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From Perth to Mandurah – Vol1
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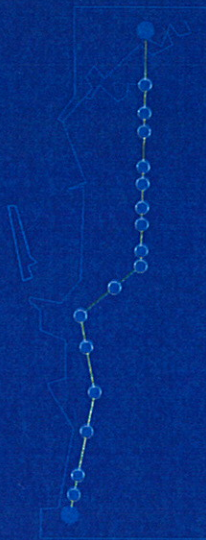
PUBLIC ENVIRONMENTAL REVIEW

PUR00067

SOUTH WEST METROPOLITAN RAILWAY FROM PERTH TO MANDURAH

Volume 1

November 2002



Prepared for:

Perth Urban Rail Development Office

Western Australian Government Railways Commission

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Western Australian
Government Railways Commission
Government of Western Australia

PERTH URBAN RAIL DEVELOPMENT



LINKING COMMUNITIES

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ENVIRONMENTAL MANAGEMENT CONSULTANTS

**PUBLIC ENVIRONMENTAL REVIEW
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INVITATION TO MAKE A SUBMISSION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The West Australian Government Railways Commission proposes the construction and operation of the South West Metropolitan Railway between Perth and Mandurah. In accordance with the Environmental Protection Act, a PER has been prepared which describes this proposal and its likely effects on the environment. The PER is available for a public review period of 10 weeks from **2 December 2002** closing on **10 February 2003**.

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the PER or the specific proposals. It helps if you give reasons for your conclusions, supported by

relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the PER;
- if you discuss different sections of the PER, keep them distinct and separate, so there is no confusion as to which section you are considering;
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name;
- address;
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: **10 February 2003**

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: **Maxine Dawson**

EXECUTIVE SUMMARY

INTRODUCTION

Perth Urban Rail Development (PURD), on behalf of the Western Australian Government Railways Commission (WAGRC), proposes the construction and operation of the South West Metropolitan Railway (SWMR) from Perth to Mandurah. Through establishment of the SWMR the Government seeks to address public transport requirements in the rapidly expanding south-west corridor of the Perth Metropolitan Region.

The proposal includes establishment of rail infrastructure between Perth and Mandurah, with the first section of the line running from the Perth Central Business District (CBD) to Parmelia along the Kwinana Freeway, then via the eastern side of Rockingham to Allnutt Street in Mandurah – a total distance of 80km.

The EPA has determined that the proposal should be assessed at Public Environmental Review (PER) level. This PER examines the potential environmental impacts of railway construction and operation and has been prepared in accordance with Guidelines provided by the EPA, which are attached in Appendix A.

Need for the Project

By 2021, the population of the South West Metropolitan Area is anticipated to rise to 500,000, comprising 25% of the total population of the Perth Metropolitan Region (Government of Western Australia (GWA), 2000a).

Without the development of an appropriate public transport system, the predicted population growth within the South West Metropolitan Area will result in increased travel by private car (GWA, 2000a). Increased reliance on private transport has the potential to generate significant social, environmental and economic impacts on the community.

The average passenger motor vehicle occupancy rate in Perth is now estimated to be 1.12 persons per vehicle. On this basis, at expected rail usage rates, the Perth –

Mandurah service will take the place of nearly 9.6 million motor vehicle journeys per year.

Factors Assessed in this PER

This PER document addresses environmental impacts associated with the construction and operation of the SWMR from Perth to Mandurah, but applies only to those aspects of the project that have not been previously assessed by the EPA.

Perth to the Southern Metropolitan Region Scheme Boundary

The South West Metropolitan Railway railways reservation in the current Metropolitan Region Scheme was assessed by the EPA as part of the EPA's assessment of land use changes in MRS amendments 937/33 and 938/33.

The EPA's assessment of the railways reservation in MRS Amendments 937/33 and 938/33 was restricted to impacts on Regionally Significant Vegetation, Fauna, Wetlands, Beeliar Regional Park and System Six areas. These factors cannot be re-assessed for this portion of the alignment. Other potential impacts additional to those relating to the definition of the railways reservation eg noise and vibration, are addressed in this PER document.

Changes to the current railways reservation in the MRS are proposed through MRS Amendment 1032/33. This amendment defines station sites and areas along the alignment of insufficient size to accommodate rail infrastructure requirements between Jandakot and the MRS Boundary.

The EPA determined that no formal assessment of MRS Amendment 1032/33 was required on the understanding that all environmental issues associated with the amendment were addressed in the PER document for the SWMR proposal. All environmental impacts associated with the development of these areas have therefore been included as part of the current assessment.

In 2001 the Perth to Jandakot and Leda to Coo롱gup sections of the route were modified. These additional portions of the proposed alignment have not been previously assessed for use as a rail corridor. All relevant environmental factors therefore require assessment in the PER.

Southern MRS Boundary to Mandurah (the Peel Region)

The Draft Peel Region Scheme (WAPC, 1999) provides for a railways reserve to accommodate the SWMR. The Peel Region Scheme has been assessed by the EPA. During the assessment of the Peel Region Scheme the EPA deferred several environmental factors for later assessment due to the broad scale of the environmental assessment or because insufficient information was considered to be available at the time of assessment. The factors on which assessment has been deferred for the Rapid Transit Corridor are vegetation, wetlands, noise and vibration. The potential impacts of construction and operation of the railway on these factors are considered in this PER.

Community Consultation

As would be expected for an infrastructure project of this magnitude, PURD has undertaken extensive community consultation for the SWMR proposal. This programme has been running since December 1998 and will continue throughout the PER process, the construction programme and the operation of the rail service.

Consultations have been undertaken at all levels of government. A number of meetings have also been held with local government authorities and local interest groups. A register of the meetings held to date is provided in Appendix B of the PER and is also available on the PURD website (www.purd.transperth.wa.gov.au).

Optimisation of the Project

Since the inception of the SWMR project, a considerable number of changes have been made to improve the project's environmental performance and benefit to the community. These changes are listed below; most are also described in the PER under the appropriate headings.

- Deviation around the Leda Nature Reserve wetland.
- Deviation to minimise disturbance to Pickle Swamp, Leda.
- Reduced width of the MRS reserve from Safety Bay Road to the intersection of Ennis Avenue and Mandurah Road south of Lake Walyungup.
- Anstey Swamp - Rail alignment moved west into the southbound carriageway of Mandurah Road to prevent any further impact on Anstey Swamp.
- Paganoni Road - Rail alignment moved west to avoid severing bushland in good condition (Bush Forever Site 395) south of Paganoni Road.

- Rockingham Loop and bypass through Rockingham Lakes Regional Park replaced by a route down the Garden Island Highway and Ennis Avenue.
- Reconfiguration of Waikiki Station site to avoid disturbance to Threatened Ecological Community (TEC) 19b near Safety Bay Road.
- Construction of CALM management tracks within the rail reserve where possible
- Undergrounding of the rail along the Perth City foreshore.
- Installation of pollutant traps on existing freeway drainage outfalls to the Swan River.
- Return of surplus land to parks and reserves.

PROJECT DESCRIPTION

Route Description

The proposed rail alignment connects with the northern suburbs rail line via the western yard of the Perth Railway Station and an above/below ground central station on the eastern side of William Street, between Murray and Wellington Streets. Access to the existing Perth Central Station will be provided by an underground walkway. The alignment continues underground south beneath William Street, with a second station at the Esplanade opposite the new Perth Convention Centre. The route then continues underground to emerge about 100m east of the Narrows Bridge. It will then continue along the centre of the bridge, which will be widened to accommodate the railway.

South of the Narrows the railway line continues in the central median of the Kwinana Freeway, across a widened Mount Henry Bridge, to approximately 1.2km south of Anketell Road in Mandogalup, where it crosses out of the freeway median under the northbound carriageway and runs south of The Spectacles, immediately north of Thomas Road.

From Thomas Road, the railway runs south-west through Parmelia and Leda then follows the Garden Island Highway reserve before turning south again at Ennis Avenue in Rockingham.

From Rockingham the railway generally follows the eastern side of Ennis Avenue/Mandurah Road, apart from a deviation to the east at Karnup, until it reaches

Paganoni Road. Where it passes Anstey Swamp, the carriageways of Mandurah Road will be shifted slightly west in order to accommodate the railway line without impacting Anstey Swamp.

At Paganoni Road the railway diverges from Mandurah Road, running south to intersect the Primary Regional Road Reserve for the proposed Kwinana Freeway extension in Meadow Springs/Parklands, just north of Mandurah. From there the line runs down the median of the freeway reserve past Meadow Springs, west of the Mandurah Greyhound Racing Track and the TAFE Peel Regional Campus, under Fremantle Road and south to terminate at the Mandurah Station located on Allnutt Street.

Construction and Operation

The railway will be constructed using 1067mm track gauge to allow integration into the existing Perth Urban Rail system.

The rail reserve will be fenced in accordance with current WAGR and Main Roads WA standards. No fencing will be constructed where the route is located in the centre of the freeway as access to this area is already restricted.

Screens will be installed over the railway line wherever bridges or other structures are erected over the track to protect persons from electrocution and to prevent vandalism. Screens will be erected in accordance with standard WAGR requirements.

The trains will obtain their power from a single phase alternating current 25kV overhead traction wire, as used by the existing Perth Urban Rail system. The power demand of the SWMR will be similar to that of the existing system to enable full integration between the proposed and existing networks.

New 132kv/25kv substations will be established at Jandakot and Karnup, which will draw power from adjacent Western Power facilities via a 132kv underground cable. Intermediate 25kV switching stations will also be established at the Esplanade, Anketell, Leda and Waikiki.

The State government plans to acquire a fleet of 93 new railcars, which will operate in three-car sets to service the anticipated demand within the South West Corridor and the Northern Suburbs line. Each three-car set will have a passenger carrying capacity of

574 (242 seated, 332 standing). Delivery of the railcars is anticipated to begin in 2004 and be completed by 2006 to coincide with the opening of the SWMR.

The railway will be designed to enable maximum operating speeds of 130km/hour, although there will be lengths of track where this speed cannot be achieved due to track curvatures or proximity to stations. The transit time between Mandurah and Perth (with limited stopping pattern) will be less than 50 minutes.

It is anticipated that services from Thomsons Lake to Perth will operate at a maximum frequency of 12 trains/hour (5 minute interval) and services from Mandurah to Thomsons Lake will operate at up to 6 trains/hour (10 minute interval).

Stations

New stations will be built at William Street (underground), The Esplanade (underground), Canning Bridge, Leach Highway, South Street (Murdoch), Beeliar Drive (Thomsons Lake), Thomas Road (Bertram), Rae Road (Rockingham), Safety Bay Road (Waikiki) and Allnutt Street (Mandurah).

Future stations are also proposed at South Perth (near Perth Zoo), Success (near Gibbs Road/Russell Road), Mandogalup (Rowley Road), Anketell (Anketell Road), South Parmelia (Challenger Avenue), Leda (near Wellard Road), Stakehill (south of Stakehill Road), Karnup (north of Paganoni Road), Lakelands (opposite Madora Beach Road) and Parklands (Gordon Road). All of these sites will be protected through the MRS for future development. The reservation and clearing of the land for these future stations is addressed in this PER.

Bridges

Existing bridges over the freight line in Jandakot, the Swan River at the Narrows and the Canning River at Mount Henry will be used for the SWMR. These bridges will require widening or addition of new structures to accommodate the combined rail and road infrastructure. Additional rail bridges are proposed over Mandurah Road and the Mundijong freight line in Hillman and at Stakehill and Paganoni Roads.

Grade Separations

Grade separated crossings (road over rail) will occur at:

- Mill Point Road, South Perth
- Canning Highway, Como
- Cranford Avenue, Mt Pleasant
- Leach Highway, Bateman
- Parry Avenue, Bull Creek
- South Street, Murdoch
- Farrington Road, Leeming
- Berrigan Drive, Jandakot
- Beeliar Drive, Jandakot
- Russell Road, Success
- Rowley Road, Mandogalup
- Anketell Road, The Spectacles
- Thomas Road, The Spectacles
- Challenger Drive, Parmelia
- Wellard Road, Wellard
- Elanora Road (Cooloongup)
- Safety Bay Road, Warnbro
- Gordon Road, Meadow Springs
- Fremantle Road, Mandurah.

The bridges required for grade separations already exist between Canning Highway and Anketell Road. The remaining bridges associated with the grade separations will require construction as part of this project.

Level Crossings

Two at-grade (level) crossings will be constructed at Paganoni and Lakelands. These will be “occupational” crossings, constructed on private roads to maintain access to existing commercial operations. They will be controlled by boom gates and legally accessible only by authorised personnel.

Pedestrian Crossings

Pedestrian crossings will be provided at all stations, either by footbridge, underpass or controlled grade crossings, and wherever there are bridges over the railway. Pedestrian footbridges will be located at Hardy Street (South Perth), Comer Street (Como), Preston Street (Como), Thelma Street (Como), Cale Street (Como), Edgewater Road (Salter Point) and Hillman (Rockingham). All but the Rockingham bridge already exist.

Noise Management

Noise management, using strategically placed acoustic reflecting walls, will be implemented at the Kwinana Freeway near the Narrows Bridge, the southeast and southwest quadrants of the Leach Highway intersection with the Freeway, Trenant Park Gardens in Golden Bay and areas in Wellard, Leda and Rockingham. Noise walls may be constructed from a variety of dense materials, including masonry and earthen bunds, to suit the locality.

The need for any additional noise protection will be assessed in consultation with nearby residents prior to and following the commencement of railway operations.

Earthworks

Earthworks are required to prepare the railway alignment for the construction of the track, signalling and other railway infrastructure.

It is likely that the earthworks to achieve the required rail formation will necessitate clearing of all vegetation over the total width of the rail reserve (40 metres in most places) throughout the majority of the alignment.

Revegetation of the final landform will be carried out in suitable areas.

Maintenance and Support Facilities

A railcar stowage and cleaning facility will be provided adjacent to the Mandurah station. This area is required due to the need to start trains from the Mandurah Station in the mornings and to the distance from other stowage areas.

All railcar mechanical and electrical servicing and exterior cleaning will be undertaken at the Nowergup Railcar Depot, north of Clarkson Station on the Northern suburbs line.

Staging of Construction Work

The staging plan proposed for the SWMR construction allows for the route into central Perth to be approved while the design of the stations, civil and rail infrastructure for the rail line south of the Narrows is still underway.

Construction work on the railway will commence in the third quarter of 2003 and be completed by 2007. In order to reduce disruption to the city section of the route a key target has been set for completion of all above-ground works near the convention centre by June 2004.

Commencement of train services is scheduled as follows:

- Perth to Waikiki by December 2006
- Waikiki to Mandurah by December 2007

Summary of Key Project Features

A concise summary of the key characteristics for the entire railway project is provided on the following page.

KEY CHARACTERISTICS		
Project Details		
Name of Project	South West Metropolitan Railway	
Name of Proponent	Commissioner of Railways C/- Perth Urban Rail Development (PURD) Level 2, 19 Pier Street PERTH WA 6000	
Project Location	Perth to Mandurah, Western Australia	
Length of Route	80km	
Area of vegetation to be cleared	208 ha	
Area of vegetation to be cleared subject to this assessment	82 ha	
Commencement Date (proposed)	Construction:	Late 2003
	Operation:	Perth to Waikiki: December 2006 Waikiki to Mandurah: December 2007
Inputs		
	<i>Item</i>	<i>Quantity (approximate)</i>
<i>Equipment</i>	Rail	300 km
	Concrete sleepers	180,000
	Tunnels	5.4 km
	Bridges	13
	Stations	10
	Fencing	50 km
	Precast concrete masts	1,500
	Electrical conductors	525 km
	Optic fibre cable	75 km
	Communications cables	150 km
	Railcars	93 three-car sets
<i>Raw Materials</i>	Earth fill	2,000,000 m ³
	Steel	15,000 tonnes
	Rock ballast	240,000 tonnes
	Concrete	100,000 m ³
	Steel reinforcement	12,000 tonnes
<i>Operating Inputs</i>	Power supply	Single phase 25kV AC supplied by overhead traction wire.
	Power consumption	150 MW hours/day (including saving due to use of regenerative braking systems)
Outputs		
	<i>Item</i>	<i>Quantity (approximate)</i>
	Greehouse gases (CO ₂ equivalent)	23,530 tonnes/yr (>50% saving over equivalent use of private motor vehicles)

EXISTING ENVIRONMENT

Vegetation and Flora

The SWMR alignment traverses areas of native vegetation within five vegetation complexes along the alignment. These are:

- Bassendean Complex – Central and South
- Karrakatta Complex – Central and South
- Cottesloe Complex – Central and South
- Herdsman Complex
- Quindalup Complex.

Little native bushland occurs in the Perth to Anketell section of the SWMR alignment. Native vegetation is limited to small remnants at the Leach Highway and Thomsons Lake station sites.

South of Anketell, the condition of the vegetation within the railway alignment ranges from Very Poor to Excellent (on the Trudgen-Keighery scale as used in *Bush Forever, 2000*). Due to the area's proximity to Perth and long history of settlement and use, the majority of the vegetation is classed as in Poor or Very Poor condition.

The native vegetation includes areas of Floristic Community Types (FCTs) 17, 19b, 21a, 23a, 24 and 28 (after Gibson *et al.*, 1994).

One Floristic Community Type, FCT 19b, is listed as a Threatened Ecological Community under Section 178 of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The impact of the SWMR on this FCT will be minimal, due in part to a redesign of the Waikiki Station site to preserve the largest occurrence of the community within the rail corridor. PURD will refer the SWMR project to Environment Australia for consideration in terms of its impact on TEC 19b.

Three Priority Flora species were identified during the field investigations within the rail corridor. These were *Grevillea thelemanniana*, *Jacksonia sericea* and *Lasiopetalum membranaceum*. Priority three flora are defined by CALM as poorly known taxa which are known from several locations and which are not believed to be under any immediate

threat of extinction. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

The SWMR alignment traverses a number of areas that are infected with Dieback disease, caused by the soil-borne fungus *Phytophthora cinnamomi*, and a number of other areas containing many species that are susceptible to the disease. Dieback hygiene will be given a high priority during clearing, earthworks and construction of the railway. Dieback hygiene is described in detail in the Dieback Management Plan.

Fauna

Due to the limited amount of native vegetation along the SWMR alignment between Perth and Anketell, there are unlikely to be any significant occurrences of native fauna in this section. Important fauna habitats in and around the southern part of the alignment include:

- seasonal and permanent wetlands;
- wetlands with emergent paperbarks or other trees;
- wetlands with dense rushes or sedges;
- dense wetland vegetation;
- large tuarts and other eucalypts;
- heathlands and shrublands; and
- woodlands.

The area within or adjacent to the SWMR rail corridor south of the Anketell Tunnel may support five freshwater fish species, nine species of frog, 43 reptile species, 146 bird species and 26 mammal species.

The extant mammal fauna along the route is likely to be depauperate, contain several introduced species and be almost outnumbered by regionally extinct species. This high level of extinction is typical of southern Australia in general and has been attributed to changes in fire regime, habitat loss and predation by foxes and cats.

The Jollytail is the only freshwater fish of conservation significance likely to occur near the route. This species is listed as Priority 3 by CALM.

No frogs of conservation significance were observed or are expected to occur along the proposed route.

Three reptile species of national conservation significance that may be present along the SWMR alignment are:

- the Perth Lined Lerista (listed as Rare or Insufficiently Known by CALM);
- the Black-striped Snake (listed as Endangered by Cogger *et al.*, 1993); and
- the South-West Carpet Python (listed as Other Specially Protected Fauna (WA *Wildlife Conservation Act 1950*) and Vulnerable (Cogger *et al.*, 1993)).

A number of other reptile species are considered to be of regional conservation significance as they occur at the limit of their known distribution. Species at their southern limit include the Barking Gecko, Gray's Legless Lizard, Worm Lerista and Western Bluetongue, whilst species at their northern limit are *Ctenotus gemmula* and the Red-legged Skink. *not on Coastal Plain*

Eight bird species of national conservation significance may occur along the SWMR alignment: These include:

- Freckled Duck (Priority 4 by CALM)
- Little Bittern (Priority 4 by CALM, Near-Threatened according to Garnett and Crowley, 2000)
- Australasian Bittern (Vulnerable according to Garnett and Crowley, 2000)
- Black Bittern (the South-West population is classed as Priority 2 by CALM)
- Square-tailed Kite (Priority 4 by CALM)
- Peregrine Falcon (Protected under the WA *Wildlife Conservation Act 1950*)
- Short-billed (Carnaby's) Black-Cockatoo (Endangered in Garnett and Crowley, 2000, under the federal *Environment Protection and Biodiversity Conservation Act 1999* and the WA *Wildlife Conservation Act 1950*)
- Masked Owl (southern race listed as Near-Threatened by Garnett and Crowley, 2000 and as Priority 4 by CALM).

Five mammal species of national conservation significance are known to occur within the area of the SWMR proposal: the Chuditch (listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 2000* and also under the WA *Wildlife Conservation Act 1950*), Quenda, Brush Wallaby, *Falsistrellus mackenziei* and the Rakali (all Priority 4 according to CALM).

Due to the decline in mammal species, virtually any native mammal present in the area can be considered to be of regional conservation significance.

Wetlands

The proposed SWMR alignment passes through or adjacent to six wetland and dampland areas between Perth and Beeliar Drive, Jandakot. The damplands and sumpland along this portion of the alignment have been disturbed by human activities and urban development. The Swan and Canning Rivers remain in good condition but are impacted by nutrients and urban contaminants. Both rivers have high conservation and recreational values.

The alignment passes through or adjacent to seventeen wetland and dampland areas between Beeliar Drive and the Southern MRS Boundary. Many of these have previously been disturbed by human activities including grazing, clearing and drainage. A significant portion of fringing vegetation around such wetlands as Bollard Bulrush Swamp and Stakehill Swamp has been previously cleared for agricultural activities, while artificial drains have been constructed through The Spectacles and Bollard Bulrush Swamp.

Between the MRS boundary and Mandurah, the SWMR alignment passes immediately to the west of three wetlands. Two of these, Paganoni Swamp and Black Swan Lake, are of regional conservation significance. Parts of the wetlands have been disturbed by human activities including grazing, clearing and drainage.

Surface Hydrology

The most significant natural surface water feature along the SWMR route is the Swan – Canning Estuary. Natural drainage lines and artificial drains in the vicinity are generally directed towards the estuary and associated rivers.

The southernmost part of the alignment is within the catchment of the Serpentine River. The Serpentine, Swan and Canning Rivers originate on and carry run-off from the Darling Range, and also carry groundwater discharge from the coastal plain.

Artificial drainage systems occur throughout the developed sections of the route. In these locations rainfall is generally disposed of via dedicated local authority and Water Corporation stormwater systems, with runoff directed to stormwater basins for disposal through infiltration.

Natural drainage is more prevalent along the undeveloped areas of the SWMR route. In general, surface drainage through these areas is dominated by infiltration to groundwater rather than surface runoff.

Low-lying areas along the route, including wetlands and topographical depressions, also act as local drainage basins, receiving water from both direct runoff and groundwater seepage. Recharge through wetlands is a primary source of seasonal recharge to the shallow aquifer.

Groundwater

Shallow groundwater occurs throughout the Swan Coastal Plain, with the depth to water generally ranging from less than a metre to a few tens of metres. Within the SWMR alignment, the groundwater table approaches to within two metres of the ground surface in a number of areas including:

- the northern end of the Narrows Bridge;
- most of the section between the Narrows Bridge and the Mount Henry Bridge;
- the southern end of the Mount Henry Bridge;
- a small area between Leach Highway and Parry Avenue and another between Parry Avenue and South Street;
- a localised section between the freight line and Berrigan Drive, Glen Iris;
- immediately south of Russell Road on the Kwinana Freeway;
- immediately north of Anketell Road;
- north of Challenger Drive, Bertram;
- within the Pickle Swamp wetlands;
- along the Garden Island Highway, immediately north of Lake Cooloongup;
- the Ennis Avenue Station locality; and
- the Stakehill Station locality.

The SWMR proposal impacts the north western corner and eastern side of the Jandakot Underground Water Pollution Control Area (UWPCA). Both of these areas are declared as Priority 3 Source Protection Areas by the Water and Rivers Commission (WRC). Priority 3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments. Protection of these areas is achieved through the establishment of management guidelines rather than by regulation.

The WRC has compiled a list of recommendations on the compatibility of a wide range of land uses with UWPCAs. The SWMR project would be classified as “establishment of major transport routes”. This activity is considered by the WRC to be compatible with the objectives of Priority 3 areas (WRC, 2001b).

The SWMR proposal encroaches on two 300m well head protection zones south of Beeliar Drive that have been established around production bores within the P3 area of the Jandakot Mound. Measures to protect these zones from impact are detailed in the PER.

The SWMR proposal encroaches on the Environmental Management Area (EMA) for some significant wetlands. Part of this area is classified as Category B, where further development is considered acceptable provided appropriate water management measures capable of meeting the EPA objective for this category are implemented (EPA, 1998). Part of the area is Category A, where there is a general presumption against further urban development (EPA, 1998).

Measures to minimise impacts on the Category A and B areas of the Jandakot EMA are detailed in the PER.

Existing and Proposed Reserves

Bush Forever

Bush Forever Site 227 surrounds the freeway reserve near Salter Point. The alignment will remain inside the freeway median in this area and will not affect the Bush Forever site.

The SWMR alignment passes through or alongside six Bush Forever sites within the Perth Metropolitan Region (Bush Forever covers only the PMR):

- Site No. 269: The Spectacles
- Site No. 272: Sicklemore Road Bushland
- Site No. 349: Leda and Adjacent Bushland
- Site No. 356: Lake Cooloongup, Lake Walyungup and Adjacent Bushland
- Site No. 395: Paganoni Swamp and Adjacent Bushland.

The original alignment of the SWMR proposal through these sites was gazetted in the MRS but subsequent minor changes have been re-examined by the Bush Forever Office. The findings of this consultative process are summarised below:

- **Site No. 269:** No objection - changes to the SWMR alignment will result in a net gain to the size of the *Bush Forever* site.
- **Site No. 272:** No objection - there is no proposal to extend the station into the *Bush Forever* site.
- **Site No. 349:** No objection – the site contains vegetation of the Quindalup Complex, which is adequately protected in the region in line with *Bush Forever* objectives.
- **Site No. 356:** No objection - all vegetation belongs to the Quindalup Complex, which is adequately protected in line with *Bush Forever* objectives. Redesign and realignment of the Waikiki Station site has eliminated impacts on TEC 19b that occurs at that site.
- **Site No. 395:** No objection - the overall impact on this site will be marginal and it may be possible to further reduce impacts at the detailed design stage of the project.

Beeliar Regional Park

The SWMR alignment intersects the Beeliar Regional Park at the Spectacles and runs adjacent to it at Bollard Bulrush Swamp. All other areas of the park are at least 500m east of the rail alignment.

Rockingham Lakes Regional Park

The SWMR alignment crosses the Rockingham Lakes Regional Park near Lakes Coo loongup and Walyungup and also at Anstey and Paganoni Swamps. As the management framework for the regional park was completed after the gazettal of the SWMR route in the MRS, the management plans developed for these sites take the rail alignment into account.

Leda Nature Reserve

The SWMR alignment crosses the northern end of the Leda Nature Reserve for a distance of about 1.2km.

Peel Region Scheme - Regional Open Space

Regional open space adjacent to the rail alignment in the Peel Region is designated in the following areas:

- East of the alignment in Lakelands (Southern section of Paganoni Swamp)
- East of the alignment in Parklands (between the alignment and the rural area).

Swan River Marine Park

The Swan River Marine Park is located adjacent to the freeway reserve between Perth and Brentwood. The rail alignment will not impact on the area of the marine park. The installation of pollutant traps on existing drains crossing the Kwinana Freeway will potentially reduce pollutant loads into the marine park.

Soil and Groundwater Quality

A Preliminary Site Investigation (PSI) has been conducted to assess the potential for soil and groundwater contamination along the proposed alignment. This has been undertaken with reference to the procedures advocated by the Department of Environment, Water and Catchment Protection.

The PSI identified seven sites of potential contamination within the alignment that require further investigation. These include:

- the Perth City Rail Reserve including the former area of Lake Kingsford;
- the Perth Foreshore where dredge spoil has historically been placed;
- market Gardens in Stakehill;
- a former piggery in Stakehill;
- Paganoni Road Market Garden;
- former infiltration basins next to the Mandurah Wastewater Treatment Plant; and
- a former uncontrolled landfill and disused road reserve in Mandurah.

Further investigations and health risk analyses will be undertaken before construction commences to ensure that any contamination present does not present a risk to construction workers, rail passengers, the general public or the environment.

In addition it is proposed to investigate groundwater quality where dewatering is required for the construction of the Perth City Tunnel.

Aboriginal Heritage

Numerous Aboriginal Heritage studies have been conducted over the proposed alignment. The studies have focussed on areas of both archaeological (physical artefacts) and ethnographic (cultural) significance.

Areas of archaeological and ethnographic significance that have potential to be disturbed are restricted to the northern end of the alignment (O'Connor & Hart, 2002). Areas of general significance are also encountered along the proposed alignment. These areas include the region's wetlands and rivers, access tracks and campsites.

All studies have concluded that sites in the vicinity of the rail alignment are not in conflict with the SWMR project. Approval has been given by the relevant Aboriginal groups consulted for development to proceed.

European Heritage

The oldest area of European settlement along the alignment is the Perth Central Business District. Many of the historical city buildings along the proposed alignment remain today. Many are now considered of heritage value.

Numerous other European heritage sites occur close to the proposed SWMR alignment between Perth and Mandurah. These include buildings, bridges, foreshore reserves, jetties, wetlands and regional parks.

IMPACTS AND MANAGEMENT

Construction of the SWMR project will result in permanent linear severance of the landscape over a distance of approximately 80km. Appropriate planning and implementation of specific management measures during construction and operation of the project will minimise impacts on the natural and social environment.

Environmental Management System

The WAGRC is currently preparing a formal Environmental Management System (EMS) for all its operations including the SWMR project. The EMS will conform to the requirements of the ISO14001 standard.

Within the framework of the EMS, PURD will develop Environmental Management Plans (EMPs) covering all aspects of the construction and operation of the SEMR project. The EMPs will be prepared to the satisfaction of relevant agencies before the commencement of each phase of the project.

The environmental management principles and procedures set out in the Environmental Management Plans will apply to all contractors and sub-contractors engaged by WAGRC in the planning, construction and operation of the project. Prior to commencing work on site, all construction and operational personnel will participate in a comprehensive induction briefing that reflects the WAGRC's commitment to safety and the environment. Each participant will be furnished with list of environmental guidelines to be adhered to at all times. Adherence to these guidelines will form part of the work contract and job description of each worker.

Summary of Impacts and Management

Table A1 presents a summary of the potential environmental and social impacts of the construction and operation of the SWMR project and the management measures that are proposed.

Table A2 summarises the auditable formal commitments to environmental management made by the WAGRC in relation to the SWMR project.

Table A1 Summary of Impacts and Management

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
BIOPHYSICAL				
Regionally Significant Vegetation	Maintain the abundance, diversity, geographic distribution and productivity of vegetation.	<ul style="list-style-type: none"> • 208 ha of native vegetation to be cleared in total. • 82 ha of native vegetation to be cleared under this assessment. • 2.39ha of TEC 19b cleared. • 5 <i>Bush Forever</i> sites affected by clearing – total 6.3ha in areas subject to assessment. • Bushfire risk from cutting and welding, vehicle movements etc. • Increased risk of weed and dieback invasion. • Fragmentation and reduced connectivity of bushland. • Dust damage to adjacent vegetation during construction. • Increased risk of soil erosion. • Clearing for CALM access tracks outside rail reserve. 	<ul style="list-style-type: none"> • Restriction of construction activities to the rail reserve. • Delineation and fencing of rail reserve before construction commences. • Location of access tracks where possible within rail reserve and outside wetland buffer zones, <i>Bush Forever</i> sites and other significant vegetation. • Rehabilitation of disturbed areas outside rail reserve. • Monitor and control weeds as set out in EMP. • Conduct follow-up dieback surveys prior to construction. • Implement dieback hygiene measures as set out in EMP. • Implement fire management measures as set out in EMP. • Discuss mitigation measures with DEWCP and CALM to compensate for loss of significant vegetation. • Revegetate the rail reserve following construction with native species near bushland areas where practicable. 	<ul style="list-style-type: none"> • Restriction of significant vegetation impacts to within the rail corridor. • No increase in rate of dieback infection. • Minimal increase in weed invasion. • Minimal increase in fire risk or occurrence.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Threatened Ecological Communities	Maintain the abundance, species diversity, geographic distribution and productivity of Threatened Ecological Communities.	<ul style="list-style-type: none"> Clearing of 2.39ha of TEC 19b in the Lake Cooloongup and Lake Walyungup Reserves. 	<ul style="list-style-type: none"> Areas to be cleared will be clearly delineated with tape, paint and isolated by limit or work fencing. Construction works will be located as far from areas of TEC 19b as possible. Vehicles and construction workers will not enter areas of TEC 19b. Site drainage will be prevented from flowing into adjacent TECs. Natural drainage regime will be maintained. Erosion control measures will be implemented to prevent high levels of sediment flowing from working areas into TEC 19b. Discuss mitigation measures with DEWCP and CALM to compensate for loss of Threatened Ecological Communities. 	<ul style="list-style-type: none"> Clearing of TEC 19b limited to areas identified within the rail reserve. No direct or indirect impacts on TEC 19b outside the rail reserve.
Rare and Priority Flora	<p>Protect Declared Rare and Priority Flora consistent with the provisions of the <i>Wildlife Conservation Act 1950</i>.</p> <p>Protect other flora of conservation significance.</p>	<ul style="list-style-type: none"> 2 Priority Flora Species located in alignment. No Declared Rare Flora (DRF) found. 	<p>Possible strategies include:</p> <ul style="list-style-type: none"> Transplanting individual plants; Collection of seed or cuttings for propagation; Use of Priority species in rehabilitation. Further investigation for rare and priority flora prior to construction. 	<ul style="list-style-type: none"> No impact on DRF. No change in conservation status of Priority Flora as a result of the SWMR.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Fauna	<p>Maintain the species diversity and geographical distribution of terrestrial fauna.</p> <p>Protect Specially Protected (Threatened) Fauna [and their habitat] consistent with the provisions of the <i>Wildlife Conservation Act 1950</i>.</p>	<p>Construction</p> <ul style="list-style-type: none"> • Reduction in area of fauna habitat. • Reduction of habitat quality through edge effects. • Direct mortality of individuals during vegetation clearance. • Severance and fragmentation of habitats by fenced rail reserve. • Loss of some small populations of mammals in isolated habitats. • Obstruction of movement across the rail reserve by most reptile, mammal and some bird species. • Restriction of movement of Kangaroos and Wallabies between The Spectacles and Sicklemore Road bushland. • Isolation of populations of Quendas, reptiles and amphibians in the north-west corner of Leda Nature Reserve. • Isolation of Quendas in the north-west corner of the Lake Cooloongup Flora and Fauna Reserve. • Obstruction of seasonal breeding movements of several duck species and Long-necked Tortoises adjacent to wetlands. • Inhibition of movement of nectar-feeding birds and perhaps Honey Possums between Banksia woodland and heathland near Paganoni Road. 	<ul style="list-style-type: none"> • Avoid significant habitat trees where possible. • Revegetate areas disturbed outside the railway reserve. • Fence railway reserve before construction to prevent vehicles straying outside the reserve. • Translocate habitat elements such as hollow logs to designated rehabilitation areas. • Avoid pre-construction clearing in spring where possible. • Maintain existing fauna underpasses. • Provide two new fauna underpasses in Leda and one near Lake Cooloongup. • Incorporate fauna passages into heavy vehicle underpasses at Leda and Anstey Swamp. • Two additional fauna crossing points at "occupational" (restricted access) level crossings at Paganoni and Lakelands. 	<ul style="list-style-type: none"> • Unavoidable reduction in habitat area and connectivity by clearing and fencing of rail reserve. • Minimal direct impact on fauna outside rail reserve. • Maintenance of fauna access across rail reserve in critical habitat areas.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Fauna (continued)		<p>Operation</p> <ul style="list-style-type: none"> Degradation of wetlands by contaminants in stormwater runoff. Direct rail kills of animals that gain entry to the rail reserve. 	<ul style="list-style-type: none"> Fauna exclusion fencing of alignment to minimise rail kill. Monitor direct rail deaths of fauna. Ongoing monitoring and maintenance of fauna underpasses. 	<ul style="list-style-type: none"> Minimal direct impact on fauna outside rail reserve. Maintenance of fauna access across rail reserve in critical habitat areas.
Wetlands	Maintain the integrity, functions and environmental values of wetlands and watercourses.	<ul style="list-style-type: none"> Alteration of hydrology of wetlands through increased or decreased surface inflow. Pollution of wetlands by contamination of runoff with hydrocarbons or spillage of hazardous or toxic materials. Loss of wetland vegetation from areas included in this assessment at Pickle Swamp and Waikiki Station. Loss of wetland buffer vegetation from areas included in this assessment at Pickle Swamp, Waikiki Station, Paganoni Swamp and Fremantle Road Sumpland. 	<ul style="list-style-type: none"> Manage drainage as described in the EMP. Demarcation and fencing of work areas prior to construction. Weed, dieback and fire control during and after construction. Monitor water levels and quality in significant wetlands before, during and after construction. No abstraction of water from wetlands for construction purposes. 	<ul style="list-style-type: none"> No significant alteration to wetland hydrology or water quality.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Surface Water	Maintain the integrity, functions and environmental values of wetlands and watercourses.	<ul style="list-style-type: none"> • Obstruction of natural surface water flow paths. • Siltation of watercourses during construction phase. • Pollution of watercourses through contamination of runoff with hydrocarbons or spillage of hazardous or toxic materials. 	<ul style="list-style-type: none"> • Maintain or modify (as required) existing artificial drainage. • Maintain or reinstate natural drainage paths during and after construction. • Plan and conduct construction activities to avoid winter peak groundwater levels. • Implement Stormwater Management Plan and Pollution Risk Management and Contingency Plan prior to construction. • Design railway to withstand 100-year flood without scouring, washout or saturation. • Direct all stormwater runoff to vegetated swales within rail reserve sized to accommodate 1-in-1-year flow. • Install gross pollutant and sediment traps as necessary. • Avoid steep slopes and banks where possible. • Fence drainage basins to keep out animals, litter and vehicles. • Design all water crossings to minimise impact and protect conservation values. • No drainage of rail reserve into wetlands or watercourses. • Inspect rail reserve for erosion annually and after heavy rain. • Monitor water quality in infiltration basins during and after construction. 	<ul style="list-style-type: none"> • Natural surface water flow paths maintained or reinstated. • Minimal entry of silt or other contaminants into watercourses during or after construction. • No entry of hazardous materials into watercourses.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Groundwater	<p>Maintain the quantity of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected.</p> <p>Maintain the quality of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected, and that National and State standards are met.</p>	<ul style="list-style-type: none"> • Reduced groundwater recharge at interchanges and car parks. • Drawdown of groundwater near wetlands and groundwater-dependent vegetation during dewatering for railway construction. • Pollution of groundwater through contaminated runoff or spillage of hazardous or toxic materials. • Contamination of well head protection zones or wetland environmental management areas. • Acidification of groundwater through dewatering of peat or estuarine/wetland sediments in Perth CBD, Elanora Drive Rockingham or Gordon Road Mandurah. • Pollution of surface waters by sediment, nutrients or other contaminants resulting from discharge of water abstracted for dewatering purposes. 	<ul style="list-style-type: none"> • Monitor groundwater levels during and for at least two years after construction. • Respond to complaints of adverse effects on domestic bores. • Monitor groundwater levels during dewatering. • Design dewatering activities to avoid impacts on wetlands. • Carry out geotechnical studies in dewatering areas to assess potential for presence of acid sulphate soils. • Monitor groundwater quality for at least two years after construction. • Investigate quality of abstracted groundwater prior to discharge and monitor throughout dewatering. • Discharge only clear, uncontaminated water from dewatering operations to the environment. • Locate potentially contaminating activities away from well head protection zones and environmental management areas. 	<ul style="list-style-type: none"> • No or minimal effect on groundwater levels or flows. • No adverse effects on wetlands or vegetation from dewatering. • No significant adverse impact on wetland or groundwater quality resulting from construction or operation. • Any acid sulphate soils are identified and managed appropriately to prevent adverse impacts.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Noise and Vibration - Operation Phase	Protect the amenity of neighbouring land users from noise and vibration impacts resulting from activities associated with the operation of the rail service, by ensuring that noise and vibration meet acceptable standards and are minimised as far as practical.	<ul style="list-style-type: none"> Excessive noise may cause nuisance at nearby residences and other sensitive receptors. Noise emitted from electric motors and rail/wheel interface. Recommended noise criteria may be exceeded at a number of location as discussed in Section 5.7. Excessive vibration from trains may cause nuisance to nearby residents and structural damage to buildings. Vibration emitted largely from rail/wheel interface. Greater potential for vibration impacts in areas of rock (e.g. limestone) or high water table. Recommended vibration criteria may be exceeded at a number of locations as discussed in Section 5.7. 	<ul style="list-style-type: none"> Proposed track and rail car system emits significantly less noise and vibration than the trains currently servicing the northern suburbs. Install noise mitigation measures (bunds, walls etc.) south of the Narrows and at other selected locations (including Leach Hwy/Kwinana Fwy intersection and in Golden Bay) in accordance with the Noise Management Plan. Investigate regenerated noise from bridge structures once detailed design is available. Consult nearby residents before and during operation phase and assess the need for additional noise protection. Prepare and implement noise and vibration management plan. Monitor, record and respond to complaints from residents regarding operational noise and vibration. 	<ul style="list-style-type: none"> Rail operations comply with recommended noise and vibration criteria in all areas. Few and decreasing complaints from residents regarding noise or vibration.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Noise and Vibration - Construction Phase	Protect the amenity of neighbouring land users from noise and vibration impacts arising from the construction activities, by ensuring that noise and vibration meet acceptable standards and is minimised as far as practical.	<ul style="list-style-type: none"> Noise from earthmoving machinery, trucks, soil compaction and rail installation may cause nuisance to nearby residents. Vibration from tunnelling and installation of bridge piles could cause nuisance to residents and others and structural damage to buildings. 	<ul style="list-style-type: none"> Construction work will comply with the <i>Environmental Protection (Noise) Regulations 1997</i> and with Australian Standard 2436-1981. Noise-generating construction work will be carried out in daylight hours wherever possible. Vibration-generating construction work will be restricted to daylight hours. Monitor, record and respond to public complaints over construction noise and vibration. Offer free structural assessment of buildings to nearby residents. 	<ul style="list-style-type: none"> Construction activities comply with appropriate regulations and standards at all times. No or minimal structural damage to houses or buildings. Few complaints over noise or vibration during construction phase. Any complaints received are recorded and responded to without delay.
Other Construction Impacts	Protect the amenity of neighbouring land users from any other factors arising from activities associated with the construction of the rail service, by ensuring that statutory requirements and acceptable standards are met.	<ul style="list-style-type: none"> Potential dust nuisance from exposed ground and soil stockpiles. Light spill into residential areas may cause temporary nuisance during construction. 	<ul style="list-style-type: none"> Manage dust in accordance with DEP Guidance No. 18 <i>Prevention of air quality impacts from development sites</i> (EPA, 2000b). Prepare a Dust Management Plan prior to construction. Stabilise exposed areas by revegetation, watering, mulching, wind fencing or retention of vegetated windbreaks. Manage outdoor lighting during construction in accordance with Australian Standard 4282 <i>Control of the Obtrusive Effects of Outdoor Lighting</i>. 	<ul style="list-style-type: none"> No or few complaints over dust or light spill during construction. Any complaints received are recorded and responded to without delay.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Public Risk and Safety	Ensure that risk is managed to meet the EPA's criteria for individual fatality risk off-site and the Department of Minerals and Petroleum Resources' requirements for public safety in relation to dangerous goods and hazards.	<ul style="list-style-type: none"> • Risk of collision between trains and cars or trucks at crossings or when running parallel on Freeway. • Slight public risk associated with railway crossing over the Dampier-Bunbury Natural Gas Pipeline (DBNGP) in Leda. 	<ul style="list-style-type: none"> • Minimal potential for train-vehicle collisions due to absence of publicly accessible at-grade (level) crossings. • Risk of collision within Kwinana Freeway alignment is minimised by 0.9m high concrete crash barriers either side of railway line. • Licence required from Department of Mineral and Petroleum Resources prior to construction of rail across DBNGP. • Install protective measures (e.g. barriers, hardening) at rail/DBNGP crossing. 	<ul style="list-style-type: none"> • No collisions or conflict between trains and road traffic. • No significant risk associated with rail crossing over DBNGP.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Bushfire Management	(none stated)	<ul style="list-style-type: none"> • Risk of bushfire during construction from sparks from welding and cutting, cigarette butts, vehicle exhausts, burning of cleared vegetation, vandals using access tracks. • Increased bushfire risk due to increased weed growth in disturbed areas. • Reduced access across alignment for fire fighting vehicles. 	<ul style="list-style-type: none"> • Implement Fire Management Plan during construction and operation. • Prohibit hot work (welding, metal cutting) in high fuel load areas on days of Very High or Extreme fire danger. • All construction machinery fitted with approved spark arrestors. • Minimise disturbance to surrounding vegetation and consequent weed invasion during construction. • Educate construction workers on dangers of cigarette butt disposal. • No burning of cleared vegetation. • All construction tracks will be securely gated and locked to prevent unauthorised access. • 4WD fire fighting unit(s) with trained operators maintained on site during construction work in fire risk areas. • Power lines fitted with spreader bars to minimise risk of arcing. • 3m wide firebreaks maintained alongside rail reserve in vegetated areas. • Control weeds and other flammable materials within rail reserve by regular slashing, mulching, weed spraying and rubbish removal. • Access for fire fighting vehicles provided beneath railway line at designated locations by agreement with CALM and Fire & Emergency Services Australia (FESA). 	<ul style="list-style-type: none"> • No bushfire outbreaks attributable to the construction or operation of the railway.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Visual Amenity	Ensure that the visual amenity experienced by nearby land users is not unduly affected by the proposal	<ul style="list-style-type: none"> • Improved visual amenity north of William Street Station due to sinking of a portion of the existing northern suburbs rail line. • No visual impact between Narrows Bridge portal and William Street Station. • Overhead wires and masts will be visible along whole above-ground alignment. • Crash barriers along Kwinana Freeway will be visible (these already exist between the Narrows and Canning Bridge). • Clearing of vegetation, cuttings, embankments and construction of fences will affect views in bushland areas. • New stations and parking areas may affect views. 	<ul style="list-style-type: none"> • Construct bored tunnel from Narrows Bridge portal to William Street Station. • Complete all above-ground construction works in CBD section before opening of Perth Convention Centre in June 2004. • Use single central masts between the Narrows and Canning Bridge, with the number of overhead wires limited to five. • Rehabilitate station sites with native species. • Use muted colours for barriers, fences, masts and other visible structures. • Design stations to fit within their local landscape context. • Use low planting in rural areas to draw attention away from overhead wires. • Plant screening vegetation between stations and nearby residential areas. • Minimise light spill onto neighbouring properties at Rockingham Station. • Install screens on pedestrian overpasses that overlook residential areas. 	<ul style="list-style-type: none"> • Acceptable level of visual amenity maintained for residents, railway users and visitors to nearby areas.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Aboriginal Heritage	<p>Ensure that changes to the biological and physical environment resulting from the proposal do not adversely affect cultural associations with the area.</p> <p>Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972.</p>	<ul style="list-style-type: none"> Development of the railway will not cause conflict with any known Aboriginal heritage sites. Aboriginal community representatives consulted have supported the development of the railway on its proposed alignment. Previously undiscovered archaeological material may be uncovered during earthworks. 	<ul style="list-style-type: none"> Comply with the requirements of the <i>Aboriginal Heritage Act 1972</i>. Monitor earthworks for archaeological material, where possible by employing Aboriginal monitors. If sites are uncovered, follow procedures detailed in the Construction Management Plan. Consult with the Aboriginal community on matters including drainage, seed collecting, Mt Henry Bridge widening and employment of Aborigines. 	<ul style="list-style-type: none"> No unauthorised damage to Aboriginal archaeological material or cultural associations. Continuing mutually beneficial relationship between the SWMR project and the Aboriginal community.
European Heritage	(none stated)	<ul style="list-style-type: none"> The Narrows Bridge is protected under the <i>Heritage of Western Australia Act 1990</i> (Register of Heritage Places). Advice must be sought from the Heritage Council of WA before work on the Narrows Bridge is authorised. The alignment passes close to or crosses several buildings, reserves and natural features listed on other heritage databases including municipal heritage registers, Register of the National Estate, National Trust register. Heritage buildings above the railway tunnels in the Perth CBD could be affected by vibration or subsidence during tunnel construction or railway operation. 	<ul style="list-style-type: none"> PURD will promote and actively participate in discussions with the Heritage Council of WA regarding Narrows Bridge works. Construction Management Plan for the CBD section will present details of comprehensive geotechnical and vibration assessments and management plan for preventing damage to heritage buildings. 	<ul style="list-style-type: none"> No significant damage to heritage buildings or other heritage places.

Table A1 (continued)

<i>Environmental Factor</i>	<i>EPA Preliminary Objective (as stated in EPA Guidelines)</i>	<i>Potential Impact(s)</i>	<i>Proposed Management</i>	<i>Predicted Outcome</i>
Soil and Groundwater Contamination	Ensure that any contaminated land or groundwater that may be impacted by the proposal is managed and remediated to an acceptable standard compatible with the intended land uses	<ul style="list-style-type: none"> • Areas requiring further assessment for possible soil contamination identified at Perth City Rail Reserve, Perth foreshore, market gardens and former piggery in Stakehill, Paganoni Road market garden, former infiltration basins at Mandurah WWTP, former landfill and disused road reserve in Mandurah. 	<ul style="list-style-type: none"> • Further investigation of identified sites, including soil sampling, will be undertaken before construction. • Water quality in areas to be dewatered for Perth City tunnel will be investigated. 	<ul style="list-style-type: none"> • Any contaminated areas treated according to accepted standards. • No significant risk to construction workers, passengers, public or the environment from contaminated soils or groundwater.
Traffic Management	<p>Ensure safe and effective vehicular and pedestrian traffic flow during and after the construction phase where existing patterns may be affected by the proposal.</p> <p>Ensure acceptable air quality during and following the construction phase where existing patterns may be affected by the proposal.</p>	<ul style="list-style-type: none"> • Kwinana Freeway between Mt Henry and The Narrows reduced to two lanes in non-peak direction for six months. • Changed traffic flows and detours in Narrows interchange, William St, Mounts Bay Rd, The Esplanade. • Wellington St reduced to two lanes in each direction for six weeks. • Temporary partial closure of freeway shoulders at Glen Iris, South St and Leach Hwy. 	<ul style="list-style-type: none"> • Possible designation of middle (peak) lane on Freeway as a combined bus and high occupancy vehicle (3 persons or more) lane during rail works. • Pedestrian movement paths maintained. • Detailed traffic management measures to be set out in the Construction Management Plan. 	<ul style="list-style-type: none"> • Some increased delays in constricted areas during peak periods. • No unmanageable traffic problems arise.

Table A2 Summary of Commitments

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
1.0	Construction Management Plan	Prepare a Construction Management Plan which addresses: <ul style="list-style-type: none"> • Measures to limit clearing • Environmentally significant areas • Impacts on fauna • Protection of declared rare and priority flora and other flora of conservation significance • Protection of Threatened Ecological Communities • Hygiene measures to minimise the spread of disease and weeds • Water quality, erosion and sedimentation control • Construction noise and vibration • Aboriginal and European heritage • Property condition surveys • Dust management • Fire management • Access during construction • Construction lay-down sites • Fencing • Light spill • Public input and complaints response procedure • Registers of waste materials/contamination, monitoring and site audit sheets • Movement, storage and refuelling of machinery during construction • Storage and handling procedures for all construction materials and hazardous chemicals • Hazardous spill contingency plan • Contamination contingency plan including measures for acid sulphate soils • Works in the vicinity of high pressure gas pipelines • Dewatering and water supply • Description of environmental standards, safeguards and emergency responses • Schedules for corrective action and verifications • Licensing requirements and approvals • Management structure and reporting 	Ensure that construction impacts (direct and indirect) on flora, fauna, wetlands, Bush Forever sites, surface water and groundwater, nearby residents, buildings, Aboriginal and European heritage sites are minimised.	Prior to site preparation work commencing for each stage of construction	DIA, DEWCP, CALM, FESA, Heritage Council, Local Governments

Table A2 **Continued**

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
1.0 (Cont)		<ul style="list-style-type: none"> • Environmental briefing, training and induction of personnel • Monitoring • Progress and compliance reporting 			
2.0	Construction Management Plan	Implement the Construction Management Plan required by Commitment 1.0.	Achieve the objectives of Commitment 1.0	During Construction	DEWCP, Local Government
3.0	Clearing Mitigation Plan	Prepare a Clearing Mitigation Plan for the mitigation (e.g. by rehabilitation of degraded land outside the rail reserve, purchase for reservation of unprotected bushland or support of CALM conservation purchases) of vegetation loss through clearing for the SWMR.	Mitigate the effects of clearing for the project and achieve the objective of no net loss of significant vegetation.	Design	DEWCP, CALM
4.0	Clearing Mitigation Plan	Implement the Clearing Mitigation Plan required by Commitment 3.0.	Achieve the objectives of Commitment 3.0	Design to post-construction	DEWCP, CALM
5.0	Rehabilitation Strategy and Landscape Management Plan	Prepare a Rehabilitation Strategy and Landscape Management Plan which addresses: <ul style="list-style-type: none"> • Visual Amenity • Protection of significant flora and ecological communities • Plant/seed selection • Plant/seed source and propagation methods • Topsoil management • Weed control • Dieback and disease management • Bushfire management • Erosion control • Fencing 	Ensure that the post-construction landscape is stable and self-sustaining, ecological functions are retained or reinstated where possible and that visual amenity is maximised.	Design	DEWCP, CALM, Local Government
6.0	Rehabilitation Strategy and Landscape Management Plan	Implement the Rehabilitation Strategy and Landscape Management Plan required by Commitment 5.0.	Achieve the objectives of Commitment 5.0	Construction to until rehabilitation complete	DEWCP, CALM, Local Government
7.0	Fauna Management Plan	Prepare a Fauna Management Plan which addresses: <ul style="list-style-type: none"> • Fauna habitats • Fauna movement • Monitoring 	Minimise impacts on fauna	Design	CALM, DEWCP

Table A2 Continued

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
8.0	Fauna Management Plan	Implement the Fauna Management Plan required by Commitment 7.0	Achieve the objectives of Commitment 7.0.	During construction and post-construction	DEWCP, CALM
9.0	Wetlands, Hydrology and Drainage Management Plan	Prepare a Wetlands, Hydrology and Drainage Management Plan which addresses: <ul style="list-style-type: none"> • Drainage design and management • Dewatering impacts • Wetland and groundwater monitoring • Areas for wetland enhancement and mitigation for the loss of any significant wetlands • Minimising loss of wetland dependant vegetation • Corrective action to local resident water supplies (if required) 	Minimise impacts on wetlands, surface water and groundwater and ensure no net loss of wetland functions and values.	Design	CALM, Local Governments
10.0	Wetlands, Hydrology and Drainage Management Plan	Implement the Wetlands, Hydrology and Drainage Management Plan required by Commitment 9.0.	Achieve the objectives of Commitment 9.0.	During construction and post-construction	DEWCP, CALM, Local Governments
11.0	Noise and Vibration Management Plan	Prepare a Noise and Vibration Management Plan which addresses: <ul style="list-style-type: none"> • Noise and vibration impacts and criteria • Location of noise sensitive premises • Noise and vibration level predictions • Mitigation measures • Monitoring and reporting program • Complaint response 	Minimise noise and vibration impacts on sensitive premises.	Design	DEWCP, Local Governments
12.0	Noise and Vibration Management Plan	Implement the Noise and Vibration Management Plan required by Commitment 11.0	Achieve the objectives of Commitment 11.0.	During construction	DEWCP, Local Governments
13.0	Access Management Plan	Prepare an Access Management Plan which addresses: <ul style="list-style-type: none"> • Railway maintenance access • Bushland management access • Recreational access • Emergency service access 	Minimise the impact of the railway on bushland and significant environments	Design	CALM, FESA, DEWCP, Local Governments

Table A2 Continued

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
14.0	Access Management Plan	Implement the Access Management Plan required by Commitment 13.0.	Achieve the objectives of commitment 13.0.	During construction and operation	DEWCP, CALM, FESA, Local Governments
15.0	Contamination Assessment and Management Plan	Prepare a Contamination Assessment and Management Plan which addresses: <ul style="list-style-type: none"> • Soil and groundwater quality at the sites requiring further investigation as identified in the PER • Investigations and procedures where there is a risk of disturbing acid sulphate soils • Agree the management/remediation requirements with the DEWCP 	Ensure the soil and groundwater quality are appropriate for the intended land use and acceptable standards are maintained.	Design	DEWCP
16.0	Contamination Assessment and Management Plan	Implement the Contamination Assessment and Management Plan required by Commitment 15.0.	Achieve the objectives of commitment 15.0.	Design	DEWCP
17.0	Traffic Management Plan	Prepare a Traffic Management Plan which addresses: <ul style="list-style-type: none"> • Disturbance to traffic flows and pedestrians • Road deviations • Management measures 	Minimise the impact of railway infrastructure on vehicle and pedestrian traffic, and where traffic patterns are affected ensure acceptable air quality is maintained.	Design	DEWCP, Main Roads WA, Local Governments
18.0	Traffic Management Plan	Implement the Traffic Management Plan required by Commitment 17.0	Achieve the objectives of commitment 17.0	During construction	DEWCP, Main Roads WA, Local Governments

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PART A: PROJECT BACKGROUND

1.0 INTRODUCTION

1.1 The Proposal

Perth Urban Rail Development (PURD), on behalf of the Commissioner of Railways, proposes the construction and operation of the South West Metropolitan Railway (SWMR) from Perth to Mandurah. Through establishment of the SWMR the Government seeks to address public transport requirements in the rapidly expanding south-west corridor of the Perth Metropolitan Region.

The proposal includes establishment of rail infrastructure between Perth and Mandurah, with the first section of the line running from the Central Business District (CBD) to Kwinana along the Freeway, then via the eastern side of Rockingham to Allnutt Street in Mandurah.

The project has been referred to the EPA under Section 38 of the *Environmental Protection Act 1986*, which has determined that the proposal should be assessed at Public Environmental Review (PER) level. This PER examines the potential environmental impacts of railway construction and operation and has been prepared in accordance with guidelines issued by the EPA. The structure and content of the review addresses guidelines provided by the EPA, which are attached in Appendix A.

1.2 Project Location

The proposed railway will run between Perth and Mandurah via Rockingham, over a total distance of 80km. The proposed railway route is shown in Figures 1 and 2 and further described in Section 2.2.

1.3 The Proponent

The proponent for the railway is the Commissioner of Railways. The PURD office has been established as a separate entity to deal with the development of railway

infrastructure within the Perth Metropolitan Region. PURD is now an integral part of WAGR and responds directly to the Commissioner of Railways. The address of PURD is:

Perth Urban Rail Development
Level 2
19 Pier Street
PERTH WA 6000

The construction contracts have yet to be awarded but the successful Contractor(s) will be required to comply with all commitments made by the proponent and also with all conditions placed on the project by the Minister for the Environment. The railway will be operated and maintained by the Western Australian Government Railways Commission (WAGRC).

1.4 Need for the Project

By 2021, the population of the Perth Metropolitan Region is estimated to be approximately 1.9 million, with over 75% of this projected population increase anticipated to settle in an area of the coastal strip no more than 15 kilometres wide between Two Rocks and Dawesville. During this period, the population of the South West Metropolitan Area is anticipated to rise to 500,000, comprising 25% of the total population of the Perth Metropolitan Region (Government of Western Australia (GWA), 2000a).

The South West Corridor is approximately 80km long and is configured in such a manner that the majority of existing and future residential development will be within a few kilometres of the proposed SWMR.

In 1997, public transport accounted for 3% of inter-suburban journeys and 35% of peak hour trips to central Perth. The total share of all trips undertaken within the Perth Metropolitan Area held by public transport was just over 6%. Without the development of an appropriate public transport system, the predicted population growth within the South West Metropolitan Area will result in increased travel by private car (GWA, 2000a).

Increased dependence on private cars will result in increased traffic congestion, longer travel times and increased pressure on existing road infrastructure. The lack of a suitable public transport system will also deprive people without private transport of mobility and access to goods and services. Increased reliance on private transport has the potential to generate significant social, environmental and economic impacts on the community.

The establishment of an integrated public transport system comprising rapid transit trunk services (rail) that are complemented by local feeder and distributor services (buses) will therefore provide a viable inter-regional, cross-suburban and intra-suburban alternative to reliance on private transport (GWA, 2000a).

1.5 Factors Assessed in this PER

This PER document addresses environmental impacts associated with the construction and operation of the SWMR from Perth to Mandurah, but applies only to those aspects of the project that have not been previously assessed by the EPA. Table 1 indicates the environmental factors considered for each section of the rail line in this PER.

1.5.1 Perth to the Southern Metropolitan Region Scheme Boundary

The rail alignment between Perth and the Metropolitan Region Scheme (MRS) Boundary has been defined in three planning stages. MRS amendments 937/33 and 938/33 defined the SWMR railways reservation between Jandakot and the MRS Boundary as shown in Figure 3. MRS amendment 1032/33 defines station sites and areas along the alignment of insufficient size to accommodate rail infrastructure requirements between Jandakot and the MRS Boundary. This MRS amendment has not yet been gazetted. The current planning has defined further changes to the alignment between Perth and Jandakot and between Leda and Cooloongup. The railways reservation which is the subject of MRS amendments 937/33 and 938/33 and 1032/33 are displayed in Figure 3.

MRS Amendments 937/33 and 938/33

In 1993, the Department of Planning and Infrastructure (DPI) (then the Department of Planning and Urban Development) put forward a proposal to amend the Metropolitan Region Scheme (MRS) to include a Rapid Transit Corridor for the construction of a future rail system. This alignment of the proposed railway reserve was documented in

Table 1: Relevant Factors for Assessment of the SWMR

Section	Characteristics	Relevant Factors to be Addressed in the PER	
MRS Amendment areas 937/33 and 938/33 (ie portions of the railways reservation shown in the current MRS)	<ul style="list-style-type: none"> • Construction and operation of new passenger line and associated infrastructure. 	<ul style="list-style-type: none"> • Vegetation (apart from Regionally Significant Vegetation) • Noise and vibration • Groundwater • Construction Impacts (dust, etc.) • Public Risk and Safety 	<ul style="list-style-type: none"> • Visual Amenity • Aboriginal Heritage • Soil and Groundwater Contamination • Traffic Management • Environmentally Sustainable Development
MRS Amendment areas 1032/33 (ie new station sites and reserve widenings)	<ul style="list-style-type: none"> • Construction and operation of new passenger line and associated infrastructure. 	<ul style="list-style-type: none"> • Vegetation • Fauna • Wetlands • Groundwater • Noise and Vibration • Construction Impacts (dust, etc.) 	<ul style="list-style-type: none"> • Public Risk and Safety • Visual Amenity • Aboriginal Heritage • Soil and Groundwater Contamination • Traffic Management • Environmentally Sustainable Development
Additional areas (Perth to Jandakot and Leda to Coo loongup)	<ul style="list-style-type: none"> • Construction and operation of new passenger line, railway tunnel and associated infrastructure. 	<ul style="list-style-type: none"> • Vegetation • Fauna • Wetlands • Groundwater • Noise and Vibration • Construction Impacts (dust, etc.) 	<ul style="list-style-type: none"> • Public Risk and Safety • Visual Amenity • Aboriginal Heritage • Soil and Groundwater Contamination • Traffic Management • Environmentally Sustainable Development
Peel Region Scheme Areas	<ul style="list-style-type: none"> • Clearance of vegetation to enable construction and operation of new passenger line and associated infrastructure.. 	<ul style="list-style-type: none"> • Vegetation • Fauna • Wetlands • Groundwater • Noise and Vibration • Construction Impacts (dust, etc.) 	<ul style="list-style-type: none"> • Public Risk and Safety • Visual Amenity • Aboriginal Heritage • Soil and Groundwater Contamination • Traffic Management • Environmentally Sustainable Development

MRS Amendments 937/33 and 938/33 and was subsequently assessed by the EPA (Bowman Bishaw Gorham & DPUD, 1994; EPA, 1994). Some areas of the alignment as described below have since changed.

The proposed Rapid Transit Corridor was subsequently approved by the Minister for the Environment subject to conditions in Statement 368, and gazetted in the MRS. The EPA's assessment was restricted to impacts on Regionally Significant Vegetation, Fauna, Wetlands, Beeliar Regional Park and System Six areas. These factors cannot be re-assessed for this portion of the alignment. Other potential impacts additional to those relating to the definition of the railways reservation may be assessed along this section of the route.

Information has also been provided on the biophysical elements previously assessed by the EPA to provide context to the project, as required by the EPA guidelines for the preparation of the PER (Appendix A).

MRS Amendment 1032/33

As a result of further planning for the SWMR, PURD has identified a number of areas where the gazetted Rapid Transit Corridor is of insufficient size or requiring minor adjustments to the alignment to accommodate all rail infrastructure requirements. The majority of these areas are associated with station sites. MRS amendment 1032/33 also proposes the deletion of portions of the SWMR railways reservation no longer required.

These changes were considered by the Hearings Committee for Amendment 1032/33 on 13 June 2002 and have been assessed in the PER. MRS Amendment No. 1032/33 incorporates the proposed changes to the gazetted alignment and was referred to the EPA by the DPI for assessment.

The EPA subsequently determined that no separate assessment of these areas was required on the understanding that all environmental issues associated with the amendments were addressed in the PER document for the SWMR proposal. All environmental impacts associated with the development of these areas have therefore been included as part of the current assessment.

Additional Areas

In 2001 the Perth to Jandakot and Leda to Coo롱gup sections of the route were modified. The Perth to Jandakot alignment was changed from passing via Kenwick to

running through the centre of the Kwinana freeway directly into the CBD (Section 1.6). The alignment between Jandakot and the Narrows Bridge lies within the freeway road reserve. The Leda to Cooloongup alignment was changed from being located east of the Cooloongup residential area to running along the Garden Island Highway Reserve and Ennis Avenue.

These portions of the proposed alignment have not been previously assessed for use as a rail corridor. All relevant environmental factors therefore require assessment in the PER.

1.5.2 Southern MRS Boundary to Mandurah (the Peel Region)

The Draft Peel Region Scheme (WAPC, 1999) provides for a railways reserve to accommodate the SWMR (Figure 4). The Scheme has been formally assessed by the EPA (EPA, 2000a) and has had environmental conditions set. At the date of publication of this PER, the Peel Region Scheme is nearing final gazettal. During the assessment of the Peel Region Scheme the EPA deferred several environmental factors for later assessment due to the broad scale of the environmental assessment or because insufficient information was considered to be available at the time of assessment.

The factors on which assessment has been deferred for the Rapid Transit Corridor are vegetation, wetlands, noise and vibration. The potential impacts of construction and operation of the railway on these factors are considered in this PER.

1.6 **Examination of Alternatives/Alternatives Considered**

1.6.1 Previous Route Selection Studies

For public transport to offer a viable alternative to private car use within the south west corridor, it must be viable between “sub regions” within the corridor and also provide strong connections to the remainder of the metropolitan area (DoT, 1998).

Prior to 1993, studies of public transport needs for the south west corridor focussed on a requirement to link Mandurah, Rockingham and Kwinana to Perth through Fremantle. Rapid transit through an established corridor was not considered to be a major priority. These studies included the South West Area Transit (SWAT) Study (DoT, 1997, 1998).

The SWAT study concentrated on the accessibility of public transport between intra regional areas. Rapid transit to the Perth Central Business District or the remainder of the metropolitan area was not considered a major priority and it was assumed that such trips could be handled using express bus services along the Kwinana Freeway. As a result, alternative rail connections to Perth by any route other than Fremantle were never seriously considered (DoT, 1998).

However, the degree to which Fremantle should be a focus of further studies was questioned given that Perth City would continue to be the dominant economic, legislative, administrative and social centre in Western Australia. Therefore further studies undertaken during this period investigated options for a direct, rapid transit link through the south west corridor to Perth (DoT, 1997).

In 1993, the DPI (then the Department of Planning and Urban Development), in conjunction with Westrail, investigated options for the provision of a direct, inter regional rapid transit (railway) route through the South West Metropolitan Area to Perth (DoT, 1998).

An early planning requirement set by the DPI for establishment of a rapid transit system from Kwinana northwards was that it must access the proposed regional centre and urban development at Thomsons Lake in Jandakot (DoT, 1997).

1.6.2 Alternative Routes Considered

Urban settlement patterns to the south of central Perth are constrained by land use and environmental considerations, including:

- the Jandakot and Stakehill Groundwater Protection Areas;
- the Kwinana Air Quality Buffer Zone;
- the Beeliar and Rockingham Regional Parks; and
- Bush Forever sites.

These restrictions on settlement patterns greatly influence travel demand for intra and inter regional trips within the South West Metropolitan corridor. However, with due consideration to all other factors, travel demand remains the overriding factor in the identification of options for the development of a rapid transit system.

The options previously considered in the identification of the preferred route for the SWMR are shown in Figure 5 and described further in the sections below.

1.6.2.1 Jandakot – Fremantle – Perth

Consideration of alternatives for the establishment of a rapid transit corridor to Perth via Fremantle was undertaken on the understanding that the primary focus of travel was to be Perth City and not Fremantle (DoT, 1997).

Two main alternatives were considered during the planning process:

- Thomsons Lake to Fremantle and Perth via the existing standard gauge (freight) railway (Option 1);
- Thomsons Lake to Fremantle and Perth via the Roe Highway reserve (Option 2).

From Thomsons Lake, Option 1 runs northwards along the western side of the Kwinana Freeway until it reaches the existing Kwinana – Woodbridge freight railway. It then runs westward along the freight line as far as the existing Cockburn – Fremantle freight line. From here, the passenger line then runs northwards along the Cockburn – Fremantle line to Fremantle station and subsequently to Perth (City of Cockburn, 1997).

Option 2 also runs along the western side of the Kwinana Freeway from Thomsons Lake, until it intersects the Roe Highway road reserve. The SWMR line then runs westward along the proposed Roe Highway alignment until it reaches the existing Cockburn – Fremantle freight line in Marine Terrace, just south of Duoro Road in Fremantle. The route then runs along the existing freight line around Arthur Head to the Fremantle railway station and Perth (City of Cockburn, 1997).

During the planning process, the City of Fremantle raised objections to the use of the existing Cockburn – Fremantle freight line for the establishment of the SWMR project. Concern was raised regarding the impact that a significant increase in train movements would have on historical buildings in close proximity to the freight line, such as the Round House and the Maritime Museum.

Objection was also raised with respect to the potential severance of the Esplanade from the Fishing Boat Harbour. It was felt that a significant increase in train movements

would preclude free pedestrian access across the rail line, whilst the increased noise and vibration associated with the SWMR proposal would significantly diminish the amenity of the area.

In response to these concerns, the option of tunnelling the rail between the Cockburn – Fremantle freight line and the Fremantle train station was examined, however the costs associated with such an alternative were considered prohibitive.

A preliminary analysis of population catchments for the rail options between Thomsons Lake and Fremantle was completed by the City of Cockburn in 1997. Population catchments for other potential alignments were also considered as part of the analysis.

The study estimated that Option 1 had an ultimate population potential of 113,338 whilst Option 2 had a population potential of 125,308. This potential passenger base was well below that of the other alignment and as a result the route became an unattractive option in comparison to other alternatives.

1.6.2.2 Jandakot – Kenwick – Perth

The Kenwick link option is shown in Figure 5. This route was considered a better alternative than the Fremantle option for the following reasons:

- it is approximately seven kilometres shorter than the alternative route via Fremantle;
- greater speed will be possible on the Jandakot - Kenwick passenger line due to the geometry of the railway reservation;
- studies showed that the patronage potential of a route via Kenwick was significantly greater than the Fremantle alternative and that a railway along this alignment would be viable in its own right, irrespective of the need to extend the line beyond Jandakot;
- it was considered that there would be substantial opposition to the extension of the existing urban rail system at ground level to the immediate south of Fremantle Station. Costs associated with tunnelling the line through this area had significant impacts on the viability of the Fremantle option.

(DoT, 1997)

The Kenwick route was considered the most favourable prior to consideration of the direct route from Jandakot to Perth. After detailed investigation the direct route was found to be favourable as outlined in Section 1.6.2.3.

1.6.2.3 Jandakot to Perth

Options for the establishment of a direct route from Jandakot to Perth City were first considered in 1993 and reviewed again in 1996. All of the options considered the location of the rail system within the existing Kwinana Freeway alignment. These included construction of the railway:

- to the west of the Kwinana freeway alignment, which would require reclamation and reconfiguration of the Swan River foreshore;
- within the existing median strip between the northbound and southbound carriageways; and
- to the east of the freeway, between the southbound carriageway and South Perth/Como residential and business areas.

The potential to construct the railway at ground level, below grade or as an elevated system was also considered. Of all options considered, the preferred option for this alignment was construction of the railway system at grade, within the existing freeway median strip.

The initial studies found the direct alignment impractical on cost grounds (PCRAC, 2002a). In 2001 the option of the direct rail route was reconsidered. It was determined that the track width requirement could be incorporated into the existing Freeway reserve, planned for use as an exclusive busway, with modifications to the Mount Henry Bridge and Narrows Bridge required.

The direct route offers the following advantages:

- significant journey time savings for all prospective commuters from Jandakot and further south;
- patronage increases;
- significantly improved level of service to the entire metropolitan rail system; and
- savings in rolling stock requirements and an increase in rolling stock utilisation.

The estimated travel time savings compared to the alignment via Kenwick are:

- Mandurah to Perth – 20%
- Rockingham to Perth – 26%
- Thomsons Lake to Perth – 42%

These travel time savings result in:

- a 20% reduction in railcar requirements
- a 50% increase in railcar utilisation

(PURD & DPI, 2002)

Based on the advantages of the direct route over other alternatives it was determined to be the most favourable option.

1.6.2.4 Perth Central Business District

Three basic options have been considered for the rail alignment from the Narrows Bridge to the Perth Central Business District (CBD). These are:

- an eastern alignment which loops in a counter clockwise direction before joining the existing Perth City Station;
- a central option which travels north along a central route under William Street (with a new station underground along this section), joining the existing rail reserve immediately west of the existing Perth City Station and connecting to the northern suburbs railway; and
- a western option which travels further along the freeway and enters the city travelling in a clockwise direction before joining the existing Perth City Station (PCRAC, 2002b).

An option including an underground rail loop roughly extending from the foreshore to Newcastle Street and the WACA ground to Thomas Street which provided a railway station within a ten minute walking distance throughout this area was also considered. This option required five additional stations and a significantly longer tunnel and was therefore prohibitively expensive (PCRAC, 2002b).

The relevant factors used in assessing the suitability of the proposed routes included:

- Aesthetic impacts and foreshore access
- Passenger convenience and interchange

- Service economy, efficiency and reliability
- Property requirements
- Costs

A version of the central option was selected as the final route alignment and announced by the Premier and the Minister for Planning and Infrastructure on 10 June 2002.

Central Route Option

The alignment of the modified central option is presented in Figure 6. This alignment has been reconsidered using a bored tunnel technique under William Street rather than the cut and cover method originally proposed. The route will leave the freeway and be submerged and fully enclosed (at ground level) from a point within approximately 80 metres of the southbound carriageway of the Mitchell Freeway.

The line will continue underground, turning north up William Street with the first station located at the Esplanade to provide connection with the busport and the convention centre. The second station will be located slightly to the east of William Street between Wellington and Murray Streets. The northern end of the platforms will be located in line with Wellington Street to reduce the distance from the current train station. An underground pedestrian link will be established between the two stations. This also has the potential to connect directly with Roe Street.

Construction of this alignment will be via cut and cover methods to the Esplanade Station and then via boring underneath William Street. The William Street Station and the final section in the Wellington Street Railway Reserve will also be constructed using cut and cover techniques. The location of the William Street station is designed to avoid major traffic disruption.

Western Route Option

The location of the western alignment is also displayed on Figure 6. The alignment will continue along the freeway, going underground near the Mount Street footbridge. The underground section would be constructed using top down, diaphragm wall construction methods.

An underground station would be provided at Elder Street to service the western section of the CBD and the area surrounding Parliament House. The alignment would then curve clockwise at Wellington Street running parallel with the Fremantle line and entering the existing Perth train station from the west.

Northbridge Connection

Both options include the possibility of sinking the existing rail line between the Bus Station and Milligan Street. The sinking of the rail lines at Northbridge together with the creation of a "land bridge" connection would create additional property development, improve access to public transport and allow the introduction of new vehicular, bicycle and pedestrian connections between the CBD and Northbridge (PCRAC, 2002b).

1.6.2.5 Rockingham Loop and Eastern Bypass

In 1996, MfP prepared the Rockingham City Centre Railway Access Study to address the under-servicing of Rockingham by public transport systems. In 1997, the State government endorsed a rail alignment into the city, which was initially incorporated into the SWMR proposal.

Concomitant with the change in the railway route between Jandakot and Perth, there was a major change in the route through Rockingham. The former Rockingham Loop and Eastern Bypass have been replaced as shown in Figures 2 and 3. The major transit interchange station at Rockingham will now be situated at the intersection of Ennis Avenue and Garden Island Highway/Rae Road (PURD & DPI, 2002).

1.6.3 The "No Rapid Transport System" Option

Travel forecasts for a situation where no rapid transport system is provided in the South West Metropolitan Area show that the daily number of private car trips is expected to grow faster than the increase in population. Without provision of a rapid transit railway, forecasts show only a marginal change to the proportion of all trips completed by public transport. A slight fall in the percentage of the population using public transport is anticipated by 2021, which would correspond to an increasing dependency on private vehicles (GWA, 2000a).

It is anticipated that the Perth Central Business District will remain the most popular peak period destination over the next 25 years and it is anticipated that there will be a significant increase in the number of public transport trips to this location by 2021. However, despite this increase, forecasts indicate that without construction of the rapid transport system there will be little change to the metropolitan-wide use of public transport in future years (GWA, 2000a).

An increase in the dominance of private vehicle use would result in a decrease in air quality due to increased vehicle emissions. It would also have a significant impact on traffic flow both intra and inter regionally, with increased pressure on local and state government to improve road networks in order to alleviate traffic congestion. Increased private transport would also ultimately increase travel times due to the sheer volume of traffic and the limited carrying capacity of the existing road networks.

1.7 Environmentally Sustainable Development

1.7.1 Introduction

Environmentally Sustainable Development (ESD) may be defined as:

“Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased ” (Commonwealth of Australia, 1992).

Put simply, ESD is development that aims to meet the needs of current Australians, while conserving ecosystems for the benefit of future generations. ESD seeks to develop ways of using environmental resources that form the basis of the economy in a way that maintains and, where possible, improves their range, variety and quality. At the same time it aims to utilise those resources to develop industry and generate employment (Commonwealth of Australia, 1992).

The core objectives of ESD are considered to be:

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;

- to provide for equity within and between generations; and
- to protect biological diversity and maintain essential ecological processes and life-support systems.

For the purposes of this discussion, environmentally sustainable development is considered to incorporate the concepts of ecologically sustainable development.

The National Strategy for Ecologically Sustainable Development (Commonwealth of Australia, 1992) was endorsed by the Council of Australian Governments in 1992. The Strategy sets the scene for the broad changes in direction and approach that governments will take to try to ensure that Australia's future development is ecologically sustainable. To do this, the Strategy has set objectives for various industry sectors and environmental considerations. With respect to future planning for urban areas and associated transport systems, the Strategy provides the following objective:

“to encourage the future development of urban transport systems which provide opportunities to limit the use of fossil fuels” (Objective 6.2: Commonwealth of Australia, 1992).

The Strategy provides measures that governments will strive to implement to ensure that the objectives can be reached. Of particular relevance to the SWMR proposal is that governments will “continue to work towards upgrading of urban public transport systems, including the rehabilitation and development of urban rail systems, integration and coordination of different modes of transport and improving service quality” (Commonwealth of Australia, 1992).

The SWMR project addresses all of these requirements in that it will:

- Develop a new public transport system for existing residents between Perth and Mandurah to expand the options for public transport in these areas.
- Provide public transport systems to proposed residential areas between Perth and Mandurah.
- Establish integrated links between bus and rail transport to increase the capture area for public transport users.
- Provide a high speed rail service to minimise travel times and improve public transport service within the southern metropolitan region.

1.7.2 Proposal Inputs and Outputs

Construction Inputs

Raw Material Usage

The construction of the railway will require:

- 300 kilometres of rail
- 180,000 reinforced concrete sleepers
- 5.4 kilometres of tunnels
- 15 bridges
- 10 Stations
- 85 kilometres of fencing surrounding the rail line
- 75 kilometres of safety barriers
- Electrified overhead traction system with 525 kilometres of conductors and 1500 precast concrete masts.
- A communications system and a signalling system with 75 kilometres of optic fibre cable and 150 kilometres of conductive cables respectively.
- 93 railcar units arranged as 31 three-car sets. Each railcar set has six air-conditioning units, four traction motors and twelve axle/wheel sets.

Raw materials required to complete the construction detailed above include:

- 2 million cubic metres of fill
- 15,000 tonne of steel used for the rail lines
- 240,000 tonnes of rock ballast
- 100,000 cubic metres of concrete with 12,000 tonnes of reinforcement

Operating Inputs

The SWMR will use electricity as its primary source of traction, which will be sourced from the Western Power grid. Operation of the SWMR will require an estimated total average energy input of 150 MWhours per day or 54.75 GWh per year. Due to the need to ensure that the SWMR can be fully integrated into the Perth Urban Rail system, which

currently operates with electricity as its primary energy source, no alternative energy sources have been considered for this project.

1.7.3 Operating Outputs

Environmentally, the principal benefit of electric traction is its potential to limit the impacts of pollutant loads on Perth's air quality, both by reduction in the absolute amount of pollutants emitted and by shifting the point of emission outside the metropolitan area. The new railcars purchased for the SWMR service will use regenerative braking technology that will effectively convert inertial energy of braking into electricity feeding back into the electrical distribution system. This measure will improve the efficiency of energy use and reduce the emissions from electricity generation by a small amount.

The average passenger motor vehicle occupancy rate in Perth is now estimated to be 1.12 persons per vehicle. On this basis, at expected rail passenger usage rates, the Perth – Mandurah service will take the place of over 9.6 million motor vehicle journeys per year. This represents savings of 37.33 million litres/year of fuel burnt for journeys between Perth and Mandurah (GWA, 2000a).

The supply of one megawatt hour of electricity to the Western Power Corporation grid (including distribution losses) incurs an atmospheric pollution factor of 1.032 tonnes of carbon dioxide equivalent (CO_{2e}) greenhouse gases. The operation of the SWMR between Perth and Mandurah will therefore result in the production of 56,500 tonnes of CO_{2e} per year. By comparison, the use of passenger cars to transport an equivalent number of passengers would result in the generation of 84,275 tonnes of CO_{2e} per year. The SWMR has the potential to reduce the emission of greenhouse gases by 27,775 tonnes, or 33%, for these journeys. Over a period of 20 years for this project, this would amount to reduction of greenhouse emissions of over 550,000 tonnes.

The introduction of the Perth to Mandurah railway will provide annual transport for an estimated 10.83 million passengers, each travelling an average distance of 33 kilometres. This high-speed service will enhance the opportunity for people to gain employment and visit areas they would normally have difficulty in accessing.

The railway will provide an alternative to road and Freeway complexes in the Metropolitan area that should relieve the already congested arterial accesses in the peak-hour travel periods.

It will link Perth City to the rapidly expanding regions to the north and south and interconnect major regional centres in these areas.

Travel times between major regional centres and Perth take advantage of the ability of rail to move at consistently high speeds at all hours of the day. Peak period timetables reflect only the frequency of services with times to destination the same as off-peak travel. This is very attractive to those commuters who demand a consistently reliable travel time.

There are significant opportunities for employment arising from the construction and operation of the railway. It has been estimated that there will be created:

- Approximately 250 direct and 750 indirect jobs over 15 years, associated with the railcar construction and maintenance;
- Approximately 1500 jobs per year between the years 2003 and 2007 for construction of the railway, and
- Approximately 200 permanent jobs for train drivers, transit guards and station staff.

Many of these jobs will be located near and supporting regional centres.

1.7.4 Waste Reduction and Recycling

Raw materials obtained from the earthworks and underlying foundations for the railway lines may be recycled. Topsoil and mulched materials from clearing can be reused to stabilise earthworks and provide limited ability to revegetate from any seeds trapped in the mulch. Individual plants may also be transplanted from clearing to rehabilitation areas. Cleared vegetation will not be burnt. This will reduce the amount of CO₂ released to the atmosphere from burning activities and reduce the amount of space taken up in landfills by the green waste.

There will also be opportunity to recycle some infrastructure materials from works undertaken in the Perth railway yard and other areas of the existing passenger railway network done in support of the SWMR project. These may take the form of rail and overhead traction equipment, to be reused in the reorganised yard or possibly the Mandurah railcar depot.

The existing Canning Bridge Bus Station is to be retained and expanded to serve as the Canning Bridge Railway Station.

All other materials will be obtained as new manufactured or constructed items, selected to maximise utilitarian use and minimise long-term maintenance.

1.8 Relevant Legislation, Policies, Strategies and Approvals

1.8.1 Western Australian Legislation

The SWMR proposal is being developed in accordance with the requirements of the *Environmental Protection Act 1986*, whilst taking into consideration all other applicable State legislation and regulations. Current legislation applicable to this proposal includes:

- *Aboriginal Heritage Act 1972-1984;*
- *Bush Fires Act 1954;*
- *Conservation and Land Management Act 1984;*
- *Environmental Protection Act 1986;*
- *Environmental Protection (Noise) Regulations 1997;*
- *Fire and Emergency Services Authority of Western Australia Act 1998;*
- *Government Railways Act 1904;*
- *Heritage of Western Australia Act 1990;*
- *Land Administration Act 1997;*
- *Local Government Act 1960;*
- *Metropolitan Region Town Planning Scheme Act 1959;*
- *National Trust of Australia (WA) Act 1964;*
- *Native Title (State Provisions) Act 1999;*
- *Parks and Reserves Act 1895;*
- *Plant Diseases Act 1914;*
- *Rail Safety Act 1998;*
- *Railway (Jandakot to Perth) Act 2002;*
- *Railway (Northern and Southern Urban Extensions) Act 1999;*
- *Railways (Access) Act 1998;*

- *Railways (Standard Gauge) Construction Act 1961;*
- *Water and Rivers Commission Act 1995;*
- *Waterways Conservation Act 1976; and*
- *Wildlife Conservation Act 1950.*

1.8.2 State Policies and Strategies

In addition to existing legislation, the following State strategies and policies have been considered in the development and evaluation of the proposal:

- State Conservation Strategy;
- EPA System Six Red Book Recommendations for Conservation Reserves of Western Australia;
- Bush Forever;
- Jandakot Land Use and Water Management Strategy;
- Proposed Port Kennedy and Rockingham Parks Management Framework;
- Environmental Protection (Swan Coastal Plain Lakes) Policy 1992; and
- Wetlands Conservation Policy, 1997.

