levied on the development.

WESTERN POWER

It is anticipated that new development will be serviced by underground power which will be able to connect to the power network which currently exists in the area. Overhead power lines exist within the area and will be progressively re-constructed with the underground system. The electrical system, including street lighting, will be developed to suit the proposed development demands.

TELECOMMUNICATIONS

Preliminary information from Telstra indicates there is an extensive service network in the vicinity of the development and that this network will have sufficient capacity to service the development with telecommunication services. Telstra will install any new telecommunication network facilities to the lots, subject to the developer providing trenching for cable laying. Alternatively, where cable routes match Western Power underground power supply routes, Telstra will wherever possible use the Western Power trenches in lieu of the developer providing additional trenching. The provision of ADSL and Broadband services for the development will be requested by the developer.

GAS SUPPLY

It is anticipated that new development will be able to connect to the gas network which currently exists in the area.

Existing gas mains are located in Frobisher Avenue and Russell Road with an extension from Russell Road into the subject area along McGrath Road. These gas mains will need to be incorporated and modified as part of the development and infrastructure planning implementation.

Refer to **Figure 11 - Existing Service Provision**

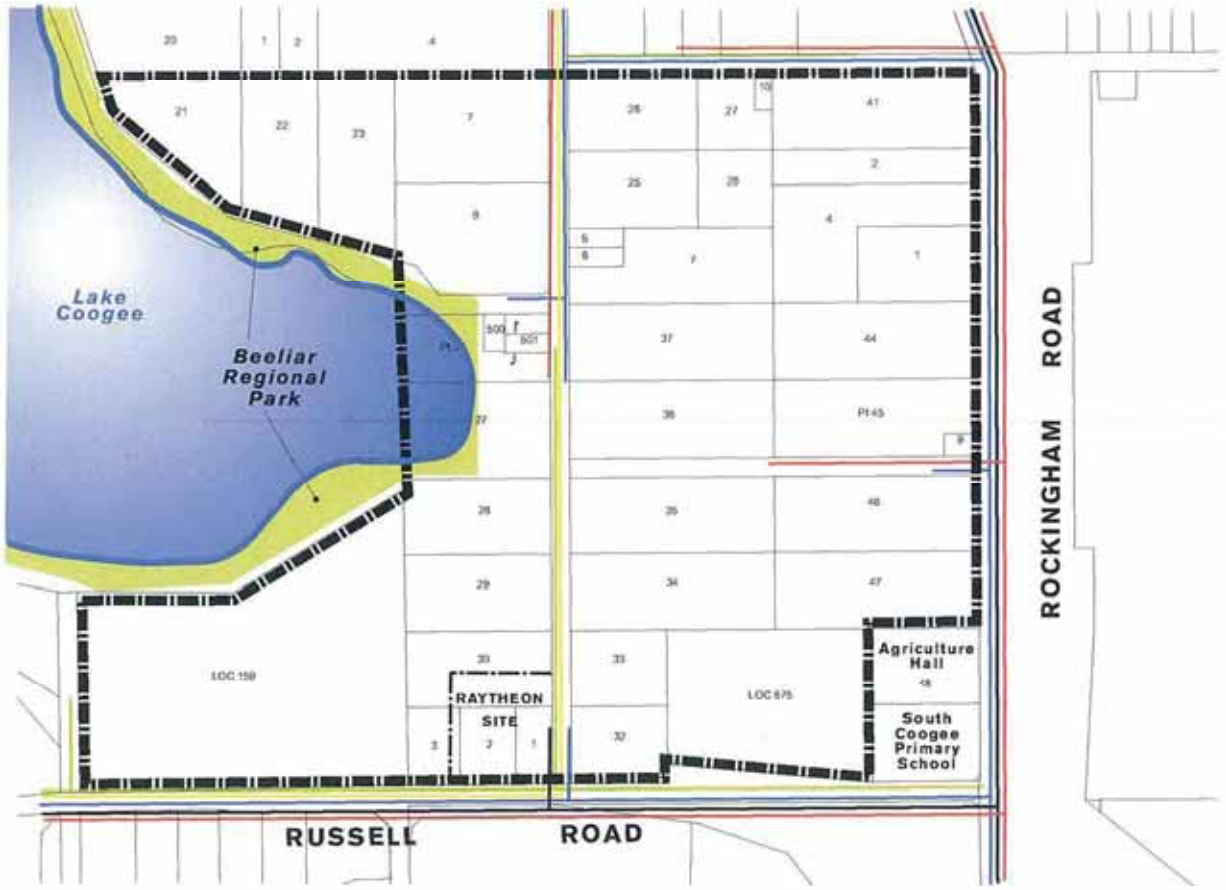
MISCELLANEOUS

Other site development infrastructure which may include footpaths, fencing and landscape treatments will be incorporated in the development guidelines or the subdivisional requirements to accord with the City of Cockburns requirements and the developers intentions.

An elevated slurry line that runs to and from Cockburn Cement is located along Gardiner Avenue (south side).

Development Constraints

No major servicing constraints are envisaged for the development, other than those already discussed in this section. The site is capable of being serviced with all essential services, and with careful and considered design will result in a high quality development.



Legend

Water — Power

Sewer — Telstra

Gas

0 200 400 600 800 1000

metres

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Figure No: 11

Title: **Services**

THE PLANNING GROUP

Date: 26 November 2014 Revision No: 1

Scale: Refer to Scale Bar Job No: 705.072

Designer: M.B. Drawn: S.L.

E Reference: Services-A3.fh10

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TECHNOLOGY PRECINCT STRUCTURE PLAN

DESIGN PHILOSOPHY

The philosophy behind the Technology Precinct Structure Plan is based on four broad design principles, being Accessibility, Environmental, Surrounding Context, and Sustainability. These principles are discussed in detail below:

Refer to **Figure 12 - Structure Plan**

Surrounding Context

Whilst the development will be self-sustaining, it will also have strong relationships with its surrounding context. The Structure Plan implements suitable linkages and interfaces with the surrounding areas and uses, including:

- Road and pedestrian/cycle links;
- integrated public transport links;
- industry links; and
- environmental links to the wetlands and Lake Coogee.

Accessibility

The development area will feature an efficient movement network with good circulation and accessibility for large vehicles. The modified grid pattern design is based on the existing road network and reinforces the legibility of the grid pattern system surrounding the subject land. Access to the site has been carefully considered given the status of Rockingham Road and Russell Road as Primary and Other Regional Roads. The development of the road pattern reinforces the existing road layout to create boulevard streets in line with the high quality building development.

Environmental

The Structure Plan demonstrates that the proposed development area can be developed in such a way as to create a clean technology precinct which respects its location adjacent to Lake Coogee and its associated wetlands by implementing comprehensive sustainability principles. The plan has been designed to incorporate remnant vegetation while also incorporating introduced landscaping. The technology precinct is intended as a high quality industry, research and development site with an appropriate form, scale and character of buildings set in landscaped surrounds.

Sustainability

The vision for the Technology Precinct is to create a quality estate that accounts for the ecology of the natural environment in which it is situated. It will provide for a high quality working and living environment with a strong sense of place, and can be assessed as being ecologically supportive, energy, water and resource efficient, and economically beneficial.

The Precinct will be designed and managed so that issues such as stormwater run off, changes in hydrology and increases in human activity do not impact directly on the adjacent wetlands.

To enable the vision to be achieved, an Environmental Management Plan has been prepared and approved which addresses protection, re establishment and maintenance of wetlands, provision of buffer zones and management of on site construction methods. In addition the EMP describes the framework, roles and responsibilities for implementing the plan, timing, and the requirements for maintenance.

Lot development, building design and construction guidelines will be prepared to complement the Structure Plan. The guidelines will address specific aspects of lot development, building design and construction, and will support the EMP and the vision for an environmentally sustainable precinct.

Together, these documents and site specific lease conditions will eventually address management of stormwater, effluent, landscape, building design and construction, and the efficiency of water and energy use.

DESIGN OBJECTIVES

To achieve the above mentioned design principles, there are a number of objectives that must be met. These are to:

- maximise the opportunities for 'clean technology' industry, research and development;
- provide a technology precinct which has high quality buildings in landscaped surrounds;
- provide well defined streetscapes;
- offer a variety of super lots to enable a robust and flexible design;
- reserve the existing wetland vegetation adjacent to Lake Coogee which can act as passive open space and a buffer to the development of land;
- reserve and conserve existing remnant vegetation on site through the provision of open space; and
- retain the existing network of major roads and reinforce the legibility of the grid street pattern.

PROPOSED LAND USES

The Technology Precinct proposes a mixture of land uses including research and development, education and training, and office administration. The proposed land uses conform with the provisions and objectives of the Development Area (DA 6) of City of Cockburn's Town Planning Scheme No.3, where uses are required to be related to or incidental to ship design, ship building, ship repair, and marine engineering.

The land uses applicable to the site are controlled through Town Planning Scheme No. 3 which identifies the following permitted and discretionary land uses.

Land Use	Use
Research and Development	P
Product or process development and improvement	P
Supply of technology based products and services	D
Provision of specialist services to increase the capability of companies in technology industries	D
Education and Training	P
Light and services industry	D
Office administration	P
Support services, including but not limited to child care facilities, lunch bar and restaurants	D
Other activities that the Council is satisfied are directly or associated to marine related activities.	D

*'P' means that the use is permitted by the Scheme providing the use complies with the relevant development standards and requirements of the Scheme. 'D' means that the use is not permitted unless the local government has exercised its discretion by granting planning approval.

An Amendment to the City of Cockburn TPS has been prepared and adopted by the City of Cockburn and is awaiting final approval. The Scheme Amendment resolves some of the inconsistencies within the scheme and provides for the following land uses.

Land Use	Use
Caretakers Dwelling	P
Educational Establishment (but excludes Primary and Secondary Schools)	P
Residential Building	P
Bank	P
Office	P
Child Care Premises	D
Civic Use	D
Community Purpose	D
Convention Centre	D
Reception (function) Centre	D
Showroom	D
Private Recreation	D
Restaurant	D
Tavern	D
Health Studio	D
Convenience Store	D
Industry - Light	D
Industry - Service	D
Lunch Bar	D
Storage	D
Telecommunications Infrastructure	D
Warehouse	D
Other activities that the Council is satisfied are directly or associated to marine related activities.	D

The amendment identifies that residential uses (including tourist accommodation or mixed use buildings incorporating a residential component) and primary and secondary schools are not permitted within the odour buffers surrounding the Woodman Point WWTP and the Kwinana Air Quality EPP Buffer. Additionally child care premises, restaurants, taverns, hotels and cafes are not permitted within the odour buffer surrounding the Woodman Point WWTP.

Consequently the structure plan will provide the land uses as indicated above and below.

The Structure Plan currently incorporates four core land uses, as follows:

- Research and Development - The majority of the Structure Plan area consists of land allocated for research and development uses (shown in light yellow). A portion of this use is allocated to Raytheon Australia. Raytheon is a mission systems integrator providing solutions for sea, land, air and office environments. The company is focused on engineering and technical workforce. The research and development site, identified on the Structure Plan in yellow, has already received planning approval from the City of Cockburn. Research and Development is a Permitted use under the Scheme.
- Mixed Use (Residential, Support Services, Office) – Two pockets of land are allocated to the north of the subject land for mixed use. It is envisioned that these two portions will incorporate residential, office and commercial uses. The residential components of this precinct will be placed outside of the Water Corporation Waste Water and Environmental Protection buffers. The residential component will provide localised accommodation opportunities for those working within the Technology Precinct. Support services such as lunch bar and restaurants are Discretionary Uses, whilst Office and Residential are Permitted Uses under the Scheme.

- Department of Industry and Resources Site (Provision of specialist services to increase the capability of companies in Technology industries) – The site (shown in orange) is allocated as a business and technology centre, and function centre.

- Education and Training - Department of Education and Training – The site (shown in blue) is allocated as an education and training (TAFE) and research and development for oil and gas research. The primary components of the campus will include an administrative building, common staff and student service centre, workshop and laboratory facilities and an external training plant containing pilot oil and gas processing training plant and sub-sea well training area. The use of Education and Training is a Permitted use under the Scheme.

With respect to the above land uses, no storage, transport, handling, use and disposal of chemicals or toxic and hazardous substances shall occur within 200 metres of the wetland boundary.

LOTS

The lots within the Technology Precinct Structure Plan area have been designed as super lots to allow for flexibility in design. The proposed land uses will have different expectations with respect to floor plates, workshops and car parking and therefore the structure plan has been designed as a robust subdivision of land which will allow for flexibility of land area. The land areas vary from 0.59 hectares to 3.43 hectares in area.

PUBLIC OPEN SPACE

The principle behind the location and amount of public open space (POS) has been based on the conservation values of the area. In particular the open space has been provided to protect the wetlands and retain remnant vegetation.

Public Open Space is proposed to partially encapsulate the Department of Industry and Resources site. This POS continues to the north-east intersection of McGrath Road and Gardiner Road. These portions of POS are to be utilised as wetland enhancement areas. As part of the development of the northern portion of the DoIR site, a wildlife corridor connection between the wetland enhancement areas is required to be provided.

An area of public open space has been located between Lake Coogee and the area to the south. The purpose of this open space strip is to provide a buffer between the two uses. The buffer area will be re-vegetated.

The existing 'A class' reserve to the south of the site is proposed to be relocated to the south of Frobisher Avenue. The proposed location and size of the reserve reflects the size of the existing reserve. The new POS location would service the recreational requirements of nearby Residents in the Mixed Use precinct, and provide as an attractive opening statement for the precinct from Rockingham Road and Frobisher Avenue.

The open space represents approximately 16 hectares of land area which is 30% of the site area. With respect to the proposed mixed use area, the area capable of residential development represents approximately 1.6 hectares. The proposed recreation reserve has an area of 3 hectares while the area set aside for conservation is approximately 13 hectares. Therefore the provision of public open space (recreation) represents approximately 200% of the area potentially capable for residential development.

ROADS

The main focus of the road network design is to ensure a legible layout capitalising on the existing road network to allow ease of movement within the site and connections and accessibility to the major connecting roads. The widths of the road reserves range from 20m to 25m, depending on their designation and importance. Roads and public accessways provide permeability that ultimately focuses on the Lake Coogee environs and more formalised open space.

Main access into the site is achieved from Frobisher Avenue and Russell Road (McGrath Road). McGrath Road has been partially retained as the north south link. The road width of McGrath Road between Russell Road and Gardiner Avenue is proposed to be 25 metres. The width will then narrow to 20 metres between Gardiner Avenue and Frobisher Avenue.

Access into the Technology Precinct from Rockingham Road will be achieved from the existing Gardiner Avenue, and one new local road to the north of Gardiner Avenue. Access restrictions to and from Rockingham Road will be restricted, where left in and left out turning will only be permitted onto Rockingham Road.

Frobisher Road has been extended west of McGrath Road to service the north-western lots while at the same time closing Fawcett Road to minimise the impacts of traffic on the wetland environment of Lake Coogee. Coogee Road north of Frobisher Avenue with be disconnected with a cul-de-sac as part of the stage 1 development with Frobisher Avenue duplicated as part of the Stage 2 development. A new road south of Lake Coogee is proposed in order to provide access to the western lots, whilst acting as a buffer to the Wetland Enhancement Area.

A Transit Square is appropriately located at an intersection north of the Department of Education site. The Transit Square will act as a hub for bus services operating through the Technology Precinct, running generally in a north south direction.

HERITAGE

The Municipal Heritage Inventory (MHI) identifies Dadley Home and Store Sheds as being a Management Category B site. The MHI recognises that there is some uncertainty about the places future given its location within the Technology Precinct.

Upon the development of stage 2 of the Precinct the design of the duplication of Frobisher Avenue, the POS Reserve and the southern POS road are to be reviewed in order to facilitate the retention of the "Dadley Home - Store Sheds". The Dadley Home and Store Sheds are listed on the City of Cockburn's Municipal Heritage Inventory and therefore the review of the road reserves is to be undertaken in order to determine whether the place can be retained. It is proposed to undertake this review during stage 2 of the precinct development as the road reserve widths will not be determine until the detailed design of Stage 2.

PERFORMANCE OF THE STRUCTURE PLAN

The Structure Plan incorporates the latest policy directions from the Department for Planning and Infrastructure, the Waters and Rivers Commission and the Environmental Protection Authority. The implementation of these policies and principles has resulted in a conscientious land proposal that supports the various elements of sustainability. These key elements can be identified as environmental, social (heritage), and economic. In addition to this, the Plan considers the existing topography and orientation of the site and the potential constraints of existing private landowners. The performance of the Structure Plan in relation to these elements is established below.

ENVIRONMENTAL

The Structure Plan takes due consideration of the outcomes of the Environmental Management Plan prepared for the site. The Lake Coogee wetland conservation boundary is adhered to, where no development occurs within this boundary. No construction will occur within 50 metres of this boundary, including roads. Wetland enhancement and restoration is to occur within the Wetland Enhancement Area, and Water Sensitive Urban Design principles are to be incorporated throughout the site.

Road reserves will be landscaped according to sustainable principles, encouraging water retention and waste material filtration. These factors limit development in some areas. As a result, the plan proposes a minimal effective public road layout. These roads front conservation areas in many places, providing access to open space. Roads and public access ways provide permeability that ultimately focuses on the Lake Coogee environs and more formalised open space.

The road network is designed in a north-south and east west grid configuration, thereby establishing good solar access and energy efficiency opportunities which will be carried through at the Development Application stage. The implementation of sustainable design guidelines for the Technology Precinct will include the principles of passive solar design and ventilation.

HERITAGE

Heritage is acknowledged by the plan. The two sites listed on the City's interim register have been incorporated into the Structure Plan, and are earmarked for potential public use. The Dadley Home and Stone Sheds may be able to be retained, however, it will depend on the review of the road reserves as part of the stage 2 development of the precinct.

ECONOMIC

The subject site benefits from being located adjacent to a primary regional road (Rockingham Road) which provides connectivity to regional locations. The internal road network of the Structure Plan has been designed with connectivity in mind. The road network provides good connectivity to Rockingham Road, and will assist the establishment of a high quality public transport service route running through the site. These elements will promote the Precinct as a desirable business location, and will contribute to the economic success of the research and development sector in this region.

TOPOGRAPHY AND ORIENTATION

The Structure Plan considers the existing landform in the layout of the road network. The change in landform along McGrath Road encourages a change in road direction, which is more consistent to the natural topography. The roads front 50m deep sites that can be benched to be flat, with frontages on two different levels. These sites will take advantage of views to the lake environs, and to Public Open Space placed on the northern boundary with adjacent residential.

LAND CONSTRAINTS

The plan considers current and proposed landowners/leaseholders, and questions the constraint of the Cockburn Cement slurry line. Land that is not yet owned by LandCorp is not threatened by the plan, but is integrated into part of it. Access to the Department of Education and Training site from the north needs to traverse the slurry line. Benching may be necessary within the site due to contours, and will determine what sort of bridging occurs over the slurry line.

STAGING AND IMPLEMENTATION

STAGING

Staging of the development will be undertaken in two phases. The first stage will create the lots between Russell Road up to Gardiner Avenue. The second stage will cover the remaining lands to the north of Gardiner Avenue to Frobisher Avenue.

The first stage has been designed to facilitate the development around the Raytheon Site, the Department of Education and the Department of Industry and Resources sites.

The Stage 1 works will include the temporary disconnection of Coogee Road north of Frobisher Avenue. The Stage 2 works will include the Frobisher Road duplication. The Frobisher Avenue duplication shall be duplicated to segregate traffic and connect with Button Street and Old Rockingham Road as part of the Stage 2 works.

The development of the land currently classified as an 'A' Class Reserve on Russell Road will only occur once declassification of the Reserve is completed.

ENVIRONMENTAL AND PLANNING APPROVALS

To enable the development of the Marine Technology Precinct, various planning and environmental approvals will be required. Listed below are the required approvals for the completion of the precinct:

- Endorse Structure Plan;
- Subdivision Approval;
- Clearances of conditions;
- Environmental clearances from the Department of Environmental Protection; and
- Town Planning Scheme amendment to include the zoning of the reserve and to address land uses.

CONCLUSION

This Structure Plan has been prepared in order to facilitate the subdivision, land use and development of the land that forms the Technology Precinct of the Australian Marine Complex at Cockburn Sound. The Technology Precinct forms one of four main precincts of the Australian Marine Complex.

The Structure Plan for the Marine Technology Precinct accepts quality sustainability principles as guiding principles. The Technology Precinct is envisioned to be a high quality working place that supports the natural ecology of its location, and is efficient in its use of energy, water and resources. To enable the vision to be achieved, an Environmental Management Plan prepared for the subject site addresses protection, enhancement and re establishment of wetlands, provision of appropriate buffer zones, and the management of on-site construction methods.

In addition to this, the design considers the protection of heritage elements, the importance of connectivity to adjoining Technology Precincts, and promoting an efficient and well serviced public transport system. The incorporation of the above elements has resulted in a Structure Plan design that will ensure a high quality land development for the region.

REFERENCES

Aboriginal Affairs Department Register of Aboriginal Sites

Bureau of Meterology 2002, Bureau of Meterology Website, Commonwealth of Australia, http://www.bom.gov.au

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Department of Industry and Technology, The Australian Marine Complex Cockburn Sound

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Metropolitan Region Scheme Amendment No 1008/33 - Report on Submissions (Volume 1)

Strategen, Australian Marine Complex Technology Precinct Environmental Management Plan, (Draft) October 2001

Welker 2002, Proposed Marine Industry Technology Park - Munster - Preliminary Evaluation of Conservation Values

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Western Australian Planning Commission 2001, Fremantle - Rockingham Industrial Area Regional Strategy

APPENDIX 1

TRAFFIC REPORT (GHD PTY LTD)

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LandCorp

AMC Technology Precinct

Traffic Report

November 2004

Contents

Table Index

Appendices

Executive Summary

LandCorp has commissioned GHD Pty Ltd (GHD) to undertake a traffic study at the Australian Marine Complex Technology Precinct, Munster to confirm access requirements.

Based on the outcomes of this study the following conclusions are reached.