1.8.3 Commonwealth Legislation

Commonwealth legislation applicable to the SWMR proposal includes the following:

- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (which operates concurrently with any existing State laws in so far as those laws would not be inconsistent with this Act);
- *Australian Heritage Commission Act 1974;*
- *Native Title Act 1993; and*
- *Environment Protection and Biodiversity Conservation Act 1999.*

The following national strategies are relevant to the SWMR proposal:

- National Strategy for Ecologically Sustainable Development;
- Intergovernmental Agreement on the Environment;

- National Conservation Strategy for Australia; and
- National Strategy for Conservation of Australia's Biological Diversity.

1.8.4 Key Approvals

MRS Amendment 937/33 and 938/33 approvals have been received to date for the project. The approvals still required for the project include:

- MRS Amendment for change of land requirements at Stations and areas requiring reserve widening.
- Development Applications to the Local Government Authorities for the entire alignment.
- Approval to Disturb a Aboriginal Site (Section 18) by the Department of Indigenous Affairs for Perth City, Narrows Bridge and Mt Henry Bridge
- Approval to clear Threatened Ecological Communities from Environment Australia.
- Pipeline Licence to traverse the High Pressure Gas Pipeline from the Department of Mineral and Petroleum Resources.
- Traffic deviation approvals from Main Roads.
- Dewatering licences (abstraction and discharge) from the Water and Rivers Commission.
- Approval of the project by the Minister for the Environment.

1.9 Government and Community Consultation

PURD has undertaken an extensive community consultation programme for the SWMR proposal. This programme has been running since December 1998 and will continue throughout the PER process and beyond. Consultations have been undertaken at all levels of government. A number of meetings have also been held with local government authorities and local interest groups.

A register of the meetings held to date is provided in Appendix B and is also available on the PURD website (www.purd.transperth.wa.gov.au).

1.10 Optimisation of the Project

Since the inception of the SWMR project, a considerable number of changes have been made to improve the project's environmental performance and benefit to the community. These changes are briefly summarised below; most are also described elsewhere in this document under the appropriate headings.

1. *1994 Public Environmental Review of MRS amendments for the Rapid Transit Reserve*

Alignment changes in Figures 1-12 of EPA Bulletin 746, July 1994:

- Deviation around the Leda Nature Reserve wetland.
- Deviation to reduce impacts on Pickle Swamp.
- Inclusion of railway alignment inside road reserve north of Safety Bay Road
- Reduced width of the MRS from Safety Bay Road to the intersection of Ennis Avenue and Mandurah Road.
- Anstey Swamp - Rail alignment moved into the southbound carriageway of Mandurah Road to prevent any further impact on Anstey Swamp.
- Paganoni Road - The original alignment south of Paganoni Road went through bushland in good condition (now Bush Forever Site 395). The alignment was moved further west to avoid severing this bushland.

2. *Rockingham Loop and bypass changed to route down the Garden Island Highway*

Environmental benefits:

- Concentration of transport infrastructure in one corridor, thereby reducing habitat severance impacts.
- Crompton Road wetlands avoided. Some impact on Pickle Swamp but less than the original MRS amendment proposal.
- Proposed Rockingham depot site moved from bushland on the Rockingham Loop to Mandurah. Clearing requirement reduced by 37.6 ha.

3. *Realignment in Leda to reduce the impact on bushland and Pickle Swamp*

Changes to the optimum grade for the route from Leda into the Garden Island Highway have reduced the width of embankments required and enabled the rail alignment to be merged into the existing road reserve as early as possible.

4. *Retention of TEC 19b at Waikiki Station site*

PURD is committed to preserving the area of Threatened Ecological Community (TEC) 19b at the Waikiki Station site. New design options for the station site are being investigated. The most likely design option leaves the area of TEC intact. Access to the Station will be from the old Safety Bay Road, with further land taken to the south of the current Station MRS reservation to maintain the required level of car parking and station functionality.

5. *CALM management tracks to be constructed within the rail reserve where possible*

Locating the 4m wide CALM management tracks within the cleared railway reserve wherever practical will enable clearing outside the rail reserve to be minimised.

6. *Undergrounding of the rail along the Perth City foreshore*

The rail will enter a tunnel after deviating east off the freeway into the city and will be underground as it passes parallel to the new convention centre, where originally it was to be above ground. This modification will minimise the visual impact of the rail on the foreshore and maintain the current level of pedestrian accessibility to the foreshore.

7. *Other foreshore modifications*

The sinking of the railway has created the opportunity to re-route roads along the Perth City foreshore, resulting in enhanced accessibility, increased area and improved amenity of the foreshore reserve.

8. *Slab track formation from Mt Henry Bridge north to Perth City.*

The railway line will be laid on concrete slab rather than ballast from Mt Henry Bridge to the city. This will result in lower noise levels and a lower train profile relative to the freeway traffic and residences along the freeway foreshore.

The overall height of the train will be reduced by approximately 400 mm

9. *Installation of pollutant traps on freeway drainage outfalls to the Swan River.*

Pollutant traps, designed to intercept sediments, oils and other contaminants, will be installed on any freeway drainage outfalls modified for the SWMR project, where none currently exist.

10. *Return of surplus land to parks and reserves*

The original MRS amendment for the SWMR had the route travelling down the west side of the freeway from just north of Beeliar Drive to just north of Thomas Road before deviating through Leda. The alignment was subsequently changed to the central median of the freeway. As a result, a strip of land measuring approximately 4.26 ha, between Anketell and Thomas Roads adjacent to The Spectacles reserve, will be ceded to Parks and Reserves and added to The Spectacles wetland management area.

The land reserved for the Rockingham loop and bypass route, which is no longer required due to the re-alignment of the railway down the Garden Island Highway reserve, will be ceded to Parks and Reserves. This land totals approximately 4.85 ha.

PART B: PROJECT DETAILS

2.0 PROJECT DESCRIPTION

The following project description is taken from the South West Metropolitan Rail (SWMR) Master Plan and Appendices (GWA, 2000a). The location and route of the SWMR is shown in Figures 1 and 2.

2.1 Project Characteristics

2.1.1 Track Construction and Protection

The railway will be constructed using 1067mm track gauge to allow integration into the existing Perth Urban Rail system. Typical rail cross sections are presented in Figure 7.

The rail reserve will be fenced in accordance with current WAGR and Main Roads WA standards. No fencing will be constructed where the route is located in the centre of the freeway as access to this area is already restricted. Allowance has been made for the construction of 1.8m high link mesh fencing along the remainder of the route, with lower fences to be constructed in transit station precincts for aesthetic purposes.

Screens will also be installed over the railway line wherever bridges or other structures are erected over the track to protect persons from electrocution and to prevent vandalism. Screens will be erected in accordance with standard WAGR requirements.

2.1.2 Power Supply

The rolling stock for the SWMR will obtain its power supply from a single phase alternating current 25kV overhead traction wire, as used by the existing Perth Urban Rail system. The power is supplied to the railcars via current collectors mounted on top of the railcars. The railcar on board equipment converts the 25kv AC to a lower voltage that powers the electric traction motors and other services.

The power demand of the proposed SWMR will be similar to that of the existing system to enable full integration between the proposed and existing network. New 132kv/25kv substations will be established at Jandakot and Karnup, which will draw power from

adjacent Western Power facilities via a 132kv underground cable. The 132kv will be reduced to 25kv to feed the overhead traction wiring system.

Intermediate 25kV switching stations will also be established at the Esplanade, Anketell, Leda and Waikiki.

2.1.3 Rolling Stock

The state government plans to acquire a fleet of 93 railcars, which will operate in 3 car sets, to service the anticipated demand within the South West Corridor and Northern Suburbs Transit Lines. The three car sets will have a seating capacity of 574 (242 seated, 332 standing). Delivery of the railcars is anticipated to begin in 2004 and be completed by 2006 to coincide with the opening of the South West Metropolitan Railway.

Performance characteristics of the rolling stock will enable transit times of less than 50 minutes between Mandurah and Perth with a limited stopping pattern.

2.1.4 Service Characteristics

The railway will be designed to enable maximum operating speeds of 130km/hour, although there will be lengths of track where this speed cannot be achieved due to track curvatures etc.

It is anticipated during peak periods that services from Thomsons Lake to Perth will operate at a maximum frequency of 12 trains/hour (5 minute intervals) and services from Mandurah to Thomsons Lake will be 6 trains/hour (10 minute intervals).

2.2 Route Description and Associated Works

2.2.1 Route Alignment

The alignment will connect with the northern suburbs rail line via an above/below ground central station on the eastern side of William Street, between Murray and Wellington Streets. Access to the central station will be provided by an underground walkway. The alignment will continue south beneath William Street in two bored tunnels with a second station at the Esplanade opposite the Convention Centre. The

route then turns towards the freeway and continues underground beneath the current roads before emerging approximately 100m east of the Narrows Bridge. It will then continue along the centre of the bridge.

After the Narrows Bridge the railway will continue in the central median of the Kwinana Freeway to approximately 1.2km south of Anketell Road, where it crosses out of the freeway median under the northbound carriageways and runs southeast of The Spectacles, immediately north of Thomas Road. From Thomas Road, the railway passed under Challenger Avenue in Parmelia.

From here, the railway passes under Wellard Road and runs in a south westerly direction through the Leda Nature Reserve. The line crosses over the Mundijong-Kwinana freight line and Mandurah Road then follows the Garden Island Highway reserve before turning south again at Ennis Avenue.

Between Rockingham and Port Kennedy Drive, the railway is located within the eastern side of the Ennis Avenue road reserve. South of Port Kennedy Drive, the railway swings in a slight easterly direction, crossing over Mandurah Road. The railway runs immediately adjacent to the south western corner of Stakehill Swamp, before passing under Stakehill Road.

The line curves in a south westerly direction through the rural residential area of Karnup and clips the north western corner of the Anstey Swamp Parks and Recreation Reserve. The line then runs south, along the boundary of Anstey Swamp, before rejoining Mandurah Road immediately south of Anstey Road. Where it passes Anstey Swamp, the railway will occupy the current position of the south bound carriageway of Mandurah Road to avoid encroaching on the swamp. Mandurah Road will be realigned a similar distance further west to accommodate the railway.

From here, the railway runs parallel and adjacent to Mandurah Road before passing over the realigned Paganoni Road. The line intersects the north western corner of Bush Forever site 395 (Paganoni Swamp and adjacent bushland, Karnup (Singleton)) and runs within and adjacent to the western boundary of the Bush Forever site until it reaches the MRS boundary.

From the southern boundary of the MRS, the line runs south alongside the western edge of Paganoni Swamp, passing between an existing limestone quarry and the wetland edge. The line continues in a southerly direction, passing to the west of a small

sumpland before intersecting the Primary Regional Road Reserve for the proposed Kwinana Freeway extension.

The rail will then run down the median of the future Mandurah Bypass Road Reserve, which runs through the Meadow Springs Residential Estate and passes to the west of the Mandurah No. 1 Wastewater Treatment Plant. The line passes under Gordon Road and runs to the west of the Mandurah Greyhound Racing Track and the TAFE Peel Regional Campus.

The line then curves to the west, passes under Fremantle Road and runs south to terminate at the Mandurah Station located on Allnutt Street.

This alignment is shown on Figures 1 and 2.

2.2.2 Stations and Car Parks

Perth to Beeliar Drive, Jandakot

Stations between Perth and Beeliar Drive, Jandakot will be located at William Street, The Esplanade/Bus Port, South Perth, Canning Bridge, Leach Highway and South Street. Concept plans of the stations are provided on Figure 8. A future station is also planned for South Perth.

The existing Canning Bridge bus transfer station, which is location directly under the Canning Highway bridge over the Kwinana Freeway, will be modified to become a railway station. Canning Bridge will act as a transfer location and incorporate the existing bus station facilities in the centre of the freeway where possible. Parking will not be provided, with car set down/pick up and walk on/cycle access available only.

Leach Highway Station will be located on the south side of the Leach Highway overpass over the Kwinana Freeway. Parking will be provided for 700 vehicles in the south western quadrant of the intersection. The station will have an island platform. Access to the platform will be via a bridge and bus concourse elevated over the freeway carriageways. Bus transfer, park & ride, car set down/pick up and walk on/cycle access will be incorporated.

The Murdoch (South Street) Station will include the existing bus transfer facilities at the Murdoch Park & Ride. In addition car set down/pick up and walk on/cycle will be

accommodated. The platform will be located in the centre of the freeway with access provided via a bridge and bus concourse which will be elevated over the freeway carriageways. The existing facilities provide parking for 925 vehicles. The carpark may be extended in the future into the south eastern quadrant of the intersection.

Beeliar Drive, Jandakot to Southern MRS Boundary

Stations will be located at Thomsons Lake (Beeliar Drive), Thomas Road, Rockingham and Waikiki.

Future stations are proposed at Success (near Gibbs Road/Russell Road), Mandogalup (Rowley Road), Anketell (Anketell Road), South Parmelia (Challenger Avenue), Leda (near Wellard Road), Stakehill (south of Stakehill Road) and Karnup (north of Paganoni Road). All of these sites are to be reserved through the MRS for future development.

Thomsons Lake Station will be located in the Kwinana Freeway median, immediately north of Beeliar Drive, with bus passenger transfer, car set down/pick up, park & ride and walk on/cycle facilities integrated into the proposed Cockburn Central town centre on the west side of the freeway. Parking has been restricted to 400 bays to reduce the amount of town centre land required for transport purposes.

The station will have an island platform in the freeway median with the entry building and associated forecourt facilities connecting to the platform by an elevated walkway over the freeway north-bound carriageway. As the originally planned South Lake Station will no longer be constructed, plans are being developed for parking an additional 600 cars on the eastern side of the freeway which will be connected with the station platform via a footbridge.

Thomas Road Station will be located on the south side of Thomas Road, west of the Kwinana Freeway extension and Johnson Road, on the boundary of the localities of Parmelia and Casuarina. Road access to the site is planned both from Thomas Road and a new local feeder road to be built as part of future residential development in the area. Facilities at the transit station will include bus passenger transfer, set down/pick up, park & ride with provision for 600 vehicles, and walk on/cycle patronage.

The Rockingham major transit interchange station will be situated at the intersection of Ennis Avenue and Garden Island Highway/Rae Road. Car set down/pick up, park & ride, with provision for 700 vehicles, and walk on/cycle facilities will be provided.

Road access to the station will be located opposite the Rae Road intersection. Pedestrian access will also be provided from the residential area to the east.

Waikiki Transit Station will be located at the intersection of Safety Bay Road and Ennis Avenue and will be bounded on the west by the railway and to the north by the Safety Bay Road bridge. Road access to the site will be from Safety Bay Road. Facilities will include bus passenger transfer, set-down, park & ride and walk on/cycle patronage. Parking for 700 cars has been provided on the limited land available. The station will have side platforms at grade with the surrounding land, with the entrance building spanning the rail tracks and connecting the facilities to the west platform.

Southern MRS Boundary to Mandurah

Mandurah Terminus Station will be the only station constructed in this section during the initial stages of the project. Future stations are proposed at Lakelands (opposite Madora Beach Road) and at Gordon Road.

The Mandurah Terminus Station will be located on Allnutt Street, immediately west of the Mandurah - Fremantle Bypass road and will be a focal point for north-bound patrons from the greater Mandurah area. Road access to the site is from the proposed upgraded Allnutt Street that will connect with the Mandurah bypass road (Fremantle Road).

Facilities provided will include bus passenger transfer, car set down/pick up, park & ride and walk on/cycle access. Parking for 850 cars will be provided. The entrance buildings and major forecourt facilities will be focussed at the south (bus transfer) end of the station with immediate access to Allnutt Street. This site also incorporates overnight stowage and train cleaning areas.

2.2.3 Crossings, Bridges and Tunnels

Level Crossings

Level crossings will be installed at Quarry Road, which traverses Paganoni Swamp and an area in Lakelands. The level crossings will be protected with automatic boom barriers and lights.

Bridges

Existing bridges over the freight line in Jandakot, Narrows Bridge and Mount Henry Bridge will be used for the alignment. The bridges will require widening or addition of new structures to accommodate the rail and road infrastructure. In addition rail bridges are proposed for Paganoni Road in Karnup, Mandurah Road in Hillman and across the freight line in Mundijong.

Tunnels

Rail tunnels are required in the Perth CBD and on leaving the Kwinana Freeway at Anketell. The Anketell tunnel already exists, whereas the Perth tunnels require construction.

Grade Separations

Grade separation underpasses along the alignment occur at:

- Mill Point Road
- Canning Highway, Como
- Cranford Avenue, Mt Pleasant
- Leach Highway, Bateman
- Parry Avenue, Bull Creek
- South Street, Murdoch
- Farrington Road, Leeming
- Berrigan Drive, Jandakot
- Beeliar Drive, Jandakot
- Russell Road, Success
- Rowley Road, Mandogalup
- Anketell Road, The Spectacles
- Thomas Road, The Spectacles
- Challenger Drive, Parmelia
- Wellard Road, Wellard
- Elanora Road (Cooloongup)
- Safety Bay Road, Warnbro
- Stakehill Road, Karnup
- Paganoni Road, Karnup
- Gordon Road, Meadow Springs
- Fremantle Road, Mandurah

The bridges required for grade separations already exist between Canning Highway and Anketell Road. The remaining bridges associated with the grade separations will require construction as part of this project.

Pedestrian Crossings

Pedestrian crossings will be available at all stations, either by footbridge, underpass or controlled grade crossings, and where there are bridges over the railway. Pedestrian footbridges will be located at Hardy Street (South Perth), Comer Street (Como), Preston Street (Como), Thelma Street (Como), Cale Street (Como), Edgewater Road (Salter Point) and Hillman (Rockingham). All but the Rockingham bridge already exist.

2.2.4 Traffic Deviations

During construction traffic deviations will be temporarily required along the southern end of William Street in the CBD. Some degree of traffic disturbance may also occur during construction of the alignment along the freeway. Following construction all public roads traversed by the railway will have continued use. A private road across Anstey Swamp will be cut off by the railway. Alternative access across this area will continue to be available from the nearby Paganoni Road.

Rural landowners in Stakehill who are cut off from Fletcher Road will have a new access road constructed.

2.2.5 Drainage Facilities

Consideration of drainage management is required for current drainage facilities traversed by the proposed alignment, the alignment itself and associated infrastructure including stations and car parks.

Drainage facilities required for the proposed alignment will consist of:

- Linear vegetated swales as the primary means of stormwater drainage, which will encourage infiltration, decreased velocity and direct runoff towards low points.
- Culverts for major crossings such as the Peel drain
- Piped crossings where necessary, which will be kept as small as practicable and incorporate gross pollutant and sediment trapping devices.

- Modifications to existing drainage infrastructure, which will be based on water sensitive design best management practices that aim to treat, retain and infiltrate where possible.

All drainage infrastructure will be contained within the railway reserve. Drainage is further discussed in Sections 3.5 and 5.5.

2.2.6 Noise Management

Noise management may involve strategically placed acoustic reflecting walls, along Kwinana Freeway near the Narrows Bridge, the southeast and southwest quadrants of Leach Highway intersection with the Freeway and Trenant Park Gardens, Golden Bay. Noise walls could be constructed from a variety of dense materials, including masonry and earthen bunds, to suit the locality. Another option being considered for noise management is to increase the height of the crash barriers. Further details on the noise management measures are provided in Section 5.7.

2.2.7 Earthworks

Earthworks are required to prepare the railway alignment for the construction of track, signalling and other railway infrastructure. It is likely that the earthworks to achieve the required rail formation will necessitate clearing of all vegetation over the total width of the rail reserve (40 metres in most places) throughout the majority of the alignment.

The cutting batters for the SWMR project will be engineered for a 3:1 slope. The experience with the northern suburbs rail line extension earthworks indicates that batters cut with a 2:1 slope experience problems with sediment collection in the drainage system. Track centres for the SWMR will be 4.7m apart instead of the standard 5.6m to reduce the width of cuttings and maintain a 3:1 batter slope. These measures will be applied as appropriate where land constraints allow.

A typical cross section of the track highlighting the earthwork extent is provided in Figure 7.

Revegetation of the final land form will be carried out in suitable areas.

Specific earthworks details are provided below.

Perth City

There will be approximately 680 metres of cut and cover concrete box structure for the rail tunnel and Esplanade Station from just East of the Kwinana Freeway along the Perth foreshore in front of the new convention centre to the Esplanade Station. Excavation depth will vary between approximately 5 and 15 metres from the existing surface with an approximate width of 10 metres.

A tunnel boring machine will excavate approximately 690 metres of tunnel from the Esplanade Station northward under William Street and the Horseshoe Bridge to a portal in the railway reserve roughly in line with Lake Street. Two 6 metre diameter tunnels will be bored (1 for each track) at a minimum depth of 12 metres below the existing surface down to about 21 metres below natural surface at the lowest points.

The underground William Street Station will be excavated by the cut and cover method. The station will be located within the retail block bounded by Wellington, William and Murray Streets and will connect directly to the existing platforms via underground concourse.

A geotechnical programme for this section of the alignment will analyse soil and water samples to assess the potential for contamination. This will include the description of soil types to assess the potential for acid sulphate soils. Management plans will be developed as appropriate pending the results of the investigation.

Spoil from excavation activities will be disposed of in a manner sanctioned by the Department of Environment and Water Catchment Protection and the City of Perth.

Narrows to Mt Henry Bridge

This section of the alignment will be constructed in the Kwinana Freeway median on a slab track formation. This will require minimal earthworks. There will be works to locate the south bound carriage way of the Kwinana Freeway a maximum of 5 metres at the South Perth Station location in the event this station is built in the first stage of construction. All work will be contained within the Freeway and Melville Parade road reserve.

Minor widening of the south bound freeway carriage way shoulder at the Glen Iris Tunnel will occur to allow room for required barriers. This widening will be no greater than 2 metres.

Mt Henry to Anketell Tunnel

Earthworks will be relatively minor with all work contained within the freeway median. The train will run on a ballasted track formation. Revegetation in the freeway median will be removed.

Anketell Tunnel to Leda

This section of the alignment is generally in cutting with some minor areas of fill. The Metropolitan Region Scheme (MRS) reservation width for the SWMR varies from approximately 20 to 40 metres in this region. The depth of cutting below the existing surface varies widely however a depth of 6 - 8 metres is not uncommon. The maximum cutting depth through this region will be approximately 12.5 metres as the alignment approaches Thomas Road Station from the north.

It must be assumed that the whole width of the MRS reservation for the SWMR will be cleared for construction. The cutting batters will be designed to a 3:1 slope to minimise the potential for erosion and sediment build up in the drainage system. Previously a 2:1 cutting batter slope had been considered. In order to reduce the volume of material to be excavated the distance between the track centres in cuttings will be reduced from 5.6 to 4.7 metres. (Refer to Figure 7 – Chainage 37000 diagram for a typical cross section of the rail formation in cutting).

It should be noted that the extent of clearing required generally will extend to the boundaries of the rail reserve even though the final width of railway infrastructure is less than the width of the reserve boundaries. The extra width is required during earth moving activities to allow the effective operation of large earth moving machinery and to achieve the desired formation.

Where the rail reserve abuts Regional Parks, as in the Leda Nature Reserve, PURD has agreed to provide 4 metre wide access tracks along the length of the alignment for park management and emergency vehicle use. Where possible these will be constructed within the rail reserve with the security fence for the railway set back into the reserve to allow unimpeded access from the track to the nature reserve. This will preserve a

significant amount of vegetation within the regional parks that otherwise would have been cleared.

Leda to Rockingham

As the alignment approaches Gilmore Avenue through the Leda Nature reserve the topography changes and the earthworks move from predominantly cut to fill. An embankment approximately 9 metres in height from the existing surface, with an approximate 30 metre foot print at the widest point, will take the rail from Leda into the Gilmore Avenue road reserve to a bridge structure that will take the train over Mandurah Road and the Mundijong Freight line. (Refer to Figure 7 – Chainage 39700 for a typical cross section of the rail formation on embankment). From here the alignment enters the Garden Island Highway reserve with the embankment declining to grade approximately 280 metres from the Mandurah Road crossing.

As the alignment enters the residential area of Rockingham it moves into a small cutting which is generally 1.5 to 2 metres below the existing surface. The high water table in this area constrains the feasibility of sinking the rail any further. (Refer to Figure 7 – Chainage 41300 for a typical cross section of the rail alignment in the Garden Island Highway).

The Rockingham station platform will be at the level of the existing surface with the rails 0.5 to 1.5 metres below the existing surface at this location. From Rockingham Station the depth of cutting increases to a maximum 4.5 metres below existing surface where the train will travel under the grade separated Elanora Drive on the east side of Ennis Avenue. The depth of cutting then decreases for approximately 120 metres before remaining in a 2 to 2.5 metre cutting on the east side of Ennis Avenue until south of Link Way in Rockingham.

Rockingham to the Mandurah Road Grade Separation

The earthworks in this section will generally alternate between minor cut and fill as the topography dictates. (Refer to Figure 7 – 50500 for a typical cross section in this region). As the alignment approaches Mandurah Road a 240 metre long embankment will take the railway over Mandurah Road. The embankment will have a maximum height of approximately 8 metres above the existing surface with an approximate maximum 22 metre wide foot print. From here the alignment moves into a cutting approximately 150 metres in length with a maximum 6.5 metre depth from the existing surface.

Mandurah Road Grade Separation to Anstey Swamp (Stakehill Deviation)

In this area the earthworks alternate between relatively minor cut and fill as the topography dictates with cut and fill differences in height from existing surface generally no greater than 3 metres. A road bridge will be built over the railway at Stakehill Road with associated earthworks. Detailed plans are not available at this time.

Anstey Swamp

Where the alignment rejoins Mandurah Road, in the vicinity of Anstey Road Secret Harbour, the railway will move into what is currently the south bound carriage way of Mandurah Road for an approximate distance of 1.6 km. in order to avoid any impact on Anstey Swamp. A new carriageway to the west of the current northbound carriageway of Mandurah Road will be built to maintain the existing level of carrying capacity for road traffic. (Refer to Figure 7 – Chainage 57500 for a typical cross section in this region).

Paganoni Road Grade Separation

A rail bridge will be built over Paganoni Road with associated earthworks. Detailed plans are yet to be developed.

Paganoni Road to the MRS Boundary

This segment of the alignment generally alternates between minor cut and fill as dictated by the topography. The most significant earthworks through this segment is an approximately 100 metre long region of cut approximately 1 km south of Paganoni Road with a maximum depth of approximately 8 metres and a maximum width of approximately 29 metres.

MRS Boundary to Gordon Road Grade Separation

The earthworks through this section consist generally of cuttings to a maximum depth of 9 metres below the existing surface with a maximum width of 26 metres. (Refer to Figure 7 – Chainage 63800 for a typical cross section in this region). At Gordon Road the railway will be in a 6.5 metre cutting where a road traffic bridge will be constructed over the railway.

Gordon Road to the Mandurah Terminus

From Gordon Road the alignment continues in cutting until entering a tunnel to take the railway under Fremantle road and into the Mandurah Terminus.

2.2.8 Landscaping

A policy of “greening” the railway reserve and station sites will be implemented, wherever possible or practicable

Landscaping will predominantly occur at the station sites. Landscaping details have not been finalised to date but the use of native vegetation, especially in areas close to bushland, will be encouraged.

2.3 Maintenance and Support Facilities

A railcar stowage and cleaning facility will be provided adjacent to the Mandurah station. This area is required due to the need to start trains from the Mandurah Station in the mornings and the distance from other stowage areas.

All railcar mechanical and electrical servicing and exterior cleaning will be undertaken at the Nowergup Railcar Depot, north of Clarkson Station on the Northern suburbs line.

2.4 Timing and Staging of Construction Work

The staging plan proposed for the SWMR construction allows for the route into central Perth to be commenced while the design of the stations, civil and rail infrastructure for the rail line south of the Narrows is undertaken.

Construction work on the railway will commence in the third quarter of 2003 and be completed by 2007. In order to reduce disruption to the city section of the route a key target has been set for June 2004 for completion of works near the convention centre. Commencement of train services is estimated as follows:

- Waikiki by December 2006
- Mandurah by December 2007

PART C: EXISTING ENVIRONMENT

3.0 BIOPHYSICAL ENVIRONMENT

3.1 Landforms, Soils and Geology

The proposed alignment passes through seven landform and soil units as mapped by Churchward & McArthur (1978). The location of these units is presented on Figure 9. Descriptions of each unit are provided below.

Aeolian Deposits

- **BASSENDEAN:** Sand plains with low dunes and occasional swamps. Iron or humus podzols.
- **KARRAKATTA:** Undulating landscape with deep yellow sands over limestone.
- **COTTESLOE:** Low hilly landscape with shallow brown sands over limestone. Much exposed limestone.
- **HERDSMAN:** Peaty swamps associated with Bassendean and Karrakatta units.
- **QUINDALUP:** Dunes and beach ridges composed of calcareous sand.

Marine Deposits

- **VASSE:** Poorly drained plains with variable undifferentiated estuarine and marine deposits.
- **YOONGARILLUP:** Plains with low ridges and swales. Shallow yellow and brown sands over marine limestone.

Acid sulphate soil risks are associated with soil units in wetland and estuarine areas where sediments commonly contain iron sulfide minerals, principally pyrite. These minerals form under waterlogged conditions where there is no oxygen available to allow the sulfides to decompose. Exposing the pyrite to air by excavation, drainage, stockpiling of peaty materials or lowering of the groundwater table can cause the sulfide to form sulphuric acid into the groundwater (DEWCP, 2002).

3.2 Vegetation

3.2.1 Introduction

Ecoscope completed vegetation surveys of the SWMR alignment between Beelias Drive and Mandurah in June and September 2001. Impacts on regionally significant vegetation between Beelias Drive, Jandakot and the Southern MRS Boundary in the existing railways reserve were previously assessed as part of the MRS amendment for gazettal of the rail reserve and therefore information on this factor for this alignment section has been included only to provide context to the project.

The EPA has not previously assessed impacts on vegetation for the rail sections between Perth and Jandakot, MRS Amendments 1032/33 areas, new Leda-Rockingham route and the Peel Region. All information for these rail sections has therefore been included for assessment purposes.

Vegetation surveys of the rail route have been conducted by Ecoscope and Ray Hart & Associates. The Ecoscope survey area extended from Anketell Road, where the alignment leaves the freeway median, to Mandurah and included the new Leda-Rockingham route and MRS amendment areas. This survey was conducted for the rail alignment and a 50m wide buffer on either side to provide greater context to the information. This additional buffer area is displayed on the relevant diagrams but has not been included in any of the area calculations. The results of the Ecoscope survey is reported in the Environmental Management Plan and associated topical management plans (Ecoscope, 2002a,b,c,d,e,f; Ecoscope & Gelvan, 2002; Ecoscope & Bamford, 2002).

Vegetation surveys which recorded the dominant and common overstorey and understorey species at representative sites were conducted by Ecoscope during autumn. This information was supplemented by detailed quadrat based floristic surveys in spring. Larger quadrat sizes (20 x 20m) were used for the flora surveys in order to pick up the maximum number of species and standard quadrat sizes (10 x 10m) were used for the floristic community data analysis so as to remain consistent with Gibson et al. (1994). The timing of these surveys was planned to assist with identification of priority flora. Further detail on the methodology is provided in the Vegetation and Flora Management Plan (Ecoscope, 2002b).

Ray Hart & Associates surveyed the MRS amendment areas including the Thomsons Lake, Thomas Road and Leda station sites. No additional buffer areas were included in the work. These surveys were conducted in August 2001.

3.2.2 Vegetation Complexes and Mapping Units

Vegetation complexes are broad units that take into account structural formation, vegetation types and floristic composition (Department of Conservation and Environment, 1980). These complexes have affinities with the soil classifications explained in Section 3.1. The SWMR alignment traverses areas of native vegetation within five vegetation complexes along the alignment (Figure 10). These are:

- Bassendean Complex – Central and South. Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - *Banksia* spp. to low woodland of *Melaleuca* spp., and sedgeland on the moister sites. This vegetation complex is found within the Bassendean Dunes, the oldest and furthest inland of the three relic dune systems on the Swan Coastal Plain.
- Karrakatta Complex – Central and South. Predominantly open forest of *E. gomphocephala* (Tuart) – *E. marginata* – *E. calophylla* (Marri) and woodland of *E. marginata* – *Banksia* spp. This vegetation complex is located on the Spearwood Dunes, the relic foredunes system that is intermediate in age between the Bassendean Dunes to the east and the Quindalup dunes to the west.
- Cottesloe Complex – Central and South. Mosaic of woodland of *E. gomphocephala* and open forest of *E. gomphocephala* – *E. marginata* – *E. calophylla*, closed heath on the limestone outcrops. Like the Karrakatta complex, this vegetation complex is located on the Spearwood Dunes.
- Herdsman Complex. Sedgeland and fringing woodland of *E. rudis* (Flooded Gum) – *Melaleuca* spp. This complex is associated with wetlands on the Swan Coastal Plain.
- Quindalup Complex. Coastal dune complex (Quindalup Dunes) consisting mainly of two alliances – the strand and fore dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *M. lanceolata* (Rottnest Island Tea Tree) – *Callitris preissii* (Southern Cypress Pine) and the closed scrub of *Acacia rostellifera* (Summer Scented Wattle).

(Hedde et al., 1980 & Ecoscape, 2002a – Environmental Management Plan)

Vegetation mapping units were mapped by recording the dominant and common overstorey and understorey species at representative sites along the railway reserve. Mapping units give a greater level of detail than vegetation complexes, although a mapping unit can occur in a number of complexes. Vegetation mapping units found within the proposed alignment between Anketell Road and Mandurah are provided in Table 2. Detailed descriptions of each vegetation complex and mapping unit are provided in the EMP for the SWMR project (Ecoscape, 2002a & 2002b – Environmental Management Plan & Vegetation and Flora Management Plan).

Limited areas of native bushland are located adjacent to the Perth to Anketell section of the SWMR alignment. Clearing will not be conducted outside of the current road reserves in this portion of the alignment, apart from the station sites. Some landscape plantings along the freeway will need to be removed to allow for construction of, or upgrades to, road infrastructure and stations. Native vegetation at the Leach Highway and Thomsons Lake Station sites will be cleared for the development. A floristic survey of the Leach Highway site will be carried out prior to construction.

Table 2: Vegetation Mapping Units within the proposed SWMR Alignment (Ecoscape, 2002b – Vegetation and Flora Management Plan).

Mapping Unit	Vegetation Mapping Units
AJ	Low shrubland on dunes of <i>Acacia cochlearis</i> , <i>A. rostellifera</i> , <i>Jacksonia furcellata</i> and <i>Xanthorrhoea preissii</i> .
Ar	Closed shrubland of <i>Acacia rostellifera</i> on Quindalup Dunes
BAX	Woodland of <i>Banksia menziesii</i> , <i>B. attenuata</i> , <i>Allocasuarina fraseriana</i> and <i>Xylomelum occidentale</i> with occasional <i>Eucalyptus marginata</i> .
Bmai	Open woodland of <i>Banksia menziesii</i> , <i>B. attenuata</i> and <i>B. ilicifolia</i> over <i>Adenanthos cygnorum</i> .
BE	Low woodland of <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>B. grandis</i> , <i>Eucalyptus gomphocephala</i> and <i>E. marginata</i> . <i>Banksia littoralis</i> also present in areas adjacent to wetland fringing vegetation.
CcBg	Open <i>Corymbia calophylla</i> and <i>Banksia grandis</i> woodland over <i>Macrozamia riedlei</i> and weeds.
EBG	Woodland of <i>Eucalyptus gomphocephala</i> with <i>Banksia littoralis</i> over sedgeland of <i>Gahnia trifida</i> .
EBH	Open woodland of <i>Eucalyptus gomphocephala</i> and <i>Banksia attenuata</i> over heath and low shrubs of <i>Acacia rostellifera</i> , <i>Allocasuarina humilis</i> , <i>Dryandra lindleyana</i> , <i>Grevillea thelemanniana</i> , <i>Hibbertia racemosa</i> , <i>Jacksonia sericea</i> and <i>Scaevola globulifera</i> .
EC	Parkland of <i>Eucalyptus marginata</i> , <i>E. gomphocephala</i> and <i>Corymbia calophylla</i> over <i>Macrozamia riedlei</i> and weeds.
ECB	Open woodland of <i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i> , <i>Banksia menziesii</i> , <i>B. attenuata</i> , <i>B. ilicifolia</i> and <i>Allocasuarina fraseriana</i> .
EgAr	Tall open woodland of <i>Eucalyptus gomphocephala</i> over <i>Acacia rostellifera</i> and <i>Xanthorrhoea preissii</i> .
EgAs	Open woodland of <i>Eucalyptus gomphocephala</i> over <i>Acacia saligna</i> .
EgBl	Woodland of <i>Eucalyptus gomphocephala</i> and <i>Banksia littoralis</i> with <i>B. grandis</i> over <i>Acacia saligna</i> , <i>Jacksonia furcellata</i> , <i>Templetonia retusa</i> , and <i>Xanthorrhoea preissii</i> .
EgGt	Open woodland of <i>Eucalyptus gomphocephala</i> over <i>Acacia</i> spp., <i>Xanthorrhoea preissii</i> and <i>Gahnia trifida</i> .
EGM	Closed wet woodland of <i>Eucalyptus gomphocephala</i> over <i>Melaleuca raphiophylla</i> and closed sedgeland of <i>Gahnia trifida</i> and other sedges.
EgC	Parkland of <i>Eucalyptus gomphocephala</i> with <i>Allocasuarina fraseriana</i> and <i>Acacia rostellifera</i> over grassy weeds in a cleared landscape.
EmB	Woodland of <i>Eucalyptus marginata</i> , <i>Banksia attenuata</i> , <i>B. menziesii</i> , <i>B. grandis</i> and <i>Allocasuarina fraseriana</i> , with occasional <i>B. ilicifolia</i> .

Table 2 (Continued)

Mapping Unit	Vegetation Mapping Units
EmgBa	Woodland of <i>Eucalyptus marginata</i> , <i>E. gomphocephala</i> , <i>Banksia attenuata</i> , and <i>Allocasuarina fraseriana</i> with occasional <i>Corymbia calophylla</i> . Other common species are <i>Dryandra sessilis</i> , <i>B. menziesii</i> , <i>B. grandis</i> , <i>Acacia rostellifera</i> and <i>Jacksonia furcellata</i> .
ErB	Woodland of <i>Eucalyptus rudis</i> over <i>Banksia menziesii</i> and <i>B. ilicifolia</i> .
Ke	Low closed woodland of <i>Kunzea ericifolia</i> with <i>Melaleuca raphiophylla</i> .
LR	Low shrubland over heathland on limestone ridges of <i>Xanthorrhoea preissii</i> , <i>Leucopogon parviflora</i> , <i>Eremaea pauciflora</i> , <i>Hakea prostrata</i> , <i>Phyllanthus calycinus</i> and <i>Grevillea thelemanniana</i> .
MBG	Closed wet woodland of <i>Melaleuca raphiophylla</i> with <i>Banksia littoralis</i> over <i>Xanthorrhoea preissii</i> and closed sedgeland of <i>Gahnia trifida</i> and <i>Lepidosperma</i> spp. in Quindalup dune swales.
MEg	Dense low woodland of <i>Melaleuca raphiophylla</i> and <i>M. teretifolia</i> with emergent <i>Eucalyptus gomphocephala</i> over sedgeland.
Mr	Closed wet woodland of <i>Melaleuca raphiophylla</i> , often over sedgeland of <i>Gahnia trifida</i> , <i>Lepidosperma longitudinale</i> and <i>Baumea juncea</i> .
MrEr	Closed wet woodland of <i>Melaleuca raphiophylla</i> and <i>Eucalyptus rudis</i> over sedges.
SpD	Closed low shrubland on Spearwood Dunes, with <i>Acacia</i> spp., <i>Allocasuarina humilis</i> , <i>Eremaea pauciflora</i> , <i>Grevillea thelemanniana</i> , <i>Hakea trifurcata</i> , <i>Hibbertia hypericoides</i> , <i>Melaleuca huegelii</i> , <i>Olearia axillaris</i> , <i>Rhagodia baccata</i> , <i>Santalum acuminatum</i> and <i>Spyridium globulosum</i> , sometimes with emergent <i>Eucalyptus gomphocephala</i> , <i>Banksia attenuata</i> and <i>Allocasuarina fraseriana</i>

3.2.3 Vegetation Condition

Ecoscape assessed vegetation condition of the SWMR alignment between Anketell Road and Mandurah in accordance with the scale devised by Kaesehagen (1995) for inclusion in the EMP document. Detailed results of this survey are presented in the EMP (Ecoscape, 2002b – Vegetation and Flora Management Plan). A summary of bushland condition along this section of the route is provided in Table 3.

Table 3: Summary of Vegetation Condition within the Proposed SWMR Alignment between Anketell Road and Mandurah including station sites (Ecoscape, 2002b – Vegetation and Flora Management Plan).

Bushland Condition Rating	Remnant Vegetation in SWMR rail corridor	
	(ha)	(%)
Very Good – Excellent	34.26	18.61
Fair – Good	27.19	14.77
Poor	62.32	33.84
Very Poor	59.13	32.11
Recently Burnt	1.24	0.67

The native vegetation at the Thomsons Lake Station was assessed separately by Hart, Simpson and Associates Pty Ltd in August 2001. Vegetation in this area belongs to the Bassendean Complex – central and south. The condition of most of the vegetation at the site is described as “vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species” to “vegetation structure altered, obvious signs of disturbance” (Hart, Simpson & Associates, 2001). These descriptions equate to very good-excellent and poor in the categories used by Ecoscape. The vegetation along the road edge in the northern end of the area is in poorer condition.

3.2.4 Floristic Communities

Floristic community types (as defined by Gibson *et al.*, 1994) that occur or are likely to occur along the rail alignment between Anketell Road and Mandurah have been assigned according to the broad geomorphic setting in which they are located and the vegetation mapping units that occur within the alignment. These are listed in Table 4.

Table 4: Potential Floristic Community Types that occur or are likely to occur within the SWMR Alignment between Anketell Road and Mandurah (Ecoscape, 2002b – Vegetation and Flora Management Plan).

Community No. ¹	Community Description ¹	Geomorphic Setting	Similar Vegetation Mapping Units
5	Mixed shrub damplands	Bassendean Dunes	Ke
11	Wet forests and woodlands	Bassendean & Spearwood Dunes	MrEr, ErBw
21a	Central <i>Banksia attenuata</i> – <i>Eucalyptus marginata</i> woodlands	Bassendean & Spearwood Dunes	BE, Bmai, EmB, ECB
24	Northern Spearwood shrublands and woodlands	Spearwood Dunes	EBH, EmgBa, SpD, LR, AJ, EgAr, BE, LR
28	Spearwood <i>Banksia attenuata</i> or <i>B. attenuata</i> – <i>Eucalyptus</i> spp. woodlands	Spearwood Dunes	EmgBa, EmgBx, BAX, Bmai
17	<i>Melaleuca raphiophylla</i> – <i>Gahnia trifida</i> seasonal wetlands	Spearwood & Quindalup Dunes	Mr, EGM, EBG, EgBl, MEG
19b ³	Woodlands over sedgeland in Holocene dune swales	Quindalup Dunes	EgGt, EGM, MBG
30b	Quindalup <i>Eucalyptus gomphocephala</i> and/or <i>Agonis flexuosa</i> woodlands	Quindalup Dunes	EgAs, SpD
30c2	Woodlands and shrublands on Holocene dunes	Quindalup Dunes	EgAr

Communities denoted by italicised number are subsets of the floristic community types identified by Gibson et al., (1994)

- 1: Gibson *et al.* (1994); GWA (2000b)
 2: Refer Table 2 for vegetation mapping unit descriptions
 3: Critically Endangered

Note: Some vegetation mapping units could not be allocated to an approximate floristic community type due to the level of disturbance to the vegetation and the loss of understorey species.

The floristic data from the defined survey quadrats were reviewed in relation to the floristic data from the Swan Coastal Plain study reference set by ME Trudgen and Associates (see Vegetation and Flora Management Plan – Ecoscape, 2002b). The quadrat data (consisting of all weeds and native species recorded from each quadrat) were added to the entire dataset of Gibson *et al.* (1994), and analyses re-run to determine to which floristic community types (FCTs) the survey quadrats were most similar.

Vegetation surveys and data analysis confirmed at least four of the floristic community types are present within the study area (types 17, 19b, 24 and 28), with a fifth type, 21a, possibly present as well. Additional floristic community types may be present along the railway, but these were not sampled definitively. The locations of the floristic communities correspond to the similar vegetation mapping units indicated on Table 4 and displayed on Figure 11.

The main area of remnant vegetation north of Anketell Road is the Thomsons Lake station site. The vegetation in the Thomsons Lake Station site appears to be community type 23a. The vegetation is part of the Bassendean Dunes and contains Jarrah-Banksia woodland with a diverse scrub and perennial herb stratum on grey sand (Hart, Simpson & Associates, 2001).

3.2.5 Threatened and Other Significant Flora

Declared Rare and Threatened Flora surveys were conducted by both Ecoscape and Hart Simpson and Associates. The surveys covered MRS amendment areas between Jandakot and Mandurah, which included the station sites, as well as likely habitat areas including:

- Bushland in good condition between Thomas Road and Challenger Avenue which formed potential habitat for *Caladenia huegelii* and *Dodonaea hackettiana*.
- All wetland and seasonally wet areas, including areas near The Spectacles, Anstey Swamp and Paganoni Swamp, which could potentially support the orchid species *Diuris micrantha*, *Drakaea elastica*, *Microtis media* subsp *quadrata* and a number of other species including *Aotus cordifolia*, *Dillwynia dillwynioides*, *Hemigenia microphylla*, *Rhodanthe pyrethrum*, *Stylidium longitubum*, *Anthotium junciforme* and *Byblis lindleyana*.

- Paganoni reserve, where a number of threatened species have previously been recorded, including *Aotus cordifolia*, *Dillwynia dillwynioides*, *Jacksonia sericea* and *Stylidium longitubum*.
- Limestone ridges within the Cottesloe vegetation complex, which could support *Jacksonia sericea*, *Grevillea thelemanniana*, *Johnsonia pubescens* subsp *cygnorum*, *Lasiopetalum membranaceum* and *Dodonaea hackettiana*. This included the dune ridge west of Paganoni Reserve and ridges within Leda Nature Reserve.
- Areas within and surrounding all flora survey quadrats, where any additional or unusual species were collected and identified.

The details of the Declared Rare and Priority Flora listed above that were previously recorded within or near the proposed reserve is provided on Table 5.

Table 5 Declared Rare and Priority Flora previously recorded within or near the proposed reserve

Species	Status
<i>Caladenia huegelii</i>	Rare
<i>Diuris micrantha</i>	Rare
<i>Drakaea elastica</i>	Rare
<i>Acacia lasiocarpa</i> var <i>bracteolata</i> long peduncle variant (GJ Keighery 5026)	P1
<i>Pityrodia canaliculata</i>	P1
<i>Byblis lindleyana</i>	P2
<i>Johnsonia pubescens</i> subsp <i>cygnorum</i>	P2
<i>Aotus cordifolia</i>	P3
<i>Dillwynia dillwynioides</i>	P3
<i>Hemigenia microphylla</i>	P3
<i>Jacksonia sericea</i>	P3
<i>Lasiopetalum membranaceum</i>	P3
<i>Rhodanthe pyrethrum</i>	P3
<i>Stylidium longitubum</i>	P3
<i>Anthotium junciforme</i>	P4
<i>Aponogeton hexapetalus</i>	P4
<i>Dodonaea hackettiana</i>	P4
<i>Eucalyptus rudis</i> subsp <i>cratyantha</i>	P4
<i>Microtis media</i> subsp <i>quadrata</i>	P4
<i>Parsonsia diaphanophleba</i>	P4
<i>Villarsia submersa</i>	P4

Three priority species were identified during the field investigations. These included *Grevillea thelemanniana*, *Jacksonia sericea* and *Lasiopetalum membranaceum*. *Grevillea thelemanniana* (priority 4) was found throughout vegetation types SpD and LR within the study area. *Jacksonia sericea* (priority 3) was also found throughout the SpD vegetation type, occupying similar habitats to *G. thelemanniana*. *Lasiopetalum membranaceum* (priority 3) was identified at one location east of Paganoni Reserve. This species was not included in the Priority and Declared Rare species known from the study area. The extent of the population is not known as the species was collected during identification of specimens rather than during field surveys.

The priority rating categories are provided by CALM. The descriptions of the rating categories of species potentially occurring within the alignment are provided below.

Declared Rare Flora – Extant Taxa. Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

Declared Rare Flora – Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

Priority One – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.

Priority Two – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey.

Priority Three – Poorly known taxa. Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. no currently endangered), either due to the number of known populations (generally >5), or known

populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

Priority 4 – Rare Taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

As the flora surveys did not cover the entire alignment, but rather the most likely places for threatened flora to be located, there is the possibility that a small number of populations of threatened species may occur within the alignment, that were not picked up during the field surveys.

Two additional species that are significant, but not listed as Declared Rare or Priority Flora are *Kennedia coccinea* and *Laxmannia grandiflora*. The Bush Forever document describes both as "significant" but also described *Laxmannia grandiflora* as "populations disjunct from their known range". *Kennedia coccinea* was found in the Lake Coo롱up Reserve and *Laxmannia grandiflora* was found south of Thomas Road (N Pauli, Ecoscape, *pers comm.*, 20/11/02).

3.2.6 Threatened Ecological Communities

Within and adjacent to the SWMR alignment there is the potential for two TEC types to occur. These are Sedgeland in Holocene dune swales (TEC 19) and *Callitris preissii* and *Melaleuca lanceolata* forests and woodlands (TEC 30a) (Ecoscape, 2002b – Vegetation and Flora Management Plan). Both of these communities are found only on the Quindalup Dunes however survey work to identify TECs completed by Ecoscape (2002b – Vegetation and Flora Management Plan) within the potential areas of occurrence found no evidence of TEC 30a either on or adjacent to the SWMR alignment.

TEC 19 occurs within seasonal freshwater wetland areas in dune swales on the Holocene beach ridge plain in the Rockingham area and is officially recognised from six sites in the Rockingham area (Department of Conservation and Land Management, 1999a). TEC 19 can be subdivided into two further groups: TEC 19a, which has no overstorey, and TEC 19b, which is known also known as Woodlands over sedgeland in Holocene dune swales. Previous surveys conducted by Ecoscape (2002b – Vegetation and Flora Management Plan) located a remnant of TEC 19b in good condition within the SWMR alignment in the Lake Coo롱up area (Figure 12).

Ecoscape (2002b – Vegetation and Flora Management Plan) also located a TEC 19b remnant in very good to excellent condition in the area originally proposed for the Waikiki Transit Station near the intersection of Safety Bay Road and Ennis Avenue (Figure 12).

Due to the presence of TEC 19b in the area an additional study was carried out for the Lake Cooloongup and Lake Walyungup reserves. Results of this study indicate that approximately 150ha of vegetation within dune swales in the area could constitute TEC 19b (Ecoscape, 2001 – Threatened Ecological Community Survey, Lake Cooloongup and Lake Walyungup). This would increase the total amount of TEC 19a and TEC 19b to approximately 200ha (Figure 12).

Further information relating to the protection of these TEC's is provided in Section 5.2.2 of this PER and also in the EMP (Ecoscape, 2002b – Vegetation and Flora Management Plan) and Lake Cooloongup and Lake Walyungup Report (Ecoscape, 2001).

3.2.7 Weeds

Weed occurrence along the proposed SWMR alignment between Anketell Road and Mandurah has been surveyed by Ecoscape. Weed occurrence at the Thomsons Lake Station site was surveyed by Hart Simpson & Associates.

The Perth to Anketell section of the alignment running within the freeway median strip and the South Street, Leach Highway and Thomsons Lake Station sites currently contain numerous weed species. Following development of the rail alignment these areas will no longer be available for colonisation as weed control is conducted on all railways operated by Westrail to maintain clear track conditions and remove any potential fire hazards. Landscaping around station sites will also include weed control.

Eighty two weed species were recorded within both the SWMR alignment and the 50m area either side of the alignment from Anketell to Mandurah during surveys completed by Ecoscape in May and September 2001. Weed species identified through this area are listed in Table 6 and further described in the EMP (Ecoscape, 2002c – Weed Control Programme).

The Environmental Weed Strategy for Western Australia (CALM, 1999b) has developed a ratings system of priority for control of weed species within Western Australia. The control priority for weed species recorded within the SWMR is also listed in Table 6.

Table 6: Weed Species Recorded within the SWMR corridor between Anketell and Mandurah Boundary (Ecoscape, 2002c – Weed Control Programme).

Taxonomic Name	Common Name	Control Priority ¹	Taxonomic Name	Common Name	Control Priority ¹
<i>Agapanthus praecox</i>	Agapanthus	Low	<i>Hordeum leporinum</i>	Barley Grass	Moderate
<i>Agave americana</i>	Agave	Low	<i>Hyparrhenia hirta</i>	Tambookie Grass	High
<i>Anagallis arvensis</i>	Pimpernel	Moderate	<i>Hypochaeris glabra</i>	Smooth Catsear	Moderate
<i>Arctotheca calendula</i>	Cape Weed	Moderate	<i>Lagurus ovatus</i>	Hare's Tail Grass	High
<i>Asparagus asparagoides</i>	Bridal Creeper	High	<i>Lupinus angustifolius</i>	Narrowleaf Lupin	Mild
<i>Asphodelus fistulosus</i>	Onion Weed	Mild	<i>Lupinus cosentinii</i>	Sandplain or Blue Lupin	High
<i>Avena</i> spp.	Wild Oats	Moderate	<i>Medicago</i> spp.	Medic	Low – Mild
<i>Brassica tournefortii</i>	Mediterranean Turnip	High	<i>Monadenia bracteata</i>	South African Orchid	Moderate
<i>Briza maxima</i>	Blowfly Grass	Moderate	<i>Nerium oleander</i>	Oleander	Not Rated
<i>Briza minor</i>	Shivery Grass	Moderate	<i>Olea europa</i>	Olive	Moderate
<i>Bromus diandrus</i>	Great Brome	High	<i>Orobanche minor</i>	Lesser Broomrape	Moderate
<i>Carpobrotus edulis</i>	South African Pigface	Moderate	<i>Tripteris clandestina</i>	Stinking Roger	Mild
<i>Centaurium erythraea</i>	Common Centaury	Moderate	<i>Oxalis pes-caprae</i>	Soursob	Mild
<i>Chamaecytisus palmensis</i>	Tagasaste / Tree Lucerne	Moderate	<i>Pelargonium capitatum</i>	Rose Geranium	High
<i>Cirsium vulgare</i>	Slender Thistle	Moderate	<i>Pennisetum clandestinum</i>	Kikuyu	Moderate
<i>Conyza albida</i>	Tall Fleabane	Low	<i>Petrorhagia velutina</i>	Velvet Pink	Mild
<i>Conyza bonariensis</i>	Flax-leaf Fleabane	Low	<i>Phyla nodosa</i>	Lippia	Moderate
<i>Cynodon dactylon</i>	Couch Grass	Moderate	<i>Pinus</i> sp.	Pine	Moderate
<i>Cyperus tenuiflorus</i>	Scaly Sedge	Low	<i>Piptatherum miliaceum</i>	Rice Millet	Low
<i>Dittrichia graveolens</i>	Stinkwort	Mild	<i>Poa annua</i>	Winter Grass	Moderate

Table 6 Continued

Taxonomic Name	Common Name	Control Priority ¹	Taxonomic Name	Common Name	Control Priority ¹
<i>Echium plantagineum</i>	Paterson's Curse	Not Rated	<i>Ranunculus muricatus</i>	Sharp Buttercup	Low
<i>Ehrharta calycina</i>	Veldt Grass	High	<i>Raphanus raphanistrum</i>	Wild Radish	Mild
<i>Ehrharta longiflora</i>	Annual Veldt Grass	Moderate	<i>Romulea rosea</i>	Guildford Grass	High
<i>Eragrostis curvula</i>	African Lovegrass	High	<i>Rumex crispus</i>	Curled Dock	Mild
<i>Erodium botrys</i>	Long Storksbill	Low	<i>Rumex pulcher</i>	Fiddle Dock	Mild
<i>Erodium</i> sp.	Storksbills	Low	<i>Salix chilensis</i>	Chilean Pencil Willow	Not Rated
<i>Erythrina</i> sp.	Coral tree	Low	<i>Schinus terebinthifolia</i>	Japanese Pepper Tree	Moderate
<i>Eucalyptus camaldulensis</i>	River Red Gum	Not Rated	<i>Sisymbrium</i> sp.	Wild mustard	Mild – Moderate
<i>Euphorbia peplus</i>	Petty Spurge	Moderate	<i>Solanum linnaeanum</i>	Apple of Sodom	Not Rated
<i>Euphorbia terracina</i>	Geraldton Carnation Weed	High	<i>Sonchus oleraceus</i>	Common Snowthistle	Moderate
<i>Ficus carica</i>	Fig	Moderate	<i>Stenotaphrum secundatum</i>	Buffalo Grass	Moderate
<i>Freesia leichtlinii</i>	Freesia	High	<i>Trachyandra divaricata</i>	Strapweed	Mild
<i>Fumaria</i> sp.	Fumitory	Mild	<i>Trifolium arvense</i>	Hare's Foot Clover	Moderate
<i>Geranium dissectum</i>	Cutleaf Cranesbill	Low	<i>Trifolium dubium</i>	Clover	Moderate
<i>Geranium molle</i>	Cranesbill	Low	<i>Trifolium</i> spp.	Clover	Low – Moderate
<i>Gladiolus caryophyllaceus</i>	Pink Gladiolus	Moderate	<i>Ursinia anthemoides</i>	Ursinia	Moderate
<i>Gomphocarpus fruticosus</i>	Narrowleaf Cottonbush	Moderate	<i>Vicia sativa</i>	Common vetch	Moderate
<i>Heliophila pusilla</i>		Moderate	<i>Vulpia</i> spp.	Fescue grass	Low – Moderate
<i>Homeria flaccida</i>	One-Leaf Cape Tulip	High	<i>Zantedeschia aethiopica</i>	Arum Lily	High

1. High: High priority for control and ongoing monitoring.
Moderate: High priority for monitoring.
Mild: Assess in relation to site conditions. Monitor and control where appropriate.
Low: Low level of monitoring and is unlikely to require control.

3.2.8 Plant Pathogens

Dieback

Dieback is a serious threat to bushland in the south-west of Western Australia, as it can kill a wide selection of species. The soil-borne pathogen *Phytophthora* requires moist conditions and a living host on which to feed. The fungus kills the host by girdling the base of the stem, destroying the roots and depriving the plant of access to nutrients and water (Ecoscape & Gelvan, 2002 – Dieback Management Plan).

In warm, moist conditions *Phytophthora cinnamomi* can produce millions of spores that can actively swim towards new hosts and initiate new infections. Clay and laterite within soils causes subsurface ponding of water, which facilitates the production of spores (Ecoscape & Gelvan, 2002 – Dieback Management Plan).

The SWMR alignment traverses the Bassendean, Spearwood and Quindalup dune systems. The Bassendean system favours conditions that allow the pathogen to express as dieback disease. The soils of the Spearwood and Quindalup systems tend to be highly calcareous, and as such the pathogen is inhibited in its expression (Ecoscape & Gelvan, 2002 – Dieback Management Plan).

The indigenous species most affected by the pathogen belong to the following families:

- Proteaceae (eg Banksia species)
- Epacridaceae (including many typical heath species)
- Papilionaceae (the pea family)
- Myrtaceae (eg Eucalyptus species)

(Ecoscape & Gelvan, 2002 – Dieback Management Plan)

Perth to Beeliar Drive, Jandakot

The portion of the alignment within the freeway median strip does not contain areas of native vegetation. Dieback infestation is therefore not an issue for this area. Dieback was noted along the north eastern edge of the Thomsons Lake Station site.

Beeliar Drive to the Southern MRS Boundary

Gelvan Dieback Consultancy Services completed a comprehensive dieback assessment of the SWMR corridor and a 50m easement either side of the alignment between in April

and May 2001. Dieback assessment was performed by visual inspection of the vegetation and all infestations were flagged in the field. A detailed description of dieback infestations along the SWMR alignment between Beeliar Drive and the Southern MRS boundary is provided in the EMP (Ecoscape & Gelvan, 2002 – Dieback Management Plan) and shown in Figure 13.

Areas along the alignment identified as dieback infested include:

- Anketell Tunnel to Thomas Road – although some areas of bushland in this section were not presently infested with the pathogen, these areas could not be suitably managed to prevent future spread of the disease.
- Thomas Road to Challenger Avenue:
 - Thomas Road to Map Reference D1 (Figure 13) – mosaic of small infestations
 - Map Reference D2 to D3 (Figure 13) – most likely caused by activity along the gas pipeline route.
 - Map Reference D4 to D5 (Figure 13) – spread along an existing track.
- Challenger Avenue, Map Reference D6 to D7 (Figure 13) – scattered deaths throughout the area

Southern MRS Boundary to Mandurah

The alignment through this area traverses coastal landforms and vegetation, with few opportunities for the *Phytophthora cinnamomi* pathogen to express as dieback disease. This area of the alignment is therefore uninterpretable.

Armillaria

The other plant pathogen investigated in this survey was *Armillaria luteobubalina*, which is a mushroom-producing fungus that is probably native to Western Australia and commonly occurs in the southwest of the state (Ecoscape & Gelvan, 2002 – Dieback Management Plan).

The infection is caused by the aerial dispersion of spores, or through mycelium in root systems. Infection entry points for the spores may be provided by wounds caused by fire, broken limbs and insect damage. *A. luteobalbina* infects a wide range of plant species from diverse families, some of which are resistant to *Phytophthora* infection. A

site can recover from an *A. luteobalbina* infestation, although individual plants will not (Ecoscape & Gelvan, 2002 – Dieback Management Plan).

There was a small area of the alignment near Gilmore Avenue infested with *Armillaria luteobubalina*, with deaths in *Xanthorrhoea* and *Banksia* species. The pathogen was not noted in any other areas.

3.3 Fauna

3.3.1 Introduction

Due to the limited amount of native vegetation along the sections of the SWMR project between Perth to Anketell, there are unlikely to be any large occurrences of native fauna. Introduced species, such as domestic cats, foxes and rabbits may be encountered.

Fauna surveys have been conducted over the remainder of the alignment and the findings are summarised below and presented in detail in the Fauna Management Plan (Ecoscape & Bamford, 2002).

3.3.2 Terrestrial Fauna Habitat

The different vegetation complexes present along the alignment provide a variety of fauna habitats. Habitat elements considered important for mammals, birds, reptiles and amphibians are described in the Fauna Management Plan (Ecoscape and Bamford, 2002) and presented on Table 7.

The open forest and woodland communities would provide suitable habitat for some mammal, bird and reptile species. The wetland areas close to the rail reserve would provide habitat for a range of water birds and waders, many of which are protected on international treaties (Ecoscape and Bamford, 2002).

The railway route also passes through cleared and partly cleared land, including existing road verges, for part of its length. Such habitats are generally of low conservation value for fauna as they support few but widespread species (Ecoscape and Bamford, 2002).

Table 7 Fauna Habitat Elements

Fauna Type	Important Habitat Elements
Mammals	<ul style="list-style-type: none"> • The amount of ground cover present, shrub layer and/or tree canopy and type for shelter and as a food source. • Occurrence of old trees containing hollows for shelter and nesting sites. • Substrate type for burrowing. • Fallen branches and trunks which may provide shelter or den sites. • Water supply.
Birds	<ul style="list-style-type: none"> • Structural features such as the extent and nature of understorey and ground stratum, extent of the canopy and flowering characteristics. • Presence of a water source. • Tree hollows for nesting.
Reptiles	<ul style="list-style-type: none"> • Dense ground cover for shelter • Fallen branches and trees as basking and shelter sites. • Solt substrate for burrowing. • Ant nests for food supply.
Amphibians	<ul style="list-style-type: none"> • Free standing water or ephemeral soaks suitable as breeding sites. • Dense reed vegetation for shelter. • Solt substrate for burrowing.

Important fauna habitats within and surrounding the alignment for species of conservation significance are summarised as:

- Seasonal wetlands and wetlands in general
- Wetlands with emergent paperbarks or other trees
- Wetlands with dense rushes or sedges
- Dense wetland vegetation
- Large tuarts and other eucalypts
- Heathlands and shrublands
- Woodlands

3.3.3 Species Occurrence

Detailed lists of vertebrate fauna species expected to occur or observed within areas adjacent to the SWMR proposal are provided in Appendix C. Comprehensive

information on the survey methods employed during the fauna surveys is provided in the Environmental Management Plan (Ecoscape & Bamford 2002 – Fauna Management Plan).

The area within or adjacent to the SWMR rail corridor within the Peel Region may support five freshwater fish species, nine species of frog, 43 reptile species, 146 bird species and 26 mammal species.

Freshwater fish of wetlands on the coastal plain between Perth and Mandurah are poorly documented, but six species may occur in the wetlands immediately adjacent to the SWMR alignment (Appendix C).

All of the species, with the exception of the Black-striped Jollytail and possibly the Mud Minnow, rely on the presence of permanent water. The Jollytail appears to survive in seasonal wetlands by sheltering in the burrows of Koonacs (*Cherax preissi*) (Ecoscape & Bamford, 2002 – Fauna Management Plan).

All nine species of frogs known from the Perth region on the Swan Coastal Plain south of the Swan River are expected to be present (Appendix C). Of these nine species, eight have aquatic larvae and breed in wetlands. However, the Moaning Frog, Pobblebonk and to some extent Guenther's Toadlet can be found up to a kilometre away from wetlands outside the breeding season. The remaining aquatic species will use terrestrial habitats but the bulk of the populations will remain close to aquatic environments (Ecoscape & Bamford, 2002 – Fauna Management Plan).

The Turtle Frog is entirely terrestrial and may be present wherever native upland vegetation remains, particularly within Banksia/eucalypt woodlands on sand (Ecoscape & Bamford, 2002 – Fauna Management Plan).

Up to 43 reptile species may be present along the SWMR alignment (Appendix C). The Long-necked Tortoise is aquatic and is likely to be present in all permanent and near-permanent wetlands along the alignment. A number of other reptiles including the South-West Cool Skink, Mourning Skink, Dusky Morethia and Tiger Snake are closely associated with riparian habitats around wetlands.

Most other species are likely to be found in upland native vegetation in good condition. Some of these species have specific habitat requirements, which may result in restricted distributions along the SWMR alignment. For example, the Spiny-tailed Gecko often

occurs at high densities in near-coastal *Acacia* shrublands around Perth (M. Bamford, pers. obs.), whilst the Barking Gecko is restricted to areas of exposed limestone on the coastal plain (Ecoscape & Bamford, 2002 – Fauna Management Plan).

A few reptile species, such as the Fence Skink, Two-toed Earless Skink, Dwarf Skink and the three species of *Lerista*, are known to be abundant and may even be favoured in degraded habitats.

Due to the mobility of birds, approximately 200 species may potentially be recorded along the SWMR route, but it is considered that only 60 waterbirds and 86 dryland species may make regular use of areas along the alignment (Appendix C).

Some species of dryland birds have specific habitat requirements and require dense, low vegetation, such as heath or a dense understorey in woodland. Species such as the Splendid Fairy-wren and White-browed Scrub-wren may therefore be absent from areas of woodland where the understorey is degraded and open, but are expected to be abundant where dense understorey is present, such as around wetlands and in areas of heath close to Mandurah. Other dryland birds have seasonal habitat requirements and will be abundant in some locations for only part of the year.

Four waterbird species are likely to occur along the alignment. All of these species forage, nest and roost within wetland areas. Distribution of these species will be determined by the availability of suitable habitat along the route. The Freckled Duck favours wetlands with emergent paperbark trees whilst the Little and Australian Bitterns favour swamps with extensive beds of rushes (Ecoscape & Bamford, 2002 – Fauna Management Plan).

Two raptors may occur along the alignment. The Square tailed Kite tends to favour heathlands so may be present in the southern part of the route, although is noted to be an uncommon visitor to the Swan Coastal Plain. The Peregrine Falcon is seen regularly around Perth and in the region is known to nest in large eucalypts (Ecoscape & Bamford, 2002 – Fauna Management Plan).

Eight species of Cockatoo may occur along the alignment. The Short-billed Cockatoo regularly uses native vegetation in the metropolitan region, favouring areas supporting *Banksia* and *Hakea* spp. It also feeds on the seeds of pine trees. It is likely to be a regular, non-breeding visitor to Eucalypt and Banksia woodlands in the area, however is

may also visit other vegetation types such as Tuart woodlands and heath when food is seasonally available (Ecoscape & Bamford, 2002).

The Masked Owl may be present in the Tuart woodland around Lake Coo loongup and along the railway route close to Mandurah, although its distribution is poorly understood (Ecoscape & Bamford, 2002).

It is estimated that 26 mammal species may be present along the alignment. The mammal fauna is likely to be poor, contain several introduced species and be almost outnumbered by regionally extinct species (Appendix C). This high level of extinction is typical of southern Australia in general and has been attributed to changes in fire regime, habitat loss and predation by foxes and cats (Ecoscape & Bamford, 2002 – Fauna Management Plan).

The Rakali or Water-Rat is amphibious and is probably present in all wetlands along the SWMR alignment. None of the remaining mammal species is as closely associated with wetlands, but the Quenda or Southern Brown Bandicoot tends to be most abundant in dense vegetation around wetlands. Other mammal species, including bats, may also make use of wetland vegetation but will also range more widely into adjacent vegetation. (Ecoscape & Bamford, 2002 – Fauna Management Plan).

The areas of *Eucalyptus/Banksia* woodland are likely to support the greatest range of mammal species. Large eucalypt trees with hollows are likely to be important for bats and the Brush-tailed Possum and may be utilised even if in otherwise cleared land. The Honey Possum may use heathland along the route at least seasonally when flowers are present. Only the Grey Kangaroo, the Brush-tailed Possum and introduced mammal species are likely to make regular use of disturbed and cleared habitats.

3.3.4 Conservation Fauna

The priority fauna rating utilised by CALM is outlined in Table 8.

The Jollytail is the only freshwater fish of conservation significance likely to occur along the route. This species is listed as Priority 3 by CALM.

No frogs of conservation significance were observed or are expected to occur along the proposed route.

Table 8 Priority Fauna Ratings

Source	Level	Description
WA Wildlife Conservation Act	Schedule 1	Fauna which is rare or likely to become extinct
	Schedule 2	Fauna presumed to be extinct
	Schedule 3	Birds protected under an international agreement
	Schedule 4	Other specially protected fauna
WA Department of Conservation and Land Management (species not listed under the Conservation Act, but for which there is some concern)	Priority 1	Taxa with few, poorly known populations on threatened lands
	Priority 2	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands
	Priority 3	Taxa with several, poorly known populations, some on conservation lands
	Priority 4	Taxa in need of monitoring
International Union for the Conservation of Nature and Natural Resources	Extinct	Taxa not definitely located in the wild during the past 50 years
	Endangered	Taxa in danger of extinction and whose survival is unlikely if the casual factors continue to operate
	Vulnerable	Taxa believed likely to become Endangered in the near future if the casual factors continue to operate
	Rare	Taxa with small populations that are not considered Endangered or Vulnerable, but which are threatened (if only by virtue of their small population size)
	Insufficiently Known	Taxa suspected of being rare, vulnerable or endangered, but whose true status cannot be determined without more information

Three reptile species of national conservation significance that may be present along the SWMR alignment are:

- The Perth Lined Lerista (listed as Rare or Insufficiently Known by CALM);
- The Black-striped Snake (listed as Endangered by Cogger *et al.*, 1993) and
- The South-West Carpet Python (listed as Other Specially Protected Fauna (WA Wildlife Conservation Act) and Vulnerable (Cogger *et al.*, 1993)).

A number of other reptile species are considered to be of regional conservation significance (Appendix C) as they occur at the limit of their known distribution. Species at their southern limit include the Barking Gecko, Gray's Legless Lizard, Worm Lerista and Western Bluetongue, whilst species at their northern limit are *Ctenotus gemmula* and the Red-legged Skink (Ecoscape & Bamford, 2002 – Fauna Management Plan).

Eight bird species of national conservation significance may occur along the SWMR alignment: These include

- Freckled Duck (Priority 4 by CALM)
- Little Bittern (Priority 4 by CALM, Near-Threatened according to Garnett and Crowley, 2000)
- Australasian Bittern (Vulnerable according to Garnett and Crowley, 2000)
- Black Bittern (the South-West population is classed as Priority 2 by CALM)
- Square-tailed Kite (Priority 4 by CALM)
- Peregrine Falcon (Specially Protected under the *WA Wildlife Conservation Act 1950*)
- Short-billed (Carnaby's) Black Cockatoo (Endangered in Garnett and Crowley, 2000, under the federal *Environment Protection and Biodiversity Conservation Act 1999* and under the *WA Wildlife Conservation Act 1950*)
- Masked Owl (southern race listed as Near-Threatened by Garnett and Crowley, 2000, and as Priority 4 by CALM)

Several bird species, such as the Great Egret, the Grey Plover and the Common Sandpiper, are also listed under international conservation treaties (Appendix C). These species are mostly migratory shorebirds that can be very abundant on large, open wetlands, especially as non-breeding visitors in summer.

Five mammal species of national conservation significance are known to occur within the area of the SWMR proposal: the Chuditch (listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Act 1999* and also under the *WA Wildlife Conservation Act 1950 - 1980*), Quenda, Brush Wallaby, *Falsistrellus mackenziei* (vesper bat) and the Rakali (all Priority 4 according to CALM) (Ecoscape and Bamford, 2002 – Fauna Management Plan).

Due to the decline in mammal species, virtually any native species present in the area can be considered of regional conservation significance (Appendix C).

3.4 Wetlands

3.4.1 Introduction

The wetlands of the Swan Coastal plain are grouped into consanguineous wetland suites, which are wetlands that share geomorphic setting, origin and maintenance (LeProvost *et al.*, 1987). Wetlands are typically found within the swamp and marine associated soil types. These include the Herdsman, Yoongarillup and Vasse Complexes encountered along the route. These are described in Section 3.1. The wetlands suites passed by the alignment include the Swan River Suite, Jandakot Suite, Bibra Suite, Becher Point Suite, Cooloongup Suite and Stakehill Suite.

The characteristics of the suites are presented below:

Swan River Suite

This includes the Swan and Canning rivers and their floodplains. The rivers were formed by fluvial incision, sedimentation and surface runoff. The stratigraphy consists of alluvium of quartz, sand and clay (Hill *et al.*, 1996a).

Jandakot Suite

These wetlands are located within the Bassendean Dunes. The suite includes areas in Jandakot (east of the Bibra Suite) as well as area north of the Swan River and south of Mandurah. The wetlands are primarily damplands and sumplands. They were formed by groundwater surfacing or near the surface in dune system depressions (Hill *et al.*, 1996a).

Bibra Suite

These wetlands are located at the interface between the Spearwood Dunes and the Bassendean Dunes, with wetlands originating in contact depressions with groundwater impounded against limestone ridges. They are irregular to round in shape and are freshwater with varying salt concentration. Wetland sediments consist of mud, peat or peaty sand overlying Bassendean Sand (Ecoscape, 2002d – Hydrology and Drainage Management Plan).

Stakehill Suite

The wetlands occur in a north-south linear belt between Wattleup and Mandurah, to the east of the zone of coastal accretion. The wetlands are found within the Spearwood Dunes in carbonate mud and peat filled depressions, which were probably originally karst depressions. They are irregular to elongate shape forming a linear chain (Ecoscape, 2002d - Hydrology and Drainage Management Plan).

Becher Point Suite

These freshwater wetlands occur in dune swales within the parallel beach ridges on the Holocene foredune plain in the Rockingham area. The wetlands consist of linear chains of sumplands and damplands within the inter-ridge depressions, which intersect or lie close to the water table. They are elongated and small in size (Ecoscape, 2002d - Hydrology and Drainage Management Plan).

Cooloongup Suite

Wetlands of this suite are located in contact between the Quindalup Dunes and the Spearwood Dunes. The wetlands originated as barred oceanic basins as part of the prograding shoreline process, and are now freshwater recharged (Ecoscape, 2002d - Hydrology and Drainage Management Plan).

Wetland location information and a brief description of the conservation policies that apply to wetlands adjacent to the alignment are presented in Section 3.4.3. The regional, national and international conservation significance of these wetlands is discussed in Section 3.4.2.

Not all wetlands occurring along the alignment are required to be assessed in this PER as assessment has previously been conducted for the 937/33 and 938/33 MRS amendment areas. Wetlands which will be assessed are identified in the sections below and further detail is provided in Section 5.4.

3.4.2 Conservation Significance and Protection Levels

International Agreements

The Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA) advocate the preservation, enhancement and prevention of damage to environments used by species of migratory birds listed under the agreement. The agreements also propose establishment of sanctuaries and other

facilities for the management and protection of migratory birds and birds in danger of extinction and their environment. These agreements are implemented by the government of each country.

National Identification

Wetlands listed in *A Directory of Important Wetlands in Australia* (ANCA, 2001) form part of the Oceania Wetland Inventory undertaken by the International Waterfowl and Wetlands Research Bureau (IWRB), the Asian Wetlands Bureau and the New Zealand Department of Conservation. To qualify for inclusion in the Directory a wetland or wetland complex must be representative of rare wetland types, have special ecological/hydrological values, contain rarity of species and communities or hold recognised cultural, scientific or recreational values.

The Register of the National Estate, which is compiled by the Australian Heritage Commission, contains over 12,000 natural and cultural places throughout Australia, including nearly 2000 natural places. The register alerts governments, planners, decision makers and the community to the heritage values of these places so they can take action to conserve them. Listing does not directly affect the way in which owners manage places, therefore it confers a moral rather than a legal obligation on the owners (GWA, 2000b).

Regional Identification

Regional significance has been identified from inclusion of wetlands in the following policies and documents:

- Environmental Protection (Swan Coastal Plain Lakes) Policy 1992
- Wetland Atlas (Hill et al., 1996a)
- Digital Wetland Mapping provided by the Water and Rivers Commission (2002)
- Bush Forever (GWA, 2000b)
- Beeliar Regional Park (Department of Planning and Urban Development, 1992)
- Rockingham Lakes Regional Park (Alan Tingay and Associates, 1997)
- Perth to Bunbury Wetland Study (LeProvost, Semeniuk & Chalmer, 1987)

The *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* prohibits the mining, filling, drainage or disposal of effluent into a defined set of wetlands without proper authorisation.

The Wetlands Atlas (Hill *et al.*, 1996a) contains mapping, classification and evaluation for wetlands on the Swan Coastal Plain. The classification presented in this atlas and electronic updates are supported by the Water and Rivers Commission (WRC). The following wetland categories are presented in the atlas:

- Conservation category wetlands are those which support high levels of attributes and functions. The management priorities are to preserve wetland attributes and functions through reservation in national parks, Crown reserves, State owned land and protection under environmental protection policies (Hill *et al.*, 1996a).
- Resource Enhancement Wetlands are described as those which have been partly modified but still support substantial functions and attributes. Management of this category aims to restore wetlands through maintenance and enhancement of wetland functions and attributes by protection in Crown reserves, State or local government owned land and by environmental protection policies, or in private property by sustainable management (Hill *et al.*, 1996a).
- Multiple Use wetlands are those with few attributes which still provide important wetland functions. Management of these areas should be considered in the context of water (catchment/strategic drainage planning), town (land use) and environmental planning through landcare (Hill *et al.*, 1996a).

The Bush Forever report was prepared by the GWA (2000b) and aims to identify and protect areas of regionally significant bushland and associated wetlands on the Swan Coastal Plain in the Perth Metropolitan Region. Any proposal affecting a Bush Forever site must be referred to the Bush Forever Office to determine whether the proposal is in accordance with the Bush Forever objectives. The Bush Forever Office will provide its recommendations to the Western Australian Planning Commission (WAPC) to be considered in the assessment process.

The Beeliam Regional Park (Department of Planning and Urban Development, 1992), Rockingham Lakes Regional Park (Alan Tingay and Associates, 1997) and Perth to Bunbury Wetland Study (LeProvost, Semeniuk & Chalmer, 1987) identify wetlands of

regional significance. These documents aim to facilitate the protection of regionally significant wetlands through conservation.

3.4.3 Location and Conservation Status

Perth to Beelias Drive, Jandakot

The proposed SWMR alignment passes through and adjacent to six wetland and dampland areas between Perth and Beelias Drive, Jandakot (Hill *et al*, 1996b). Impacts on all these wetlands will be assessed as this area has not been previously assessed for use as a rail reserve. The location of these wetlands relative to the SWMR alignment is shown on Figure 14. A description of the conservation values of each wetland is provided in Table 9.

The damplands and sumpland along this portion of the alignment have been disturbed by human activities and urban development. The Swan and Canning Rivers remain in good condition but are impacted by nutrients and urban contaminants. Both rivers have high conservation and recreational value.

Table 9: Conservation Values of Wetlands Adjacent to the SWMR Alignment between Perth and Beelias Drive, Jandakot.

Wetland Name	Conservation Significance
Swan River Estuary	<p><u>Regional</u></p> <ul style="list-style-type: none"> • Conservation category wetland¹ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study³ <p><u>National</u></p> <ul style="list-style-type: none"> • Included in <i>A Directory of Important Wetlands in Australia</i>²
Canning Estuary	<p><u>Regional</u></p> <ul style="list-style-type: none"> • Conservation category wetland¹ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study³ <p><u>National</u></p> <ul style="list-style-type: none"> • Included in <i>A Directory of Important Wetlands in Australia</i>²
Leach Hwy / Freeway Dampland	<p>Conservation significance not recognised at regional, national or international level</p> <ul style="list-style-type: none"> • Multiple use category wetland¹
Melville Cres / Parry Ave Dampland	<p>Conservation significance not recognised at regional, national or international level</p> <ul style="list-style-type: none"> • Resource enhancement category wetland¹

Table 9: Continued

Wetland Name	Conservation Significance
Kwinana Fwy / Berrigan Dve Sumpland	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Multiple use category wetland¹
Forest Rd / Princep Rd Dampland	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Multiple use category wetland¹

- 1: Hill *et al.*, 1996a
2: ANCA, 2001
3: LeProvost, Semeniuk & Chalmer, 1987

Beeliar Drive, Jandakot to the Southern MRS Boundary

The proposed SWMR alignment passes through, or lies adjacent to, seventeen wetland and dampland areas between Beeliar Drive and the Southern MRS Boundary (Figure 14). Table 10 identifies the regional, national and international conservation significance of these wetlands. The wetlands that have some portion to be assessed are identified with an asterisk.

Many of the wetlands have previously been disturbed by human activities, including grazing, clearing and drainage. A significant portion of fringing vegetation around such wetlands as Bollard Bulrush Swamp and Stakehill Swamp has been previously cleared for agricultural activities and artificial drains have been constructed through The Spectacles and Bollard Bulrush Swamp (Ecoscape, 2002d - Hydrology and Drainage Management Plan).

Table 10: Conservation Values of Wetlands Adjacent to the SWMR Alignment between Beeliar Drive, Jandakot and the Southern MRS Boundary (Ecoscape, 2002d – Hydrology and Drainage Management Plan).

Wetland Name	Conservation Significance
Bartram/ Beenup Road wetland	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Resource enhancement category wetland⁴
Bartram/Lyon Road wetland	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Multiple use category wetland⁴
Russell/Barfield Road wetland	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Multiple use category wetland⁴
Dampland south of Russel Road	Conservation significance not recognised at regional, national or international level <ul style="list-style-type: none"> Resource enhancement category wetland⁴

Table 10 Continued

Wetland Name	Conservation Significance
Mandogalup Swamp	<p>Regional</p> <ul style="list-style-type: none"> • Conservation, resource enhancement and multiple use category wetland⁴
The Spectacles*	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 269¹ • Part of Beeliar Regional Park² • Included in the Lakes EPP³ • Conservation category wetland⁴ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵ <p>National</p> <ul style="list-style-type: none"> • Included in <i>A Directory of Important Wetlands in Australia</i>⁶
Dampland north of Peel Main Drain, Bertram	<p>Conservation significance not recognised at regional, national or international level</p> <ul style="list-style-type: none"> • Resource enhancement category wetland⁴
Bollard Bulrush Swamp	<p>Regional</p> <ul style="list-style-type: none"> • Included in the Lakes EPP³ • Part of Beeliar Regional Park² • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵ <p>• Multiple Use and Resource Enhancement Category wetland⁴</p>
Leda Wetlands (Seven wetlands)	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 349¹ • One wetland is included in the Lakes EPP³ • Five wetlands are Conservation category and one is resource enhancement⁴ • Regionally significant wetlands identified in the Perth to Bunbury Wetland Study⁵
Pickle Swamp Series*	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 349¹ • Included in the Lakes EPP³ • Conservation category wetlands⁴
Lake Cooloongup	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 356¹ • Part of Rockingham Lakes Regional Park⁷ • Included in the Lakes EPP³ • Conservation category wetland⁴ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵ <p>National</p> <ul style="list-style-type: none"> • Included within an area listed on the Register of the National Estate <p>International</p> <ul style="list-style-type: none"> • Habitat for waders listed in the JAMBA and CAMBA international agreements
Lake Walyungup*	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 356¹ • Part of Rockingham Lakes Regional Park⁷ • Included in the Lakes EPP³ • Conservation category wetland⁴ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵ <p>National</p> <ul style="list-style-type: none"> • Included within an area listed on the Register of the National Estate <p>International</p> <ul style="list-style-type: none"> • Habitat for waders listed in the JAMBA and CAMBA international agreements

Table 10 Continued

Wetland Name	Conservation Significance
Ennis Avenue/ Lake Walyungup Damplands (Two wetlands)	<p>Regional</p> <ul style="list-style-type: none"> • Conservation category wetlands⁴ • Northern dampland included in the Rockingham Lakes Regional Park⁷
Stakehill Swamp	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 275¹ • Included in the Lakes EPP³ • Conservation category wetland⁴ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵
Dampland south of Stakehill Rd	<p>Regional</p> <p>Conservation category wetland⁴</p>
Anstey Swamp	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 379¹ • Part of Rockingham Lakes Regional Park⁷ • Included in the Lakes EPP³ • Conservation category wetland with a resource enhancement section where the wetland is dissected by Mandurah Road⁴ • Regionally significant wetland identified in the Perth to Bunbury Wetland Study⁵
Paganoni Swamp*	<p>Regional</p> <ul style="list-style-type: none"> • <i>Bush Forever</i> Site 395¹ • Part of Rockingham Lakes Regional Park⁷ • Included in the Lakes EPP³ • Conservation category wetland⁴

1: GWA, 2000b

2: Department of Planning & Urban Development, 1992

3: *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*

4: Hill et al., 1996a

5: LeProvost, Semeniuk & Chalmer, 1987

6: ANCA, 2001

7: Alan Tingay & Associates, 1997

* Wetlands where sections require assessment

Southern MRS Boundary to Mandurah (the Peel Region)

Between the MRS boundary and Mandurah the SWMR alignment passes immediately to the west of three wetlands. Parts of these wetlands have been disturbed by human activities, including grazing, clearing and drainage. The conservation significance of these wetlands is detailed in Table 11 (Ecoscape, 2002d – Hydrology and Drainage Management Plan). As impact on wetlands was deferred from assessment in the Peel Region Scheme assessment is required in the PER.

Table 11: Conservation Values of Wetlands Adjacent to the SWMR Alignment south of the MRS Boundary (Ecoscape, 2002d – Hydrology and Drainage Management Plan).

Wetland Name	Regional, National and International Conservation Significance
Paganoni Swamp ¹	<p>Regional</p> <ul style="list-style-type: none"> • Part of Rockingham Lakes Regional Park² • Included in the Lakes EPP³ • Conservation category wetland⁴
Fremantle Road Sumpland (Black Swan Lake)	<p>Regional</p> <ul style="list-style-type: none"> • Included in the Lakes EPP³ • Resource enhancement wetland⁴
Stock Road Sumpland (Marlee Swamp)	<p>Conservation significance not recognised at regional, national or international level.</p> <ul style="list-style-type: none"> • Resource enhancement wetland⁴

1. As the MRS boundary was the limit for the *Bush Forever* study only the portion of Paganoni Swamp Reserve north of the boundary is classified as a Bush Forever site (Section 3.7.2).
- 2: Alan Tingay & Associates, 1997
- 3: *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*
- 4: Hill et al., 1996a

3.5 Surface Hydrology

3.5.1 Natural Drainage

The most significant natural surface water feature along the SWMR route is the Swan – Canning Estuary. Natural drainage lines and artificial drains in the vicinity are generally directed towards the estuary and associated rivers. The 1-in-100 year flood levels for these water bodies remain west of the freeway and do not intersect the proposed alignment.

The southernmost part of the alignment is within the catchment of the Serpentine River. The Serpentine, Swan and Canning Rivers originate and carry run-off from the Darling Range, and also carry groundwater discharge from the coastal plain (Cargeeg *et al.*, 1987).

Low lying areas along the route, including wetlands and topographical depressions, also act as local drainage basins. They receive water from both direct run-off and seepage via groundwater. Recharge through wetlands is a primary source of seasonal recharge to the shallow aquifer.

Natural drainage is more prevalent along the undeveloped areas of the SWMR route. In general surface drainage through these areas is dominated by infiltration to groundwater rather than surface run-off.

3.5.2 Artificial Drainage

Artificial drainage systems occur throughout the developed sections of the route. In these locations rainfall is generally disposed of via dedicated local authority and Water Corporation stormwater systems, with run-off directed to stormwater basins for disposal through infiltration.

3.6 **Groundwater**

3.6.1 Groundwater Levels

Perth to Beeliar Drive, Jandakot

Groundwater levels between Perth and Beeliar Drive, Jandakot are influenced by the Swan River and the wetland chain west of Jandakot. Groundwater levels through this area vary from being exposed at the surface to 22m below ground level (Water and Rivers Commission (WRC), 1997). The average depth to groundwater is approximately 4m below ground level. Groundwater is within 2m of the surface at a number of locations including:

- Northern end of the Narrows Bridge
- Majority of the section between the southern end of the Narrows Bridge to the Mount Henry Bridge.
- Southern end of the Mount Henry Bridge.
- Small area between Leach Highway and Parry Avenue and another between Parry Avenue and South Street.
- Localised section between the freight line and Berrigan Drive, Glen Iris.

Implications associated with the construction and operation of the SWMR through these areas are further considered in Section 5.6.

Beelias Drive, Jandakot to the Southern MRS Boundary

Groundwater levels between Beelias Drive and the Southern MRS boundary are dictated by the proximity of the SWMR alignment to wetland areas. Groundwater levels in this area average approximately 10 to 12m below ground level (WRC, 1997). However, there are a number of locations along the route where groundwater levels are within two metres of the ground surface, including:

- Immediately south of Russell Road on the Kwinana Freeway.
- The Hoffman Road area, located immediately north of Anketell Rd.
- North of Challenger Drive, Bertram.
- Within the Pickle Swamp Wetlands.
- Along the Garden Island Highway, immediately north of Lake Cooloongup.
- Ennis Avenue Station locality.
- Stakehill Station locality.

Groundwater forms an elongate mound (Safety Bay Mound) near the intersection of Ennis Avenue and the Garden Island Highway reserve (Figure 15). This mound sits at approximately 2.5 metres AHD and flows east to Lake Cooloongup and west to the ocean (Davidson, 1995).

The alignment also passes through the Jandakot and Stakehill groundwater mounds (Figure 15). The watertable lies at approximately 25m AHD at the centre of the Jandakot Mound and 2.6 mAHD below the centre of the Stakehill Mound (Davidson, 1995). This equates to approximately 0 to 6 m below ground level (bgl) at the centre of the Jandakot Mound and 3 to >12 mbgl at the centre of the Stakehill Mound. Groundwater flows radially from both mounds.

Implications associated with the construction and operation of the SWMR through these areas are further considered in Section 5.6.

The Southern MRS Boundary to Mandurah

Groundwater levels range from 3m to greater than 12 m below ground level between the southern MRS boundary and Mandurah (Davidson, 1995). Groundwater levels are

shallower adjacent to the wetland chain that runs parallel to the coastline and in the low lying interdunal swales.

3.6.2 Groundwater Expression and Flow Direction

Perth is underlain by a major unconfined groundwater aquifer that extends throughout the coastal plain in the area west of the Gingin and Darling Scarps. The aquifer has a maximum thickness of 70m, with an average thickness of 20m in the region south of Perth city. It has been divided into ten discrete hydrogeological areas on the basis of topography, geology and discharge boundaries formed by rivers and the ocean (Davidson, 1995).

The SWMR alignment crosses five of these hydrogeological areas: Gnangara Mound (South), Cloverdale Area, Jandakot Mound, Stakehill Mound and Safety Bay Mound (Figure 15). All of the groundwater mounds are recharged directly by rainfall infiltration and are generally characterised by the absence of surface flows. The rate of infiltration to groundwater is normally greater than the horizontal flow of groundwater through the aquifer, resulting in the formation of groundwater mounds in the near surface sediment (Davidson, 1995).

The Gnangara Mound (South) covers an area of approximately 1,212 km² and extends from Ellen Brook in the east, the ocean in the west and south to the Swan River. Adjacent to the Swan River clayey sediments retard groundwater flow. Steep hydraulic gradients are common leading to the generation of numerous springs and naturally occurring drains (Davidson, 1995). There are six separate groundwater flow channels within the Gnangara Mound (South), with groundwater in the vicinity of the Perth to the Narrows Bridge sections of the SWMR alignment flowing in a southerly direction towards the Swan River.

The Cloverdale Area is approximately 171 km² and is bounded by the Darling Scarp to the east and elsewhere by the Helena, Swan and Canning Rivers. The area is underlain by Guildford Clay interfingered with Bassendean Sand, which affects the infiltration capacity of the sediments. The area has been divided into two groundwater flow channels. Groundwater flow for the sections of the SWMR alignment between the Narrows Bridge and the Mount Henry Bridge is generally in a westerly direction (Davidson, 1995).

The Jandakot Mound is the largest groundwater mound south of Perth, encompassing an area of approximately 522 km². The crest of the Mound is located south of Jandakot Airport and the SWMR alignment lies immediately to the north and west of the crest. The Jandakot Mound has been divided into seven separate groundwater flow channels that originate at the crest of the Mound and carry groundwater radially to the discharge boundaries (Davidson, 1995). Groundwater generally flows in a northerly to westerly direction for the section of the SWMR route between the Mount Henry Bridge and Thomsons Lake and a south westerly direction between Thomsons Lake and Lake Coo loongup.

The Safety Bay Mound lies between the Cape Peron Peninsula and Lakes Coo loongup and Walyungup, encompassing an area of approximately 49 km². The crest of the mound lies approximately midway between the coast and the lakes, with the SWMR proposal lying to the east of the mound crest. Groundwater flow in the vicinity of the SWMR alignment is to the west and south west.

South of Lake Walyungup the SWMR alignment overlies the Stakehill Mound. The Mound covers an area of approximately 153 km² between the Serpentine River and the coast. The crest of the Mound lies immediately south east of Lake Walyungup and the SWMR route crosses the south west corner of the crest. Groundwater flow is generally to the west.

3.6.3 Jandakot Underground Water Pollution Control Area

Underground Water Pollution Control Areas (UWPCAs) have been declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* to protect shallow groundwater resources used for public water supplies (Water & Rivers Commission (WRC), 2001a). The SWMR proposal impacts the north western corner and eastern side of the Jandakot UWPCA (Figure 16).

The protection of these areas from pollution is managed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, which is administered under the *Water and Rivers Commission Act 1995*. By-laws of the Acts enable the WRC to control potentially polluting activities and regulate land use within UWPCA's (WRC, 2001a)

To assist in the regulation of land use within these areas, the WRC has divided UWPCAs into three levels in order to identify the appropriate level of pollution control

to be implemented in each location. These levels are referred to as priority classification or priority protection areas and the objectives of each are described below:

- **Priority 1 (P1)** source protection areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. These areas are defined to ensure that there is no degradation of groundwater, and land development within these areas is generally not permitted.
- **Priority 2 (P2)** source protection areas are defined to ensure that there is no increased risk of pollution to groundwater sources. Protection of the public water supply is a high priority. P2 areas are declared over land where low intensity development (such as rural) already exists and so further conditional development is permitted.
- **Priority 3 (P3)** source protection areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments. Protection of these areas is achieved through the establishment of management guidelines.

(WRC, 2001b)

The SWMR proposal impacts only Priority 3 protection areas, as shown in Figure 16.

The WRC has compiled a list of practices and activities that have the potential to impact upon water resource quality in UWPCAs (WRC, 2001b). The list provides an indication of the compatibility of each activity or practice with the objectives of each priority protection area, although it is important to note that these are recommendations only and may be varied at the discretion of the WRC.

The SWMR project would be classified as the establishment of major transport routes (WRC, 2001b). The activity is considered compatible with the objectives of P3 areas.

3.6.4 Well-Head Protection Zones

Well-head protection zones are defined to protect water resources from contamination in the immediate vicinity of groundwater production wells. Protection zones are usually circular, with a radius of 500m from the well in P1 areas and 300m in P2 and P3 areas. Development is generally restricted within these areas.

The SWMR proposal potentially impacts on two 300m well head protection zones south of Beeliar Drive that have been established around production bores within the P3 area of the Jandakot Mound immediately east of the Kwinana Freeway (Figure 16). Measures to limit impacts on this area are further considered in Section 5.6.

3.6.5 Environmental Management Areas

Groundwater environmental management areas (EMAs) are defined as the groundwater catchment areas of environmentally significant wetlands whose hydrology is dominated by groundwater and not surface water (EPA, 1998).

The EPA has developed EMAs to ensure that, where land use changes are proposed within the catchment of important wetlands, such changes will not lead to detrimental impacts either to water quality or to the hydrology of the wetland (EPA, 1998).

For the purposes of developing EMAs, the EPA has divided wetlands into two categories:

- **Category A:** wetlands of international or national significance; and
- **Category B:** wetlands of regional or state significance.

Wetlands of local significance are managed through means other than the establishment of EMAs (EPA, 1998).

To ensure that the overall objectives for EMAs are achieved, the EPA has also developed objectives for each EMA Category. These objectives are as follows:

- **Category A:** to ensure that water quality in the wetland is maintained or enhanced and that the existing hydrological regime is maintained.
- **Category B:** to ensure that changes to water quality and water levels in the wetland do not lead to unacceptable impacts.

The SWMR proposal between Perth and Beeliar Drive, Jandakot impacts on the edge of the Category B EMA for the Jandakot Mound as shown in Figure 16. Further development within these areas is considered acceptable provided appropriate water management measures capable of meeting the EPA objective for this category are implemented (EPA, 1998).

South of Beeliar Drive the proposal impacts on both Category A and B of the EMA as shown in Figure 16. There is a general presumption against further development within Category A EMAs as further urbanisation is considered to represent a significant risk to both water quality and water levels within adjacent important wetlands (EPA, 1998).

Measures to ameliorate impacts on Category A and B of the Jandakot EMA are further considered in Section 5.6.

3.7 Existing and Proposed Nature Reserves

3.7.1 Introduction

This section describes the occurrence and significance of existing and proposed nature reserves that will be traversed by the proposed rail alignment. Potential impacts and management objectives that will be applied to these areas are included within the vegetation, fauna and hydrology sections of Part D.

3.7.2 Bush Forever

Bush Forever is a whole of government initiative designed to identify, protect and manage regionally significant bushland within the Perth Metropolitan Region in order to achieve a sustainable balance between bushland conservation and development (GWA, 2000b).

Bush Forever aims to ensure that at least 10% of each vegetation complex currently remaining on the Swan Coastal Plain is protected and there is a general presumption against clearing of bushland containing Threatened Ecological Communities (GWA, 2000b).

The original SWMR alignment to Mandurah, comprising the route via Perth, Kenwick and the Kwinana Freeway, was gazetted in the MRS prior to completion of the *Bush Forever* process. *Bush Forever* recognises the strategic importance of reserved road and rail transport routes and as such provides guidelines for the implementation of road and rail projects within *Bush Forever* sites. With respect to the SWMR proposal, these implementation guidelines include:

- Ensuring that design and management of the railway will minimise the impact on the *Bush Forever* site and retain and protect bushland values wherever possible.
- A presumption that PURD has a right to undertake the required works for establishment of the railway and associated infrastructure.
- Consideration be given to transfer of vesting to an appropriate body to enable ongoing bushland management should an existing reserve, or part thereof, no longer be required.

(GWA, 2000b)

Planning for the SWMR has progressed since reservation of the initial alignment and some proposed changes to the alignment and associated infrastructure have the potential to impact on *Bush Forever* sites. There are no impacts on *Bush Forever* sites between Perth and Jandakot via the Kwinana Freeway. It is also important to note that *Bush Forever* only considers potential sites within the MRS boundary and therefore there are no *Bush Forever* sites within the Peel Region.

Changes to the alignment between Perth and the MRS boundary are included in MRS Amendment number 1032/33 and are shown on Figure 3. PURD has consulted with the *Bush Forever* Office concerning changes to the alignment and the potential impacts on *Bush Forever* sites (Beardmore & Collingwood, 2001). The outcomes of this consultation process are summarised below. The impacts of other alignment changes, which are yet to be incorporated into the MRS, are also considered below. The sites specifically assessed in the PER are detailed in Section 5.2.

Perth to Beelihar Drive, Jandakot

Bush Forever Site 227 surrounds the freeway reserve near Salter Point. The alignment will remain inside the freeway median in this area and will not affect the bush forever site (Figure 17).

Beelihar Drive to the Southern MRS Boundary

Between Beelihar Drive and the Southern MRS Boundary the SWMR alignment passes through five *Bush Forever* sites as follows (Figure 17):

- Site No. 269: The Spectacles
- Site No. 272: Sicklemore Road Bushland
- Site No. 349: Leda and Adjacent Bushland
- Site No. 356: Lake Cooloongup, Lake Walyungup and Adjacent Bushland
- Site No. 395: Paganoni Swamp and Adjacent Bushland

The alignment also passes adjacent to Sites 275 and 379. As the alignment will not enter these sites, impacts are not anticipated.

The original alignment of the SWMR proposal through these sites was gazetted in the MRS but subsequent minor changes have been re-examined by the *Bush Forever* Office and the findings of this consultation process are summarised below (Beardmore & Collingwood, 2001). These changes are assessed in the PER.

- **Site No. 269 (The Spectacles):** Realignment of the rail reserve along the Kwinana Freeway will result in the transfer of land from Railway Reserve to Parks and Recreation Reserve. Minor changes to the alignment in the southern corner of the *Bush Forever* site will result in a minor loss of vegetation. The predominant vegetation complex within the site is Bassendean Complex Central and South. Changes to the SWMR alignment in this area will result in a net gain to the size of the *Bush Forever* site and therefore the *Bush Forever* Office raises no objections to the proposed amendment.
- **Site No. 272 (Sicklemore Road Bushland):** The eastern edge of the Thomas Road Station abuts this site, although there is no proposal to extend the station into the *Bush Forever* site. The *Bush Forever* Office raises no objections to the location of the station but recommends that existing vegetation be retained and incorporated into the carpark design wherever practicable and that areas earmarked for future carpark purposes not be cleared until required.
- **Site No. 349 (Leda and Adjacent Bushland):** The rail alignment will deviate from the original rail reserve in this area to accommodate the changes in the Rockingham area. The alignment will continue in a south westerly direction from Bollard Bulrush Swamp to Mandurah Road. The alignment intersects Site 349 south of the Leda residential area and continues to its western boundary at

Mandurah Road. This *Bush Forever* site contains vegetation of the Quindalup Complex, which is adequately protected under *Bush Forever* objectives. Therefore the *Bush Forever* Office raises no objection to these amendments.

- **Site No. 356 (Lake Coo롱gup, Lake Walyungup and Adjacent Bushland):** All vegetation within the site belongs to the Quindalup Complex, which is adequately protected under *Bush Forever* objectives. The amendment occurs immediately south of the intersection of Ennis Avenue and Safety Bay Road and is required to enable construction of Waikiki Station. The *Bush Forever* office raises no objections to this amendment, however since provision of this advice TEC 19b has been located at the Waikiki Station site (Section 5.2.2) and additional measures have been implemented to limit potential impacts on this community.
- **Site No. 395 (Paganoni Swamp and Adjacent Bushland):** South of Paganoni Road the existing rail reserve has been expanded slightly eastward to cater for changes to the grade of the rail track. Vegetation in this area has been mapped as a transitional area between Karrakatta Central and South and Cottesloe Central and South. Under *Bush Forever* objectives, Cottesloe Complex Central and South is considered adequately protected however Karrakatta Complex Central and South is not.

The *Bush Forever* Office considers that the overall impact on this site will be marginal and that it may be possible to limit potential impacts on the site at the detailed design stage of the project. Therefore the Office has no objection to this amendment.

3.7.3 Beeliar Regional Park

The Beeliar Regional Park Proposal for Establishment, Administration and Use was published by the then Department of Planning and Urban Development in 1992. The document proposes the establishment of the park through consolidation of existing and proposed regional reservations.

The park extends over approximately 2,700 ha and includes 26 wetland areas (Figure 18). The SWMR alignment intersects the regional park at the Spectacles and the Leda Nature Reserve. All other areas of the park are at least 500m west of the rail alignment.

Management of the park is proposed to be conducted through a joint management agreement between the local authorities and the Department of Conservation and Land Management (CALM). CALM was identified as the most appropriate co-ordinating agency due to the high proportion of conservation lands in the park.

3.7.4 Rockingham Lakes Regional Park

The Rockingham Lakes Regional Park is one of eight regional parks recognised by the Government as having a formal identity. The Park incorporates Lake Cooloongup, Lake Walyungup and Lake Richmond, Tamworth Hill Swamp, Port Kennedy Scientific Park and Anstey and Paganoni Swamps (Figure 18).

In 1997, a management framework was developed that recognises the State, national and international significance of the extensive Rockingham system and allows for protection of the environmental values of the park whilst allowing for the widest possible range of appropriate use by the public. The government is now in the process of developing a detailed management plan for the area, which will provide broad direction for the planning, management and development of Rockingham Lakes Regional Park.

The SWMR alignment impacts on Lakes Cooloongup and Walyungup and also on Anstey and Paganoni Swamps. As the Management Framework for the Park was completed following gazettal of the SWMR route in the MRS, management plans developed for each of these sites take into account the rail alignment.

3.7.5 Leda Nature Reserve

Leda Nature Reserve is a Crown reserve vested in the Conservation Commission and managed by CALM (Figure 18). The reserve covers 438 hectares and is gazetted as an A class reserve for the conservation of flora and fauna.

3.7.6 Peel Region Scheme - Regional Open Space

Regional open space adjacent to the rail alignment in the Peel Region is designated east of the alignment in Lakelands (Southern section of Paganoni Swamp) and east of the alignment in Parklands (between the alignment and the rural area).

The location of these areas is outlined on Figure 4.

3.7.7 Swan Estuary Marine Park

The Swan Estuary Marine Park protects three biologically important areas of the Swan River. The park encompasses Alfred Cove (190 ha adjacent to Attadale and Applecross), Pelican Point (40 ha in Crawley) and Milyu (95 ha adjacent to the Como Foreshore and Kwinana Freeway) (Department of Conservation and Land Management, 2002).

The marine park encompasses mudflats, seagrass beds and intertidal vegetation such as sedges and salt marshes.

The alignment abuts the Milyu section of the park.

3.8 **Soil and Groundwater Quality**

3.8.1 Introduction

By today's public health and environmental standards, soil and groundwater along the proposed alignment may have been impaired by historical land uses. A Preliminary Site Investigation (PSI) has been conducted to assess the potential for soil and groundwater contamination along the proposed alignment. This has been undertaken with reference to the procedures advocated by the Department of Environment, Water and Catchment Protection.

The PSI was conducted for the entire alignment and is summarised in the following sections and presented in full in Appendix D.

3.8.2 Historical Land Use and Activities

Prior to settlement of Perth in 1829 a linear chain of lakes was located at the northern end of the city. Lake Kingsford was at the site of the present railway station and the railway goods yard was constructed over Lake Irwin. Both lakes were drained and filled in 1854.

The Esplanade and South Perth/Como foreshores have been progressively reclaimed between 1883 and 1972 using dredge spoil from the river.

The Narrows Bridge and initial section of the Kwinana Freeway was opened in 1959. The freeway progressively developed throughout the proposed alignment to include extensions to Manning Road (1979), South Street (1982), Farrington Road (1991), Beeliar Drive (1992) and Thomas Road (1994).

Horticultural areas developed along the alignment in the 1950s and 1960s near Berrigan Drive, Jandakot; Stakehill Road, Karnup; and Paganoni Road, Karnup. Market gardens were also established in the 1970s and 1980s along the current freeway alignment in Banjup and Wandi.

3.8.3 Potential Contamination

The PSI identified several areas/sites of potential contamination within the alignment that require further investigation. This will be conducted in consultation with the DEWCP.

In addition it is proposed to investigate groundwater quality where dewatering is required for the construction of the Perth City Tunnel.

4.0 SOCIAL ENVIRONMENT

4.1 Existing Land Use

4.1.1 Perth to Beeliar Drive, Jandakot

Between Perth Station and the Narrows Bridge the SWMR alignment passes through the shopping and commercial areas of the Perth Central Business District. From the base of William Street the SWMR will be aligned within existing road reserves.

From the Narrows Bridge to Jandakot the SWMR is located entirely within the Kwinana Freeway Road Reserve. Between Perth and the Canning Bridge the alignment is bordered by the Swan River to the west and the residential areas to the east. From Canning Bridge to Mount Henry Bridge, the Freeway runs between the Canning River to the west and residential areas to the east. From Mount Henry Bridge to Beeliar Drive, the Freeway runs through residential suburbs on both sides.

4.1.2 Beeliar Drive, Jandakot to Southern MRS Boundary

The alignment runs within the freeway reserve from Beeliar Drive to north of Thomas Road. This is surrounded by residential areas, rural-residential properties and uncleared bushland.

From Thomas Road to Ennis Avenue the majority of the route is uncleared bushland. The residential areas of Parmelia, Wellard, Leda, Hillman and Coo loongup are adjacent to this section.

The railway runs adjacent to Ennis Avenue between the intersection with the Garden Island Highway and Mandurah Road. The land use to the west of this section is dominated by residential development to Warnbro, then cleared land. The Rockingham Golf Course, Coo loongup residential area, Lake Coo loongup and Lake Walyungup lie to the east of Ennis Avenue.

Between the Ennis Avenue – Mandurah Road intersection and Anstey Road, Secret Harbour the alignment passes through the Baldivis and Karnup special rural area which includes hobby farms, market gardens and uncleared bushland.

South of Anstey Road the alignment runs alongside Mandurah Road to Dampier Drive. Anstey Swamp Nature Reserve is located to the east and uncleared heathland and rural-residential properties are located to the west.

South of Dampier Drive the route runs through farmland then adjacent to the Paganoni Wetlands to the Southern MRS boundary. The land to the west contains a mixture of rural-residential, uncleared heathland and quarries.

4.1.3 Southern MRS Boundary to Mandurah

From the Southern MRS Boundary to the beginning of Meadow Springs the alignment and land to the west is comprised of parkland cleared farm land and quarries. The land to the east contains the southern end of the Paganoni Swamps.

The route then passes through uncleared bushland to the east until immediately north of the Mandurah Waste Water Treatment Plant. The final section passes through the Mandurah Light Industrial Area, then into the Greenfields residential area.

4.2 **Visual Amenity**

The railway passes through a range of landform and vegetation types. From the Narrows interchange to Mt Henry Bridge the Swan and Canning Rivers are dominant water body features. Wetlands occur along most of the alignment however most are not visible because of dense fringing vegetation (Ecoscape, 2002e – Visual Impact Assessment).

The northern end of the line, from Mt Henry Bridge to the Narrows interchange, has the highest scenic quality due to the topography, vegetation variety, recreation use, urban and civic context and the significant influence of the river. For train users it will represent a highlight of the journey because of its high scenic amenity. The scenic quality for the rest of the line ranges from moderate to low except for a small section in Baldivis near the Stakehill Road Station where it is again high (Ecoscape, 2002e – Visual Impact Assessment).

Further detail on visual amenity is provided in Section 5.11.

4.3 Aboriginal Heritage

4.3.1 Aboriginal Sites

Aboriginal heritage areas are protected under the *Aboriginal Heritage Act 1972*. An Aboriginal Site is defined in the Act as:

- (a) Any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made for or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present;
- (b) Any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent;
- (c) Any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the state;
- (d) Any place where objects to which this Act applies are traditionally stored or from which, under the provisions of the Act, such objects have been taken or removed.

Numerous Aboriginal Heritage studies have been conducted for areas of the proposed alignment between Perth and Mandurah. These studies include:

- Report on an Aboriginal Site Survey of the proposed South West Corridor Transport Reserve (O'Connor *et al.*, 1994)
- Report on Further Archaeological Investigations for Aboriginal Sites, South West Metropolitan Rail Line Corridor (Quartermaine Consultants, 2001a)
- Report on an Ethnographic Survey of the proposed South West Metropolitan Railway Reserve (O'Connor, 2001a)
- Consultation with Combined Metropolitan Working Group Regarding CBD Section of Proposed South West Metropolitan Railway (Hart, 2002)
- Report on Ethnographic Survey of the Perth City Section of the Proposed South West Metropolitan Railway (O'Connor, 2002)

- Aboriginal Heritage and associated considerations relevant to the proposed South West Metropolitan Rail Link between South Perth and Perth Central Railway Station (O'Connor & Hart, 2002)
- Survey for Archaeological Sites in relation to the proposed widening of the Narrows Bridge, Kwinana Freeway, Perth (Pasqua, 1998)
- Narrows Bridge Proposed Widening, Report on Ethnographic Consultation (Wildes & Goble-Garratt, 1998)
- Report of an Archaeological Investigation of Aboriginal Sites, Mount Henry Bridge Widening, Kwinana Freeway Bus Transitway Project (Quartermaine Consultants, 2001b)
- Report on an Ethnographic Survey of the proposed Mount Henry Bridge Widening Project (O'Connor, 2001b)
- Consultation with the Combined Metropolitan Working Group regarding the proposed Mount Henry Bridge Widening Project (Hart, 2001)
- Report on an Ethnographic Survey of the Kwinana Freeway Bus Transitway (O'Connor, 1999)
- Report on an Archaeological Investigation of Aboriginal Sites Kwinana Freeway Bus Transitway Richardson Street, South Perth, to South Street, Murdoch (Quartermaine Consultants, 1999)

The studies have focused on areas of both archaeological and ethnographic significance. Ethnographical significance relates to areas of cultural significance such as camp sites, hunting grounds, water sources and mythological sites. Archaeological significance relates to physical remains such as artefact scatters, quarries, art sites, stone patches, shell middens, burials and marked trees. Common features of aboriginal archaeological sites are outlined as follows:

- Small, low density, surface stone artefact scatters are the most numerous archaeological site type.
- Larger sites are most likely to occur near bodies of permanent water.
- Quartz is the dominant lithic material used for the manufacture of artefacts.
- Flakes and chips form the major class of artefact types in the recorded artefact assemblages.
- River, lake and swamp margins, and areas of devegetated sand, are the main areas where sites have been recorded.

- Most sites in the metropolitan area have been recorded on the Bassendean Dunes landform with few sites on the Quindalup and Spearwood Dunes landforms.

(Quartermaine Consultants, 2001a)

Areas of archaeological and ethnographic significance that have potential to be disturbed along the proposed alignment are restricted to the northern end of the alignment (O'Connor & Hart, 2002). The areas potentially affected by the alignment are listed in Table 12. All other studies concluded that sites in the vicinity of the project area were not in conflict with the alignment and consent was given by the relevant Aboriginal groups consulted for development to proceed. Recommendations provided in the report are included in Section 5.12.

Areas of generalised significance are also encountered along the proposed alignment. These areas include the region's wetlands and rivers, which were food and water resources, access tracks and campsites. These areas are considered spiritual repositories in a general sense which draws on the fundamentals of Aboriginal philosophic-religious belief under which every living being represents a part of the wider spiritual universe and shares a common spiritual essence. The region's wetlands, as breeding grounds for numerous living creatures, are therefore repositories of this spiritual essence realised generationally by individuals (O'Connor *et al.*, 1994).

Table 12 Aboriginal Sites Within and Adjacent to the Proposed Alignment from Perth to Mount Henry Bridge

Name and Site Number	Location	Description	Site Type
Foreshore Camping Area (S02205)	South Perth Foreshore from Mill Point to Richardson Park	Camp Sites	Ethnographic
Gudinup (S02419)	Near northern end of Narrows Bridge	Former mythological site associated with water sources	Ethnographic
Kings Park (S02154)	Mount Eliza across Mounts Bay Road to the Narrows Bridge	Traditional hunting ground and ceremonial area	Ethnographic

Table 12 Continued

Name and Site Number	Location	Description	Site Type
Mount Eliza Waugal (S02144)	Extends under the northern portion of the Narrows Bridge	Mythological Site	Ethnographic
Esplanade (S02202)	Esplanade foreshore area	Traditional water source and camping area	Ethnographic
Perth Central Railway Station (S02184)	Wellington Street	Traditional water source, camping area and hunting place.	Ethnographic
Mounts Bay Road (S02126)	Near northern section of the Narrows Bridge	Traditional camping and water source	Ethnographic
Swan River (S02548)	Reclaimed Land	Nyungar people consider reclaimed land as part of the original river and therefore part of the mythological site	Ethnographic
Canning River (S02550)		Mythological significance	Ethnographic
Como (S00053)	Como Waters	Fish Trap	Archaeological

4.3.2 Native Title

Native Title is the recognition in Australian law of Indigenous Australians' rights and interests in land and waters according to their own traditional laws and customs. Native title can be held by Aboriginal and Torres Strait Islander people who have maintained a continuing connection with their country according to their traditions and customs. Providing a continuing connection usually involves showing that traditional laws and customs have been passed down through generations of Indigenous Australians to the present day (National Native Title Tribunal, 2002).

Native title is administered under the Commonwealth *Native Title Act 1993*. Native title cannot take away existing valid land rights.

The Combined Metropolitan Working Group (CMWG) and the Ballaruk Aboriginal Corporation (BAC) have Native Title applications relevant to the Perth Metropolitan area, and therefore to the project area. The CMWG claim has been entered on the

Register of Native Title Claim whereas the BAC claim has not satisfied the requirements of the Act. Although both groups should be consulted regarding the project, only the registered claim has the statutory Right to Negotiate under the Future Act procedures of the Act (O'Connor & Hart, 2002).

Based on previous projects in the Perth Metropolitan Area, the existence of road and rail reserves leads to the extinguishment of native title over those areas.

4.4 European Heritage

The oldest area of European settlement along the alignment is the Perth Central Business District.

The railway was constructed in 1881. This was upgraded in the 1890s including establishment of the marshalling yards between Wellington and Roe Streets, west of William Street. The Horseshoe Bridge was constructed in 1902-03 to provide ease of access across the rail line.

Many of the historical city buildings along the proposed alignment remain today. Many are now considered of heritage value. The registers, inventories and lists that cover these buildings include:

- Register of the National Estate – sites entered on the recommendations of the Australian Heritage Commission
- Register of Heritage Places – sites entered on recommendations of the Heritage Council of Western Australia
- City of Perth Municipal Heritage Inventory – sites of exceptional significance entered by the City of Perth in compliance with the *Heritage of Western Australia Act 1990*
- City of Perth TPS Schedule – listed places are subject to the heritage provisions of the TPS
- Classified by the National Trust – sites are entered by the National Trust
- Heritage Database – includes places of considerable significance and some significance entered by the City of Perth.

The buildings adjacent to the proposed alignment with heritage significance are listed in Table 13. Areas of European heritage significance along the remainder of the route are outlined in Table 14.

Table 13 Sites adjacent to the proposed alignment with European Heritage Significance in the Perth Central Business District

Site Name	Date	Location	Listings
Wesley Church	1870	75 William Street (cnr Hay Street)	Register of the National Estate Register of Heritage Places City of Perth Municipal Heritage Inventory City of Perth TPS Schedule Classified by the National Trust
3 Fast Food in One	1890	96 William Street	Heritage Database
Queens Buildings	1900	97-107 William Street (cnr Murray Street)	Heritage Database
Dick Smith Electronics Building & Co	1900	119 William Street	Heritage Database
Horseshoe Bridge	1902/03	William Street	Register of Heritage Places City of Perth Municipal Heritage Inventory City of Perth TPS Schedule Classified by the National Trust
Wellington Buildings	1905	150-160 William Street (cnr Wellington Street)	City of Perth TPS Schedule Classified by the National Trust
Commercial	1910	132 William Street	Heritage Database
Mitchells Building	1912	132-142 William Street	City of Perth Municipal Heritage Inventory City of Perth TPS Schedule
MacLaren's Chambers	1915	144-148 William Street	Heritage Database
P&O Building	1930	56-60 William Street	City of Perth Municipal Heritage Inventory Classified by the National Trust
Ackers Building	1920	124-130 William Street	Heritage Database

Table 13 Continued

Site Name	Date	Location	Listings
Bankwest (former Palace Hotel)	1895	108 St George's (north east corner of William Street intersection)	Register of the National Estate Register of Heritage Places City of Perth Municipal Heritage Inventory City of Perth TPS Schedule Classified by the National Trust
Former Economics Stores	1921-22	726-728 Hay Street (cnr William Street)	Register of the National Estate City of Perth TPS Schedule Classified by the National Trust
Gledden Building	1938	731-737 Hay Street	Register of the National Estate Register of Heritage Places City of Perth Municipal Heritage Inventory City of Perth TPS Schedule Classified by the National Trust
Wentworth Plaza Hotel (former Hotel Wentworth)	1928	300 Murray Street (cnr William Street)	Heritage Database
Royal Hotel	1882	531 Wellington Street	Register of Heritage Places City of Perth Municipal Heritage Inventory City of Perth TPS Schedule
Former Levi Green's/Bairds' Store	1900	491-493 Wellington Street	Within former Myer Store listing Heritage database
Globe Hotel	1910	495-497 Wellington Street	Heritage Database
Retail, former Blues Store	1900	499 Wellington Street	Heritage Database

Table 14 Sites adjacent to the proposed alignment with European Heritage Significance from South Perth to Mandurah

Site Name	Date	Location	Listings
Narrows Bridge	1959	Perth and South Perth	Heritage Council of WA register Municipal Inventory for the local council
Shenton's Mill	1837	111 Mill Point Rd, South Perth	Heritage Council of WA register Statutory data base Register of the National Estate Heritage Agreement Municipal inventory for the local council Classified by the National Trust
Mill Point Reserve	-	Mill Point Foreshore, South Perth	Municipal Inventory for the local council Included in TPS
Mt Henry Bridge	1982	Canning River, South Perth	Municipal Inventory for the local council Included in TPS
Canning Bridge Camps (former)	1930	South Perth	Municipal Inventory for the local council
Coode Street Jetty	1896	Coode St, South Perth	Municipal Inventory for the local council
Milyu Nature Reserve and Marine Park	-	Kwinana Freeway, South Perth	Municipal Inventory for the local council
Canning Bridge Site	-	South Perth	Municipal Inventory for the local council
Como Beach and Jetty	1907 – 1982	Western end of Preston Street, Como	Municipal Inventory for the local council Included in TPS
House	NA	107 Melville Parade, Como	
House	1975 – 1989	5 Eric Street, Como	Municipal Inventory for the local council
Pagoda Ballroom	1922	Melville Parade, Como	Municipal Inventory for the local council
House	1970	28 Edgewater Rd, Manning	Catholic Church inventory
Aquinas College and Chapel	1938	53 Redmond Street, Salter Point	Municipal Inventory for the local council Included in TPS

Table 14 Continued

Site Name	Date	Location	Listings
House	1886	Cnr Pulo Road and Spinaway Cr, Brentwood	Heritage Council WA – interim register Register of the National Estate Municipal Inventory for the local council Heritage Agreement Classified by the National Trust
Beeliar Regional Park and Adjacent Areas	-	Melville, Kwinana and Hamilton Hill	Municipal Inventory for the local council Register of the National Estate
The Spectacles Wetland	-	Cnr Thomas / McLaughlan / Anketell Rds, The Spectacles / Postans	Municipal Inventory for the local council
Wellard Swamp / Bollard Bulrush Swamp	-	Nr Cnr Medina Avenue & Hoyle Rd, Medina	Municipal Inventory for the local council
Paganoni Swamp and Adjacent Areas	-	Mandurah Road, Rockingham	Classified by the National Trust
13 Mile		Bertram Road, Wellard	Municipal Inventory for the local council
9 Mile Dumps		Thomas Rd, The Spectacles	Municipal Inventory for the local council

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PART D: ASSESSMENT OF ENVIRONMENTAL FACTORS

5.0 IMPACTS AND MANAGEMENT

5.1 Introduction

Construction of the SWMR project will result in permanent linear severance of the landscape, albeit over a restricted area. Environmental impacts of the proposal have been minimised by designing the route to coincide with existing linear features such as the Kwinana Freeway. Appropriate planning and implementation of specific management measures during construction and operation phases of the project will, further, assist in limiting impacts to the natural and social environment.

This section has been structured with direct reference to the environmental factors considered relevant to the project as determined by the EPA (Appendix A). In consideration of each factor, the potential impacts associated with construction and operation of the SWMR project have been identified and management measures developed to minimise impacts.

The EPA has previously assessed areas covered by MRS Amendments 937/33 and 938/33 between Anketell Road and the Southern MRS Boundary. Preparation of an EMP to address the amelioration of construction and operational impacts was a condition of project approval within this area. An EMP that addresses management of environmental impacts is being prepared by PURD for the project between Beeliar Drive and Mandurah (Ecoscape, 2002a – Environmental Management Plan). This PER primarily addresses the management of impacts for the remainder of the project, but also incorporates management measures from the EMP as appropriate.

Environmental Management System

The WAGRC is currently preparing a formal Environmental Management System (EMS) for all its operations including the SWMR project. The EMS will conform to the requirements of the ISO14001 standard.

Within the framework of the EMS, PURD will develop Environmental Management Plans (EMPs) covering all aspects of the construction and operation of the SEMR

project. The EMPs will be prepared to the satisfaction of relevant agencies before the commencement of each phase of the project.

The environmental management principles and procedures set out in the Environmental Management Plans will apply to all contractors and sub-contractors engaged by WAGRC in the planning, construction and operation of the project. Prior to commencing work on site, all construction and operational personnel will participate in a comprehensive induction briefing that reflects the WAGRC's commitment to safety and the environment. Each participant will be furnished with list of environmental guidelines to be adhered to at all times. Adherence to these guidelines will form part of the work contract and job description of each worker.

Environmental Management Plans

A detailed Environmental Management Plan (EMP) for the part of the SWMR between Anketell and Mandurah is currently being prepared by PURD. The EMP addresses all significant environmental issues pertaining to that section of the alignment.

A further EMP for the section between Perth and Anketell will be prepared before construction. This additional EMP will focus on issues associated with the Perth CBD and freeway sections, such as dewatering, drainage, noise and vibration management.

5.2 Vegetation

5.2.1 Regionally Significant Vegetation

The assessment of the impacts on regionally significant vegetation is restricted to the areas not included in Metropolitan Region Scheme (MRS) amendments 937/33 and 938/33 as regionally significant vegetation in these areas has already been assessed by the EPA.

Preliminary EPA Objective

“Maintain the abundance, diversity, geographic distribution and productivity of vegetation.”

Potential Impacts

The area of assessment for regionally significant vegetation is relatively small between Perth and the southern MRS boundary as the majority of the alignment is within existing transport reserves already cleared of vegetation or has previously been assessed under MRS amendments 937/33 and 938/33. The railway reserve between the southern MRS boundary and Mandurah has been assessed under the Peel Region Scheme, however the EPA deferred assessment of impacts on vegetation within the railway reserve.

The clearing requirements between Perth and Anketell are to enable the construction of station sites and associated road and parking infrastructure as the centre section of the Freeway where the railway tracks will be located has previously been cleared of vegetation.

South of the Anketell tunnel the SWMR alignment passes through previously undeveloped areas, which will necessitate the removal of vegetation from within the rail reserve to enable construction. The width of this reserve is generally 40m. The width of the infrastructure including tracks and ballast will range between 10.5 and 40m. The clearing of the entire reserve is required to enable earthmoving equipment to construct the railway. The area covered by the reserve is displayed in Figure 2.

Vegetation will also be removed from station sites as these are progressively constructed. There will be opportunity to partially rehabilitate many of these areas at the completion of construction works. A policy of “greening” the railway reserve and station sites will be implemented, wherever possible or practicable.

Approximately 208 ha of native vegetation will be removed from within the reserve and the associated infrastructure sites to enable construction and operation of the SWMR project. The areas of vegetation to be removed are summarised in Table 15. The vegetation complexes affected by the proposal and the reservation status of each complex are also provided in Table 15.

This data indicates the extent of vegetation to be cleared in the area being assessed is approximately 82 ha. Less than 0.3% of each vegetation complex and 1.2% of the reserved area will be cleared. The clearing is therefore unlikely to impact the conservation status of the complexes.

Table 15 Area of Vegetation Complexes to be removed by Construction of the SWMR and Associated Infrastructure.

Vegetation Complex	Remaining Area (percentage of Original Area)	Bushland with some existing protection (percentage of Remaining Area)	Total area of vegetation to be removed ¹	Area to be removed that requires assessment ²
Bassendean Complex – central and south	10,919 ha (24%) – PMR 3,166 ha (13.4%) – Peel	2,818 ha (26%) – PMR 17 ha (0.07%) – Peel	37.31 ha	10.86 ha
Cottesloe Complex – central and south	12,362 ha (36%) – PMR 7,322 ha (34.5%) – Peel	5,289 ha (43%) – PMR 2,560 ha (12%) – Peel	99.43 ha	41.04 ha
Karrakatta Complex – central and south	6,275 ha (18%) – PMR 2,883 ha (52.8%) – Peel	1,941 ha (8%) – PMR 228 ha (4%) – Peel	37.71 ha	24.37 ha
Quindalup Complex – central and south	11,598 ha (48%) – PMR 2,397 ha (43.8%) – Peel	3,527 ha (30%) – PMR 1,164 ha (21%) – Peel	31.82 ha	5.77 ha
Herdsmen Complex	2,017 ha (31%) – PMR 566 ha (28.6%) – Peel	1,423 ha (71%) – PMR 0 ha – Peel	1.28 ha	0 ha
TOTAL			207.55 ha	82.04 ha

1. From within the rail reserve and associated infrastructure sites.

2. Area not included in MRS amendments 937/33 and 938/33.

Perth Metropolitan Region (PMR) reservation status information from Bush Forever (WAPC, 2000)

Peel Regional reservation status information from Peel Region Scheme Environmental Review (WAPC, 1999)

The railway corridor traverses wetland vegetation associated with The Spectacles, Pickle Swamp, the dune swales west of Lake Coo loongup and Lake Walyungup, a depression south of Stakehill and Anstey Swamp. The amount of wetland vegetation to be cleared and the areas within sections being assessed is listed in Table 16. The impact of removing dryland buffer vegetation is considered highest in areas of Very Good – Excellent bushland condition.

Wetland dependant vegetation in the Pickle Swamp and Waikiki Transit station are the only areas that require assessment.

Table 16 Areas of Wetland Dependent Vegetation within the SWMR Alignment

Location	Area of Wetland Dependent Vegetation within entire Alignment	Area of Wetland Dependent Vegetation in this assessment	50m Dryland Buffer Vegetation in this assessment	Bushland Condition Rating
South east corner of The Spectacles reserve	0.26 ha	0 ha	0 ha	Fair – Good
Pickle Swamp both sides of Gilmore Ave	1.68 ha	0.40 ha	0.33 ha	Fair – Excellent
Lake Walyungup western side, north of the new Safety Bay Road	0.31 ha	0 ha	0 ha	Very Good – Excellent
Dune swales south of the new Safety Bay Road (proposed Waikiki Transit Station)	1.38 ha ¹	1.38 ha ¹	0.79 ha ¹	Very Good - Excellent
Depression south of Stakehill, north of Anstey Swamp	0.38 ha	0 ha	0 ha	Fair – Excellent
Northern end of Anstey Swamp	0.13 ha	0 ha	0 ha	Very Good – Excellent
West of Paganoni Swamp	0 ha	0 ha	1.36 ha	Sparse vegetation only
West of Fremantle Road Sumpland	0 ha	0 ha	0.32 ha	Sparse vegetation only
TOTAL	4.14 ha	1.78 ha	2.80 ha	

Note: 1 This area will be reduced following the realignment of Waikiki Station to avoid an area of TEC 19b at the former station site.

Nine floristic community types may occur along the SWMR alignment (Section 3.2.4). The ratings of reservation and conservation status assigned by Gibson *et. al.* (1994) give an indication of the significance of the clearing proposed of each community for the project. These are presented in Table 17.

Seven of the nine floristic communities impacted by the project are well reserved. Of the remaining two (including one threatened ecological community) CALM has

provided advice that the development with regard to the floristic communities is acceptable.

Table 17 Reservation and Conservation Status of Floristic Communities likely to occur within the SWMR Alignment.

Floristic Community	Reservation Status	Conservation Status
5	Well Reserved	Low Risk
11	Well Reserved	Low Risk
17	Well Reserved	Low Risk
19	Unreserved	Endangered
21a	Well Reserved	Low Risk
24	Well Reserved	Susceptible
28	Well Reserved	Low Risk
30b	Well Reserved	Susceptible
30c	Unreserved	Insufficiently Known

Construction of the SWMR project and associated infrastructure will also directly impact on five *Bush Forever* sites. The area of vegetation within existing road and rail reserves was excluded from calculations when determining the total area of each vegetation complex proposed for protection within *Bush Forever* sites. The impact of the gazetted rail reserve between Perth and the Southern MRS Boundary has already been considered as part of the *Bush Forever* assessment (GWA, 2000b).

However, the impact of the proposed amendments to the MRS alignment have not been addressed previously. The total area of vegetation affected by these changes to the SWMR is detailed in Table 18.

This data indicated approximately 6.3 ha of vegetation in *Bush Forever* sites in the areas being assessed will be cleared for the project. This equates to between 0.07% and 0.39% of the total site areas. In two out of three sites within the assessment area the portions to be cleared are located on the edge of the site and impacts will therefore be less.

Table 18 Area of Vegetation to be Removed from Bush Forever Sites through Construction of the SWMR

Site No.	Site Area (ha)	Vegetation Complexes within the Site	Total area of Vegetation to be Removed	Area to be removed that requires assessment
269 – The Spectacles	349.7 ha bushland (Site also includes open water)	<ul style="list-style-type: none"> • Bassendean Complex – Central and South; • Karrakatta Complex – Central and South; • Cottesloe Complex – Central and South; • Herdsman Complex 	1.31 ha (Bassendean C & S)	0 ha
272 – Sicklemore Road Bushland, Parmelia/ Casuarina	84.6 ha bushland	<ul style="list-style-type: none"> • Bassendean Complex – Central and South; • Karrakatta Complex – Central and South; • Herdsman Complex 	5.41 ha (Bassendean C & S)	0 ha
349 – Leda and adjacent bushland, Leda	959.8 ha bushland (Site also includes open water)	<ul style="list-style-type: none"> • Serpentine River Complex; • Bassendean Complex – Central and South; • Karrakatta Complex – Central and South; • Cottesloe Complex – Central and South; • Quindalup Complex 	12.46 ha (Quindalup and Cottesloe C & S)	3.76 ha (Quindalup and Cottesloe C & S)
356 – Lake Cooloongup, Lake Walyungup and adjacent bushland, Hillman to Port Kennedy	1617.5 ha bushland (Site also includes open water)	<ul style="list-style-type: none"> • Karrakatta Complex – Central and South; • Cottesloe Complex – Central and South; • Quindalup Complex 	41.01 ha (Quindalup)	2.03 ha (Quindalup)
395 – Paganoni Swamp and adjacent bushland, Karnup	705.5 ha bushland (Site also includes open water)	<ul style="list-style-type: none"> • Karrakatta Complex – Central and South; • Cottesloe Complex – Central and South; • Herdsman Complex 	6.47 ha (Karrakatta)	0.51 ha (Karrakatta)

In general, construction of the SWMR and associated infrastructure has the potential to:

- Reduce the abundance, species diversity, geographic distribution and productivity of vegetation mapping units;
- Remove Declared Rare or Priority Species;
- Increase bushfire risk in adjacent vegetation through welding and grinding activities and the operation of equipment or vehicles in high fire risk areas/conditions;
- Increase the risk of introduction of weeds and disease;

- Fragmentation of bushland with associated follow-on impacts including:
 - Deterioration in vegetation quality through “edge-effects”;
 - Severance of vegetation mapping units, reducing animal movement and the spread of the seeds of some plants between the severed areas; and
 - A reduction in the size of vegetation remnants, reducing the integrity of these remnants.
- Reduce the habitat values of bushland through loss of connectivity;
- Degrade adjacent vegetation via dust accumulation due to the movement of construction machinery and equipment through the construction area; and
- Increase the risk of soil erosion from cleared areas into surrounding vegetation.

Other areas of vegetation may also require removal outside of the rail reserve for access tracks required by CALM/FESA/WAGRC. The agreement reached with CALM is that they will utilise the WAGRC access track which will be within the rail reserve where ever possible, with the railway security fence located between the track and the rail lines. Access points will be placed in the fence for WAGRC use. The locations where the track cannot be incorporated into the rail reserve will be determined following the detailed design process but they are likely to occur where cuttings and embankments fill the width of the reserve. FESA will be able to utilise the these access tracks when required.

Soil compaction may occur in heavily trafficked areas, such as equipment storage areas, and construction access tracks and borrow pit floors. Soil compaction can impede surface drainage and vegetation regeneration, which will in turn affect the success of rehabilitation strategies for these areas.

Management

Measures as described below will be implemented to manage the potential impacts.

Restriction of construction activities to the rail reserve and the requirement for the contractor to fence the reserve prior to the commencement of construction activities will prevent unnecessary clearing and limit vegetation edge effects adjacent to the SWMR. Preferential location of equipment storage yards and borrow pits in areas necessary for rail and associated services will also limit impacts on natural vegetation.

Vegetation to be retained within the alignment will be clearly delineated with tape, paint or other appropriate marking. These areas will be cordoned off from construction workers and vehicles.

Where not necessary for construction, vegetation in high conservation value areas will be fenced prior to commencing construction work. High conservation value areas are defined as:

- Within 50m of wetlands and within wetlands
- Within Nature Reserves and Bush Forever sites
- Threatened Ecological Communities
- Potential habitat for threatened flora and fauna
- Large tracts of vegetation in Fair – Good condition or better

The location of these areas is identified on Figures 11, 12, 14, 17, 18 and 19.

Wetland vegetation and a buffer zone of 50m of dryland vegetation surrounding wetland vegetation will not be cleared except where necessary for the construction of railway tracks and combined access tracks/firebreaks. To prevent unnecessary wetland vegetation clearing, these area will be clearly demarcated and access prevented. Laydown sites for construction vehicles and equipment will not be placed within 50m of wetland vegetation where practicable.

The number of access tracks into construction sites will be minimised and located within the rail alignment wherever possible. Access tracks for construction will follow existing firebreaks and tracks where appropriate. Prior to using any access track the contractor must obtain permission from the appropriate authority and inform the superintendent.

Where practical, access tracks for construction and maintenance will not be sited within 50m of wetland vegetation, in areas with recognised conservation values such as bushland within Bush Forever sites and Nature Reserves, or in areas that form potential habitat for threatened flora species.

All native vegetation and topsoil cleared from bushland within the rail reserve in Fair-Good condition or better will be reused to its maximum potential by providing mulch and seed stock for rehabilitation.

Rehabilitation works will be implemented both within the railway reserve and in areas outside the rail reserve in the unlikely event of accidental damage to vegetation during construction. Rehabilitation works will follow the requirements in the Rehabilitation Strategy and Landscape Management Plan (Ecoscape, 2002f) and will be commenced as soon as practicable following construction.

PURD will consult with the DEWCP and CALM before, during and after construction of the SWMR over possible mitigation measures to compensate for the loss of significant vegetation in the development of the SWMR project. Such mitigation might involve PURD rehabilitating degraded land outside the railway reserve, purchasing areas of high quality vegetation elsewhere for vesting with CALM or contributing to other CALM conservation efforts.

5.2.2 Threatened Ecological Communities

Preliminary EPA Objective

“Maintain the abundance, species diversity, geographic distribution and productivity of Threatened Ecological Communities.”

Potential Impacts

The presence of TEC 19b was confirmed during the floristic data analysis (Ecoscape, 2001 – Threatened Ecological Community Survey, Lake Coo롱up and Lake Walyungup). This is listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. TEC 19b is present within and adjacent to portions of the rail reserve in the Lake Coo롱up and Lake Walyungup Reserves. Ecoscape also identified a TEC 19b remnant in very good to excellent condition in the area originally proposed for the Waikiki Transit Station near the intersection of Safety Bay Road and Ennis Avenue (Ecoscape, 2001 – Threatened Ecological Community Survey, Lake Coo롱up and Lake Walyungup).

Up to 2.39ha of TEC 19b in the Lake Coo롱up and Lake Walyungup Reserves is planned to be cleared for the construction of the railway and associated infrastructure. This area constitutes approximately 2% of TEC 19b identified during vegetation survey in the western portion of the Lake Coo롱up and Lake Walyungup reserves (Ecoscape, 2001 – Threatened Ecological Community Survey, Lake Coo롱up and

Lake Walyungup). The Waikiki Transit Station is in the process of being redesigned to avoid clearing the area of TEC 19b present at the site.

Areas of TEC 19b identified by Ecoscape are mapped as:

- EgGt – open woodland of Tuart over Acacia species, *Xanthorrhoea preissii* and *Gahnia trifida* in a few dune swales in Lake Cooloongup
- EGM – Closed wet woodland of *Eucalyptus gomphocephala* over *Melaleuca raphiophylla* and *Melaleuca teretifolia* and closed sedgeland of *Gahnia trifida*
- MBG – closed woodland of *Melaleuca raphiophylla* with *Banksia littoralis* over *Xanthorrhoea preissii* and sedgeland of mixed species (previously confirmed as TEC 19b)

It is not confirmed if mapping unit EGM is part of TEC 19b or the non-threatened Floristic Community Type 17.

Areas of TEC identified along the alignment and within the Lake Cooloongup and Lake Walyungup reserves are shown on Figure 12.

Changes to the hydrological regime near the Waikiki Transit Station may impact an area of TEC 19b located within the Lake Walyungup Reserve, south of the Waikiki Station. The vegetation within the dune swales can be considered as freshwater seasonally waterlogged wetlands, which rely on groundwater and freshwater seepage from the high Holocene dunes east of Ennis Avenue. If the supply of groundwater to these swales was either increased or decreased as a result of the construction of the railway, the vegetation within the communities could be adversely affected.

Management

As construction of the SWMR will necessitate the removal of up to 2.39ha of TEC 19, PURD will refer to Environment Australia the project under the Commonwealth *Environment Protection and Biodiversity Act 1999*.

The following management measures will be implemented to protect areas of TEC 19b adjacent to the rail reserve:

- Areas will be clearly delineated with tape, paint and isolated by limit or work fencing.
- Construction works will be located as far from areas of TEC 19b as possible.
- Vehicles and construction workers will not enter areas of TEC 19b.
- Site drainage will be prevented from flowing into adjacent TECs;
- Natural drainage regime will be maintained;
- Erosion control measures will be implemented as appropriate to prevent surface run-off with high levels of sediment flowing from the working area into adjacent TECs.

Standard vegetation protection measures as detailed in Section 5.2.1 will also apply. Redesigning Waikiki Station will also allow additional TEC areas to be conserved.

PURD will consult with the DEWCP and CALM before, during and after construction of the SWMR over possible mitigation measures to compensate for the loss of TECs in the development of the SWMR project.

5.2.3 Declared Rare and Priority Flora

Preliminary EPA Objective

“Protect Declared Rare and Priority Flora consistent with the provisions of the Wildlife Conservation Act 1950.”

“Protect other flora of conservation significance.”

Potential Impacts

Two species of Priority Flora have been identified within and surrounding the rail alignment. A number of orchid species are also suspected to occur in the area. Location and abundance estimates of species identified are presented on Table 19.

Table 19 Priority Flora identified within and surrounding the proposed alignment

Species	Locations	Abundance
<i>Jacksonia sericea</i> (Priority 3)	<ul style="list-style-type: none"> • West of the alignment near Paganoni Swamp (6 locations) • West of the alignment in the Meadow Springs area (2 locations) • Mandurah Station site (See Figure 11c & 11d) 	Locally common at each site.
<i>Lasiopetalum membranaceum</i> (Priority 3)	<ul style="list-style-type: none"> • East of the alignment near Paganoni Swamp (See Figure 11c) 	Undetermined.

On the basis of the abundance data for *J. sericea*, the low priority rating of the species and the fact that the vegetation mapping units in which they were found were widespread in the areas adjacent to the railway corridor, the loss of individuals within the alignment would not significantly affect the population in these areas, or the overall conservation status of the species.

L. membranaceum is not listed as a priority species for the area and was identified after field surveys were complete. The species was documented outside of the alignment in one quadrant only and not during transect surveys of the SpD vegetation type. *L. membranaceum* probably exists as scattered individuals in this area although this could not be confirmed. The species is thought to be relatively common, but is rarely collected. On the available information, if any individuals occur within the alignment, the impact of the loss of a few is not expected to be substantial (Ecoscape, 2002b – Vegetation and Flora Management Plan).

Management

Consultation will be undertaken with CALM prior to and during construction of the railway to determine the most appropriate strategies regarding threatened flora and flora with conservation significance within the rail reserve. The following strategies could be attempted, depending upon the species found and the location of specimens:

- Transplantation of individuals to secure sites.
- Collection of seed and/or other fertile material from specimens, and germination of this material for later planting at a secure site.
- Inclusion of threatened species within rehabilitation areas.

- Cordoning off and signposting areas of vegetation within or adjacent to the rail reserve that contain threatened flora.

Additional surveys should be considered in areas where there is a likelihood of Declared Rare flora occurring, to ensure that no populations are missed by field surveys.

5.2.4 Weed Control

Potential Impacts

Weed species can compete with, replace or compromise native species. Wetlands and low-lying areas are particularly vulnerable to weed infestation as higher moisture levels may encourage rapid infestation. Eighty two weed species have been identified along the proposed SWMR, although weed infestations along the route are heavier in some areas than others. Potential impacts have been summarised by Ecoscape (2002c – Weed Control Programme) and are presented below.

Construction activities may provide conditions for opportunistic weed species to invade and thrive in disturbed soils, thus boosting weed populations along the alignment. This problem is compounded by the fact that many weed seeds remain dormant in soil until the area is disturbed. The linear nature of the SWMR proposal also introduces the potential for weeds to be spread along the construction area, increasing the potential for weed infestations to occur in other locations along the route.

The impacts related to weeds and weed invasion along the alignment during construction and operation are summarised as:

- Potential to increase weed invasion as a result of soil disturbance (construction). Soil disturbances favour fast growing, rapid seeding weed species over slower-maturing native species. Weeds have a greater advantage when there is less remnant vegetation present.
- Potential to increase weed distribution and abundance through vehicle movement (construction and operation). Vehicle movement can disturb the soil therefore inhibiting native vegetation establishment and can also inadvertently spread weed species.
- Potential to introduce new weed species or increase the distribution of existing weeds species through the use of unclean fill (construction). Soil brought onto

the site may contain seeds and propagules of weed species that may impact the existing native vegetation.

- Potential for increased edge effects encouraging weed invasion into bushland areas (construction and operation). The greater the length of the edges of bushland blocks, the greater the exposure to weeds and other disturbances.
- Potential for fire to increase the abundance of grassy weeds (operation). Frequent fires favour the growth of grassy weeds particularly over native species that have a longer recovery period. Occurrence of grassy weeds may also increase the risk of more frequent and hotter fires than would otherwise occur in undisturbed bushland.

Management

Weed control will be conducted in areas where the development of the railway may introduce weed or facilitate spread of existing weed infestations in the adjacent bushland. The most appropriate control methods and timing requirements for high priority weed species along the alignment are outlined in the Weed Control Program (Ecoscape, 2002c – Weed Control Programme). This program will be implemented during construction and will continue through the operation phase of the project. The location of priority areas to target control is displayed in Figure 19. The priority for weed control actions is:

1. Bushland in Very Good – Excellent condition (green areas)
2. Bushland in Fair – Good condition (blue areas)
 - Blue within green areas, then
 - Green bordering blue areas
3. Bushland in Poor condition (orange areas)
 - Orange within green or blue areas, then
 - Orange bordering green or blue areas

Weed monitoring quadrats will be established in areas subject to weed control to assess the effectiveness of control methods, and any new weed species will be recorded and incorporated into the weed control programme as appropriate.

In addition to the general weed control strategies the following specific measures will be implemented during the project:

- Maintenance tracks and bordering vegetation will be sprayed with a herbicide such as glyphosate to prevent weed growth, except near wetlands where a “frog friendly” glyphosate (eg Roundup ® Bioactive) or other appropriate herbicide will be used.
- Soil and plant material cleared for the railway corridor will be reused as mulch and topsoil for areas to be rehabilitated. Topsoil removed from Poor and Very Poor condition areas will be disposed of and will not be used in rehabilitation works to prevent weed seed banks being spread.
- Initial weed control will be followed up by annual re-treatment until such time that the weed species is either eradicated or reduced in area and abundance to the extent that it no longer poses a threat to the ecological integrity of the bushland.
- Vehicle movement will be minimised beyond the immediate construction site to prevent excessive disturbance and dispersal of weeds.
- Imported soils and filler materials will be obtained from weed free sources.

5.2.5 Dieback

Potential Impacts

Dieback infested and uninterpretable sites along the SWMR alignment were identified and mapped during site surveys conducted for the EMP (Ecoscape & Gelvan, 2002 – Dieback Management Plan). The presence of disease along the alignment increases the potential for the spread of dieback into currently uninfected areas. Potential vectors for the spread of disease include:

- mixing of infected and disease-free vegetation during clearing activities;
- mixing infected and disease-free topsoil during topsoil removal;
- movement of vehicles between infected and disease free areas without adequate hygiene precautions being observed; and
- introduction of diseased material (soil or vegetation) to wetland and low-lying areas either through inadequate storage of diseased material or inadequate hygiene procedures.

The areas at highest risk of dieback infection resulting from construction and operation of the SWMR are:

- Bushland surrounding The Spectacles wetlands (Bush Forever Site 269) – high conservation priority, but infestation already present and unmanageable to prevent further spread.
- Leda bushland, including Bush Forever Site 349, Leda Wetlands and Pickle Swamp series – high conservation priority.
- Bush Forever Site 272 (Sicklemore Road Bushland) – high conservation priority.
- Bushland between Thomas Road and Challenger Avenue not included in Bush Forever site 272 – lower conservation priority as it is earmarked for urban development. However the bushland in this area is generally in better condition than that within the adjoining Bush Forever Site 272
- Bushland between Challenger Avenue and Wellard Road – lower conservation priority, as it is earmarked for urban development and degraded.

(Ecoscape & Gelvan, 2002 – Dieback Management Plan)

Armillaria luteobalbina, was also found to occur at one location along the alignment near Gilmore Ave. As *A. luteobalbina* is not purely a soil-borne pathogen, it is impossible to contain the pathogen by utilising current hygiene practices.

Management

To minimise the spread of dieback along the rail alignment specifications for dieback management and hygiene practices outlined in the Dieback Management Plan (DMP) will be written into all construction contracts (Ecoscape and Gelvan, 2002). The DMP identifies appropriate strategies to prevent the spread of disease along the route and includes such measures as:

Boundaries and Segregation

- Definitive operational hygiene boundaries will be put in place in areas of infested or uninterpretable dieback conditions prior to construction works commencing. These operational boundaries will be clearly pegged, taped or signposted and indicate whether an area is dieback infected, dieback free or uninterpretable.
- Vehicles and machinery will be segregated within interpretable areas, so that machines do not cross the boundary from dieback infected into dieback free without cleaning down before leaving the dieback infected area.

- Segregating soil and plant material stockpiles to within hygiene boundaries. Any soil moved or plant material cleared in dieback infested or uninterpretable areas will be stockpiled within the hygiene boundary, including topsoil to be used for rehabilitation works, and either used within these boundaries or transported to a disposal site selected and approved by CALM.
- All hygiene boundaries will be reassessed by field survey prior to commencing any earthmoving and at 12 month intervals thereafter for the duration of the construction phase.

Cleaning

- All machinery capable of carrying dieback disease from infested to uninfested areas will be cleaned as appropriate at designated clean-down points. An object is considered to be clean if it is free of soil and plant tissue and slurry consisting of soil and water.
- The criteria for machinery cleaning are presented in Table 20. The location considerations and required standards for blowdown/washdown areas are described in the DMP.
- In dry soil conditions, at clean-down points vehicles will be brushed down or cleaned using compressed air in preference to water to ensure that mud is not created at the site.
- Machinery will always be inspected for the presence of potentially contaminated matter prior to commencement of work, or prior to entering dieback free sites.
- Any wash water will not be allowed to drain into areas of intact bushland or wetlands.

Timing

- Where feasible, and in accordance with local government regulations on dust control, maintenance works and construction in dieback infested areas will be restricted to summer only, when dry soil conditions prevail (November to March). Regardless of the timing strict hygiene procedures as outlined in the PER, EMP and DMP will be adhered to.

Access

- In areas where dieback occurs, the number of access points to construction sites will be minimised, thereby minimising the number of interfaces between infested and non-infested areas.
- Where possible, a limestone base will be used on access and construction tracks to minimise the likelihood of spreading dieback along access tracks. If construction roads and tracks cannot be upgraded with suitable surfaces and drainage to reduce the risk of dieback spreading along these roads, seasonal closures will be implemented in the wetter months.
- Permanent access tracks for maintenance and operation of the railway will be sited away from dieback infected areas where possible.

Rehabilitation

- Ensure that all imported rehabilitation materials (imported soil, rehabilitation tube stock etc.) are certified dieback disease-free.
- Plants salvaged from cleared areas for later use in rehabilitation will not be moved between hygiene boundaries, and will be replanted within the hygiene boundaries that they came from.
- Selecting dieback resistant species for rehabilitation works in dieback infested areas where possible.
- A programme of spraying and/or injecting phosphoric acid will be considered for all plants in rehabilitated areas, in areas that are either at risk of dieback infection, or are already infected.

Audits

- Regular audits will be utilised to ensure that dieback control protocols are adhered to in the field.
- Clean-down points will be subject to regular audits to ensure that they are operating correctly and that effluent is disposed of appropriately.

Table 20 Criteria for Cleaning Machinery in Areas of Different Hygiene Categories (Ecoscape & Gelvan, 2002 – Dieback Management Plan)

Hygiene Category	Clean Machinery on Entry	Clean Machinery on Exit
Areas infested with <i>Phytophthora cinnamomi</i>	No	Yes
Areas considered to be uninterpretable to the disease	Yes (unless coming from a dieback free area)	Yes (if proceeding into non-infected areas)
Areas determined to be non-infected with the disease	Yes	No

5.2.6 Bushland Access

Potential Impacts

Prior to railway operation the entire alignment, apart from the centre of the freeway, will be fenced with 1.8m high mesh fencing topped with barbed wire to discourage pedestrian movement over the railway.

Where the alignment directly abuts CALM managed estate, currently unfenced or fenced with 3-strand agricultural fencing, the railway fencing will be sunk 300mm into the ground, still retaining a 1.8m height above the ground. Virtually all existing fencing adjacent to road reserves is of a relatively low standard and with the introduction of the proposed railway security fence there will be a greatly reduced risk of fauna movement across the railway corridor, and it will reduce the size of bushland areas and range of habitat types available to fauna.

Where fauna exclusion skirting exists on fences, railway fencing will incorporate this exclusion skirting. In areas where the rail reserve is immediately adjacent to CALM managed estate and is not associated with an existing road, fauna exclusion skirting will be provided to the security fencing.

Once the fencing is in place access to many bushland areas adjacent to the proposed rail corridor will be prevented. These areas require access to enable:

- Bushland management
- Fire management

- Public recreation
- Utility servicing.

Bushland management and fire management is particularly important for the Beeliar and Rockingham Lakes Regional Parks, Bush Forever sites and the Leda Nature Reserve. Recreational areas where access will be impacted by the proposed alignment include parts of the Leda Nature Reserve and the Rockingham Golf Course. The Leda Nature Reserve also contains the Dampier to Bunbury gas pipeline, Western Power lines and Water Corporation facilities (Ecoscape, 2002g – Access Management Plan).

Provision for access tracks by CALM, FESA and WAGRC is also required. CALM has agreed that access tracks will be within the rail reserve where ever possible, with the railway security fence set back into the rail reserve. FESA will also have access to bushland areas via these tracks. Underpasses for emergency vehicles are provided in bushland areas. WAGRC will maintain tracks alongside the rail lines for maintenance.

Management

The loss of access to bushland management areas will be mitigated by:

- Any vehicle entrances impacted upon or restricted during construction and operation of the railway will be either temporarily or permanently relocated.
- Where access is restricted during construction, appropriate signage and temporary tracks will be constructed and appropriate signage installed.
- Ongoing consultation with CALM will be undertaken to ensure that changes to vehicle access into land within the Regional Parks are consistent with the Regional Park Management Plans, including access for fire management.
- The design of fences and gates will be determined through consultation with CALM and other land managers to suit individual locations.

Emergency vehicle access will be provided through:

- Heavy vehicle underpasses at Leda and to the north of the MRS Boundary for emergency service access.
- Emergency service and public access at grade separations.

Appropriate measures will be implemented to maintain access where existing pedestrian and cyclist access to parks and recreation reserves is impacted by the development of the

railway wherever possible. CALM will be consulted in this regard to ensure recreational access changes are consistent with the Regional Park Management Plans.

As access to the Recreational area in the Lake Cooloongup area adjacent to Dixon Road will be prevented, an equivalent area off Elanora Drive north of the Rockingham Golf Course will be developed.

Fragmentation of surrounding bushland will be minimised by minimising access points associated with the railway reserve. Where possible construction vehicles will utilise existing tracks in areas of regionally significant vegetation and remain within the rail reserve.

The location of pedestrian crossings was described in Section 2.2.3.

5.3 Fauna

The assessment of impacts on fauna is restricted to the areas not included in Metropolitan Region Scheme (MRS) amendments 937/33 and 938/33 (These areas already assessed by the EPA).

Preliminary EPA Objectives

“Maintain the species diversity and geographical distribution of terrestrial fauna.”

“Protect Specially Protected (Threatened) Fauna consistent with the provisions of the Wildlife Conservation Act 1950 and their habitat.”

Potential Impacts

The Fauna Management Plan (Ecoscape & Bamford, 2002) presents the issues relevant to terrestrial fauna in the area.

General Potential Impacts

Impacts on terrestrial fauna that may occur as a result of construction of the SWMR alignment include:

- Loss and reduction in fauna habitat areas including the removal of habitat elements such as fallen logs, hollow bearing trees and dense shrub understorey.
- Reduction of habitat quality in areas adjacent to the alignment through edge effects, reduction of wetland buffers, changes in hydrology, and noise and dust pollution.
- Mortality of individuals during vegetation clearance, particularly when hollow bearing trees are felled or when nest or shelter sites are disturbed
- Increased competition between species for remaining habitats, increasing the likelihood of individual mortality.
- Barrier to fauna movement through noise and disturbance and as a physical barrier interrupting continuous habitat areas.
- Habitat degradation and isolation may lead to the extinction of populations if there is no movement across the railway.
- Small, sedentary birds such as the Splendid Fairy-wren, White-browed Scrubwren and Inland Thornbill are found in areas with dense heath land vegetation or woodland with a dense understorey. These species are dependent on native vegetation cover for survival and do not readily disperse over cleared areas, so they are vulnerable to local extinction in isolated habitats suffering from reduced habitat quality. The railway may act as a barrier to movement of these species. Small reptiles, amphibians and mammals may also find the railway a barrier.

Potential impacts to fauna movement identified during the field surveys at trapping locations include:

- Restriction of movement of large terrestrial fauna including the Western Grey Kangaroo and Brush Wallaby between the Spectacles and the Sicklemore Road bushland.
- Isolation of populations of Quenda, amphibians, and reptiles such as the long neck tortoise and south western cool skink in the wetland area of the north west corner of the Leda Nature Reserve from the remainder of the reserve.
- Isolation of parts of the Quenda population in the Lake Coo loongup Flora and Fauna Reserve.
- Loss of wetland habitat for Quenda, reptiles and amphibians at Anstey Swamp. As Ennis Road runs to the west of the railway reserve little isolation is expected

at this location. Long-necked Tortoises are known to cross Ennis Avenue at this point during breeding season. The railway may add to problems experience by the tortoises.

- Restriction of movement for species who seasonally use both the Banksia woodland and heathland which occur on either side of the railway alignment near the Paganoni Road bushland. Examples of such species include nectar feeding birds and the Honey Possum (if present).

Operation of the SWMR may impact fauna as follows:

- Introduced contaminants such as oil in stormwater runoff may lead to degradation of low lying or wetland areas adjacent to the rail line.
- Rail kill may occur should any fauna enter the rail corridor.
- Loud and intermittent construction noise has the potential to scare fauna away from the site during this period. Fauna are expected to become accustomed to the operational noise of the trail and inhabit vegetated areas close to the rail line.
- Artificial lighting may attract insects and therefore nocturnal fauna that feed on them. This may increase the likelihood of rail kill.

Specific Potential Impacts

Specific fauna groups may potentially be impacted as outlined below. The conservation priority rating of species potentially occurring along the alignment is included in Appendix C.

Fish

It is unlikely that the railway development will have any impact upon freshwater fish except in the event of an accidental spillage polluting a wetland.

Frogs

Development of the railway will lead to some habitat loss for frogs. Major impacts will be where the route passes close to wetlands and therefore disrupts the wetland fringe, such as along Paganoni Swamp. There is also the potential for the railway to disrupt the dispersal of Moaning Frogs and Pobblebunks from wetlands. Changes to the hydrological cycles of wetlands could affect breeding, especially by the Moaning Frog.

Reptiles

If the Carpet Python is present, the railway could fragment populations in woodland areas and could introduce a source of mortality that may be significant for a small, isolated population of the species.

Potential impacts of the railway development upon reptiles will mainly concern species found in restricted habitats, such as the fringe of wetlands. In addition, fragmentation of contiguous native vegetation by the railway, in areas such as Leda and to the north-west of Lake Cooloongup, could affect some species. This would be especially significant for large species that occur at low population densities, such as goannas and the larger snakes.

Birds

The rail route passes close to a number of wetlands including The Spectacles, Bollard Bulrush Swamp, Leda Wetlands, Pickle Swamp, Lake Cooloongup, Lake Walyungup, Anstey Swamp and Paganoni Swamp. In general, however, the route avoids directly impacting upon these sites, although it passes through fringing vegetation at Anstey and Paganoni Swamps, and the northern end of Pickle Swamp.

The development has implications for waterbirds because a number of species, notably the Australian Shelduck, Pacific Black Duck, Australasian Shoveler and Australian Wood Duck, nest in adjacent habitat and walk their young to the nearest wetland. Therefore, as well as the loss of nesting habitat, wherever the rail route passes close to a wetland the potential exists for the development to create a barrier for the movement of ducklings of these species.

Breeding of the Shelduck, Black Duck and Wood Duck occurs in tree hollows, so the effect is likely to be greatest where adjacent dryland vegetation includes large eucalypts, such as around The Spectacles, Bollard Bulrush Swamp, Leda Wetlands, Pickle Swamp, Lake Cooloongup and Anstey Swamp.

The Spectacles contains a major waterbird breeding colony but this is located in the North Eye, well away from the railway route (M. Bamford, pers. obs.). Therefore, this is unlikely to be affected by the development. The rail development could also affect waterbirds as a result of birds striking overhead powerlines, through alterations to drainage and through pollution incidents.

Unlike waterbirds, dryland birds will be directly affected by habitat loss due to the development of the railway, as the route traverses woodland areas at several locations. While the actual loss of habitat as a proportion of areas retained will be small, this habitat loss could be significant if individual nesting trees are removed. The railway will also tend to fragment woodland areas, including a number of Bush Forever sites, and while the mobility of birds means that the impact of this fragmentation will be minimal there are long-term implications of this fragmentation. For example, weed invasion along the railway can lead to the degradation of native vegetation.

Mammals

Development of the railway will result in some habitat loss for mammals but habitat fragmentation is more of a concern, as mammals are more sensitive to habitat fragmentation compared with other fauna groups. The railway and associated fencing will create a barrier to movement of terrestrial fauna, while mammal populations are sensitive to such barriers because the densities of mammals are likely to be lower than for other fauna, notably reptiles. The combination of barriers and low densities means that populations can become fragmented into very small and unsustainable groups.

The effects of fragmentation upon terrestrial mammals may be most significant where the railway route will isolate small areas of habitat, such as to the south-east of The Spectacles, north-west of Lake Coo롱gup and at the southern end of the Paganoni Swamp area. Small populations of mammals in these isolates are unlikely to persist. Where the route passes through a large block of native vegetation, such as in the Leda area, fragmentation is less of an immediate concern. In the long term, however, even large but isolated populations face an increased chance of local extinction compared with populations that are contiguous with adjacent populations.

The action of the railway as a barrier for the movement of terrestrial mammals can be especially significant close to wetlands, as the railway can prevent the daily and seasonal movement of mammals between adjacent habitats. For example, although Quendas shelter in dense vegetation close to wetlands, they may forage into adjacent woodland, especially in winter when the ground around wetlands becomes waterlogged.

At least for the Quendas, underpasses could be created close to where the animals are known to occur. Underpasses are most effective if fencing guides the animals to the underpass entrances and if cover is available up to and within the underpass. Underpasses for Quendas would also have potential for use by other small to medium-

sized terrestrial mammals, but wallabies and kangaroos would only be able to cross the railway at bridges.

Management

Management measures that will be put in place to reduce the impact of railway construction and operation on fauna are focussed on habitat reduction and disturbance, fauna movement corridors, protection of threatened species and minimisation of the impact of feral animals and domestic pets.

These measures as identified in the Fauna Management Plan (Ecoscape and Bamford, 2002) include:

Habitat Disturbance

- Habitat trees will be avoided where possible and marked for retention prior to pre-construction clearing.
- Areas outside the rail reserve disturbed during construction will be revegetated.
- Access by construction personnel to adjacent vegetated areas, particularly wetland areas, will be prevented during the railway construction by use of fencing.
- Construction vehicles and machinery will be confined to the proposed rail alignment, where possible.

Habitat Enhancement

- Fauna habitat will be enhanced by placing hollow branches and logs, felled from clearing operations, into designated rehabilitation areas.
- Placing mulch in rehabilitation areas will form habitat for small reptiles and invertebrates.

Timing

- Pre-construction clearing will be avoided during spring where possible.

Fauna Movement

- Fauna exclusion fencing will be incorporated on railway fencing where fauna exclusion skirting currently exists and where the railway reserve is immediately adjacent to area of the CALM managed estate not adjacent to an existing road. In

other areas where the alignment abuts the CALM estate which is currently unfenced or fenced with three strand agricultural fencing, the railway fencing will be sunk 300mm into the ground, while still maintaining a 1.8m height above ground.

- Existing fauna underpasses will be maintained. The heavy vehicle underpasses at Leda and north of the MRS Boundary will include purpose built fauna passages to allow movement of larger fauna. There will be provision for two additional fauna underpasses (1200mm x 1200mm reinforced concrete box culverts) in the Leda area and one in the Lake Cooloongup (north) area across the Garden Island Highway. Specific locations are to be finalised with CALM. Fencing and vegetation will direct fauna to the underpasses, and habitat elements such as logs, mulch etc. will be placed within the underpass to provide shelter and protection for fauna using the culverts.
- Fencing associated with fauna underpasses will be maintained and kept in good repair.

Monitoring

- Rail deaths of fauna will be monitored with particular attention to the deaths of any threatened species.
- An appropriate monitoring program for the underpasses will be negotiated with CALM.

Noise

- Construction noise will be managed as per the requirements of the *Environmental Protection (Noise) Regulations 1997* as described in Section 5.7.2.

5.4 Wetlands

The assessment of the impacts on wetlands is restricted to the areas not included in Metropolitan Region Scheme (MRS) amendments 937/33 and 938/33.

Preliminary EPA Objective

“Maintain the integrity, functions and environmental values of wetlands and water courses.”

Potential Impacts

The extent of wetlands within the MRS amendment areas impacted by the alignment is summarised on Table 21. In addition approximately 3.2 km of the area in the centre of the freeway and along the Perth foreshore falls within 50m and 6.3 km falls within 200m of the reclaimed edge of the Swan and Canning Rivers. A further 0.8 km of the alignment is located on bridges over the rivers. The impacts of the rail on the river in this section are considered small compared to the historical context and existing land use.

Table 21 Wetland Areas Requiring Assessment Impacted by SWMR Alignment

Wetland	Area of wetland requiring assessment	Area within 50m buffer requiring assessment	Area within 200m buffer requiring assessment
Bollard Bulrush Swamp	0ha	0ha	0.21 ha
Pickle Swamp	0.40 ha	0.33 ha	1.02 ha
Lake Walyungup	1.38 ha	0.79 ha	0 ha
Paganoni Swamp	0 ha	1.36 ha	5.81 ha
Fremantle Road Sumpland	0 ha	0.32 ha	5.35 ha

Note: Wetland area calculations based on extent of wetland dependant vegetation.

The potential impacts related to the wetlands and buffer vegetation include:

- Alteration to the existing function of wetlands, as a result of a decrease or increase in the volume of surface and groundwater flow to the wetlands, especially during construction.
- Pollution of watercourses and wetlands resulting from run-off and subsoil drainage flushing pollutants into natural or man-made drainage systems, and from accidental spills of hazardous and toxic materials.
- Loss of wetland buffer vegetation through clearing associated with construction or as a result of altering the water quality and quantity available for the vegetation.
- Loss of wetland vegetation.

- Filling of wetland areas to accommodate the railway (only applicable in the Leda area where the railway crosses the northern section of Pickle Swamp in order to maintain a suitable railway curve).

(Ecoscape, 2002d – Hydrology and Drainage Management Plan)

Management

Management of drainage and run-off that may impact wetlands along the alignment is detailed in Section 5.5. The management measures outlined are anticipated to be adequate to protect most of the wetlands and environmental management areas of wetlands (Section 3.6.5) traversed by the alignment. Detailed descriptions of the management of each wetland area are contained in the Hydrology and Drainage Management Plan (Ecoscape, 2002d). Areas that may require additional measures include the Leda Wetlands, Pickle Swamp, Anstey Swamp and Paganoni Swamp.

The detailed design of drainage structures near wetlands will be planned to protect the conservation value of the wetlands and minimise the likelihood of adverse impacts to wetland hydrology and water quality. These drainage structures will be planned so that there will be no alteration to water regimes or water quality within wetlands along the route. Construction activities in wetland areas will be minimised to avoid siltation and erosion.

Water for construction activities will not be abstracted from existing local wetlands.

Loss of wetland vegetation throughout the proposed alignment will be minimised during the construction and operation phases of the project as follows:

- During construction, the proposed alignment will be clearly demarcated to ensure unnecessary clearing of vegetation does not occur.
- During construction, contractors will not be permitted to move vehicles outside of the demarcated corridor.
- During construction and operation, the Weed Control Program and Dieback and Fire Management Plans will be implemented to ensure remaining vegetation is not threatened by weed invasion, fire or spread of dieback.

A wetland monitoring program will be developed during the detailed design stage and will include monitoring of surface water quality in The Spectacles, Bollard Bulrush

Swamp, Leda Wetlands, Pickle Swamp, Stakehill Swamp, Anstey Swamp and Paganoni Swamp, twice a year during construction and for at least twelve months after construction is completed. The analytical program will include salinity, dissolved oxygen, nutrients, suspended solids and heavy metals. The details of the program will be developed in conjunction with the WRC.

In addition to the measures described above, PURD will investigate the possibility of moving the alignment further to the west at the northern end of Paganoni Swamp to increase the distance of the rail reserve from the wetland.

5.5 Surface Water

Potential Impacts

Construction and operation of the SWMR may impact the hydrology and drainage of the proposed alignment and surrounding area including surface water flow regimes and surface water quality. Potential impacts are outlined below.