- The Technology Precinct could generate up to 1600vph in the peak hour
- Access to the precinct will require appropriate measures to accommodate the predicted traffic generation for both the interim stage and when the future planned road upgrades are implemented.
- Future major road works planned include:
  - the grade separation of Russell Road/Rockingham Road intersection, Russell Road will align east-west rather than the existing staggered intersection
  - construction of a new southbound carriageway on Rockingham Road, with the existing northbound carriageway becoming a service road.
  - the grade separation of Beeliar Drive/Rockingham Road intersection
  - the upgrade of Russell Road, forming part of the Fremantle –Rockingham Highway Route. As part of this work Cockburn Road is planned to be realigned to the west of Lake Coogee. The route will be a Controlled Access Highway.
- Following assessment of the traffic generation from the proposed Technology Precinct analysis was undertaken of the access requirements for the precinct.
- In earlier discussions, Main Roads advised that they were not supportive of interim measures, which would be lost when the ultimate road works are undertaken, specifically traffic signal controlled access to Rockingham Road or left in/out at proposed east-west roads other than Gardiner Ave.
- The existing intersection of Russell Road/Coogee Road will not accommodate the projected traffic volumes at full development from the Technology Precinct and traffic signals are required.

The following access strategy is recommended;

Stage 1

- Russell Road/Coogee Road – Traffic signals to include:
  - exclusive left turn lane from Russell Road west with 70 degree island , under give way control.
  - localised widening to accommodate turning lanes appropriate to the design speed of Russell Road and one through lane in each direction.
  - left and right turn lanes from Coogee Road
- Provide left in/out access to Rockingham Road at Gardiner Ave and at east-west access road to north with left turn lanes OR acceleration lanes and deceleration

lane at Gardiner Ave. For permeability to the site two east-west accesses are preferred.

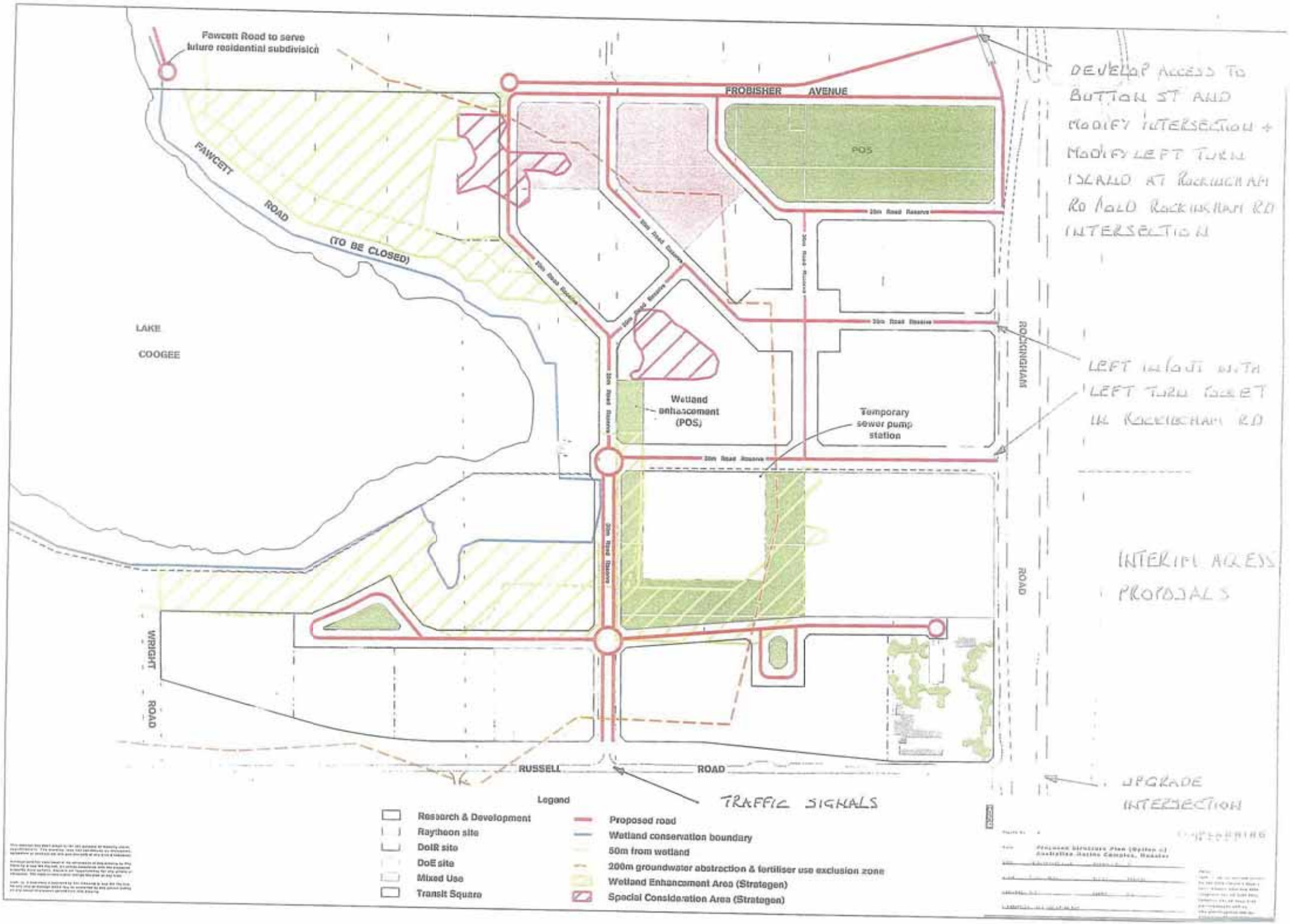
- Bus access to the precinct via Russell Road for Stage 1 access.
- Cul de sac Fawcett Road just north of development
- Upgrade Russell Road/Rockingham Road intersection to include a double right turn in Russell Road and left turns under give way control.
- Provide for a small bus facility in Transit Area, to include 4 bus stands adjacent to the Educational establishment.
- Provide small roundabouts at internal 4 way intersections
- Provide access to Button Street and Old Rockingham Road. Access to the TP development from the north would be highly desirable for both Stage 1 and the ultimate development. Analysis indicates that there would be benefit for the operation of the southern access points if this northern access were developed. In the first stage Button Street/Old Rockingham Road could operate to allow all movements with appropriate upgrade of the intersection. This will also be compatible with future planning.
- In order to improve the operation and safety of the Button Street/Old Rockingham Road intersection the following measures are recommended.
    - traffic turning left from Rockingham Road into Old Rockingham Road do so at high speed due to the angle of the left turn island. This should be modified to 70 degrees and include give way signs. This will slow approaching traffic and improve safety at the Button Street intersection.
    - a right turn pocket should be provided in Old Rockingham Road to accommodate increased traffic turning right into Button Street to access the Technology Precinct

Stage 2 When Russell Road/Rockingham Road is upgraded and grade separated

- When the ultimate road works are undertaken access to Rockingham Road will be lost due to the construction of the new southbound carriageway east of the existing southbound carriageway and the northbound carriageway becoming a service road.
- Good access should be maintained to the north via Old Rockingham Road to the future Beeliar Drive interchange. This access should connect to the new service road (current northbound carriageway of Rockingham Road) which is accessed by the east-west access roads
- Opportunities for left in/out to Rockingham Road from the service road should also be pursued to maintain permeability to the precinct, it is apparent those opportunities are limited due to ramp requirements for the interchange and the difference in levels between the current northbound and southbound carriageways.
- Benefits of providing and maintaining the northern access include:

- provides ultimate access to precinct from all directions via Beeliar Dr and Russell Road.
- allows buses to access the precinct from Rockingham Road north, for ultimate scenario
- allows access from precinct to Beeliar Drive interchange.
- no access through central residential area to north.
- no additional impact to Controlled Access Highway

- The operation of the Russell Road/Coogee Road traffic signals should be reviewed and upgraded based on the prevailing traffic volumes. Analysis indicates that the initial Stage 1 geometry will not accommodate likely 2021 volumes. This intersection remains critical to providing good access to the Technology Precinct and should be carefully considered as part of the future upgrade of Russell Road.
- If good permeability is not achieved to the site as part of the long term planning congestion is likely to occur for traffic accessing the precinct.
- Stakeholders should further consider access opportunities, compatible with future major road planning.



1. Introduction

1.1 General

LandCorp has commissioned GHD Pty Ltd (GHD) to undertake a traffic study at the Australian Marine Complex Technology Precinct, Munster. The purpose of this report is

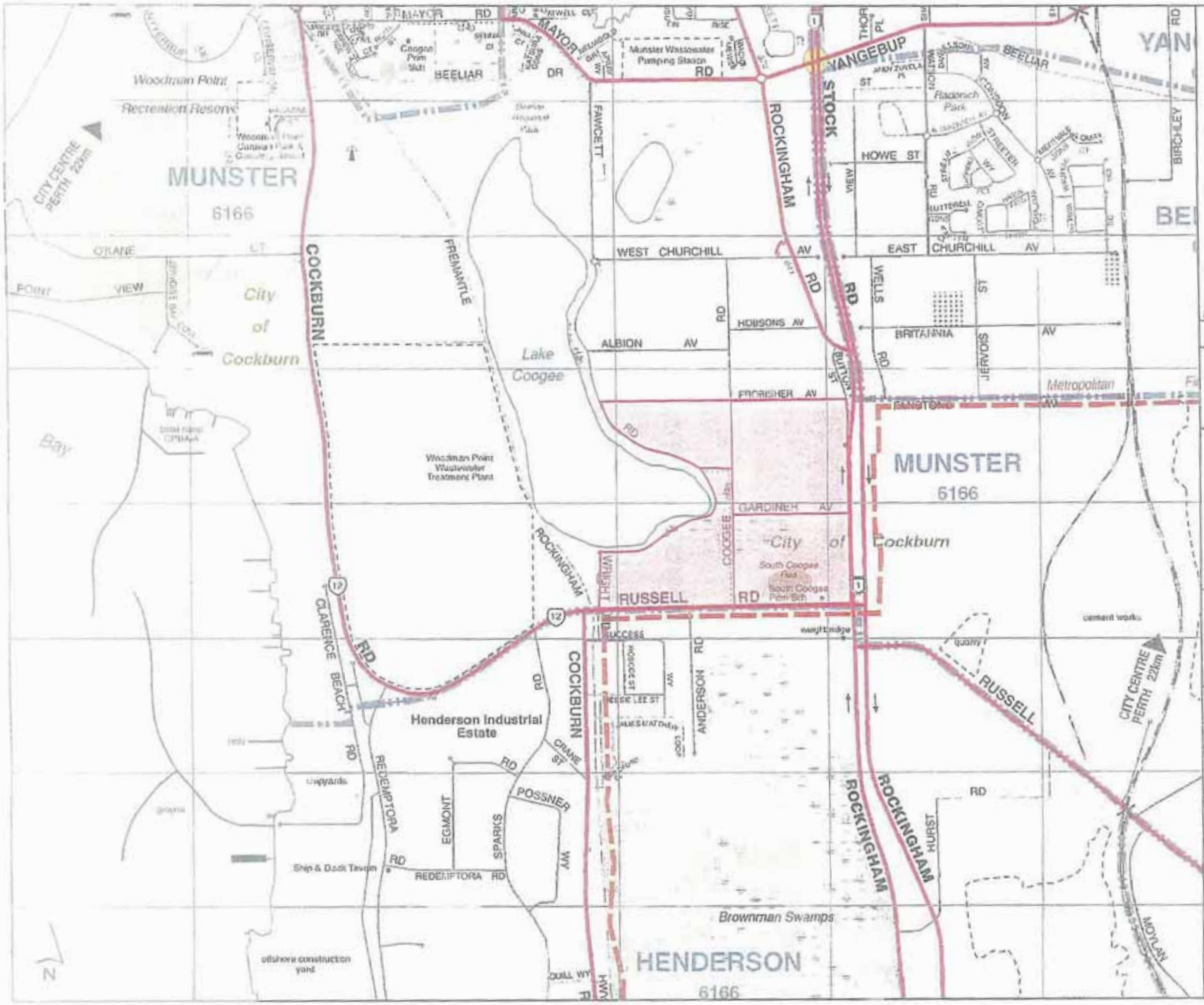
- to address Councils requirements regarding traffic issues;
- justify additional access to Rockingham Road;
- confirm public transport planning for the development;
- minimise traffic impacts to the northern residential area; and
- identify a strategy for access to Old Rockingham Road

The Marine Technology Precinct locality plan and draft structure plan are shown overleaf.

1.2 Scope of Study

The following scope has been identified for the study:

- Site inspection;
- Examine previous traffic study reports for the area and review;
- Review comments made by City of Cockburn on previous traffic report;
- Confirm the traffic generation from the proposed development;
- Apply traffic generation to the new precinct and assign traffic to the network and intersections;
- Assess the operation of the proposed external intersections to determine the adequacy of the number of access points:
- Assess the operation of:
  - Russell Road/Rockingham Road intersection; and
  - Coogee Road/Russell Road intersection.
- Consider minimising impacts to residential area to north;
- Liaise with City of Cockburn, Main Roads and Public Transport Authority;
- Prepare report of findings, analysis and make recommendation on adequacy or otherwise of the access points to serve the precinct on full development; and
- Recommend improvements/modifications.



LEGEND

MARINE TECHNOLOGY PARK PRECINCT

NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS

SCALE

400 200 0 400m

1:20000 at A4

CREATED BY	CHECKED	APPROVED
GC		

HORIZONTAL DATUM:	PROJECTION:
HEIGHT DATUM:	METADATA RECORDED:
DATE: 22 01 03	FILE LOCATION: [illegible]
REVISION: 0	DRAWING NO / LAYOUT NAME: 6134418-G1

GHD MANAGEMENT ENGINEERING ENVIRONMENT

LANDCORP
MARINE TECHNOLOGY PARK
LOCALITY PLAN

2. Initial Liaison and Background Information

2.1 General

At the outset of the study a meeting was held with LandCorp, Ewing Consulting Engineers, Hassell (Spowers) Architects to obtain any background information and initiate the project.

The following summarise the outcome of the meeting:

- Ove Arup prepared a traffic report in February 2000, Ewings to obtain and forward a copy.
- A hard copy of the latest draft structure plan for the Marine Technology Precinct was provided. The structure plan was subsequently modified and this traffic report updated in November 2004.
- Two connections are currently shown to Rockingham Road. GHD to pursue the need and justification for a new intersection at Rockingham Road/Frobisher Ave (or vicinity). A strategy is required as part of this updated report for access to Old Rockingham Road.
- Traffic access to/from the precinct is of concern via the residential area to the north. Fawcett Road is constrained by a narrow road reserve and Council do not want this route upgraded.
- There is likely to be a residential component around the educational establishment. This will be rental type accommodation for attendance at courses and also for people from overseas undertaking research.
- The Structure Plan is indicative at this stage.
- Council is supportive subject to certain issues that need to be addressed including traffic.
- The north-south road will be a low speed environment Boulevard.
- GHD need to confirm the public transport planning for the precinct by liaison with PTA, to include;
  - routes
  - confirm stops
  - how pedestrians will cross Rockingham Road
  - pedestrian connections to bus stops on Rockingham Road
- Land will remain in LandCorp ownership and leased. Land within the area is also owned by Department of Industry and Technology.
- Some additional uses have been encouraged ie accommodation, shops.
- Need to liaise with City of Cockburn, Allen Blood and Steve Hiller.
- Need to liaise with Main Roads regarding access from Rockingham Road.

- The following documents were provided
  - Future traffic Beeliar Dr, Uloth and Ass.
  - Letter from Allen Blood dated 23 April 2001 re Arup traffic report.
  - Memo from City of Cockburn Senior Planner re Structure Plan.

2.2 PTA

The public Transport Authority have provided the following advice regarding planning for public transport in the area.

Road Network

"From a discussion some time ago in 2002 with Main Roads WA representatives, Transperth's understanding is that there are plans to upgrade Russell Road as a primary link between Kwinana Freeway and the northern end of the AMC (timeframe not known, but probably within 10 years), including realignment and grade separation at Rockingham Road.

(Rowley Road is also planned for upgrading as a parallel primary link to the southern end of the AMC.)

The intended redevelopment of the Hope Valley / Wattleup Redevelopment Project as an industrial and commercial area to support the AMC has also prompted a rethink on the likely alignment of the planned Rockingham - Fremantle Transitway in the sector between Kwinana and Munster. The feasibility / viability of a revised alignment parallel with and close to the freight railway (eg, Moylan Road) is under consideration. Given that there is uncertainty within the Department for Planning & Infrastructure (DPI) while its organisational structure is being decided upon, it is hard to say when this matter will be progressed or finalised. Transperth would prefer that the Transitway penetrate the Hope Valley / Wattleup area on a more central alignment, rather than traverse either the eastern or western fringe.

With the above factors in mind, and the planned development of the Technology Precinct incorporating Educational facilities of some substance (TAFE), it would be logical to also slightly alter the Transitway alignment north of Russell Road to penetrate the Technology Precinct and surrounding area to better serve likely travel patterns to and from this particular district. The Transitway would be altered to utilise Russell and Coogee Roads, plus West Churchill Avenue - not Frobisher Avenue - provided these roads are built / maintained to a standard that is sufficiently compatible with the smooth, efficient and cost effective operation of a high capacity public transport facility".

Bus Services

"Existing route 116 is a remnant of a once busy and well patronized service which has been gradually superseded when other routes in the network were improved over the years. It now has a very low service level aimed at catering for a quite small clientele whose travel patterns are not adequately catered for by other routes (yet). However, it will be discontinued when the bus route network is heavily revised for the start of the

new train service between Perth and Rockingham in late 2006, if not before. This will ultimately leave the high frequency 920 service as the primary public transport link for the Technology Precinct (TP) area. This runs on a base frequency of 15 minutes for most of the day on weekdays and 30 minutes during evenings and at weekends. There is a fairly high probability, particularly if the above changes to the road network and/or Transitway occur, that the route would be altered to pass through the TP using Russell and Coogee Roads, plus West Churchill Avenue – not Frobisher Avenue - provided these roads are built / maintained to a standard that is sufficiently compatible with the smooth, efficient and cost effective operation of a high frequency public transport service.

However, Transperth envisages that there would be other bus routes serving the TP. A secondary route operating along Hamilton, Mayor and Fawcett Roads, plus West Churchill Avenue and Coogee Road is also proposed in the 2007 Network Plan. This would ideally terminate at a small purpose built facility at or near the education / training (TAFE) site in the Technology Precinct, with some buses continuing on at appropriate times into the other AMC precincts to cater for worker travel (and for TAFE students doing work experience or research projects).

To facilitate the right hand turn from Coogee Road onto Russell Road for southbound buses, it would be advisable to install a large diameter roundabout at that intersection.

Subject to the availability and suitability of the above terminus facility, an existing secondary route which currently terminates near Santich Park in Munster (and links that suburb with Spearwood, Hamilton Hill and Fremantle) is also likely to be extended to the Technology Precinct. This extension would utilise West Churchill Avenue and Coogee Road.

There is also a fairly strong likelihood of a bus route being established to link Cockburn Central, the Technology Precinct and other AMC precincts, probably around or after introduction of the South West Metro Railway in 2006/07. This route would travel (in part) via Beeliar Drive, Rockingham Road, West Churchill Avenue and Coogee Road.

Transperth's current thinking on likely bus services is still substantially the same. If a roundabout cannot be achieved at Rusell Road/Coogee Road then an acceleration lane or holding bay to facilitate the right turn from Coogee Road"

2.3 DPI

A meeting was held with DPI (Gary Manning) who confirmed the following

- Russell Road becomes part of the Fremantle- Rockingham Highway route following the recent completion of road works for the Australian Marine Complex.
- Rockingham Road northbound carriageway ultimately becomes a service road and a new southbound carriageway constructed east of the existing carriageway.
- Rockingham Road/Russell Road will be grade separated with Russell Road over.

- In view of deletion of Fremantle Eastern Bypass and possible deletion of Roe Highway Stage 8 there will be demand for improved interchanges on Rockingham Road.
- Ultimately interchanges to serve this area on Rockingham Road will be at Russell Road and Beeliar Drive, no other access is planned.
- A signalised intersection on Rockingham Road to serve this development could only be considered as an interim measure until the ultimate major road works are completed
- DPI has current concept plans for the future upgrade of Russell Road to a dual carriageway and grade separation at Rockingham Road. A construction date has not been programmed for the upgrade.
- In view of Russell Road becoming a Controlled Access Highway (CAH) a roundabout at Coogee Road/Russell Road could only be considered an interim measure.

3. Existing Traffic and Site Conditions

3.1 Existing Traffic Volumes

Main Roads have provided traffic data for Cockburn Road north of Russell Road and north of Rockingham Road, Russell Road and Rockingham Road. This and other traffic data supplied by Council is summarised in Table 3.1

Table 3.1 Traffic Volumes

Location	Average Weekday Traffic
Cockburn Road North of Russell Road	11,460 vpd (a)
Perimeter Road South of Russell Road	7,850 vpd (a)
Cockburn Road North of Rockingham Road	11,310 vpd (a)
Cockburn Road West of Russell Road	12,290 vpd (b)
Rockingham Road North of Russell Road	24399 vpd (c)
Rockingham Road South of Russell Road	25286 vpd (a)
Russell Road West of Rockingham Road	7264 vpd (a)

(a) Sept 2002, (b) Sept 2001, (c) Oct 2001 (Source Main Roads)

3.2 Russell Road/Rockingham Road Intersection

The intersection of Russell Road/Rockingham Road has recently been signalised and Russell Road has been upgraded to include channelisation, and turn pockets. There is a left turn pocket (signal controlled) in Rockingham Road south and two through lanes, right turn pocket in Rockingham Road north and two through lanes and left and right turn lanes in Russell Road.

GHD have undertaken a survey of the signalised intersection as part of the AMC project for LandCorp on 17 November 2003. The survey was undertaken between 3pm and 5.30pm, to quantify its current performance for eastbound traffic on Russell Road and is summarised as follows.

The cycle time varies between 107 secs and 158 secs during the period 3 pm to 5.30 pm. The green time for approaching eastbound traffic varies between 13 secs and 47 secs. Maximum queue lengths for eastbound left turns were 7 vehicles and for right turning traffic 21 vehicles. Generally all vehicles cleared the intersection during one phase, however on 4 occasions during the survey period a number of vehicles did not clear with subsequent delays of 112 secs to 268 secs.