Surface Run-off:

- Interference with existing surface water flow patterns resulting from local alterations to topography and physical impedance of flow, especially in the direction of surface run-off during seasonal flooding.
- Interference with existing drainage infrastructure along the rail alignment.

Surface Water Quality:

- Siltation of watercourses and wetlands resulting from changes to surface water flows, especially during the construction phase.
- Pollution of watercourses and wetlands resulting from run-off and subsoil drainage flushing pollutants into natural or man-made drainage systems, and from accidental spills of hazardous and toxic materials.
- Concentration of nutrients and heavy metals in drainage basins due to the collection of storm water run-off.

Management

The following strategies are proposed for managing impacts associated with drainage during the construction phase of the project:

- Existing drainage basins, subsoil drainage systems and open drains impacted by the project will be modified or relocated during the construction phase.
- Natural drainage systems and associated drainage contours will be maintained during construction, or replaced following construction, to minimise up-stream or down-stream impacts caused by changing flow regimes.
- Water for construction activities will not be obtained from existing local wetlands.
- Aside from areas where tunnels are required, construction activities will be planned and conducted so that they do not breach the winter watertable in the project area. Dewatering activities required for tunnel construction will be planned to minimise potential environmental impacts, and will adhere to WRC guidelines for dewatering activities.

Prior to work commencing the contractor must submit and have approved by the WRC the storm water drainage plans for the project, which include best management practices. A risk management and contingency plan must also be submitted to and approved by the WRC to mitigate accidental pollution of wetlands arising from construction and operation activities.

The following strategies are proposed for managing impacts associated with drainage during the operation of the railway:

Design

- The railway formation will be drained to prevent scouring, washaway and saturation.
- The system will be designed to direct all storm water and run-off into linear, vegetated swales designed to maximise infiltration and decrease run-off velocity. These swales will be constructed to contain a 1 in 1 year rainfall event.
- Gross pollutant and sediment trapping devices will be installed as necessary.
- Steep slopes and banks will be minimised where possible.

- A major drainage system check will be undertaken to prevent property or structural damage from a 100 year flood event.

Access

- Drainage basins will be fenced to keep out domestic and feral animals, litter and unauthorised vehicles.

Wetlands

- Surface water crossings will be designed to protect the conservation value of wetlands, and to minimise impact on the hydrology of the wetlands.
- Vegetation removal and construction activities in wetland areas will be minimised to avoid the potential for siltation and erosion. Disturbed areas will need rapid stabilisation through rehabilitation. Steep slopes and banks will be minimised where possible.
- All storm water drainage will be directed to infiltration basins rather than into wetlands. No water from the rail alignment will drain directly into a wetland.

Rehabilitation

- At the completion of the project, drainage patterns will be returned as close as possible to their original state.

Inspection of the rail reserve will be completed annually and after heavy rainfall, for erosion which may cause siltation of surface water bodies and groundwater, and remedial action will be undertaken as required. Monitoring will be carried out for three years after construction is complete.

Artificial surface water bodies will be monitored periodically during construction. Initially surface water monitoring will include total oil and grease, total dissolved salts (TDS), heavy metals and alkalinity. The requirement for continued monitoring can then be re-evaluated, but it is anticipated to be required for one year after construction.

Surface water which drains into infiltration swales will be monitored twice a year during rail construction for salinity, dissolved oxygen, nutrients, suspended solids, and heavy metals and then annually after construction is complete. Baseline data on water quality will be collected prior to construction commencing and used to compare ongoing monitoring.

5.6 Groundwater

Preliminary EPA Objective

“Maintain the quantity of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected.”

“Maintain the quality of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected, and that National and State standards are met.”

Potential Impacts

The potential impacts related to the groundwater regime are:

- Loss of groundwater recharge area and reduced infiltration, particularly at the proposed interchanges and associated car parks along the alignment.
- Effects of dewatering.
- Creation of preferred groundwater flow paths, particularly along the bored tunnel that rises into the Perth CBD beneath William Street.

The potential impacts related to the groundwater quality are:

- Pollution of groundwater through contaminated run-off or spills of hazardous and toxic materials.
- Contamination in the vicinity of Well Head Protection Zones and wetland Environmental Management Areas.

In most instances it is considered unlikely that the local groundwater elevations will be significantly impacted by changes to recharge due to impermeable surfaces, or changes in the rate of evapo-transpiration due to clearing of vegetation. Some minor localised changes however are expected in the immediate vicinity of drainage basins.

Groundwater pH in areas of peat excavation and areas containing wetland/estuarine sediments that require dewatering may be affected by acid sulphate generation. Dewatering is planned to occur in the Perth City area, Elanora Drive in Rockingham and Gordon Road in Mandurah.

Management

As surface water directly impacts groundwater, management measures identified in Section 5.5 will assist in maintaining groundwater quality and quantity. Additionally, in areas where groundwater recharge is modified, the following may be implemented to monitor impacts:

- Groundwater levels and quality will be monitored periodically using established groundwater bores, where available, for at least two years after construction has been completed.
- Although unlikely, local residents who experience a decline in performance of their domestic bores as a result of the construction of the railway will be entitled to corrective action, such as the relocation of their bore or provision of an alternative water supply of equivalent volume and quality.

In areas where dewatering is occurring, impacts will be minimised and managed as follows:

- Groundwater levels will be monitored at dewatering locations and discharge locations.
- The quality of the groundwater abstracted will be investigated prior to initial discharge and monitored throughout the dewatering program
- The dewatering program will be designed to avoid or minimise impacts on wetlands.
- Discharge water will be free from silt and sediments where it is being discharged directly into the natural environment. Where possible groundwater will be first placed into detention ponds
- Should the groundwater supply of any residence be impacted by dewatering alternative water sources will be provided for the duration of the impact.

Groundwater quality in Well Head Protection zones and wetland Environmental Management Areas will be protected by ensuring that site uses and activities with a higher potential to cause soil or groundwater contamination, such as infrastructure sites and equipment lay down areas, are not located within these zones.

The potential for dewatering activities to cause acidic groundwater generation from acid sulphate soils (ASS) and location of areas where excavation may cause problems will be assessed during the detailed geotechnical works and detailed design phase of the project. In areas of potential ASS occurrence testing will be conducted in accordance with DEWCP guidelines. An acid sulphate soils management plan will be prepared prior to earthworks commencing in these areas.

5.7 Noise and Vibration

5.7.1 Operation Phase

Preliminary EPA Objective

“Protect the amenity of neighbouring land users from noise and vibration impacts resulting from activities associated with the operation of the rail service, by ensuring that noise and vibration meet acceptable standards and are minimised as far as practical.”

Potential Impacts

Noise

The best-practice design of the South West Metropolitan Railway, in particular the proposed track and rail car system, will result in a significant reduction in noise levels compared to the trains currently servicing the Perth northern suburbs rail system. Despite this, noise emissions resulting from the rail/wheel interaction and the traction motors will occur and this requires assessment in terms of predicted noise levels to noise sensitive receivers located adjacent to the alignment.

Noise levels have been predicted to the external façade of 441 noise sensitive receivers adjacent to the railway corridor from the Narrows Bridges to Mandurah, and compared to a range of criteria that take into consideration the transportation noise criteria currently being evaluated for Western Australia by the Working Group on Road and Rail Transportation Noise under the Infrastructure Co-ordinating Committee (ICC) of the WA Planning Commission. The criteria used are:

Criteria 1 Noise level above which noise mitigation will be provided:

- $L_{Aeq}(\text{daytime})$ 60 dB(A); and
- $L_{Aeq}(\text{night-time})$ 55 dB(A).

Criteria 2 Noise level above which noise mitigation will be considered:

- $L_{Aeq}(\text{daytime})$ 55 dB(A); and
- $L_{Aeq}(\text{night-time})$ 50 dB(A).

Where the L_{Aeq} is equivalent steady-state A-weighted sound level (“equal energy”) which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the “average” noise level. For this assessment the “daytime” period is between 6.00am and 10.00pm and the “night-time” period is between 10.00pm and 6.00am.

Figure 20 displays a representation of typical noise levels and how they relate to the noise criteria proposed.

The results, provided in Appendix E, show that assuming the preferred design options, all criteria will be met at 338 (77%) of the receivers considered. *Criteria 1* are predicted to be exceeded at 5 locations, all of which are future residential developments within the Centennial Park Area, and *Criteria 2* are predicted to be exceeded at 98 locations.

For receivers where the noise levels are predicted to exceed *Criteria 2*, the decision whether to provide noise mitigation should take into consideration the existing noise environment. For the receivers located adjacent to major roads, the existing noise levels are generally high and placing barriers to reduce noise from the railway may be of limited benefit. For receivers adjacent to minor roads or located in semi-rural areas, where existing background noise levels are relatively low, noise mitigation measures are likely to be beneficial.

It has been found that, for those areas where noise barriers are likely to be beneficial, a 1.5 m high noise barrier positioned on the boundary of the railway reserve, would provide sufficient attenuation to achieve *Criteria 2*.

Although not included in the noise prediction calculations, where the railway is located within a road reserve, such as the Freeway and Ennis Avenue, safety barriers will be required to ensure vehicles are unable to cross the railway if involved in an accident.

Should these safety barriers be constructed of concrete or other solid material, the noise levels, resulting from the trains, to receivers adjacent to these sections of the railway alignment will be reduced (Lloyd Acoustics, 2002). The full results are provided in Appendix E.

Vibration

Vibration energy, resulting from the interaction between the train wheels and the rail, can be transmitted into the ground and propagate through the intervening soil into buildings in the near vicinity. There the vibration may be felt by the occupant (felt vibration) or may be radiated into the rooms of the building and heard as a low-frequency rumble (regenerated noise) (Lloyd Acoustics, 2002). The propagation of vibrational energy through the ground is highly dependant on the soil/rock structure and ground conditions, including moisture content, and can vary greatly from site to site. Therefore, unless the ground properties are known for each propagation path considered in an assessment, the predictions are generally highly inaccurate and should be taken as indicative only.

In respect to regenerated noise, this is generally only an issue in situations where the level of air-borne noise is very low, such as the case when the rail track is in a tunnel. As there are no tunnels near to noise sensitive premises along the section of the railway covered in this assessment, regenerated noise has not been addressed (Lloyd Acoustics, 2002).

As criteria addressing vibration levels from transportation corridors to affected premises does not exist in Western Australia, a range of criteria, developed in consultation with the DEP, is suggested for this project. The criteria require certain actions to be undertaken based on the predicted vibration levels and are as follows:

- *Criterion 1* - Vibration Limit – 109 dB (Curve 2 - AS2670.2); and
- *Criterion 2* - Vibration Planning and Design Level - 106 dB (Curve 1.4 - AS2670.2).

Above *Criterion 1 (Vibration Limit)*, vibration isolation measures would be required and should be incorporated in the design of the railway. In terms of planning, noise-sensitive rezoning/development would only be permitted where the new building was vibration isolated.

Criterion 2 (Planning and Design Level) is a level to which the project should be designed, and above which the planning system should avoid placing new residential areas where practicable. Vibration levels below *Criterion 2* would be considered acceptable.

Between *Criterion 1* and *Criterion 2* would be a conditional level, where isolation measures would be considered at the design stage, but decisions would be based on the cost benefits of their application. Actual levels would be measured during operation, and where found to be between *Criterion 1* and *Criterion 2*, non-isolation measures such as rail grinding would be considered. New residential development would be discouraged, and where this took place, notification on titles would be required.

The new generation electric trains proposed for the railway have motors that are to be mounted as part of the sprung mass of the train as opposed to mounting them onto the un-sprung mass (axle). This is expected to result in a reduction of energy transmitted to the rail and therefore a reduction in the resultant vibration levels. Lloyd Acoustics has estimated the attenuation of vibration levels of the new generation trains with distance. The resultant curve together with the suggested criteria is presented in Figure 21 (Lloyd Acoustics, 2002).

The predicted ground-borne vibration levels to receivers adjacent to the proposed railway alignment, provided in Appendix E, show that:

- 37 receivers exceed *Criterion 1 (Vibration Limit)* requiring vibration isolation measures to be incorporated in the design of the railway;
- 269 receivers are below *Criterion 2 (Planning and Design Level)* and considered acceptable; and
- 135 receivers are between *Criterion 1* and *Criterion 2* requiring consideration of non-isolation vibration control measures after construction.

Note: As described previously, these results are indicative only

Management

Noise

Noise mitigation is required to be considered at a number of locations along the alignment of the South West Metropolitan Railway. The erection of noise barriers is the

most common method of attenuating ground level transportation noise and the barriers need be heavy enough to prevent the noise travelling straight through them (transmission loss characteristics), as well as being high enough to stop the noise diffracting over the top. Suitable barrier materials include:

- Brick and Blockwork;
- Compressed Fibre Cement (SuperSix)
- Concrete;
- Fabricated Metal (Colorbond);
- Lapped and Capped Timber Fencing (at least 12mm thick); and
- Earth Bunding.

Once a suitable material for a noise barrier has been selected, the diffraction of noise over the top or sides of the barrier will determine the noise reduction that can be achieved. In most cases, where noise mitigation is required, a 1.5m high barrier placed on the edge of the railway reserve will sufficiently attenuate the noise levels to achieve the noise level criteria, however, this must be assessed at each specific site.

The position of these noise barriers will vary depending on the land topography between the railway and the residence and the available space, however, a general rule is to try to position the barrier as close to the source (i.e. the railway) or the receiver as possible.

Although not strictly necessary, strategically placed acoustic walls will also be installed in the southeast and southwest quadrants of the Leach Highway intersection with the freeway, and at Trenant Park Gardens, Golden Bay.

Vibration

Vibration mitigation is required to be considered at a number of locations along the alignment of the South West Metropolitan Railway. For those areas exceeding *Criterion 1*, resiliently mounted rails or isolated slabs would be required. For those areas between *Criterion 1* and *Criterion 2*, non-isolation measures such as rail grinding would be considered

Should high vibration levels be observed or complaints received from any receivers along the alignment, PURD will investigate the situation and implement management as required.

PURD will investigate possible regenerated noise from bridge structures once detailed design plans are available. Noise and Vibration Management Plans will also be prepared in conjunction with the detailed design phase once detailed earthworks plans are available.

5.7.2 Construction Phase

Preliminary EPA Objective

“Protect the amenity of neighbouring land users from noise and vibration impacts arising from the construction activities, by ensuring that noise and vibration meet acceptable standards and are minimised as far as practical.”

Potential Impacts

Noise may be generated by earthmoving machinery, trucks, compaction and installation equipment. Vibration impacts are most likely to be generated from piling associated with bridge widening and tunnel construction.

Noise and vibration impacts are likely to be a greater concern to residences should construction activities extend out of normal hours (7am to 7pm Monday to Sunday).

Management

Construction noise levels will be managed to ensure that they comply with regulation 13 of the *Environmental Protection (Noise) Regulations 1997*, which establishes a procedure to manage noise impacts in terms of amenity and welfare (EPA, 1997).

For daytime construction (work carried out between 7am and 7pm on any day which is not a Sunday or public holiday) the regulations state:

- Construction work must be carried out in accordance with control of noise practices set out in section six of Australian Standard 2436-1981 “Guide to Noise Control on Construction, Maintenance and Demolition Sites”;

- Equipment used for the construction work must be the quietest reasonably available; and
- The Chief Executive Officer (CEO) may request that a noise management plan be submitted for the construction work at any time.

For out of hours construction the regulations state:

- The work must be carried out in accordance with section six of AS 2436-1981;
- The equipment used must be the quietest reasonably available;
- The builder must advise all nearby occupants of the work to be done at least 24 hours before it commences;
- The builder must show that it was reasonably necessary for the work to be done out of hours; and
- The builder must submit to the CEO a noise management plan at least seven days before the work starts, and the plan must be approved by the CEO. The noise management plan must include details of:
 - Need for the works to be done out of hours
 - Type of activity which could be noisy
 - Predictions of noise levels
 - Control measures for noise and vibration
 - Monitoring of noise and vibration
 - Complaint response

Vibration causing activities will be restricted to daytime hours in order to minimise the disturbance to nearby residents. As with the noise management requirements a complaint register will be established to document and facilitate response to complaints.

In addition PURD will offer free structural assessment of buildings that may be affected by vibration prior to commencement of earthworks. This will facilitate assessment of any structural impacts resulting from construction.

5.8 Additional Construction Impacts

Preliminary EPA Objective

“Protect the amenity of neighbouring land users from any other factors arising from activities associated with the construction of the rail service, by ensuring that statutory requirements and acceptable standards are met.”

5.8.1 Dust

Potential Impacts

The extensive earthworks proposed during the construction of the railway has the potential to create a short-term dust nuisance unless properly managed. This is particularly of concern in the sandier soil complexes such as the Quindalup, Bassendean, Karrakatta and Cottesloe units. This may impact surrounding residents, construction workers and nearby vegetation.

The potential for dust nuisance can be assessed with respect to the dominant seasonal wind patterns. In summer, when dry conditions create the greatest potential for dust generation, strong winds generally occur from the east or south west. During winter, strong pre-frontal winds from the north-west could carry dust away from the site. However, the damp conditions that prevail at this time of year will mean that little if any dust will be generated.

Management

Management of dust impacts will be undertaken in accordance with the DEP Guidance Statement No. 18 *“Prevention of air quality impacts from land development sites”* (EPA, 2000b).

The EPA requires cleared areas of land development sites to be stabilised following vegetation clearance. Management approaches presented in the statement include maintenance of patches and strips of vegetation as wind breaks and stabilisation of soil using wind fencing, water to damp down areas, hydro-mulch, chemical stabilisation and chipped vegetation (EAP, 2000b).

5.8.2 Light

Potential Impacts

During construction of the railway there may be a need to light the construction site if building is required after daylight hours. Light-spill into neighbouring residential areas may cause a temporary nuisance to residents, however this impact is expected to be minimal and restricted to isolated areas.

Management

To minimise the potential impacts of light-spill construction will be managed in accordance with Australian Standard 4282 *Control of the Obtrusive Effects of Outdoor Lighting*.

5.9 Public Risk and Safety

Preliminary EPA Objective

“Ensure that risk is managed to meet the EPA’s criteria for individual fatality risk off-site and the Department of Minerals and Petroleum Resources’ requirements for public safety in relation to dangerous goods and hazards.”

Potential Impacts

All major road crossings along the alignment will be via grade separations, therefore the potential for vehicle-train collisions is reduced. The exceptions will be two boom gate protected “occupational” crossings at Paganoni Swamp and Lakelands, constructed on private roads serving existing commercial operations, with legal access restricted to authorised personnel.

The risk of collisions between trains and vehicles where the railway runs down the centre of the Kwinana Freeway will be minimised by the presence of 0.9m high concrete crash barriers each side of the railway line.

The alignment must traverse the high pressure gas pipeline in the Leda Nature Reserve, although the potential for this to cause problems is very low.

Management

Prior to construction of the rail over the high pressure gas pipeline a pipeline licence must be obtained from the Department of Mineral and Petroleum Resources (DMPR). This licence will be issued when DMPR considers that the safety implications of the proposal have been addressed to their satisfaction.

5.10 Bushfire Management

Potential Impacts

The risk of ignition of bushfires increases with proximity to urban areas and ease of access into bushland. Dumping and burning of car bodies is known to be a significant fire causing factor. The Fire Management Plan (Ecoscape, 2002h) identifies the bushland areas at greatest risk of deliberate ignition near the SWMR as:

- Bushland west of Homestead Drive and south of Wellard Road
- Bushland near the suburb of Leda
- The Spectacles Reserve
- Bollard Bulrush Swamp
- Tuart woodland north of Dixon Road
- Lake Cooloongup and Lake Walyungup
- Anstey Swamp and Paganoni Reserve

Impacts of fires on the receiving environment include:

- Promotion of weed growth.
- Alteration of species composition.
- Threat to the viability of rare, endangered or geographically restricted species.
- Threat to the viability of obligate seeding species (which are typically more sensitive to fire than lignotuberous species that can re-sprout following fire).

Fires at intervals more frequent than the inherent regenerative capacity of the vegetation can promote the spread of exotic weeds. Increased weed growth, particularly annual grassy weeds, greatly increases the fire risk.

The construction of the SWMR increases the risk of bushfires starting by:

- Cigarette butts and matches from workers
- Sparks from welding equipment and exhaust systems
- Arson by vandals gaining access to bushland on construction site access tracks
- Unauthorised burning of cleared vegetation.

The construction of the SWMR could indirectly increase the risk of fire by increasing disturbance in surrounding bushland, leading to an increase in grassy and/or annual weeds and resultant increased fuel loads.

The fencing requirement along the proposed alignment and the presence of a high voltage electricity supply could provide a barrier to fire-fighting vehicles needing to cross the rail line, especially near bushland areas. Conversely the security fencing for the alignment will reduce the number of access points into parks and reserves which will reduce the potential for accidental and deliberate outbreaks of fire.

Management

A Fire Management Plan (Ecoscape, 2002h) has been prepared for the proposed alignment which details the management strategies for hazard reduction, fire suppression, post-fire recovery and incident analysis. A summary of the management strategies identified in the plan is presented below.

Existing fire management throughout the areas traversed by the proposed alignment is undertaken by Fire and Emergency Service Authority (FESA), which encompasses the Fire and Rescue Service (FRS) and the Bush Fire Brigades (BFB). The FRS gazetted area covers urban and other built-up areas. Fire suppression throughout the rest of the rail corridor falls to the Bush Fire Brigades (BFBs), which are managed by Local Governments.

Management strategies that will be implemented to reduce the risk of fire during construction of the railway are:

- Hot work such as welding and metal cutting will be restricted to specified safe areas, in areas of high fuel load, on days where fire danger is Very High or Extreme.
- All construction machinery will have spark arrestors fitted to the exhaust systems.
- Construction workers will be discouraged from disposing of cigarette butts and matches in bushland or grassland areas.
- All vegetation cleared from the corridor will be mulched. Burning of cleared vegetation will not be permitted.

Disturbance of surrounding vegetation will be kept to a minimum during construction to prevent weed establishment as much as practical in line with the recommendations of the Vegetation and Flora Management Plan (Ecoscape, 2002b) and the Weed Control Programme (Ecoscape, 2002c).

Secure gates and locks will be fitted to all construction tracks in bushland areas to prevent uncontrolled access and reduce the risk of stolen cars being dumped and burnt and arsonists entering bushland areas.

Appropriate fire suppression techniques, determined in consultation with FESA, will be available on-site during construction, with personnel train in fire suppression on site.

Hazard reduction measures that will be put in place during operation of the railway include:

- Firebreaks/maintenance tracks at least 3m in width will be located on one side of the railway corridor where the route passes through areas of flammable material such as grasses and native vegetation. Establishment of the tracks will be done in conjunction with CALM and FESA.
- Maintenance tracks will be regularly sprayed with glyphosate to discourage weed growth.
- The abundance of weeds within the rail corridor will be kept to a minimum by implementing the Weed Control Program.

Methods of fuel reduction within the rail corridor include:

- Mowing or slashing of grasses.
- Mechanical reduction in fuel loads through raking and removal of weeds and leaf litter.
- Weed control.
- Removal of rubbish.

The Department of Planning and Infrastructure will ensure the Fire and Rescue Service, Town of Kwinana, City of Rockingham, City of Mandurah, CALM and associated Bush Fire Brigades are aware of the number and nature of access points across the rail line for emergency vehicles. DPI will also ensure all parties are aware of boundaries and responsibilities.

Access points across the rail line will be located at grade separations as well as at underpasses for emergency and park management vehicles in the Leda area and to the north of the MRS Boundary. Bush Fire Brigade and Fire and Rescue Service fire-fighters will be informed of the locations of access points as well as the hazards of and correct procedures and distances for using water to fight fires near overhead power lines, and the locations of any Special Environmental Areas within or adjacent to the rail reserve. Fire fighting groups will also be requested to avoid using surfactants and detergents in areas near wetlands.

Where necessary following a fire, erosion and weed controls will be implemented as soon as possible. Subsequent to commencement of operations, access to burnt areas will be limited to management access only for the first six to twelve months.

If a fire occurs in early summer, weed control will be carried out three months after the fire. With late summer fires, inspections will be carried out at four, six and eight week intervals after the fire to assess the most appropriate intervals at which to carry out weed control. Any fire affected areas will be monitored and a follow-up treatment applied if necessary.

All fires that occur on the railway reserve will be recorded including the date, season, time, cause of ignition, intensity and extent of the fire, fire control methods used and damage caused.

5.11 Visual Amenity

Preliminary EPA Objective

“Ensure that the visual amenity experienced by nearby land users is not unduly affected by the proposal.”

Potential Impacts

A visual amenity impact study was conducted for the entire alignment between Perth and Mandurah (Ecoscape, 2002e). The findings of this investigation are summarised below.

Visual impacts are derived from a change to the visual amenity of an area, which may be either direct or indirect, that affects the character and quality of the extant views. Impacts can arise from railway vertical and horizontal alignment, bridge structures, station design, bulk, colour and form of the train, train speed, cut and fill operations, mast design and overhead power transmission lines (Ecoscape, 2002e).

A summary of the areas of high, medium and low potential impacts are presented on Figure 22. The visual assessment findings for discrete areas along the route is presented below.

Perth City

The area between the Narrows Bridge and the tunnel entrance is of high visual sensitivity because of the public views of the train. The impacts are generally considered to be low because the visual intrusion of the railway within the context of the freeway scale and form will be low (Ecoscape, 2002e).

Positive external and internal views will be created with the enhancement of public open space north of the William Street Station created by the sinking of the train line and potential removal of the existing ramp at the western freeway end of William Street.

Freeway: Perth to Mount Henry Bridge

Visual intrusion along this section of the freeway is likely to result from masts, overhead wires and concrete crash barriers. These factors are likely to be cause the greatest impact on residents along Melville Parade.

This area has a high scenic quality due to the presence of the Swan and Canning Rivers. The visual impacts are likely to be moderate when taken in context with the existing freeway.

Freeway: Mount Henry Bridge to Anketell

The alignment will remain within the freeway reserve between Mt Henry Bridge and Anketell. The main visual impacts will be associated with the bus ramps and buildings at Leach Highway and Murdoch, clearing of the median vegetation and addition of railway infrastructure. The scale of the visual impacts ranges between High and Low, with the greatest impact occurring between Mt Henry Bridge and South Street where the transit bus depots at Leach Highway Station and bus ramps at Murdoch will be visible to adjoining residents and from surrounding roads.

Leda: Anketell to Mundijong Rail Bridge

The majority of the railway reserve in this area will need to be cleared of native vegetation for the earthworks. The visual impacts are expected to be low to moderate in this area. Possible impacts include scarring of the landscape from clearing and earthworks which is visible from Thomas Road, Challenger Drive and Wellard Drive, clearing vegetation at station sites, steep earthworks and fencing in bushland areas.

Rockingham: Mundijong Rail Bridge to Lake Walyungup

Visual impacts along this section of the route are generally low except around the Rockingham Station where impacts are expected to be high. The impacts include loss of vegetation, construction of fencing along the track (especially in the Rockingham Lakes Regional Park), development of pedestrian overpasses potentially overlooking neighbouring houses, construction of station and associated car parks and infrastructure, loss of existing screen vegetation and changes to parabolic dunes along Ennis Avenue bordering Lake Walyungup.

Stakehill: Lake Walyungup to Anstey Road

Visual impacts on the amenity through the construction of the rail infrastructure are expected to be high. The main impacts include severing market gardens (grid pattern crops), station lighting in a relatively dark rural setting, loss of vegetation through clearing and increased infrastructure associated with the rail bridge in a natural setting.

Karnup to Mandurah: Anstey Road to Mandurah Terminus

This section of the alignment has low to moderate visual impacts which include changes to the landform due to the fill requirement near Karnup station, vegetation clearing and scarring and installation of infrastructure relating to the station, traffic bridge and future freeway entrance at Mandurah.

Management

Potential impacts of rail operation through the CBD have been removed by sinking the rail underground from approximately 80m east of the freeway off ramps. The rail will not emerge above ground until north of Wellington Street. The visual amenity of the city foreshore will therefore not be impacted once construction is complete. The SWMR project is the catalyst for improvements to the Perth foreshore that will occur during construction in this area.

Construction will be timed with visual amenity in mind. Construction of the cut and cover tunnel between the freeway and the Esplanade is scheduled to be complete by June 2004, which coincides with the planned opening of the Convention Centre. Visitors to the Convention Centre will therefore not be presented with views of the construction in front of the river.

A number of options to improve the visual amenity of the railway have been considered for the section along the freeway. These options include use of a third rail line for electricity provision, which would remove the need for overhead lines, and combining the street light poles with the rail power poles to reduce the number of structures present along the alignment. Combining the street light poles with the rail power poles has been ruled out due to safety considerations. The use of third rail power supply has been ruled out due to cost, operational inefficiencies and the 2.5m barbed wire topped security fence that would need to be installed. This fence would have a negative impact on visual amenity in this area.

Areas that require revegetation and rehabilitation, including station sites, will be planted with native species to enhance the character of the local environment and attempt to blend the railway reserve into the surrounding land where possible. It is noted that for safety reasons the majority of the rail reserve must remain free of vegetation, especially tall plants.

Specific management measures that will be considered in the final design stages of the project to further assist with the visual amenity issues include:

- Station designs along the Swan and Canning Rivers to utilise the river views.
- Using darker colours for concrete barriers and other infrastructure to reduce vividness.
- Ensure station designs fit within the landscape context. The carparks should be as compact as possible minimising the use of planter beds but enhancing tree planting for shade purposes.
- Use low planting in rural areas to draw attention away from the overhead power transmission lines but maintain views to the rural environment.
- Mulch the newly constructed alignment in areas where vegetation has been cleared as soon as practically possible.
- The lookout and walk trail in the Spectacles wetlands should be screened from the train line.
- Use of black chain mesh fencing to diminish vividness of fence alongside uncleared areas.
- Use appropriate screening vegetation between station infrastructure and adjoining residential areas.
- Reduce lighting impacts on adjoining neighbours at Rockingham station.
- Install screens on footbridges that overlook residential areas (such as at the Rockingham Station) to minimise overlooking and ensure colour selection of footbridges minimises visual intrusion.
- Utilise appropriate clump planting in rural areas adjacent to the rail reserve to fragment the linear nature of the rail infrastructure and accentuate view to the surrounding rural character for train users.
- Screen the rail from future urban areas at Lakeland where the rail corridor is narrow.
- Screen the Mandurah Waste Water Treatment Plant.

5.12 Aboriginal Heritage

Preliminary EPA Objective

“Ensure that changes to the biological and physical environment resulting from the proposal do not adversely affect cultural associations with the area.”

“Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972.”

Potential Impacts

Aboriginal site investigations were conducted along the proposed alignment to comply with the provisions of the W.A. *Aboriginal Heritage Act 1972*. The investigations concluded that development of the rail line will not cause a conflict with known sites. The investigations included site information reviews, searches along the alignment for archaeological sites and consultation with relevant Aboriginal groups.

Sites are usually associated with features in the landscape such as rivers, lakes and swamps. There is some possibility that sub-surface material may be present along parts of the alignment, including skeletal material, but this can not be determined from a surface survey. This may occur in the alluvial terraces of rivers, around swamps, and in sand hills or ridges.

The obligations related to sites under the *Aboriginal Heritage Act 1972* are summarised below. Full details are provided in the Act.

Report of Findings

All findings including Aboriginal burial grounds, symbols or objects of sacred, ritual or ceremonial significance, cave or rock paintings or engravings, stone structures or arranged stones, carved trees, or of any other place or thing to which the Act applies or is suspected to apply must be reported to the Registrar, or to a police officer, unless it is already known to the Registrar.

Excavation of Aboriginal Sites

The right to excavate or remove anything from an Aboriginal Site is reserved for the Registrar. The Registrar can conditionally authorise excavation, removal or examination activities.

Offences Relating to Aboriginal Sites

Anyone who excavates, destroys, damages, conceals or in any way alters any Aboriginal site or alters, damages, removes, conceals, or who deals with in a manner not sanctioned by relevant custom, or assumes the possession, custody or control of, any object on or under an Aboriginal site commits an offence unless authorised by the Registrar or Minister.

Consent to Certain Uses

When a owner uses land for a purpose that may cause an offence relating to Aboriginal sites they must advise the Trustee. The Committee must then review the situation and advise the Minister of their recommendations. The Minister must decide if consent will be given and can set conditions. If consent is given, actions in accordance with conditions cannot constitute an offence. The Committee can also direct the removal of any object to which the Act applies from the land.

Management

Approval from the Minister for Indigenous Affairs will be sought regarding the disturbance of Aboriginal sites along the proposed alignment. An Aboriginal community consultation process will also be undertaken. This will occur for the parts of the project associated with the Perth City works, the Narrows Bridge and the Mount Henry Bridge.

If any Aboriginal material is uncovered as a result of earthmoving activities work will immediately cease in that area and the discovery will be reported to the relevant authorities.

Project personnel and construction workers will be informed of the requirement of the *Aboriginal Heritage Act 1972* with regards to interference with Aboriginal sites.

The following requests included in the heritage reports will be undertaken where possible:

- Employment of Aboriginal monitors during the clearing of bushland areas.
- Details regarding planning and design for water catchment and run-off, and also sump pond provisions and drainage points be provided to the Naramaya Aboriginal Corporation as requested.

- Access to be provided for seed collectors in advance of scrub clearing.
- Widening of Mount Henry Bridge at the northern end does not encroach into the hill on the right hand side of the road.
- The Wilkes and Corunna families will be consulted regarding Mount Henry Bridge widening and disturbance to the Canning River.
- Consideration will be given to employment of Aboriginal people.
- Rehabilitation will be carried out using native vegetation.
- If any old *Melaleuca* trees are removed from the South Perth foreshore, the Aboriginal community will be allowed to use the timber.

5.13 European Heritage

Potential Impacts

Heritage sites have different forms of protection depending on what they are registered under. The Register of the National Estate is Australia's national inventory of natural and cultural heritage places which are worth keeping for the future. It is compiled by the Australian Heritage Commission, the Commonwealth Government's adviser on the National Estate (Australian Heritage Commission, 2002). Legal constraints are not imposed on private owners who have sites on the register, only on the Commonwealth Government.

The Western Australian Register of Heritage Places requires that State and local governments seek advice from the Heritage Council if they are considering undertaking or approving the development of a place entered on the Register of Heritage Places.

Municipal Heritage Inventories are maintained by local authorities in order to comply with the *Heritage of Western Australia Act 1990*. The inventory has no statutory implications. Heritage places identified in local government Town Planning Schemes (TPS) are subject to the heritage provisions of the TPS.

Sites classified by the National Trust and other local government and church databases have no statutory basis.

Heritage sites in the path of the alignment that will be directly impacted by the proposed development include:

- Buildings along the eastern side of William Street between Wellington and Murray Streets to be internally modified for use as part of the station
- Narrows Bridge (Register of Heritage Places, Municipal Heritage Inventory)
- Mount Henry Bridge (Municipal Heritage Inventory, included in TPS)
- Mill Point Reserve (Municipal Heritage Inventory, included in TPS)
- Beeliar Regional Park (Register of the National Estate, Municipal Heritage Inventory)
- The Spectacles (Municipal Heritage Inventory)
- Paganoni Swamp (National Trust)

Other sites adjacent to the alignment may also be impacted during construction of the railway via vibration and potential weakening of foundations should tunnelling occur in the immediate vicinity. This is especially relevant to the heritage buildings in the Perth Central Business District where tunnelling is planned to occur.

Management

Development plans for heritage listed sites will be submitted to the appropriate authorities as required.

The Construction Management Plan will outline measures to prevent structural impacts on heritage buildings adjacent to the alignment, especially in the Perth Central Business District. Consultation will be undertaken with the Heritage Commission also in this regard. Impacts on heritage areas for the remainder of the alignment are not expected to impair value of the sites.

5.14 Soil and Groundwater Contamination

Preliminary EPA Objective

“Ensure that any contaminated land or groundwater that may be impacted by the proposal is managed and remediated to an acceptable standard compatible with the intended land uses.”

Potential Impacts

Historical activities conducted within and surrounding the alignment may have impaired soil and groundwater quality. A Preliminary Site Investigation (PSI) for potential contamination has been conducted for the alignment. The PSI has identified several areas of potential contamination within the proposed alignment. The PSI report is included in Appendix D.

Management

It is proposed to assess identified potential contamination at the above areas in accordance with the site contamination assessment process described in DEP Contaminated Sites Management Series (Figure 23). The next assessment phase will involve site specific PSIs for each of the identified areas. The scope of the PSIs will include:

- Site specific inspections
- Further consultations with persons knowledgeable of site histories
- A targeted soil sampling and analysis program for the potential contaminants

In addition it is proposed to investigate groundwater quality where dewatering is required for the construction of the Perth City Tunnel. The bores installed to monitor water levels during the dewatering program will be sampled for potential contaminants. A groundwater sampling and analysis program will be developed in consultation with the DEWCP.

Management/remediation requirements, which will take into account the proposed land use, will be determined in consultation with the DEWCP.

5.15 Traffic Management

Preliminary EPA Objective

“Ensure safe and effective vehicular and pedestrian traffic flow during and after the construction phase where existing patterns may be affected by the proposal.”

“Ensure acceptable air quality during and following the construction phase where existing patterns may be affected by the proposal.”

Potential Impacts

Perth City

In the CBD section of the route, existing traffic flows will be affected within the Narrows interchange area, at the intersection of William Street, Mounts Bay Road and the Esplanade, and at the intersection of William and Wellington Streets. In the foreshore and Mounts Bay Road area traffic management plans will be developed in consultation with the City of Perth.

It may also be necessary to remove a parking lane in the lower section of William Street for a period of nine months. At Wellington Street it is proposed that two lanes in each direction be provided over a period of twelve weeks

Freeway

Comprehensive studies have been carried out to assess the extent of disruption to traffic on the Kwinana Freeway between Thomas Road and the Narrows Bridge. South of Glen Iris, where the carriageway median is wide, little or no disruption is expected as all work will be contained within the median. At Glen Iris, South Street and Leach Highway there will be some disruption associated with the widening and realignment of the north and south carriageways. This work is likely to involve partial closures of the freeway shoulders, while the existing traffic lanes remain open.

Anketell Tunnel to Mandurah

All areas where grade separation between the SWMR and the existing road network is planned will require traffic management to varying degrees. Grade separations will occur at Thomas Road, (the Spectacles), Challenger Drive (Parmelia), Wellard Road (Wellard), Mandurah Road and the Mundijong freight line (Hillman), Elanora Road (Cooloongup), Mandurah Road (Baldivis), Stakehill Road (Karnup), Paganoni Road (Karnup), Gordon Road (Meadow Springs) and Fremantle Road (Mandurah).

Approximately 1.5 km of the southbound lane of Mandurah Road where it passes through Anstey Swamp in Karnup will be taken up by the railway to avoid any further

impact on the wetland. A new northbound carriageway will be constructed to the west of the current north bound carriageway. Traffic management measures will be necessary over this period.

Management

Perth City

Pedestrian traffic flows will be maintained along all existing routes, although some alternative pathways will need to be provided to replace those that are cut by the construction works, as it proceeds. On the foreshore, pedestrian access will be improved and enhanced as a result of the Project works.

Freeway

A preliminary traffic management plan has been prepared for the section from Mount Henry north along the Freeway. The plan provides for the maintenance of three lanes in the dominant traffic flow direction at peak times and the continuance of the bus priority lanes until six months before the opening of the railway. During those six months, when the bus lanes are being converted to the railway, the buses will be relocated to the central lane of the freeway. Investigations are continuing into the practicality of making this lane a high occupancy vehicle (HOV) only lane over this period. Under this arrangement, only buses and vehicles with multiple occupants (probably three or more) will be allowed in the lane; all other traffic being confined to the two remaining general traffic lanes. This plan will be reviewed and updated by the construction contractor as a requirement of the contract.

Anketell Tunnel to Mandurah

Traffic management plans will be prepared for each discreet section of the works where they are required in consultation with Main Roads WA and the relevant Local Authority.

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6.0 CONCLUSION AND COMMITMENTS

This Public Environmental Review has been prepared with the intention of providing environmental guidance for the construction and operation of the proposed South West Metropolitan Railway.

This document provides a brief summary of the construction and operation details and the environmental conditions encountered along the alignment.

This strategic review also provides specific commitments that will be undertaken during and after infrastructure construction. The onus will be on PURD and the construction contractor to satisfy these commitments and to ensure that construction is conducted in an environmentally acceptable manner.

A summary of the commitments is presented in Table 22. Specific issues that need to be considered in order to comply with these commitments are presented in the relevant sections of this document.

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Table 22 Summary of Commitments

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
1.0	Construction Management Plan	<p>Prepare a Construction Management Plan which addresses:</p> <ul style="list-style-type: none"> • Measures to limit clearing • Environmentally significant areas • Impacts on fauna • Protection of declared rare and priority flora and other flora of conservation significance • Protection of Threatened Ecological Communities • Hygiene measures to minimise the spread of disease and weeds • Water quality, erosion and sedimentation control • Construction noise and vibration • Aboriginal and European heritage • Property condition surveys • Dust management • Fire management • Access during construction • Construction lay-down sites • Fencing • Light spill • Public input and complaints response procedure • Registers of waste materials/contamination, monitoring and site audit sheets • Movement, storage and refuelling of machinery during construction • Storage and handling procedures for all construction materials and hazardous chemicals • Hazardous spill contingency plan • Contamination contingency plan including measures for acid sulphate soils • Works in the vicinity of high pressure gas pipelines • Dewatering and water supply • Description of environmental standards, safeguards and emergency responses • Schedules for corrective action and verifications • Licensing requirements and approvals • Management structure and reporting 	<p>Ensure that construction impacts (direct and indirect) on flora, fauna, wetlands, Bush Forever sites, surface water and groundwater, nearby residents, buildings, Aboriginal and European heritage sites are minimised.</p>	<p>Prior to site preparation work commencing for each stage of construction</p>	<p>DIA, DEWCP, CALM, FESA, Heritage Council, Local Governments</p>

Table 22 Continued

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
1.0 (Cont)		<ul style="list-style-type: none"> • Environmental briefing, training and induction of personnel • Monitoring • Progress and compliance reporting 			
2.0	Construction Management Plan	Implement the Construction Management Plan required by Commitment 1.0.	Achieve the objectives of Commitment 1.0	During Construction	DEWCP, Local Governments
3.0	Clearing Mitigation Plan	Prepare a Clearing Mitigation for the mitigation (e.g. by rehabilitation of degraded land outside the rail reserve, purchase for reservation of unprotected bushland or support of CALM conservation purchases) of vegetation loss through clearing for the SWMR.	Mitigate the effects of clearing for the project and achieve the objective of no net loss of significant vegetation.	Design	DEWCP, CALM
4.0	Clearing Mitigation Plan	Implement the Clearing Mitigation Plan required by Commitment 3.0.	Achieve the objectives of Commitment 3.0	Design to post-construction	DEWCP, CALM
5.0	Rehabilitation Strategy and Landscape Management Plan	Prepare a Rehabilitation Strategy and Landscape Management Plan which addresses: <ul style="list-style-type: none"> • Visual Amenity • Protection of significant flora and ecological communities • Plant/seed selection • Plant/seed source and propagation methods • Topsoil management • Weed control • Dieback and disease management • Bushfire management • Erosion control • Fencing 	Ensure that the post-construction landscape is stable and self-sustaining, ecological functions are retained or reinstated where possible and that visual amenity is maximised.	Design	DEWCP, CALM, Local Governments
6.0	Rehabilitation Strategy and Landscape Management Plan	Implement the Rehabilitation Strategy and Landscape Management Plan required by Commitment 5.0.	Achieve the objectives of Commitment 5.0	Construction to until rehabilitation complete	DEWCP, CALM, Local Governments
7.0	Fauna Management Plan	Prepare a Fauna Management Plan which addresses: <ul style="list-style-type: none"> • Fauna habitats • Fauna movement • Monitoring 	Minimise impacts on fauna	Design	CALM, DEWCP

Table 22 Continued

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
8.0	Fauna Management Plan	Implement the Fauna Management Plan required by Commitment 7.0	Achieve the objectives of Commitment 7.0.	During construction and post-construction	DEWCP, CALM
9.0	Wetlands, Hydrology and Drainage Management Plan	Prepare a Wetlands, Hydrology and Drainage Management Plan which addresses: <ul style="list-style-type: none"> • Drainage design and management • Dewatering impacts • Wetland and groundwater monitoring • Areas for wetland enhancement and mitigation measures for the loss of any significant wetlands • Minimising loss of wetland dependant vegetation • Corrective action to local resident water supplies (if required) 	Minimise impacts on wetlands, surface water and groundwater and ensure no net loss of wetland functions and values	Design	DEWCP, CALM, Local Governments
10.0	Wetlands, Hydrology and Drainage Management Plan	Implement the Wetlands, Hydrology and Drainage Management Plan required by Commitment 9.0.	Achieve the objectives of Commitment 9.0.	During construction and post-construction	DEWCP, CALM, Local Governments
11.0	Noise and Vibration Management Plan	Prepare a Noise and Vibration Management Plan which addresses: <ul style="list-style-type: none"> • Noise and vibration impacts and criteria • Location of noise sensitive premises • Noise and vibration level predictions • Mitigation measures • Monitoring and reporting program • Complaint response 	Minimise noise and vibration impacts on sensitive premises.	Design	DEWCP, Local Governments
12.0	Noise and Vibration Management Plan	Implement the Noise and Vibration Management Plan required by Commitment 11.0	Achieve the objectives of Commitment 11.0.	During construction	DEWCP, Local Governments
13.0	Access Management Plan	Prepare an Access Management Plan which addresses: <ul style="list-style-type: none"> • Railway maintenance access • Bushland management access • Recreational access • Emergency service access 	Minimise the impact of the railway on bushland and significant environments.	Design	CALM, FESA, DEWCP, Local Governments

Table 22 Continued

<i>No.</i>	<i>Topic</i>	<i>Action</i>	<i>Objective</i>	<i>Timing</i>	<i>Advice</i>
14.0	Access Management Plan	Implement the Access Management Plan required by Commitment 13.0.	Achieve the objectives of commitment 13.0.	During construction and operation	DEWCP, CALM, FESA, Local Governments
15.0	Contamination Assessment and Management Plan	Prepare a Contamination Assessment and Management Plan which addresses: <ul style="list-style-type: none"> • Soil and groundwater quality at the sites requiring further investigation as identified in the PER • Investigations and procedures where there is a risk of disturbing acid sulphate soils • Agree the management/remediation requirements with the DEWCP 	Ensure the soil and groundwater quality are appropriate for the intended land use and acceptable standards are maintained.	Design	DEWCP
16.0	Contamination Assessment and Management Plan	Implement the Contamination Assessment and Management Plan required by Commitment 15.0.	Achieve the objectives of commitment 15.0.	Design	DEWCP
17.0	Traffic Management Plan	Prepare a Traffic Management Plan which addresses: <ul style="list-style-type: none"> • Disturbance to traffic flows and pedestrians • Road deviations • Management measures 	Minimise the impact of railway infrastructure on vehicle and pedestrian traffic, and where traffic patterns are affected ensure acceptable air quality is maintained.	Design	DEWCP, Main Roads WA, Local Governments
18.0	Traffic Management Plan	Implement the Traffic Management Plan required by Commitment 17.0	Achieve the objectives of commitment 17.0	During construction	DEWCP, Main Roads WA, Local Governments

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* Copies of reports can be obtained upon request from PURD. Please contact Mr Colin Stedman, Ph: 9231 2799.

FIGURES

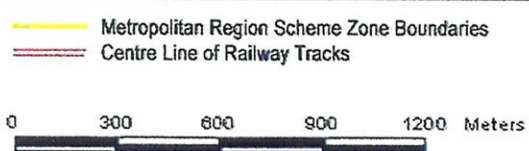


Figure 1

Overview of Proposed SWMR Alignment

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

Source: PURD & DPI, 2002

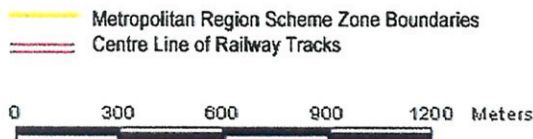


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Figure 2a

**Aerial Photography of
Proposed SWMR Alignment**

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

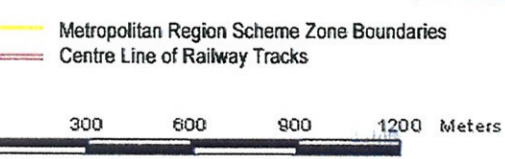
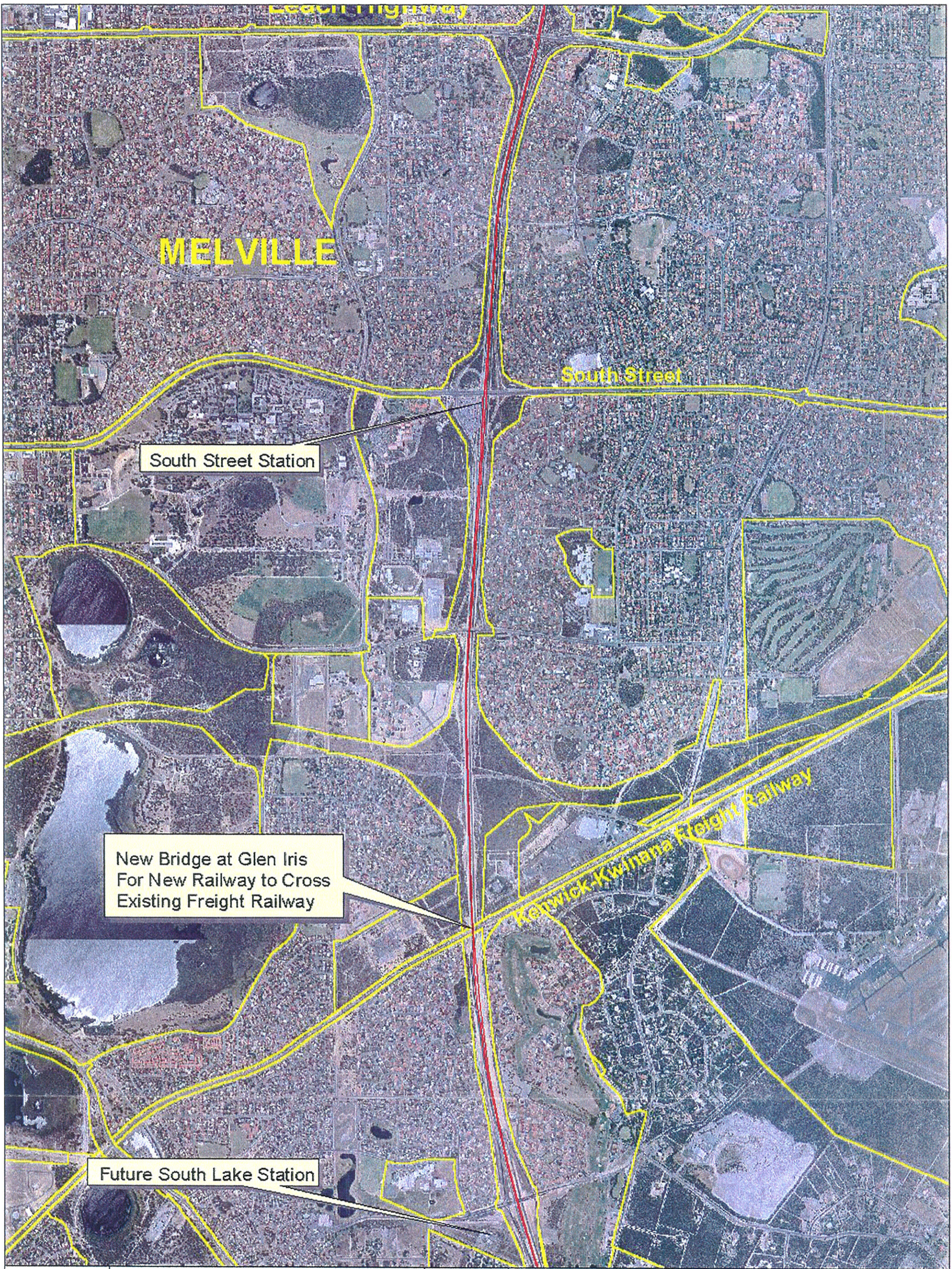


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Figure 2b

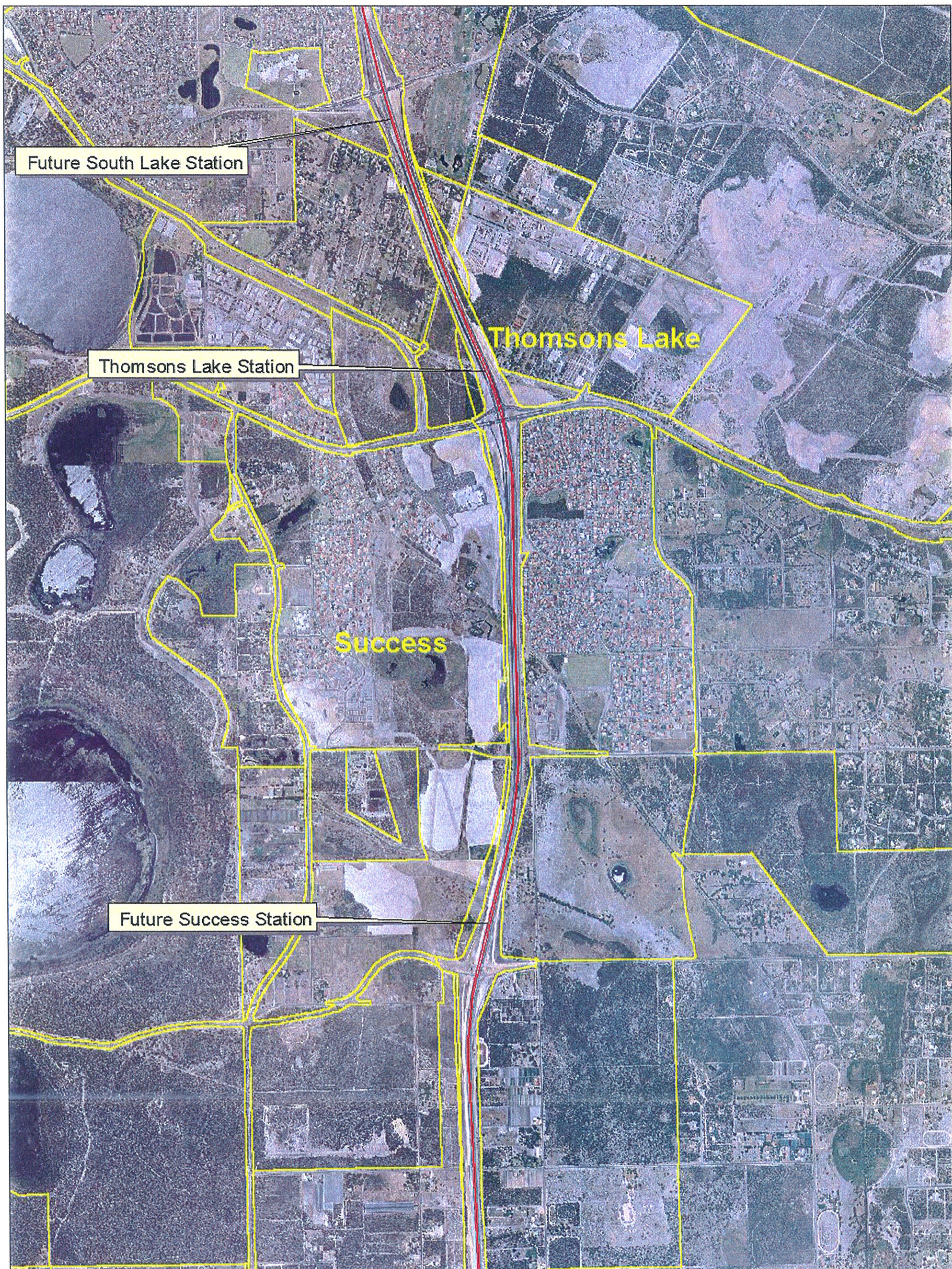
Aerial Photography of Proposed SWMR Alignment

Source: PURD



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Figure 2c
Aerial Photography of Proposed SWMR Alignment



Future South Lake Station

Thomsons Lake Station

Thomsons Lake

Success

Future Success Station

Metropolitan Region Scheme Zone Boundaries

Centre Line of Railway Tracks

0 300 600 900 1200 Meters



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Figure 2d

Aerial Photography of Proposed SWMR Alignment



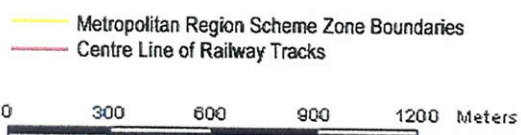
Future Mandogalup Station

MANDOGALUP

Future Anketell Station

**The Spectacles
Wetlands**

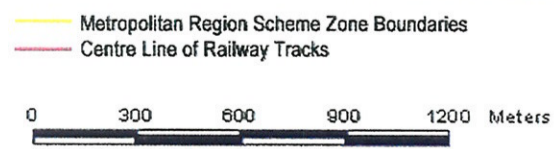
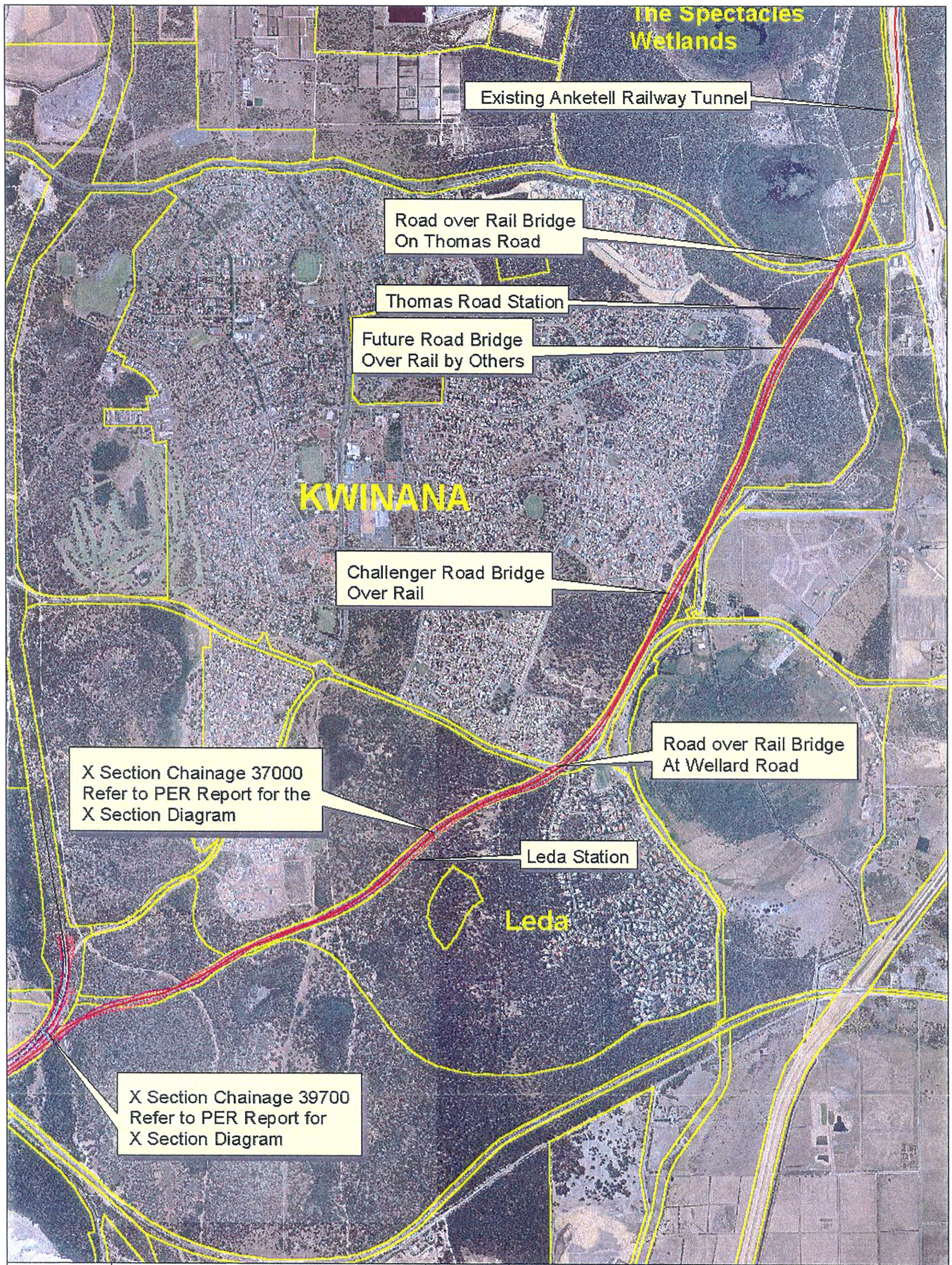
Existing Anketell
Railway Tunnel



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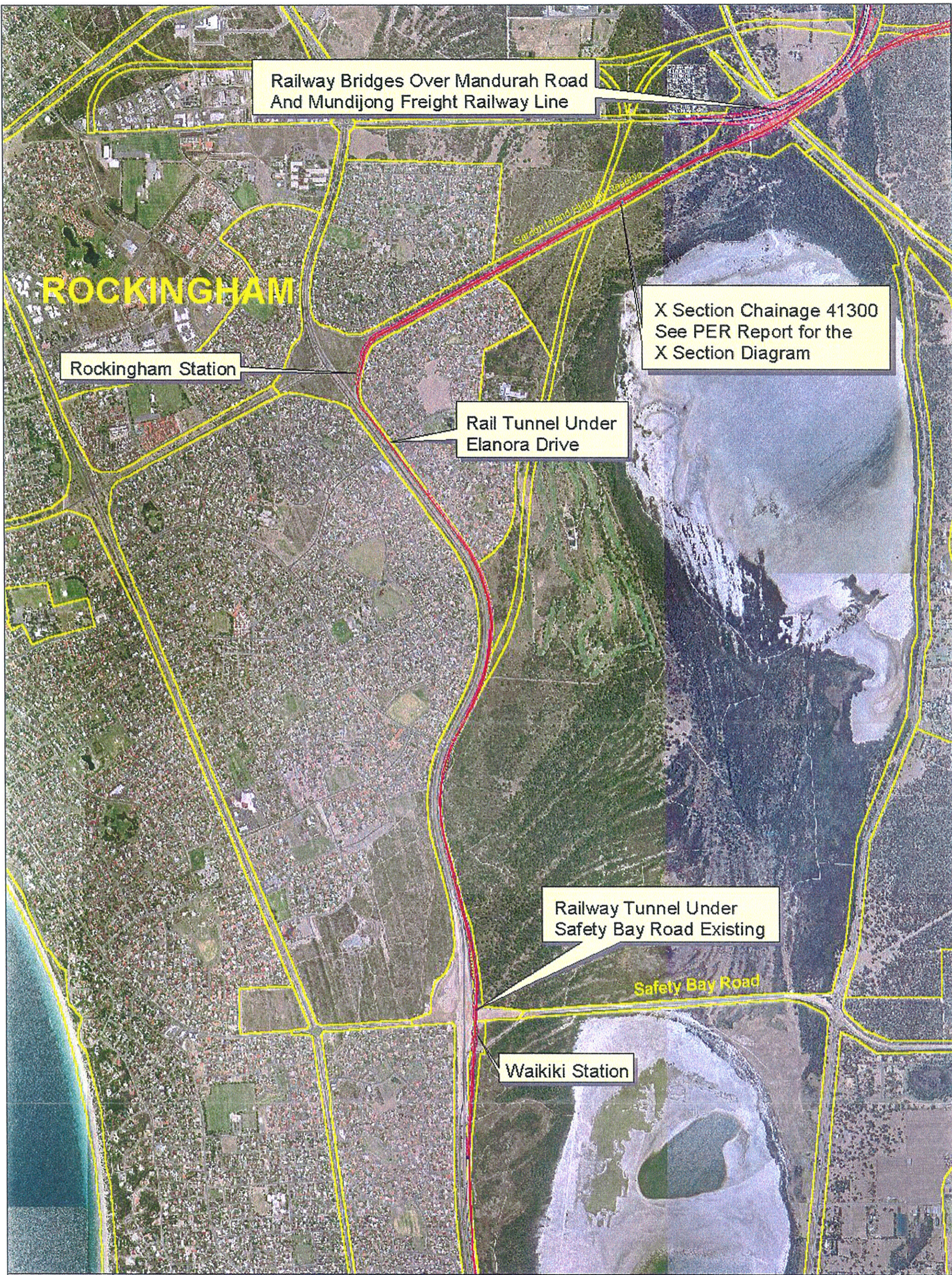
Figure 2e

**Aerial Photography of
Proposed SWMR Alignment**



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Figure 2f
Aerial Photography of Proposed SWMR Alignment



Railway Bridges Over Mandurah Road
And Mundijong Freight Railway Line

ROCKINGHAM

Rockingham Station

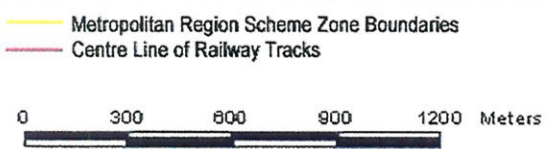
X Section Chainage 41300
See PER Report for the
X Section Diagram

Rail Tunnel Under
Elanora Drive

Railway Tunnel Under
Safety Bay Road Existing

Safety Bay Road

Waikiki Station



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Figure 2g

**Aerial Photography of
Proposed SWMR Alignment**

Source: PURD

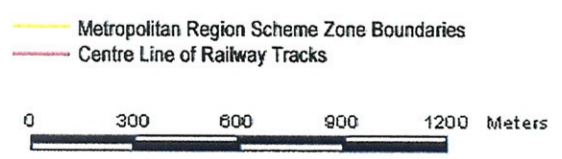


X Section Chainage 50500
See PER Report For
X Section Diagram

Railway Bridge over
Mandurah Road

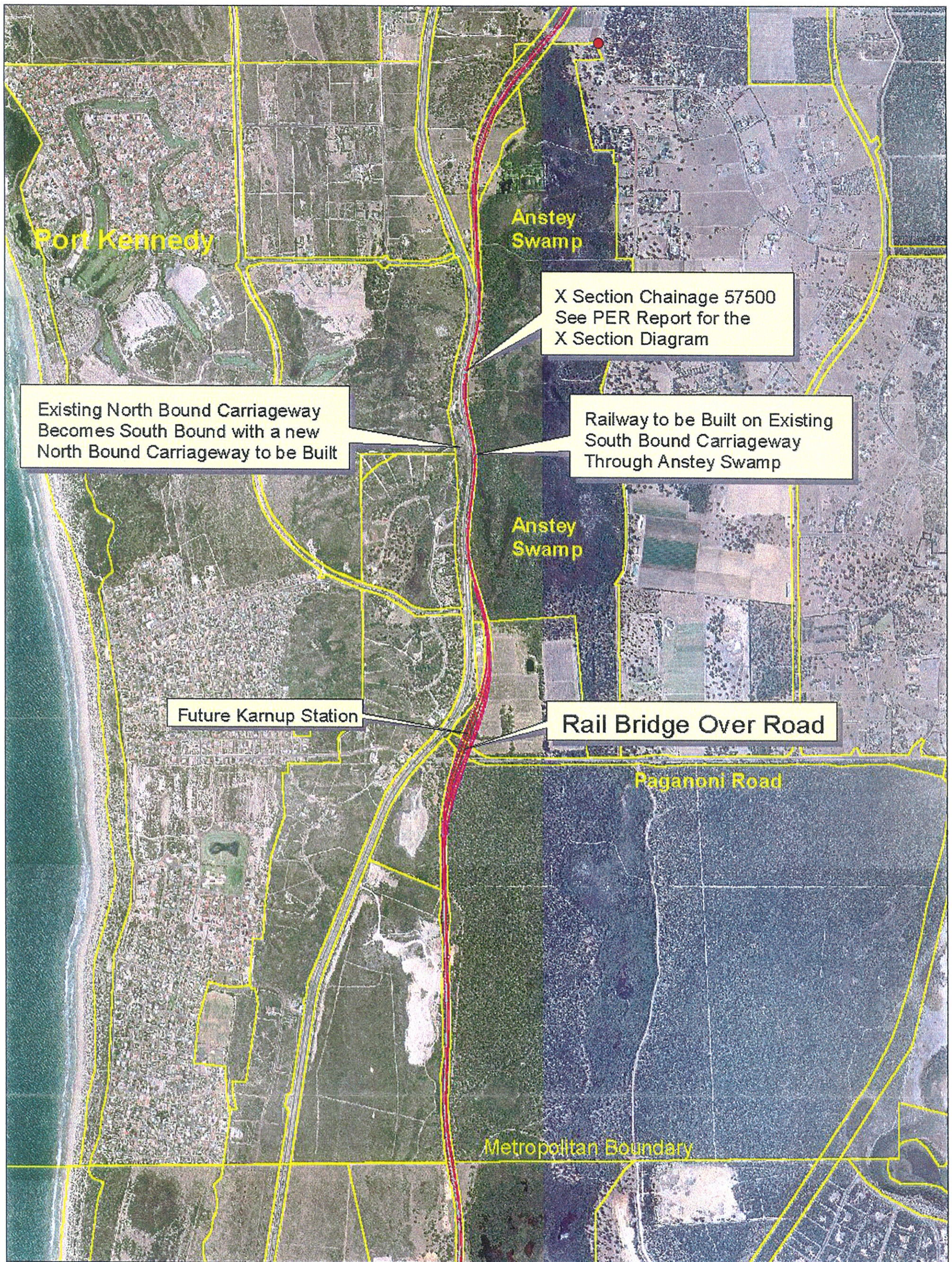
Road Bridge over Railway

Future Stakehill Road Station



UNCONTROLLED DOCUMENT

Figure 2h
Aerial Photography of
Proposed SWMR Alignment



Existing North Bound Carriageway Becomes South Bound with a new North Bound Carriageway to be Built

X Section Chainage 57500
See PER Report for the X Section Diagram

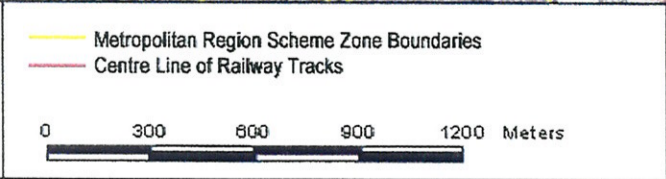
Railway to be Built on Existing South Bound Carriageway Through Anstey Swamp

Future Karnup Station

Rail Bridge Over Road

Paganoni Road

Metropolitan Boundary



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Figure 2i
Aerial Photography of Proposed SWMR Alignment



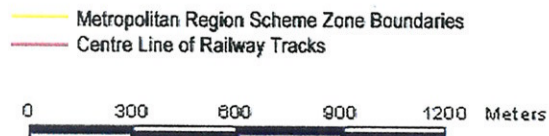
X Section Chainage 63800
See PER Report for the
X Section Diagram

Future Lakelands Station

Interim At Grade
Occupational Crossing

Gordon Road Road
over Rail Bridge

Future Gordon Road Station



UNCONTROLLED DOCUMENT

Figure 2j
**Aerial Photography of
Proposed SWMR Alignment**



— Metropolitan Region Scheme Zone Boundaries
— Centre Line of Railway Tracks

0 300 600 900 1200 Meters



UNCONTROLLED DOCUMENT

Figure 2k

**Aerial Photography of
Proposed SWMR Alignment**

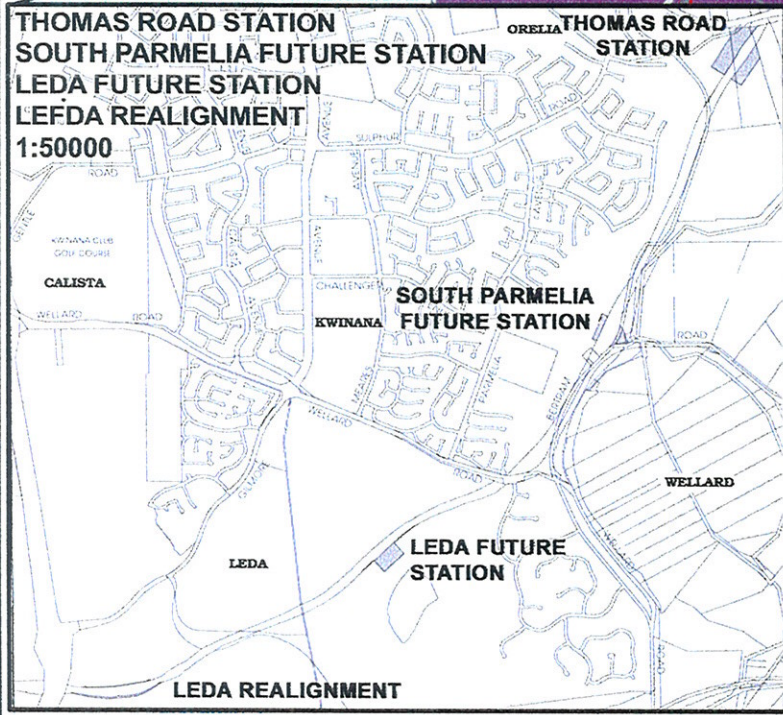
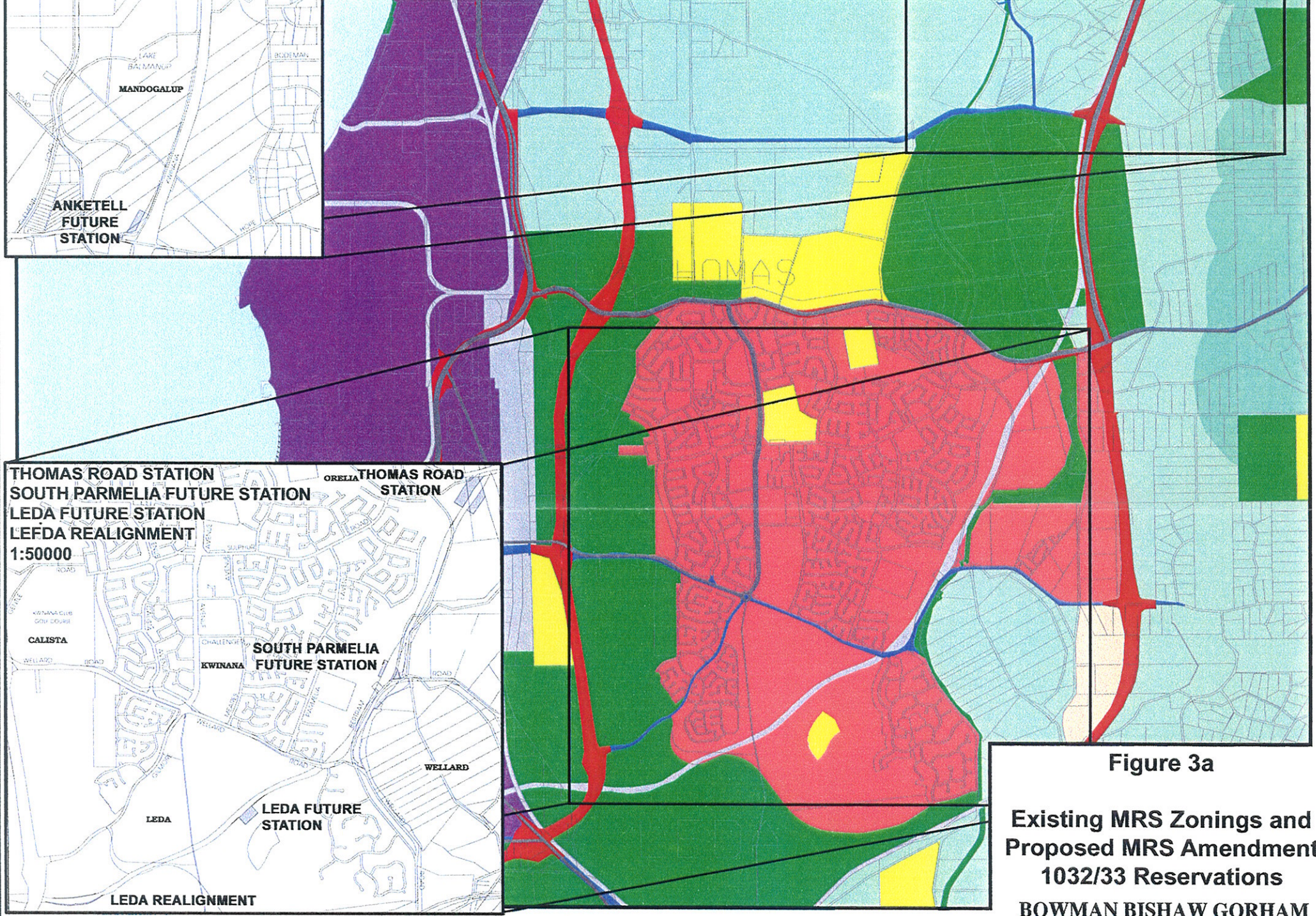


Figure 3a
Existing MRS Zonings and Proposed MRS Amendment 1032/33 Reservations
BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

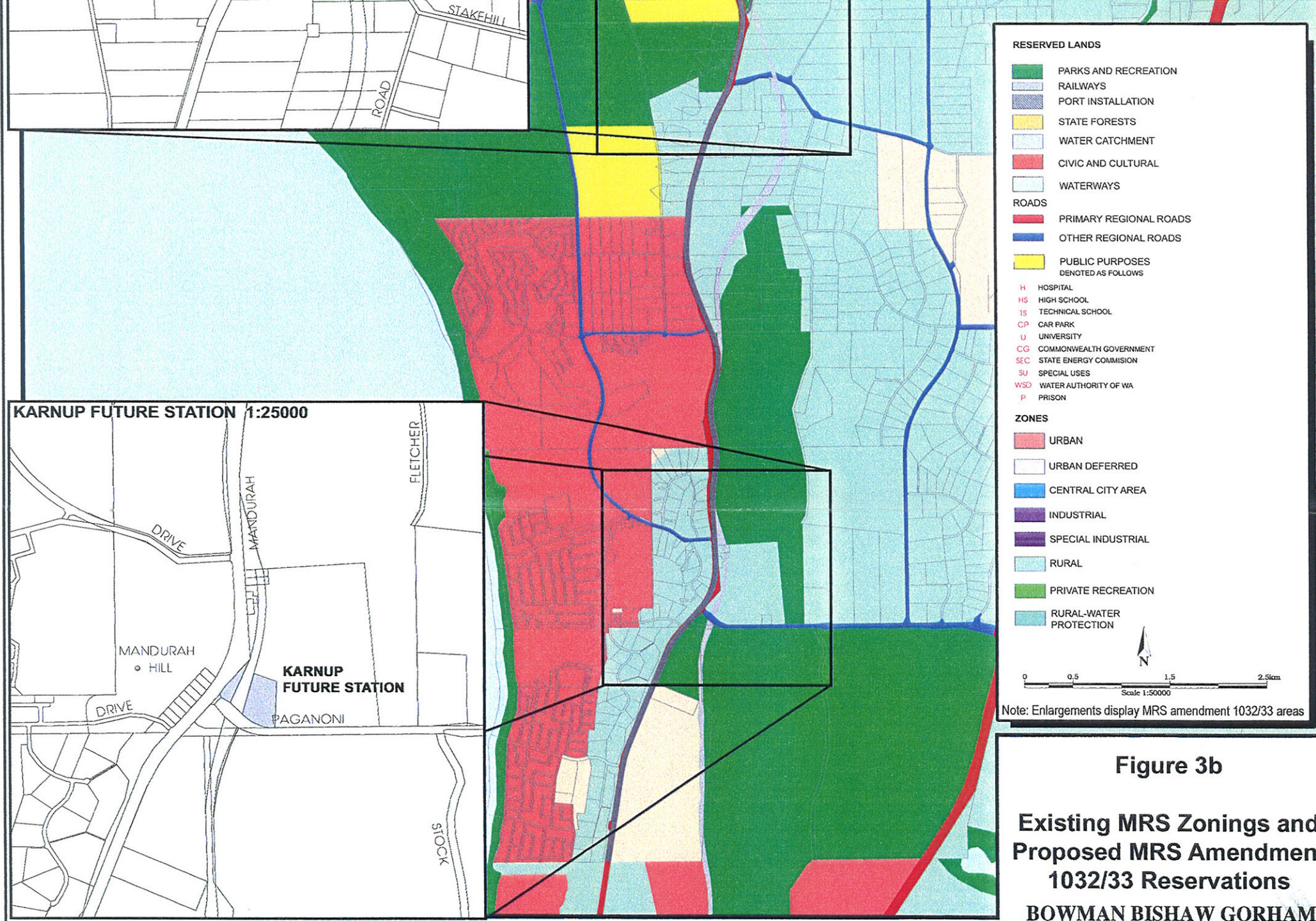


Figure 3b

**Existing MRS Zonings and
Proposed MRS Amendment
1032/33 Reservations**

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

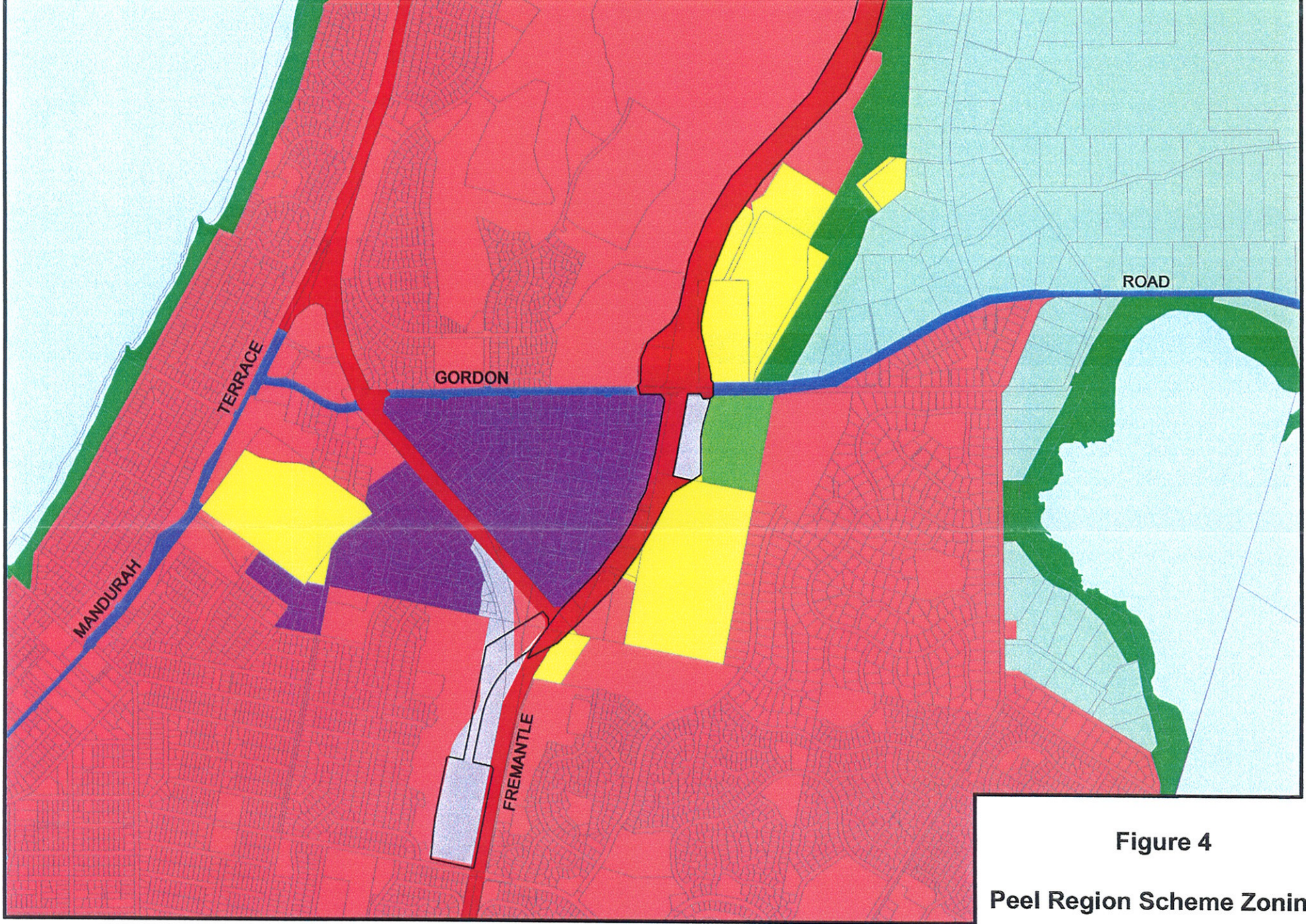
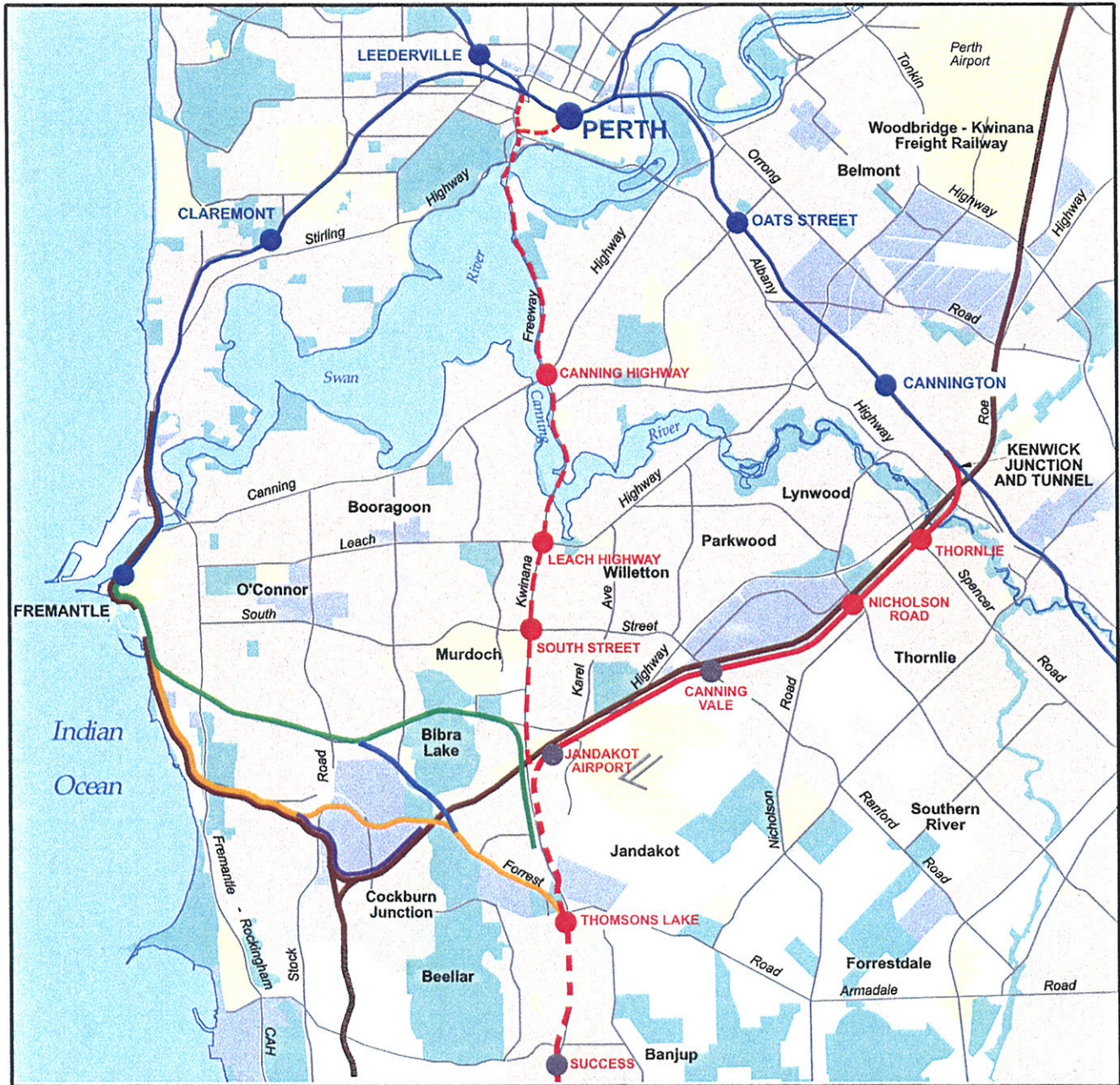


Figure 4

Peel Region Scheme Zonings



LEGEND

- Proposed Passenger Line ---
- Jandakot to Perth via Kenwick option —
- SWMR Stations ●
- Future Stations ●
- Existing Passenger Lines —
- Existing Freight Lines —

Thomsons Lake to Fremantle Route Options

- Option 1 - Roe Highway —
- Option 2 - Existing Rail Reserve Through Bibra Lake/Forrest Road —
- Option 3 - Existing Rail Reserve —
- Option 4 - Roe Highway / Forrest Road —

Figure 5

Previous SWMR Alignment Options

Source: Government of Western Australia, 2002

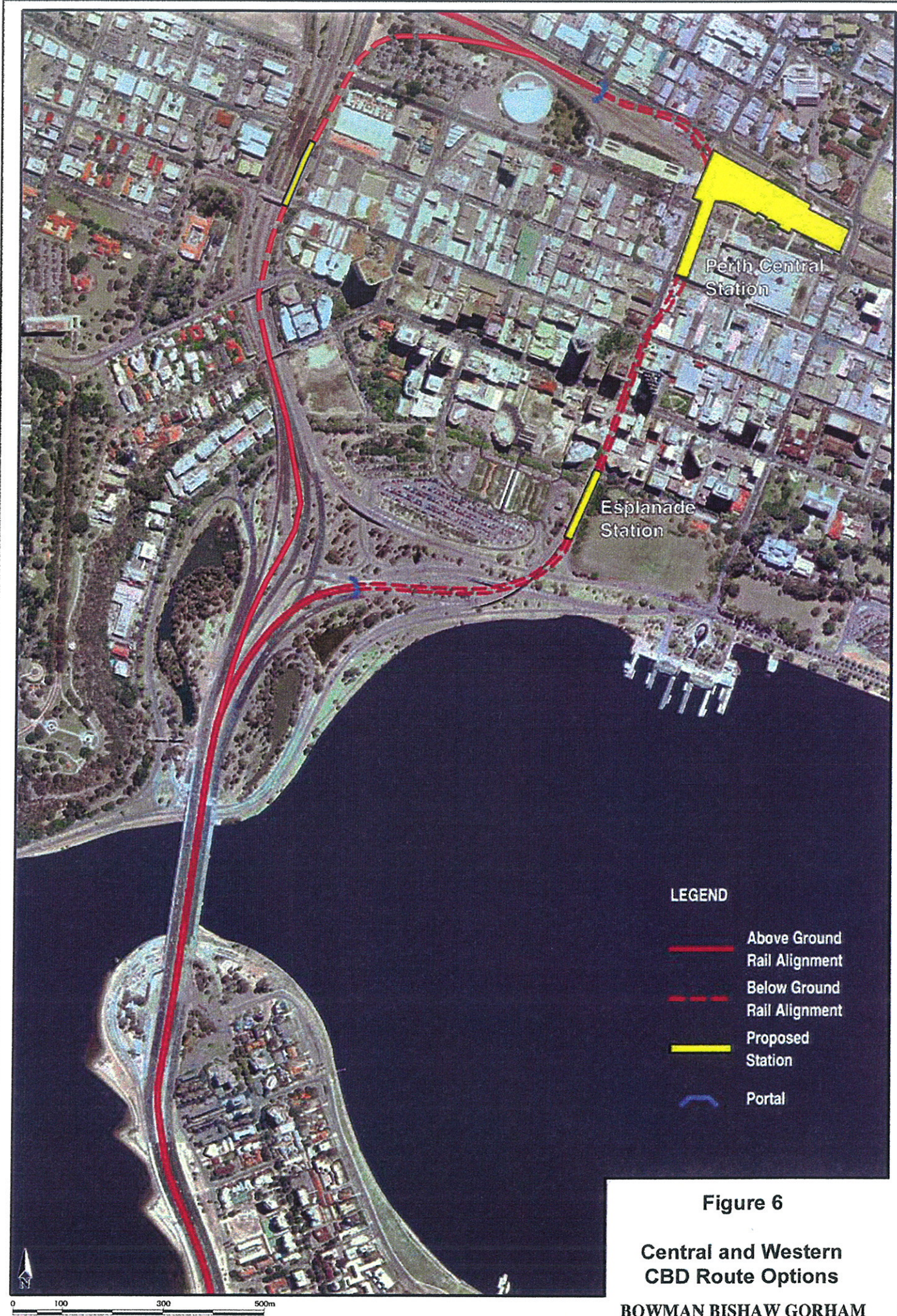


Figure 6

**Central and Western
CBD Route Options**

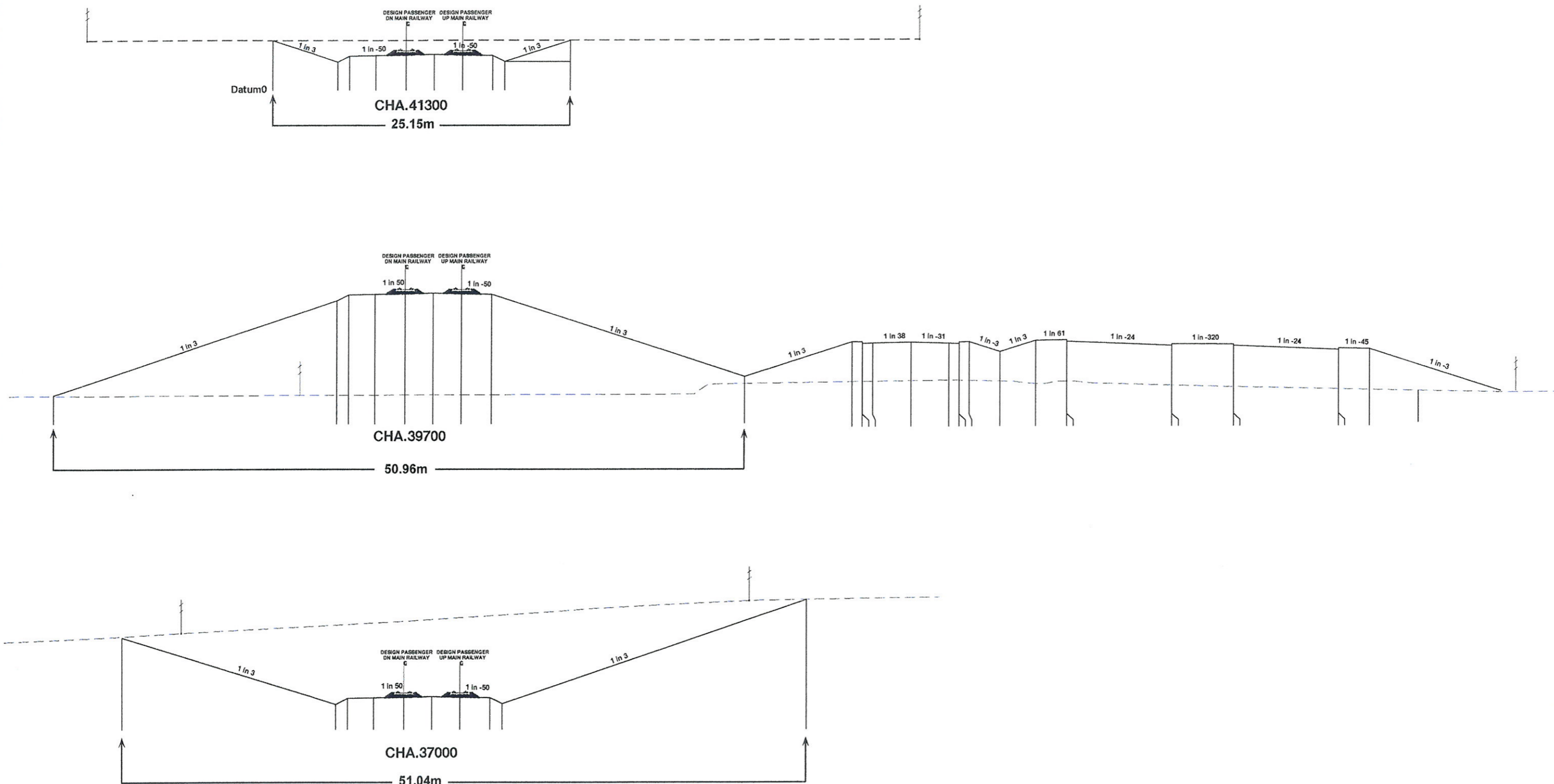


Figure 7a

Railway Cross Section

Note: See Figure 2 for chainage locations

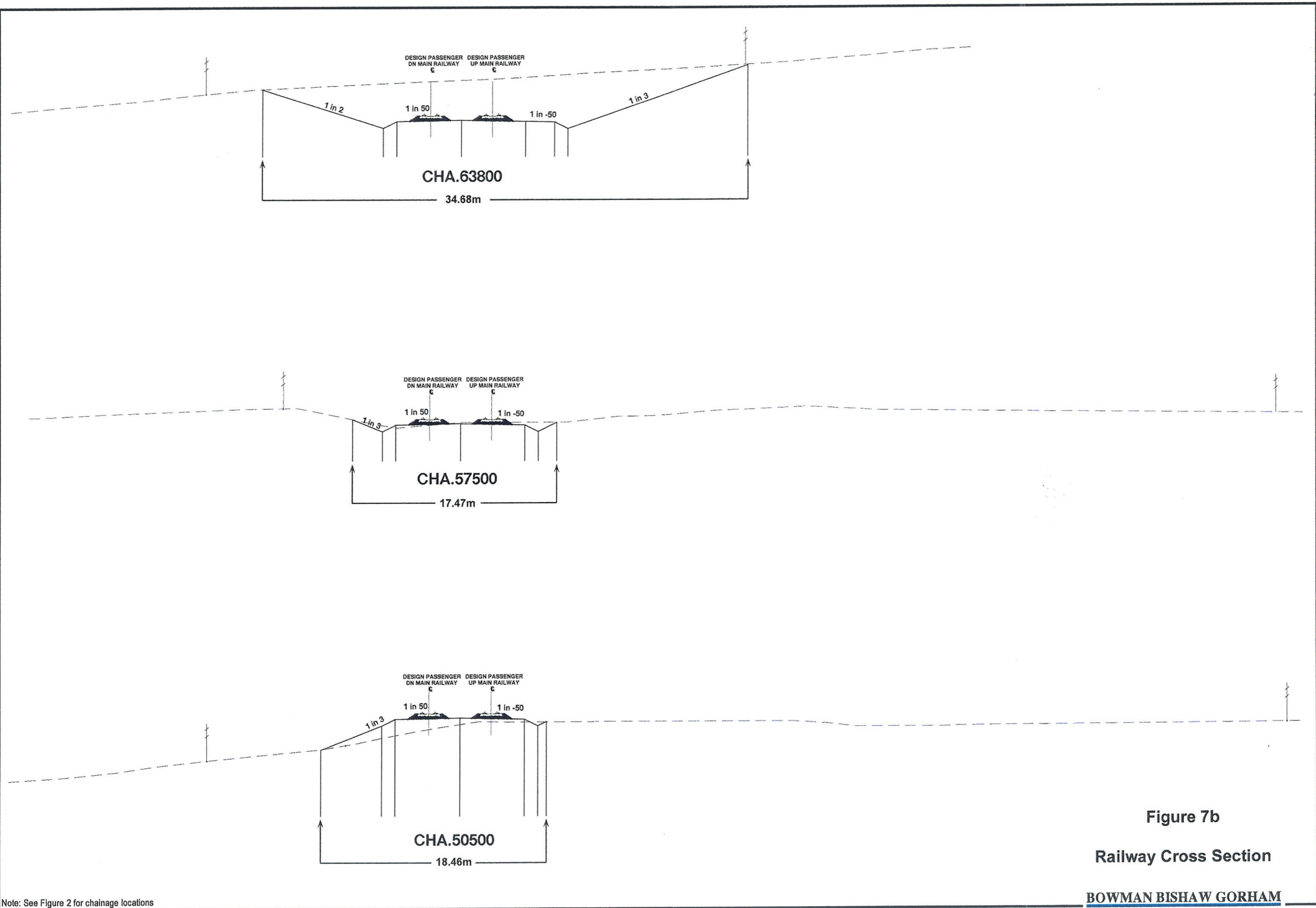


Figure 7b

Railway Cross Section

Note: See Figure 2 for chainage locations

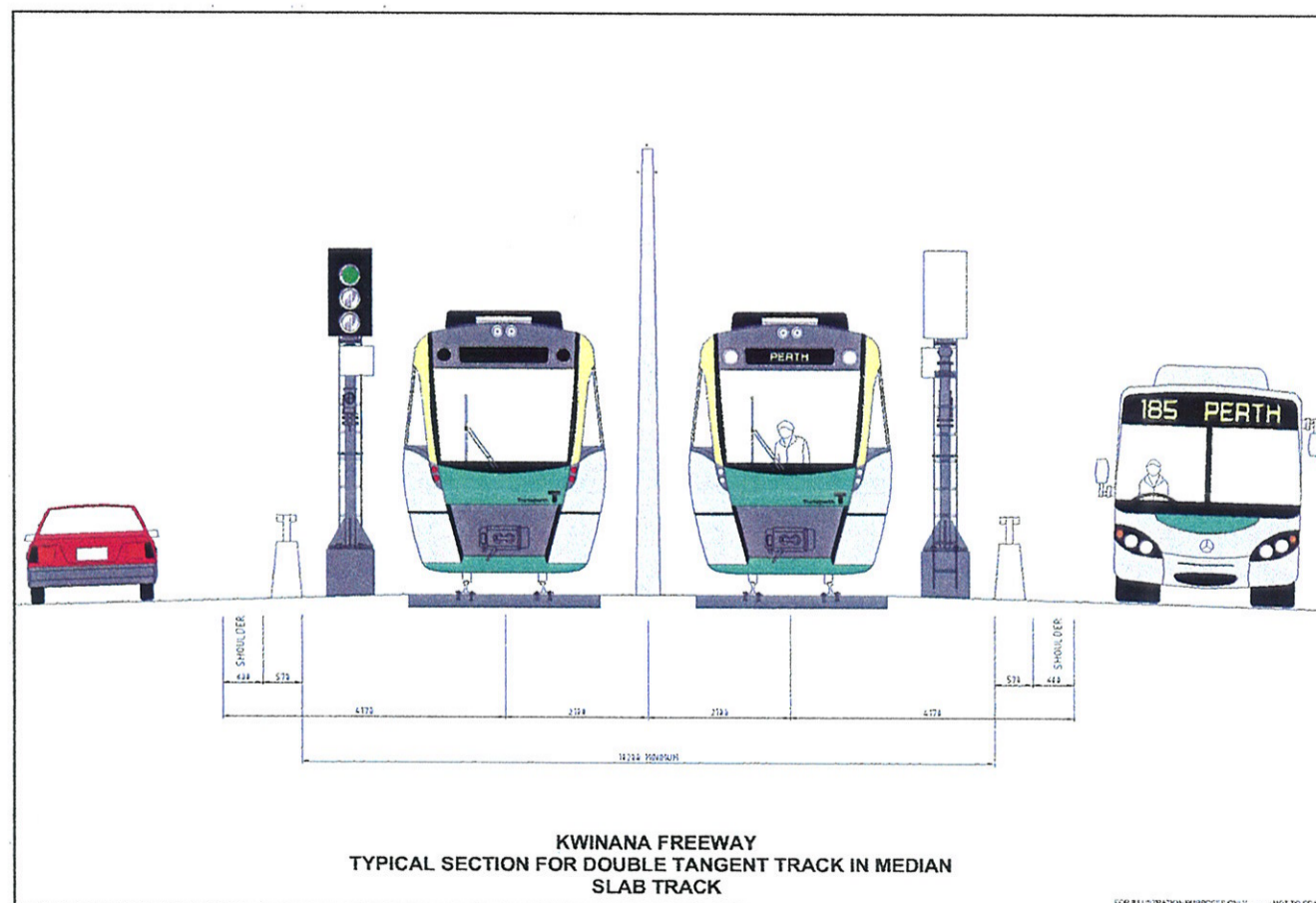
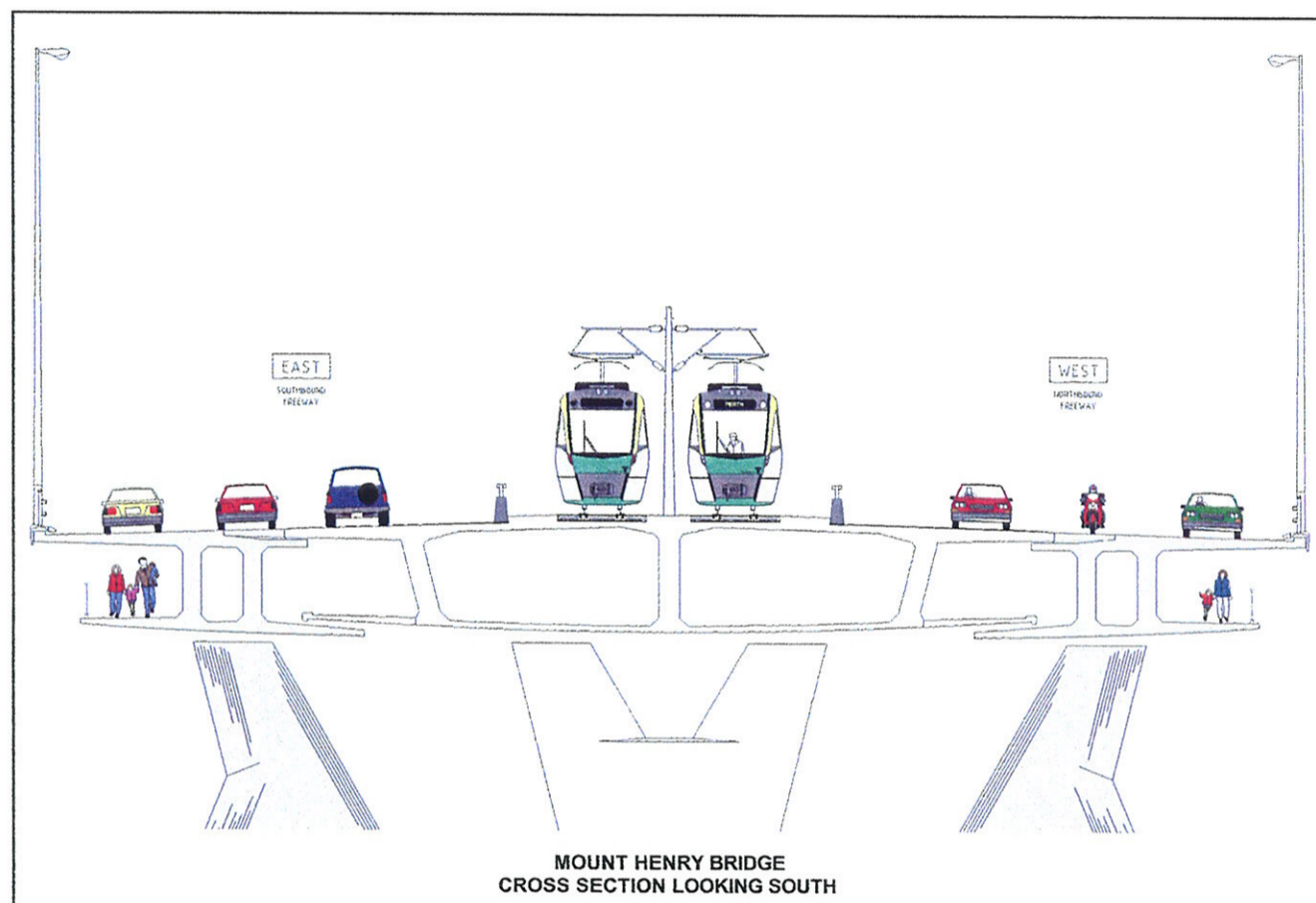
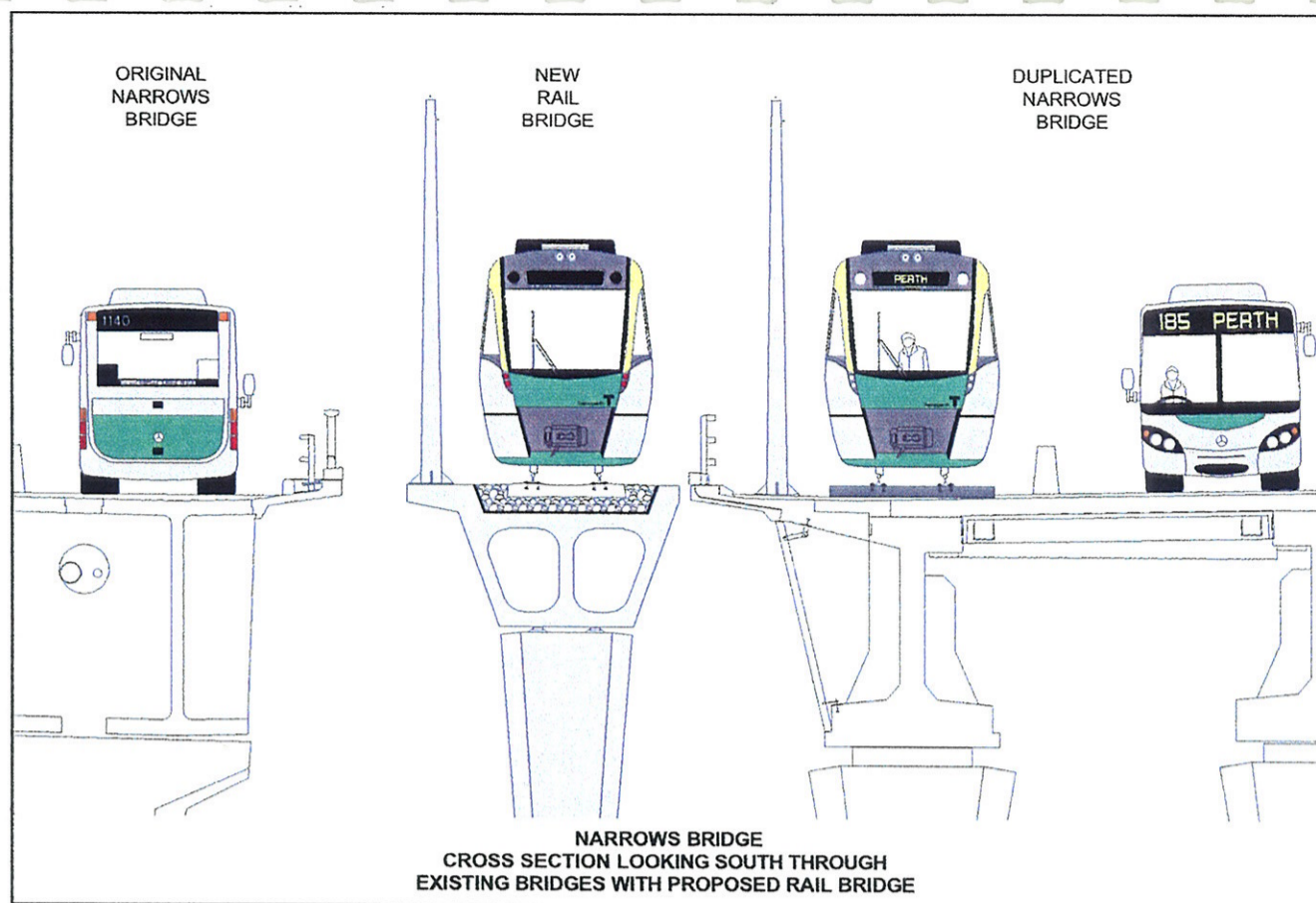
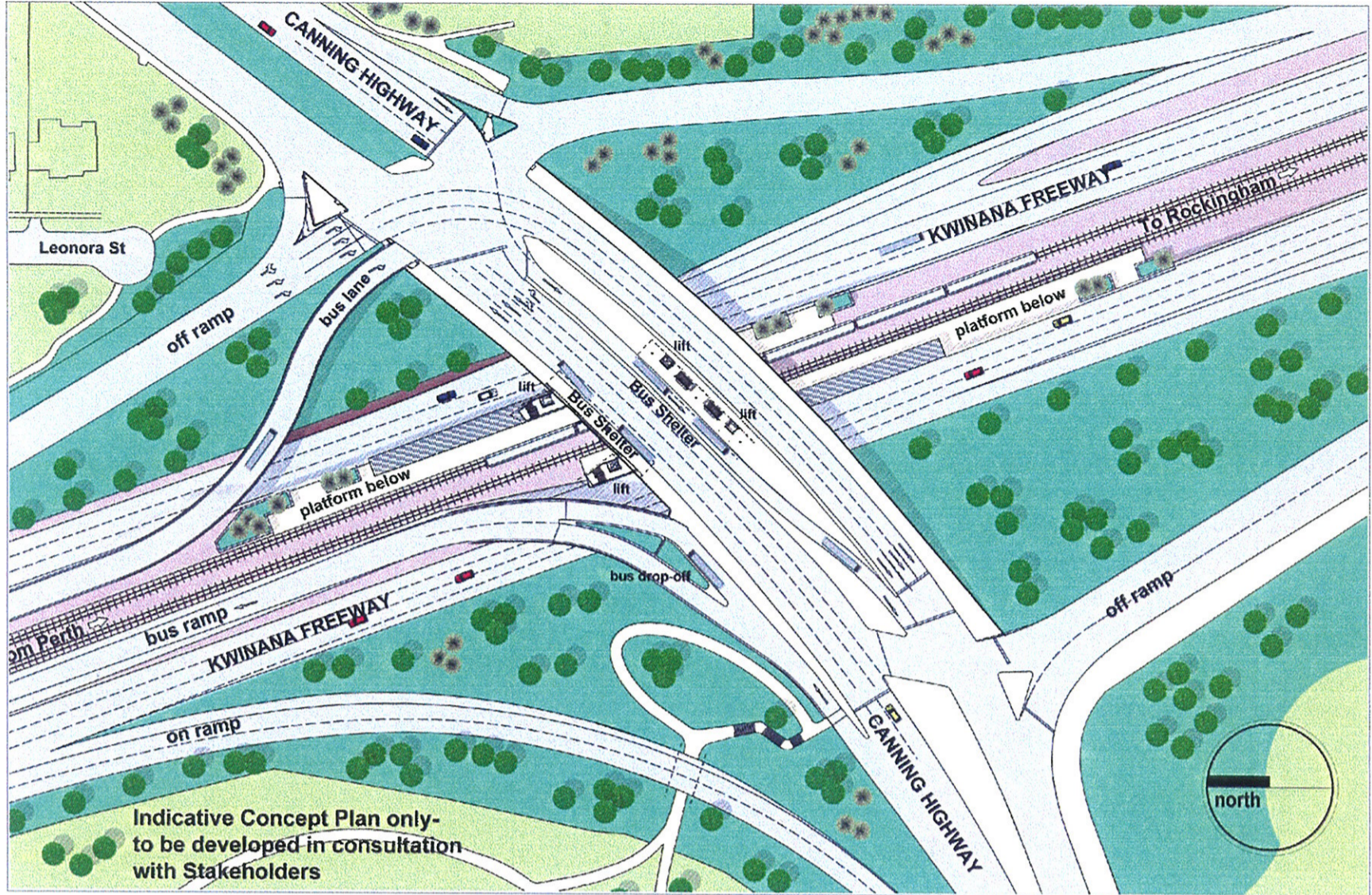


Figure 7c

Railway Cross Section

* INDICATIVE CONCEPT TO BE DEVELOPED WITH STAKEHOLDERS

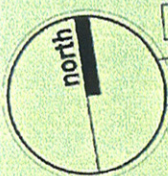
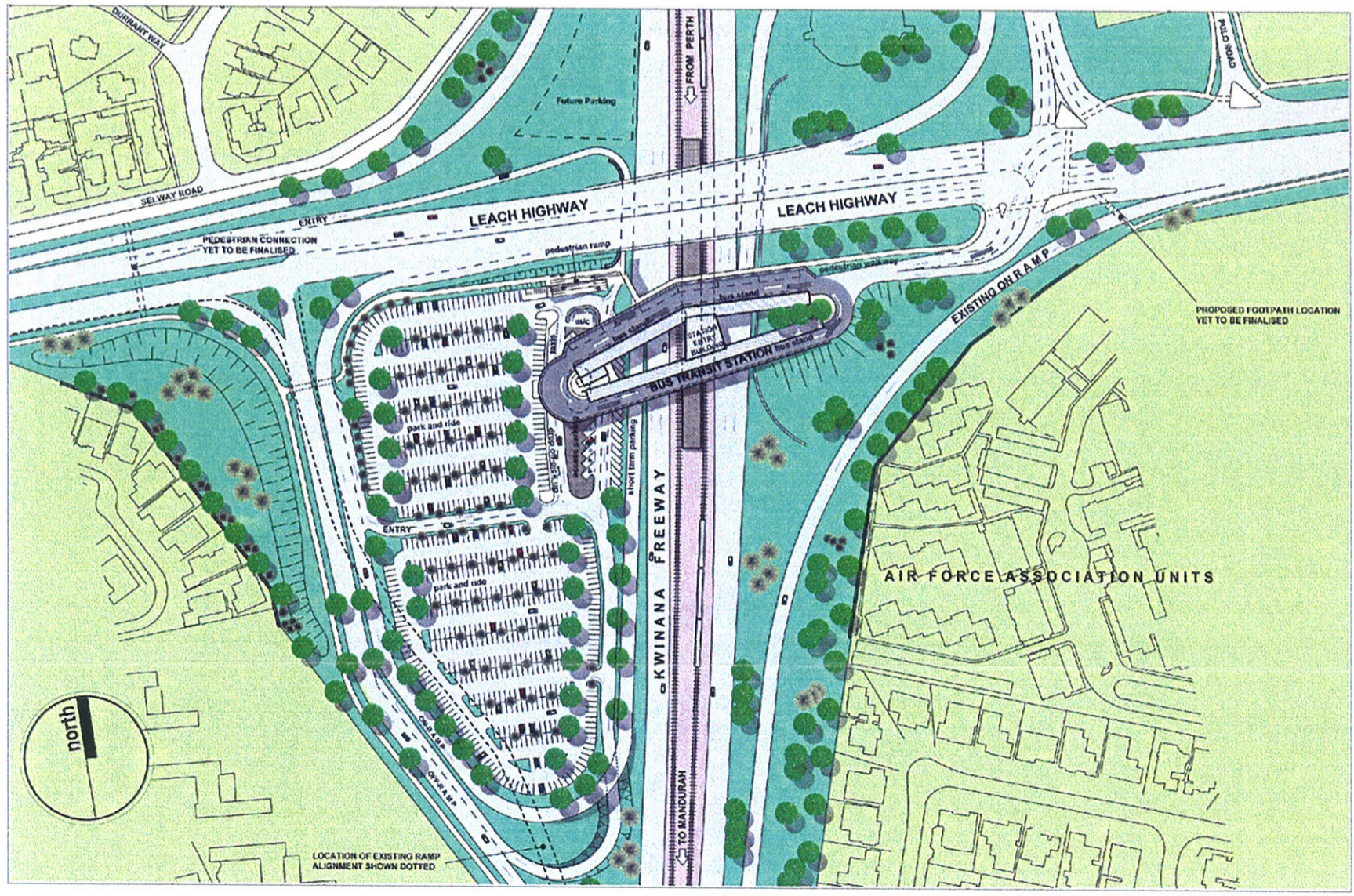


Indicative Concept Plan only -
to be developed in consultation
with Stakeholders

CANNING BRIDGE TRANSIT STATION - BRIDGE LEVEL

FOR ILLUSTRATION PURPOSES ONLY NOT TO SCALE

* INDICATIVE CONCEPT TO BE DEVELOPED WITH STAKEHOLDERS



LOCATION OF EXISTING RAMP
ALIGNMENT SHOWN DOTTED

LEACH HIGHWAY TRANSIT STATION

FOR ILLUSTRATION PURPOSES ONLY NOT TO SCALE

Figure 8b

Station Concept Plans

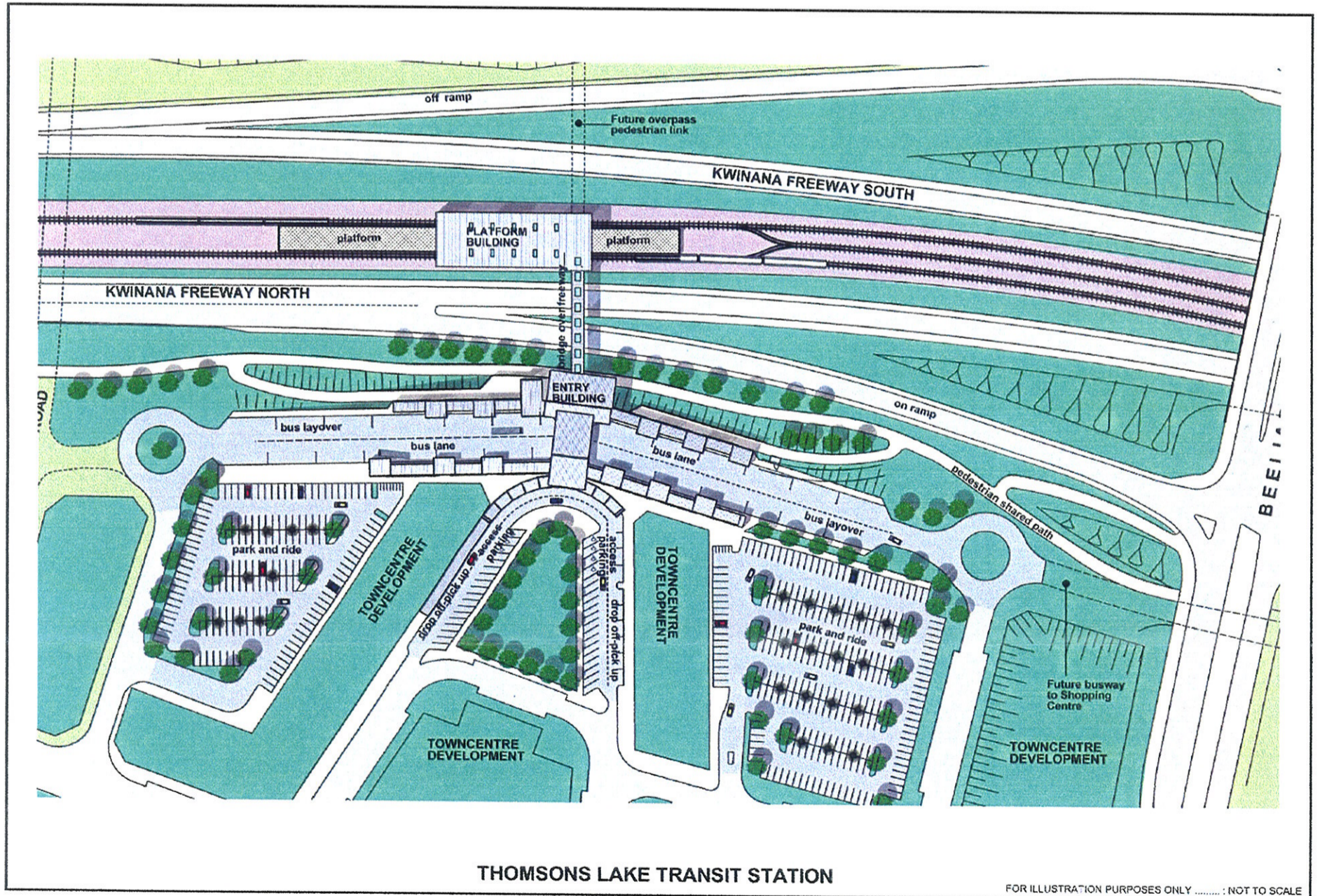
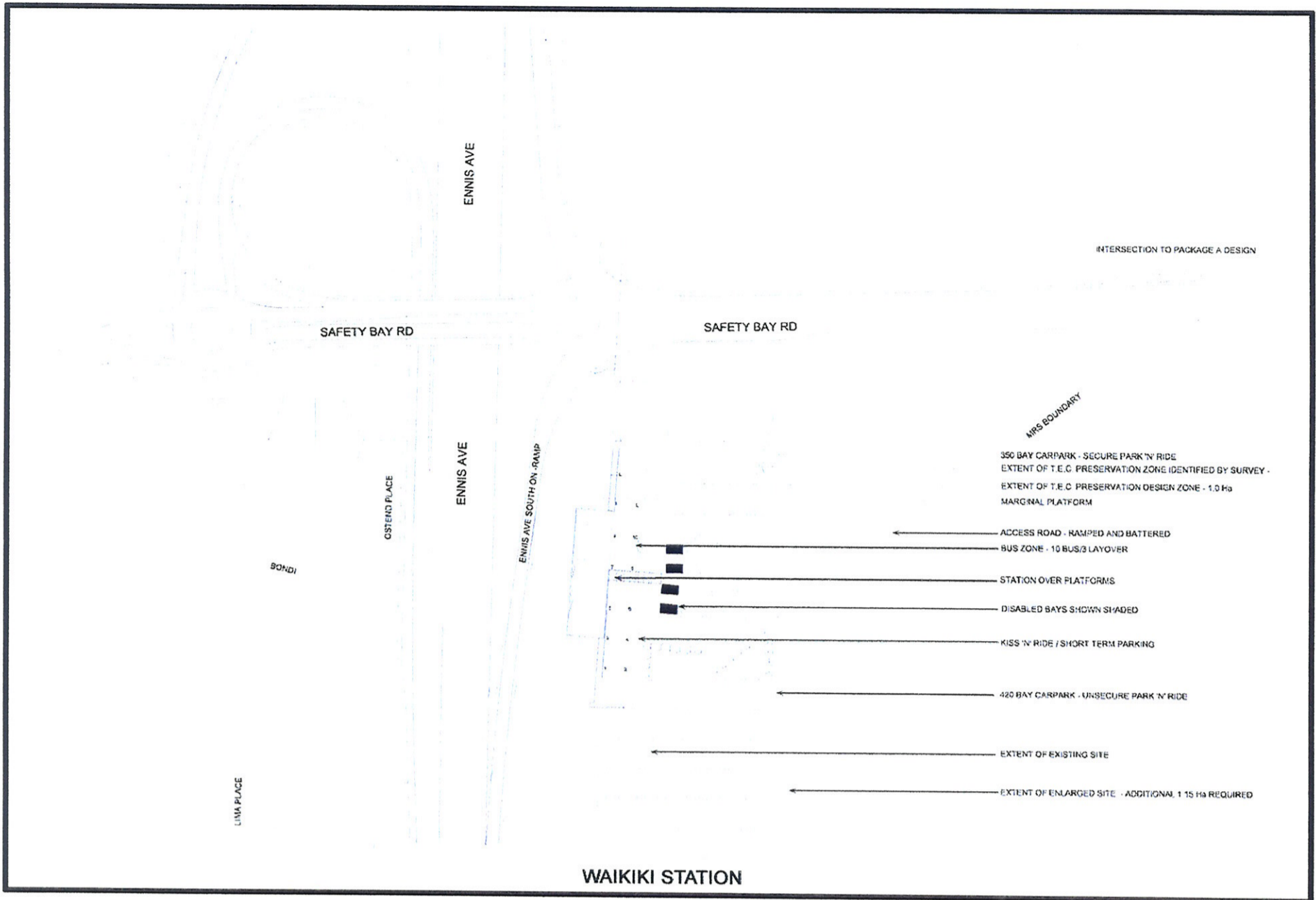
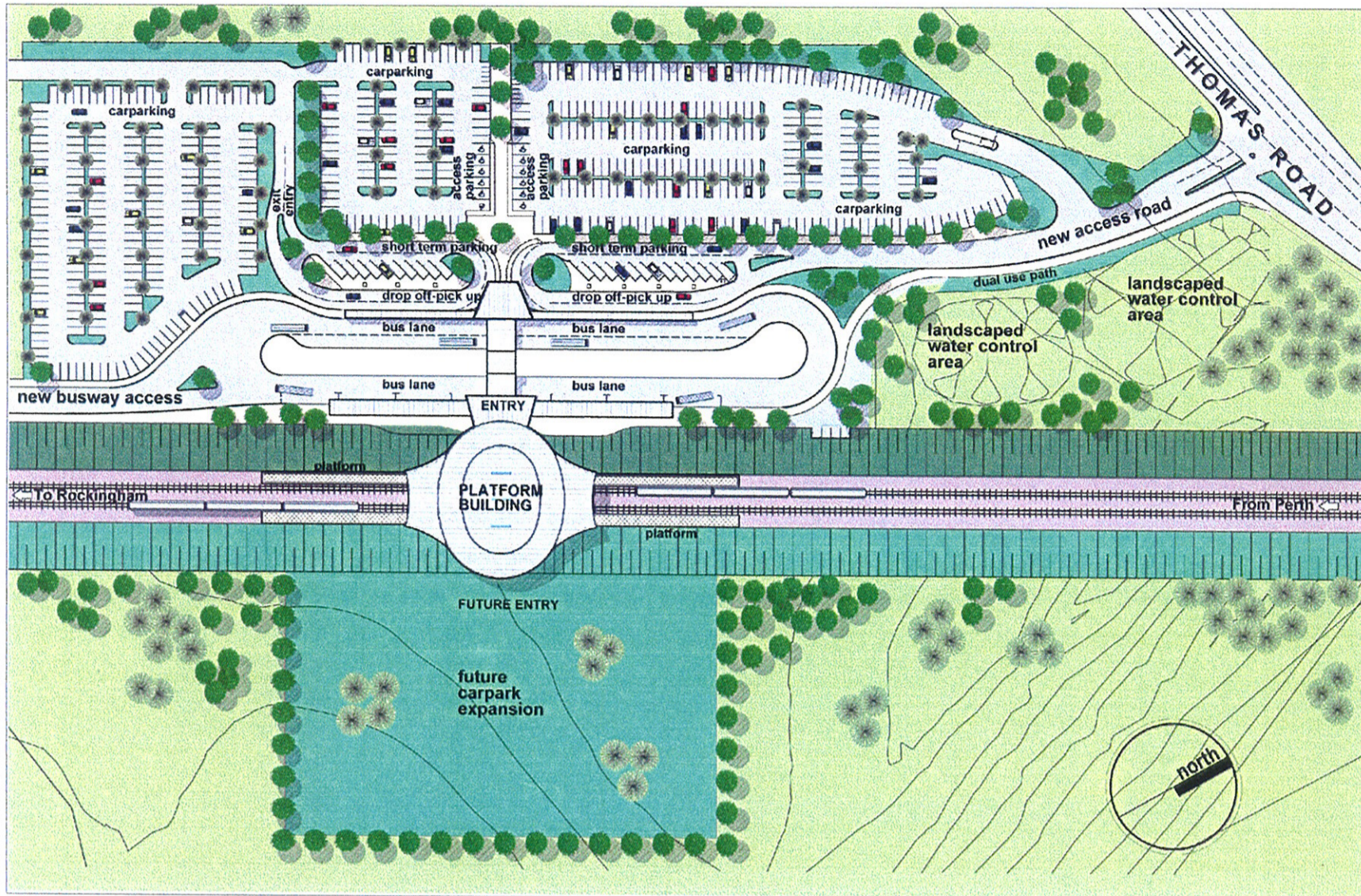


Figure 8c

Station Concept Plans

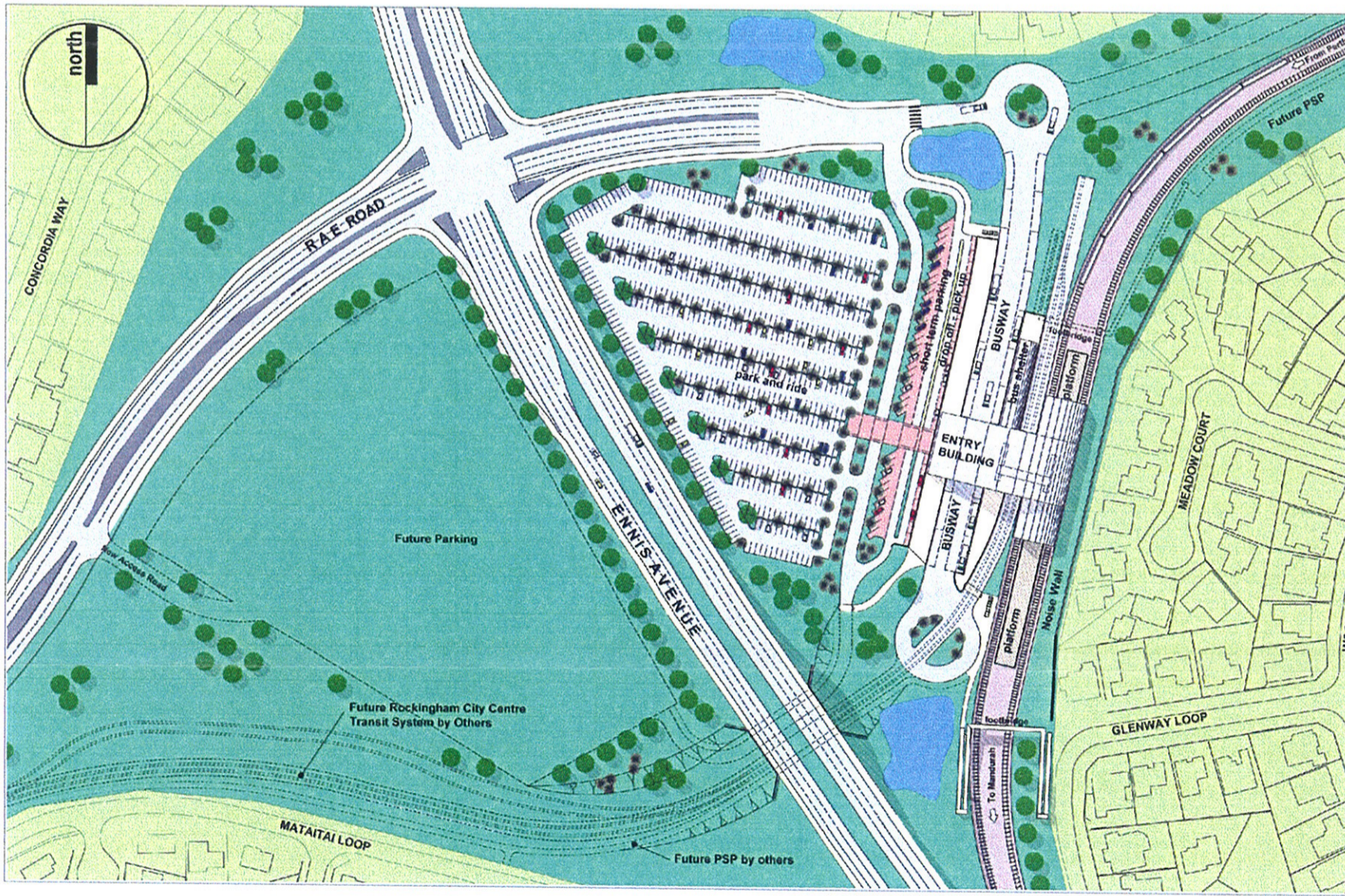
* INDICATIVE CONCEPT TO BE DEVELOPED WITH STAKEHOLDERS



THOMAS ROAD TRANSIT STATION

FOR ILLUSTRATION PURPOSES ONLY : NOT TO SCALE

* INDICATIVE CONCEPT TO BE DEVELOPED WITH STAKEHOLDERS



ROCKINGHAM TRANSIT STATION

FOR ILLUSTRATION PURPOSES ONLY : NOT TO SCALE

Figure 8d

Station Concept Plans

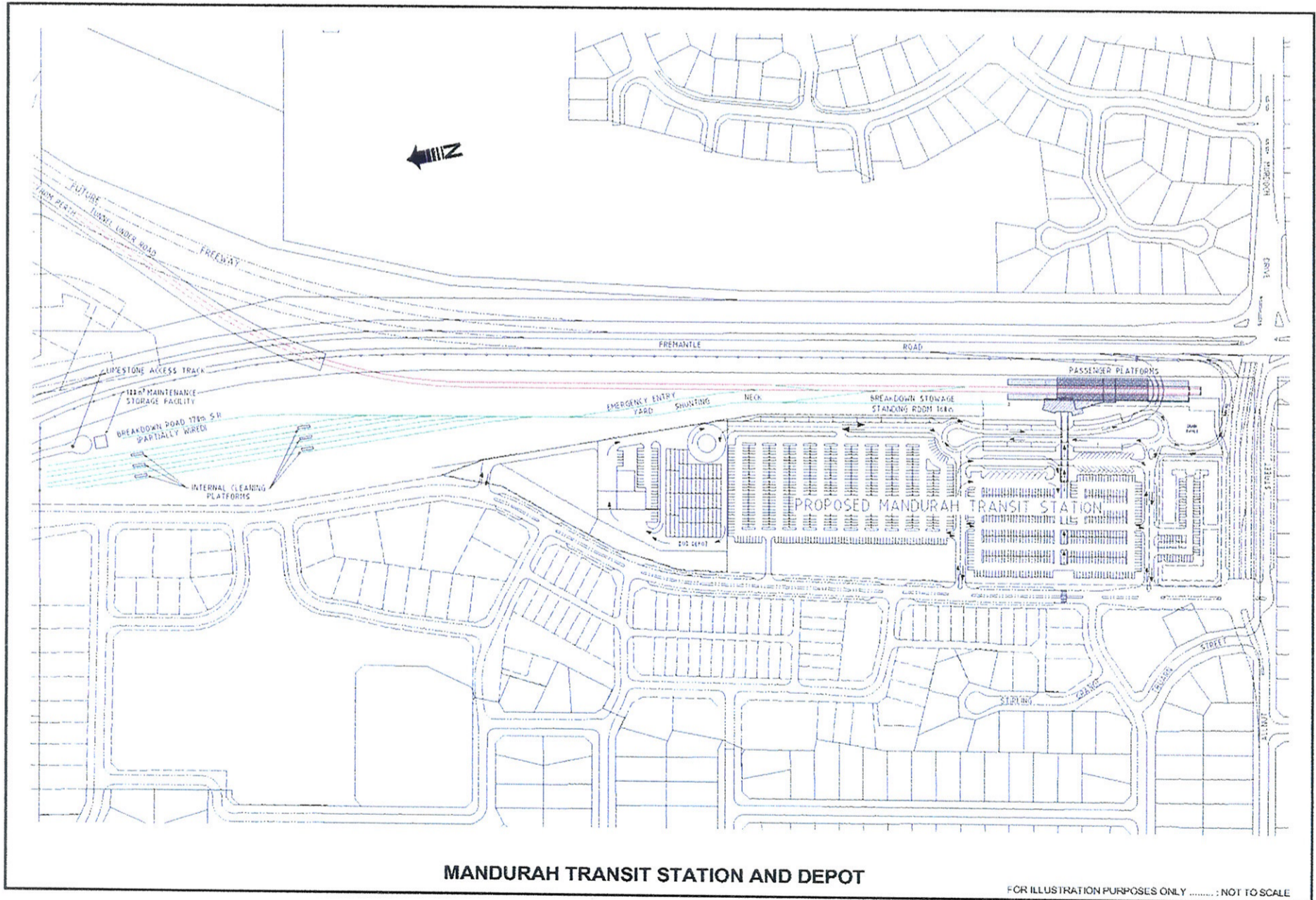
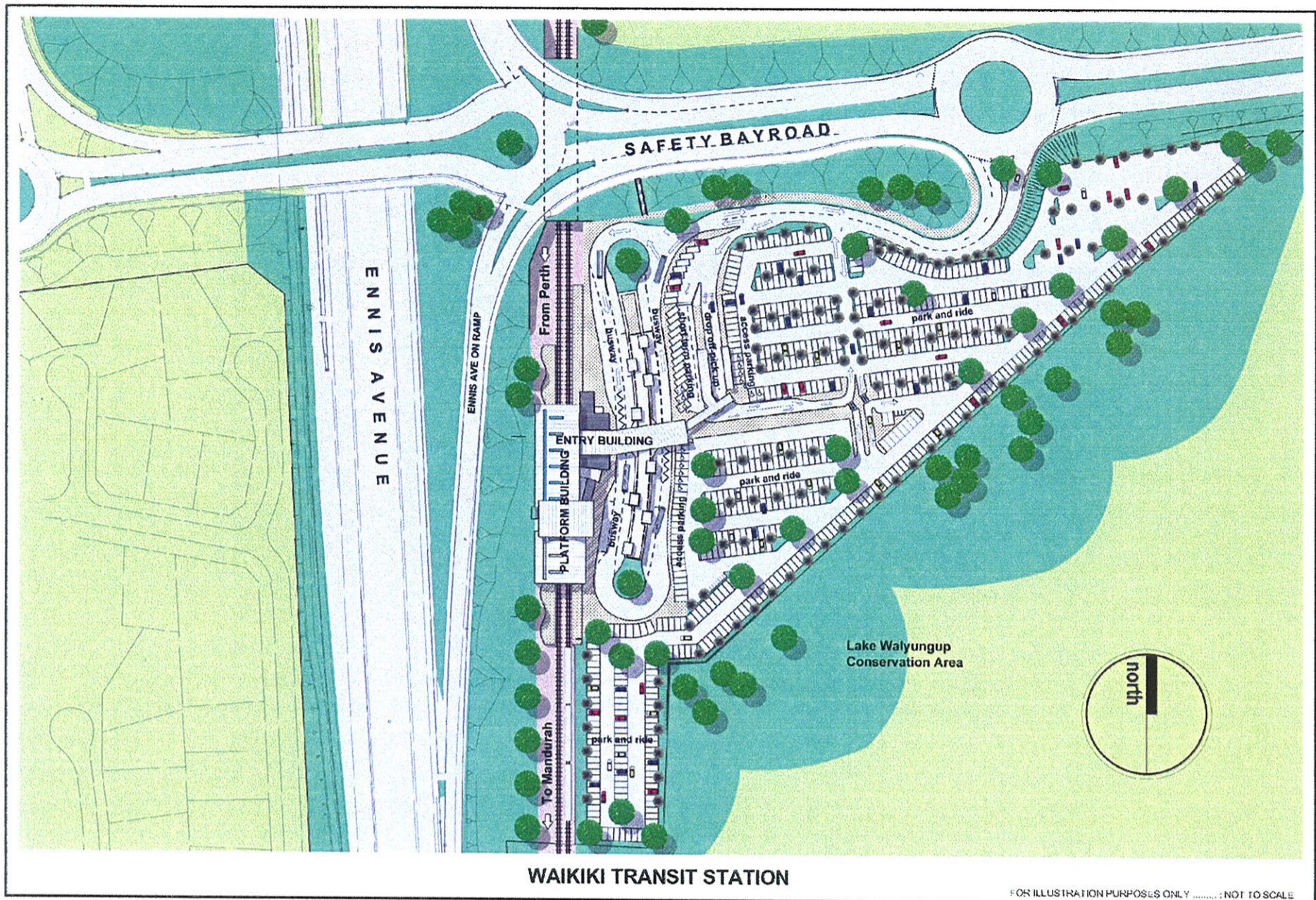


Figure 8e

Station Concept Plans

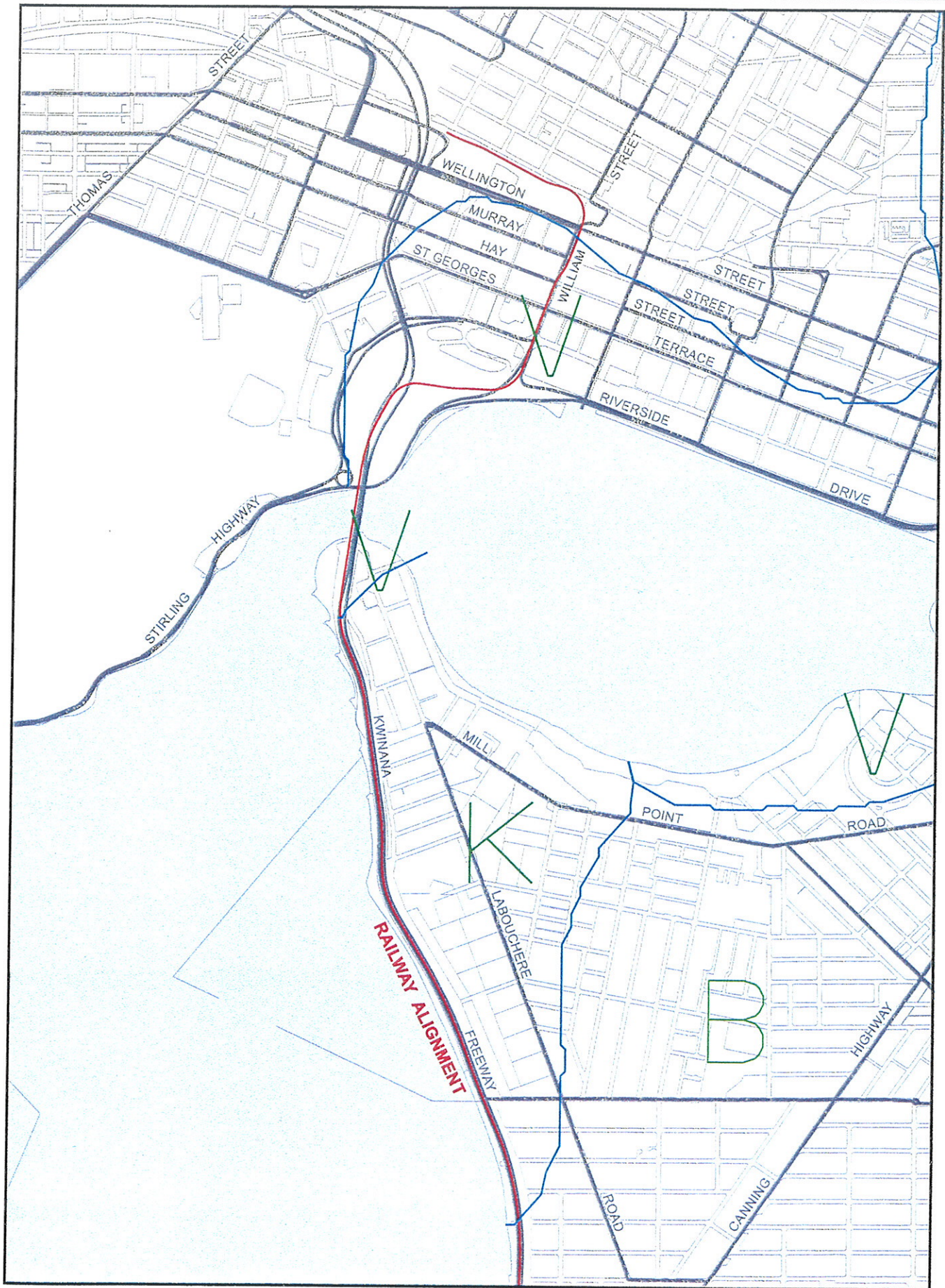
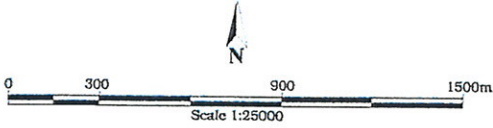


Figure 9a

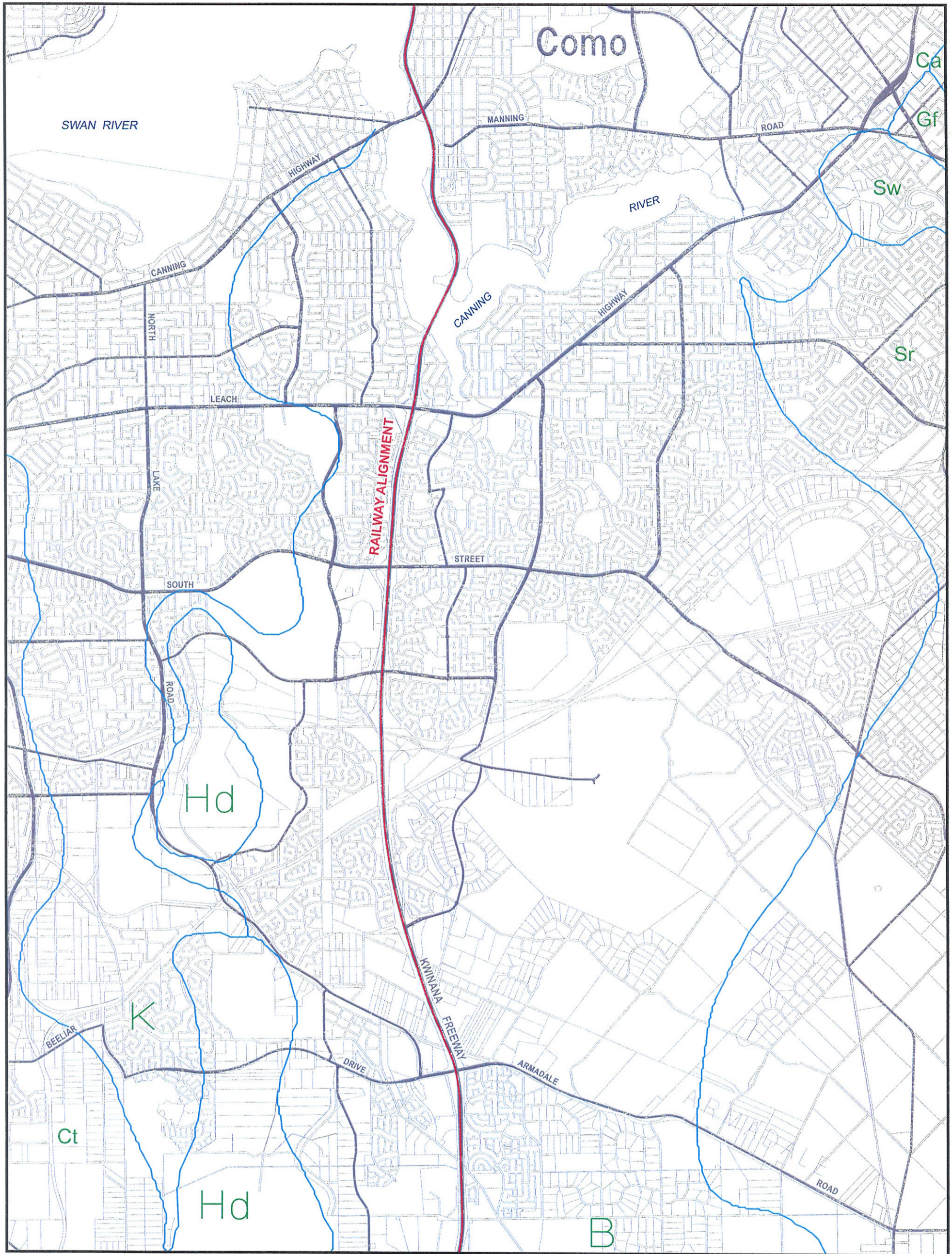
LEGEND	
V	Vasse
K	Karakatta
B	Bassendeau



Landform and Soil Units
(Churchward & McArthur, 1978)

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

Source: Ministry for Planning



LEGEND	
—	Railway Alignment
B	Bassendean
Hd	Herdsmen
K	Karrakatta
Ct	Cottesloe
Ca	Cannington
Gf	Guildford
Sw	Swan
Sr	Southern River

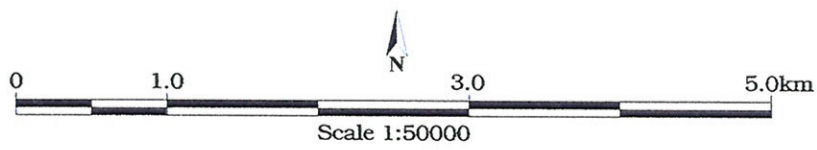
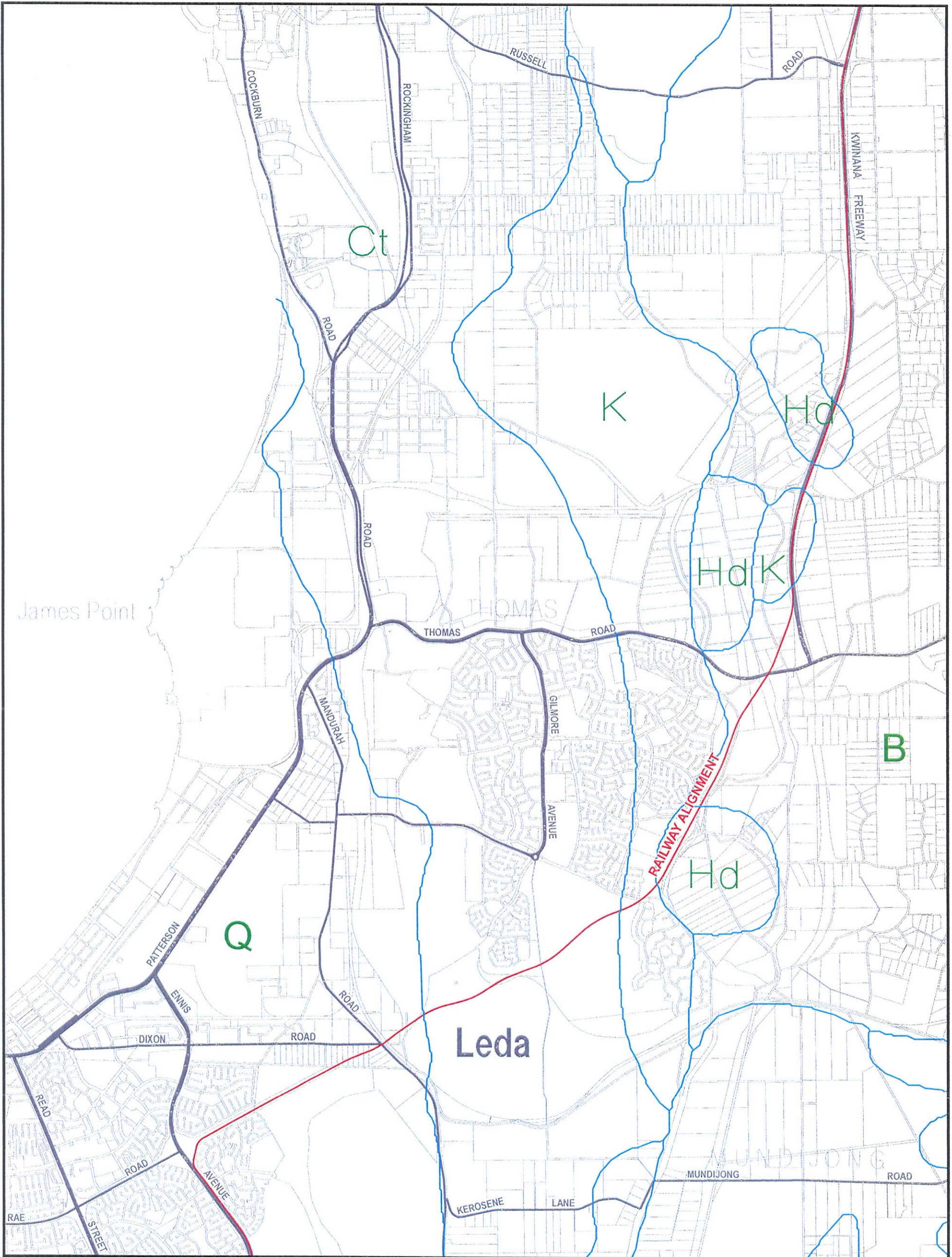


Figure 9b

Landform and Soil Units
(Churchward and McArthur, 1978)



LEGEND

—	Railway Alignment
B	Bassendean
Hd	Herdsmen
K	Karrakatta
Ct	Cottesloe
Ca	Cannington
Gf	Guildford
Sw	Swan
Q	Quindalup

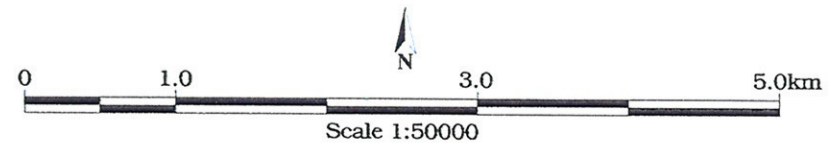
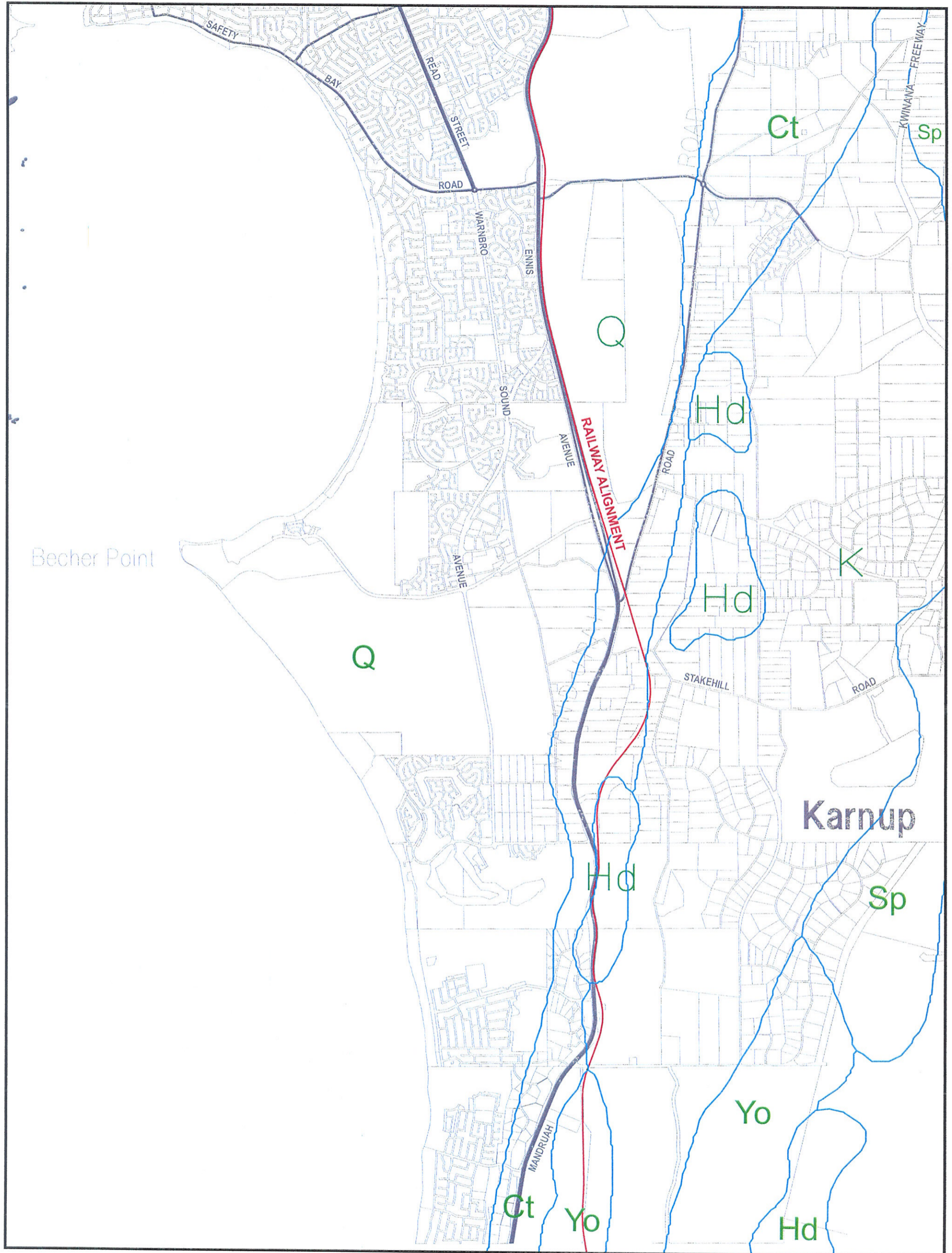


Figure 9c

**Landform and Soil Units
(Churchward & McArthur, 1978)**

Source: Ministry for Planning



LEGEND

	Railway Alignment
	Quindalup
	Cottesloe
	Serpentine River
	Herdsman
	Karrakatta
	Yoongarillup

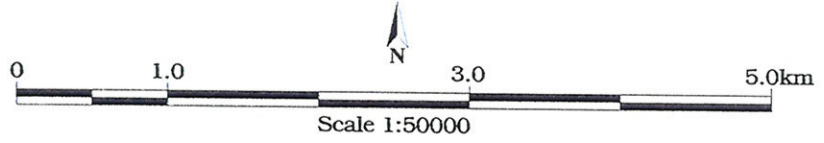
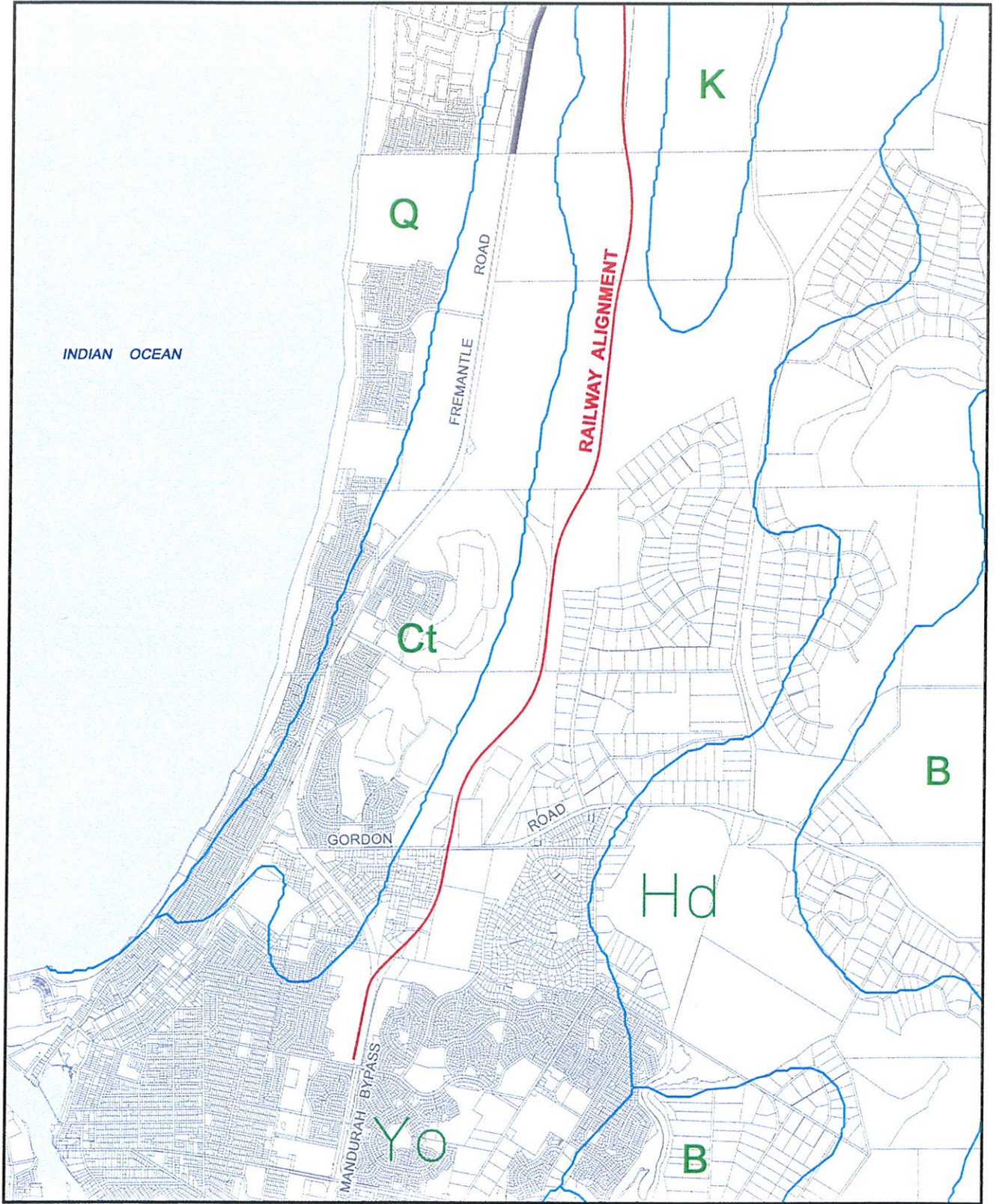


Figure 9d

**Landform and Soil Units
(Churchward & McArthur, 1978)**

Source: Ministry for Planning



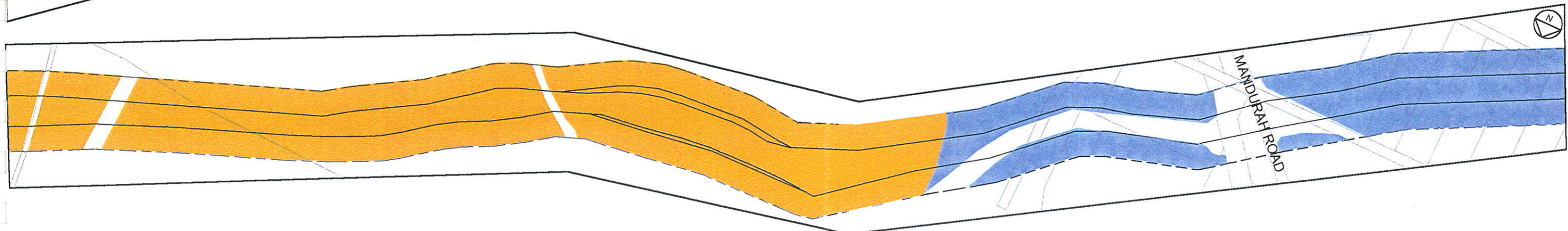
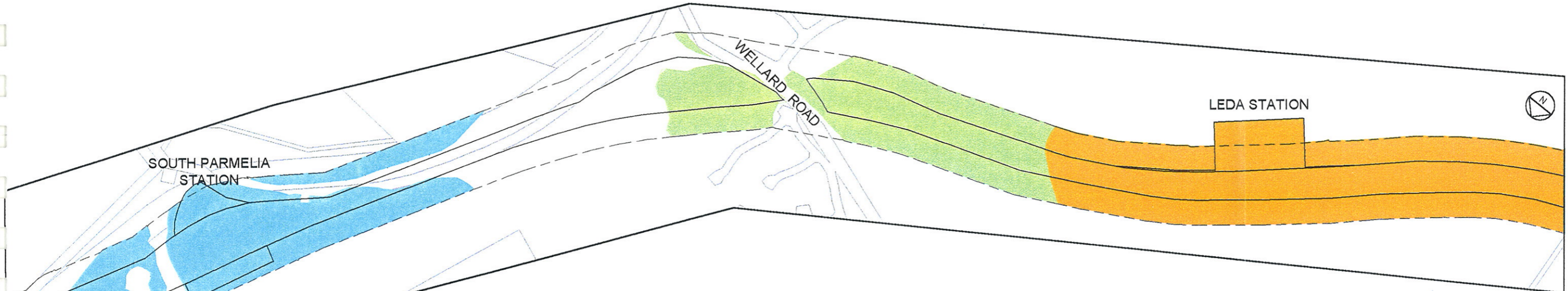
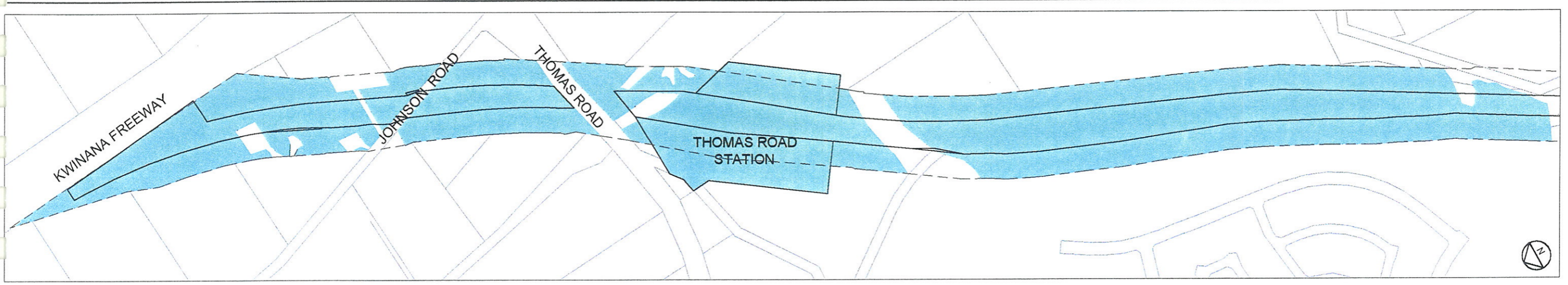
LEGEND

K	Karrakatta
B	Bassendean
Q	Quindalup
Ct	Cottesloe
Hd	Herdsman
Yo	Yoongarillup

Figure 9e

**Landform and Soil Units
(Churchward & McArthur, 1978)**





- Bassendean - Central and South
- Karrakatta - Central and South
- Cottesloe - Central and South
- Herdsman
- Quindalup
- MRS railway reserve boundary
- 50m buffer boundary

SCALE: 1 : 8000

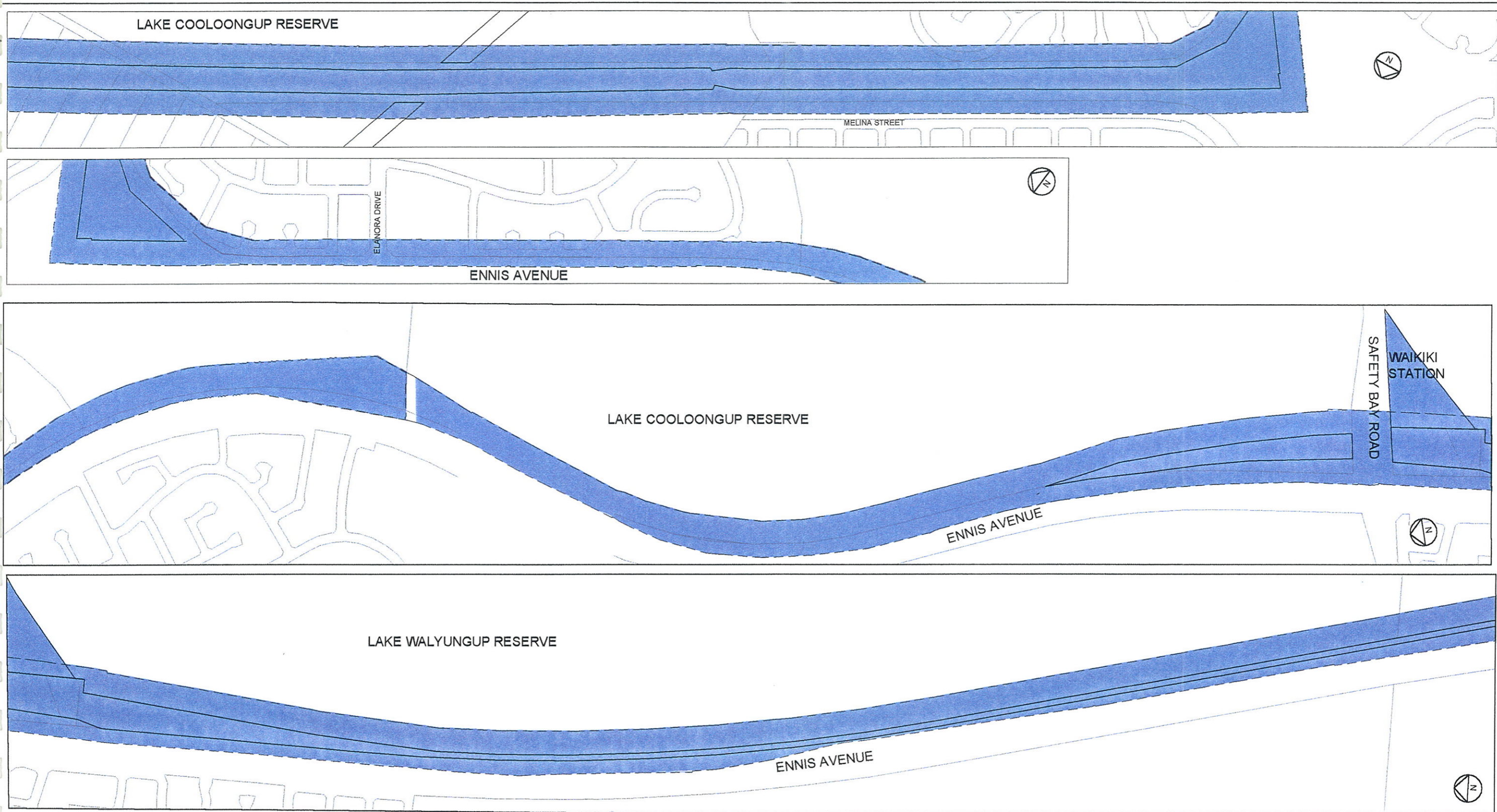
ECOSCAPE

ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
 mail : ecoscape @ inet. net. au

Figure 10a

Vegetation Complexes

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



- Bassendean - Central and South
- Karrakatta - Central and South
- Cottesloe - Central and South
- Herdsman
- Quindalup
- MRS railway reserve boundary
- 50m buffer boundary