A total of 20 vehicles were observed to go through the red signal when turning right from Russell Road into Rockingham Road during the period of the survey (3 pm-5.30 pm). This occurred during the periods of higher approach volumes, the surveyor observed that these were not queuing or delayed vehicles but simply high approach speed drivers driving carelessly.

No problems were observed caused by slow moving trucks using the intersection, however Stakeholders advise of problems caused by large slow moving trucks negotiating the intersection and should be addressed as part of any upgrade to thee intersection.

3.3 Gardiner Ave/Rockingham Road Intersection

Gardiner Avenue currently intersects with Rockingham Road and provides for left turn in and left turn out only. There is no left turn pocket, although there is an embayment just prior to the intersection. The southbound carriageway of Rockingham Road is 5-6m higher than the northbound carriageway, therefore this intersection would require geometric investigation to confirm suitability for any future traffic signals. Subsequent discussions with Main Roads indicate they are not supportive of traffic signals.

It would seem logical to maintain this intersection to provide access (left in/out) into the precinct.

3.4 Frobisher Ave/Rockingham Road

Frobisher Ave currently connects into Button Street at its eastern end, Button Street then connects to Old Rockingham Road at a point approximately 30m west of the Stock Road/Rockingham Road unsignalised intersection. The geometry includes grades and curves on the approaches.

The north-south section of Rockingham Road carriageway adjacent to Frobisher Ave is 4-5m higher than Frobisher Ave. A current intersection with Fanstone Ave exists opposite Frobisher Ave and includes a right turn pocket in Rockingham Road. This intersection is located approximately 180m south of the Rockingham Road/Stock Road intersection.

In view of the significant difference in levels between the northbound and southbound carriageways between Gardiner Ave and Frobisher Ave there is no logical location for traffic signals to serve the Technology Precinct and allow all movements. It may be possible to signalise the northbound movement and right turn out only.

If Frobisher Ave connects with Rockingham Road then it could operate left in/out only, however in view of the existing intersection with Fanstone Ave and proximity to the intersection to the north, an intersection to the south would be preferable and a safer option.

The development of the Button Street route to Old Rockingham Road should be further examined.

3.5 Coogee Road/Russell Road Intersection

The intersection is currently channelised and provides a left turn pocket approximately 60m long in Russell Road west, a painted right turn pocket approximately 60m long in Russell Road east and a left and right turn lane in Coogee Road, the right turn short lane is approximately 50m long. There is a crest to the west, however sight distance is reasonable.

3.6 Coogee Road/West Churchill Ave Intersection

Coogee Road intersects with West Churchill Ave, which connects to Rockingham Road to the east and to Mayor Road via Fawcett Road to the north.

3.7 Fawcett Road

Fawcett Road south of West Churchill Ave runs adjacent to Lake Coogee and provides a recreational route and includes a recreational cycle path along side the lake. The road reserve width is constrained along this route.

3.8 Old Rockingham Road

Old Rockingham Road is 10m wide and carries around 5000vpd, it connects Stock Road with Yangebup Road and areas to the north. The road is classed as a District Distributor A in the Metropolitan Functional Road Hierarchy.

3.9 Bus Stops

Currently bus stops are located in Rockingham Road on each side within an embayment just north of Russell Road and just north of the Frobisher Ave alignment. PTA advise that it is unlikely that these will remain as services will be rerouted as previously described.

4. Proposed Development & Traffic Volumes

4.1 Technology Precinct, Draft Structure Plan - Predicted Traffic Generation

LandCorp have provided GHD with the structure plan for the proposed Technology Precinct located on the northwest corner of Rockingham Road/Russell Road intersection bounded by Frobisher Avenue to the north, Rockingham Road to the east, Russell Road to the south and Lake Coogee to the west. The Technology Precinct area comprises a total area of approximately 49 hectares. The Technology Precinct proposes a mixture of land uses, primarily including research and development, education and training and office and administration. The NSW Guide to Traffic Generating Development indicates a traffic generation of 1.1 trip per hour per 100m2 of gross leasable area. The proposed area to be developed south of Gardiner Ave is around 120,000m2 and north of Gardiner Ave around 132,000m2. Assuming 50% site coverage of the developed areas and including the school site in the southeast corner, this development could potentially generate in the order of 1600 vph in the peak hour.

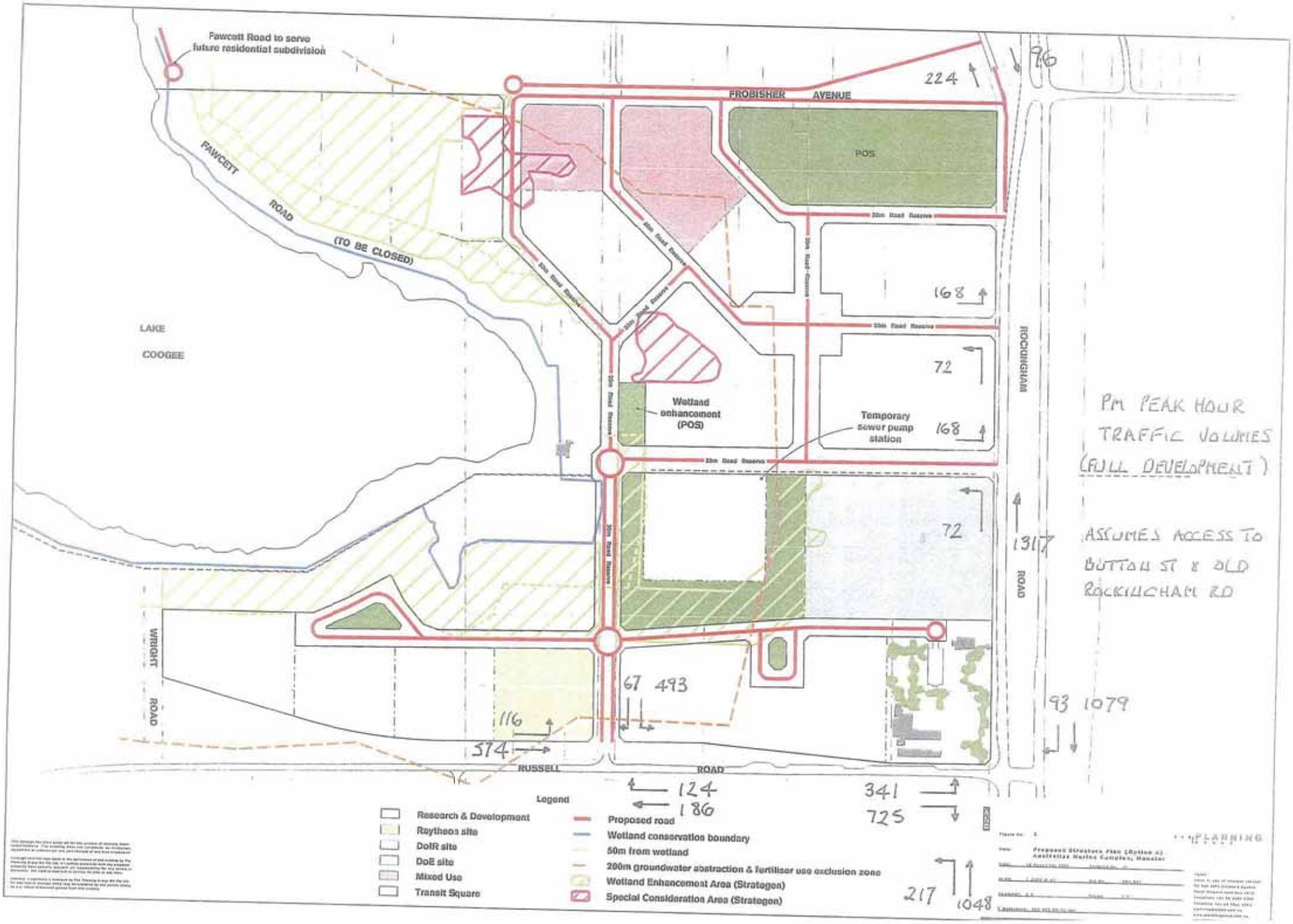
No additional consideration of modal split has been undertaken for the trip rate, however with the proposed public transport planned for the precinct the traffic volumes generated could be a little lower than predicted.

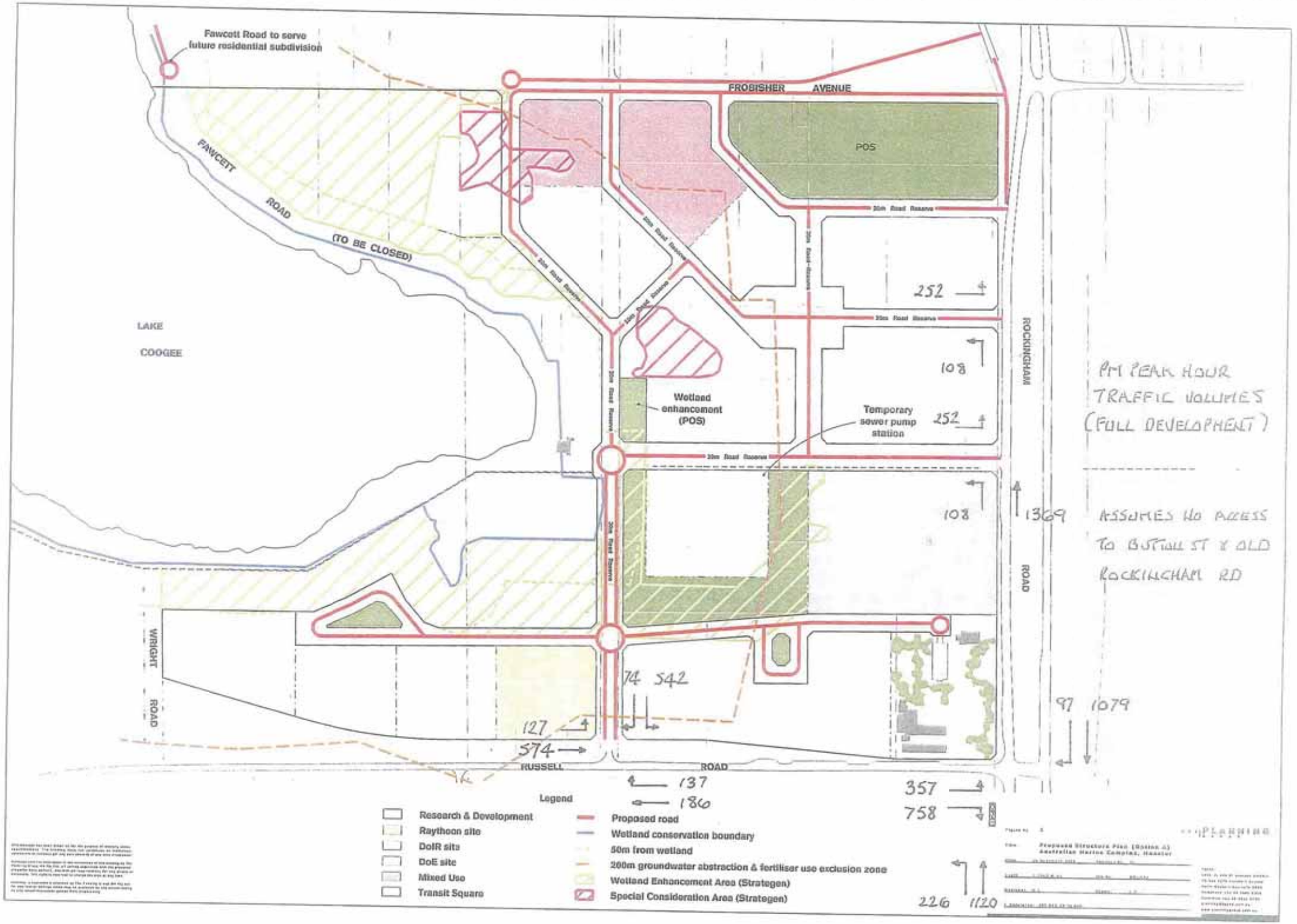
4.1.1 Traffic Distribution

Based on the proposed road layout and access to the surrounding road network, the anticipated pm traffic distribution is as follows, assuming access is achieved as described in the table.

Access to Button Street and Old Rockingham Road

	Distribution	VPH	In (30%)	Out (70%)
Traffic Generation		1600	30%	70%
Russell Road via Coogee Rd	50%	800	240	560
Gardiner Ave onto Rockingham Road	15 %	240	72	168
East-west road north of Gardiner Ave	15%	240	72	168
Old Rockingham Road to North	20%	320	96	224
Total		1600	480	1120





No access to Button Street and Old Rockingham Road

	Distribution	VPH	In (30%)	Out (70%)
Traffic Generation		1600	30%	70%
Russell Road via Coogee Rd	55%	880	264	616
Gardiner Ave onto Rockingham Road	22.5 %	360	108	252
East-west road north of Gardiner Ave	15%	360	108	252
Old Rockingham Road to North	No Access			
Total		1600	480	1120

4.2 Australian Marine Complex Fabrication Precinct West of Perimeter Road

In addition to this development the AMC Fabrication Precinct located west of Perimeter Road will generate between 1,900 vph – 6,500 vph (LandCorp report dated November 2003 refers). If it is assumed that 23% of the additional traffic uses Russell Road (based on previous surveys) then this will add around 180 to 1200 vph in the evening peak hour.

4.3 Australian Marine Complex Support Precinct Stage 2+3 East of Perimeter Road

The Stage 2 Development will generate around 200 vph which could add a further 46 vph to Russell Road in the evening peak hour.

5. Traffic Analysis

5.1 Access

The City of Cockburn in correspondence dated 23 April 2001 provided comment on a previous traffic report prepared for the Technology Precinct (TP). The City required:

- Nil or limited connections between the TP and the residential area depending on the impacts of TP traffic on the amenity of the residential area
- Fawcett Road, Old Rockingham Road and Coogee Road should be disconnected.

Analysis has been undertaken based on the following scenarios;

- access via Coogee Road, Gardiner Ave left in /out, east-west road with access to Rockingham Rd and Button Street to Old Rockingham Road
- as above with no access to Old Rockingham Road

The analysis takes into account the traffic volumes generated by the Australian Marine Complex Precincts and full development of the Technology Precinct (TP).

Sidra analysis is included in Appendix A.

5.2 Russell Road/Coogee Road – Traffic Signals

Assumes access to Button Street and Old Rockingham Road – Single Through Lanes on Russell Road

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Russell Road East								
2	T	186	1203	0.155	4.2	LOS A	19	0.38
4	R	131	245	0.531	30.9	LOS C	30	0.79
Approach		316	1447	0.531	15.2	LOS B	30	0.55
Coogee Road								
7	L	493	738	0.668	22.4	LOS C	81	0.87
9	R	71	246	0.284	29.8	LOS C	16	0.75
Approach		563	985	0.668	23.4	LOS C	81	0.85
Russell Road West								
10	L	116	1216	0.095	9.7	LOS A	6	0.68
12	T	604	686	0.88	25.2	LOS C	132	1.14
Approach		720	1902	0.88	22.7	LOS C	132	1.07
All Vehicles		1599	4334	0.88	21.5	LOS C	132	0.89

Assumes access to Button Street and Old Rockingham Road – Two Through Lanes on Russell Road

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Russell Road East								
2	T	186	2029	0.092	5	LOS A	10	0.42
4	R	131	304	0.427	25.1	LOS C	24	0.78
Approach		316	2333	0.427	13.3	LOS B	24	0.57
Coogee Road								
7	L	493	918	0.537	16.5	LOS B	58	0.83
9	R	71	306	0.229	24.3	LOS C	13	0.75
Approach		563	1224	0.537	17.4	LOS B	58	0.82
Russell Road West								
10	L	116	1229	0.094	10	LOS B	6	0.69
12	T	604	747	0.809	20.1	LOS C	58	1
Approach		720	1975	0.809	18.5	LOS B	58	0.95
All Vehicles		1599	5533	0.809	17.1	LOS B	58	0.83

Assumes NO access to Button Street and Old Rockingham Road– Single Through Lanes on Russell Road

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Russell Road East								
2	T	186	1203	0.155	4.2	LOS A	19	0.38
4	R	144	244	0.59	31.4	LOS C	34	0.82
Approach		330	1447	0.59	16.1	LOS B	34	0.57
Coogee Road								
7	L	542	739	0.734	24.1	LOS C	94	0.92
9	R	78	247	0.316	29.9	LOS C	18	0.76
Approach		620	986	0.734	24.8	LOS C	94	0.9
Russell Road West								
10	L	127	1218	0.104	9.9	LOS A	7	0.68
12	T	604	686	0.88	25.2	LOS C	132	1.14
Approach		731	1904	0.88	22.6	LOS C	132	1.06
All Vehicles		1681	4336	0.88	22.1	LOS C	132	0.91

Assumes NO access to Button Street and Old Rockingham Road– Two Through Lanes on Russell Road

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Russell Road East								
2	T	186	2029	0.092	5	LOS A	10	0.42
4	R	144	304	0.474	25.3	LOS C	27	0.78
Approach		330	2333	0.474	13.9	LOS B	27	0.58
Coogee Road								
7	L	542	918	0.59	16.7	LOS B	64	0.83
9	R	78	307	0.254	24.4	LOS C	14	0.75
Approach		620	1225	0.59	17.7	LOS B	64	0.82
Russell Road West								
10	L	127	1221	0.104	10.1	LOS B	6	0.69
12	T	604	747	0.809	20.1	LOS C	58	1
Approach		731	1968	0.809	18.3	LOS B	58	0.95
All Vehicles		1681	5526	0.809	17.2	LOS B	64	0.83

5.2.1 Summary

Analysis of the operation of a unsignalised 'T' intersection assuming current geometry, indicates that it will not accommodate predicted traffic volumes and will result in unacceptable queues and delays.

Assumes access to Button Street and Old Rockingham Road

Single Through Lanes on Russel Road

The above analysis (TP + other AMC precincts) indicates that traffic signals will operate to a good Level of Service (LoS C) assuming single through lanes on Russell Road, right and left turn pockets. However queues of 132m on Russell Road west are

predicted. It may be worth considering the provision of two through lanes for eastbound traffic to reduce queue lengths in view of the crest and an intersection on the south side of Russell Road.

Sensitivity analysis has been undertaken assuming all pm exiting volumes are increased by 50% to take into account fluctuations in traffic volumes, the analysis indicates that the intersection will operate to a LoS of C however queue lengths on Russell Road west increase to 165m. Anderson Road on the south side of Russell Road is approximately 160m west of Coogee Road, queue lengths may therefore extend to this intersection.

As volumes increase due to surrounding development this intersection will need to be upgraded.

Two Through Lanes on Russell Road

The above analysis (TP + other AMC precincts) indicates that traffic signals will operate to a good Level of Service (LoS B) assuming two through lanes on Russell Road, right and left turn pockets. Predicted queue lengths are up to 58m.

Assumes NO access to Button Street and Old Rockingham Road

Single Through Lanes on Russell Road

The above analysis (TP + other AMC precincts) indicates that if no access is available to Button Street this intersection controlled by traffic signals will operate to a good Level of Service.(LoS C) assuming single through lanes on Russell Road, right and left turn pockets. However queues of 132m on Russell Road west are predicted.

Two Through Lanes on Russell Road

The above analysis (TP + other AMC precincts) indicates that traffic signals will operate to a good Level of Service (LoS B) assuming two through lanes on Russell Road, right and left turn pockets. Predicted queue lengths are up to 58m.

In Councils response to an earlier traffic report they indicate that Russell Road traffic volumes in 2021 could be 31,400 vpd.

Analysis has also been undertaken for 2021 volumes with traffic signals assuming the above-described geometry and lengthy delays and queues are predicted indicating future upgrade will be required as traffic volumes increase. The impacts to this intersection will be reduced if a northern access is developed.

Assumes NO access to Button Street, Old Rockingham Road or Rockingham Road eg Russell Road is the only access.

Two Through Lanes on Russell Road

Analysis indicates an overall LoS of C however lengthy queues are predicted including 239m in Coogee Road. As traffic volumes increase on Russell Road due to surrounding development and major road works a single access to the precinct will become severely congested. Analysis assuming 2021 levels of traffic indicate delays of 3.5 minutes and queues of around 1km on Russell Road.

5.3 Rockingham Road/Gardiner Ave and Rockingham Road/ Access Road to north - Left in/out only.

Assumes access to Button Street and Old Rockingham Road

Analysis indicates that left turning exiting traffic will be delayed with lengthy queues if only Gardiner Ave is available to access Rockingham Road under give way control. However if both Gardiner and a new east-west access road to the north are available then good operating conditions are achieved. The provision of left in/out at both intersections would allow good permeability to and from the development. If access is provided via Gardiner Ave only then a continuous left turn lanes should be provided, eg deceleration lane into Gardiner Ave and acceleration lane into Rockingham Road which overcomes any queuing problems.

Assumes NO access to Button Street and Old Rockingham Road

If no access is available to Button Street and both east-west intersections are left in/out under give way control, unacceptable operating conditions are predicted at peak times.

If access is provided via Gardiner Ave only, then continuous left turn lanes should be provided, eg deceleration lane into Gardiner Ave and accele ration lane into Rockingham Road which overcomes any queuing problems.

5.4 Rockingham Road/Russell Road – Signals

Assumes access to Button Street and Old Rockingham Road – Upgraded intersection with a double right turn from Russel Road.

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Rockingham Road South								
1	L	217	1274	0.17	9.1	LOS A	10	0.67
2	T	1048	1198	0.875	35.9	LOS D	162	1.08
Approach		1265	2471	0.875	31.3	LOS C	162	1.01
Rockingham Road N								
8	T	1079	2187	0.493	9.9	LOS A	93	0.57
9	R	93	436	0.213	22	LOS C	17	0.76
Approach		1172	2623	0.493	10.8	LOS B	93	0.58
Russell Road								
10	L	341	1070	0.319	14.8	LOS B	51	0.74
12	R	725	940	0.771	39.5	LOS D	105	0.94
Approach		1066	2010	0.771	31.6	LOS C	105	0.87
All Vehicles		3503	7104	0.875	24.5	LOS C	162	0.83

Assumes NO access to Button Street and Old Rockingham Road - Upgraded intersection with a double right turn from Russel Road.

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate
Rockingham Road South								
1	L	226	1269	0.178	9.1	LOS A	10	0.67
2	T	1120	1267	0.884	37.1	LOS D	178	1.1
Approach		1346	2536	0.884	32.4	LOS C	178	1.03
Rockingham Road N								
8	T	1079	2231	0.484	9.6	LOS A	93	0.55
9	R	97	425	0.228	22.2	LOS C	17	0.76
Approach		1176	2655	0.484	10.6	LOS B	93	0.57
Russell Road								
10	L	357	1044	0.342	15.8	LOS B	56	0.76
12	R	758	915	0.828	43.9	LOS D	118	1
Approach		1115	1958	0.828	34.9	LOS C	118	0.93
All Vehicles		3637	7149	0.884	26.1	LOS C	178	0.85

5.4.1 Summary

Assumes access to Button Street and Old Rockingham Road

Analysis of the existing geometry assuming full development of TP and AMC other precincts indicates some lengthy queues (215m) and delays in excess of 60 seconds on Rockingham Road North. A LoS of D is predicted and LoS of E for the worst movement.

Analysis (as shown in the above table) for modified geometry predicts a good LoS of C. Modifications to the intersection include:

- A double right turn in Russell Road

- Left turn lanes under give way control
- It is acknowledged that this intersection will ultimately be grade separated.

It is recommended that this intersection is upgraded as described above.

Assumes NO access to Button Street and Old Rockingham Road

If no access is available to Button Street analysis indicates that a modified signalised intersection as described above is predicted to operate to a good LoS of C.

5.5 Button Street/Old Rockingham Road

Button Street connects to Old Rockingham Road at a point approximately 30m west of the Stock Road/Rockingham Road unsignalised intersection. The geometry is poor for all approaches. However analysis has been undertaken to determine its likely operation should access be available to/from the Technology Precinct.

Analysis indicates that a good Level of Service (B) will be achieved assuming all movements with no significant queuing or delays. Sensitivity analysis has been undertaken assuming all traffic volumes are increased by 50% to allow for growth and fluctuations in volumes and a good operation is maintained. Recommended upgrades to this intersection are discussed later in this report.

5.6 Impacts to Residential Area

In order to restrict access to the residential area to the north the following measures are discussed:

5.6.1 Coogee Road

Two options have been considered.

- Option 1 - A bus only access is in Coogee Road just north of Frobisher Ave to allow bus services to access the precinct. This would consist of a narrowed section of carriageway with appropriate signs.

  There are similar examples elsewhere in the Metropolitan area eg Jaggs Way in Kardinya and Adie Court in Victoria Park. The disadvantage of this option is that it cannot easily be enforced, however PTA advise that at the other similar measures, incursion by unauthorised traffic has not been a problem.
- Option 2 – Cul de sac Coogee Road just north of Frobisher Ave

  The advantage of this proposal is that it is self enforcing, however proposed bus services are restricted

On balance a well-designed bus only access is preferred in order to allow bus access. PTA concur with this option. Subsequent discussion with City off Cockburn indicates they are not supportive in view of likely enforcement issues.

5.6.2 Frobisher Ave

The proposed structure plan restricts access to Frobisher Avenue from the TP.

5.6.3 Fawcett Road

No access is proposed to Fawcett Road.

5.6.4 Internal Roads

A number of 4 way intersections (3) are proposed as part of the structure plan. It is proposed that each is treated with a small roundabout to facilitate turning movements and encourage a low speed environment.

5.7 Access Strategy

Based on the results of the analysis the following access strategy is recommended.

Stage 1

- Russell Road/Coogee Road – Traffic signals to include:
  - exclusive left turn lane from Russell Road west with 70 degree island , under give way control.
  - localised widening to accommodate turning lanes appropriate to the design speed of Russell Road and one through lane in each direction. (Two eastbound lanes will reduce queue lengths on full development.)
  - left and right turn lanes from Coogee Road
- Provide left in/out access to Rockingham Road at Gardiner Ave and at east-west access road to north with left turn lanes OR acceleration lanes and deceleration lane at Gardiner Ave. For permeability to the site two east-west accesses are preferred.
- Bus access to the precinct via Russell Road for Stage 1 access.
- Cul de sac Fawcett Road just north of development
- Upgrade Russell Road/Rockingham Road intersection to include a double right turn in Russell Road and left turns under give way control.
- Provide for a small bus facility in Transit Area, to include 4 bus stands adjacent to the Educational establishment.
- Provide small roundabouts at internal 4 way intersections
- Provide access to Button Street and Old Rockingham Road. Access to the TP development from the north would be highly desirable for both Stage 1 and the ultimate development. Analysis indicates that there would be benefit for the operation of the southern access points if this northern access were developed. In the first stage Button Street/Old Rockingham Road could operate to allow all movements with appropriate upgrade of the intersection. This will also be compatible with future planning.
- In order to improve the operation and safety of the Button Street/Old Rockingham Road intersection the following measures are recommended.

- traffic turning left from Rockingham Road into Old Rockingham Road do so at high speed due to the angle of the left turn island. This should be modified to 70 degrees and include give way signs. This will slow approaching traffic and improve safety at the Button Street intersection.
- a right turn pocket should be provided in Old Rockingham Road to accommodate increased traffic turning right into Button Street to access the Technology Precinct

Stage 2 When Russell Road/Rockingham Road is upgraded and grade separated

- When the ultimate road works are undertaken access to Rockingham Road will be lost due to the construction of the new southbound carriageway east of the existing southbound carriageway and the northbound carriageway becoming a service road.
- Good access should be maintained to the north via Old Rockingham Road to the future Beeliar Drive interchange. This access should connect to the new service road (current northbound carriageway of Rockingham Road) which is accessed by the east-west access roads
- Opportunities for left in/out to Rockingham Road from the service road should also be pursued to maintain permeability to the precinct, it is apparent those opportunities are limited due to ramp requirements for the interchange and the difference in levels between the current northbound and southbound carriageways. It is also noted that Main Roads are not supportive of additional access to Rockingham Road.
- Benefits of providing and maintaining the northern access via Old Rockingham Road to Beeliar Drive include:
  - provides ultimate access to precinct from all directions via Beeliar Dr and Russell Road.
  - allows buses to access the precinct from Rockingham Road north, for ultimate scenario
  - allows access from precinct to Beeliar Drive interchange.
  - no access through central residential area to north.
  - no additional impact to Controlled Access Highway
- The operation of the Russell Road/Coogee Road traffic signals should be reviewed and upgraded based on the prevailing traffic volumes. Analysis indicates that the initial Stage 1 geometry will not accommodate likely 2021 volumes. This intersection remains critical to providing good access to the Technology Precinct and should be carefully considered as part of the future upgrade of Russell Road.
- If good permeability is not achieved to the site as part of the long term planning congestion is likely to occur for traffic accessing the precinct.
- Stakeholders should further consider access opportunities, compatible with future major road planning.

Section 6 further considers the longer-term access opportunities.

5.8 Liaison Regarding Traffic Impacts and Access

Traffic access issues have previously been discussed with stakeholders and their comments are noted as follows:

5.8.1 Main Roads and City of Cockburn

A meeting was held with Main Roads, City of Cockburn and Ewing Consulting Engineers on 19 January 2003 at City of Cockburn.

- It was confirmed that the northbound carriageway of Rockingham Road will become a service road as part of future road works including the grade separation of Russell Road interchange.
- It was confirmed that the future alignment of Fremantle - Rockingham Road will be just west of Lake Coogee and will connect into Russell Road. Russell Road will be upgraded.
- Main Roads are not supportive of interim access measures, which would need to be removed or are lost when the ultimate road network is constructed.
- Main Roads concur that initial access via Gardiner Ave could be utilised until future construction of a new southbound carriageway.
- It was noted that there is no current time frame for completion for the ultimate road works.
- An access strategy should consider the broader area and longer term planning for the area.
- There was discussion on the requirements for access to Rockingham Road and the provision of grade - separation was suggested at Frobisher Ave to allow southbound access and northbound exit for the precinct and future development to the east of Rockingham Road. It was considered that access to Beeliar Drive could be significant for traffic to from the north and east. Beeliar Drive provides a more direct link to the Kwinana Freeway than Russell Road.
- Main Roads advise that because Rockingham Road is a Controlled Access Highway no further access to those planned, ie Russell Road and Beeliar Dr is supported.
- Traffic signals are preferred by Main Roads at Coogee Road/Russell Road, although it is acknowledged that a roundabout could also work.
- Justification is required for the access requirements including supporting analysis.
- Council, DPI and Main Roads need to be involved to agree a strategy for access.
- The need to provide good access to the precinct to avoid future congestion and safety problems was emphasised. Analysis to date of the traffic generated by the precinct indicates that single access alone to Russell Road is not adequate and other access must also be provided.

- City of Cockburn are not supportive of bus only links due to possible enforcement problems, it is preferred that the road network provides adequate access.
- Council does not support the use of Fawcett Road or Coogee Road to access the precinct.
- A collaborative approach is required to include Council, DPI and Main Roads to address the broader access issues.
- Town Planning Scheme No 3 Scheme Map was provided which shows the future land use planning and roads for the region.

6. Long Term Access Strategy Options

Following liaison with stakeholders it is clear that interim measures for access to the Technology Precinct are not supported if they are lost or need to be removed as part of future road works. It is also clear that the access strategy needs to accommodate future planned surrounding development. Not withstanding these requirements, the Technology Precinct cannot compromise its access for long-term road works, which currently have no planned construction date. Good access must be achieved for both the interim and long-term scenario, if not addressed access is likely to be difficult at peak times with resultant congestion and safety issues.

A number of long term access strategies are put forward for further discussion with stakeholders and subsequent evaluation of feasibility: Sketch plans are shown in Appendix B

Note: All strategies require evaluation of feasibility particularly in view of the difference in levels between Frobisher Ave and Rockingham Road and distances from major intersections.

The access strategies assume the use of the redundant northbound carriageway of Rockingham Road following it's future upgrade as shown in the DPI plans.

Access Strategy	Advantages	Disadvantages
1. Russell Road/Coogee Road- Signals, Left in/out at Gardiner Ave with acceleration/ deceleration lane initially, ultimate grade-separation at Frobisher Ave with northbound on-ramp and south-bound off ramp, no access to Coogee Road north, no access to Fawcett Road from precinct.	▸ Provides ultimate access to precinct from all directions. ▸ Allows buses to access the precinct from Rockingham Road north, for ultimate scenario ▸ Will serve access to residential precinct to east of Rockingham Road ▸ Allows access from precinct to Beeliar Drive interchange. ▸ No access through residential area to north.	▸ No right turn access from precinct directly onto Rockingham Road ▸ Focuses all ultimate access via Frobisher Ave, which limits permeability. (Feasibility of linking to service road needs to be examined) ▸ Significant cost for new interchange ▸ Close proximity to Russell Road interchange (740m)

Access Strategy	Advantages	Disadvantages
2. Russell Road/Coogee Road- Signals, Left in/out at Gardiner Ave initially, ultimate grade-separation at Frobisher Ave with northbound on-ramp and south-bound on/off ramp, no access to Coogee Road north, no access to Fawcett Road from precinct.	▸ Provides ultimate access to precinct from all directions. ▸ Allows buses to access the precinct from Rockingham Road north, for ultimate scenario ▸ Will serve access to residential precinct to east of Rockingham Road ▸ Allows access from precinct to Beeliar Drive interchange. ▸ No access through residential area to north.	▸ Significant cost for new interchange ▸ Close proximity to Russell Road interchange (740m) ▸ Focuses all ultimate access via Frobisher Ave, which limits permeability. (Could be linked to service road)
3. Russell Road/Coogee Road- Signals, Left in/out at Gardiner Ave initially, ultimate use service road (current nb carriageway and Old Rockingham Road) with roundabout access to Beeliar Dr. Access to service road from all east-west roads within Marine Technology Precinct. No access to Coogee Road north, no access to Fawcett Road from precinct.	▸ Provides ultimate access to precinct from all directions via Beeliar Dr and Russell Road. ▸ Allows buses to access the precinct from Rockingham Road north, for ultimate scenario ▸ Allows access from precinct to Beeliar Drive interchange. ▸ No access through central residential area to north. ▸ No additional impact to Controlled Access Highway	▸ Does not provide additional access to residential area east of Rockingham Road (however could provide southbound on - ramp only as part of scheme ▸ Roundabout at Beeliar in close proximity to Stock Road interchange (150m approx)

Access Strategy	Advantages	Disadvantages
4. Russell Road/Coogee Road - Signals, Left in/out at Gardiner Ave initially, ultimate grade-separation at Frobisher Ave with northbound on-ramp and southbound off ramp, parclo for southbound on – ramp and northbound off-ramp. No access to Coogee Road north, no access to Fawcett Road from precinct.	▸ Provides ultimate access to precinct from all directions on Rockinghm Road ▸ Allows buses to access the precinct from Rockingham Road north, for ultimate scenario ▸ Will serve access to residential precinct to east of Rockingham Road to allow all movements. ▸ Allows access from precinct to Beeliar Drive interchange via Rockingham Rd. ▸ No access through residential area to north.	▸ Significant cost for new interchange ▸ Close proximity to Russell Road interchange (740m) ▸ Focuses all ultimate access via Frobisher Ave which limits permeability (could provide access to service road which then accesses other east-west roads)

From the above it can be seen that there are a number of options available that could be further examined to provide ultimate access to the precinct from Rockingham Road and also the future development on the east side of Rockingham Road. However the broader transport modelling to determine access requirements for the land east of Rockingham Road is beyond the scope of this study.

At this stage, Option 3,access to Beeliar Drive interchange via Old Rockingham Road is preferred.

7. Conclusions

Based on the outcomes of this study the following conclusions are reached.

- The Technology Precinct could generate up to 1600vph in the peak hour
- Access to the precinct will require appropriate measures to accommodate the predicted traffic generation for both the interim stage and when the future planned road upgrades are implemented.
- Future major road works planned include:
  - the grade separation of Russell Road/Rockingham Road intersection, Russell Road will align east-west rather than the existing staggered intersection
  - construction of a new southbound carriageway on Rockingham Road, with the existing northbound carriageway becoming a service road.
  - the grade separation of Beeliar Drive/Rockingham Road intersection
  - the upgrade of Russell Road, forming part of the Fremantle –Rockingham Highway Route. As part of this work Cockburn Road is planned to be realigned to the west of Lake Coogee. The route will be a Controlled Access Highway.
- Following assessment of the traffic generation from the proposed Technology Precinct analysis was undertaken of the access requirements for the precinct.
- In earlier discussions, Main Roads advised that they were not supportive of interim measures, which would be lost when the ultimate road works are undertaken, specifically traffic signal controlled access to Rockingham Road or left in/out at proposed east-west roads other than Gardiner Ave.
- The existing intersection of Russell Road/Coogee Road will not accommodate the projected traffic volumes at full development from the Technology Precinct and traffic signals are required.

The following access strategy is recommended;

Stage 1

- Russell Road/Coogee Road – Traffic signals to include:
  - exclusive left turn lane from Russell Road west with 70 degree island , under give way control.
  - localised widening to accommodate turning lanes appropriate to the design speed of Russell Road and one through lane in each direction.
  - left and right turn lanes from Coogee Road
- Provide left in/out access to Rockingham Road at Gardiner Ave and at east-west access road to north with left turn lanes OR acceleration lanes and deceleration lane at Gardiner Ave. For permeability to the site two east-west accesses are preferred.

- Bus access to the precinct via Russell Road for Stage 1 access.
- Cul de sac Fawcett Road just north of development
- Upgrade Russell Road/Rockingham Road intersection to include a double right turn in Russell Road and left turns under give way control.
- Provide for a small bus facility in Transit Area, to include 4 bus stands adjacent to the Educational establishment.
- Provide small roundabouts at internal 4 way intersections
- Provide access to Button Street and Old Rockingham Road. Access to the TP development from the north would be highly desirable for both Stage 1 and the ultimate development. Analysis indicates that there would be benefit for the operation of the southern access points if this northern access were developed. In the first stage Button Street/Old Rockingham Road could operate to allow all movements with appropriate upgrade of the intersection. This will also be compatible with future planning.
- In order to improve the operation and safety of the Button Street/Old Rockingham Road intersection the following measures are recommended.
    - traffic turning left from Rockingham Road into Old Rockingham Road do so at high speed due to the angle of the left turn island. This should be modified to 70 degrees and include give way signs. This will slow approaching traffic and improve safety at the Button Street intersection.
    - a right turn pocket should be provided in Old Rockingham Road to accommodate increased traffic turning right into Button Street to access the Technology Precinct

Stage 2 When Russell Road/Rockingham Road is upgraded and grade separated

- When the ultimate road works are undertaken access to Rockingham Road will be lost due to the construction of the new southbound carriageway east of the existing southbound carriageway and the northbound carriageway becoming a service road.
- Good access should be maintained to the north via Old Rockingham Road to the future Beeliar Drive interchange. This access should connect to the new service road (current northbound carriageway of Rockingham Road) which is accessed by the east-west access roads
- Opportunities for left in/out to Rockingham Road from the service road should also be pursued to maintain permeability to the precinct, it is apparent those opportunities are limited due to ramp requirements for the interchange and the difference in levels between the current northbound and southbound carriageways.
- Benefits of providing and maintaining the northern access include:
    - provides ultimate access to precinct from all directions via Beeliar Dr and Russell Road.

- allows buses to access the precinct from Rockingham Road north, for ultimate scenario
- allows access from precinct to Beeliar Drive interchange.
- no access through central residential area to north.
- no additional impact to Controlled Access Highway

- The operation of the Russell Road/Coogee Road traffic signals should be reviewed and upgraded based on the prevailing traffic volumes. Analysis indicates that the initial geometry will not accommodate likely 2021 volumes. This intersection remains critical to providing good access to the Technology Precinct and should be carefully considered as part of the future upgrade of Russell Road.
- If good permeability is not achieved to the site as part of the long term planning congestion is likely to occur for traffic accessing the precinct.
- Stakeholders should further consider access opportunities, compatible with future major road planning.

8. Recommendations

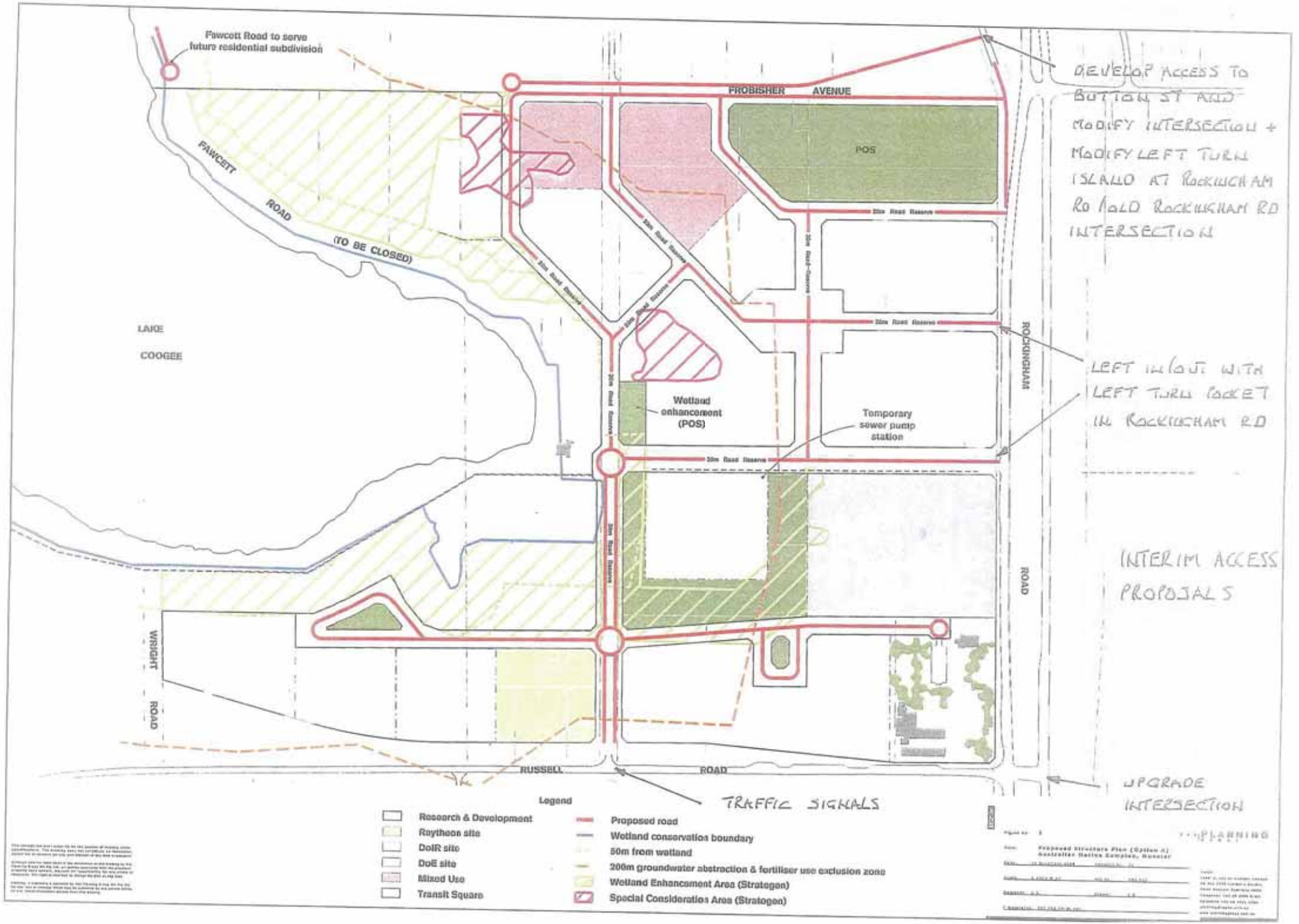
The following recommendations are presented as shown in the Executive Summary.