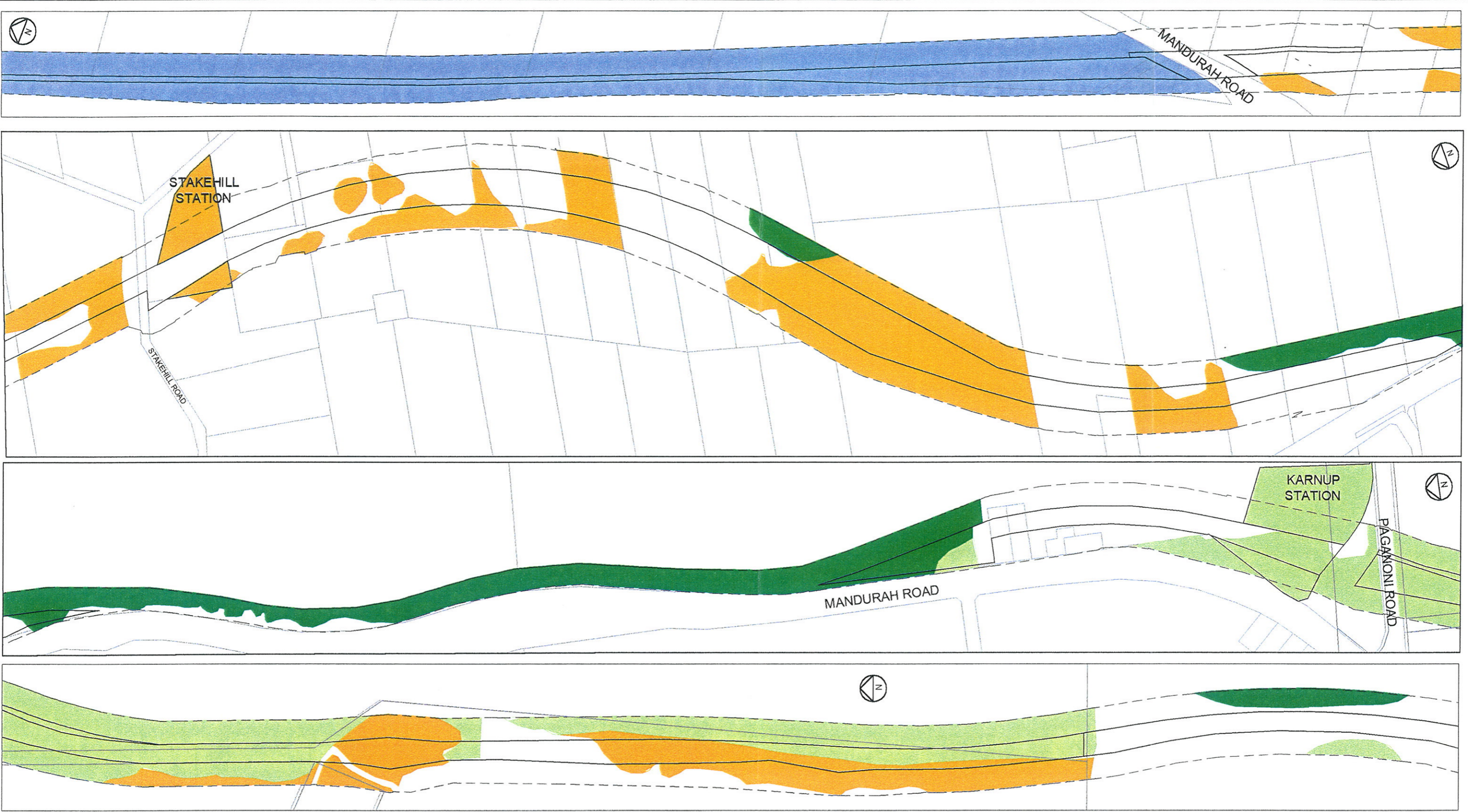
SCALE: 1 : 8000

ECOSCAPE
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Figure 10b

Vegetation Complexes

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



- Bassendean - Central and South
- Karrakatta - Central and South
- Cottesloe - Central and South
- Herdsman
- Quindalup
- — MRS railway reserve boundary
- - - 50m buffer boundary

SCALE: 1 : 8000

ECOSCAPE
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Figure 10c

Vegetation Complexes

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



LAKELANDS
STATION

GORDON ROAD
STATION

MANDURAH TERMINUS

GORDON ROAD

FREMANTLE ROAD

- Bassendean - Central and South
- Karrakatta - Central and South
- Cottesloe - Central and South
- Herdsman
- Quindalup
- MRS railway reserve boundary
- 50m buffer boundary

SCALE: 1 : 8000

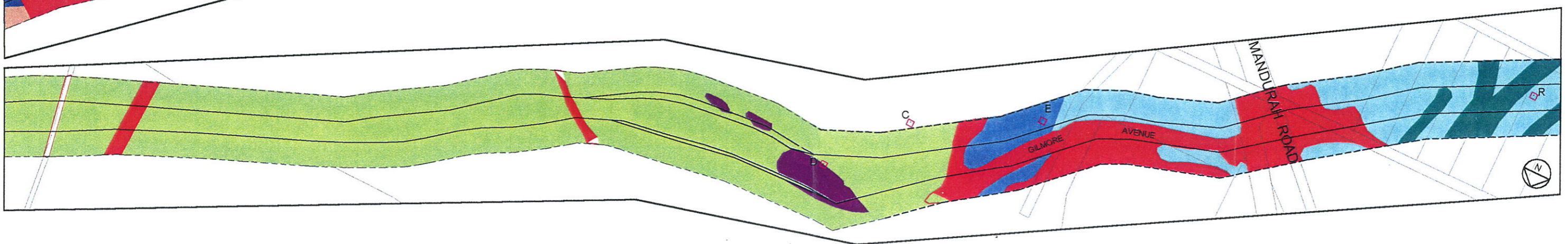
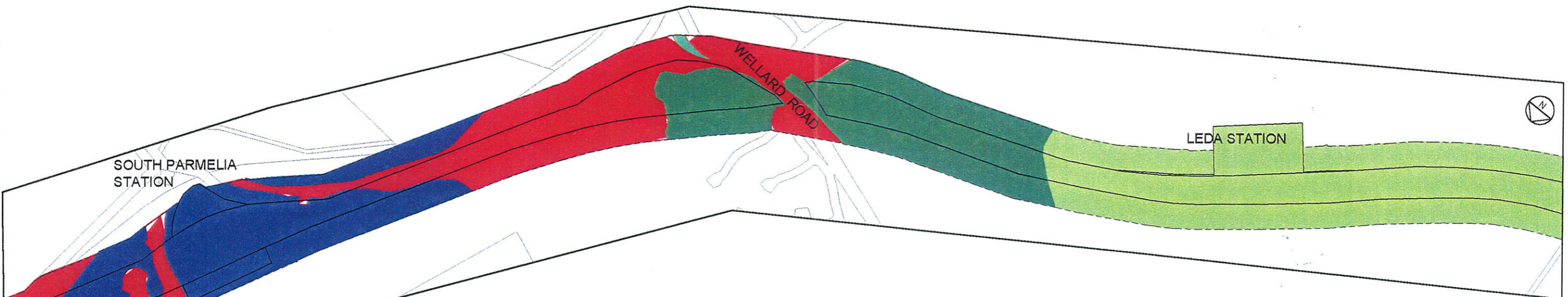
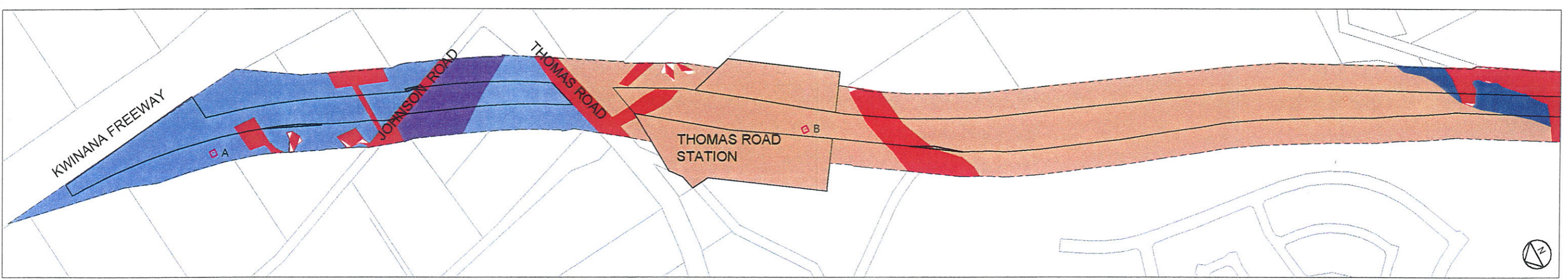
ECOSCAPE

ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
 email : ecoscape @ inet. net. au

Figure 10d

Vegetation Complexes

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



SCALE: 1 : 8000

ECOSCAPE ◦

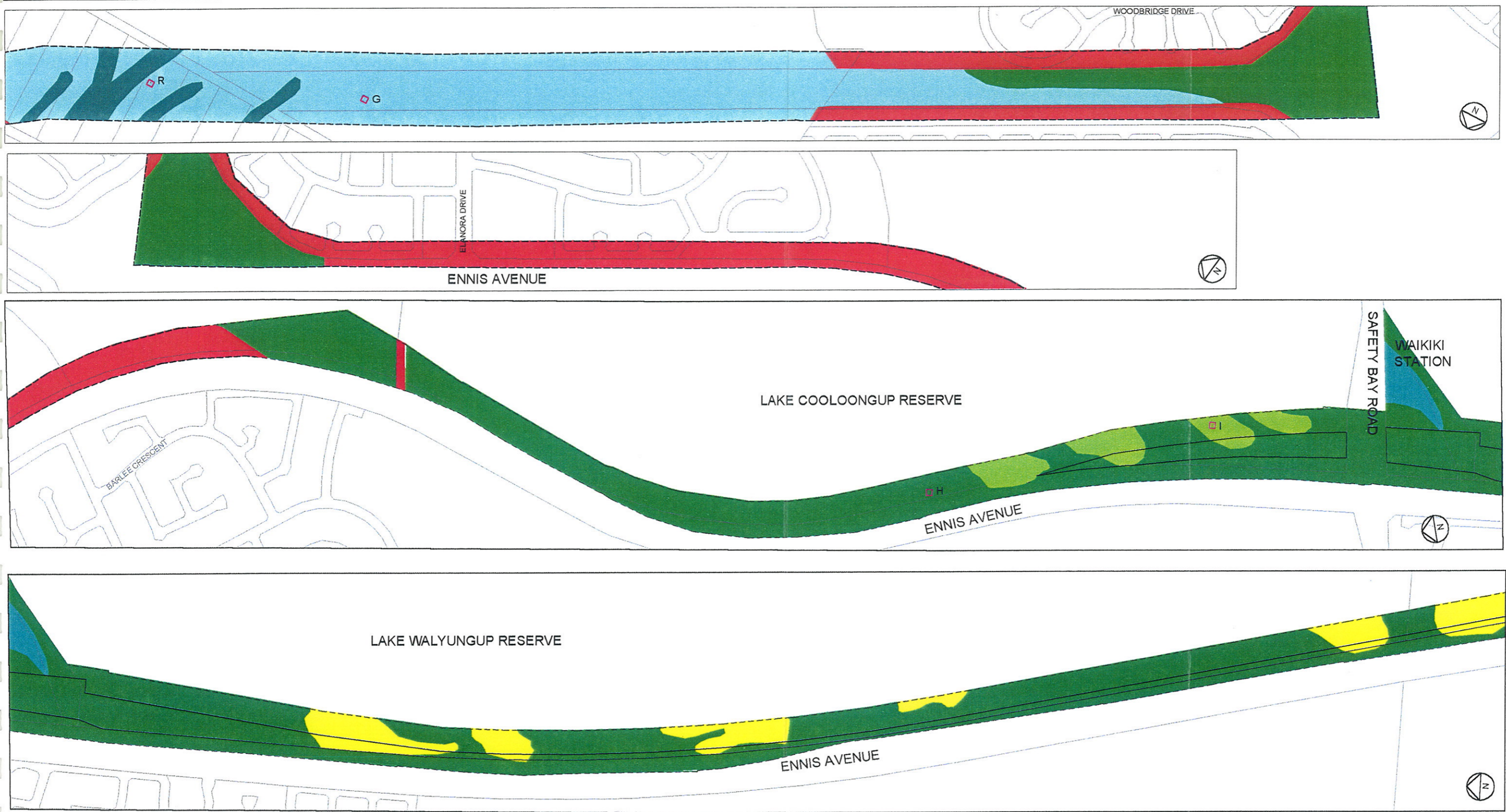
ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 ANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 ◦ Facsimile (08) 9430 8977
 mail : ecoscape @ inet.net.au

- MRS railway reserve
- - - 50m buffer boundary
- ◻ A Quadrat sites
- ✂ Priority flora locations

Figure 11a

Vegetation Mapping Units

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



SCALE: 1 : 8000

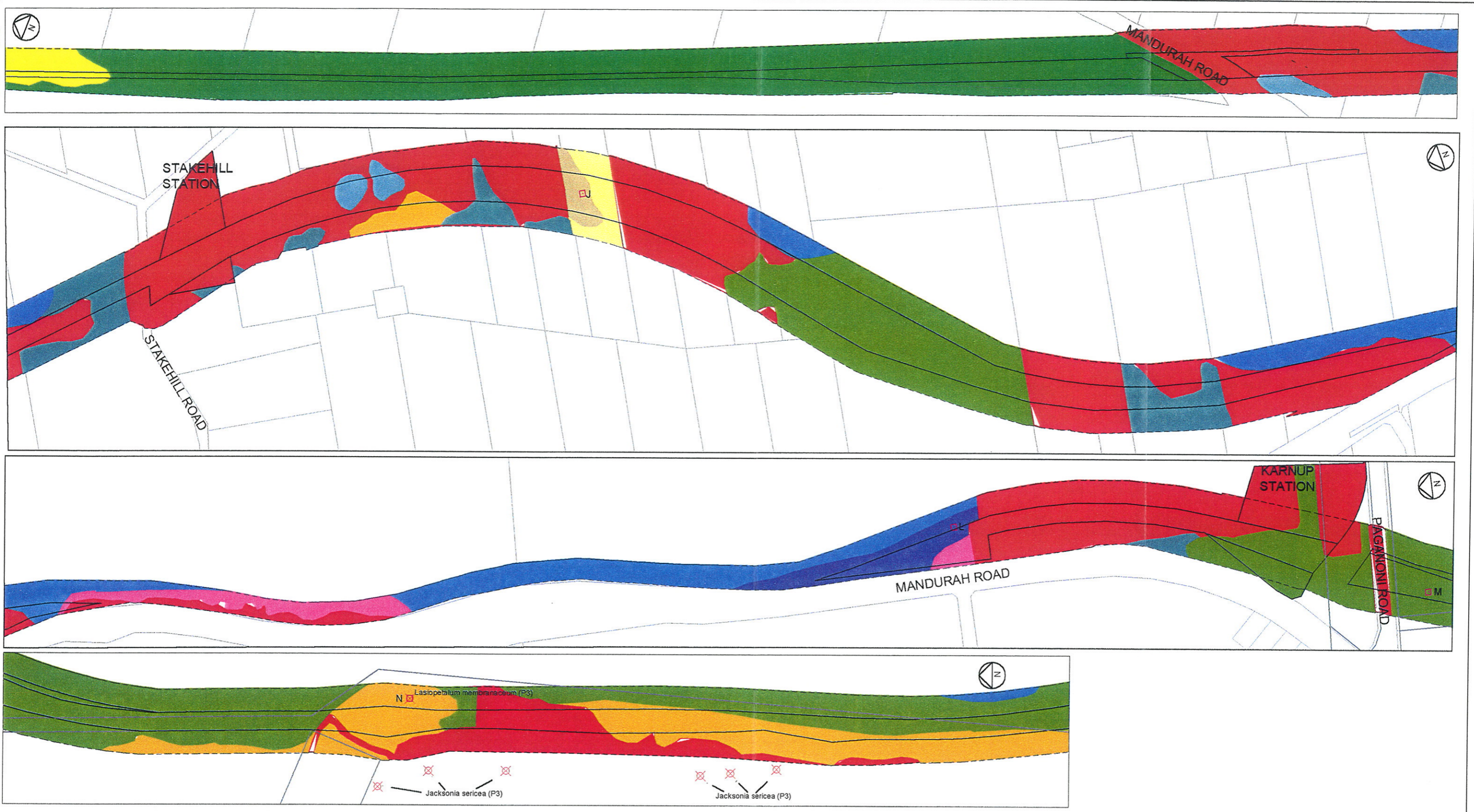
- MRS railway reserve
- - - 50m buffer boundary
- A Quadrat sites
- ✱ Priority flora locations

Figure 11b

Vegetation Mapping Units

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

ECOSCAPE
 ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
 :mail : ecoscape @ iinet. net. au



SCALE: 1 : 8000

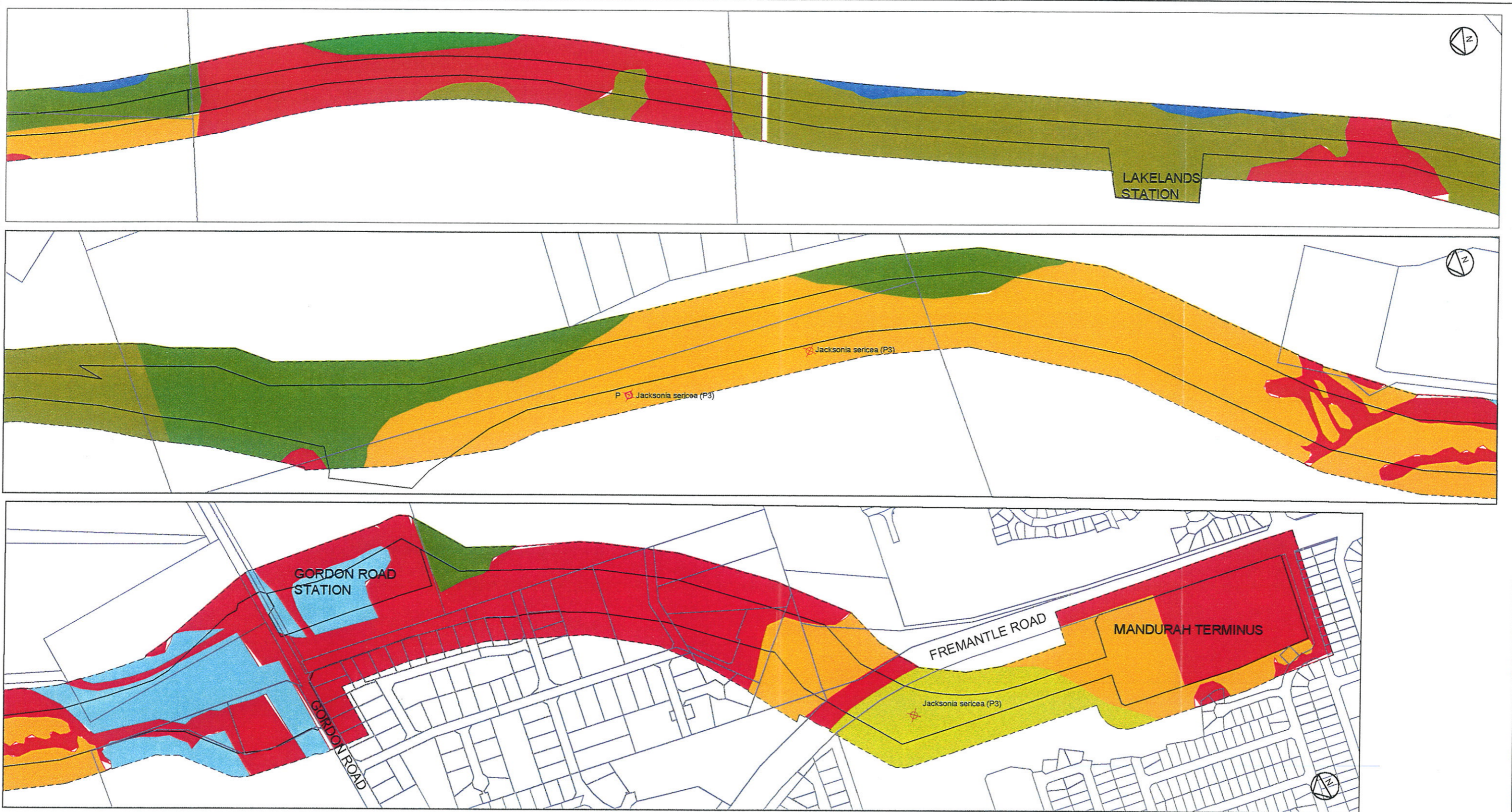
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 ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 LANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 ◦ Facsimile (08) 9430 8977
 mail : ecoscape @ inet.net.au

- MRS railway reserve
- - - 50m buffer boundary
- ◻ A Quadrat sites
- ⊗ Priority flora locations
(P3) = Priority 3 flora species

Figure 11c

Vegetation Mapping Units

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



SCALE: 1 : 8000

ECOSCAPE ◦

ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
 ANDSCAPE ECOLOGISTS ENVIRONMENTAL CONSULTANTS
 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 ◦ Facsimile (08) 9430 8977
 mail : ecoscape @ inet.net.au

- MRS railway reserve
- - - 50m buffer boundary
- ◻ A Quadrat sites
- ◻ X Priority flora locations
- (P3) = Priority 3 flora species

Figure 11d

Vegetation Mapping Units

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

- Minimal or no native vegetation**
- BAX** Woodland of *Banksia menziesii*, *B. attenuata*, *Allocasuarina fraseriana* and *Xylomelum occidentale* with occasional *Eucalyptus marginata* over a diverse understorey.
- Brai** Open woodland of *Banksia menziesii*, *B. attenuata* and *B. ilicifolia* over *Adenanthos cygnorum* and *Kunzea ericifolia*.
- CcBg** Open *Corymbia calophylla* and *Banksia grandis* woodland over *Macrozamia riedlei* and weeds.
- ECB** Open woodland of *Eucalyptus marginata*, *Corymbia calophylla*, *Banksia menziesii*, *B. attenuata*, *Banksia ilicifolia* and *Allocasuarina fraseriana*.
- EgAr** Tall open woodland of *Eucalyptus gomphocephala* over *Acacia rostellifera* and *Xanthorrhoea preissii*.
- EmB** Woodland of *Eucalyptus marginata*, *Banksia attenuata*, *B. menziesii*, *B. grandis* and *Allocasuarina fraseriana*, with occasional *B. ilicifolia*.
- Ar** Closed shrubland of *Acacia rostellifera*.
- BE** Low woodland of *Banksia attenuata*, *B. menziesii*, *B. grandis*, *Eucalyptus gomphocephala*, *E. marginata* and *Allocasuarina fraseriana* over *Hibbertia hypericoides*.
- EBG** Woodland of *Eucalyptus gomphocephala* with *Banksia littoralis* over sedgeland over *Gahnia trifida*.
- EgAs** Open woodland of *Eucalyptus gomphocephala* over *Acacia saligna*.
- EgBl** Woodland of *Eucalyptus gomphocephala* and *Banksia littoralis* with *Banksia grandis* over *Acacia saligna*, *Jacksonia furcellata*, *Templetonia retusa*, and *Xanthorrhoea preissii*.
- EgC** Open woodland of *Eucalyptus gomphocephala* with *Allocasuarina fraseriana* and *Acacia rostellifera* over grassy weed in a cleared landscape.
- AJ** Low shrubland on dunes of *Acacia cochlearis*, *A. rostellifera*, *Jacksonia furcellata*, *Xanthorrhoea preissii*, *Olearia axillaris* and *Rhagodia baccat*.
- EgG** Open woodland of *Eucalyptus gomphocephala* with occasional *Melaleuca raphiophylla* over *Acacia* spp., *Xanthorrhoea preissii* and sedgeland dominated by *Gahnia trifida* (TEC19b).
- EGM** Closed wet woodland of *Eucalyptus gomphocephala* over *Melaleuca raphiophylla* and *Melaleuca teretifolia* and closed sedgeland of *Gahnia trifida* (TEC 19b).
- MBG** Closed wet woodland of *Melaleuca raphiophylla* and *Banksia littoralis* over *Xanthorrhoea preissii* and closed sedgeland of *Gahnia trifida* and *Lepidosperma* spp. in Quindalup dune swales (TEC 19b).
- EmgBa** Woodland of *Eucalyptus marginata*, *E. gomphocephala*, *Banksia attenuata*, and *Allocasuarina fraseriana* with occasional *Corymbia calophylla*. Other common species are *Dryandra sessilis*, *D. lindleyana*, *Banksia menziesii*, *B. grandis*, *Hakea lissocarpha*, *Acacia rostellifera* and *Jacksonia furcellata*.
- ErB** Woodland of *Eucalyptus rudis* over *Banksia* species.
- Ke** Low closed woodland of *Kunzea ericifolia* with *Melaleuca raphiophylla*.
- LR** Low shrubland over heathland on limestone ridges of *Xanthorrhoea preissii*, *Leucopogon parviflorus*, *Melaleuca systemans*, *Hakea prostrata*, *Phyllanthus calycinus*, *Acacia* species and *Grevillea thelemanniana*.
- Mr** Closed wet woodland of *Melaleuca raphiophylla*, often over sedgeland of *Gahnia trifida*, *Lepidosperma longitundate* and *Baumea juncea*.
- MEg** Dense low woodland of *Melaleuca raphiophylla* and *M. teretifolia* with emergent *Eucalyptus gomphocephala* over sedgeland.
- SpD** Closed low shrubland on Spearwood Dunes, with *Acacia* spp., *Allocasuarina humilis*, *Melaleuca systemans* ms, *Grevillea thelemanniana*, *Hakea trifurcata*, *Hibbertia hypericoides*, *Melaleuca huegellii*, *Olearia axillaris*, *Rhagodia baccata*, *Santalum acuminatum* and *Spyridium globulosum*, sometimes with emergent *Eucalyptus gomphocephala*, *Banksia attenuata* and *Allocasuarina fraseriana*.

- Alignment boundary
- 50m buffer boundary
- A Quadrat sites
- Priority flora locations

Figure 11e

Vegetation Communities



LEGEND

- * Boundary of MRS Amendment
- * Sample Sites 1-11
- ⊕ Safety Bay Road South site (previous survey)
- ⊗ Waikiki transit station site (previous survey)
- ⊕ Sample Sites 1-8, previous survey (Ecoscape 2001)
- ⊕ Uncertain floristic community type under comparison 1; Threatened Ecological Community 19 under Comparison 2 (see text)
- ▨ Threatened ecological community 19 under comparison 1 and comparison 2 (see text)
- ▨ Floristic Community type 17 under comparison 1, Threatened Ecological Community 19 under comparison 2 (see text)
- ▨ Degraded Threatened Ecological Community Type 19

N

0 0.5 1.5 2.5km

Scale 1:30000

Figure 12a

**Areas of TEC 19b
in the Lake Cooloongup
and Lake Walyungup Reserves**

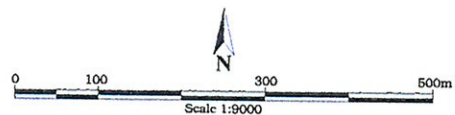
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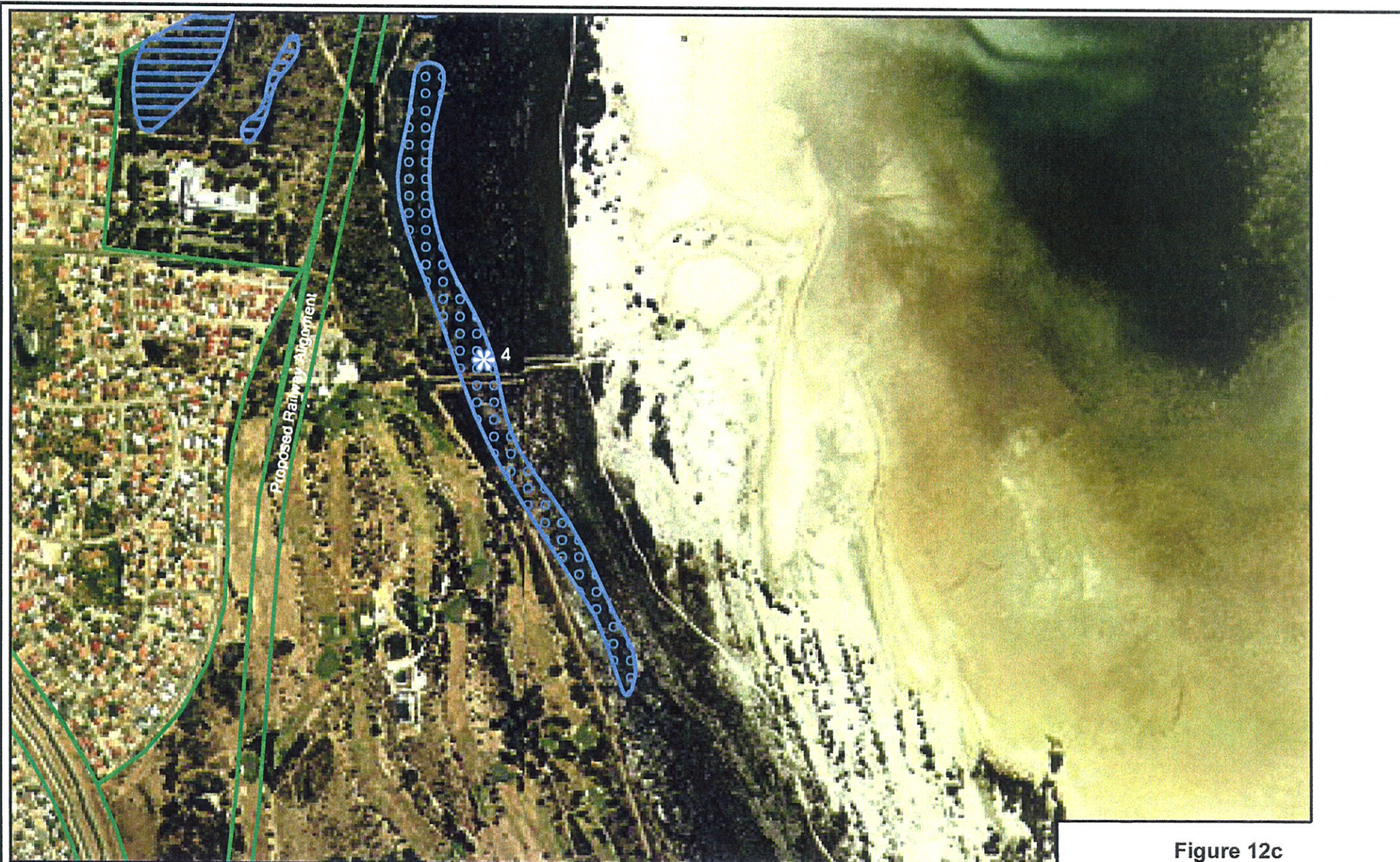


Figure 12b
 Areas of TEC 19b
 in the Lake Cooloongup
 and Lake Walyungup Reserves

LEGEND

-  Boundary of MRS Amendment
-  Sample Sites 1-3 of present survey
-  Sample Sites 1-8, previous survey (Ecoscape 2001)
-  Threatened ecological community 19 under comparison 1 and comparison 2 (see text)
-  Floristic Community type 17 under comparison 1; Threatened Ecological Community 19 under comparison 2 (see text)
-  Uncertain floristic community type under comparison 1; Threatened Ecological Community 19 under Comparison 2 (see text)





LEGEND

-  Boundary of MRS Amendment
-  Sample Site 4
-  Threatened ecological community 19 under comparison 1 and comparison 2 (see text)
-  Floristic Community type 17 under comparison 1; Threatened Ecological Community 19 under comparison 2 (see text)
-  Uncertain floristic community type under comparison 1; Threatened Ecological Community 19 under Comparison 2 (see text)

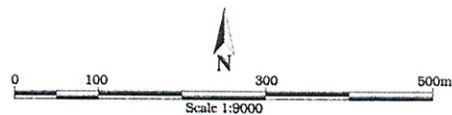
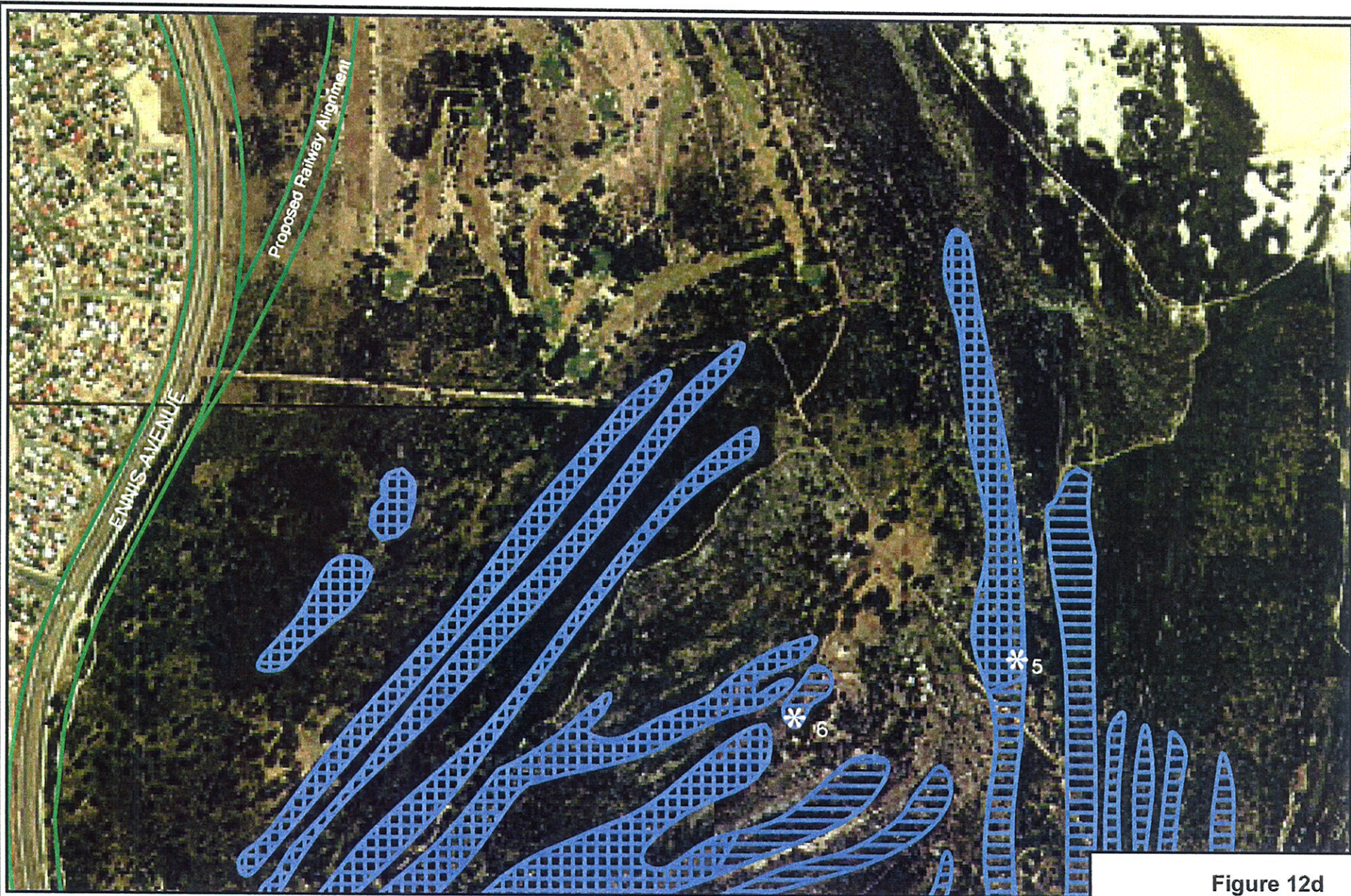


Figure 12c
Areas of TEC 19b
in the Lake Cooloongup
and Lake Walyung Reserves



- LEGEND**
- Boundary of MRS Amendment
 - * Sample Site 4
 - Threatened ecological community 19 under comparison 1 and comparison 2 (see text)

 Floristic Community type 17 under comparison 1; Threatened Ecological Community 19 under comparison 2 (see text)

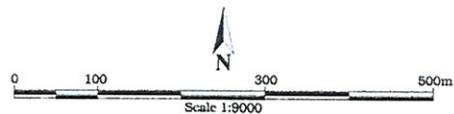
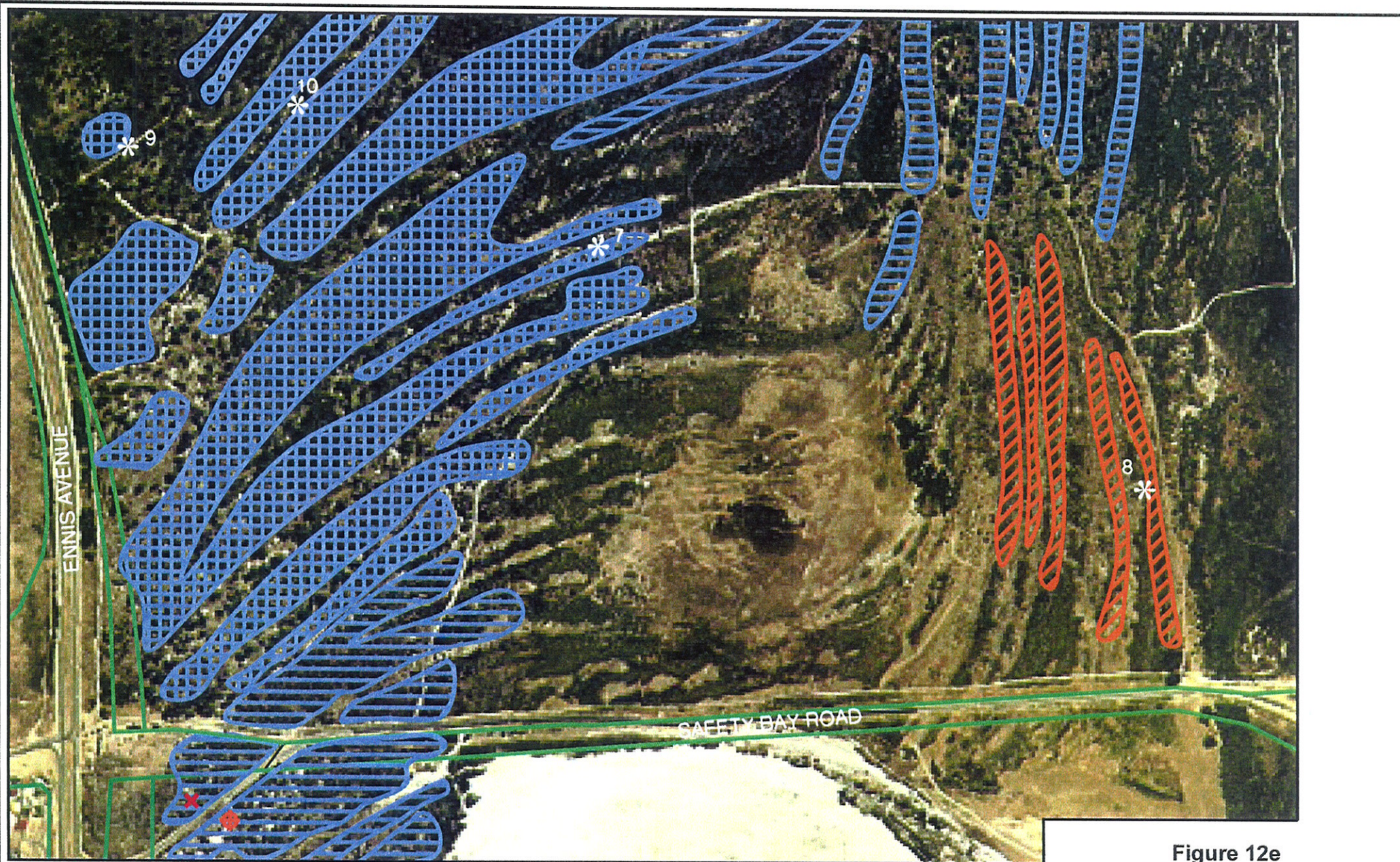


Figure 12d
Areas of TEC 19b
in the Lake Cooloongup
and Lake Walyungup Reserves



LEGEND

- * Boundary of MRS Amendment
- * Sample Sites 1-11
- ⊕ Safety Bay Road South site (previous survey)
- ⊗ Waikiki transit station site (previous survey)
- [Blue hatched box] Threatened ecological community 19 under comparison 1 and comparison 2 (see text)
- [Blue grid hatched box] Floristic Community type 17 under comparison 1, Threatened Ecological Community 19 under comparison 2 (see text)
- [Red hatched box] Degraded Threatened Ecological Community Type 19

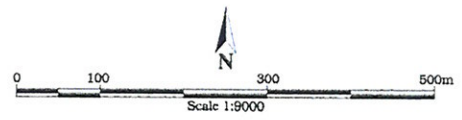
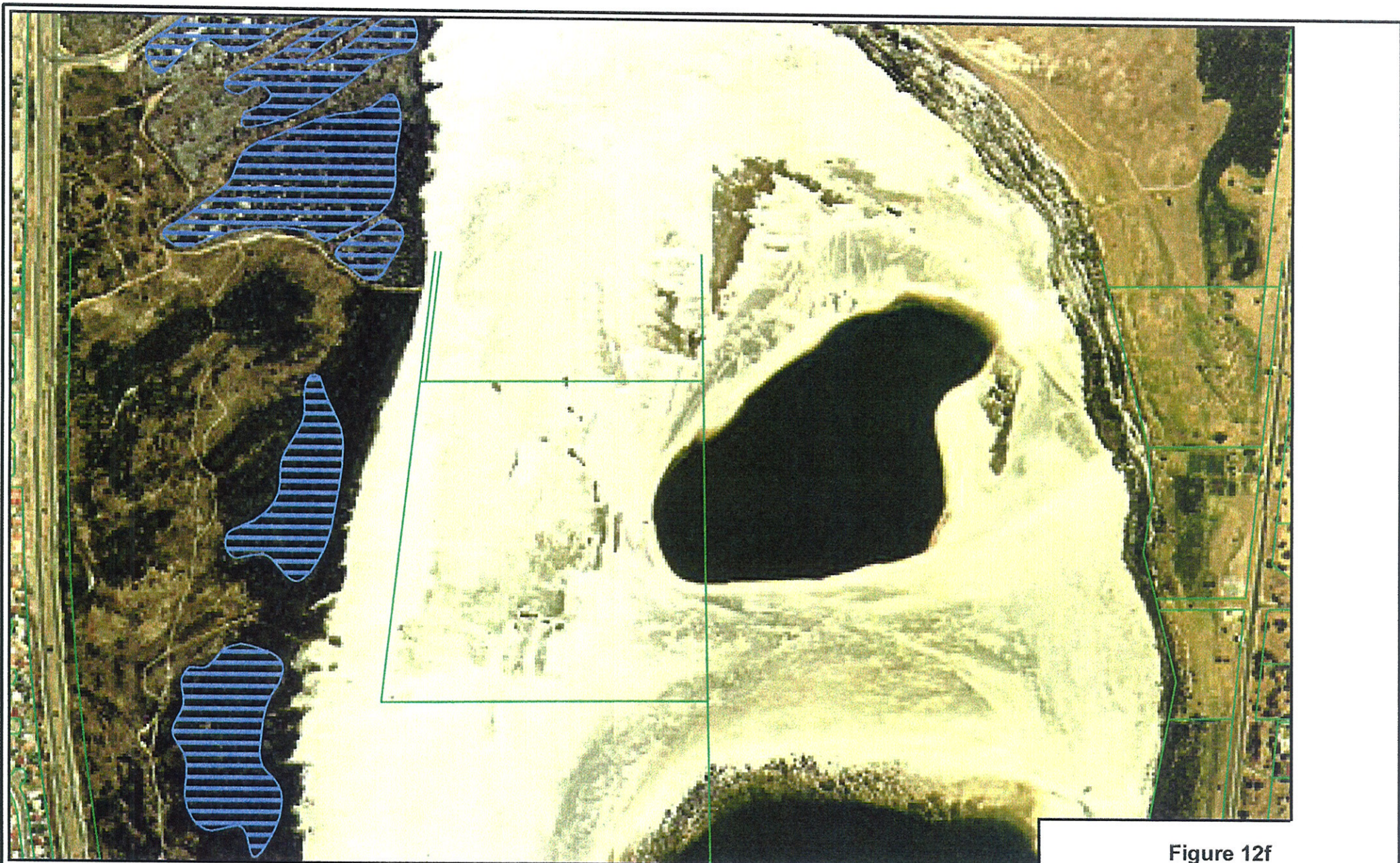




Figure 12e
Areas of TEC 19b
in the Lake Coo롱up
and Lake Walyungup Reserves



- LEGEND**
-  Boundary of MRS Amendment/cadastral boundaries
 -  Threatened ecological community 19 under comparison 1 and comparison 2 (see text)

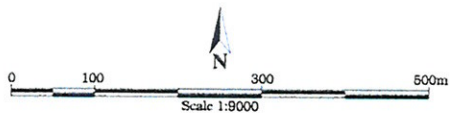
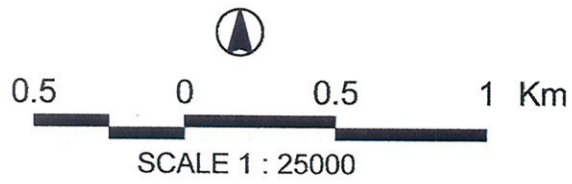


Figure 12f
Areas of TEC 19b
in the Lake Coolongup
and Lake Walyungup Reserves



- LEGEND**
- Dieback Infested
 - Dieback Free
 - Uninterpretable



Figure 13a

Dieback Categories

WETLAND CONSERVATION CATEGORIES

WETLAND TYPE	WETLAND MANAGEMENT CATEGORY
L - LAKE	c - CONSERVATION
S - SUMPLAND	r - RESOURCE ENHANCEMENT
D - DAMPLAND	m - MULTIPLE USE
EW - ESTUARY WATERBODY	

LEGEND

- Reserve not within buffer zones
- Reserve within wetlands
- Reserve within 50m buffer zone of wetlands
- Reserve within 200m buffer zone of wetlands
- Wetland
- 50m buffer zone of wetlands
- 200m buffer zone of wetlands

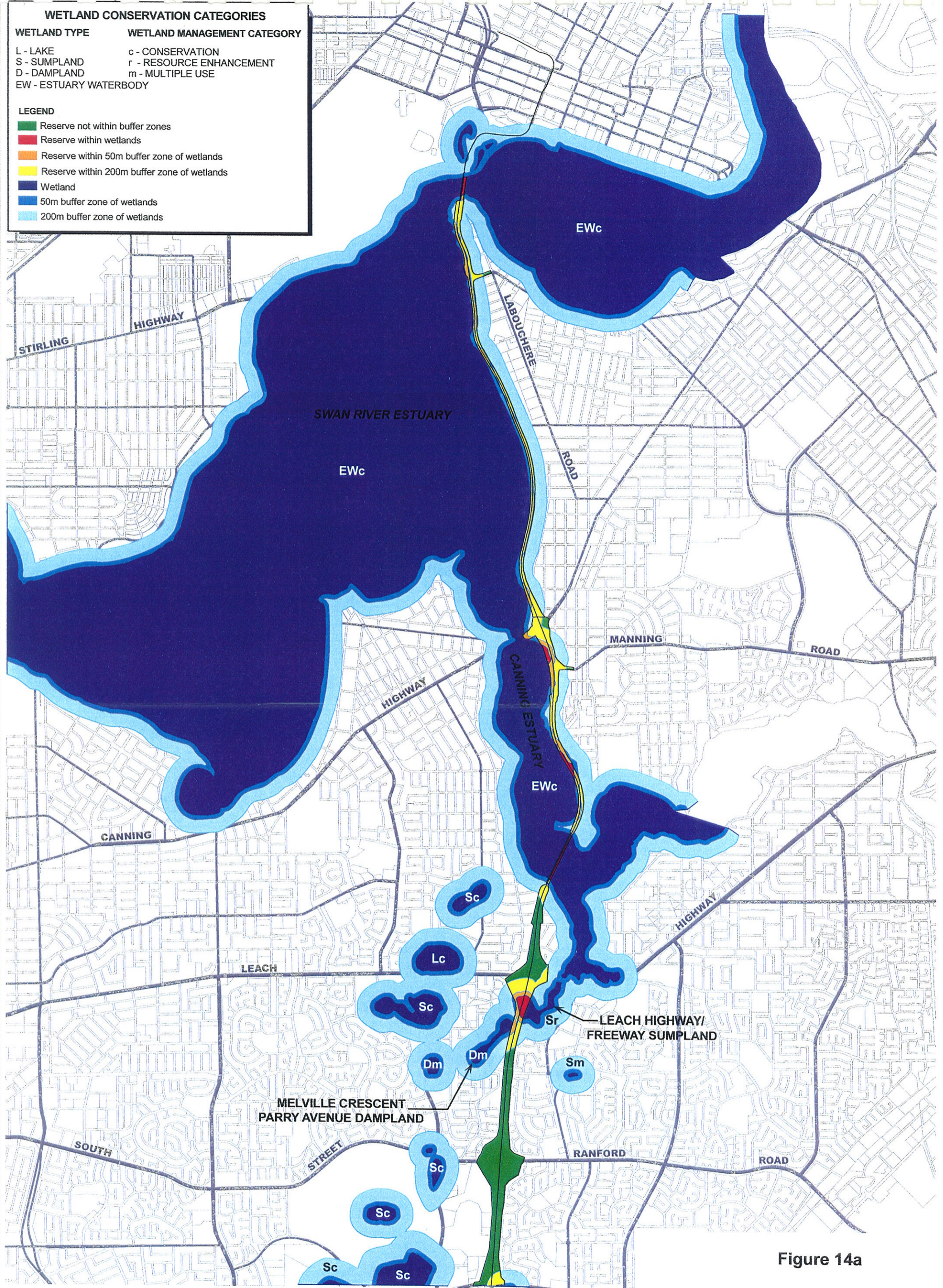


Figure 14a

Wetland Locations and Conservation Categories

WETLAND CONSERVATION CATEGORIES

WETLAND TYPE	WETLAND MANAGEMENT CATEGORY
L - LAKE	c - CONSERVATION
S - SUMPLAND	r - RESOURCE ENHANCEMENT
D - DAMPLAND	m - MULTIPLE USE
EW - ESTUARY WATERBODY	

LEGEND

- Reserve not within buffer zones
- Reserve within wetlands
- Reserve within 50m buffer zone of wetlands
- Reserve within 200m buffer zone of wetlands
- Wetland
- 50m buffer zone of wetlands
- 200m buffer zone of wetlands

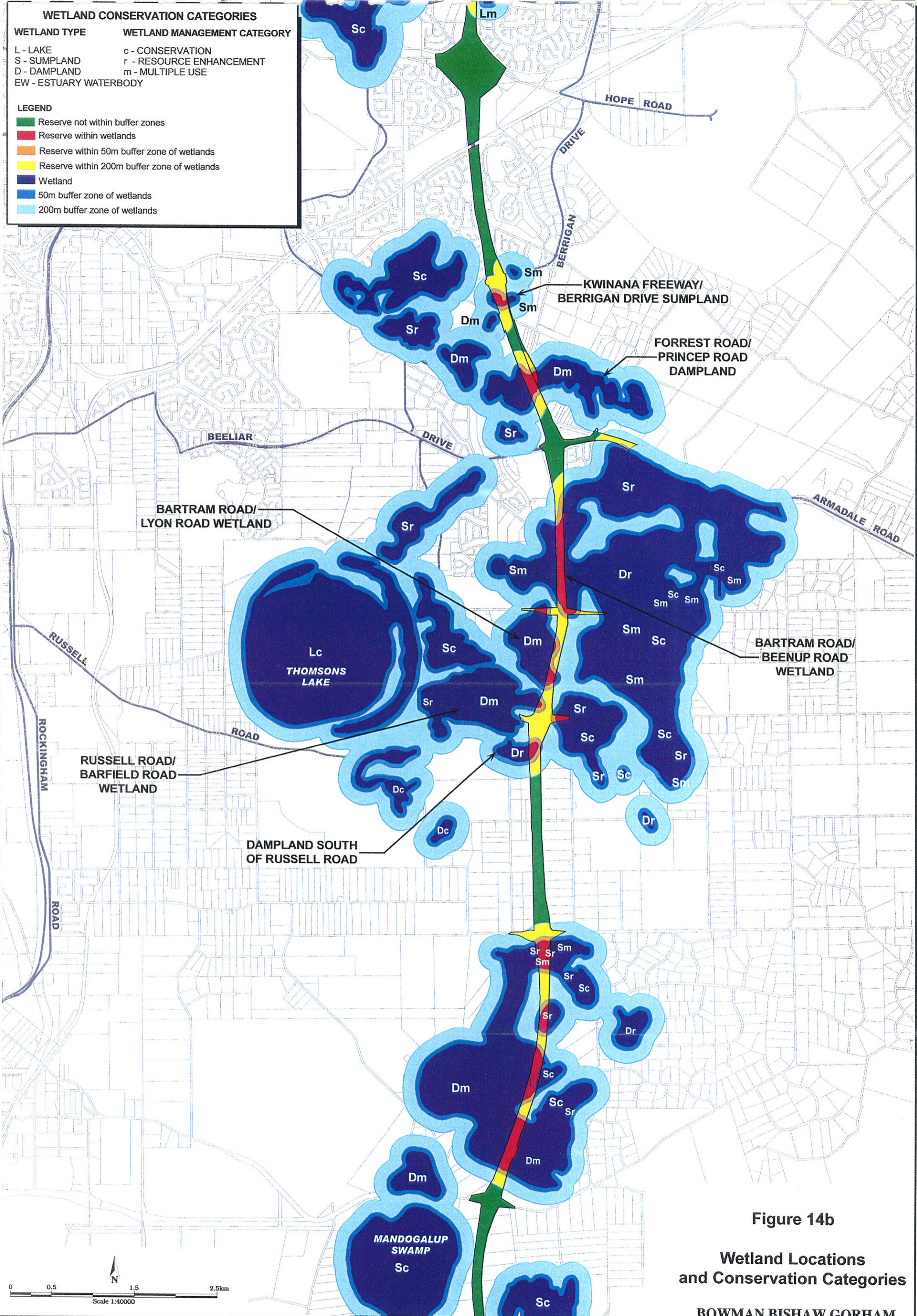
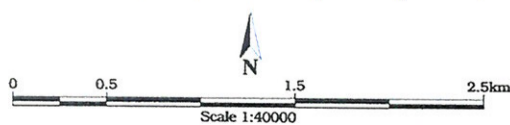


Figure 14b

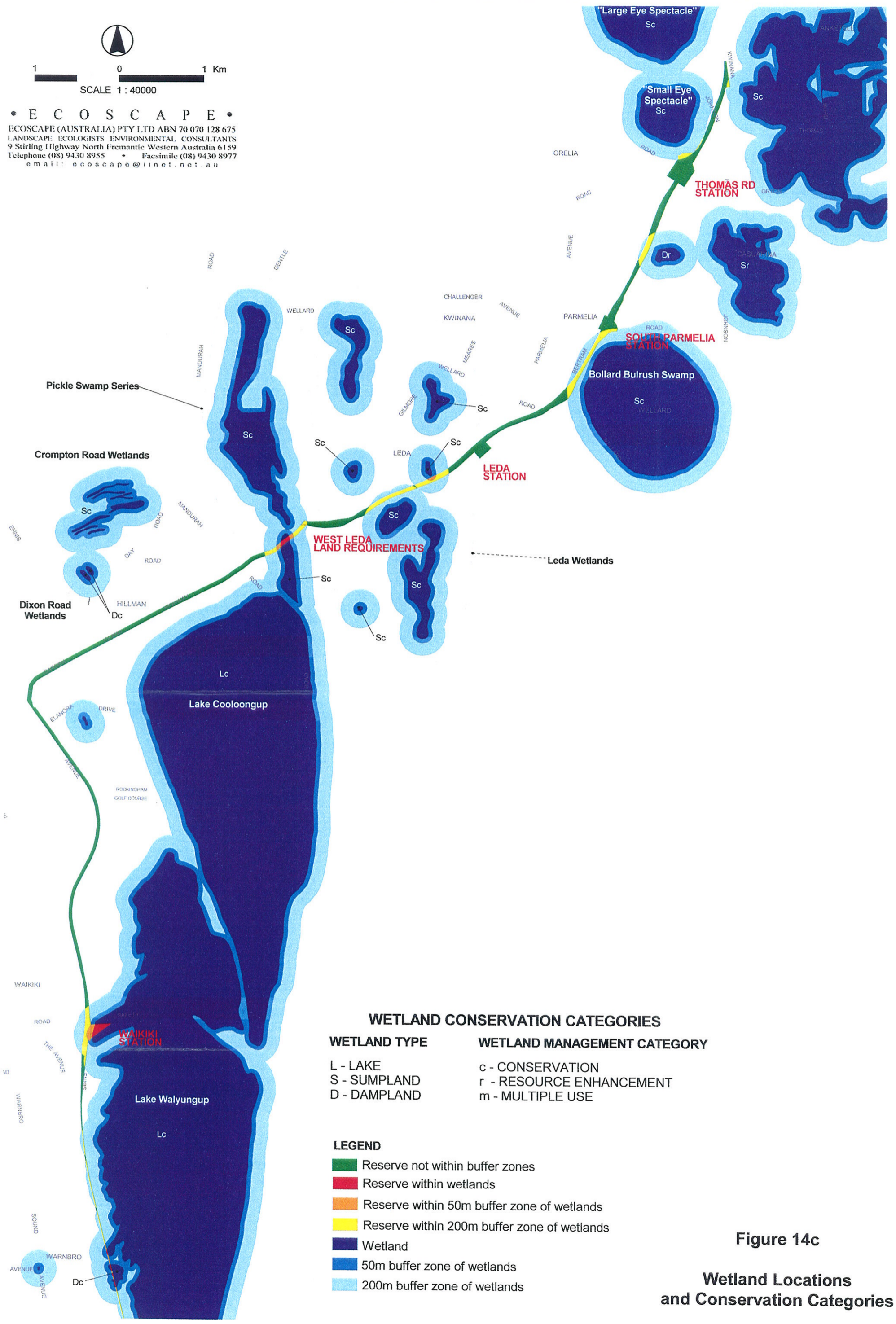
Wetland Locations and Conservation Categories





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 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
 email: ecoscape@inet.net.au



WETLAND CONSERVATION CATEGORIES

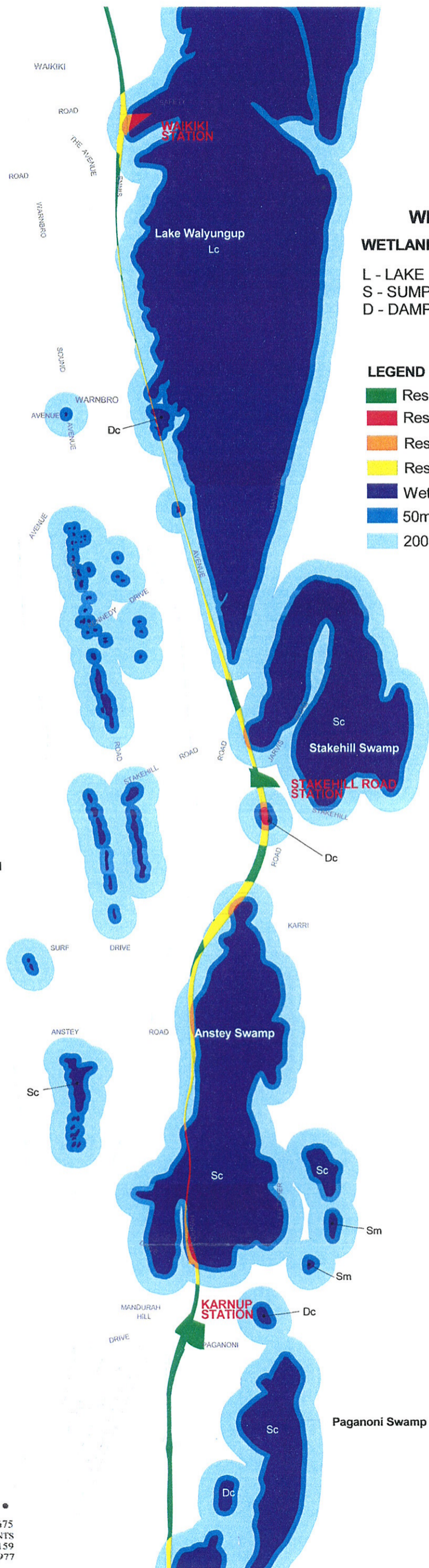
WETLAND TYPE	WETLAND MANAGEMENT CATEGORY
L - LAKE	c - CONSERVATION
S - SUMPLAND	r - RESOURCE ENHANCEMENT
D - DAMPLAND	m - MULTIPLE USE

LEGEND

- Reserve not within buffer zones
- Reserve within wetlands
- Reserve within 50m buffer zone of wetlands
- Reserve within 200m buffer zone of wetlands
- Wetland
- 50m buffer zone of wetlands
- 200m buffer zone of wetlands

Figure 14c

Wetland Locations and Conservation Categories



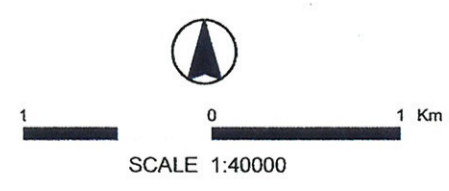
WETLAND CONSERVATION CATEGORIES

WETLAND TYPE	WETLAND MANAGEMENT CATEGORY
L - LAKE	c - CONSERVATION
S - SUMPLAND	r - RESOURCE ENHANCEMENT
D - DAMPLAND	m - MULTIPLE USE

- LEGEND**
- Reserve not within buffer zones
 - Reserve within wetlands
 - Reserve within 50m buffer zone of wetlands
 - Reserve within 200m buffer zone of wetlands
 - Wetland
 - 50m buffer zone of wetlands
 - 200m buffer zone of wetlands

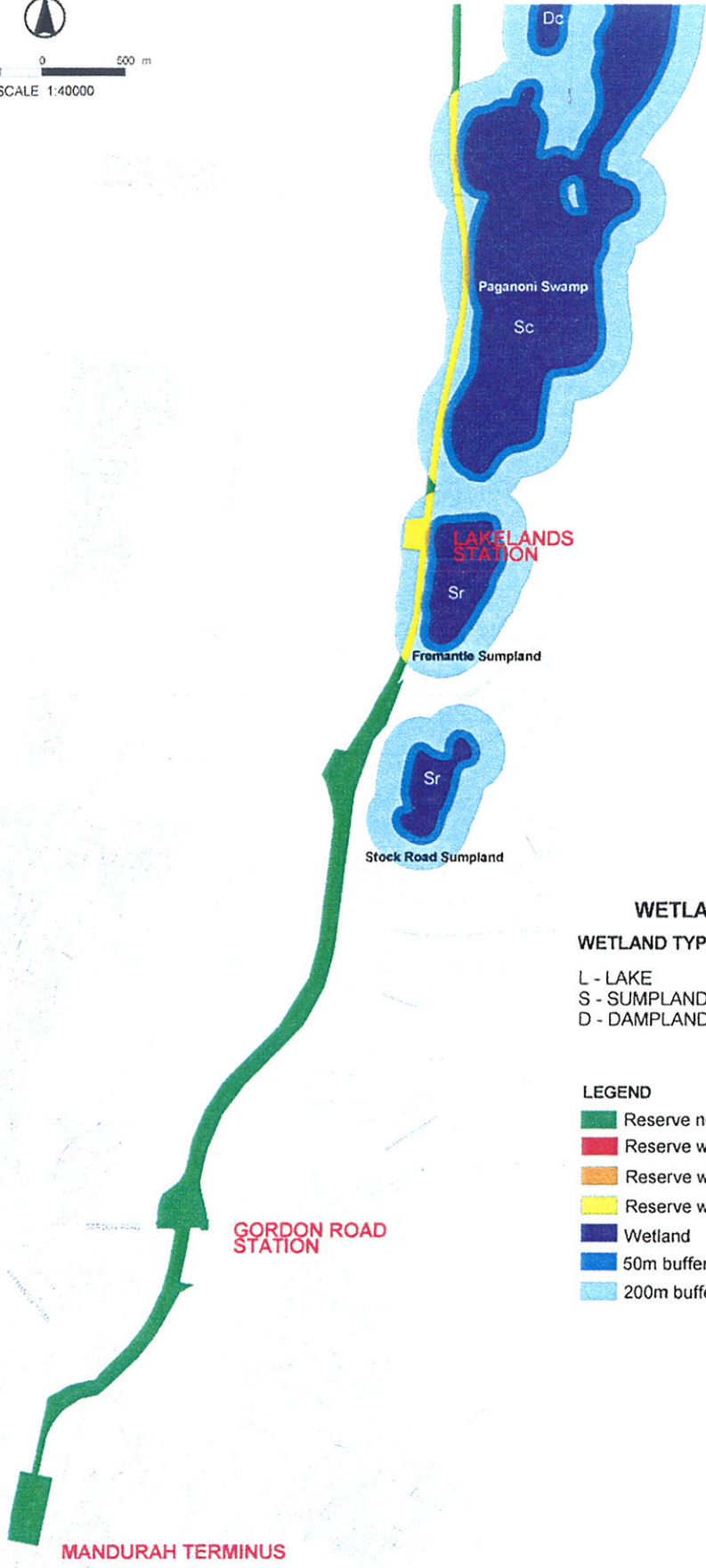
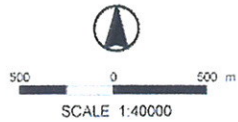
BECHER POINT WETLANDS

Note:
Becher Point wetlands are a combination of damplands and sumplands. All are rated as Conservation Management category, and are mapped in detail in, Hill et al. (1996)



• ECOSCAPE •
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Figure 14d
Wetland Locations and Conservation Categories



WETLAND CONSERVATION CATEGORIES

WETLAND TYPE	WETLAND MANAGEMENT CATEGORY
L - LAKE	c - CONSERVATION
S - SUMPLAND	r - RESOURCE ENHANCEMENT
D - DAMPLAND	m - MULTIPLE USE

LEGEND

- Reserve not within buffer zones
- Reserve within wetlands
- Reserve within 50m buffer zone of wetlands
- Reserve within 200m buffer zone of wetlands
- Wetland
- 50m buffer zone of wetlands
- 200m buffer zone of wetlands

Figure 14e

Wetland Locations and Conservation Categories

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

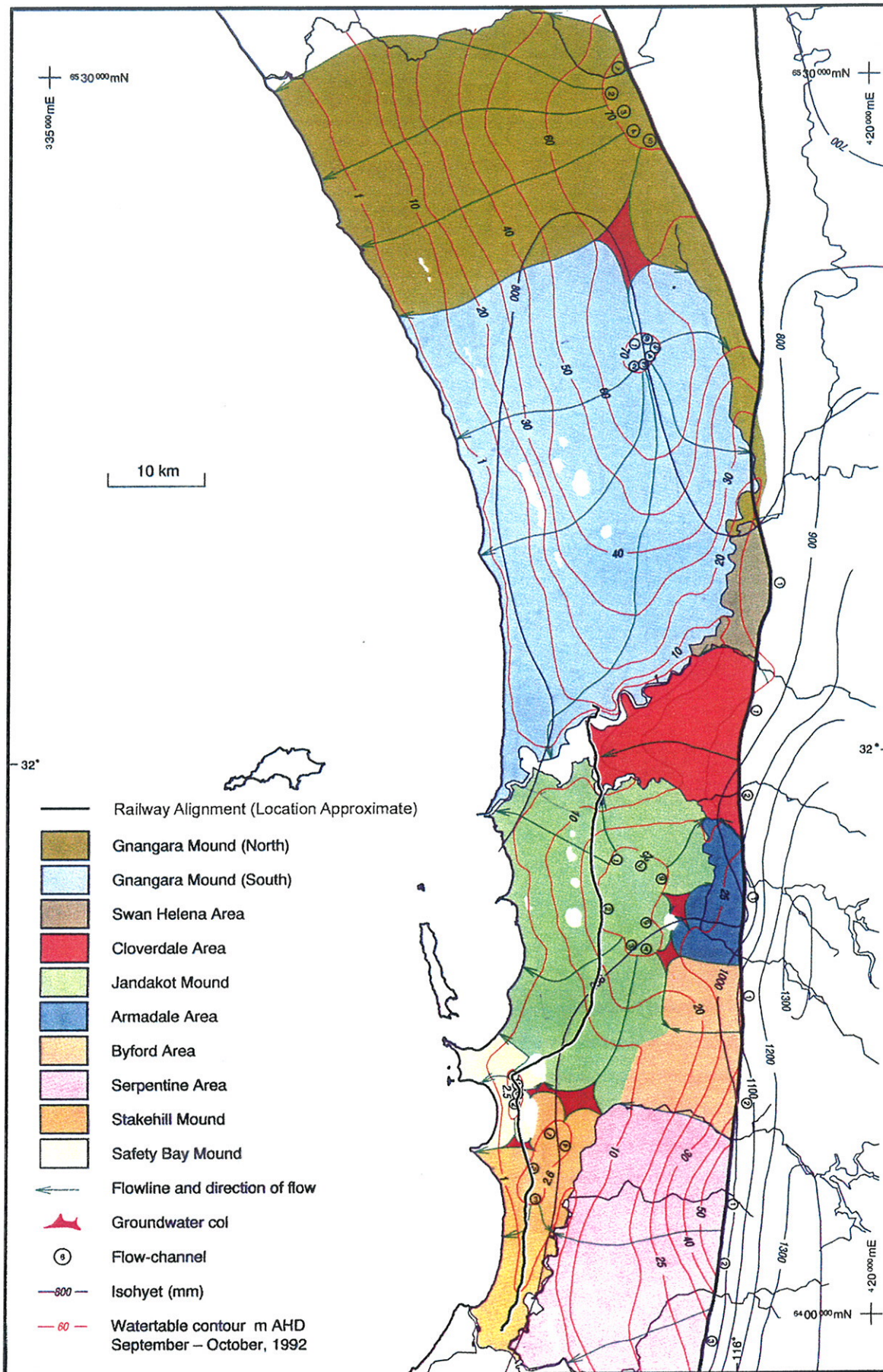


Figure 15

Groundwater

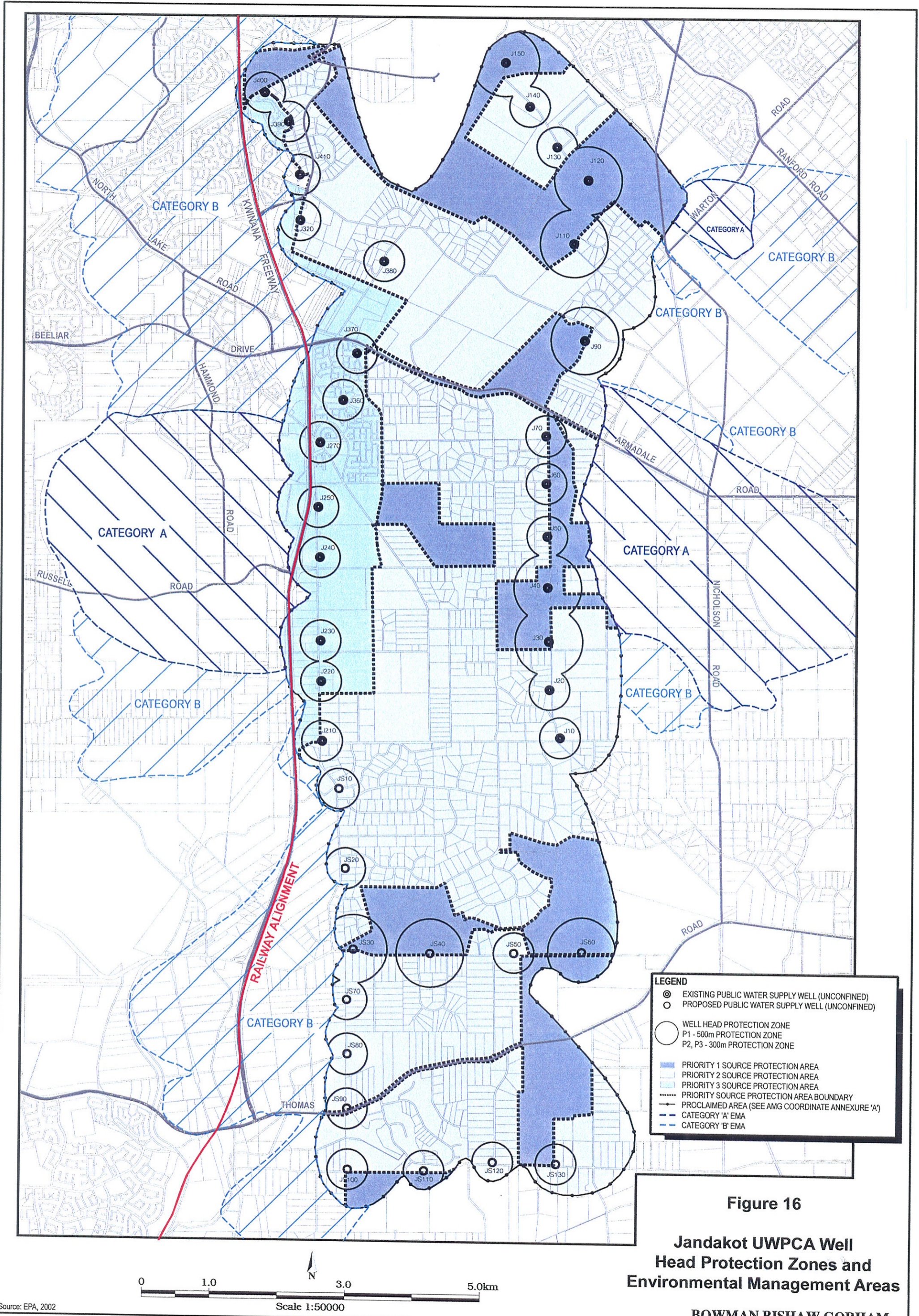
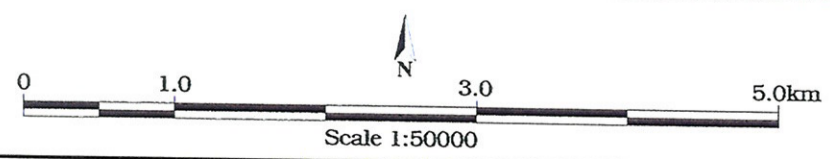
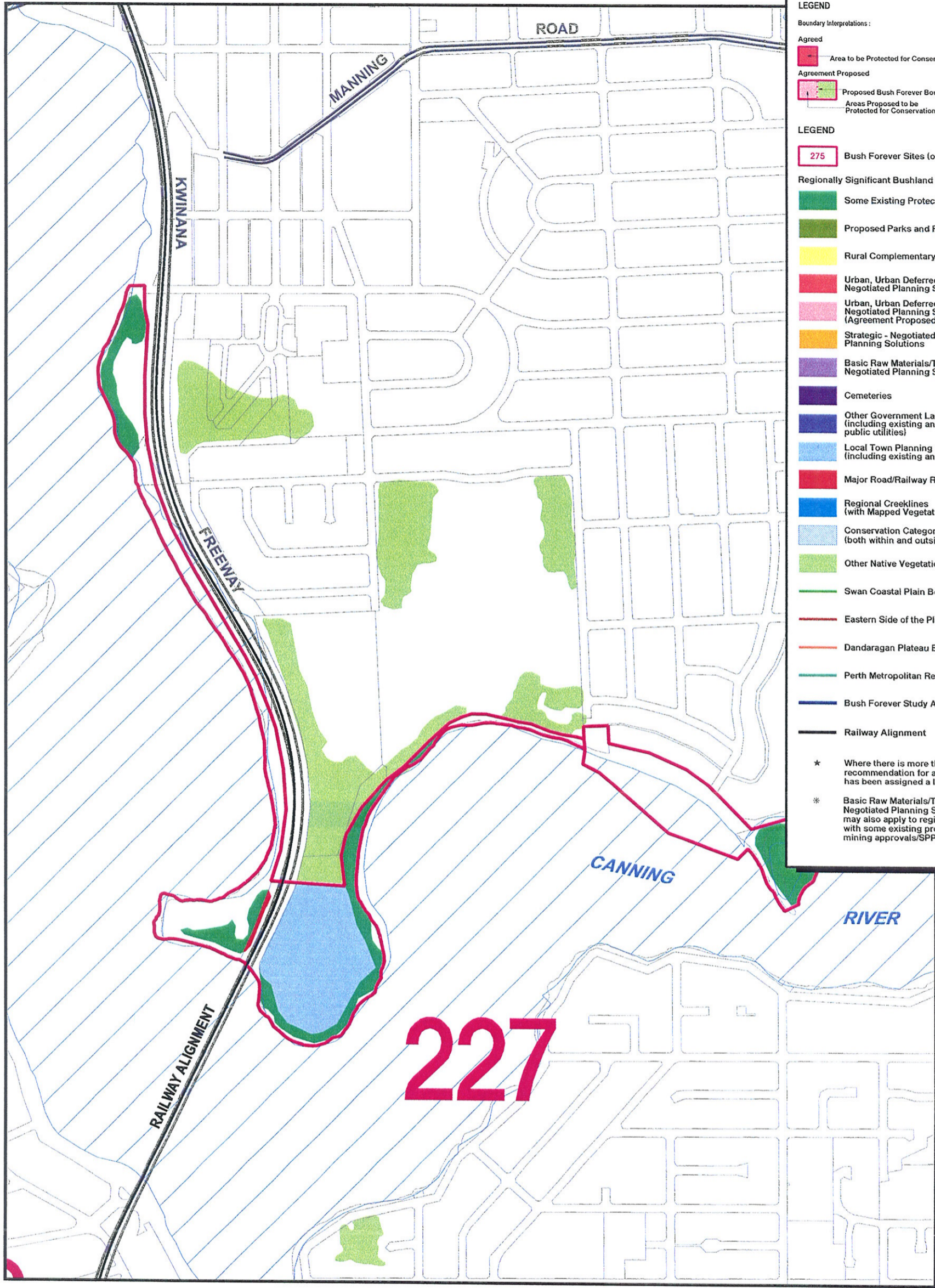


Figure 16

Jandakot UWPCA Well Head Protection Zones and Environmental Management Areas



Source: EPA, 2002



LEGEND

Boundary Interpretations:

Agreed

- Area to be Protected for Conservation

Agreement Proposed

- Proposed Bush Forever Boundary
- Areas Proposed to be Protected for Conservation

LEGEND

- 227 Bush Forever Sites (or part/s thereof)

Regionally Significant Bushland

- Some Existing Protection
- Proposed Parks and Recreation
- Rural Complementary
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreed)
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreement Proposed and To Be Determined)
- Strategic - Negotiated Planning Solutions
- Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions
- Cemeteries
- Other Government Lands (including existing and proposed public utilities)
- Local Town Planning Scheme Reserves (including existing and proposed public utilities)
- Major Road/Railway Reserves
- Regional Creeklines (with Mapped Vegetation)
- Conservation Category Wetlands (both within and outside Bush Forever Sites)
- Other Native Vegetation
- Swan Coastal Plain Boundary
- Eastern Side of the Plain Boundary
- Dandaragan Plateau Boundary
- Perth Metropolitan Region Boundary
- Bush Forever Study Area Boundary
- Railway Alignment

* Where there is more than one implementation recommendation for a Bush Forever Site, each part has been assigned a letter (A, B, C etc)

* Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions may also apply to regionally significant bushland with some existing protection and/or existing mining approvals/SPP No.10 policy areas

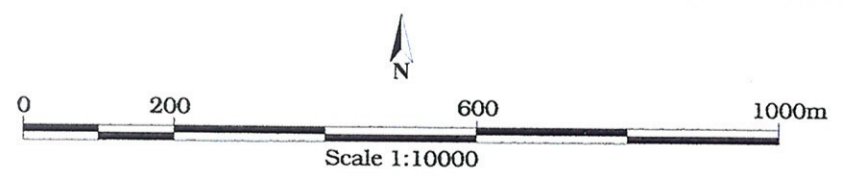
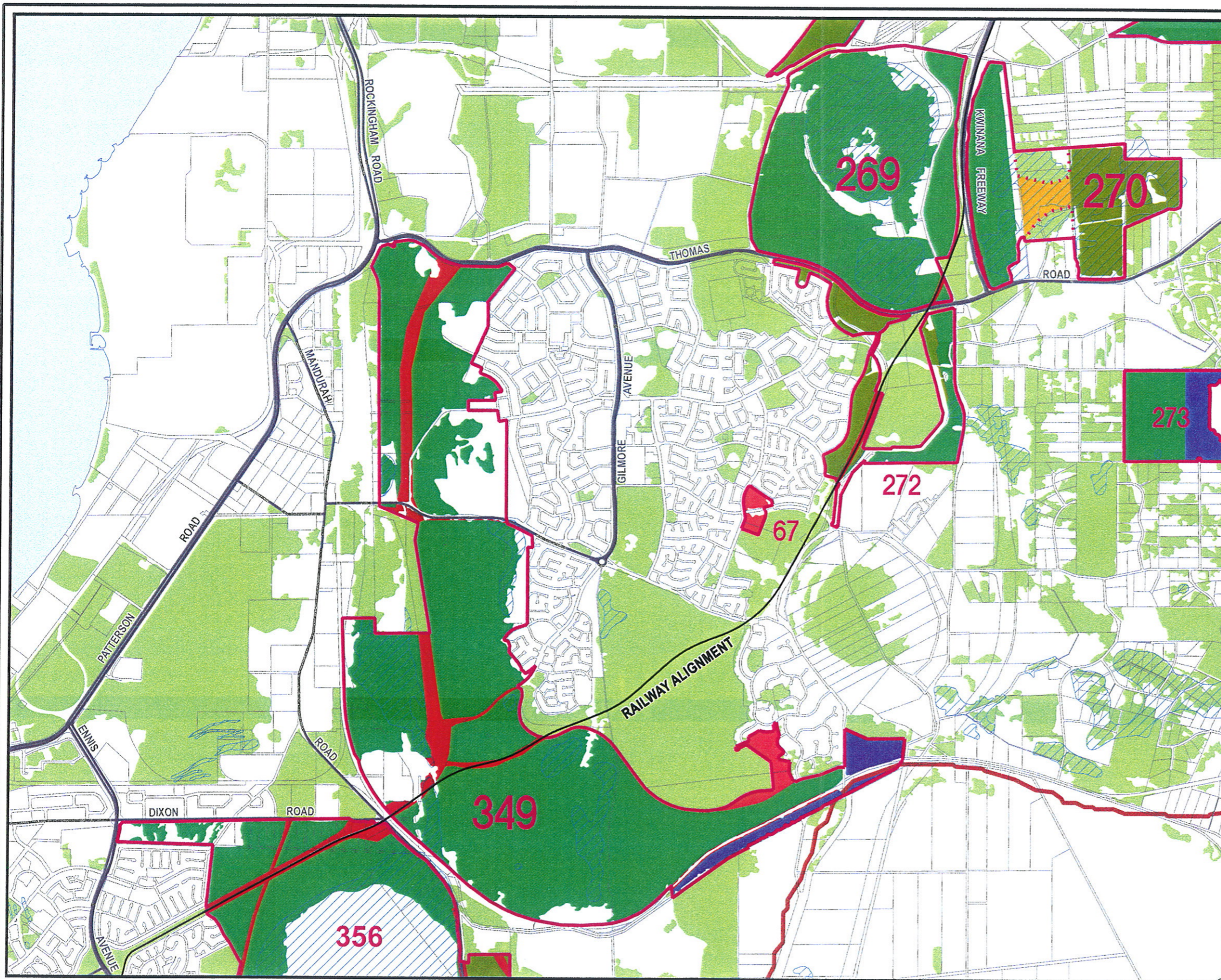


Figure 17a

Bush Forever Site 227



LEGEND

Boundary Interpretations:

Agreed

- Area to be Protected for Conservation

Agreement Proposed

- Proposed Bush Forever Boundary
- Areas Proposed to be Protected for Conservation

LEGEND

- 275 Bush Forever Sites (or part/s thereof)

Regionally Significant Bushland

- Some Existing Protection
- Proposed Parks and Recreation
- Rural Complementary
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreed)
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreement Proposed and To Be Determined)
- Strategic - Negotiated Planning Solutions
- Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions
- Cemeteries
- Other Government Lands (including existing and proposed public utilities)
- Local Town Planning Scheme Reserves (including existing and proposed public utilities)
- Major Road/Railway Reserves
- Regional Creeklines (with Mapped Vegetation)
- Conservation Category Wetlands (both within and outside Bush Forever Sites)
- Other Native Vegetation
- Swan Coastal Plain Boundary
- Eastern Side of the Plain Boundary
- Dandaragan Plateau Boundary
- Perth Metropolitan Region Boundary
- Bush Forever Study Area Boundary
- Railway Alignment

* Where there is more than one implementation recommendation for a Bush Forever Site, each part has been assigned a letter (A, B, C etc)

* Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions may also apply to regionally significant bushland with some existing protection and/or existing mining approvals/SPP No.10 policy areas