Stage 1

- Russell Road/Coogee Road – Traffic signals to include:
  - exclusive left turn lane from Russell Road west with 70 degree island , under give way control.
  - localised widening to accommodate turning lanes appropriate to the design speed of Russell Road and one through lane in each direction.
  - left and right turn lanes from Coogee Road
- Provide left in/out access to Rockingham Road at Gardiner Ave and at east-west access road to north with left turn lanes OR acceleration lanes and deceleration lane at Gardiner Ave. For permeability to the site two east-west accesses are preferred.
- Bus access to the precinct via Russell Road for Stage 1 access.
- Cul de sac Fawcett Road just north of development
- Upgrade Russell Road/Rockingham Road intersection to include a double right turn in Russell Road and left turns under give way control.
- Provide for a small bus facility in Transit Area, to include 4 bus stands adjacent to the Educational establishment.
- Provide small roundabouts at internal 4 way intersections
- Provide access to Button Street and Old Rockingham Road. Access to the TP development from the north would be highly desirable for both Stage 1 and the ultimate development. Analysis indicates that there would be benefit for the operation of the southern access points if this northern access were developed. In the first stage Button Street/Old Rockingham Road could operate to allow all movements with appropriate upgrade of the intersection. This will also be compatible with future planning.
- In order to improve the operation and safety of the Button Street/Old Rockingham Road intersection the following measures are recommended.
  - traffic turning left from Rockingham Road into Old Rockingham Road do so at high speed due to the angle of the left turn island. This should be modified to 70 degrees and include give way signs. This will slow approaching traffic and improve safety at the Button Street intersection.
  - a right turn pocket should be provided in Old Rockingham Road to accommodate increased traffic turning right into Button Street to access the Technology Precinct

Stage 2 When Russell Road/Rockingham Road is upgraded and grade separated

- When the ultimate road works are undertaken access to Rockingham Road will be lost due to the construction of the new southbound carriageway east of the existing southbound carriageway and the northbound carriageway becoming a service road.
- Good access should be maintained to the north via Old Rockingham Road to the future Beeliar Drive interchange. This access should connect to the new service road (current northbound carriageway of Rockingham Road) which is accessed by the east-west access roads
- Opportunities for left in/out to Rockingham Road from the service road should also be pursued to maintain permeability to the precinct, it is apparent those opportunities are limited due to ramp requirements for the interchange and the difference in levels between the current northbound and southbound carriageways.
- Benefits of providing and maintaining the northern access include:
    - provides ultimate access to precinct from all directions via Beeliar Dr and Russell Road.
    - allows buses to access the precinct from Rockingham Road north, for ultimate scenario
    - allows access from precinct to Beeliar Drive interchange.
    - no access through central residential area to north.
    - no additional impact to Controlled Access Highway
- The operation of the Russell Road/Coogee Road traffic signals should be reviewed and upgraded based on the prevailing traffic volumes. Analysis indicates that the initial geometry will not accommodate likely 2021 volumes. This intersection remains critical to providing good access to the Technology Precinct and should be carefully considered as part of the future upgrade of Russell Road.
- If good permeability is not achieved to the site as part of the long term planning congestion is likely to occur for traffic accessing the precinct.
- Stakeholders should further consider access opportunities, compatible with future major road planning.



Appendix A

Sidra Analysis

Button/Old Rockingham Rd
PM
Intersection ID:
Stop Sign Controlled Intersection

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
South: Button St												
1 LR	45		179	224	3				0.208	11.1	8	
	45	0	179	224	3				0.208	11.1	8	
East: Old Rockingham Rd E												
1 LT	77	251		328	3				0.174	2.1	0	
	77	251	0	328	3				0.174	2.1		
West: Old Rockingham Rd W												
1 T		251		251	3				0.131	0.0	0	
2 R			19	19	5				0.029	12.6	1	30
	0	251	19	270	3				0.131	0.9	1	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	822	3	0.208	4.2	8

Total flow period = 60 minutes. Peak flow period = 60 minutes.

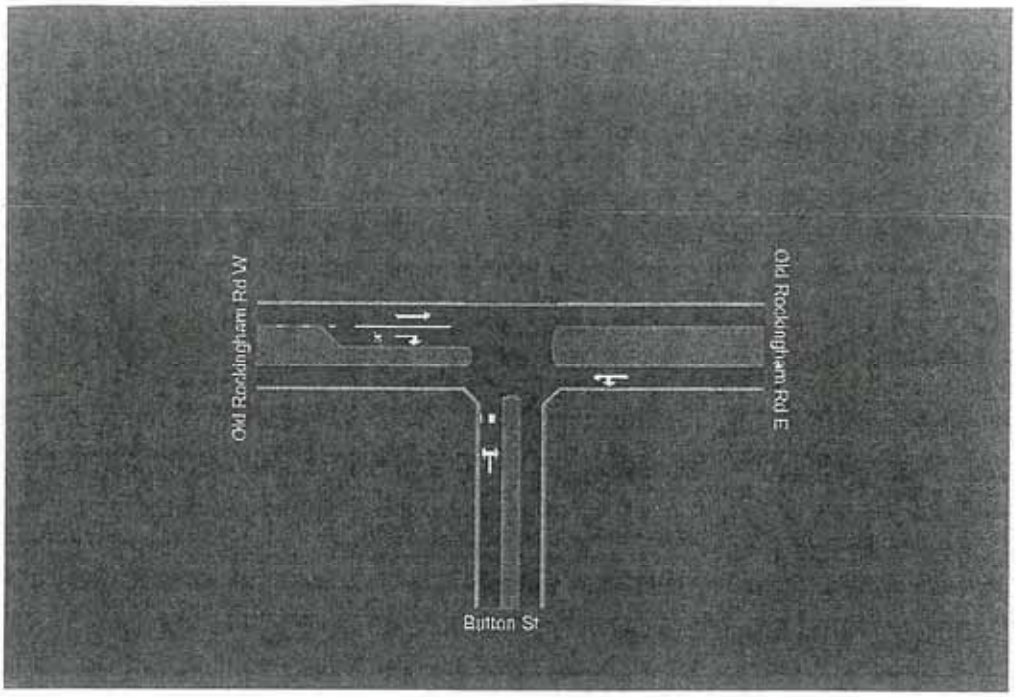
Queue values in this table are 95% back of queue (metres).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Button/Old Rockingham Rd
PM
Intersection ID:
Stop Sign Controlled Intersection

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
South: Button St						
1	L	45	216	0.208*	11.1	B
2	R	179	860	0.208*	11.1	B
		224	1076	0.208	11.1	B
East: Old Rockingham Rd E						
4	L	77	444	0.173	9.1	A
5	T	251	1446	0.174	0.0	A
		328	1890	0.174	2.1	A
West: Old Rockingham Rd W						
11	T	251	1910	0.131	0.0	A
12	R	19	645	0.029	12.6	B
		270	2555	0.131	0.9	A
ALL VEHICLES:		822	5521	0.208	4.2	A



Gardiner Road/Rockingham Road MTC Full Devt Current Vols PM
PM Assumes access to Button
Intersection ID:
Stop Sign Controlled Intersection

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
South: Rockingham Rd S												
1 L	72			72	4				0.040	10.8	0	
2 T		659		659	4				0.347	2.6	0	
3 T		659		659	4				0.347	2.6	0	
	72	1317	0	1389	4				0.347	3.0		
West: Gardiner Ave												
1 L	168			168	3				0.648	34.1	28	
	168	0	0	168	3				0.648	34.1	28	

ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	1557	4	0.649	6.3	28

Total flow period = 60 minutes. Peak flow period = 60 minutes.

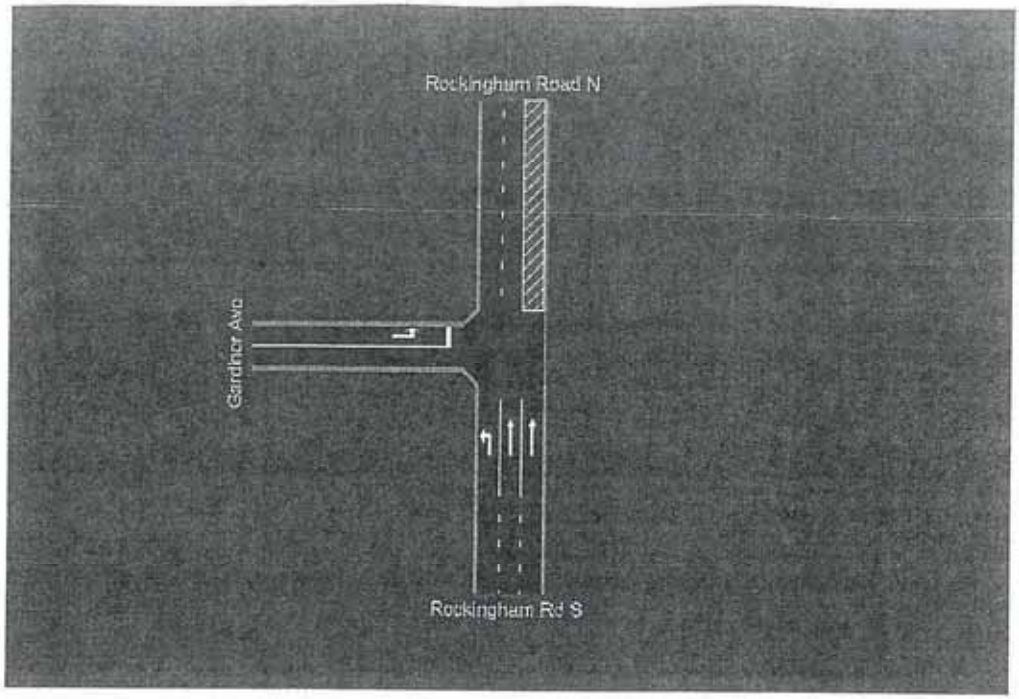
Queue values in this table are 95% back of queue (metres).

Note: Basic Saturation Flows are not adjusted at roundabouts or sign-controlled intersections and apply only to continuous lanes.

Gardiner Road/Rockingham Road MTC Full Devt Current Vols PM
PM Assumes access to Button
Intersection ID:
Stop Sign Controlled Intersection

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
South: Rockingham Rd S						
1	L	72	1803	0.040	10.8	B
2	T	1317	3801	0.346	2.6	A
		1389	5604	0.346	3.0	A
West: Gardiner Ave						
10	L	168	259	0.649*	34.1	D
		168	259	0.649	34.1	D
ALL VEHICLES:		1557	5863	0.649	6.3	A



Gardiner Road/Rockingham Road MTC Full Devt Current Vols PM
PM Assumes NO access to Button
Intersection ID:
Stop Sign Controlled Intersection

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
South: Rockingham Rd S												
1 L	108			108	4				0.060	10.8	0	
2 T		685		685	4				0.360	2.6	0	
3 T		685		685	4				0.360	2.6	0	
	108	1369	0	1477	4				0.360	3.2		
West: Gardiner Ave												
1 L	252			252	3				1.065	197.2	232	
	252	0	0	252	3				1.065	197.2	232	

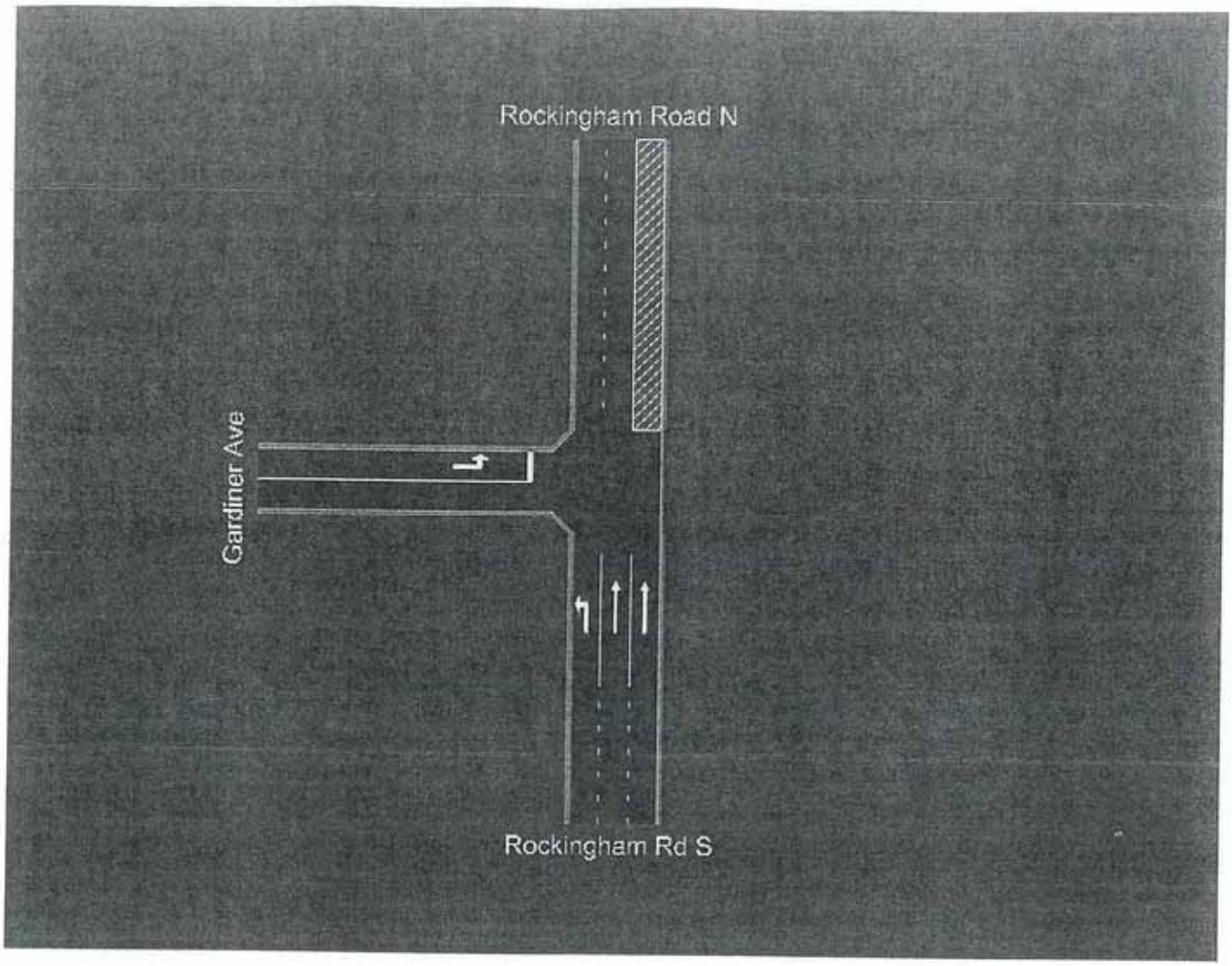
ALL VEHICLES	Total Flow	% HV	Max X	Aver. Delay	Max Queue
	1729	4	1.063	31.5	232

Total flow period = 60 minutes. Peak flow period = 60 minutes.

Gardiner Road/Rockingham Road MTC Full Devt Current Vols PM
PM Assumes NO access to Button
Intersection ID:
Stop Sign Controlled Intersection

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
South: Rockingham Rd S						
1	L	108	1809	0.060	10.8	B
2	T	1369	3801	0.360	2.6	A
		1477	5610	0.360	3.2	A
West: Gardiner Ave						
10	L	252	237	1.063*	197.2	F
		252	237	1.063	197.2	F
ALL VEHICLES:		1729	5847	1.063	31.5	D



Russell Road/Coogee Road Full Development of MTC and AMC Vols
PM Peak Signals (Access to Button assumed) Single Thro Lanes
Intersection ID:
Fixed-Time Signals, Cycle Time = 46

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
East: Russell Road East												
1 T		186		186	4	2024	28		0.155	4.2	19	
2 R			130	130	4	2024	6		0.531	30.9	30	150
	0	186	130	316	4				0.531	15.2	30	
North: Coogee Road												
1 L	493			493	3	2024	18		0.668	22.4	81	
2 R			70	70	3	2024	6		0.284	29.8	16	
	493	0	70	563	3				0.668	23.4	81	
West: Russell Road West												
1 L	116			116	4	2024	4	28	0.095	9.7	6	80
2 T		604		604	4	2024	16		0.880	25.2	132	
	116	604	0	720	4				0.880	22.7	132	

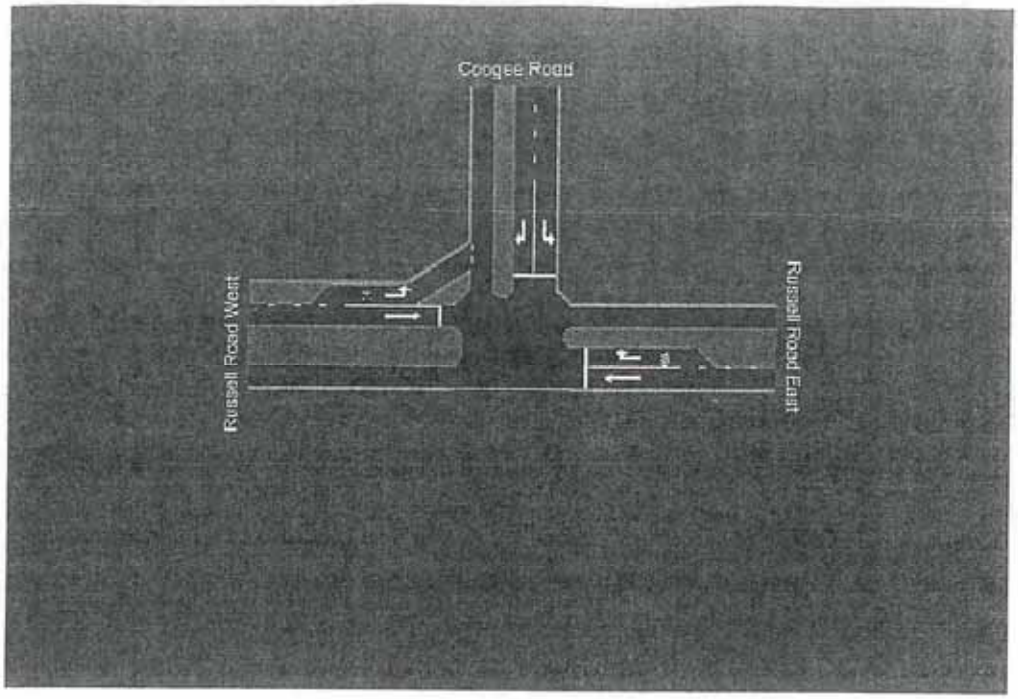
ALL VEHICLES	Total Flow	% HV	Cycle Time	Max X	Aver. Delay	Max Queue
	1599	4	46	0.880	21.5	132

Total flow period = 60 minutes. Peak flow period = 60 minutes.

Russell Road/Coogee Road Full Development of MTC and AMC Vols
PM Peak Signals (Access to Button assumed) Single Thro Lanes
Intersection ID:
Fixed-Time Signals, Cycle Time = 46

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Green Time Ratio (g/C) 1st grn	2nd grn	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
Russell Road East								
2	T	0.609		186	1203	0.155	4.2	A
4	R	0.130*		130	245	0.531	30.9	C
				316	1447	0.531	15.2	B
Coogee Road								
7	L	0.391		493	738	0.668	22.4	C
9	R	0.130*		70	246	0.284	29.8	C
				563	985	0.668	23.4	C
Russell Road West								
10	L (Und)	0.087	0.609	116	1216<	0.095	9.7	A
12	T	0.348*		604	686	0.880*	25.2	C
				720	1902	0.880	22.7	C
ALL VEHICLES:				1599	4334	0.880	21.5	C
INTERSECTION (persons):				2399	4334	0.880	21.5	

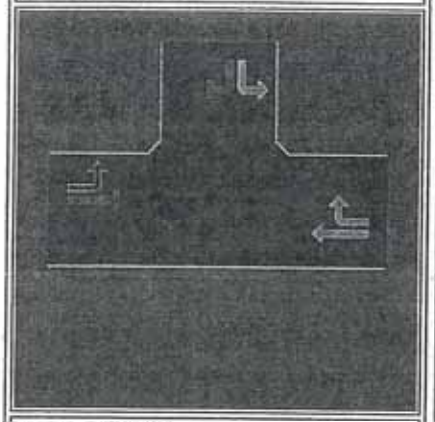
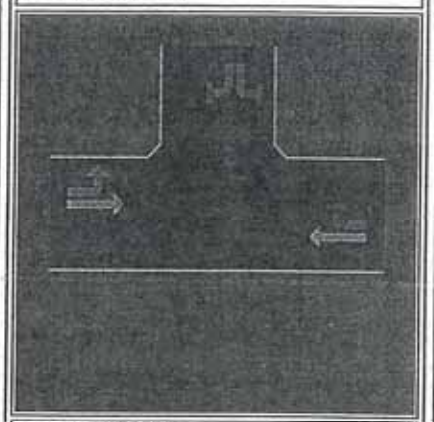
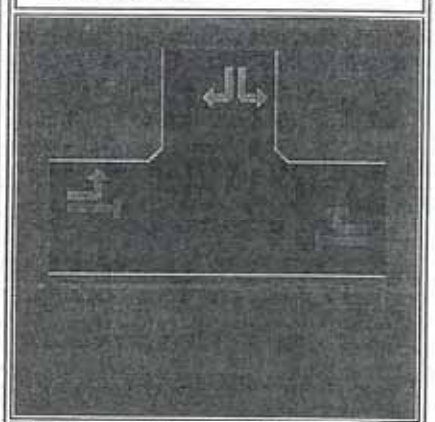


Phasing

akcelik & associates
aaTraffic SIDRA

Russell Road/Coogee Road Full Development of MTC and AMC Vols

C = **46** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase D	Phase B	Phase A
		
G = **6** seconds G + I = **12** seconds (G + I)/C = **26.1** %	G = **16** seconds G + I = **22** seconds (G + I)/C = **47.8** %	G = **6** seconds G + I = **12** seconds (G + I)/C = **26.1** %

Normal Vehicle | Permitted/Opposed | Stopped Vehicle
Slip-Lane | Opposed Slip-Lane | Continuous
Pedestrian | Turn On Red | Dummy

C Cycle Time
G Green Time
I Intergreen Time (yellow plus all-red)
(G + I)/C Phase time as a percentage of cycle

N:\61\14418\Revised November04 \RussellCoogee\RussellCoogeeSignalsMTP+AMCVolsAccesstoButtonSingle Thro Lanes
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Russell Road/Coogee Road Full Development of MTC and AMC Vols
PM Peak Signals (NO Access to Button assumed) Single Thro Lanes
Intersection ID:
Fixed-Time Signals, Cycle Time = 46

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
East: Russell Road East												
1 T		186		186	4	2024	28		0.155	4.2	19	
2 R			144	144	4	2024	6		0.590	31.4	34	150
	0	186	144	330	4				0.590	16.1	34	
North: Coogee Road												
1 L	542			542	3	2024	18		0.734	24.1	94	
2 R			78	78	3	2024	6		0.316	29.9	18	
	542	0	78	620	3				0.734	24.8	94	
West: Russell Road West												
1 L	127			127	4	2024	3	28	0.104	9.9	7	80
2 T		604		604	4	2024	16		0.880	25.2	132	
	127	604	0	731	4				0.880	22.6	132	

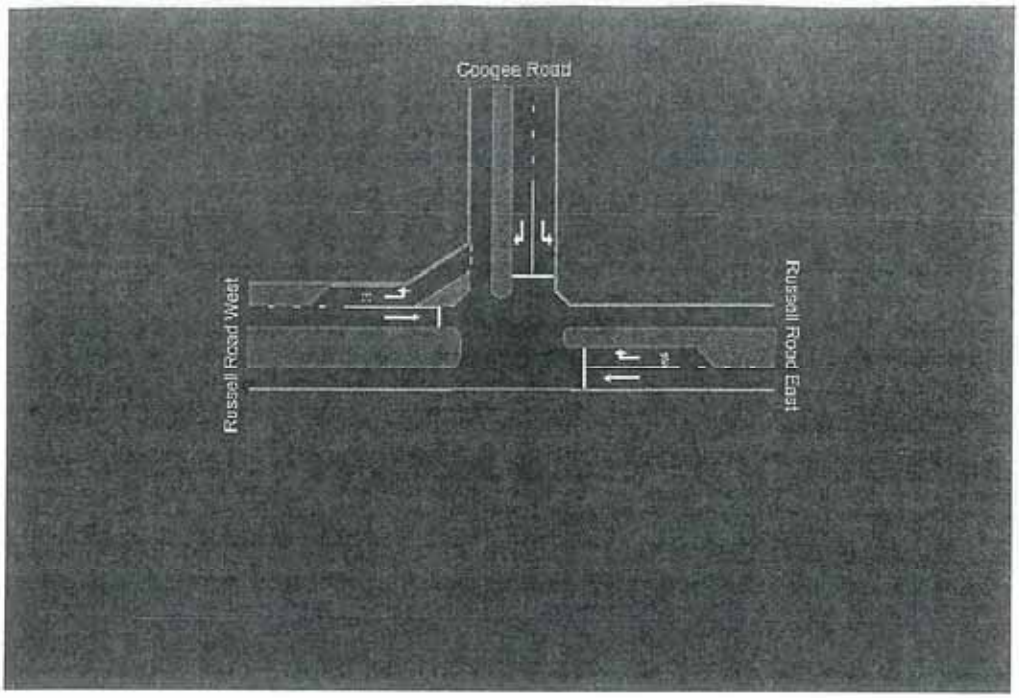
ALL VEHICLES	Total Flow	% HV	Cycle Time	Max X	Aver. Delay	Max Queue
	1681	4	46	0.880	22.1	132

Total flow period = 60 minutes. Peak flow period = 60 minutes.

Russell Road/Coogee Road Full Development of MTC and AMC Vols
PM Peak Signals (NO Access to Button assumed) Single Thro Lanes
Intersection ID:
Fixed-Time Signals, Cycle Time = 46

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Green Ratio (g/C) 1st grn	Green Ratio (g/C) 2nd grn	Time Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
Russell Road East								
2	T	0.609		186	1203	0.155	4.2	A
4	R	0.130*		144	244	0.590	31.4	C
				330	1447	0.590	16.1	B
Coogee Road								
7	L	0.391		542	739	0.734	24.1	C
9	R	0.130*		78	247	0.316	29.9	C
				620	986	0.734	24.8	C
Russell Road West								
10	L (Und)	0.065	0.609	127	1218<	0.104	9.9	A
12	T	0.348*		604	686	0.880*	25.2	C
				731	1904	0.880	22.6	C
ALL VEHICLES:				1681	4336	0.880	22.1	C
INTERSECTION (persons):				2522	4336	0.880	22.1	



Russell Road/Rockingham Road PM Peak Hour MPT+ AMC Vols
Accessto Button PM
Intersection ID:
Fixed-Time Signals, Cycle Time = 73

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
South: Rockingham Road South												
1 L	217			217	4	1950	12	48	0.170	9.1	10	80
2 T		524		524	4	1950	23		0.875	35.9	162	
3 T		524		524	4	1950	23		0.875	35.9	162	
	217	1048	0	1265	4				0.875	31.3	162	
North: Rockingham Road N												
1 T		540		540	4	1950	42		0.493	9.9	93	
2 T		540		540	4	1950	42		0.493	9.9	93	
3 R			93	93	4	1950	13	4	0.214	22.0	17	80
	0	1079	93	1172	4				0.493	10.8	93	
West: Russell Road												
1 L	341			341	4	1950	4	38	0.319	14.8	51	150
2 R			363	363	4	1950	19		0.771	39.5	105	
3 R			363	363	4	1950	19		0.771	39.5	105	
	341	0	725	1066	4				0.771	31.6	105	
Pedestrians												
Across N approach				21			6		0.021	30.7	0.1	
Across W approach				20			6		0.020	30.7	0.1	

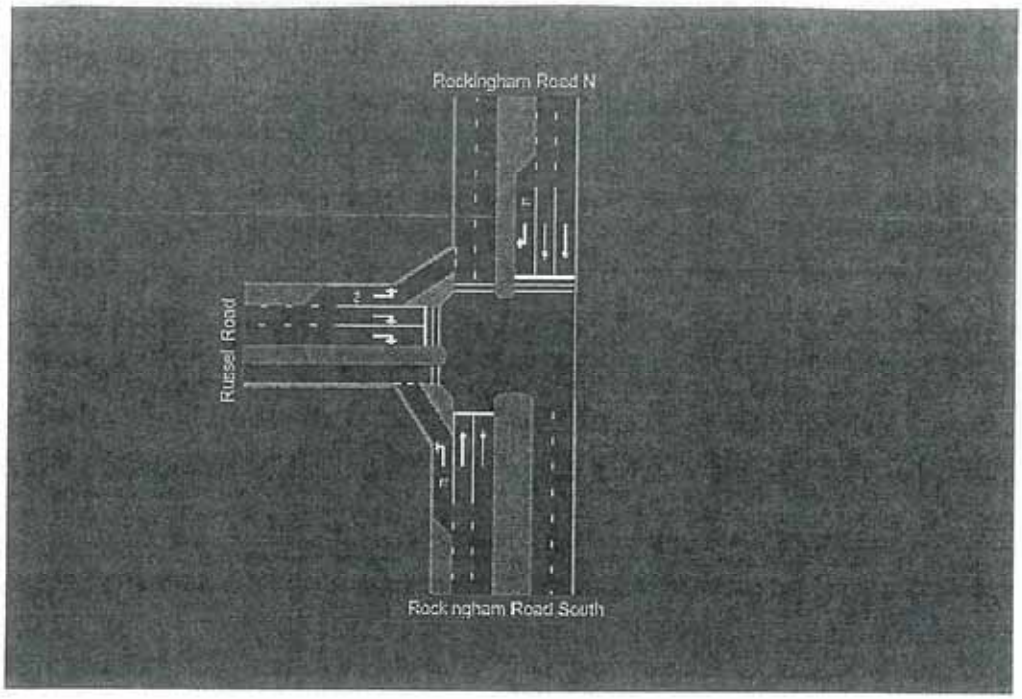
ALL VEHICLES	Total Flow	% HV	Cycle Time	Max X	Aver. Delay	Max Queue
	3503	4	73	0.875	24.5	162

Total flow period = 60 minutes. Peak flow period = 60 minutes.

Russell Road/Rockingham Road PM Peak Hour MPT+ AMC Vols
Accessto Button PM
Intersection ID:
Fixed-Time Signals, Cycle Time = 73

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Green Ratio 1st grn	Green Ratio 2nd grn	Time (g/C)	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
South: Rockingham Road South									
1	L (Und)	0.164	0.658		217	1274<	0.170	9.1	A
2	T	0.315*			1048	1198	0.875*	35.9	D
					1265	2472	0.875	31.3	C
North: Rockingham Road N									
8	T	0.575			1079	2187	0.493	9.9	A
9	R	0.178*	0.055		93	436	0.213	22.0	C
					1172	2623	0.493	10.8	B
West: Russell Road									
10	L (Und)	0.055	0.521		341	1070	0.319	14.8	B
12	R	0.260*			725	940	0.771	39.5	D
					1066	2010	0.771	31.6	C
Pedestrians									
55	(Ped)	0.082			21	986	0.021	30.7	D
57	(Ped)	0.082			20	986	0.020	30.7	D
					41	1973	0.021	30.7	D
ALL VEHICLES:					3503	7104	0.875	24.5	C
INTERSECTION (persons):					5296	7104	0.875	24.6	



Russell Road/Rockingham Road PM Peak Hour MPT+ AMC Vols
NO Accessto Button PM
Intersection ID:
Fixed-Time Signals, Cycle Time = 75

Table S.14 - SUMMARY OF INPUT AND OUTPUT DATA

Lane No.	Demand Flow (veh/h) L	T	R	Tot	%HV	Adj. Basic Satf.	Eff Grn (secs) 1st	2nd	Deg Sat x	Aver. Delay (sec)	Longest Queue (m)	Shrt Lane (m)
South: Rockingham Road South												
1 L	226			226	4	1950	12	50	0.178	9.1	10	80
2 T		560		560	4	1950	25		0.884	37.1	178	
3 T		560		560	4	1950	25		0.884	37.1	178	
	226	1120	0	1346	4				0.884	32.4	178	
North: Rockingham Road N												
1 T		540		540	4	1950	44		0.484	9.6	93	
2 T		540		540	4	1950	44		0.484	9.6	93	
3 R			97	97	4	1950	13	5	0.228	22.2	17	80
	0	1079	97	1176	4				0.484	10.6	93	
West: Russell Road												
1 L	357			357	4	1950	5	38	0.342	15.8	56	150
2 R			379	379	4	1950	19		0.828	43.9	118	
3 R			379	379	4	1950	19		0.828	43.9	118	
	357	0	758	1115	4				0.828	34.9	118	
Pedestrians												
Across N approach				21			6		0.022	31.7	0.1	
Across W approach				20			6		0.021	31.7	0.1	

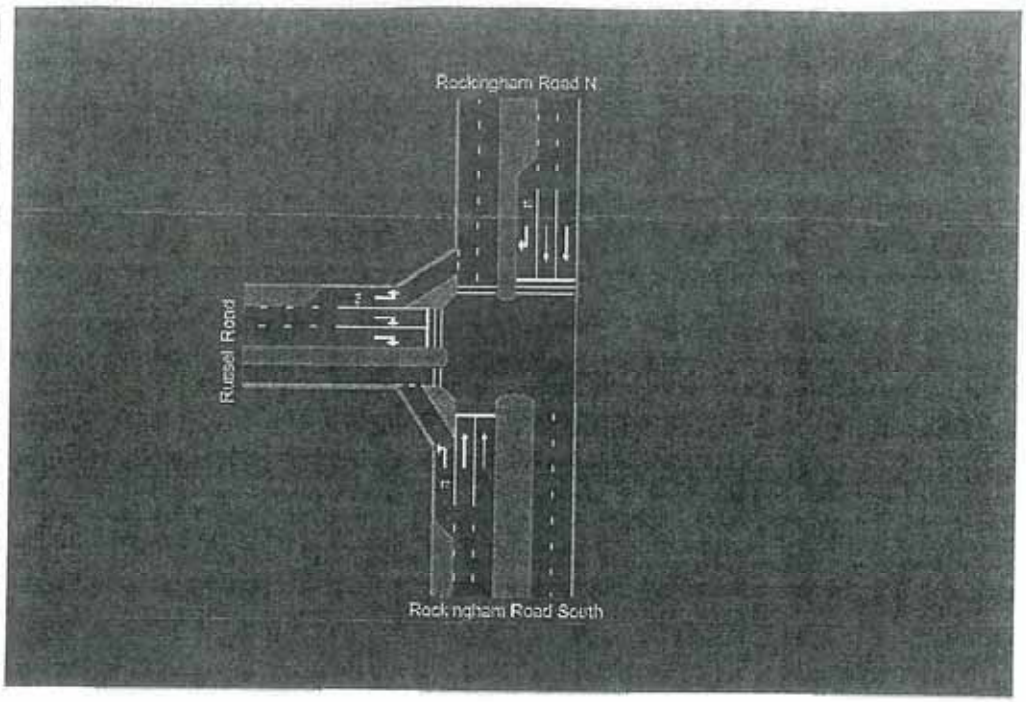
ALL VEHICLES	Total Flow	% HV	Cycle Time	Max X	Aver. Delay	Max Queue
	3637	4	75	0.884	26.1	178

Total flow period = 60 minutes. Peak flow period = 60 minutes.

Russell Road/Rockingham Road PM Peak Hour MPT+ AMC Vols
NO Accessto Button PM
Intersection ID:
Fixed-Time Signals, Cycle Time = 75

Table S.15 - CAPACITY AND LEVEL OF SERVICE

Mov No.	Mov Typ	Green Ratio 1st grn	Green Ratio 2nd grn	Time (g/C)	Total Flow (veh /h)	Total Cap. (veh /h)	Deg. of Satn (v/c)	Aver. Delay (sec)	LOS
South: Rockingham Road South									
1	L (Und)	0.160	0.667		226	1269<	0.178	9.1	A
2	T	0.333*			1120	1267	0.884*	37.1	D
					1346	2536	0.884	32.4	C
North: Rockingham Road N									
8	T	0.587			1079	2231	0.484	9.6	A
9	R	0.173*	0.067		97	425	0.228	22.2	C
					1176	2655	0.484	10.6	B
West: Russell Road									
10	L (Und)	0.067	0.507		357	1044	0.342	15.8	B
12	R	0.253*			758	915	0.828	43.9	D
					1115	1959	0.828	34.9	C
Pedestrians									
55	(Ped)	0.080			21	960	0.022	31.7	D
57	(Ped)	0.080			20	960	0.021	31.7	D
					41	1920	0.022	31.7	D
ALL VEHICLES:					3637	7149	0.884	26.1	C
INTERSECTION (persons):					5497	7149	0.884	26.2	

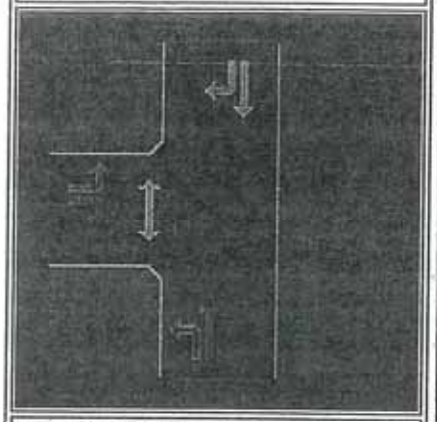
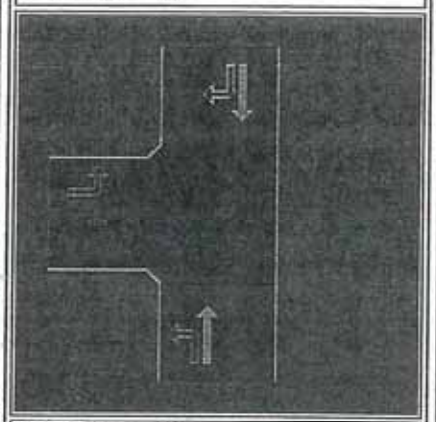
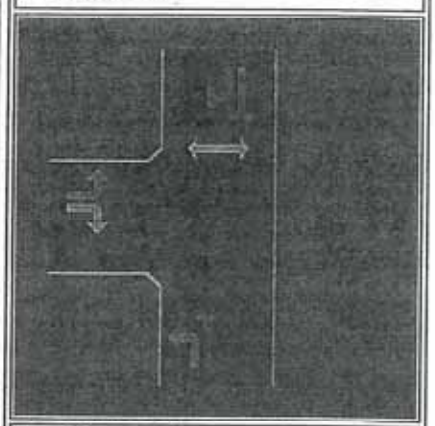


Phasing

akcelik & associates
aaTraffic SIDRA

Russell Road/Rockingham Road PM Peak Hour MPT+ AMC Vols

C = **75** seconds
Cycle Time Option: **Program calculated cycle time**
Phase times determined by the program.

Phase C	Phase A	Phase B
		
G = **13** seconds G + I = **19** seconds (G + I)/C = **25.3** %	G = **25** seconds G + I = **31** seconds (G + I)/C = **41.3** %	G = **19** seconds G + I = **25** seconds (G + I)/C = **33.3** %

Normal Vehicle | Permitted/Opposed | Stopped Vehicle
Slip-Lane | Opposed Slip-Lane | Continuous
Pedestrian | Turn On Red | Dummy

C Cycle Time
G Green Time
I Intergreen Time (yellow plus all-red)
(G + I)/C Phase time as a percentage of cycle

N:\61\14418\Revised November04
\RockinghamRussell\RussellRockinghamRdPMMTP+AMCDevtNOAccesstoButton
Produced by aaSIDRA 2.0.0.205

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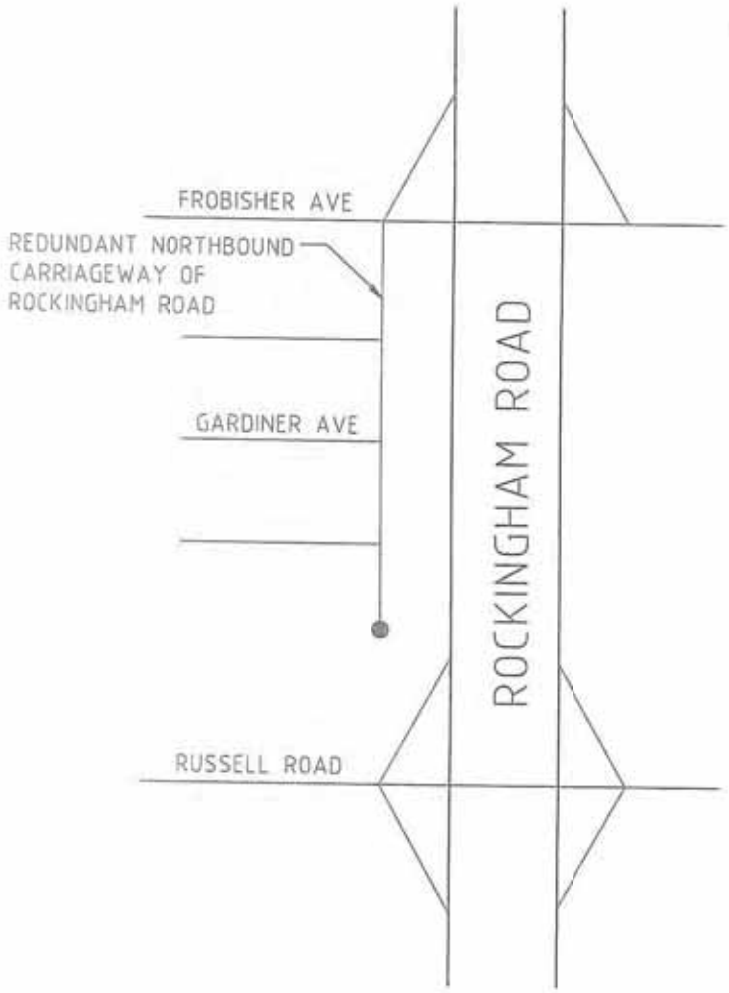
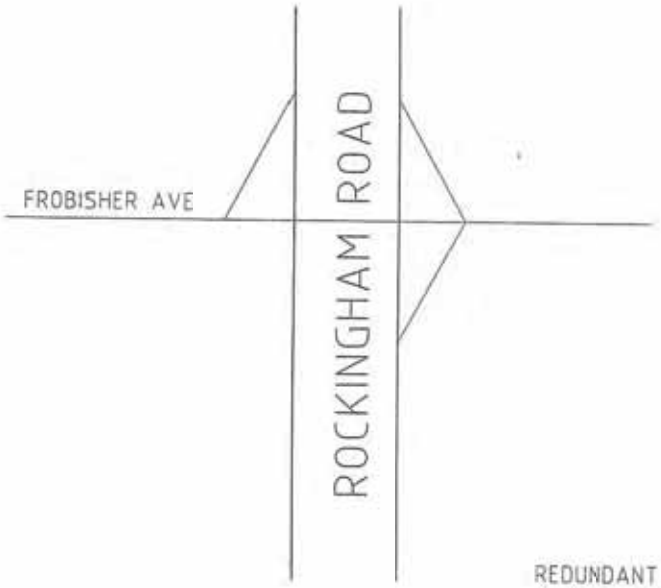
Appendix B