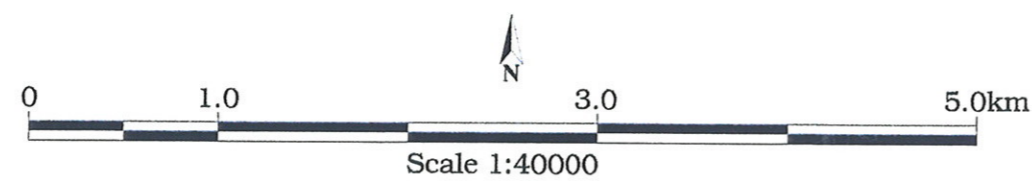
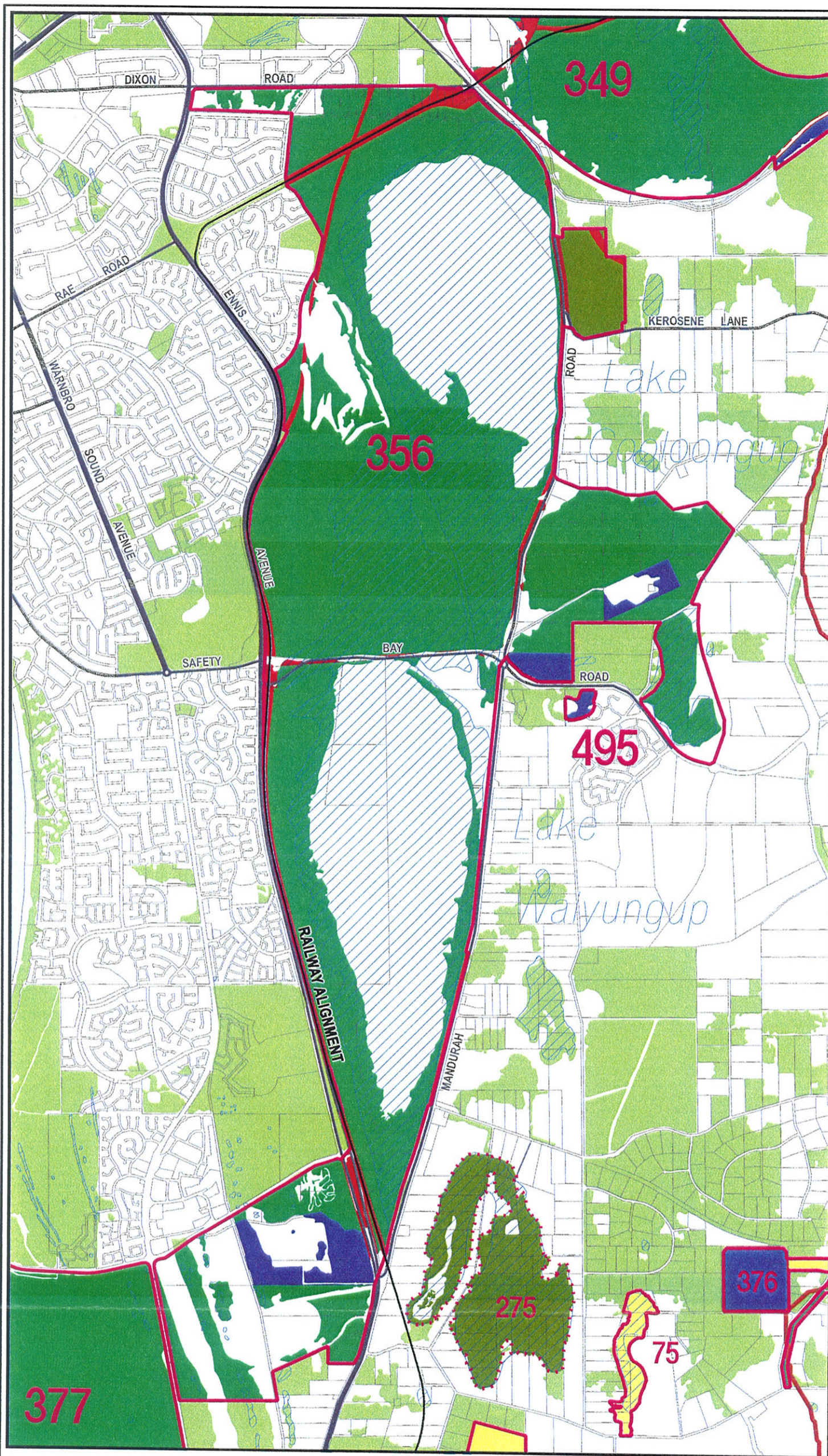


Figure 17b

**Bush Forever Sites
269, 272 and 349**

Source: Ministry for Planning, 2001



LEGEND

Boundary Interpretations:

Agreed

- Area to be Protected for Conservation

Agreement Proposed

- Proposed Bush Forever Boundary
- Areas Proposed to be Protected for Conservation

LEGEND

- 275 Bush Forever Sites (or part/s thereof)

Regionally Significant Bushland

- Some Existing Protection
- Proposed Parks and Recreation
- Rural Complementary
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreed)
- Urban, Urban Deferred, Industrial Negotiated Planning Solutions (Agreement Proposed and To Be Determined)
- Strategic - Negotiated Planning Solutions
- Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions
- Cemeteries
- Other Government Lands (including existing and proposed public utilities)
- Local Town Planning Scheme Reserves (including existing and proposed public utilities)
- Major Road/Railway Reserves
- Regional Creeklines (with Mapped Vegetation)
- Conservation Category Wetlands (both within and outside Bush Forever Sites)
- Other Native Vegetation

Swan Coastal Plain Boundary

Eastern Side of the Plain Boundary

Dandaragan Plateau Boundary

Perth Metropolitan Region Boundary

Bush Forever Study Area Boundary

Railway Alignment

* Where there is more than one implementation recommendation for a Bush Forever Site, each part has been assigned a letter (A, B, C etc)

* Basic Raw Materials/Titanium Minerals Negotiated Planning Solutions may also apply to regionally significant bushland with some existing protection and/or existing mining approvals/SPP No.10 policy areas

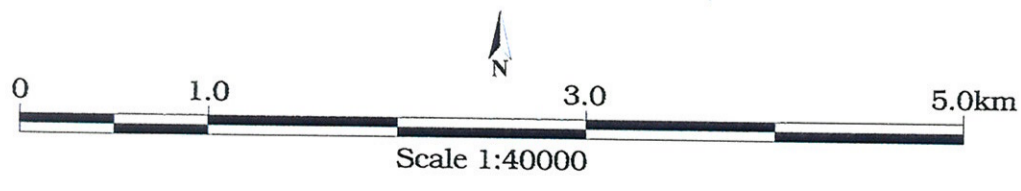
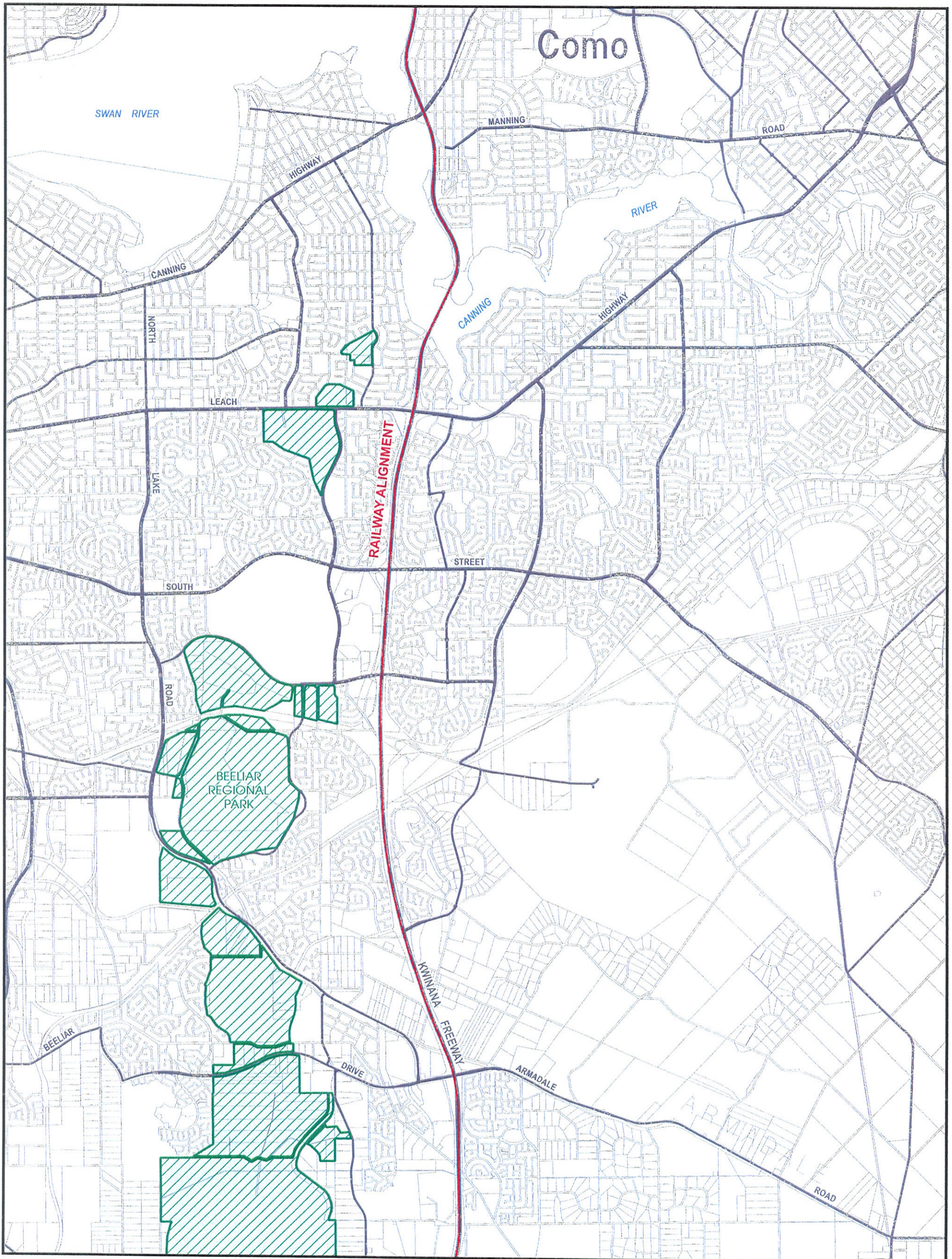


Figure 17c

Bush Forever Site 356

Source: Ministry for Planning, 2001



LEGEND

- Railway Alignment
- Beeliar Regional Park
- Leda Nature Reserve
- Rockingham Lakes Regional Park

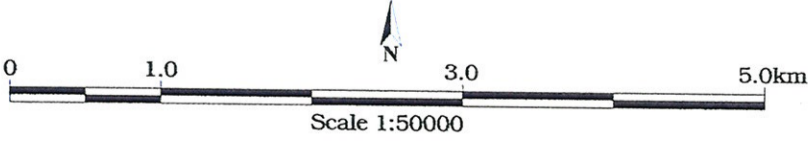
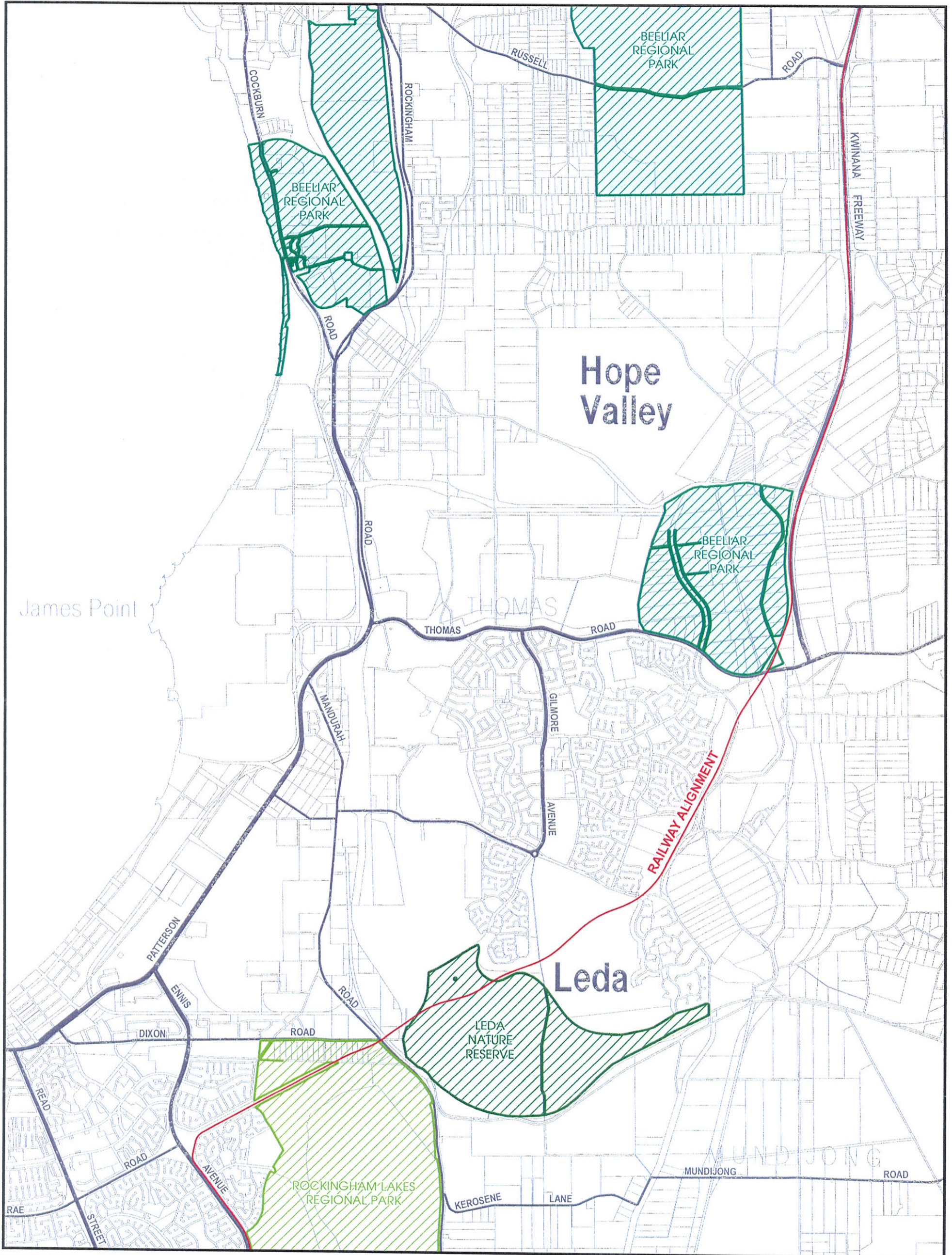


Figure 18a
Regional Parks and Nature Reserves

Source: Ministry for Planning



LEGEND

- Railway Alignment
- Beeliar Regional Park
- Leda Nature Reserve
- Rockingham Lakes Regional Park

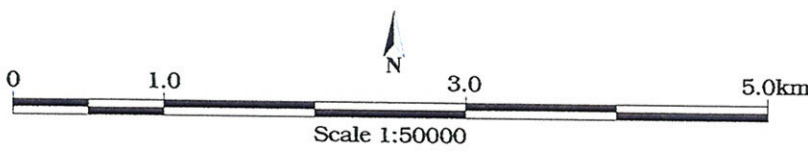
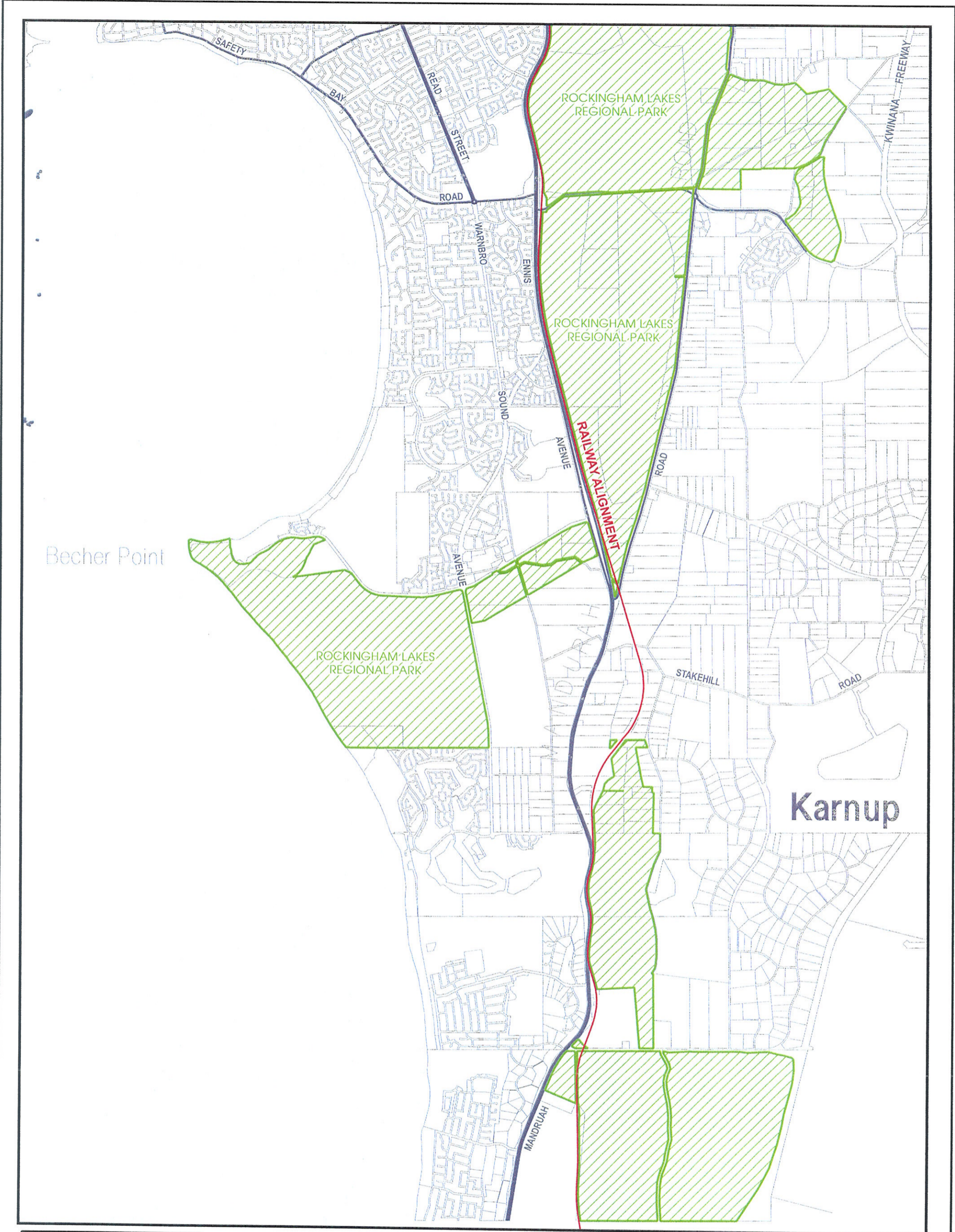


Figure 18b

Regional Parks and Nature Reserves

Source: Ministry for Planning



LEGEND

- Railway Alignment
- Beeliiar Regional Park
- Leda Nature Reserve
- Rockingham Lakes Regional Park

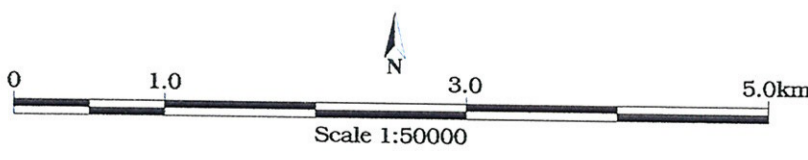
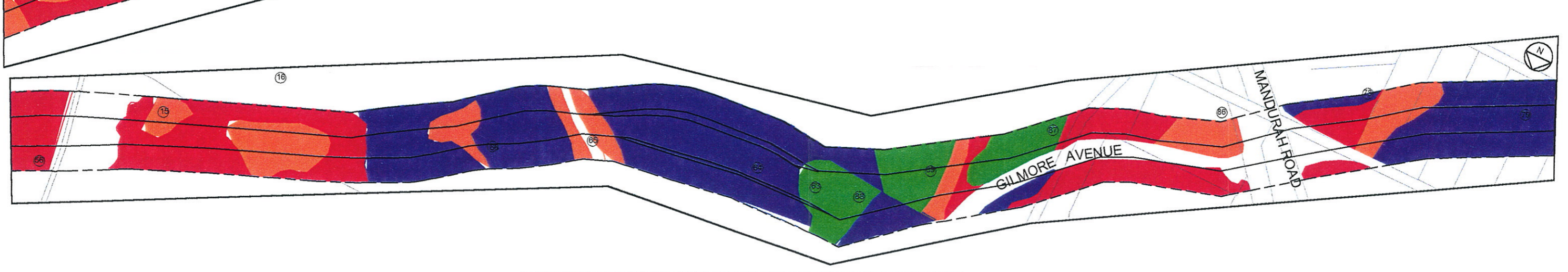
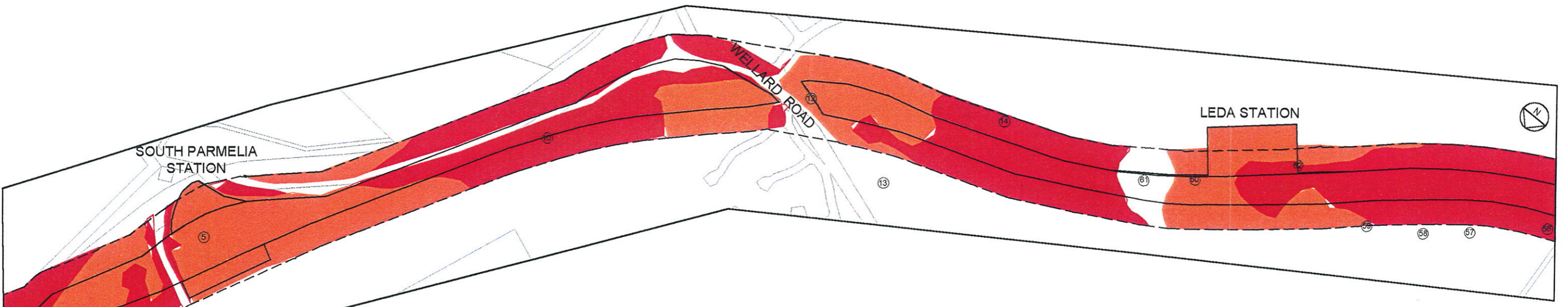
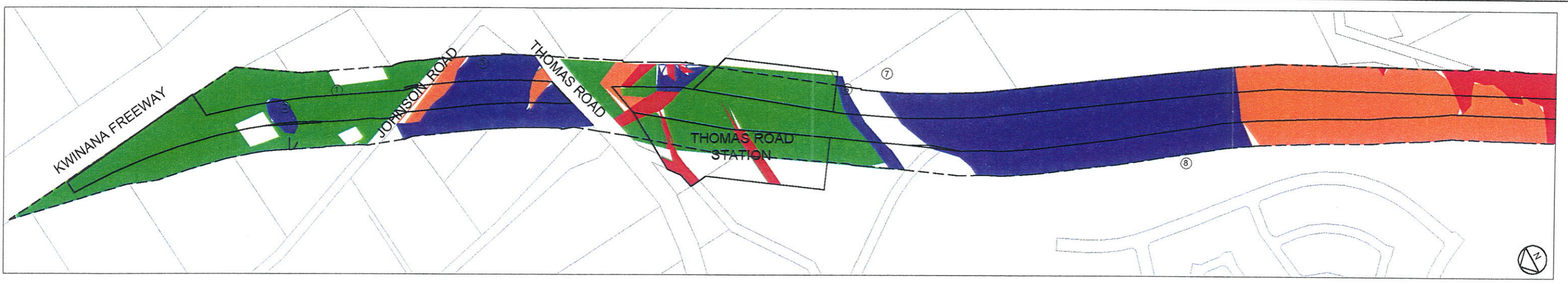


Figure 18c

Regional Parks and Nature Reserves

Source: Ministry for Planning



Bushland Condition Scale

<p>Very Good - Excellent 80 - 100% native flora composition. Cover/abundance of weeds less than 5 % Minor signs of disturbance.</p> <p>Fair - Good 50 - 80% native flora composition. Vegetation structure modified or nearly so. Disturbance influence moderate. Cover/abundance of weeds 5 - 20 %</p> <p>Recently Burnt</p>	<p>Poor 20 - 50 % native flora composition. Vegetation structure completely modified. Disturbance incidence high. Cover/abundance of weeds 20 - 60 %</p> <p>Very Poor 0 - 20 % native flora composition. Vegetation structure disappeared. Disturbance incidence very high. Cover/abundance of weeds 60 - 100 %</p> <p>MRS railway reserve boundary</p> <p>50m buffer boundary</p> <p>① Weed survey points</p>
--	--

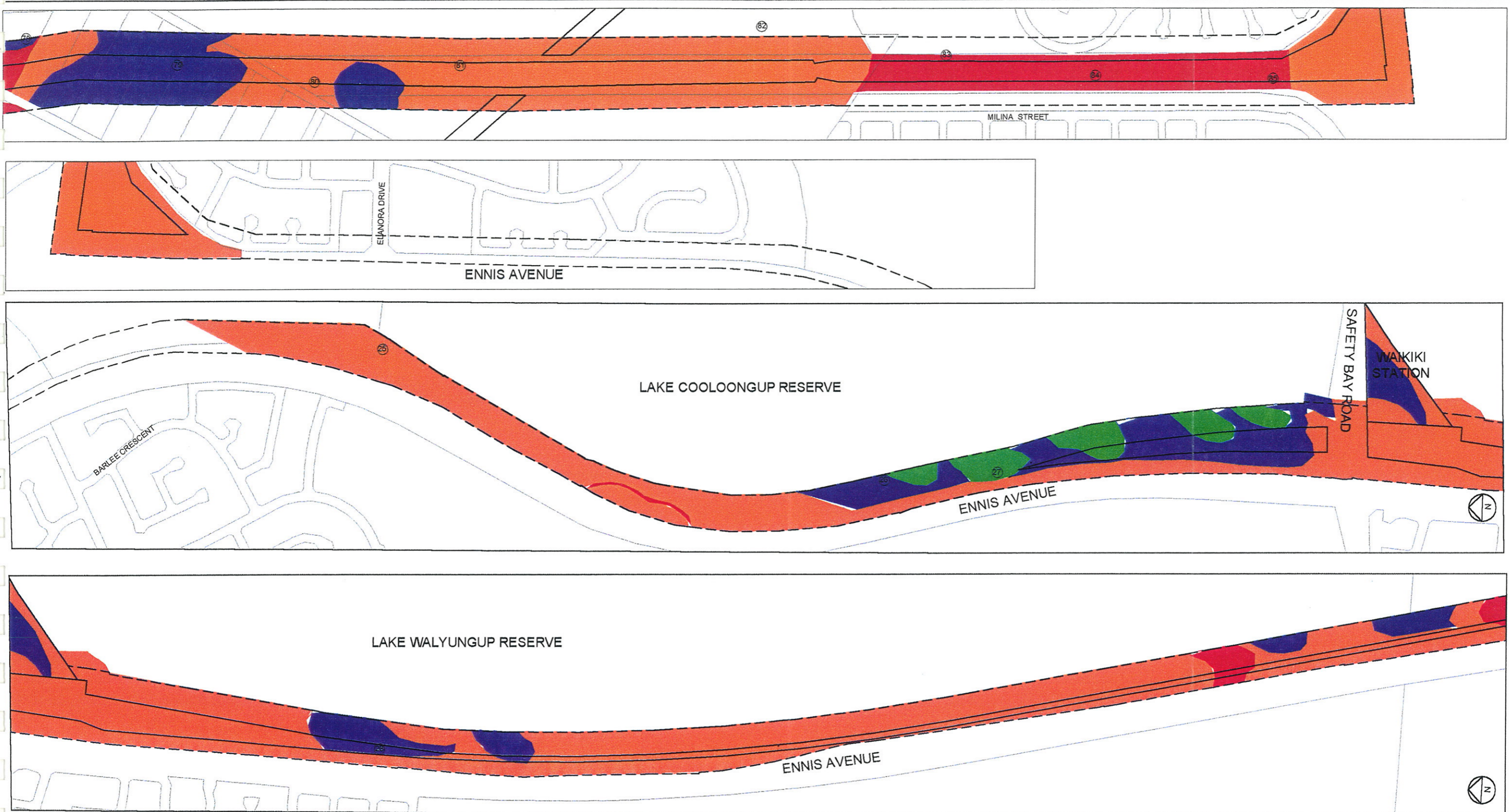
SCALE: 1 : 8000

ECOSCAPE
 ECOSCAPE (AUSTRALIA) PTY LTD ACN 070 128 675
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Figure 19a

Vegetation Condition

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



Bushland Condition Scale	
■ Very Good - Excellent 80 - 100% native flora composition. Cover/abundance of weeds less than 5 % Minor signs of disturbance.	■ Poor 20 - 50 % native flora composition. Vegetation structure completely modified. Disturbance incidence high. Cover/abundance of weeds 20 - 60 %
■ Fair - Good 50 - 80% native flora composition. Vegetation structure modified or nearly so. Disturbance influence moderate. Cover/abundance of weeds 5 - 20 %	■ Very Poor 0 - 20 % native flora composition. Vegetation structure disappeared. Disturbance incidence very high. Cover/abundance of weeds 60 - 100 %
Recently Burnt	MRS railway reserve boundary
	50m buffer boundary
	Weed survey points

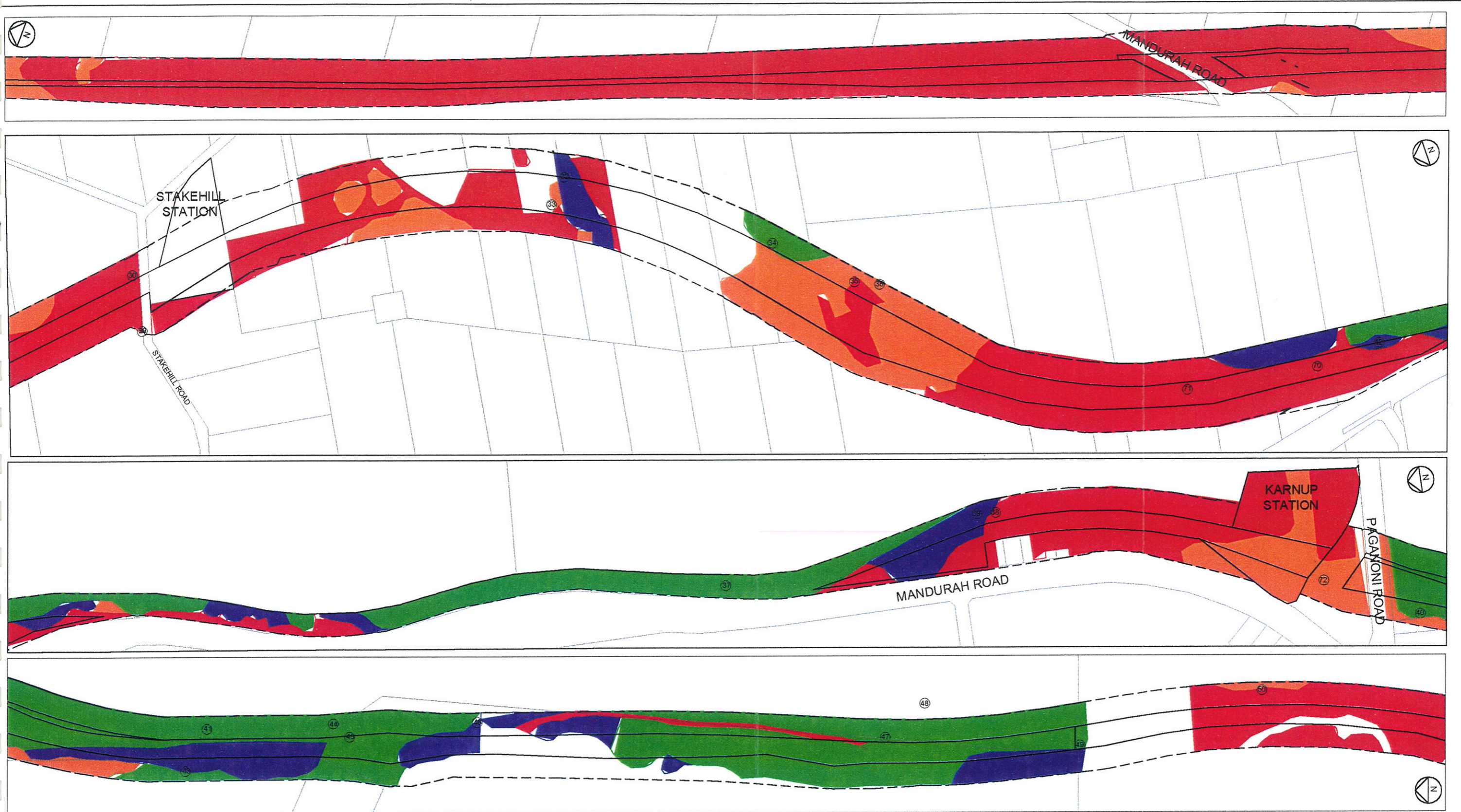
SCALE: 1 : 8000

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Figure 19b

Vegetation Condition

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



SCALE: 1 : 8000

ECOSCAPE

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 9 Stirling Highway, North Fremantle, W. Australia 6169
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 Email: ecoscape @ inet.net.au

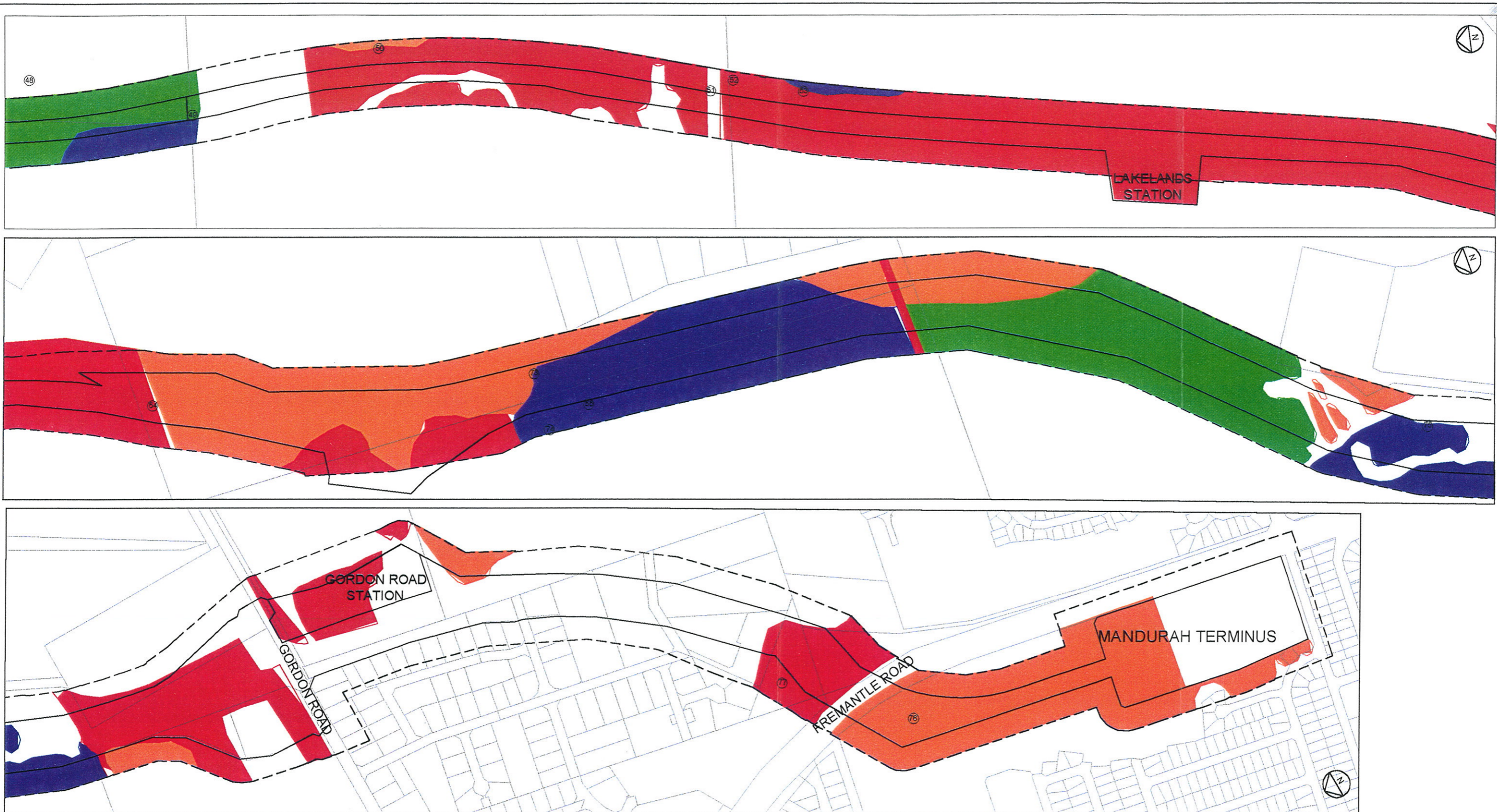
Bushland Condition Scale

- | | |
|---|--|
| <p>Very Good - Excellent
 80 - 100% native flora composition.
 Cover/abundance of weeds less than 5 %
 Minor signs of disturbance.</p> <p>Fair - Good
 50 - 80% native flora composition.
 Vegetation structure modified or nearly so.
 Disturbance influence moderate.
 Cover/abundance of weeds 5 - 20 %</p> <p>Recently Burnt</p> | <p>Poor
 20 - 50 % native flora composition.
 Vegetation structure completely modified.
 Disturbance incidence high.
 Cover/abundance of weeds 20 - 60 %</p> <p>Very Poor
 0 - 20 % native flora composition.
 Vegetation structure disappeared.
 Disturbance incidence very high.
 Cover/abundance of weeds 60 - 100 %</p> <p>MRS railway reserve boundary</p> <p>50m buffer boundary</p> <p>Weed survey points</p> |
|---|--|

Figure 19c

Vegetation Condition

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS



SCALE: 1 : 8000

ECOSCAPE

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 9 Stirling Highway, North Fremantle, W. Australia 6169
 Telephone (08) 9430 8955 • Facsimile (08) 9430 8977
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

Bushland Condition Scale	
	Very Good - Excellent 80 - 100% native flora composition. Cover/abundance of weeds less than 5 % Minor signs of disturbance.
	Fair - Good 50 - 80% native flora composition. Vegetation structure modified or nearly so. Disturbance influence moderate. Cover/abundance of weeds 5 - 20 %
	Poor 20 - 50 % native flora composition. Vegetation structure completely modified. Disturbance incidence high. Cover/abundance of weeds 20 - 60 %
	Very Poor 0 - 20 % native flora composition. Vegetation structure disappeared. Disturbance incidence very high. Cover/abundance of weeds 60 - 100 %
	Recently Burnt
	MRS railway reserve boundary
	50m buffer boundary
	Weed survey points

Figure 19d

Vegetation Condition

BOWMAN BISHAW GORHAM
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

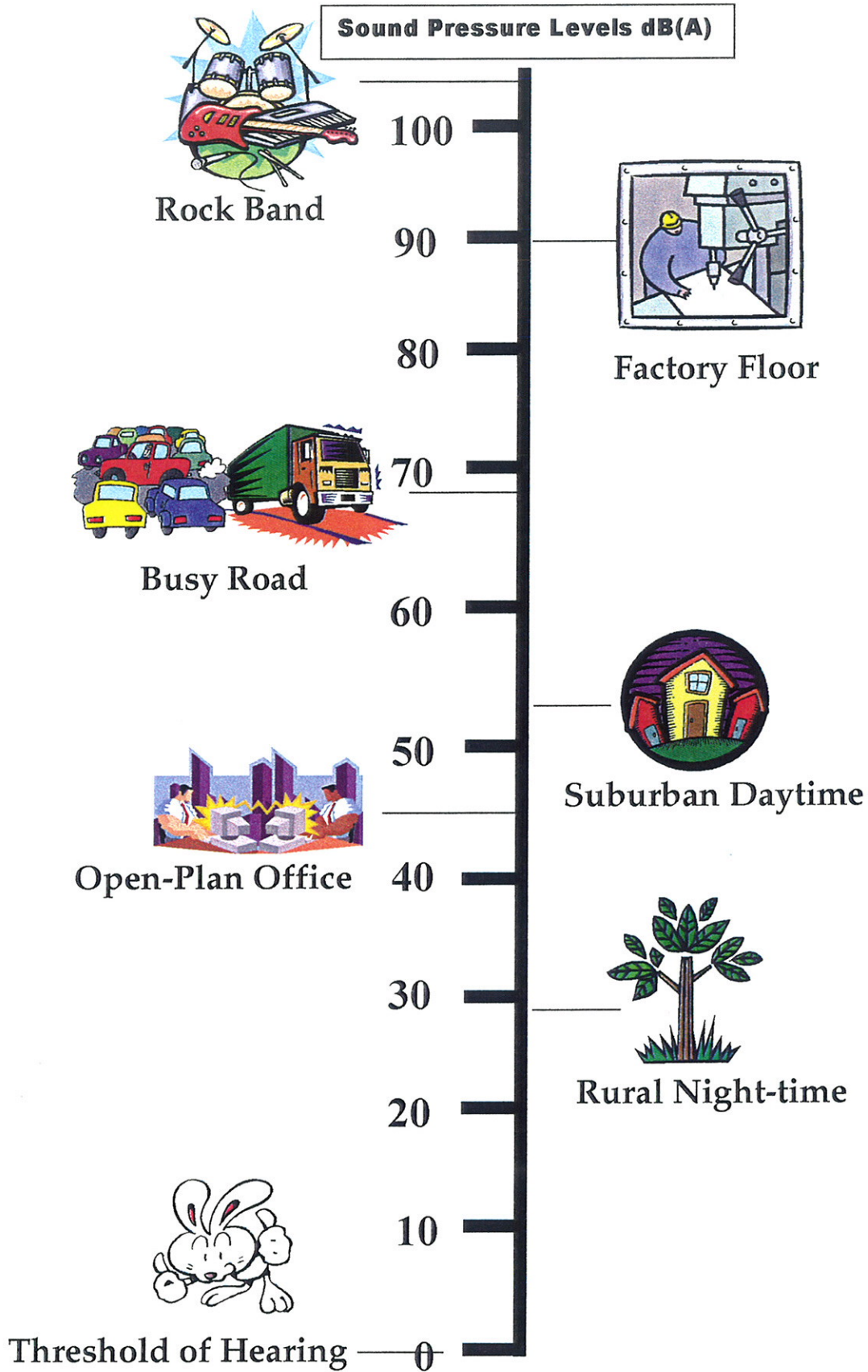


Figure 20
Typical Average Noise Levels for Everyday Events

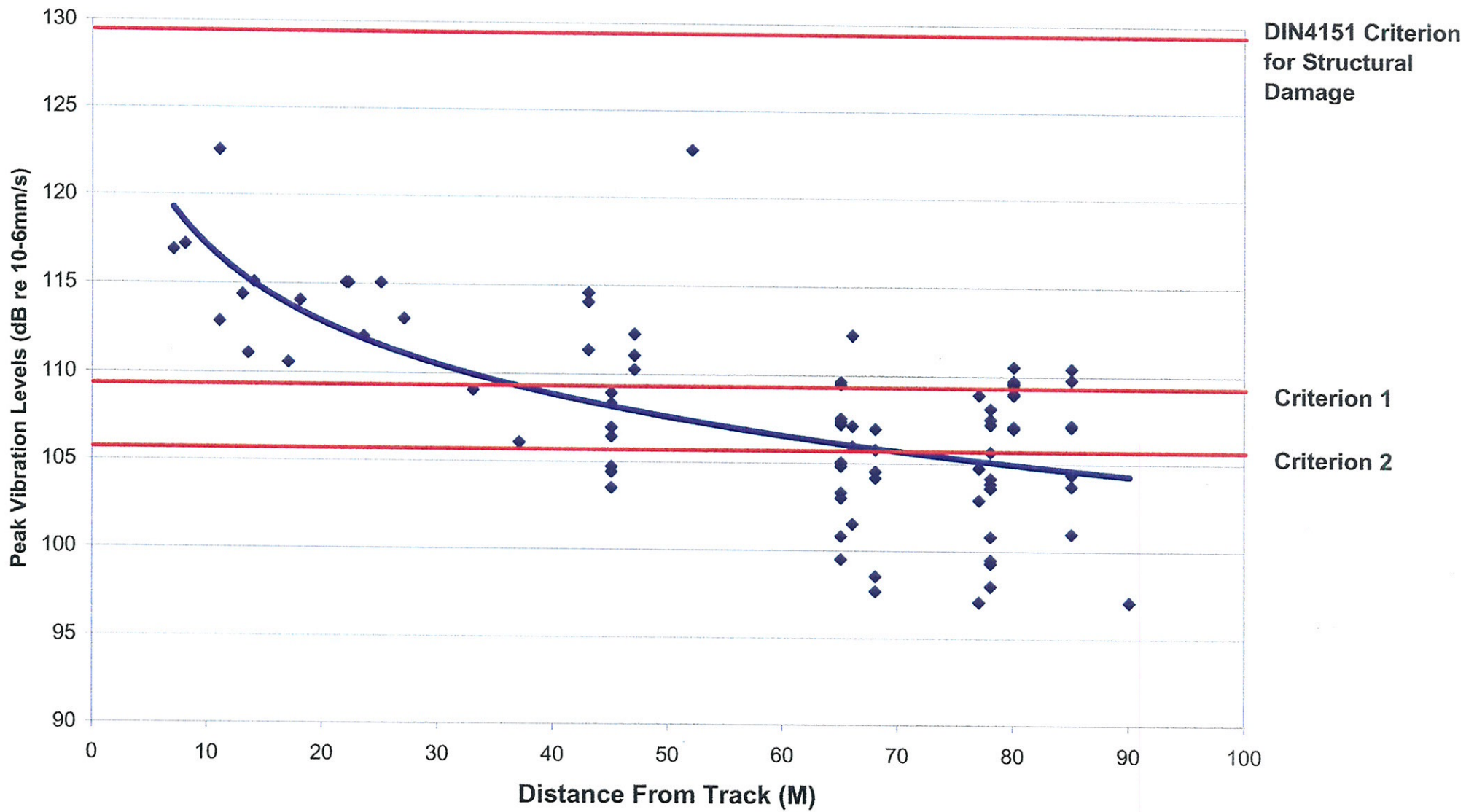


Figure 21

Attenuation of Vibration Levels with Distance from Track

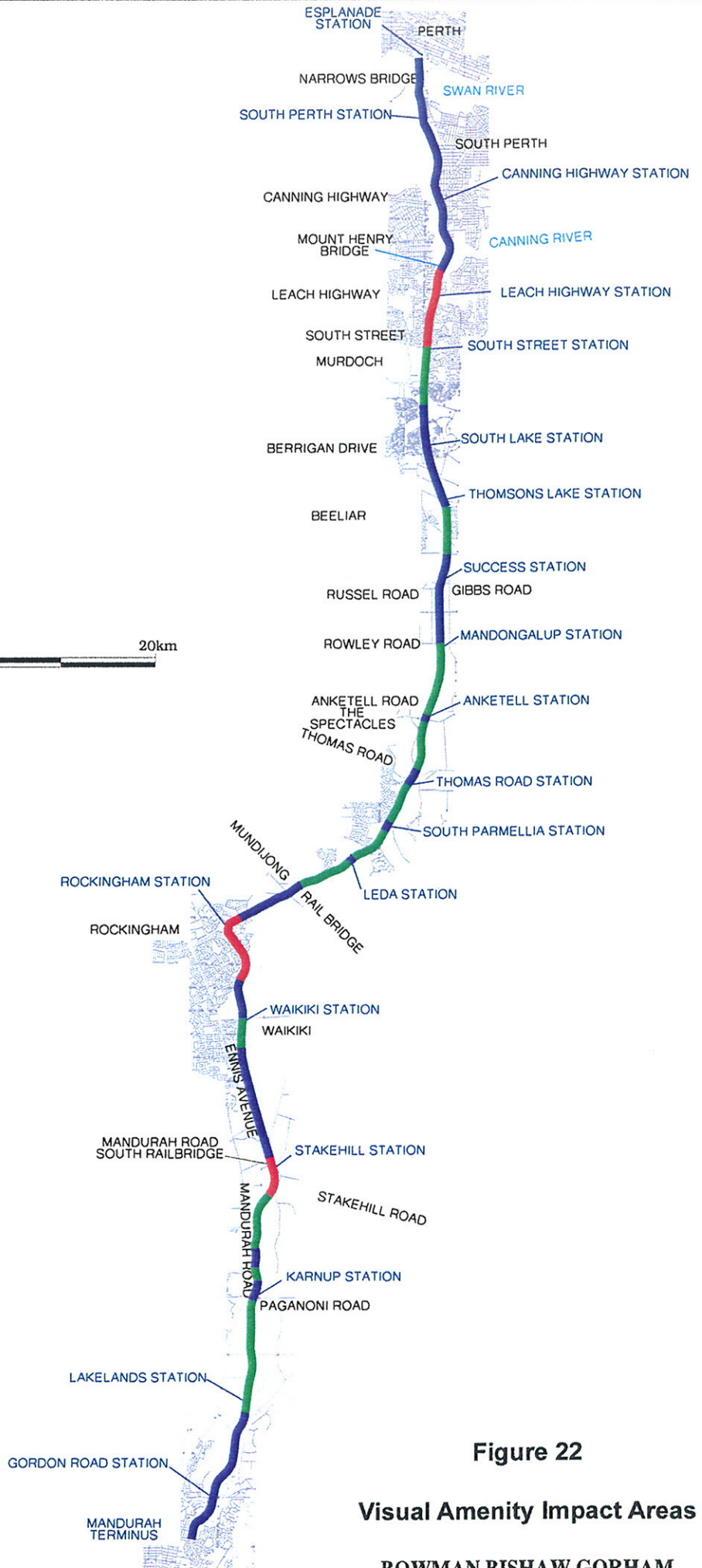
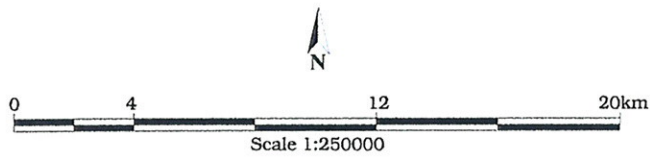


Figure 22

Visual Amenity Impact Areas

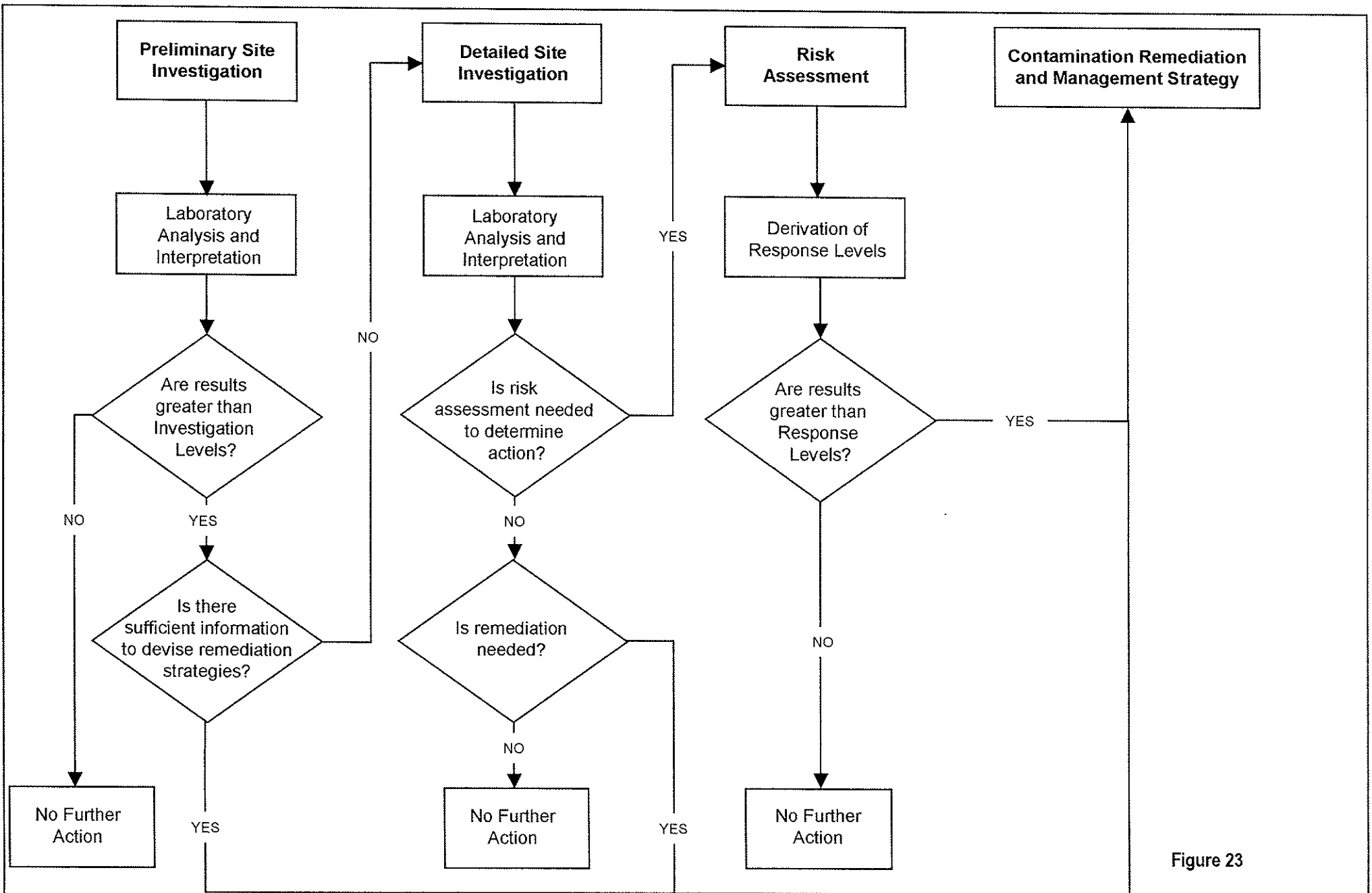


Figure 23

Site Contamination Assessment Process

(DEP, 2001)

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

APPENDIX A

EPA Guidelines



Environmental Protection Authority

Guidelines

SOUTH WEST METROPOLITAN RAILWAY FROM PERTH TO MANDURAH (Assessment Number 1369)

- Part A Specific Guidelines for the preparation of the Public Environmental Review (PER) document
- Part B Generic Guidelines for the preparation of an environmental review document
- Attachment 1 Example of the invitation to make a submission
- Attachment 2 Advertising the environmental review
- Attachment 3 Example of the newspaper advertisement
- Attachment 4 Proposal location map
- Attachment 5 Railways reserve under MRS Amendments 937/33 and 938/33

These Guidelines are provided for the preparation of the proponent's environmental review document. The specific environmental factors and other matters to be addressed are identified in Part A. The generic Guidelines for the format of an environmental review document are provided in Part B.

The environmental review document must address all elements of Part 'A' and Part 'B' of these Guidelines prior to approval being given to commence the public review.

Could you please supply the project officer with an electronic copy of the PER document for use on Macintosh, Microsoft Word Version 6, together with scanned figures. **Figures should be reproducible in a black and white format** unless the proponent agrees to cover the costs of including colour figures in the EPA's published report.

Upon approval being given to commence the public review, the proponent is requested to place an electronic copy of the PER on their website, if this is possible.

Part A: Specific Guidelines for the preparation of the Public Environmental Review (PER)

Specific guidelines are provided below for the following matters to be addressed in the PER:

- The work required to address environmental factors (section 2);
- A discussion on Ecologically Sustainable Development (section 3); and
- Distribution of the PER for the public review period (section 4).

These sections follow an outline of the proposal being assessed by the EPA, in section 1.1.

The generic guidelines in Part B also need to be addressed.

1.1 The proposal

The Department of Transport (the proponent) intends to construct and operate the South West Metropolitan Railway, from Perth to Mandurah. The proposed route of the South West Metropolitan railway is indicated on the attached plan (Attachment 4).

This Public Environmental Review (PER) applies to the construction and operation of the South West Metropolitan Railway between Perth and Mandurah **except** for the particular aspects that have been previously assessed.

The EPA has previously assessed and therefore is not generally able to assess in this PER:

- **The railways reserve as defined by Metropolitan Region Scheme (MRS) Amendments 937/33 and 938/33 in terms of the potential impacts on System 6 recommendations M103 and M104; the Beeliar Regional Park; and regionally significant vegetation, fauna and wetlands** (EPA Bulletin 746, July 1994). Since the previous proposal was not assessed in terms of a number of pollution management factors, such as noise and vibration, it is considered that these factors may be assessed as part of the subject PER. The portions of the existing gazetted railways reserve that were finalised after the referral of MRS Amendments 937/33 and 938/33 to the EPA are shown indicatively in Attachment 5.

At the date of issue of these Guidelines, there are two “schemes” that deal with portions of the railways reserve that are being dealt with under the environmental impact assessment procedures set out in Division 3 of Part IV of the Environmental Protection Act 1986. The extent to which environmental factors relating to these portions need to be addressed in this PER will depend on the outcomes of the relevant environmental impact assessment procedures. The two schemes are as follows:

- **The Peel Region Scheme** – A railways reserve to accommodate the South West Metropolitan Railway is shown in the Peel Regional Scheme. This scheme has been formally assessed by the EPA but environmental conditions had not been set by the Minister for the Environment at the date of issue of these Guidelines. The EPA identified vegetation, wetlands, noise and vibration as deferred factors for the railway corridor (EPA Bulletin 994, 2000). At the time of issue of these Guidelines, it is expected that the deferred factors will be addressed as part of this PER. However, the extent to which environmental issues relevant to the portion of the railway within the City of Mandurah should be addressed will depend on the outcome of the Minister for the Environment’s consideration of the EPA’s report and appeals on the report.
- **MRS Amendment No 1032/33 South West Metropolitan Transit** – This Amendment has been recently referred to the EPA, and proposes adjustments to the MRS railways reserve. However, the level of assessment had not been set at the date of issue of the Guidelines. At this stage it is expected that environmental factors relevant to this amendment will be addressed in this PER.

The PER should include a discussion of the environmental factors that have previously been assessed, to provide context where necessary. However, to the extent that these factors have been previously assessed, they cannot be reassessed.

1.2 Description of the proposal required

A comprehensive description of the proposal is required in the PER. This should include:

- o Location details – provide plans (also see Part B section 5.1.3 of Guidelines) showing:
 - ❖ the overall route from Perth to Mandurah in its metropolitan context;
 - ❖ the location of the elements required for the rail service in relation to local cadastral boundaries, topographic information and key environmental constraints (show the railway reserve, tracks, station and parking areas, railcar depot, drainage basins, grade separated areas and other relevant features); and
 - ❖ the railway and associated features superimposed on aerial photographs would be very helpful;
- o justification and objectives for the proposed development, (this may include a discussion of benefits);
- o the role of the proponent - will other authorities be involved in constructing and then operating and maintaining the railway and facilities?
- o the legal framework, including zoning and environmental approvals required; identify decision making authorities and involved agencies;
- o a description of previous referrals to the EPA, the environmental factors and portions of the railway already assessed, the outcomes of the previous environmental impact assessment procedures and the relationship of previous referrals with the current proposal. Include plans showing portions of the railway subject to previous environmental impact assessment procedures;
- o a discussion of the advantages and disadvantages of alternative options for the rail route and associated features, including those that may have fewer adverse environmental impacts. The consideration of options is an important part of environmental impact assessment;
- o railways reserve and railway line details – including typical width, construction type, and cross section; and details of areas that may be of specific interest eg raised or sunken portions, and portions through environmentally sensitive areas (alternatively address the latter in the discussion on relevant environmental issues);
- o a description of all features associated with the rail service eg rolling stock, power, overhead infrastructure, stations, car parks, bridges, drainage facilities, areas of cut and fill (where not known address how and when will be identified);
- o a description of ancillary and peripheral works that will be required (eg road relocations, services relocations, parking areas, vehicle accesses at stations) and land use changes that may be generated by the South West Metropolitan Railway particularly those that may affect the natural environment of the area, or the community's relationship with it. It is understood ancillary works include the relocation of roads including the Fremantle-Mandurah Road in the vicinity of Anstey Swamp;
- o a description of how the service is likely to operate (including frequency of services, operating speeds, express services etc);
- o a description of how the loop through Rockingham will be constructed and will operate; and
- o timing and staging of construction work.

2. Environmental issues relevant to this proposal

At this preliminary stage, the Environmental Protection Authority (EPA) believes that the key environmental issues are:

- The impacts of noise and vibration on the amenity of neighbouring land users during the operation of the rail service;
- The impacts of construction activities (noise, vibration, dust etc) on neighbouring land users; and
- The protection of significant vegetation and flora, threatened fauna habitats, and significant wetlands and watercourses.

It is considered that other main management issues include:

- Protection of public safety and risk minimisation;
- Protection of groundwater resources during any dewatering or activities in the public water supply area; and
- Management of contaminated soil and groundwater.

The work required to address the environmental factors applicable to these issues is detailed in the table below. The table also provides the EPA's preliminary objectives for the factors. The work carried out to address the factors should be described within the environmental review document for the public to consider and make comment to the EPA. The EPA expects to address these factors in its report to the Minister for the Environment.

The EPA also expects the proponent to identify potential impacts and management processes for **all** other environmental factors that may be associated with the project, in the broad categories of biophysical, pollution management and social surrounds. Other factors may include, but are not limited to, visual amenity, local traffic management, Aboriginal culture and heritage and European culture and heritage, and odour associated with tunnel vents.

For factors not associated with a significant impact on the environment, it is sufficient for an outline of the impacts and the proposed management to be provided in the PER.

However, should any additional factor be found to be associated with a potentially significant impact on the environment, then the proponent should discuss the work that will be necessary to address the factor with the DEP.

The EPA expects the proponent to consult fully with interested members of the public in developing the proposal and management measures.

(See table of work required over)

Issue	Site specific factor	Preliminary EPA objective	Work required for the environmental review (see also Part B of Guidelines)
Vegetation	<p>Regionally significant vegetation</p> <p>Threatened ecological communities</p> <p>Declared rare and priority flora, and other significant flora</p>	<p>Maintain the abundance, diversity, geographic distribution and productivity of vegetation.</p> <p>Maintain the abundance, species diversity, geographic distribution and productivity of threatened ecological communities.</p> <p>Protect Declared Rare and Priority Flora, consistent with the provisions of the Wildlife Conservation Act 1950.</p> <p>Protect other flora of conservation significance</p>	<p>Note: For those portions of the route and aspects of vegetation that have previously been assessed by the EPA, sufficient information should be included in the PER to provide context for the current proposal.</p> <p>EXISTING ENVIRONMENT</p> <ul style="list-style-type: none"> • Describe the vegetation complexes and community types, and the flora and its significance, on land that will be affected by, or may potentially be affected by, construction of the railway and associated elements. • Address Bush Forever, Regional Parks, System 6 outside the MRS boundary, threatened ecological communities (TESSs), declared rare and priority flora (DRPF), and other significant vegetation and flora (address likelihood of habitat existing for DRPF species that may be difficult to find). In particular, TEC 19 is known to occur in and near portions of the railways reserve. • Undertake appropriate botanical survey and mapping work to determine the diversity, distribution and condition of the vegetation (refer to EPA position statement on general requirements for terrestrial biological surveys in WA for methodology). • For Bush Forever sites, the assessment should be at a level that allows the Bush Forever selection criteria to be addressed in detail. <p>IMPACTS</p> <ul style="list-style-type: none"> • Describe the potential direct and indirect impacts on all significant vegetation and flora, including Bush Forever and other regionally significant vegetation sites, threatened ecological communities, and rare and priority flora species. • Describe areas to be cleared of native vegetation in terms of each vegetation complex and floristic community type. • Include maps clearly showing the extent and characteristics of vegetation that may be cleared and in other ways impacted. • Include a description of potential impacts on vegetation during the construction phase. <p>MANAGEMENT</p> <ul style="list-style-type: none"> • Discuss options for reducing and avoiding impacts. • Describe management measures that ensure the avoidance, or, where this is not possible, the minimisation of adverse impacts on vegetation during the construction, operation and maintenance of the proposal – include management of weeds, fire, disease, access, location of construction storage sites etc. • Detail proponent commitments (see section on commitments in Part B section 5.3). It is important to be aware that the EPA generally expects the commitments to include details of offsets for the loss of significant vegetation and flora, such as threatened ecological communities. • Provide the key elements of any Environmental

Issue	Site specific factor	Preliminary EPA objective	Work required for the environmental review (see also Part B of Guidelines)
			<p>Management Plans (EMPs) that may be proposed to manage environmental impacts. Any such Plans need to integrate with relevant broader scope management plans, and the EMP required by Statement 368.</p> <ul style="list-style-type: none"> Identify management and emergency access points across the rail reserve (during and post construction) where the rail reserve adjoins a natural area such as a regional park.
Fauna		<p>Maintain the abundance, species diversity and geographical distribution of terrestrial fauna.</p> <p>Protect Specially Protected (Threatened) Fauna consistent with the provisions of the Wildlife Conservation Act 1950, and their habitat.</p>	<p>Note: For those portions of the route and aspects of fauna that have previously been assessed by the EPA, sufficient information should be included in the PER to provide context for the current proposal.</p> <p>EXISTING ENVIRONMENT</p> <ul style="list-style-type: none"> Describe the fauna and its significance, that may occur on land that will be affected by, or may potentially be affected by, construction of the railway and associated elements. Describe baseline survey and mapping work to identify the existing fauna in the project area (refer to EPA position statement on general requirements for terrestrial biological surveys in WA for methodology). <p>IMPACTS</p> <ul style="list-style-type: none"> Describe the potential direct and indirect impacts on the existing fauna, particularly Specially Protected (Threatened) Fauna, and their habitats. Identify areas including adequate buffer areas that may provide habitat for threatened species or species that may be particularly sensitive to disturbance. <p>MANAGEMENT</p> <ul style="list-style-type: none"> Describe management measures that ensure the avoidance, or, where this is not possible, the minimisation of adverse impacts on fauna and in particular Specially Protected (Threatened) Fauna, during the construction and operation of the proposal, including the minimisation of the risks of exotic species and diseases being introduced into the environment, fencing of the railways reserve and fauna crossing culverts. Detail proponent commitments (see section on commitments in Part B section 5.3). It is important to be aware that the EPA generally expects the commitments to include details of offsets for the loss of significant environmental values. Provide the key elements of any Environmental Management Plans that may be proposed to manage the impacts of the proposal on fauna. Any such Plans need to integrate with relevant broader scope management plans, and the EMP required by Statement 368.
Wetlands and water courses		<p>Maintain the integrity, functions and environmental values of wetlands and water courses</p>	<p>Note: For those portions of the route and aspects of wetlands that have previously been assessed by the EPA, sufficient information should be included in the PER to provide context for the current proposal.</p>

Issue	Site specific factor	Preliminary EPA objective	Work required for the environmental review (see also Part B of Guidelines)
			<p>EXISTING ENVIRONMENT</p> <ul style="list-style-type: none"> • Identify and describe the characteristics of all wetlands and watercourses on land that will be affected by, or may potentially be affected by, construction of the railway and associated elements. • Map the extent of wetland/watercourse dependant vegetation. • Identify the environmental significance of the wetlands and watercourses, and identify the wetland management category. • Identify buffers/foreshores around significant wetlands and water courses. <p>IMPACTS</p> <ul style="list-style-type: none"> • Describe the potential direct and indirect impacts on wetlands and their buffers and watercourses and their foreshores eg area of clearing, alteration to natural contours, effects on wetland hydrology, drainage impacts etc. • Include a description of potential construction phase impacts. <p>MANAGEMENT</p> <ul style="list-style-type: none"> • Describe management measures and options that ensure the avoidance, or, where this is not possible, the minimisation of adverse impacts during the construction and operation of the proposal. • Detail proponent commitments (see section on commitments in Part B section 5.3). It is important to be aware that the EPA expects no loss of wetland function, and the commitments should detail offsets to compensate for the loss of any significant wetlands. • Provide the key elements of any Environmental Management Plans that may be proposed to manage impacts on wetlands and waterbodies. Any such Plans need to integrate with relevant broader scope management plans, and the EMP required by Statement 368.
Groundwater		<p>Maintain the quantity of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected.</p> <p>Maintain the quality of groundwater so that existing and potential uses including ecosystem maintenance and public water supply are protected, and that National and State standards are met.</p>	<ul style="list-style-type: none"> • Discuss potential impacts from the construction, operation and maintenance activities on the groundwater within the Jandakot Underground Water Pollution Control Area and the Well Head Protection Zones. • Discuss potential impacts from construction, operation and maintenance activities on the environmental management areas over the groundwater catchments of important wetlands on the western side of the Jandakot Mound. • Describe management and design measures that will ensure the protection of the groundwater resource associated with the Jandakot Mound. • Provide the key elements of any Environmental Management Plans that may be proposed to manage impacts on the Jandakot Mound public water supply area and groundwater environmental management areas. These should include contingency plans to manage any incidents that

Issue	Site specific factor	Preliminary EPA objective	Work required for the environmental review (see also Part B of Guidelines)
			<p>may occur as a result of construction, operation and maintenance activities.</p> <ul style="list-style-type: none"> • Discuss whether groundwater elsewhere may be impacted in any other way during the construction, and operation phases eg by dewatering. In places where the groundwater may be impacted, describe the characteristics and significance of the existing groundwater resource, and potential direct and indirect impacts. • Describe design and management measures that ensure the avoidance of, or where this is not possible, the minimisation of adverse impacts on groundwater in relation to the above dotpoint. Provide the key elements of any Environmental Management Plans that may be proposed to manage impacts.
Noise and vibration	Noise and vibration from the operation of the rail service	Protect the amenity of neighbouring land users from noise and vibration impacts resulting from activities associated with the operation of the rail service, by ensuring that noise and vibration meet acceptable standards and are minimised as far as practical.	<ul style="list-style-type: none"> • Undertake ambient noise measurements and discuss existing noise levels along each section of the rail corridor. • Undertake preliminary noise modelling to the requirements of the DEP. Where predicted noise levels exceed agreed noise criteria, model noise levels including noise barriers and/or alternative noise reduction methods in consultation with DEP. • Discuss the potential impacts of rail noise upon nearby residents in existing and proposed residential areas. • Discuss potential ground vibration impacts on premises adjacent to the rail corridor. Identify locations and conditions where vibration may be significant, particularly for residents. Discuss ameliorative measures. • Discuss how significant noise and vibration impacts will be identified, monitored and managed to ensure that these impacts will be minimised as far as practical, that any statutory requirements will be fulfilled, and that wherever feasible noise and vibration levels will meet interim acceptable standards established in consultation with the DEP/EPA. • Provide the key elements of any Environmental Management Plans that may be proposed to manage noise and vibration.
Noise and vibration	Management of noise and vibration during construction activities	Protect the amenity of neighbouring land users from noise and vibration impacts arising from the construction activities, by ensuring that noise and vibration meet acceptable standards and are minimised as far as practical.	<ul style="list-style-type: none"> • Describe potential noise and vibration impacts associated with construction work, including the transport of raw materials to the site. • Detail how construction impacts will be identified, monitored and managed to ensure that any impacts will be minimised as far as practical, that any statutory requirements will be complied with, and that standards acceptable to the EPA will be met. Hours of operation should be addressed. • Provide the key elements of any Environmental Management Plans that may be proposed to manage construction impacts, including

Issue	Site specific factor	Preliminary EPA objective	Work required for the environmental review (see also Part B of Guidelines)
			contingency plans and liaison with local government and other authorities.
Other construction impacts	Management of other factors that may adversely affect the amenity of neighbouring land users, as a result of construction activities	Protect the amenity of neighbouring land users from any other factors arising from activities associated with the construction of the rail service, by ensuring that statutory requirements and acceptable standards are met.	<ul style="list-style-type: none"> • Describe any other potential construction impacts, not addressed above, on amenity, including impacts of dust on residents and users of adjacent roads, and traffic management. • Detail how the construction impacts will be identified, monitored and managed (including design measures) to ensure that these impacts will be minimised as far as practical, that any statutory requirements will be complied with, and that standards acceptable to the EPA will be met. • Provide the key elements of any Environmental Management Plans that may be proposed to manage construction impacts, including contingency plans and liaison with local government and other authorities.
Public risk and safety		Ensure that risk is managed to meet the EPA's criteria for individual fatality risk off-site and the Department of Minerals and Energy's requirements in respect of public safety.	<ul style="list-style-type: none"> • Using a methodology acceptable to the DEP, establish if there are any risks to the public associated with the construction and operation of the railway, for example through the proximity of the Kwinana industrial area, high pressure gas and other pipelines, and the Baldivis Explosives Reserve. • Detail how the risks will be managed.
Soil and groundwater contamination		Ensure that any contaminated land or groundwater that may be impacted by the proposal is managed and remediated to an acceptable standard compatible with the intended land uses	<ul style="list-style-type: none"> • Identify any potentially contaminated land or groundwater that may be impacted directly or indirectly by the proposal, using the DEP Contaminated Sites Branch preliminary site assessment methodology. • If potentially contaminated sites are identified, detail the procedures to be followed to assess the level and extent of contamination, and management and remediation measures, as appropriate, that will be carried out.

3. Ecological Sustainability

The EPA considers that the issue of ecologically sustainable development should also be discussed in the PER.

The EPA is developing a position statement on the issue of ecologically sustainable development. In the interim, for the purposes of the assessment of the South West Metropolitan Railway the EPA expects the issue to be discussed consistent with the outline below.

For the purposes of the discussion in the PER, ecologically sustainable development is considered to be "development that improves the total quality of life, both now and in the future, in a way that

maintains the ecological processes on which life depends” (National Strategy for Ecologically Sustainable Development at <http://www.environment.gov.au>).

Ecologically sustainable development may be viewed as having three main interrelated thrusts:

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- To provide for equity within and between generations; and
- To protect biological diversity and maintain essential ecological processes and life-support systems.

(National Strategy for Ecologically Sustainable Development at <http://www.environment.gov.au>).

It is noted that some aspects of ecological sustainability will be addressed in the parts of the PER on individual environmental factors as required by section 2 of the Guidelines.

The discussion in the PER on ecological sustainability should integrate the discussion on the individual factors with a discussion on other aspects of ecological sustainability, namely the wise use of natural resources.

As part of the discussion, the following matters should be addressed:

- Raw materials - identify the main raw materials required by the project including sleepers, crushed rock, materials in rolling stock, building materials for car parks, bridges, stations etc, and their sources;
- Operating inputs (energy, water and other) -
 - identify options for energy sources for the ongoing operation of the project, and those that are proposed to be used, and why;
 - discuss measures to minimise energy use in infrastructure (eg design of stations to minimise use of energy) and the operation of the rail service (eg low fuel consumption stock); and
 - discuss measures to minimise any other operating inputs that may be required in large quantities or that use a scarce or environmentally important resource (eg water); and
- Waste reduction and recycling - discuss measures to minimise the production of wastes, and to maximise recycling.

4. Availability of the environmental review

4.1 Copies for distribution free of charge

Supplied to DEP:

- o Library/Information Centre 9
- o EPA members..... 5
- o Officers of the DEP (Perth)..... 4

Distributed by the proponent to:

- | | |
|------------------------------|---|
| Government departments | <ul style="list-style-type: none"> o Ministry for Planning 2 o Water and Rivers Commission..... 2 o Department of Conservation and Land Management 2 o Department of Land Administration 1 o Aboriginal Affairs Department 1 o Swan River Trust..... 1 o Department of Minerals and Energy 1 o Heritage Council 1 o Main Roads WA..... 1 |
| Local government authorities | <ul style="list-style-type: none"> o City of Perth 2 o Town of Victoria Park..... 2 o City of Canning 2 o City of Gosnells..... 2 o City of Melville 2 o City of Cockburn..... 2 o Town of Kwinana..... 2 o City of Rockingham 2 o City of Mandurah 2 |
| Libraries | <ul style="list-style-type: none"> o J S Battye Library..... 3 o The Environment Centre 2 o All local libraries within the above municipalities at least one copy per library |
| Other | <ul style="list-style-type: none"> o Conservation Council of WA 1 o Service providers whose facilities may be impacted eg Western Power, pipeline operators 1 each o The proponent should identify community groups within the catchment of the South West Metropolitan Railway and either supply a copy of the PER or advise where a copy may be sighted. (A copy on the proponent's website is recommended). |

4.2 Available for public viewing

- o J S Battye Library;
- o all local libraries in the municipalities traversed by the South West Metropolitan Railway;
- o Department of Environmental Protection Library; and
- o the proponent's website (if possible)

Part B: Generic Guidelines for the preparation of an environmental review document

1. Overview

All environmental reviews have the objective of protecting the environment. Environmental impact assessment is deliberately a public process in order to obtain broad-ranging advice. The review requires the proponent to describe:

- o the proposal;
- o receiving environment;
- o potential impacts of the proposal on factors of the environment; and
- o proposed management strategies to ensure those environmental factors are appropriately protected.

Throughout the assessment process it is the objective of the Environmental Protection Authority (EPA) to help the proponent to design the proposal to improve the protection to the environment. The DEP administers the environmental impact assessment process on behalf of the EPA.

The primary purpose of the environmental review is to provide information to the EPA on the proposal within the local and regional framework, with the aim of emphasising how the proposal may impact the relevant environmental factors and how those impacts may be mitigated and managed.

The language used in the body of the environmental review should be kept simple and concise, considering the audience includes non-technical people, and any extensive technical detail should either be referenced or appended to the environmental review. The environmental review document will form the legal basis of the Minister for the Environment's approval of the proposal and therefore should include a description of all the main and ancillary components of the proposal, including options where relevant.

Information used to reach conclusions should be properly referenced, including personal communications. Such information should not be misleading or presented in a way that could be construed to mislead readers. Assessments of the significance of an impact should be soundly based, rather than unsubstantiated opinion, and each assessment should lead to a discussion of the management of the environmental factor.

2. Objectives of the environmental review

The objectives of the environmental review are to:

- o place this proposal in the context of the local and regional environment;
- o adequately describe all components of the proposal, so that the Minister for the Environment can consider approval of a well-defined project;
- o provide the basis of the proponent's environmental management program, which shows that the environmental impacts resulting from the proposal, including cumulative impact, can be acceptably managed; and
- o communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government.

3. Environmental management

The EPA expects the proponent to have in place an environmental management system appropriate to the scale and impacts of the proposal, including provisions for performance review and a

commitment to continuous improvement. The system may be integrated with quality and health and safety systems and should include the following elements:

- o environmental policy and commitment;
- o planning of environmental requirements;
- o implementation and operation of environmental requirements;
- o measurement and evaluation of environmental performance;
- o review and improvement of environmental outcomes.

A description of the proposed environmental management system should be included in the environmental review documentation. If appropriate, the documentation can be incorporated into a formal environmental management system (such as AS/NZS ISO 14001). Public accountability should be incorporated into the approach on environmental management.

The environmental management program (EMP) is the key document of an environmental management system that should be adequately defined in an environmental review document. The EMP should provide plans to manage the relevant environmental factors, define the performance objectives, describe the resources to be used, outline the operational procedures and outline the monitoring and reporting procedures which would demonstrate the achievement of the objectives.

4. Format of the environmental review document

Proponents are encouraged to maintain close contact with the DEP officer during the preparation of the environmental review. The draft environmental review should be provided to the DEP officer for comment. At this stage the document should have all figures produced in the final format and colours.

The proponent and DEP officer/Manager should agree on the time to be taken to review the draft, taking into account the level of consultation during the environmental review preparation, DEP officer's availability and the need for external review. Revision of the document may be requested to ensure that it addresses all topics and issues in these Guidelines, can be read by the educated lay-person, contains no significant error of science and meets the required format.

Under Section 40(3) of the Environmental Protection Act, the EPA has responsibility to determine the "form, content, timing and procedure of any environmental review required to be undertaken". This responsibility has been delegated to the Director of the Evaluation Division for PERs and ERMPs, although it is advisable to liaise with the EPA Chairman for the latter. (Responsibility remains with the EPA Chairman for EPSs and PUEAs).

When the DEP officer is satisfied with the standard of the environmental review document (s)he will provide a written sign-off (through the Manager and Assistant Director as required) from the Director, Evaluation Division to the proponent giving approval to advertise the document for public review. The review document may not be advertised for release before written approval is received.

The proponent is also requested to provide the final document to the DEP in an electronic format for use on Microsoft Word 2000, and any scanned figures. Where possible, figures should be reproducible in black and white.

5. Contents of the environmental review document

The contents of the environmental review should include an executive summary, introduction and at least the following:

5.1 The proposal

The PER should include the following information on the proposal.

5.1.1 Description of proposal

A comprehensive description of the proposal is required as detailed in Part A of these Guidelines.

5.1.2 Key characteristics table

The Minister's statement will bind the proponent to implementing the proposal in accordance with any technical specifications and key characteristics¹ to be listed in the "Key Characteristics Table" in the environmental review document. It is important therefore, that the level of technical detail in the environmental review, while sufficient for environmental assessment, does not bind the proponent in areas where the project is likely to change in ways that have no environmental significance.

Include a description of the components of the proposal, including the nature and extent of works proposed, in the form of a table, an example of which follows:

Table 1: Key characteristics (example only)

Element	Description
Life of project (mine production)	< 5 yrs (continual operation)
Size of ore body	682 000 tonnes (upper limit)
Area of disturbance (including access)	100 hectares
List of major components <ul style="list-style-type: none"> o pit o waste dump o infrastructure (water supply, roads, etc) 	refer plans, specifications, charts section immediately below for details of map requirements
Ore mining rate <ul style="list-style-type: none"> o maximum 	o 200 000 tonnes per year
Solid waste materials <ul style="list-style-type: none"> o maximum 	o 800,000 tonnes per year
Water supply <ul style="list-style-type: none"> o source o maximum hourly requirement o maximum annual requirement 	<ul style="list-style-type: none"> o XYZ borefield, ABC aquifer o 180 cubic metres o 1,000,000 cubic metres
Fuel storage capacity and quantity used	litres; litres per year
Heavy mineral concentrate transport <ul style="list-style-type: none"> o truck movements (maximum) 	o 75 return truck loads per week

5.1.3 Plans, Specifications, Charts

Include adequately dimensioned plans showing clearly the location and elements of the proposal which are significant from the point of view of environmental protection. The location and dimensions (for progressive stages of development, if relevant) of plant, amenities buildings, access

¹ Changes to the key characteristics of the proposal following final approval, would require assessment of the change and can be treated as non-substantial and approved by the Minister, if the environmental impacts are not significant. If the change is significant, it would require assessment under section 38 or section 46. Changes to other aspects of the proposal are generally inconsequential and can be implemented without further assessment. It is prudent to consult with the Department of Environmental Protection about changes to the proposal.

ways, stockpile areas, dredge areas, waste product disposal and treatment areas, all dams and water storage areas, mining areas, storage areas including fuel storage, landscaped areas etc.

Only those elements of plans, specifications and charts that are significant from the point of view of environmental protection are of relevance here.

Figures that should always be included are:

- o a map showing the proposal in the local context - an overlay of the proposal on a base map of the main environmental constraints;
- o a map showing the proposal in the regional context; and, if appropriate,
- o a process chart / mass balance diagram showing inputs, outputs and waste streams.

The plan/s should include contours, a north arrow, a scale bar and legend, grid co-ordinates, the source of the data, and a title. If the data is overlaid on an aerial photo then the date of the aerial photo should be shown.

5.2 Environmental factors

The environmental review should focus on the relevant environmental factors for the proposal and these should be agreed in consultation with the EPA and DEP and relevant public and government agencies. Preliminary environmental factors identified for the proposal are shown in Part A of these Guidelines.

Further environmental factors may be identified during the preparation of the environmental review, therefore on-going consultation with the EPA, DEP and other relevant agencies is recommended. The DEP can advise the proponent on the recommended EPA objective for any new environmental factors raised. Minor matters which can be readily managed as part of normal operations for the existing operations or similar projects may be briefly described.

For discussion under each environmental factor:

- o a clear definition of the area of assessment for this factor;
- o the EPA objective for this factor;
- o a description of what is being affected - why this factor is relevant to the proposal;
- o a description of how this factor is being affected by the proposal - the predicted extent of impact;
- o a description of where this factor fits into the broader environmental / ecological context (only if relevant - this may not be applicable to all factors);
- o a straightforward description or explanation of any relevant standards / regulations / policy;
- o environmental evaluation - does the proposal meet the EPA's objective as defined above;
- o if not, environmental management proposed to ensure the EPA's objective is met;
- o predicted outcome.

The proponent should provide a summary table of the above information for all environmental issues:

Table 2: Environmental factors and management (example only)

Environmental Factor	Preliminary EPA Objective	Existing environment	Potential impact	Environmental management	Predicted outcome
BIOPHYSICAL					
vegetation community types 3b and 20b	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation community types 3b and 20b	Reserve 34587 contains 45 ha of community type 20b and 34 ha of community type 3b	Proposal avoids all areas of community types 20b and 3b	Surrounding area will be fully rehabilitated following construction	Community types 20b and 3b will remain untouched Area surrounding will be revegetated with seed stock of 20b and 3b community types
POLLUTION MANAGEMENT					
Dust	Ensure that the dust levels generated by the proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards	Light industrial area - three other dust producing industries in close vicinity Nearest residential area is 800 metres	Proposal may generate dust on two days of each working week.	Dust Control Plan will be implemented	Dust can be managed to meet EPA's objective
SOCIAL SURROUNDINGS					
Visual amenity	Visual amenity of the area adjacent to the project should not be unduly affected by the proposal	Area already built-up	This proposal will contribute negligibly to the overall visual amenity of the area	Main building will be in 'forest colours' and screening trees will be planted adjacent to road	Proposal will blend well with existing visual amenity and the EPA's objective can be met

5.3 Environmental management commitments

The final stage of the Environmental Impact Assessment (EIA) process is reached when the Minister for the Environment issues the Ministerial statement for the project, which is a set of legally enforceable conditions and procedures for the implementation of the project. One of the standard procedures is a requirement for the proponent to implement the commitments which it has made during the EIA process. It is accepted practice for a consolidated list of the proponent's commitments to be attached to the Minister's statement.

Commitment formatting

1. Commitment components

Commitments which address key environmental factors will be audited by the DEP, together with the environmental conditions. Unless the commitments are framed in a standard format it may become difficult in practice to implement or audit them. By applying the principles of quality management, a standard format for the commitments has been arrived at. The format ensures that a chain of responsibility is established to facilitate compliance and that redundant, overlapping or non-enforceable commitments are avoided.

The required standard format for all commitments comprises a number of components as follows:

The proponent (**who**) will undertake an action (**what, how, where**) to meet an environmental objective (**why**) to a time frame (**when**), and on advice of somebody (**to whom**, eg. third party, government agencies such as Department of Conservation and Land Management, Department of Minerals and Energy, Water and Rivers Commission, Shire Council). With regard to 'whom' this need only be included if the expertise of a third party is relevant to implementing the commitment.

It is important for the consolidated list of commitments to be numbered correctly for easy reference in the implementation and auditing stages of the project. These should therefore be sequentially numbered 1, 2, 3, ... without use of subgroups such as 1.1, 1.2 or 2(i) or 2(a), 2(b).

2. Paragraph format

In applying the standard components (who, what, why, how, where, when, to whom) an example of a commitment in paragraph form is as follows:

The proponent will prepare and implement a Dust Control Program which will minimise dust generation on-site and prevent dust emission from construction of the foreshore extension in order to protect the amenity of nearby land users. The Program will be prepared during the design (project planning) phase and will meet EPA dust control criteria (EPA, 1996), on advice of the Shire of Widgiemooltha. The approved Program will be implemented during the construction phase.

However, writing the commitment in paragraph form can result in a confusing or clumsy sentence structure that may be difficult to interpret for future auditing purposes. Also it is difficult to verify that all components have been incorporated into every commitment. A paragraph format is therefore not the preferred format.

3. Tabular format

Due to the limitations of the paragraph format, it is preferable to format a commitment in tabular form. It is recommended that the table column headings be ordered as: 'commitment number',

'topic', 'action', 'objective', 'timing' and 'advice'. However table headings can be re-ordered if necessary.

The example in paragraph form on page 1 can therefore be written in tabular form as per examples 1 and 2 below. Note that the tabular format makes it easier to ensure that no component of the commitment is left out and that each action is recognised as a separate commitment. This format also permits the inclusion of additional clauses or more precise wording of clauses which can be difficult in a sentence structure. It is acceptable for table columns to be re-ordered if necessary. Finally, the tabular format provides an immediate audit framework for use by the proponent and the DEP, enabling efficient administration of environmental approvals.