Ultimate Access



OPTION 1



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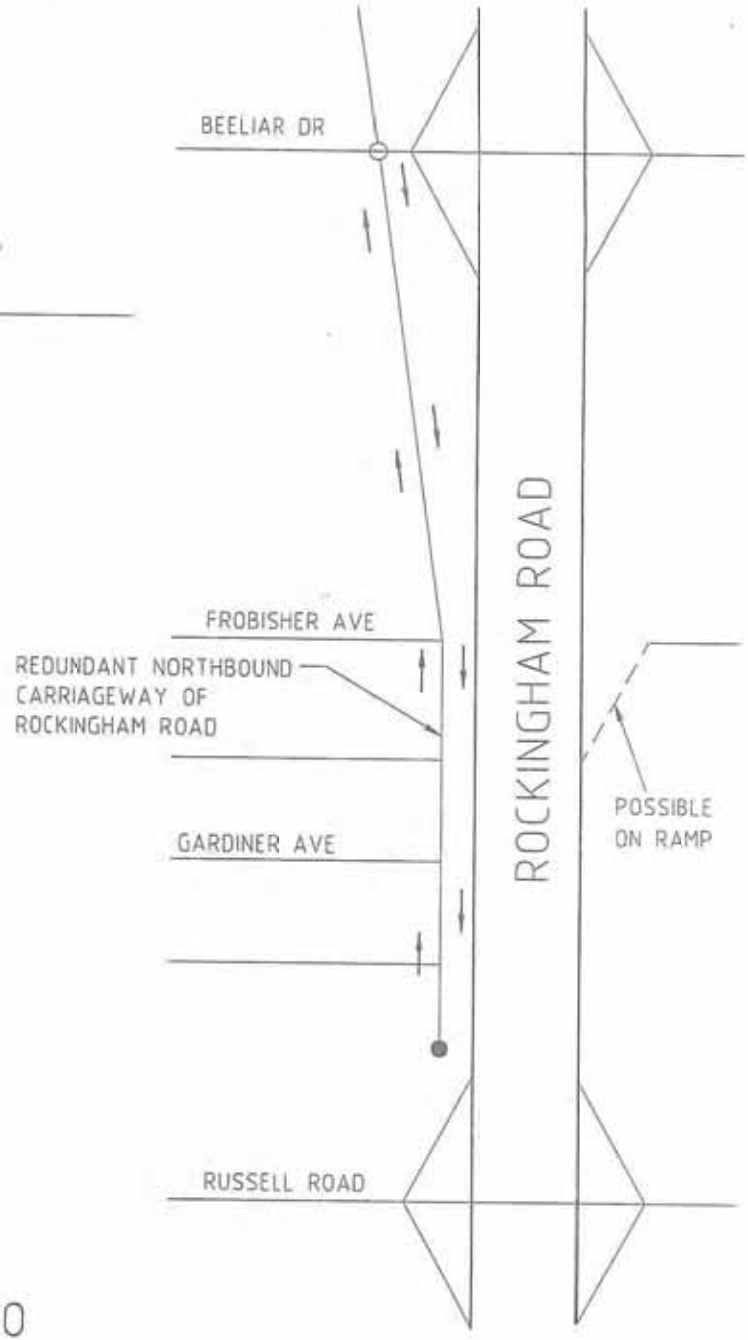
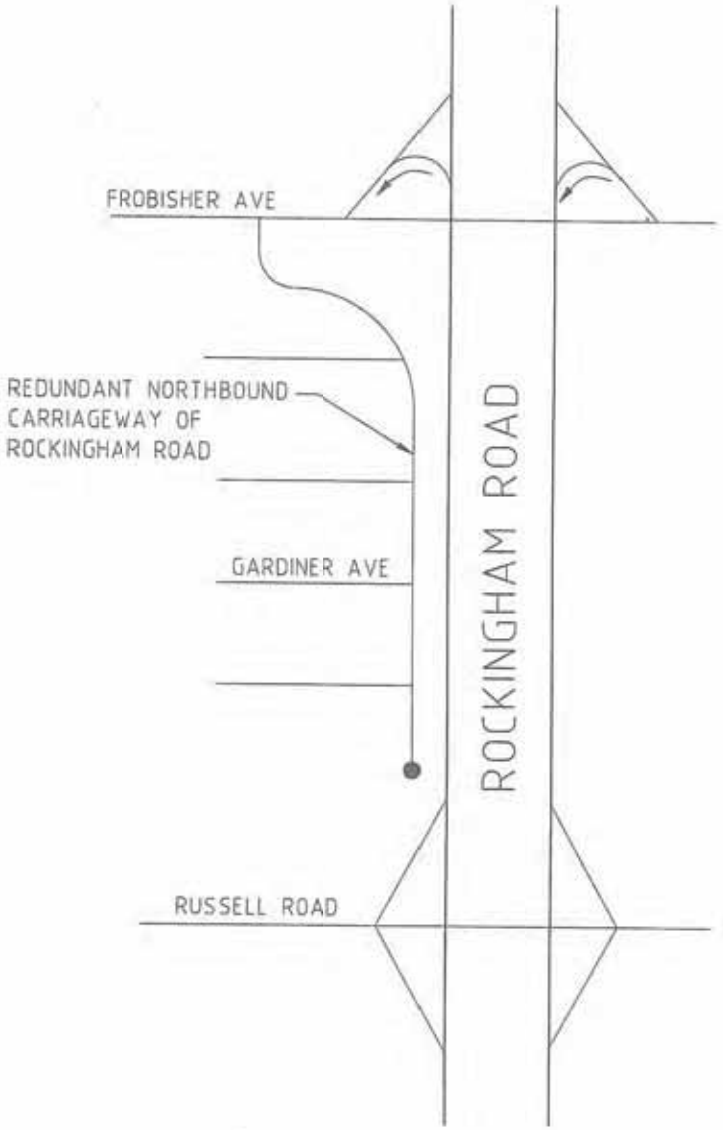


OPTION 3

ULTIMATE ACCESS TO ROCKINGHAM ROAD

GHD
MANAGEMENT
ENGINEERING
ENVIRONMENT

S MCDERMOTT/J CORBY 22/01/04
JOB 61/14418 DRG FIG 1 REV A
PATH N:\61\14418\CAD\FIG1.DWG



OPTION 4

GHD
MANAGEMENT
ENGINEERING
ENVIRONMENT

S MCDERMOTT / J CORBY 22/01/04
JOB 61/14418 DRG FIG 2 REV A
PATH N:\61\14418\CAD\FIG2.DWG

ULTIMATE ACCESS TO ROCKINGHAM ROAD

GHD Pty Ltd ABN 39 008 488 373

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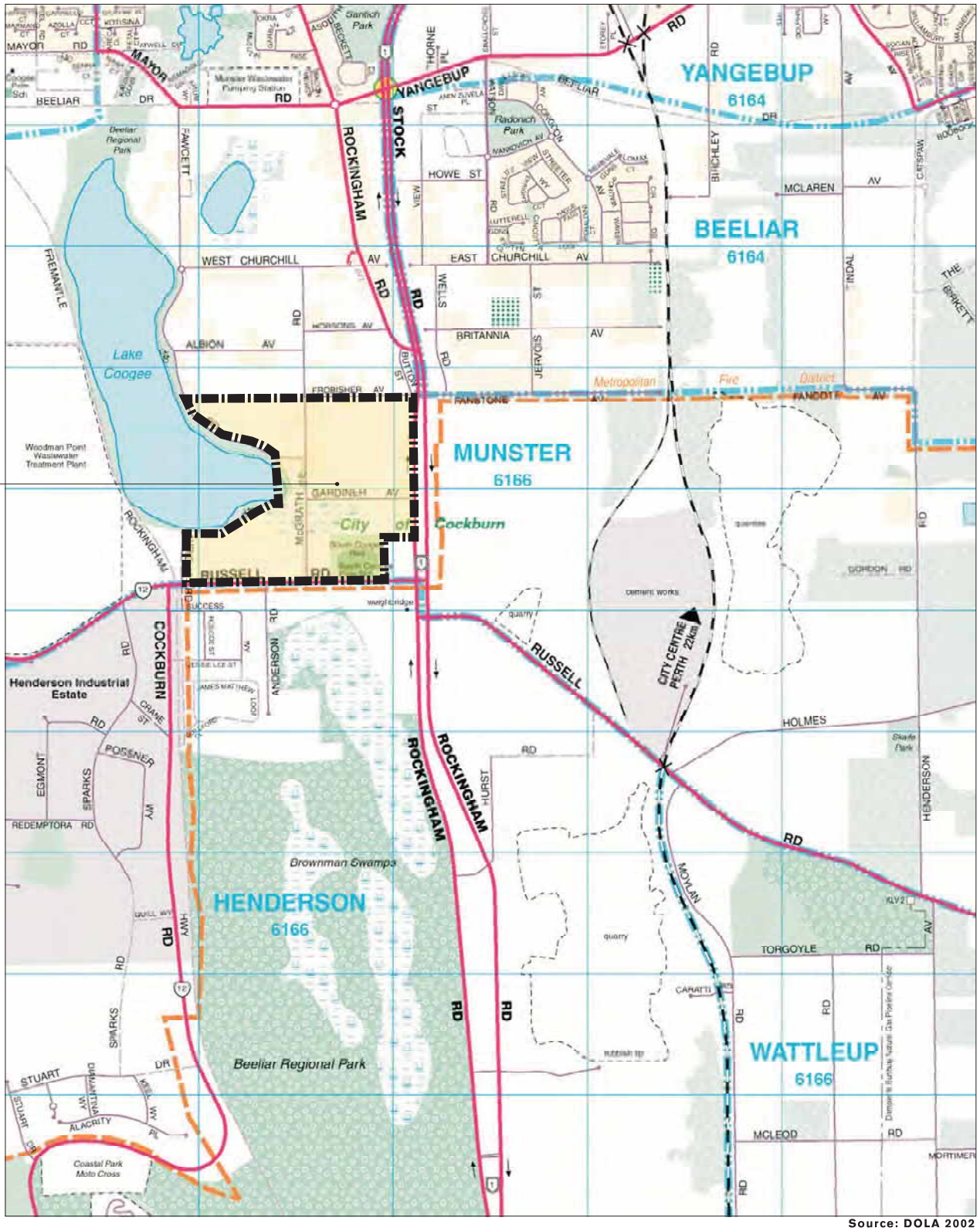
T: 61 8 9429 6666 F: 61 8 9429 6555 E: permail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
B1	S McDermott	M Ryan		M Ryan		11/04



Source: DOLA 2002

Figure No: 1

Title: **Location Plan**

Date: 27 April 2006 Revision No: 1

Scale: Refer to Scale Bar Job No: 705.072

Designer: M.R. Drawn: S.L.

E Reference: Location Plan.fh10

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0 200 400 600 800 1000

metres

N

Figure No: 2

Title: **Aerial Photo**

Date: 27 April 2004 Revision No: 1

Scale: Refer to Scale Bar Job No: 705.072

Designer: M.R. Drawn: L.C.

E Reference: Aerial-A3.fh10

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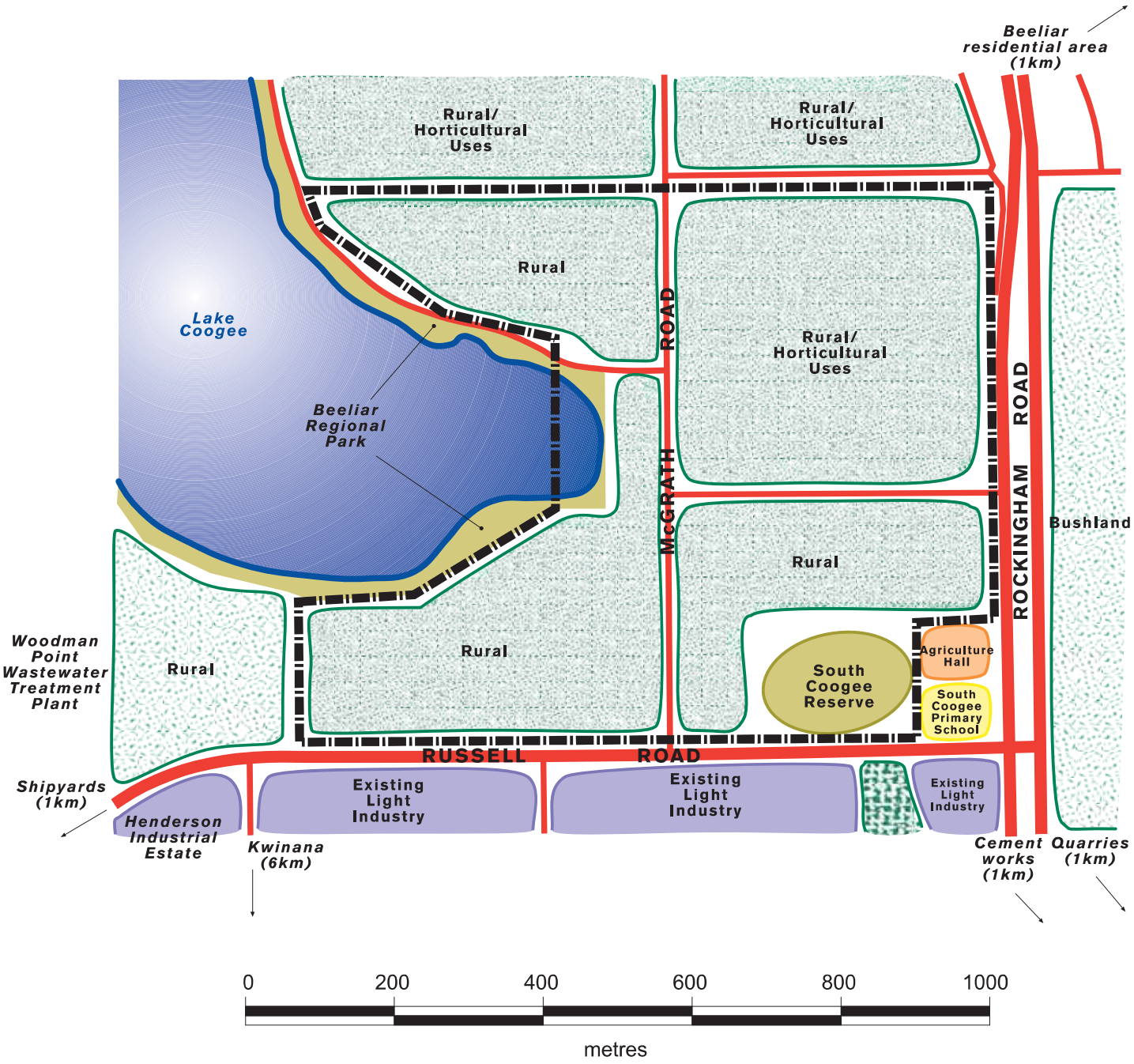

N

Figure No: 3

Title: **Context Analysis**

Date: 27 April 2006 Revision No: 1

Scale: Refer to Scale Bar Job No: 705.072

Designer: M.R. Drawn: S.L.

E Reference: Context-A3.fh10

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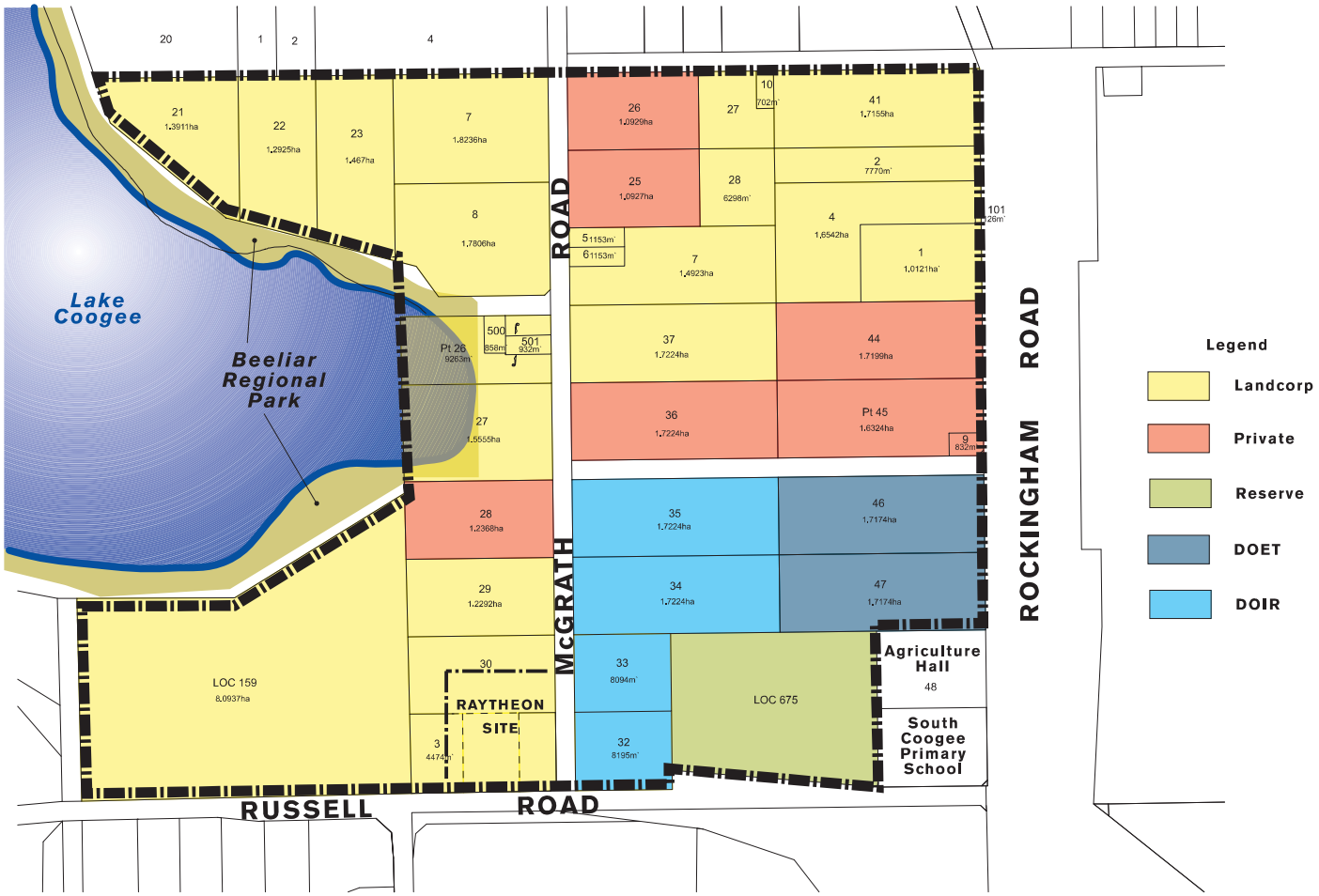

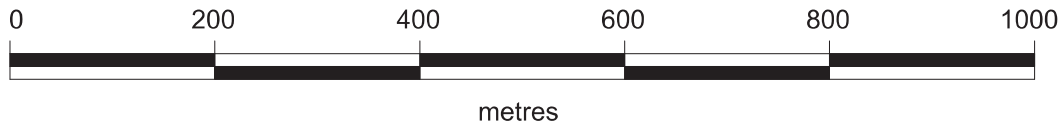

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Figure No: 4

Title: **Land Ownership**

Date: 27 April 2006 Revision No: 1

Scale: Refer to Scale Bar Job No: 705,072

Designer: M.R. Drawn: S.L.

E Reference: Ownership-A3.fh10

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Figure No: 5

THE PLANNING GROUP

Title: Heritage
Australian Marine Complex, Munster

Date: 1 May 2006 Revision No: 3V

Scale: 1:3500 @ A3 Job No: 703.072

Designer: PS Drawn: SL

E Reference: 703.072.CP-3V - Heritage.dgn

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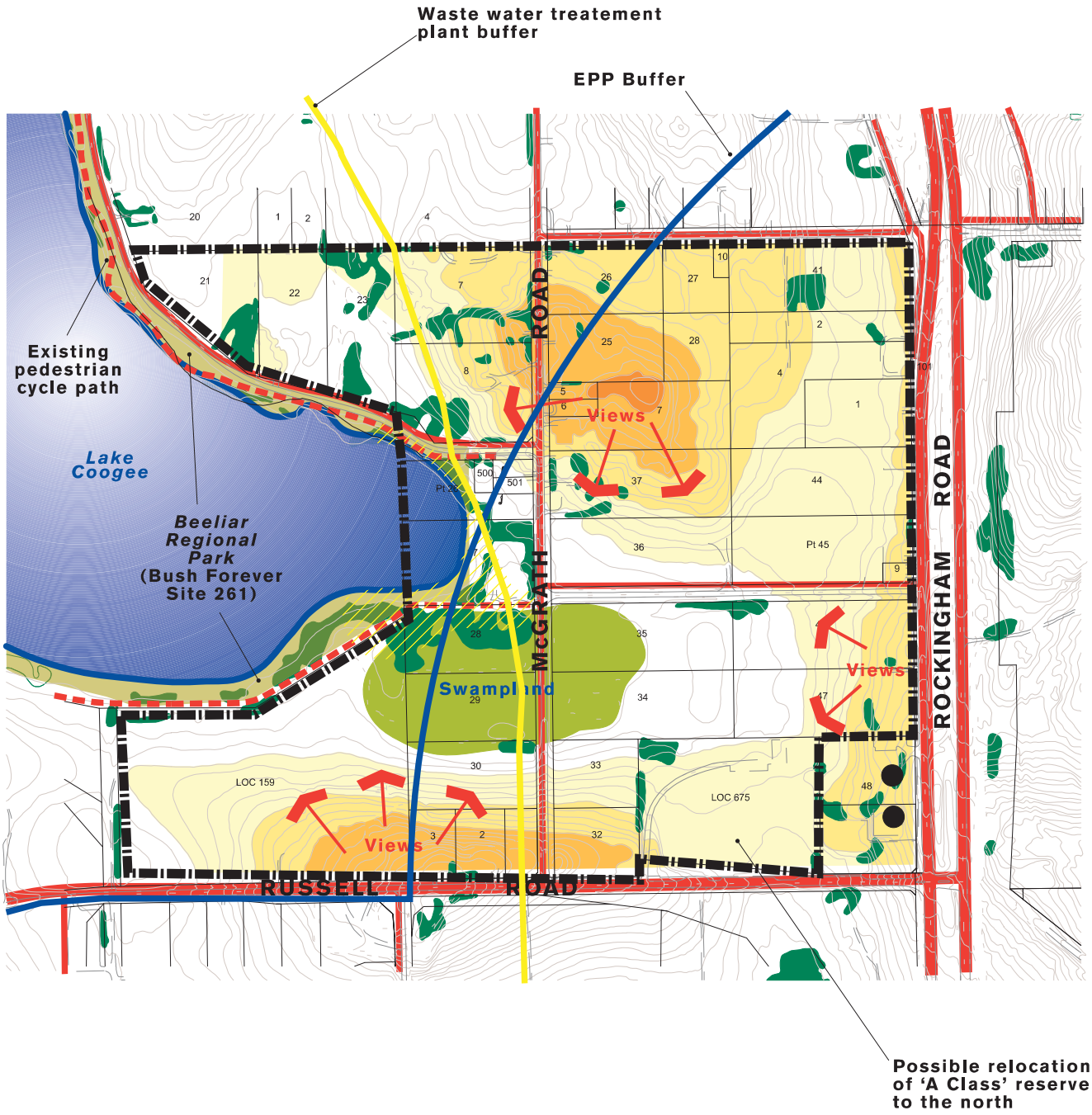

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Figure No: 6

Title: **Site Analysis**

Date: 27 April 2006 Revision No: 1

Scale: Refer to Scale Bar Job No: 705,072

Designer: M.R Drawn: S.L.

E Reference: Site-A3.fh10

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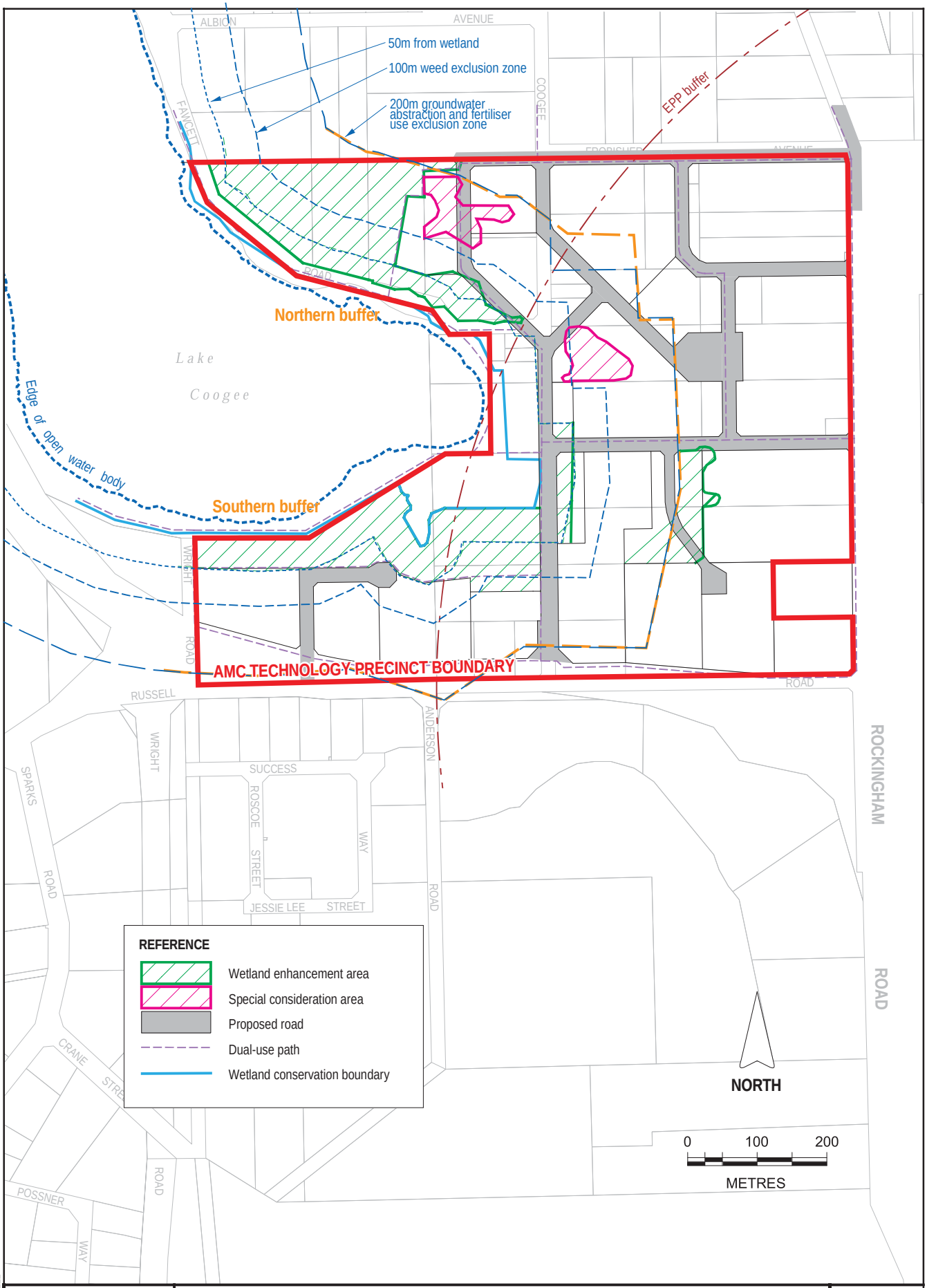

strategen

ENVIRONMENTAL GIS (08) 9486 9222

0421_Stage1_F7.dgn

LandCorp

AUSTRALIAN MARINE COMPLEX - TECHNOLOGY PRECINCT

PROPOSED WETLAND BUFFER STRATEGY

Figure 7

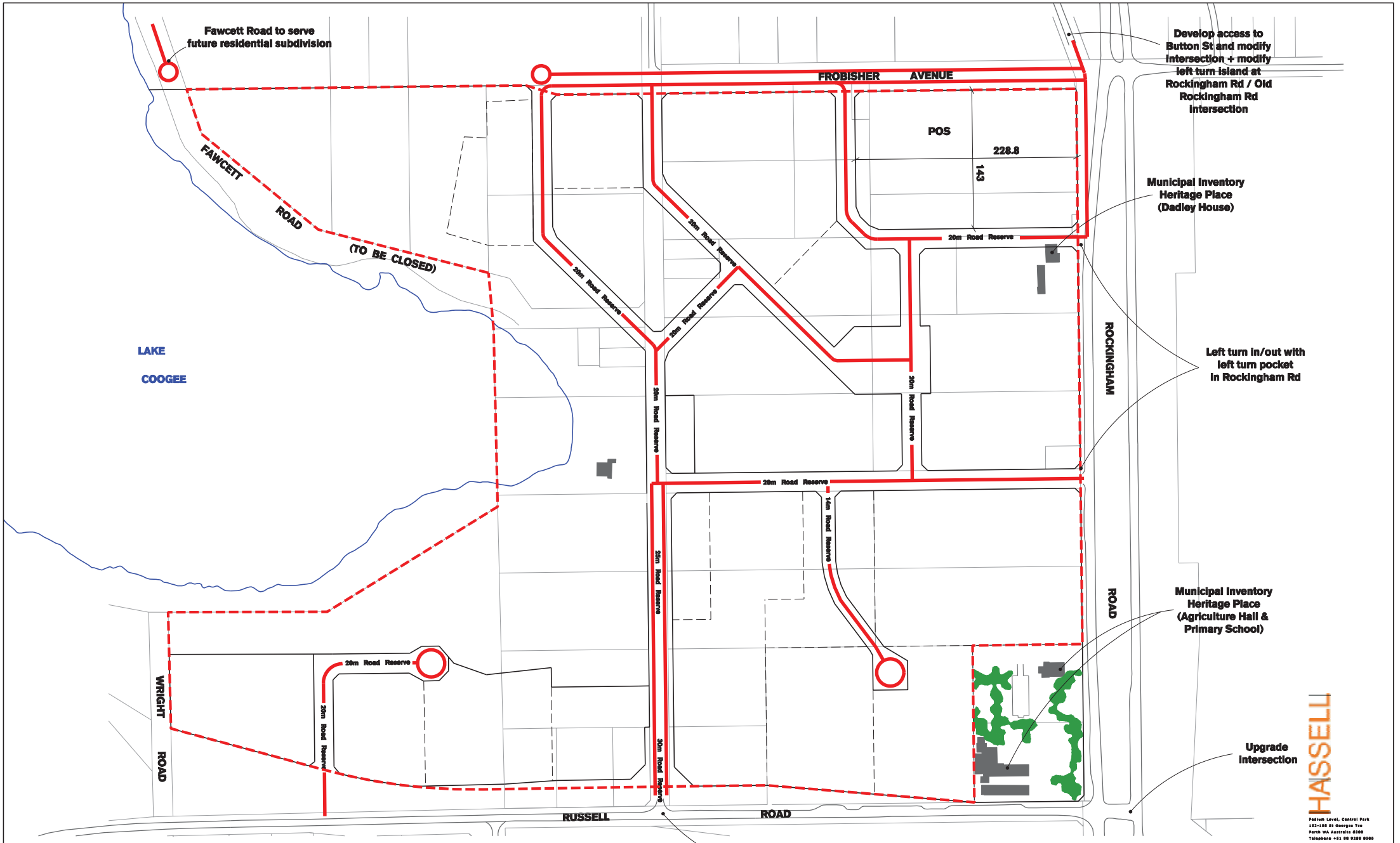

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Figure No: 8

THE PLANNING GROUP

Title: Interim Access Strategy
Australian Marine Complex, Munster

Date: 1 May 2006 Revision No: 3V

Scale: 1:3500 @ A3 Job No: 705.072

Designer: PS Drawn: SL

E Reference: 705.072.CP-3v - Interim Access.dgn

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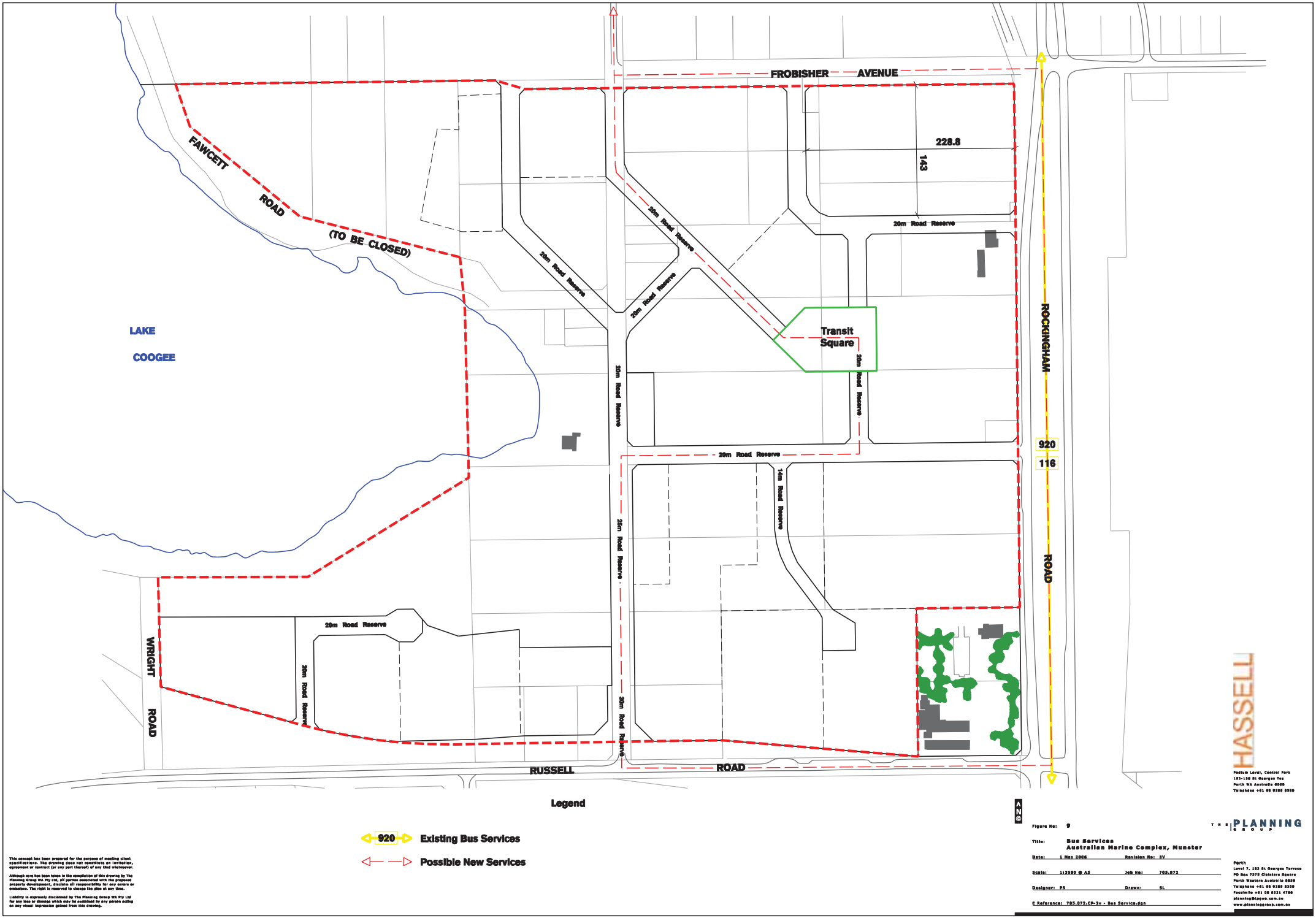

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426

Figure No: 9

THE PLANNING GROUP

Title: Bus Services
Australian Marine Complex, Munster

Date: 1 May 2006 Revision No: 2V

Scale: 1:3500 @ A3 Job No: 785.072

Designer: PS Drawn: SL

E Reference: 785.072.CP-3v - Bus Service.dgn

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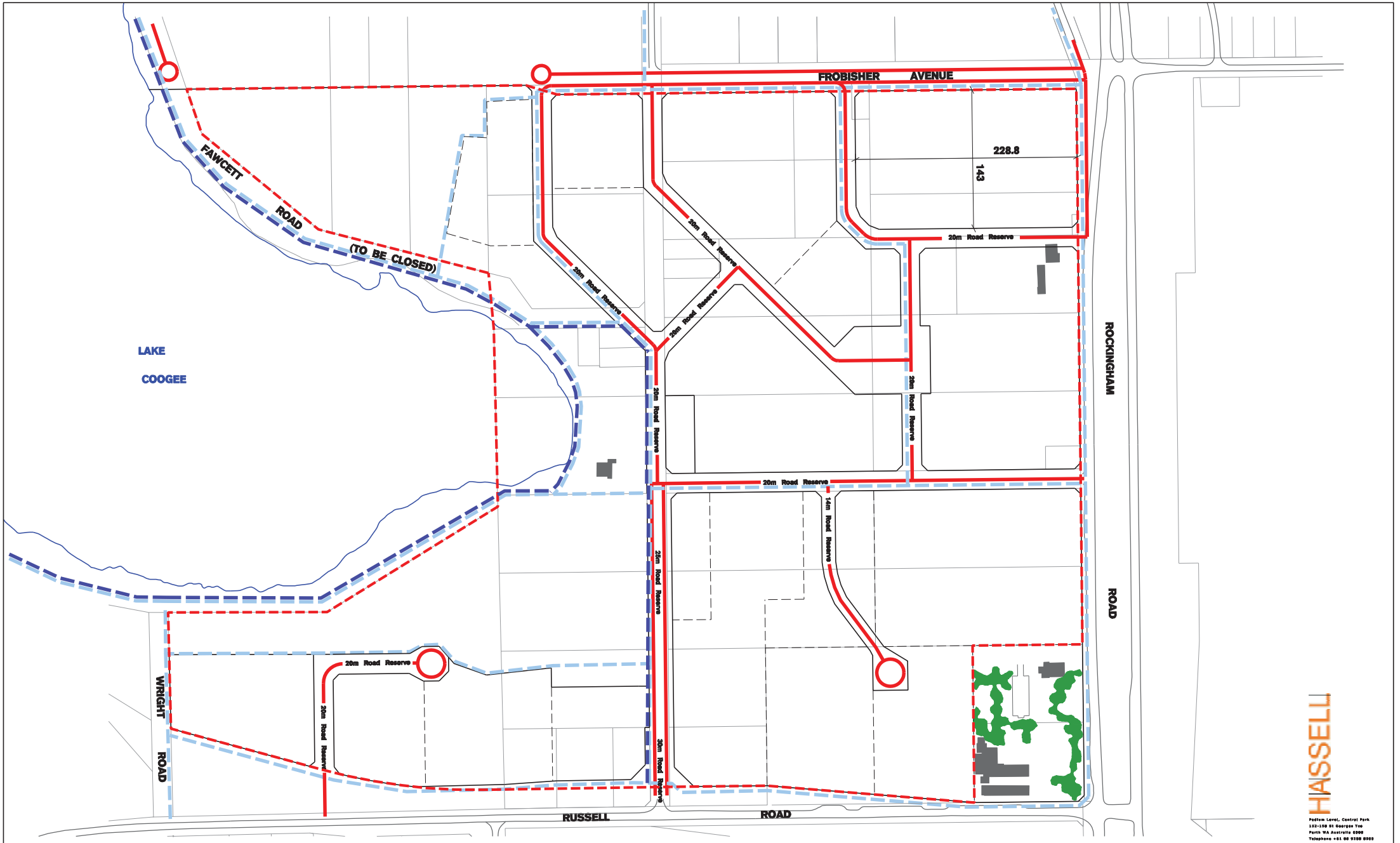

Legend

- Proposed road
- Proposed Dual-use path
- Existing Dual-use path

Figure No: 10

Title: Pedestrian/Cyclist Facilities
Australian Marine Complex, Munster

Date: 1 May 2006 Revision No: 3V

Scale: 1:3500 @ A3 Job No: 705.07

Designer: PS Drawn: SL

E Reference: 705.07.CP-3v - Pedestrian Cyclist.dgn

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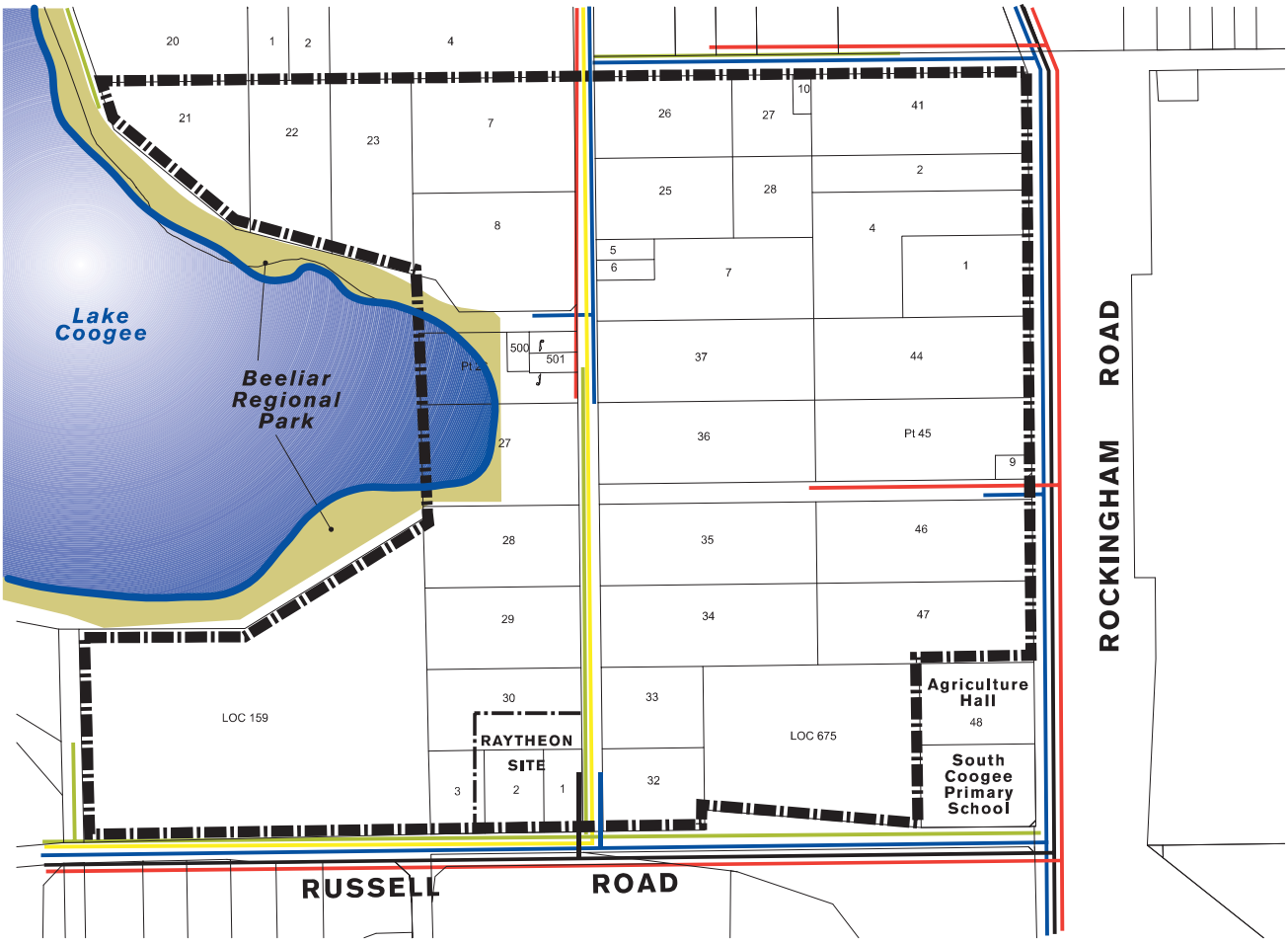

Legend

- Water
- Power
- Sewer
- Telstra
- Gas

0 200 400 600 800 1000

metres

N

Figure No: 11

Title: **Services**

Date: 26 November 2004 Revision No: 1

Scale: Refer to Scale Bar Job No: 705,072

Designer: M.R. Drawn: S.L.

E Reference: Services-A3.fh10

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Note

1. Residential/Childcare facilities/Primary & Secondary Schools/Restaurants/ Taverns and Cafes will only be considered outside of the WWTP Buffer.
2. Development of the northern portion of the Common User Facility is to include a wildlife corridor connection between the Wetland Enhancement areas.
3. Upon development of Stage 2, the detailed design of Frobisher Avenue, the POS Reserve and the southern POS Road is to be reviewed in order to facilitate the retention of the "Dadley Home - Store Sheds".
4. Upon development of the Class A Reserve a vehicle access may need to be provided from the cul-de-sac to the South Coogee Hall.

Legend

- Research & Development
- Common User Facility
- Education & Training
- Mixed Use
- Transit Square
- Wetland Enhancement Area (Strategen)
- Special Consideration Area (Strategen)
- Proposed road
- Dual-use path
- Wetland conservation boundary
- 50m from wetland
- 200m groundwater abstraction & fertiliser use exclusion zone
- Cockburn Cement Slurry Line
- WWTP Buffer
- EPP Buffer

Figure No: 12

Title: Proposed Structure Plan
Australian Marine Complex, Munster

Date: 12 July 2006 Revision No: 3V

Scale: 1:2500 @ A2 Job No: 705.07Z

Designer: N.S. Drawn: L.C.

E Reference: 705.07Z.CP-3v.dgn

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