Examples 1 & 2.

The proponent is committed to the following:

No.	Topic	Action (What/How/Where)	Objective/s (Why)	Timing (When)	Advice (Agency to provide advice to EPA))
1.	Dust management	Prepare a Dust Control Program for the foreshore construction site which addresses: 1) abc 2) xyz	<ul style="list-style-type: none"> o Minimise dust during the construction phase o Maintain the amenity of nearby land users o To meet EPA dust control criteria 	Pre-construction	Shire
2.	Dust management	Implement the approved Dust Control Program	Achieve the objectives of Commitment 1	Construction	-

Example 3.

No	Topic	Action	Objective/s	Timing	Advice
3.	Fauna protection	Undertake a trapping programme for capturing and relocating the Southern Brown Bandicoots	Minimise impact on Southern Brown Bandicoots	Pre- construction (prior to commencement of ground disturbance)	CALM

Example 4.

No	Topic	Action	Objective/s	Timing	Advice
4.	Vegetation	Revegetate disturbed areas with vegetation types indigenous to the area	<ul style="list-style-type: none"> o To minimise impact on local flora o To achieve the completion criteria stated in PER (Section 5.1.1) 	Post- construction (progressively during operations)	Kings Park Board

Example 5.

No	Topic	Objective	Action	Timing	Advice
5.	Ground water	Minimise impact on groundwater levels, surface water levels and surrounding vegetation	Groundwater drawdown shall not exceed 0.5 m at any boundary of the mine site	Operation	Water and Rivers Commission

Example 6.

No	Topic	Action	Objective	Timing	Advice
6.	Clean-up	Post-clean up activities will only proceed after demonstrating to (and gaining approval from) the DEP that the site clean-up criteria identified in the 1993 CER have been met	To achieve the soil quality objectives in the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Jan 1992	Post-clean up (On completion of cleanup and prior to commencement of post-cleanup activities)	--

5.4 Public consultation

A description of the public participation and consultation activities undertaken by the proponent in preparing the environmental review should be provided. It should describe the activities undertaken, the dates, the groups/individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management of the factors which should clearly indicate how community concerns have been addressed. Those concerns which are dealt with outside the EPA process can be noted and referenced.

Consultation with other government agencies should also be described.

5.5 Other information

Additional detail and description of the proposal, if provided, should go in a separate section.

Attachment 1

The first page of the proponent's environmental review document must be the following invitation to make a submission, with the parts in square brackets amended to apply to each specific proposal. Its purpose is to explain what submissions are used for and to detail why and how to make a submission.

Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

[the proponent] proposes [the rezoning of land and the development of a Marina Complex in the City of Bunbury]. In accordance with the Environmental Protection Act, a [PER] has been prepared which describes this proposal and its likely effects on the environment. The [PER] is available for a public review period of [8] weeks from [date] closing on [date].

Comments from government agencies and from the public will help the EPA to prepare an assessment report in which it will make recommendations to government.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the [PER] or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific elements of the [PER]:

- o clearly state your point of view;
- o indicate the source of your information or argument if this is applicable;
- o suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- o attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- o refer each point to the appropriate section, chapter or recommendation in the [PER];
- o if you discuss different sections of the [PER], keep them distinct and separate, so there is no confusion as to which section you are considering;
- o attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- o your name;
- o address;
- o date; and
- o whether you want your submission to be confidential.

The closing date for submissions is: **[date]**

Submissions should be addressed to:

The Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: **[Project Officer name]**

Attachment 2

Advertising the environmental review

The proponent is responsible for advertising the release and arranging the availability of the environmental review document in accordance with the following Guidelines:

Format and content

The format and content of the advertisement should be approved by the DEP before appearing in the media. For joint State-Commonwealth assessments, the Commonwealth also has to approve the advertisement. The advertisement should be consistent with the attached example.

Note that the DEP officer's name should appear in the advertisement.

Size

The size of the advertisement should be two newspaper columns (about 10 cm) wide by about 14 cm long. Dimensions less than these would be difficult to read.

Location

The approved advertisement should, for CER's, appear in the news section of the main local newspaper and, for PER's and ERMP's, appear in the news section of the main daily paper's ("The West Australian") Saturday edition, and in the news section of the main local paper at the commencement of the public review period and again two weeks prior to the closure of the public review period.

Timing

Within the Guidelines already given, it is the proponent's prerogative to set the time of release, although the DEP should be informed. The advertisement should not go out before the report is actually available, or the review period may need to be extended.

ATTACHMENT 3 Example of the newspaper advertisement

(Proponent Name)

Public/ Environmental Review

(TITLE OF PROPOSAL)

(Public Review Period: [date] to [date])

(Proponent) is planning to (brief description of proposal).

A Public Environmental Review has been prepared by (the company) to examine the environmental effects associated with the proposed development, in accordance with Western Australian Government procedures. The PER describes the proposal, examines the likely environmental effects and the proposed environmental management procedures.

(Proponent) has prepared a project summary which is available free of charge from (the company's office address).

Copies of the PER may be purchased for \$5/\$10 from:

Company Name

Street

Suburb/Town WA Postcode

Telephone: (08) 9xxx xxxx

Copies of the complete PER will be available for examination at:

- o Department of Environmental Protection • (List relevant local libraries)
Library Information Centre
8th Floor, Westralia Square
141 St Georges Terrace
PERTH WA 6000
- o Department of Environmental Protection

Submissions on this proposal are invited by [**closing date**]. Please address your submission to:

Chairman

Environmental Protection Authority

8th Floor, Westralia Square

141 St Georges Terrace

PERTH WA 6000

Attention: [**Project Officer name**]

If you have any questions on how to make a submission, please ring the project officer, [**Project Officer name**], on (08) 9222 7xxx.

APPENDIX B

Register of Community Meetings

PERTH URBAN RAIL DEVELOPMENT

Register of Briefings and Consultations given to Parliamentarians, Local Government and Local Community

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
21 November 2002	City Rail Development Issues Workshop Outline	Christine Moro Wardholt Corporate Communications Consultants	Stuart Hicks, Chairman, City Rail Development Advisory Committee, Paul Joyce, Policy Advisor Minister for Planning and Infrastructure, Peter Martinovich, Richard Mann, Rob Lowe, Niel Hammer, Richard Barrett, Gary Merritt, Mard Burgess	PURD
21 November 2002	PURD / DEWCP fortnightly meeting	Peter Martinovich	Neil Hammer, Colin Stedman Purd, Phil Bayley, Kristen Bennetts BBG, John Macpherson, Shane Sadleir DEWCP, Daniel Lloyd Lloyd Acoustics	Regular fortnightly meeting
13 November 2002	City of South Perth / Narrows Bridge Consultation	Garry Willox	City of South Perth Officers, Neil Hammer, Rob Lowe	City of South Perth
12 November 2002	EPA / Tour of the SWMR alignment	Neil Hammer	Bernard Bowen, Libby Mattiske, Maxine Dewson, Shane Sadleir, from EPA, Gary Willox and Reece Waldock	EPA Service Unit / PURD
8 November 2002	PURD Industry Briefing	Garry Willox, Peter Martinovich, Richard Mann, Matt Bradovich, Pat Aguero (IOS), Phil Ladner (MRWA)	PURD Management Staff, Consultants and Contractors	PURD
7 November 2002	DEWCP / PURD – Progress of the PURD PER review for public release meeting	DEWCP / PURD	Phil Bayley (BBG), Kristen Bennetts (BBG), Maxine Dawson (DEWCP), John Macpherson (DEWCP), Garth Humphries (Biota), Michi Maer (Biota), Daniel Lloyd (Lloyd Acoustics), Peter Martinovich (PURD), Neil Hammer (PURD), Colin Stedman (PURD)	PURD – Will be fortnightly until conclusion of PER Process
5 November 2002	CALM/PURD	Mark Bosisto Mausell – SKM (Package A Consultants)	Stefan de Haan (CALM), Tim Bowar (CALM), Mike Bodsworth (CALM), Neil Hammer (PURD), Colin Stedman (PURD), Richard Baron – Hay (Package A coordinator, Bruce Keay	MSKM

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
28 October 2002	Rail Briefing	Peter Martinovich	Paddy Emry MLC, Frank Hough MLC, Jon Fischer MLC, officers from Minister MacTiernan's department	Hon Alannah MacTiernan MLA
25 October 2002	DEWCP / Discuss noise and vibration issues SWMR	Neil Hammer	John Macpherson (DEWCP), Maxine Dawson (DEWCP)	Neil Hammer
23 October 2002	Leeming Rotary Club	Peter Martinovich	Leeming Rotary Club	Leeming Rotary Club
23 October 2002	Town of Victoria Park Lathlain Station	Peter Martinovich, Guy Mander	Ralph James, Alex Sheridan and Councillor Hayes	Town of Victoria Park
22 October 2002	DEP / Public Environmental Review process timeline	Neil Hammer Peter Martinovich	Warren Tacey (DEP), Maxine Dawson (DEP), Colin Murray (DEP).	Peter Martinovich
17 October 2002	Maxine Dawson (DEP), Tour of SWMR alignment	Neil Hammer Tim Auret	Maxine Dawson, Neil Hammer, Tim Auret	Maxine Dawson (DEP)
10 October 2002	PURD Environmental Community consultative committee (ECCC)/ Environmental Consultation SWMR	Colin Stedman	Jeff Anderton, Shirley Joiner, Tony Paschier, Eddy Wajon, Richard Smith, Lindsay Ginbey	PURD. On going committee to meet monthly
8 October 2002	Transperth Seminar at Mandurah City Council	Peter Martinovich, Carolyn Sandell-Hay (Transperth Services),	Mandurah councillors and officers and community groups	Transperth
3 October 2002	City of Gosnells/ Kenwick Sub Station	Neil Hammer	Steve Walker (CoG), Colin Stedman	Neil Hammer
3 October 2002	Thailand State Rail Authority	Peter Martinovich	Max Collins, Delegates from the Thailand State Rail Authority	Thailand State Rail Authority
27 September 2002	Briefing to Ken Matthews Secretary (Commonwealth) Department of Transport and Regional Services	Peter Martinovich, Nick Belyea (Director Aviation Policy) Bruce James (A/Director Investment Evaluation DPI) Robert Campbell (Director Public Transport Policy DPI) Dough Brindal (Director Land Transport Policy and Development DPI) Jiff Gooding (Director Kimberley Development Commission	Greg Martin Director General DPI, Ken Matthews Secretary, (Commonwealth) Department of Transport and Regional Services".	Department for Planning and Infrastructure
12 September 2002	PURD Environmental Community Consultative committee (ECCC)/Environmental Consultation SWMR	Colin Stedman	Jeff Anderton, Shirley Joiner, Tony Passchier, Eddy Wajon, Richard Smith, Athol Wigg, Lindsay Ginbey, Paul Neilson (City of Rockingham)	PURD. On going Committee to meet monthly
9 September 2002	City of Mandurah Officers	Neil Hammer	Jane O'Mally (CoM), Tony Free (CoM), John Harris (CoM), Joceyln Ullman (DPI Peel region), Colin Stedman (PURD)	Neil Hammer
4 September 2002	PURD ECCC Members meeting with PURD planners Alignment through Leda & Waikiki Stations	Guy Mander and Bill Larke	Eddy Wajon, Jeff Anderton, Tony Passchier, Colin Stedman	Jeff Anderton

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
3 September 2002	Town of Victoria Park - Victoria Park Station	Ralph James	Victoria Park Councillors and Officers	Town of Victoria Park
30 August 2002	Australian Institute Project Management	Peter Martinovich	Members of Australian Institute Project Management	Australian Institute Project Management
29 August 2002	Town of Kwinana Master Plan Meeting	Peter Martinovich, Guy Mander	Town of Kwinana Councillors and Officers	Town of Kwinana
29 August 2002	Meeting with City of Gosnells	Peter Martinovich, Guy Mander	Hon Shelia McHale	Hon Shelia McHale
28 August 2002	Supplementary Master Plan Presentation for Mandurah Council	Peter Martinovich, Guy Mander	City of Mandurah Councillors and Officers	City of Mandurah
27 August 2002	Western Australian Planning Commission	Hon Alannah MacTiernan, Paul Frewer (DPI), Peter Martinovich (PURD), Kerry Sanderson (Fremantle Ports) and Steve Eggar (APP Consultants)	Same as Briefed	WA Planning Commission
26 August 2002	Technical Presentation to Institution of Engineering Technical Group – Aust Geomechanics Society Geotechnical aspects of Perth CBD Rail Tunnels	Peter Martinovich Eric Hudson-Smith (Coffey) Mike Bluck (SMEC)	Members of Institution of Engineering Technical Group	IE Group
26 August 2002	Department of Housing Presentation	Peter Martinovich	Amy Thorpe, Department of Housing	Dep of Housing
25 August 2002	Site Inspection/Consultation with Combined Metro Group	Ted Hart	R Wilkes/A Coronna and other Members of the Combined Metro Group	PURD
24 August 2002	Site inspection/consultation with Combined Metro Group	Ted Hart	R Bropho/Garlett and other Members of the Combined Metro Group	PURD
21 August 2002	Site Inspection/Consultation with Bibulmun Group	Neil Hammer, Ted Hart and Rory O'Connor	K Colbung and other Members of the Bibulmun Group	PURD
21 August 2002	Site Inspection/Consultation with Jacobs Clan	Neil Hammer, Ted Hart and Rory O'Connor	Rev. C Jacobs and other Members of the Jacobs Clan	PURD
21 August 2002	Site Inspection/Consultation with Independent Environmental Group	Neil Hammer, Ted Hart and Rory O'Connor	S Hume and other Members of the Independent Environmental Group	PURD
21 August 2002	Presentation for Peel Group	Peter Martinovich	Peel Group	Peel Group
21 August 2002	Briefing to Members of Parliament	Andrew Cartledge, Bernard Martinovich	Cheryl Edwards, Jamie Edwards, Katie Hodson-Thomas, Dan Sullivan, Paul Joyce	Cheryl Edwards
20 August 2002	Site Inspection/Consultation with Ballaruk Native Title Group	Neil Hammer, Ted Hart and Rory O'Connor	C Bodney and other Members of Ballaruk Native Title Group	PURD
16 August 2002	Supplementary Master Plan for the South West Metropolitan Rail Project Presentation	Peter Martinovich	City of Perth, Town of Kwinana, City of Cockburn, Gosnells City Council, City of Canning, and Rockingham City Council	Minister for Planning and Infrastructure
15 August 2002	Combined Metro Group	Neil Hammer and Ted Hart	R Bropho/G Garlett and other Members of the combined Metro Group	PURD

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
15 August 2002	Combined Metro Group	Neil Hammer and Ted Hart	R Wilkes/A Corunn and other Members of the combined Metro Group	PURD
15 August 2002	Master Plan Presentation at Weld Club	Peter Martinovich	Amy Thorpe, Weld Club Members	Weld Club
15 August 2002	South West Group Transport Committee Presentation	Peter Martinovich	Amy Thorpe, Councilor Chris Stone, Kumar Badivale, Stewart Marshall, Cllr Bal Oliver, Cllr Allan Hill, Bob Willis, John McDonald, John Radaich, Martin Spencer, John McIlhone and Alicia Trneny	South West Group Transport Committee
14 August 2002	Ballaruk Native Title Group	Neil Hammer and Ted Hart	C Bodney and other Members of the Ballaruk Native Title Group	PURD
14 August 2002	Bibulmun Group	Neil Hammer and Ted Hart	K Colbung, and other Members of the Bibulmun Group	PURD
13 August 2002	Jacobs Clan	Neil Hammer and Ted Hart	Rev. C Jacobs, and other Members of Jacobs Clan	PURD
13 August 2002	Independent Environmental Group	Neil Hammer and Ted Hart	S. Hume and other Members of Independent Environmental Group	PURD
13 August 2002	Supplementary Master Plan for the South West Metropolitan Rail Project Presentation	Peter Martinovich	City of Perth, City of Victoria Park	Minister for Planning and Infrastructure
6 August 2002	Mt Henry Preservation Group/Freeway drainage out fall into Mt Henry Bush Forever site.	John Chapman	Jan King (MHPG), Colin Stedman, John Chapman, Les Marchant(Main Roads), Mark Misitch (Main Roads)	John Chapman
5 August 2002	Presentation at UWA	Peter Martinovich	Amy Thorpe, Paul Lau, UWA Students	Paul Lau UWA
3 August 2002	PURD Environmental Community Consultative Committee (ECCC) members/Leda walk through	Neil Hammer	Colin Stedman, Tim Auret, Eddy Wajon, Shirley Joiner, Tony Passchier, Jeff Anderton, Athol Wigg, Lindsay Ginbey, Judy Trembath	PURD ECCC
1 August 2002	PURD Environmental Community Consultative Committee (ECCC) Environmental Consultation	Neil Hammer, Colin Stedman	Jeff Anderton, Shirley Joiner, Jan King, Tony Passchier, Eddy Wajon, Richard Smith, Athol Wigg, Lindsay Ginbey	PURD. On going committee to meet monthly
30 July 2002	City of Melville/Drainage for the SWMR along Kwinana Freeway	John Chapman	Colin Stedman, Brad Harris-City of Melville	John Chapman, PURD Consultant
24 July 2002	Station Design Lecture UWA	Guy Mander	Paul Lau, UWA Students	Paul Lau-UWA
23 July 2002	City of South Perth/Drainage for the SWMR along Kwinana Freeway	John Chapman	Neil Hammer, Colin Stedman, Amelia Linnet, Ross Povey-City of South Perth	John Chapman PURD Consultant
22 July 2002	Presentation at UWA	Peter Martinovich	Paul Lau, UWA Students	Paul Lau-UWA
16 July 2002	Presentation to Swan River Trust	Peter Martinovich	Neil Hammer, Amy Thorpe, Swan River Trust	Swan River Trust

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
9 July 2002	Concrete Institute Presentation	Peter Martinovich	Concrete Institute Members	Concrete Institute
5 July 2002	Water and rivers Commission / Drainage for the SWMR along Kwinana Freeway	John Chapman	Neil Hammer, Colin Stedman, Amelia Linnett, Bill Till, Peter Kata, Peter Tapsell	John Chapman, PURD Consultant
1 July 2002	Water and Rivers Commission / NSR drainage inspection	Colin Stedman	Peter Kata, Mark Manning, Rob Scerincini	Peter Kata
20 June 2002	DPI / Meeting re: SWMR environmental issues and MRS amendments	Neil Hammer	Colin Stedman, Alan Kleidon Rob Griffiths	Alan Kleidon
20 June 2002	PURD Environmental Community consultative Committee (ECCC), Environmental Consultation SWMR	Neil Hammer	Colin Stedman, Jeff Anderton, Shirley Joiner, Jan King, Tony Passchier, Judy Trembath, Eddy Wajon	PURD. On going. Committee to meet monthly
18 June 2002	Friends of Brixton Street Wetlands. Re: Kenwick sub station site	Colin Stedman	Regina Drummond, Karl Karu, Stuart Jeffries	Regina Drummond
14 July 2002	CALM / Inspection of NSR fence line survey for the rehabilitation area in the Neerabup National Park	Colin Stedman	Stefan DeHaan	Stefan De Hann (CALM)
12 June 2002	Briefing to Perth Central City Planning Committee	Peter Martinovich	Mayor Peter Natrass (City of Perth), Frank Bryant Sharni Howe, Jeff Gardiner, Amelia Linnett	Perth Central City Planning Committee
11 June 2002	Members Briefing Session for Victoria Park	Peter Martinovich	Elected Members and Officials for Victoria Park Town Council, Amelia Linnett, Christine Moro	Joint
11 June 2002	Probus Club of Perth	Peter Martinovich	Probus Club Members	Probus Club
10 June 2002	DEP/Discuss draft EMP document and DEP recommendation on the PER and EMP process	Neil Hammer	Colin Stedman, Maxine Dawson and Kym Martin	Neil Hammer
5 June 2002	Meeting with Cockburn City Council	Peter Martinovich	Allen Blood, Steve Hiller	PURD
28 May 2002	Rotary Club of Kwinana	Peter Martinovich	Amelia Linnett, Member's of Kwinana Rotary Club	Rotary Club of Kwinana
22 May 2002	REIWA, Luncheon Presentation	Peter Martinovich	REIWA Members	REIWA
16 May 2002	PURD Environmental Community Consultative Committee (ECCC)/ Environmental Consultation SWMR	Colin Stedman	Jan King, Tony Passchier, Shirley Joiner, Judy Trembath, Jeff Anderton, Richard Smith, Eddy Wajon, Lindsay Ginbey	PURD
11 May 2002	PURD ECCC, Community Environmental Group representatives / Tour of SWMR alignment	Neil Hammer, Colin Stedman, Tim Auret, Bert Linden, John Clifford	Jeff Anderton, Kristen Bennetts, Ken Barker, John Birks, Roy Fieldgate, Lindsay Ginbey, Shirley Gwynne, Shirley Joiner, Jan King, Christine Moro, Jane O'Mally, Tony Passchier, Richard Smith, Jim Trembath, Judy Trembath, Eddy Wajon, Athol Wigg.	PURD ECCC

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
3 May 2002	Glen Iris Residents	Colin Stedman, David Wheeler (Landscape Consultant)	Paul Stockley, Bob Butcher, Dave Brennan	Paul Stockley, Glen Iris Residents Association
24 April 2002	Perth City Rail Alignment Project Stakeholder Workshop	Hon Alannah MacTiernan MLA, Reece Waldock, Stuart Hicks and Peter Martinovich	Peter Martinovich, Garry Willox, Mike Harris, Graham Guilford, Chritine Moro, Rob Lowe, Reece Waldock,	
17 April 2002	Gosnells Chambers Luncheon Talk	Peter Martinovich	Gosnells and Armadale Local Chambers, Small Business's	Gosnells Local Chambers
17 April 2002	Elected Members and Officials of the City of Wanneroo, regarding the Quinns Road/Hester Avenue level crossing	Bert Linden and Andrew Cartledge	Andrew Cartledge, Bert Linden, Elected Members and Officials of the City of Wanneroo	Charles Johnson, CEO City of Wanneroo
16 April 2002	Victoria Park Stakeholders Meeting	Design Consultant, MPS Architects	Victoria Park Stakeholder Review Group, Guy Mander, Ralph James	PURD
12 April 2002	Office of Key Project Inspectors, Peoples Republic of China (Delegation organised by the Australia Overseas Training Delegation of the ADB)	Andrew Cartledge and Martin Pugh	Andrew Cartledge, Martin Pugh, Sharon Winks (Stanton Partners)	Mike Harris, Stanton Partners
April 10, 2002	Direct Route Steering Committee Meeting	Peter Martinovich	Garry Willox Peter Martinovich, Amelia Linnett, Paul Frewer, Reece Waldock, Phil Ladner, Stephen Goldie, Robert Willis-CEO City of Melville, Ross Povey-City of South Perth, Garry Dunne-Acting CEO City of Perth	PURD
28 March 2002	RAAF Reference Group Meeting	Peter Martinovich	Amy Thorpe, Members of RAAF	RAAF Reference Group
18 April 2002	PURD Environmental Community Consultative Committee (ECCC) / Environmental Consultation SWMR	Neil Hammer, Coling Stedman	Jeff Andetton, Lindsay Ginbey, Shirley Joiner, Jan King, Tony Passchier, Judy Trembath, Eddy Wajon, Athol Wigg	PURD
15 March 2002	Victoria Park Stakeholders Review Group Meeting	Guy Mander	Victoria Park Stakeholder Review Group, Ralph James	PURD
7 May 2002	PURD Environmental Community Consultative Committee (ECCC) / Environmental Consultation SWMR	Colin Stedman	Jeff Anderton, Lindsay Ginbey, Shirley Joiner, Jan King, Tony Passchier, Richard Smith, Athol Wigg, Eddy Wajon	PURD
1 March 2002	Mandurah Public Information Evening	Peter Martinovich, Guy Mander, Jayson Miragliotta, Linton Pike	Christine Moro, Amy Thorpe, Felicity Dowling, Alex Lockett, Gary Merritt, Bill Burrell, City of Mandurah Officers and Councillors, David Templeman, MLA, Local Residents	Joint

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
27 February 2002	RAAF Association Meeting	Peter Martinovich, Christine Moro	Allan Stuart, Amy Thorpe, Christine Moro, Martin Spencer, Cr. Russell Albury and Andy Driver	RAAF Association
20 February 2002	Victoria Park Stakeholder Meeting	Peter Martinovich and Guy Mander	Elizabeth Bredemeyer, Andrew Cartledge, Ralph James, Gary Merritt, Amy Thorpe, Anthony Vuleta John Birks, Ainsley Turner, ChristineMoro, Diane Smith, Carol Solosy, Tina Bosnar, Brett Priest, Steve Moor, Mike Leach, Peter McKenzie, Linton Pike and Chris Bebich	PURD
15 February 2002	Meeting with Bateman Residents Re: Leach Highway Station	Neil Hammer, Rob Lowe, Guy Mander	Amy Thorpe, Christine Moro, Helena Blackley, Helen Robinson, Mary Allen, Frances Lismore, Daisy and SK Ling, John Hiron, Cattherine Gosney, John Holbrood, Tim Lam Kan, City of Melville officers	PURD
14 February 2002	Melville Public Meeting	Neil Hammer, Peter Martinovich, Rob Lowe, Guy Mander	Gary Merritt, Chris Smith, Amy Thorpe, Rob Arnott, Christine Moro, City of Melville Officers and local Residents	Joint
14 February 2002	Golden Bay Progress Association	Peter Martinovich, Amy Thorpe	Golden Bay Progress Association	Golden Bay Progress Association
13 February 2002	Rail Service to Thornlie and Nicholson Road at City of Gosnells	Peter Martinovich, Stephen Goldie	Stuart Jardine, Ray Haeren	City of Gosnells
13 February 2002	Minister for Planning and Infrastructure	Garry Willox and Peter Martinovich	Hon.Alannah MacTiernan, Paul Joyce, Mike Harris and Reece Waldock	Ministry for Planning and Infrastructure
5 February 2002	South Perth Public Meeting	Peter Martinovich, Stephen Goldie, Chris Smith, Guy Mander, Rob Lowe and Neil Hammer.	Gary Merritt, Amy Thorpe, Rob Arnott, Christine Moro, Phil Pental, City of South Perth Officers, local residents	Joint
5 February 2002	Briefing to local Melville (Bateman) residents – planning of Leach Hwy station and impact on adjacent properties	Rob Lowe, Guy Mander, Neil Hammer	Christine Moro, Amy Thorpe, Cr Katie Mair (Mayor of Melville), City of Melville officers, local residents from Wilson Lane & Brooke Gardens Bateman	City of Melville & local residents
30 January 2002	Briefing with the City of South Perth Elected Members	Chris Smith, Ralph James, Rob Lowe and Peter Martinovich	Ralph James, Robert Lowe, Christine Moro, Chris Smith, Amy Thorpe and Peter Martinovich	South Perth

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
22 January 2002	Rockingham Public Meeting	Peter Martinovich, Rob Lowe, Neil Hammer, Guy Mander and Mark McGowan	Barrow Emerson, Neil Hammer, Amelia Linnett, Christine Moro, Peter Martinovich John Chapman, Gary Merrit (Transperth), City of Rockingham officers and local residents	PURD
21 January 2002	Minister for Planning and Infrastructure	Garry Willox and Peter Martinovich	Hon. Alannah MacTiernan, Paul Joyce, Mike Harris and Reece Waldock	PURD
17 January 2002	City of Mandurah – Briefing on location planning of railcar overnight stowage & cleaning facility	Garry Willox, Peter Martinovich, Guy Mander	David Templeman MLA, City of Mandurah executive officers and Councillors	City of Mandurah
15 January 2002	Direct Route Steering Committee Meeting	PURD	Garry Willox, Peter Martinovich, Rob Lowe, Amelia Linnett, Paul Frewer, Robert Willis, Ross Povey, Cliff Frewing John Bruning, Gary Hunt, Greg Martin and Phil Ladner	PURD
20 December 2001	Industry Briefing for Consultants and Contractors	Garry Willox, Peter Martinovich, Guy Mander, John Keady	PURD Management Staff, Consultants and Contractors	PURD
18 December 2001	Mandurah Executive	Garry Willox, Peter Martinovich, Guy Mander	Christine Moro, City of Mandurah executive and Councillors	PURD
12 December 2001	Briefing to Murdoch Precinct Group	Rob Lowe	Amelia Linnett, Murdoch Precinct Group	Murdoch Precinct Group
10 December 2001	Workshop – Rockingham Transit Study	Barrow Emerson	Barrow Emerson, Gary Merritt, Katrina Stuetzel, City of Rockingham, Main Roads WA, Transperth	DPI
3 December 2001	Melville Community Meeting	Peter Martinovich, Rob Lowe, Linton Pike Darren Levy and Bob Murray.	Mayor Katie Mair, Councillors, Amelia Linnett, Christine Moro, Melville Residents.	PURD
3 December 2001	Rockingham Station Stakeholder group meeting	John Chapman, Guy Mander, Peter Martinovich	Peter Martinovich, Guy Mander, John Chapman, Tim Aurret, Bob Jeans, Stewart Marshall, Max Marguetts, Kevin Smith, Michael Somerville-Brown, Gary Meritt and David Cecchele.	PURD
30 November 2001	Railway Operations into Perth from Kwinana Freeway	Graham Guildord, Elwyn Gearon, Peter Martinovich.	Elwyn Gearon, Graham Guilford, Rob Lowe, Peter Martinovich John Bruning, Max Hipkins, Om Gupta – City of Perth	PURD
29 November 2001	Leach Highway Station Residents Meeting	Ralph James, Rob Lowe	Residents, Ward Councillors	PURD
29 November 2001	Melville Station Planning	Rob Lowe, Ralph James	Councillors of City of Melville	City of Melville

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
28 November 2001	Melville Elected Members Presentation	Rob Lowe, Bob Murray, Ralph James	Christine Moro, Councillors of City of Melville	City of Melville
27 November 2001	City of Cockburn, Thomsons Lake design	Guy Mander, Felicity Dowling	Mayor and Councillors, City of Cockburn.	City of Cockburn
27 November 2001	Melville Stakeholders Meeting	Rob Lowe, Ralph James, Christine Moro	Ralph James, Amelia Linnett, Rob Lowe,	Joint
22 November 2001	Murdoch Precinct Group		Hon Sue Ellery MLC, Hon Mike Board, Cr Ron Brown, Mr Alan McGregor MrPhil Porter Mr Keith Bodman Nr Neil McAullay, Mr Jim Williamson Mr Chris Binks, Mr Jeff Enoch, Mr Richard Morrison Mr Simon Jessamine Mr Glyn Palmer, Ms Elezabeth Flurry, Mr Rod Bickley, Mr Greg Rruscott, Mr Garry Merritt, Senior Sergeant Phil Gors, Inspector Pat O'Connell, Mr Robert Willis, Mr Craig McClure, Mr Warren Faulkner, Ms Kirsten Jones, Peter Martinovich, Rob Lowe	City of Melville
22 November 2001	Briefing with David Templeman, Local Member of City of Mandurah	Garry Willox and Guy Mander	Garry Willox, David Templeman and Guy Mander	PURD
20 November 2001	Association for the Blind WA	Guy Mander, Ralph James	Dr Margaret Crowley Carol Soloey, Diane Smith (all Association for the Blind), Guy Mander, Ralph James	PURD
14 November 2001	Property Council Owners Meeting	Rob Lowe, Peter Martinovich	Peter Martinovich, Rob Lowe, Amelia Linnett, Steve Goldie, Tony Murphy – Becon Hill Investments John Phillips, Geoff Brow – Wesley Property Committee	Property Council
13 November 2001	Victoria Park Meeting		Peter Martinovich, Andrew Cartledge, Barrow Emerson, Amelia Linnett, Tony Lubicz, Garry Merritt.	
13 November 2001	City of Cockburn Success Station concept planning review workshop	Guy Mander, Tim Auret, Felicity Dowling	City of Cockburn Councillors	City of Cockburn
13 November 2001	City of Mandurah Presentation	Garry Willox, Guy Mander	Garry Merritt, Garry Willox, Guy Mander, Cameron Stone, (Major City of Mandurah) Stephen Goude (CEO City of Mandurah), Alan Clayden, bill Burrell, Tony Free (City of Mandurah), City of Mandurah Councillors, Ian Hill, Paul Trechilo, Christine Moro	PURD

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
12 November 2001	City of Mandurah pre-briefing meeting	Garry Willox, Guy Mander	Garry Merritt, Garry Willox, Guy Mander, Cameron Stone, Keith Holmes (Mayor City of Mandurah) Stephen Goude (CEO City of Mandurah), Alan Clayden, Bill Burrell, Tony Free (City of Mandurah).	PURD
8 November 2001	South Perth Meeting	Rob Lowe	City of South Perth Officers Barrow Emerson, Amelia Linnett, Rob Lowe, Christine Moro, Chris Smith, Peter Martinovich, Mark Walker, Martin Spencer, Stephen Goldie, John Chortis	South Perth City Council
7 November 2001	Direct Route Steering Committee	PURD	Peter Martinovich, Garry Willox, Amelia Linnett, Reece Waldock, Paul Frewer, Mark Walker, Gary Hunt	PURD
30 October 2001	South Perth Meeting	Peter Martinovich, Rob Lowe, Christine Moro	Members of South Perth City Council	South Perth City Council
29 October 2001	Victoria Park Workshop	Workshop	Victoria Park Mayor & CEO, Mark Burgess, Andrew Cartledge, Barrow Emerson, Neil Hammer, Nigel Hunt, Tony Lubicz, Guy Mander, Peter Martinovich	Premier
23 October 2001	Rail Forum	Peter Martinovich	Christine Moro, Rob Lowe, Amelia Linnett, Reece Waldock, Guy Mander, 250 people	Property Council
17 October 2001	City of Melville Public Meeting	Peter Martinovich, Guy Mander, Rob Lowe, Christine Moro	Approx. 300 Melville residents	PURD
15 October 2001	South West Master Plan	Peter Martinovich	Chamber of Commerce, Amelia Linnett, Christine Moro	Chamber of Commerce
4 October 2001	Clarkson Station and drainage.	Guy Mander, Felicity Dowling	Members of Wanneroo City Council	Wanneroo Shire Offices
26 September 2001	Rockingham Lakes Regional Park Community Advisory Committee.	Peter Martinovich, Neil Hammer, Colin Stedman, Christine Moro	Local environmental groups	PURD
22 September 2001	Planning workshop for Canning Hwy, Leach Hwy, South Street Stations	Rob Lowe, Mike Leach	Rob Lowe, Mike Leach, DPI, Transperth, City of Melville	City of Melville
20 September 2001	William Street Stakeholders Group	Peter Martinovich	Peter Martinovich, Rob Lowe, Amelia Linnett, Barrow Emerson, Mark Burgess	PURD
14 September 2001	Victoria Park Council Committee	Peter Martinovich	Peter Martinovich	Victoria Park Council
13 September 2001	Rachel Yates, student from Edith Cowan University	Christine Moro	Rachel Yates	Paul Joyce from Minister's office

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
10 September 2001	Canning Vale Public Meeting	P Martinovich, Paul Andrews, Member for Southern River, Christine Moro	Approx. 40 Residents	Paul Andrews, Member for Southern River
5 September 2001	Melville Stakeholders Group	Peter Martinovich	Mark Burgess, Colin Davison, Barrow Emerson, Mike Leach, Amelia and Garry Meritt, Christine Moro	Melville Stakeholders Group
5 September 2001	South Perth Public Meeting	Peter Martinovich, P Pandal, Dr Ian Alexander	Approx. 200 residents, Christine Moro	City of South Perth
4 September 2001	Sacred Heart College re new route	Elwyn Gearon, Christine Moro	Yr 12 Media students	
30 August 2001	City of Mandurah	Garry Willox, Steve Goldie	Mandurah Council	DPI
16 August 2001	Sue Emmett from Southern Gazette re Direct Route	P Martinovich, Christine Moro	Sue Emmett	PURD
10 August 2001	City of Melville community Meeting of the Bull Creek/Leeming ward residents	Peter Martinovich, Greg Martin	Local residents, Christine Moro	City of Melville
9 August 2001	Meeting CEO John McNally City of Melville, show railway Plan, expanding Park and ride South Street	Peter Martinovich, Christine Moro	Melville City Council	City of Melville
8 August 2001	City of South Perth Briefing re Direct Route through South Perth	Peter Martinovich, Christine Moro	Commissioners, CEO, Executive Management Group	PURD
7 August 2001	Minister MacTiernan/City of Canning	Garry Willox, Mike Harris	Garry Willox and Mike Harris	Allanah MacTiernan
7 August 2001	Meeting City of Rockingham re Direct Route impact on Rockingham route	Garry Willox, Peter Martinovich, Barrow Emerson, Christine Moro	Rockingham Council	City of Rockingham
31 July 2001	Meeting Steven Lee Mayor City of Cockburn	Peter Martinovich, Christine Moro, Garry Willox	Peter Martinovich, Steven Lee, Rod Brown, Allen Blood	Peter Martinovich
31 July 2001	Thomsons Lake Steering committee re PURD at Thomsons Lake	Guy Mander, Christine Moro	Steering Committee Members	Landcorp
26 July 2001	WAMA Re lack of consultation re Direct Route	Peter Martinovich, G Willox, Christine Moro	WAMA reps, all Local Councils	WAMA
25 July 2001	Trevor Robb, The West Australian re Direct Route	Peter Martinovich, Christine Moro	Amelia Linnett	PURD
18 July 2001	Local Government – re Minister's announcement of Direct Route	Minister MacTiernan, G Willox, P Martinovich, Christine Moro	Local Council	PURD
16 July 2001	Brief Ross Field (P&C), on Southern Railway Project	Garry Willox, Peter Martinovich	Garry Willox, Peter Martinovich, Ross Field, Geoff Clem, Gary Stokes, Professor Peter Newman, Ministry of the Premier and Cabinet	Ross Field
27 June 2001	Joondalup Public Meeting	Tony O'Gorman, Nigel Hunt, Mike Leach, Christine Moro	Approx 80 Residents	Tony O'Gorman, MLA
6 June 2001	Meeting re The Cabinet Submission	Peter Martinovich, Garry Willox	Garry Willox, Peter Martinovich, Paul Frewer, Evan Jones, John Chortis (MfP), Chris Thompson (WAMA)	

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
23 May 2001	Thornlie CCG Meeting	G Mander, Christine Moro, Stuart Jardine, Jeff Falconer, Patrick de Villiers	CCG Members	PURD
3 May 2001	Minister turns sod at Currambine	Minister MacTiernan	Local members, M Harris, R Waldock, media reps	Government
2 May 2001	Craig & Mrs Lilleyman, Turtle Pt. Cove Jandakot	Neil Hammer, Terry George (HSA)	Neil Hammer, Terry George	Residents
30 April 2001	Property Council Lunch talk by Alannah Mactiernan	Alannah Mactiernan	Andrew Cartledge, Mike Leach, Guy Mander, Garry Willox Peter Martinovich	Alannah MacTiernan
27 April 2001	Thornlie CCG Meeting	Guy Mander, Christine Moro, Stuart Jardine, Jeff Falconer, Patrick de Villiers, Sheila McHale, MLA	CCG Members	PURD
5 April 2001	Glen Iris Residents	John Clifford, Christine Moro, Dave Thomas (MRWA)	Approx 30 Residents	David Keefe
4 April 2001	Residents of Glen Iris Estate, Jandakot	Neil Hammer	Neil Hammer, various residents	Residents
14 March 2001	CALM TEC Recovery Team	Neil Hammer, Alan Kleiden MfP	Neil Hammer, Alan Kleiden	Neil Hammer
6 March 2001	Representatives of Conservation Council	Neil Hammer, Tim Auret	Neil Hammer, Tim Auret, Geoff Anderton, David Wake	Conservation Council
1 March 2001	Thornlie Residents Community Meeting	Peter Martinovich, Guy Mander, Neil Hammer, Christine Moro	As per briefing	Thornlie community
22 Feb 2001	Review Conditions of Development Application Approval with Min. Planning and City of Wanneroo	Peter Martinovich	Tim Auret, Peter Martinovich, Nigel Hunt, John Clifford, Ministry for Planning, City of Wanneroo	City of Wanneroo
8 February 2001	David Wake, Conservation Council	Neil Hammer	Neil Hammer	Neil Hammer
4 Jan 2001	Herzog Briefing	Peter Martinovich, Garry Willox, Dolf Martino, Macquarie Bank	Peter Martinovich, Garry Willox, Dolf Martino, Macquarie Bank	Herzog
24 Nov 2000	Briefing to G.H.D. Perth and N2 People	Peter Martinovich, Guy Mander, Garry Willox, Wendy Payne	Peter Martinovich, Guy Mander, Garry Willox, Wendy Payne	GHD
23 Nov 2000	Briefing with Arthur Marshall	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox	Arthur Marshall
22 Nov 2000	Post briefing meeting Leighton/Bar Mowlem	Peter Martinovich, Dolf Martino, Macquarie Bank, Garry Willox	Peter Martinovich, Dolf Martino, Macquarie Bank, Garry Willox	Leighton
22 Nov 2000	Briefing with John Bruning (C.O.P.)	Peter Martinovich	Peter Martinovich	COP
22 Nov 2000	Briefing with T.O.V.P.	Peter Martinovich	Peter Martinovich, TOVP members	TOVP
21 Nov 2000	Post Briefing meeting with G.R.O. Kirfield	Peter Martinovich, Dolf Martino, Garry Willox, Macquarie Bank	Peter Martinovich, Dolf Martino, Garry Willox, Macquarie Bank	GRO Kirfield
21 Nov 2000	Post briefing meeting with Halcrow	Peter Martinovich, Dolf Martino, Garry Willox, Macquarie Bank	Peter Martinovich, Dolf Martino, Garry Willox, Macquarie Bank	Halcrow
21 Nov 2000	Post Briefing meeting Transfield	Peter Martinovich, Dolf Martino, Garry Willox, Macquarie Bank	Peter Martinovich, Dolf Martino, Garry Willox, Mac Bane	Transfield

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
21 Nov 2000	Briefing to Ind. Re Infrastructure	Everyone	Everyone	Department of Transport
21 Nov 2000	Briefing to Railcar Tenders	Peter Martinovich, Garry Willox, Macquarie Bank, Andrew Cartledge, Gillian Shortreed	Peter Martinovich, Garry Willox, Macquarie Bank, Andrew Cartledge, Gillian Shortreed	Department of Transport
20 Nov 2000	Briefing to Mandurah 2001 Transport Government Agency Group	Peter Martinovich, Guy Mander	Peter Martinovich, Guy Mander, and other transport reps	Mandurah 2001 Transport Government Agency Group
17 Nov 2000	Briefing to Rockingham residents	Peter Martinovich	Peter Martinovich	Minister for Transport
15 Nov 2000	Briefing to Minister for Transport	Garry Willox, Peter Martinovich, Mike Harris	Garry Willox, Peter Martinovich, Mike Harris	
15 Nov 2000	Briefing to C.O. Rockingham Re Rockingham Loop	Peter Martinovich, Mike Harris, Garry Willox	Peter Martinovich, Mike Harris, Garry Willox	Department of Transport, CO Rockingham Loop
13 Nov 2000	Briefing – Department of Commerce and Trade	Peter Martinovich, Garry Willox, Dolf Martino	Peter Martinovich, Garry Willox, Dolf Martino	Dept Com. and Trade
9 Nov 2000	Thornlie C.C.G. meeting with public	Guy Mander, Peter Martinovich, Christine Moro	Guy Mander, Peter Martinovich	Department of Transport and Thornlie CCG
8 Nov 2000	Railway Workshop at Quinns Rock	Guy Mander	Tim Auret, Guy Mander, Members of City of Wanneroo	PURD
7 Nov 2000	Briefing to C.O. Wanneroo re Project	Peter Martinovich, Gillian Shortreed, Garry Willox, Andrew Cartledge	Peter Martinovich, Gillian Shortreed, Garry Willox, Andrew Cartledge	CO Wanneroo
7 Nov 2000	Meeting LPG and LG re project	Peter Martinovich, Gillian Shortreed, Garry Willox, Andrew Cartledge	Peter Martinovich, Gillian Shortreed, Garry Willox, Andrew Cartledge	LPG and LG
6 Nov 2000	Briefing to C.O.P. re Moore	Peter Martinovich, Guy Mander	Peter Martinovich	Indec
31 Oct 2000	Burns Beach Property Trust Meeting	Garry Willox, Peter Martinovich	Garry Willox, Peter Martinovich, Tim Auret, Mike Harris, Warwick Hemesley-Peat and Co, Burns Beach Property Trust	PURD
20 October 2000	Briefing re project	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox	
19 Oct 2000	Briefing to Corp Services	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox	Corp Services
17 Oct 2000	Briefing to Siemens re project	Peter Martinovich, Garry Willox	Norm Daffer	Siemens
12 Oct 2000	Visit to Glen Iris Residents with Minister for Transport	Peter Martinovich, Mike Harris, Garry Willox, Minister	Minister for Transport. Peter Martinovich, Mike Harris, Garry Willox, Christine Moro	
6 Oct 2000	Glen Iris Residents Briefing	Peter Martinovich, Gillian Shortreed, Nigel Hunt	Peter Martinovich, Gillian Shortreed, Nigel Hunt	Glen Iris Residents and Department of Transport

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25 Aug 2000	Aerial tour of the route with Macquarie Bank	Garry Willox, Peter Martinovich, Vince Scully, Rob Lowe, Andrew Cartledge	Garry Willox, Peter Martinovich, Vince Scully, Rob Lowe, Andrew Cartledge	Department of Transport
20 Sep 2000	Briefing to P.C.C. re Perth	Peter Martinovich, Gillian Shortreed, Garry Willox	Peter Martinovich, Gillian Shortreed, Garry Willox	PCC
19 Sep 2000	Briefing to Siemens re project	Mike Harris, Peter Martinovich, Garry Willox	Members of Siemens	Siemens
18 Sep 2000	AIE Excellence Awards – Awards Night	Garry Willox, Mike Harris, Peter Martinovich, Andrew Cartledge	Garry Willox, Mike Harris, Peter Martinovich, Andrew Cartledge	
8 Sep 2000	Meeting with Glen Iris	Peter Martinovich, Gillian Shortreed, Neil Hammer	Peter Martinovich, Gillian Shortreed, Neil Hammer	Glen Iris
7 Sep 2000	Briefing to C.O.P. re Roe Street	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox	Department of Transport
4 Sep 2000	Discussion with Tourism Commission re project	Peter Martinovich	Peter Martinovich	Tourism Commission
31 Aug 2000	Briefing to Transfield re project	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox,	Transfield
30 Aug 2000		Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox,	
29 Aug 2000	Briefing to Mandurah City Council	Peter Martinovich, Garry Willox	Members of Mandurah City Council	Mandurah City Council
28 Aug 2000	Briefing to Arthur Marshall	Peter Martinovich, Garry Willox	Peter Martinovich, Garry Willox	Department of Transport
28 Aug 2000	Briefing to Geoff Gallop re Victoria Park	Garry Willox, Peter Martinovich, Mike Harris	Geoff Gallop and others	Geoff Gallop
25 Aug 2000	Meeting to discuss issues to do with LG	Peter Martinovich, Garry Willox, Guy Mander, Andrew Cartledge, Mike Harris	LGP and LG	Department of Transport
3 August 2000	Meeting with Thornlie Tech Group	Guy Mander, Peter Martinovich, Mark Burgess	Members of Thornlie Tech Group	Department of Transport
2 August 2000	Briefing to ABB re discussion of railway in general	Garry Willox, Peter Martinovich		
1 August 2000	Conference re Signalling	Peter Martinovich		
24 July 2000	Discussion of rail extension north	Guy Mander, Peter Martinovich, Mike Harris	Ian Maclean – Wanneroo member	Ian Maclean
20 July 2000	Siemens	Mike Harris, Garry Willox, Peter Martinovich	Siemens Norm Daffer and others	Siemens
17 July 2000	WA Infrastructure Conference	Peter Martinovich	Various private and government agencies	WA Infrastructure
17 July 2000	TOVP re Grade Separation at Carlisle Station	Andrew Cartledge, Peter Martinovich, Garry Willox	Council	Department of Transport
5 July 2000	Victoria Park Community Association, Grade Separation Study	Andrew Cartledge and Gary John	Andrew Cartledge and Gary John	Victoria Park Community Association
28 June 2000	Briefing to various Agencies in NSW and Queensland	Peter Martinovich Garry Willox	Various Agencies and Consortiums	Railway Technical Institute of Australia

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25 – 30 June 2000	Westrail Managers, Grade Separation Study, Victoria Park	Peter Martinovich, Andrew Cartledge, Robert Johnson (BGE)	Peter Martinovich, Andrew Cartledge	Richard Leonhardt
23 June 2000	City of Wanneroo	Peter Martinovich, Garry Willox, Mike Harris	Mayor, CEO and others	Department of Transport PURD
20 June 2000	Meeting with Charles Johnson City of Wanneroo	Garry Willox	Guy Mander, Peter Martinovich, Garry Willox and Andrew Cartledge	
16 June 2000	John Holland re Urban Rail Development	Garry Willox Peter Martinovich	John Holland representatives	John Holland
12 June 2000	Strategic Policy Forum	Peter Martinovich	Executive Directors of Transport	Department of Transport
9 June 2000	Urban Rail Development Briefing for Minister	Mike Harris, Garry Willox, Peter Martinovich	Minister, Steve Imms and Graeme Harman	Minister's Office
7 June 2000	Town of Victoria Park	RW, Peter Martinovich, Garry Willox	Mayor, CEO and others	Department of Transport
2 June 2000	City of Gosnells	Peter Martinovich	Mayor, CEO and others	Department of Transport
24 May 2000	Core 2000 Conference	Reece Waldock, Garry Willox Peter Martinovich	Institute of Engineers	Institution of Engineers
21 – 23 May 2000	City of Canning	Peter Martinovich, Reece Waldock, Garry Willox	Mayor, CEO and others	Department of Transport
19 May 2000	TOVP Elected Members meeting, Grade Separation study	Andrew Cartledge, Robert Johnson (BGE)	Andrew Cartledge	Alex Sheridan, TOVP
16 May 2000	City of Cottesloe	John MacKenzie, Peter Martinovich	Stakeholders in Fremantle – Cottesloe Issues	Department of Transport
16 May 2000	City of Rockingham	Reece Waldock, Garry Willox, Peter Martinovich	Mayor, CEO and others	Department of Transport
11 May 2000	City of Mandurah	Reece Waldock, Garry Willox, Peter Martinovich	Mayor, CEO and others	Department of Transport
4 May 2000	Town of Kwinana	Andrew Cartledge, Mike Harris, Reece Waldock, Gary Willox, Peter Martinovich	Mayor, CEO and others	Department of Transport
2 May 2000	City of Cockburn	Peter Martinovich, Reece Waldock, Mike Harris, Garry Willox, Andrew Cartledge	Mayor, CEO, others	Department of Transport
18 April 2000	BGE Briefing for Victoria Park	Andrew Cartledge John MacKenzie Guy Mander Peter Martinovich	Alex Sheridan, Taylor Burrell, MPS, BGE	BGE/Transport
31 March 2000	Clarkson District Centre	Peter Martinovich, Guy Mander	Tim Auret, Andrew Cartledge, Guy Mander, Peter Martinovich, Andrew Foremen (TP)	PURD

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1 March 2000	City of Gosnells re Aylesford Way	Peter Martinovich Andrew Cartledge	Mayor of Gosnells	City of Gosnells
31 January 2000	Liz Constable	Peter Martinovich	Liz Constable	Liz Constable
11 January 2000	Clarkson-Butler MRS Amendment at Kinross Primary School	Andrew Cartledge, Neil Hammer	Andrew Cartledge, Neil Hammer, Tim Auret, Neil Foley MFP, Members of City of Wanneroo, DEP, Members of the Public	City of Wanneroo
8 January 2001	Ove Arup Briefing on Oats Street	Andrew Cartledge Guy Mander	Peter Damien and Colleagues	Transport
11 November 1999	Town of Victoria Disability Access Advisory Committee	Peter Martinovich Peter Martinovich	Andrew Cartledge Peter Martinovich	Town of Victoria Park
10 November 1999	South West Integrated Transport System – Breakfast Briefing	Peter Martinovich	Peter Martinovich	South West Development Commission
5 November 1999	Town of Victoria Park regarding Oats Street	Peter Martinovich	Peter Martinovich Mike Harris	Town of Victoria Park – Alex Sheridan
2 November 1999	Town of Victoria Park	Mike Harris Peter Martinovich	Mayor, CEO, Manager Tech Services	Town of Victoria Park
2 November 1999	Customer Services Council Westrail	Peter Martinovich Andrew Cartledge	Peter Martinovich Andrew Cartledge	John Robertson
28 October 1999	City of Gosnells	Mike Harris Chris Moro Peter Martinovich	Council Members City of Gosnells	City of Gosnells
27 October 1999	City of Gosnells regarding Thornlie issues	Peter Martinovich	Mike Harris Christine Moro Peter Martinovich	
27 October 1999	Laurie Graham and another rep from Rail Services Australia	Peter Martinovich	Peter Martinovich Andrew Cartledge	Laurie Graham
26 October 1999	Presentation to the Rockingham Rail Options Task Force at Parliament House	Peter Martinovich	Christine Moro Ross Drabble, Peter Martinovich	Neil Roberts
21 October 1999	Barbara Scott	Mike Harris Chris Moro Peter Martinovich	Barbara Scott	Barabara Scott
21 October 1999	Neil Roberts and Gordon Nutall	Peter Martinovich Andrew Cartledge	Peter Martinovich, Andrew Cartledge	Neil Roberts
19 October 1999	Queensland local members	Andrew Cartledge Guy Mander Chris Moro Peter Martinovich	Neil Roberts Gordon Nutall	Queensland

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19 October 1999	City of Wanneroo	Andrew Cartledge Peter Martinovich John Clifford Guy Mander Christine Moro	Kath White Charles Johnson Paul Neilson	City of Wanneroo
13 October 1999	AIPM Seminar	Peter Martinovich	AIPM	AIPM
12 October 1999	Clarkson Station/Freeway	Peter Martinovich, Andrew Cartledge	Andrew Cartledge, Peter Martinovich, John Clifford, Ministry for Planning, MRWA, Westrail and Landstart	PURD
30 September 1999	Minister, re South West Rail Link	Peter Martinovich	Peter Martinovich, Greg Martin, Graeme Harman, Christine Moro	Minister
14 Jan 1999	Graeme Harman re City of Rockingham	Peter Martinovich	Peter Martinovich, Graeme Harman	Peter Martinovich
31 Dec 1998	Steve Hiller, City of Cockburn	Peter Martinovich	Peter Martinovich	City of Cockburn
29 Dec 1998	Allen Blood, City of Cockburn	Peter Martinovich	Peter Martinovich	City of Cockburn
22 Dec 1998	Minister and City of Cockburn Representatives	Peter Martinovich	Peter Martinovich, Greg Martin, Jo Jarrott, Graeme Harman	City of Cockburn
11 Dec 1998	Thomsons Lake Steering Committee	Peter Martinovich	Peter Martinovich	Thomsons Lake SC
10 Dec 1998	City of Gosnells re Spencer Road	Peter Martinovich, Guy Mander	City of Gosnells	City of Gosnells
8 Dec 1998	Present Master Plan to the Premier	Peter Martinovich	Premier, Richard Court, Chief-of-Staff Ian Fletcher, Minister for Transport, Graeme Harman	Premier, Richard Court
7 Dec 1998	Atwell Community Association	Peter Martinovich	Peter Martinovich, Christine Moro	
23 Nov 1998	IE Aust - Peel Region Member's meeting	Andrew Cartledge	Andrew Cartledge	
17 Nov 1998	Carlisle Ratepayers Association	Peter Martinovich	Peter Martinovich, Christine Moro	
4 Nov 1998	Association for the Blind of WA	Peter Martinovich	Peter Martinovich, Andrew Cartledge	
3 Nov 1998	Leader of the Opposition	Peter Martinovich	Dr. Geoff Gallop, Christine Moro	Dr. Geoff Gallop
23 Oct 1998	The Premier	Peter Martinovich	Greg Martin, Gareth Widger	
22 Oct 1998	Brief Minister on the Transitway	Barrow Emerson	Barrow Emerson, Peter Martinovich	
1 Oct 1998	Alannah MacTiernan	Peter Martinovich	A. MacTiernan, Greg Martin, Hugo Wildermuth, Barrow Emerson, Gareth Widger.	A. MacTiernan
22 Sept 1998	Hon Minister, Barbara Scott MLC	Peter Martinovich; Gareth Widger	Murray Criddle, Barbara Scott MLC, Gary Holland, Dr. Chris Elliott, Graeme Harman	Barbara Scott
7 Sept 1998	Shire of Harvey	Peter Martinovich	Peter Martinovich	Shire of Harvey
4 Sept 1998	Ian Fletcher - Chief-of Staff	Peter Martinovich; Greg Martin	Ian Fletcher, Peter Martinovich, Graeme Harman, Greg Martin	Graeme Harman
2 Sept 1998	City of Canning	Peter Martinovich; Gareth Widger		City of Canning
1 Sept 1998	Hon. Minister Murray Criddle	Andrew Cartledge; Gareth Widger	Murray Criddle, Graeme Harman, Andrew Cartledge, Gareth Widger	SWMR Master Plan

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21 August 1998	Deputy Premier, Hendy Cowan	Peter Martinovich		
7 August 1998	Town of Victoria Park – Presentation	Peter Martinovich		
4 August 1998	Victoria Park Impact Study Stakeholders meeting	Peter Martinovich; Andrew Cartledge; Guy Mander; John Clifford		
24 July 1998	Briefing at IE Australia, Freeway Briefing	Peter Martinovich		
9 July 1998	Simon O'Brien MLC	Peter Martinovich	Peter Martinovich; Gareth Widger	Simon O'Brien
8 July 1998	Kenwick Joint Project Steering Committee			
26 June 1998	Monica Holmes - Legislative Assembly (Southern River)	Peter Martinovich	Monica Holmes, Joan Hopson (Electorate Officer), Deanne Raseta, Peter Martinovich, Gareth Widger, Neil Hammer	Monica Holmes

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22 June 1998	Thomsons Lake Regional Centre Committee	Ministry for Planning, Peter Martinovich		
17 June 1998	Mandurah Interest Group Forum, including Roger Nicholls am	Peter Martinovich	Peter Martinovich; Gareth Widger; Mandurah Times etc.	Roger Nicholls
8 June 1998	City of Mandurah Stakeholders Forum pm	Peter Martinovich	Stakeholders (as listed on fax of 5/6)	City of Mandurah
8 June 1998	Hon. Mike Board, Legislative Assembly (Murdoch)	Greg Martin; Peter Martinovich; Gareth Widger	Hon. Mike Board	M. Board
5 June 1998	Hon. G. Kierath, Legislative Assembly (Riverton)	Greg Martin; Peter Martinovich; Gareth Widger	Graham Kierath	G. Kierath
22 May 1998	Cockburn Bus Presentation	Hugo Wildermuth and Colin Davison - Transperth	City of Cockburn	
20 May 1998	City of Mandurah and Peel Development Commission	Greg Martin; Peter Martinovich	Mayor and CEO City of Mandurah; John Styants; Ken Fisher from PDC	City of Mandurah
19 May 1998	Briefing to the Dept of Training, Murdoch Uni	Peter Martinovich; Barrow Emerson; Guy Mander	Chris Binks, Tony Tate, Ron Innis, Roger Leithbridge, 2 officers from Murdoch University	WA Dept of Training
19 May 1998	Arthur Marshall, Legislative Assembly (Dawesville) Hon. Roger Nicholls, Legislative Assembly (Mandurah)	Peter Martinovich, Gareth Widger	A. Marshall, MLA Hon. Roger Nicholls, MLA CEO Peel Development Commission Mayor and CEO, City of Mandurah	A. Marshall
15 May 1998	City of Cockburn Briefing	Allen Blood of City of Cockburn	Peter Martinovich, Andrew Cartledge, Tim Auret, John Clifford, Peter Lawrence, Guy Mander	City of Cockburn
13 May 1998	Monica Holmes, Legislative Assembly (Southern River)	Peter Martinovich; Gareth Widger	M. Holmes	M. Holmes
6 May 1998	Hon. Barbara Scott, Legislative Council (South Metropolitan)	Peter Martinovich; Gareth Widger	B. Scott	B. Scott
30 April 1998	Rockingham - presentation for Western Australian Planning Commission	Peter Martinovich	WAPC members	Mike Allen, MfP
28 April 1998	Thomsons Lake Regional Steering Committee - Implementation Committee meeting	Ministry for Planning; Peter Martinovich		
22 April 1998	Kenwick Special Community Committee meeting	Tony Loudon, MRWA, Peter Martinovich		
21 April 1998	Karel Avenue Interchange	Peter Martinovich	City of Melville Mayor Ms Katie Mair, Mr Robert Willis, Steve Hiller from City of Cockburn	City of Melville
3 April 1998	Kenwick Joint Project Steering Committee at MRWA			
27 March 1998	Representatives from USA	Peter Martinovich, Andrew Cartledge		Minister's request
27 March 1998	The Minister, Mr Eric Charlton, South West Metropolitan Railway	Peter Martinovich	Eric Charlton, Graeme Harman, Project team	SWMR

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18 March 1998	Meadow Springs	Peter Martinovich	John Burgess	
11 March 1998	Rockingham	Barrow Emerson, Transitway		
9 March 1998	Hon. J. Cowdell, Legislative Council (South West)	Greg Martin; Peter Martinovich	John Cowdell	J Cowdell
9 March 1998	Rockingham meeting	Peter Martinovich, Andrew Cartledge, Tim Auret		John Quigley
25 February 1998	City of Gosnells Workshop No. 4	Peter Martinovich, Guy Mander, Andrew Cartledge	Simon Holtby, Shayne Silcox, Stuart Jardine, Stephen Thorne, John Bayly	City of Gosnells
18 February 1998	Joondalup Park'n'Ride Proposal	Ross Holt from Landcorp	Peter Martinovich, Brett Inchley, Ian Vinicombe	
6 February 1998	City of Gosnells Workshop No. 3	Peter Martinovich		
30 January 1998	City of Gosnells Workshop No. 2	Peter Martinovich, Guy Mander, Andrew Cartledge, Ian MacRae (MfP)	Simon Holtby, CEO and Mayor Norm Smith, City of Gosnells	
28 January 1998	City of Cockburn consultation	Peter Martinovich		
21 January 1998	Discuss the railway route through Rockingham and go over route already defined.	Greg Martin, Peter Martinovich, Hugo wildermuth, Paul Frewer (MfP)	Gary Holland, CEO, Bob Jeans	City of Rockingham
14 January 1998	WAMA representative Cr. Linton Reynolds	Peter Martinovich	Cr. Linton Reynolds	WAMA
11 December 1997	City of Canning briefing session	Peter Martinovich, Andrew Cartledge, Mike Crawford, Tim Auret		
10 December 1997	Allen Blood, City of Gosnells consultation	Peter Martinovich, Andrew Cartledge, Mike Crawford		
10 December 1997	City of Gosnells - informal Council meeting	Peter Martinovich		
4 December 1997	City of Gosnells consultation	Peter Martinovich, Ron Chamberlain		
26 November 1997	Station Planning - Town of Kwinana	Peter Martinovich, Andrew Cartledge, Mike Crawford, Barrow Emerson	Bob Smillie - CEO, Kumar Vadivale, Doug smith, Paul Rokich	SWMR
12 November 1997	Station Planning - City of Canning	Peter Martinovich, Mike Crawford, Ron Chamberlain, Tim Auret	Ian Kinner CEO, Judy Bell, Silvio Trinca	SWMR
12 November 1997	John Birks re Belmont Reserve	Peter Martinovich		
10 November 1997	Rockingham works - technical engineering issues	Peter Martinovich, Barrow Emerson	Bob Jeans, Max Margetts R/Ham Arthur Phillips MRWA, Andrew Cartledge, Ron Chamberlain	
7 November 1997	Spencer Road w/Workshop			
6 November 1997	Allen Blood, City of Cockburn	Peter Martinovich	Allen Blood	City of Cockburn
30 October 1997	Rockingham presentation - with Rockingham Council	Greg Martin, Peter Martinovich, Gareth Widger, Andrew Cartledge	Rockingham Council	City of Rockingham

Briefing Date	Briefing To/Subject	Briefing By	Attended By	Requested By
20 October 1997	Gordon road and Allnutt Street prelim layout at the City of Mandurah	Peter Martinovich, Andrew Cartledge, Mike Crawford	Des Sheppard, Daniel Arndt, Derek Lee, MRWA, Tim Auret, Ron Chamberlain	City of Mandurah
14 October 1997	Thomsons Lake	Greg Martin, Emmerson Richardson, Peter Martinovich	Allen Blood	City of Cockburn
13 October 1997	Gary Holland, City of Rockingham	Peter Martinovich		
7 October 1997	Jim Skinner, Cockburn Rotary Club	Peter Martinovich		
6 October 1997	City of Mandurah presentation	Peter Martinovich		City of Mandurah
6 October 1997				

APPENDIX C

**Vertebrate Fauna Lists
Beeliar Drive, Jandakot to Mandurah
(Ecoscape & Bamford, 2002)**

Table 1 Freshwater Fish species expected in the area of the South-West Metropolitan Rail route between Anketell Road and Mandurah

Species		Significance
Western Minnow	<i>Galaxias occidentalis</i>	
Swan River Goby	<i>Pseudogobius olorum</i>	
Black Striped Jollytail	<i>Galaxiella nigrostriata</i>	Priority 3
Nightfish	<i>Bostockia porosa</i>	
Pygmy Perch	<i>Edlia vittate</i>	
Mud Minnow	<i>Galaxiella munda</i>	

Table 2 Amphibian and reptile species expected in the area of the South-West Metropolitan Rail route between Anketell Road and Mandurah

Species	Significance	
Myobatrachidae (ground frogs)		
Quacking Frog	<i>Crinia georgiana</i>	
Glauert's Froglet	<i>Crinia (Ranidella) glauerti</i>	
Sandplain Froglet	<i>Crinia (Ranidella) insignifera</i>	
Moaning Frog	<i>Heleioporus eyrei</i>	
Pobblebonk	<i>Limnodynastes dorsalis</i>	
Turtle Frog	<i>Myobatrachus gouldii</i>	
Guenther's Toadlet	<i>Pseudophryne guentheri</i>	
Hylidae (tree frogs)		
Slender Tree Frog	<i>Litoria adelaidensis</i>	
Motorbike Frog	<i>Litoria moorei</i>	
Chelidae (side-neck tortoises)		
South-West Long-necked Tortoise	<i>Chelodina oblonga</i>	
Typhlopidae (blind snakes)		
	<i>Ramphotyphlops australis</i>	
Boidae (boas and pythons)		
South-West Carpet Python	<i>Morelia spilota imbricata</i>	NCS
Elapidae (front-fanged snakes)		
Crowned Snake	<i>Drysdalia coronata</i>	
Bardick	<i>Echiopsis (Notechis) curta</i>	
Black-naped Snake	<i>Neelaps (Vermicella) bimaculatus</i>	
Black-striped Snake	<i>Neelaps (Vermicella) calonotus</i>	NCS
Western Tiger Snake	<i>Notechis scutatus</i>	
Dugite	<i>Pseudonaja affinis</i>	
Gould's Snake	<i>Suta (Rhinoplocephalus) gouldii</i>	
Jan's Bandy-Bandy	<i>Simoselaps (Vermicella) bertholdi</i>	
Narrow-banded Snake	<i>Simoselaps (Vermicella) fasciolata</i>	
Half-ringed Snake	<i>Simoselaps (Vermicella) semifasciatus</i>	
Gekkonidae (geckoes)		
Southern Spiny-tailed Gecko	<i>Diplodactylus spinigerus</i>	
Marbled Gecko	<i>Phyllodactylus marmoratus</i>	
Barking Gecko	<i>Underwoodisaurus milii</i>	RCS

Table 2 Continued

Species		Significance
Pygopodidae (legless lizards)		
Sand-Plain Worm-Lizard	<i>Aprasia repens</i>	
Fraser's Legless Lizard	<i>Delma fraseri</i>	
Gray's Legless Lizard	<i>Delma grayii</i>	RCS
Burton's Legless Lizard	<i>Lialis burtonis</i>	
Common Scaleyfoot	<i>Pygopus lepidopus</i>	
Agamidae (dragon lizards)		
Western Bearded Dragon	<i>Pogona minor</i>	
Varanidae (monitors or goannas)		
Gould's Sand Goanna	<i>Varanus gouldii</i>	
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	
Black-tailed Monitor	<i>Varanus tristis</i>	
Scincidae (skink lizards)		
South-West Cool Skink	<i>Acritoscincus (Bassiana) trilineatum</i>	
Fence Skink	<i>Cryptoblepharus plagioccephalus</i>	
West Coast Ctenotus	<i>Ctenotus fallens</i>	
	<i>Ctenotus impar</i>	
	<i>Ctenotus gemmula</i>	RCS
Western Limestone Ctenotus	<i>Ctenotus australis (lesueurii)</i>	
Red-legged Ctenotus	<i>Ctenotus labillardieri</i>	RCS
King's Skink	<i>Egernia kingii</i>	
Salmon-bellied Skink	<i>Egernia napoleonis</i>	
Mourning Skink	<i>Egernia luctuosa</i>	
Two-toed Earless Skink	<i>Hemiergis quadrilineata</i>	
West Coast Four-toed Lerista	<i>Lerista elegans</i>	
Perth Lined Lerista	<i>Lerista lineata</i>	NCS
Worm Lerista	<i>Lerista praepedita</i>	RCS
Dwarf Skink	<i>Menetia greyii</i>	
West Coast Morethia	<i>Morethia lineoocellata</i>	
Dusky Morethia	<i>Morethia obscura</i>	
Western Bluetongue	<i>Tiliqua occipitalis</i>	RCS
Bobtail	<i>Tiliqua rugosa</i>	
Number of species observed or expected:	Amphibians	9
	Reptiles	43

NCS = national conservation significance; RCS = regional conservation significance.

Table 3 Bird species expected in the area of the South-West Metropolitan Rail route between Anketell Road and Mandurah

Part A: Waterbirds

Species		Significance
Anatidae (ducks, geese and swans)		
Freckled Duck	<i>Stictonetta naevosa</i>	Priority 4
Black Swan	<i>Cygnus atratus</i>	
Australian Shelduck	<i>Tadorna tadornoides</i>	
Pacific Black Duck	<i>Anas superciliosus</i>	
Grey Teal	<i>Anas gibberifrons</i>	
Chestnut Teal	<i>Anas castanea</i>	
Australasian Shoveler	<i>Anas rhynchotis</i>	
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	
Hardhead (White-eyed Duck)	<i>Aythya australis</i>	
Australian Wood Duck	<i>Chenonetta jubata</i>	
Musk Duck	<i>Biziura lobata</i>	
Blue-billed Duck	<i>Oxyura australis</i>	
Podicipididae (grebes)		
Great Crested Grebe	<i>Podiceps cristatus</i>	
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	
Anhingidae (darters)		
Darter	<i>Anhinga melanogaster</i>	
Phalacrocoracidae (cormorants)		
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	
Pelecanoididae (pelicans)		
Australian Pelican	<i>Pelecanus conspicillatus</i>	
Ardeidae (herons and egrets)		
White-faced Heron	<i>Egretta novaehollandiae</i>	
Little Egret	<i>Egretta garzetta</i>	
White-necked Heron	<i>Ardea pacifica</i>	
Great Egret	<i>Egretta alba</i>	JAMBA, CAMBA
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	
Little Bittern	<i>Ixobrychus minutus</i>	Near Threatened
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Vulnerable
Black Bittern (South-West)	<i>Dupetor flavicollis</i>	Priority 2

Table 3 Continued

(Part A)

Species		Significance
Plataleidae (ibis and spoonbills)		
Glossy Ibis	<i>Plegadis falcinellus</i>	
Australian White Ibis	<i>Threskiornis molucca</i>	
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	
Accipitridae (hawks and eagles)		
Swamp Harrier	<i>Circus approximans</i>	
Rallidae (crakes and rails)		
Buff-banded Rail	<i>Rallus philippensis</i>	
Baillon's Crake	<i>Porzana pusilla</i>	
Australian Spotted Crake	<i>Porzana fluminea</i>	
Spotless Crake	<i>Porzana tabuensis</i>	
Black-tailed Native-hen	<i>Gallinula ventralis</i>	
Dusky Moorhen	<i>Gallinula tenebrosa</i>	
Purple Swamphen	<i>Porphyrio porphyrio</i>	
Eurasian Coot	<i>Fulica atra</i>	
Scolopacidae (sandpipers)		
Marsh Sandpiper	<i>Tringa stagnatalis</i>	JAMBA, CAMBA
Common Greenshank	<i>Tringa nebularia</i>	JAMBA, CAMBA
Wood Sandpiper	<i>Tringa glareola</i>	JAMBA, CAMBA
Common Sandpiper	<i>Tringa hypoleucos</i>	JAMBA, CAMBA
Red-necked Stint	<i>Calidris ruficollis</i>	JAMBA, CAMBA
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	JAMBA, CAMBA
Curlew Sandpiper	<i>Calidris ferruginea</i>	JAMBA, CAMBA
Recurvirostridae (stilts and avocets)		
Black-winged Stilt	<i>Himantopus himantopus</i>	
Banded Stilt	<i>Cladorhynchus leucocephalus</i>	
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	
Charadriidae (lapwings and plovers)		
Grey Plover	<i>Pluvialis squatarola</i>	JAMBA, CAMBA
Red-capped Plover	<i>Charadrius ruficapillus</i>	
Black-fronted Dotterel	<i>Elsyornis melanops</i>	
Red-kneed Dotterel	<i>Erythrogonys cinctus</i>	

Table 3 Continued

(Part A)

Species	Significance	
Laridae (gulls and terns)		
Silver Gull	<i>Larus novaehollandiae</i>	
Gull-billed Tern	<i>Gelochelidon nilotica</i>	
Caspian Tern	<i>Sterna caspia</i>	JAMBA, CAMBA
Fairy Tern	<i>Sterna nereis</i>	
Whiskered Tern	<i>Chlidonias hybrida</i>	
Sylviidae (Old World warblers)		
Clamorous Reed-Warbler	<i>Acrocephalus stentoreus</i>	
Little Grassbird	<i>Megalurus gramineus</i>	
Number of waterbird species:	60	

Part B: Dryland birds.

Species	Significance	
Phasianidae (pheasants and quails)		
Stubble Quail	<i>Coturnix pectoralis</i>	
Brown Quail	<i>Coturnix ypsilophora</i>	
Accipitridae (kites, hawks and eagles)		
Black-shouldered Kite	<i>Elanus notatus</i>	
Square-tailed Kite	<i>Lophoictinia isura</i>	Priority 4
Whistling Kite	<i>Haliastur sphenurus</i>	
Spotted Harrier	<i>Circus assimilis</i>	
Brown Goshawk	<i>Accipiter fasciatus</i>	
Collared Sparrowhawk	<i>Accipiter cirrhocephalus</i>	
Wedge-tailed Eagle	<i>Aquila audax</i>	
Little Eagle	<i>Hieraaetus morphnoides</i>	
Falconidae (falcons)		
Peregrine Falcon	<i>Falco peregrinus</i>	Specially protected
Australian Hobby	<i>Falco longipennis</i>	
Brown Falcon	<i>Falco berigora</i>	
Nankeen Kestrel	<i>Falco cenchroides</i>	
Turnicidae (button-quails)		
Painted Button-quail	<i>Turnix varia</i>	

Table 3 Continued

(Part B)

Species	Significance	
Charadriidae (lapwings and plovers)		
Banded Lapwing	<i>Vanellus tricolor</i>	
Columbidae (pigeons and doves)		
Rock Dove (Domestic Pigeon)	<i>Columba livia</i> (I)	
Laughing Turtle-Dove	<i>Streptopelia senegalensis</i> (I)	
Common Bronzewing	<i>Phaps chalcoptera</i>	
Brush Bronzewing	<i>Phaps elegans</i>	
Crested Pigeon	<i>Ocyphaps lophotes</i>	
Cacatuidae (cockatoos)		
Short-billed Black-Cockatoo	<i>Calyptorhynchus latirostris</i>	Endangered
Galah	<i>Cacatua roseicapilla</i>	
corella	<i>Cacatua</i> spp. (I)	
Psittacidae (lorikeets and parrots)		
Rainbow Lorikeet	<i>Trichoglossus haematodus</i> (I)	
Purple-crowned Lorikeet	<i>Glossopsitta porphyrocephala</i>	
Red-capped Parrot	<i>Purpureicephalus spurius</i>	
Regent Parrot	<i>Polytelis anthopeplus</i>	
Australian Ringneck	<i>Barnardius zonarius</i>	
Elegant Parrot	<i>Neophema elegans</i>	
Cuculidae (cuckoos)		
Pallid Cuckoo	<i>Cuculus pallidus</i>	
Fan-tailed Cuckoo	<i>Cuculus pyrrhophanus</i>	
Horsfield's Bronze-Cuckoo	<i>Chrysococcyx basalis</i>	
Shining Bronze-Cuckoo	<i>Chrysococcyx lucidus</i>	
Strigidae (hawk-owls)		
Southern Boobook Owl	<i>Ninox novaeseelandiae</i>	
Tytonidae (barn owls)		
Barn Owl	<i>Tyto alba</i>	
Masked Owl	<i>Tyto novaehollandiae novaehollandiae</i>	Near Threatened
Podargidae (frogmouths)		
Tawny Frogmouth	<i>Podargus strigoides</i>	
Apodidae (swifts)		
Fork-tailed Swift	<i>Apus pacificus</i>	

Table 3 Continued

(Part B)

Species	Significance
Halcyonidae (forest kingfishers)	
Laughing Kookaburra	<i>Dacelo novaeguineae</i> (I)
Sacred Kingfisher	<i>Todiramphus sanctus</i>
Meropidae (bee-eaters)	
Rainbow Bee-eater	<i>Merops ornatus</i> JAMBA
Maluridae (fairy-wrens)	
Splendid Fairy-wren	<i>Malurus splendens</i>
Pardalotidae (pardalotes)	
Spotted Pardalote	<i>Pardalotus punctatus</i>
Striated Pardalote	<i>Pardalotus striatus</i>
White-browed Scrubwren	<i>Sericornis frontalis</i>
Weebill	<i>Smicrornis brevirostris</i>
Western Gerygone	<i>Gerygone fusca</i>
Inland Thornbill	<i>Acanthiza apicalis</i>
Western Thornbill	<i>Acanthiza inornata</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>
Meliphagidae (honeyeaters)	
Red Wattlebird	<i>Anthochaera carunculata</i>
Little Wattlebird	<i>Anthochaera chrysoptera</i>
Yellow-throated Miner	<i>Manorina flavigula</i>
Singing Honeyeater	<i>Lichenostomus virescens</i>
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>
Brown Honeyeater	<i>Lichmera indistincta</i>
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>
White-cheeked Honeyeater	<i>Phylidonyris nigra</i>
Tawny-crowned Honeyeater	<i>Phylidonyris melanops</i>
Western Spinebill	<i>Acanthorhynchus superciliosus</i>
White-fronted Chat	<i>Epthianura albifrons</i>
Petroicidae (Australian robins)	
Scarlet Robin	<i>Petroica multicolor</i>
Neosittidae (sittellas)	
Varied Sittella	<i>Daphoenositta chrysoptera</i>

Table 3 Continued

(Part B)

Species	Significance	
Pachycephalidae (whistlers)		
Rufous Whistler	<i>Pachycephala rufiventris</i>	
Golden Whistler	<i>Pachycephala pectoralis</i>	RCS
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	
Dicruridae (flycatchers)		
Restless Flycatcher	<i>Myiagra inquieta</i>	RCS
Magpie-lark	<i>Grallina cyanoleuca</i>	
Grey Fantail	<i>Rhipidura fuliginosa</i>	
Willie Wagtail	<i>Rhipidura leucophrys</i>	
Campephagidae (cuckoo-shrikes)		
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	
White-winged Triller	<i>Lalage sueurii</i>	
Artamidae (woodswallows)		
Black-faced Woodswallow	<i>Artamus cinereus</i>	
Dusky Woodswallow	<i>Artamus cyanopterus</i>	
Grey Butcherbird	<i>Cracticus torquatus</i>	
Australian Magpie	<i>Gymnorhina tibicen</i>	
Corvidae (ravens and crows)		
Australian Raven	<i>Corvus coronoides</i>	
Motacillidae (pipits and true wagtails)		
Richard's Pipit	<i>Anthus novaeseelandiae</i>	
Dicaeidae (flower-peckers)		
Mistletoebird	<i>Dicaeum hirundinaceum</i>	
Hirundinidae (swallows)		
White-backed Swallow	<i>Cheramoeca leucosternus</i>	
Welcome Swallow	<i>Hirundo neoxena</i>	
Tree Martin	<i>Hirundo nigricans</i>	
Sylviidae (Old World warblers)		
Rufous Songlark	<i>Cincloramphus mathewsi</i>	
Brown Songlark	<i>Cincloramphus cruralis</i>	
Zosteropidae (white-eyes)		
Silvereye	<i>Zosterops lateralis</i>	
Number of species:	86	

RCS = regional conservation significance only, JAMBA = listed under the Japan Australia Migratory Bird Agreement, CAMBA = listed under the China Australia Migratory Bird Agreement.

Table 4 Mammal species expected in the South-West Metropolitan Rail route between Anketell Road and Mandurah

Species	Significance
Tachyglossidae (echidnas)	
Echidna	<i>Tachyglossus aculeatus</i>
Dasyuridae	
Chuditch	<i>Dasyurus geoffroii</i> Vulnerable
dunnart	<i>Sminthopsis griseoventer</i> RCS
Peramelidae (bandicoots)	
Quenda or Southern Brown Bandicoot	<i>Isoodon obesulus</i> Conservation Dependent
Phalangeridae (possums)	
Brush-tailed Possum	<i>Trichosurus vulpecula</i> RCS
Burramyidae (pygmy possums)	
Western Pygmy Possum	<i>Cercartetus concinnus</i> RCS
Tarsipedidae (honey possum)	
Honey Possum	<i>Tarsipes rostratus</i> RCS
Macropodidae (kangaroos and wallabies)	
Western Grey Kangaroo	<i>Macropus fuliginosus</i>
Brush or Black-gloved Wallaby	<i>Macropus irma</i> Priority 4
Mollosidae (mastiff bats)	
White-striped Bat	<i>Nyctinomus australis</i>
	<i>Mormopterus planiceps</i>
Vespertilionidae (vesper bats)	
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>
Chocolate Wattled Bat	<i>Chalinolobus morio</i>
King River Eptesicus	<i>Vespadelus (Eptesicus) regulus</i>
	<i>Falsistrellus mackenziei</i> Priority 4
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>
Gould's Long-eared Bat	<i>Nyctophilus gouldii</i>
Greater Long-eared Bat	<i>Nyctophilus timoriensis</i>
Muridae (rats and mice)	
Rakali or Water Rat	<i>Hydromys chrysogaster</i> Priority 4
House Mouse	<i>Mus musculus</i> (I)
Noodji or Ashy-grey Mouse	<i>Pseudomys albocinereus</i> RCS
Moodit or Bush Rat	<i>Rattus fuscipes</i> RCS
Black Rat	<i>Rattus rattus</i> (I)

Table 4 Continued

Species	Significance
Leporidae (rabbits and hares)	
Rabbit	<i>Oryctolagus cuniculus</i> (I)
Canidae (foxes and dogs)	
European Red Fox	<i>Vulpes vulpes</i> (I)
Felidae (cats)	
Feral Cat	<i>Felis catus</i> (I)
Number of species:	26

RCS = regional conservation significance only, I = introduced species.

Table 5 Species believed to be extinct in the project area between Anketell Road and Mandurah

Species		Conservation Status
Dromaiidae (emus)		
Emu	<i>Dromaius novaehollandiae</i>	
Otididae (bustards)		
Australian Bustard	<i>Ardeotis australis</i>	Nr Th (Garnett and Crowley)
Burhinidae (stone-curlews)		
Bush Stone-curlew	<i>Burhinus grallarius</i>	Priority 4 (CALM), Nr Th (Garnett and Crowley)
Psittacidae (parrots and lorikeets)		
Ground Parrot (South-West)	<i>Pezoporus wallicus flaviventris</i>	End (EPBC Act, WC Act, Garnett and Crowley)
Petroicidae (Australian robins)		
Western Yellow Robin	<i>Eopsaltria griseogularis</i>	
Cinclosomatidae (quail-thrushes and allies)		
Western Whipbird	<i>Psophodes nigrogularis</i>	End (EPBC Act, WC Act), Vuln (Garnett and Crowley)
Dasyuridae		
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Priority 3 (CALM)
Dibbler	<i>Parantechinus apicalis</i>	End (EPBC Act, WC Act)
Myrmecobiidae (numbat)		
Numbat	<i>Myrmecobius fasciatus</i>	Vuln (EPBC Act, WC Act)
Thylacomyidae (bilbies or rabbit-eared bandicoots)		
Bilby, Dalgyte or Walpiri	<i>Macrotis lagotis</i>	Vuln (EPBC Act, WC Act)
Peramelidae (bandicoots)		
Western Barred Bandicoot	<i>Perameles bougainville</i>	End (EPBC Act, WC Act)
Potoroidae (rat-kangaroos and allies)		
Woylie	<i>Bettongia penicillata</i>	Cons Dep (WC Act)
Boodie	<i>Bettongia lesueur</i>	Vuln (EPBC Act, WC Act)
Macropodidae (kangaroos and wallabies)		
Muning or Banded Hare-Wallaby	<i>Lagostrophus fasciatus</i>	Vuln (EPBC Act, WC Act)
Mala or Rufous Hare-Wallaby	<i>Lagorchestes hirsutus</i>	Cr End (WC Act) End (EPBC Act)
Tammar	<i>Macropus eugenii</i>	Cons Dep (WC Act)
Quokka	<i>Setonix brachyurus</i>	Vuln (EPBC Act, WC Act)

Table 5 Continued

Species		Conservation Status
Muridae (rats and mice)		
Dayang or Heath Rat	<i>Pseudomys shortridgei</i>	Vuln (EPBC Act, WC Act)
Canidae (foxes and dogs)		
Dingo	<i>Canis lupus dingo</i>	Least Concern

Con Dep = Conservation Dependent; Vuln = Vulnerable; End = Endangered; Cr End = Critically Endangered; Nr Th = Near Threatened.

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

WC Act = *Wildlife Conservation Act 1950* (Western Australia)