Jandakot Structure Plan

Final Report / August 2007

Includes part of the localities of Mandogalup, Spectacles, Bertram, Wellard, Wandi, Anketell, Casurina, Oakford and Oldbury

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Minister's Foreword

The Jandakot Structure Plan provides a broad planning framework at the regional level. The structure plan addresses future land use and infrastructure planning and development expectations, while balancing environmental issues.

The structure plan identifies potential development areas, road networks, major community facilities, conservation wetlands, Bush Forever sites and neighbourhood structure based on Liveable Neighbourhoods principles.

Complex ranges of issues have been addressed and a balanced approach to conservation, planning and development provided.

A workable implementation process has been outlined to achieve the structure plan's proposals. This includes the preparation of a water resource management strategy and outline development plans; amendments to the Metropolitan Region Scheme and local government town planning schemes; and detailed subdivision.

The structure plan has been produced by the Western Australian Planning Commission in full consultation with the Town of Kwinana, Shire of Serpentine-Jarrahdale, major stakeholders and the community.

I thank all those involved in the preparation of this structure plan and look forward to the ongoing implementation and creation of new communities in this area.

Hon Alannah MacTiernan MLA
Minister for Planning and Infrastructure

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Abbreviations

DEC
Department of Environment and Conservation

EPA
Environmental Protection Authority

ERIC
Eastern Residential Intensification Concept

JLUWMS
Jandakot Land Use and Water Management Strategy

JUWPCA
Jandakot Underground Water Pollution Control Area

JWRMS
Jandakot Water Resource Management Strategy

LWMS
Local Water Management Strategy

MRS
Metropolitan Region Scheme

WAPC
Western Australian Planning Commission

Summary

Background

Following the recommendations of the Select Committee Report on Metropolitan Development and Groundwater Supplies, the boundaries of the Jandakot Underground Water Pollution Control Area were reviewed. The review resulted in a decrease in the underground water pollution control area coverage, leaving an area without strategic planning direction. This Jandakot Structure Plan has been prepared to provide that direction.

Study area

The structure plan area is situated in the south-west corridor in the Town of Kwinana and Shire of Serpentine-Jarrahdale and includes the localities of Oakford, Mandogalup, Casuarina, Wellard, Anketell, Wandi, Bertram, Oldbury and The Spectacles.

Purpose

The Western Australian Planning Commission is conscious that there is increasing pressure for development in the rural and undeveloped areas of the south-west corridor that are not necessarily consistent with the aims of the Jandakot Land Use and Water Management Strategy (WAPC 1995). This structure plan therefore seeks to coordinate and plan the development expectations of the region while balancing environmental constraints, conservation, infrastructure provision and lifestyle, and community and neighbourhood objectives.

The structure plan provides a guide to the future development of the area and management of key environmental issues. It includes potential development areas, road networks, major community facilities, conservation and Bush Forever areas, and a neighbourhood structure. It also provides proposals for the implementation of the plan such as zoning mechanisms, staging, and financial and management arrangements.

Issues such as nutrient, drainage and water resource management, conservation areas, multiple ownership, and how these and community expectations for development could be integrated were dealt with in the preparation of the structure plan.

Process

This structure plan was prepared by consultants Turner Master Planners Australia, under the direction of a steering committee chaired by the Department for Planning and Infrastructure. The committee included representatives from the Town of Kwinana, Shire of Serpentine-Jarrahdale, Water Corporation and the former Department of Environment and former Department of Conservation and Land Management.

The process involved extensive community consultation, technical data collection and review, and advice from local and state government authorities. Community input has been a significant part of this process, being sought at major steps during the preparation of this structure plan.

Consultation with the community is a continuing process with additional opportunities provided for public comment and submissions at various stages in the planning process.

This is illustrated as follows:

The draft Jandakot Structure Plan identified the need to prepare a water resource management strategy prior to finalisation of the plan. A framework for preparing a water resource management strategy has been prepared and identified the need for further investigations (refer Appendix 5). Various requirements and processes for water management and planning are set out in Appendices to this structure plan.

Community consultation

The initial community workshop attended by residents, landowners, developers and other members of the public defined the key issues and values which influenced the preparation of the draft structure plan. These were focused on lifestyle objectives, opportunities to be realised and matters that may impede the plan.

The list of values, objectives and opportunities were used to establish assessment criteria for the preparation of the structure plan. The assessment criteria have been used throughout the preparation of the structure plan to maintain faith with the initial (and ongoing) expectations of the community.

The preparation of the structure plan was an iterative process with the community. Concepts were presented to community workshops and evaluated against the assessment criteria set by the community at the first workshop. Three concepts were presented to the community for evaluation, following which a preferred concept was presented to the community for comment and refinement.

The preferred concept was evaluated with positive aspects identified and given an overall "listened to reasonably well" satisfaction rating. A range of matters was also identified as aspects "that could not be lived with". These matters and others raised by government agencies have been addressed in the process of preparing the draft structure plan, however, not all issues raised have been accepted or incorporated into it.

The draft structure plan was advertised for a three month public comment period and submissions were considered and determined by the WAPC. These determinations have been incorporated into this structure plan.

Major planning influences

Liveable Neighbourhoods has been adopted as the building block for the establishment of a physical neighbourhood structure to shape the new communities. These liveable neighbourhoods are generally in linear 'bands' either side of the Kwinana Freeway due to the urbanisation opportunities available. North-south local roads join the neighbourhoods together and provide access to local shops and facilities and employment opportunities.

The mapping of site constraints showed the study area is highly constrained. However, many land uses that are incompatible with urban use are generally not permanent constraints (eg poultry farms and sand quarries). Because the evolutionary nature of many of these land uses could lead to their relocation or cessation, there is a future potential for urbanisation, not withstanding existing constraints.

Environmental issues generally fall into six main categories:

- integrated urban water management;
- retention of important bushland and wetlands;
- buffers around wetlands for their protection and to minimise midge and mosquito nuisance;
- management of pollutants, contamination and risk, including buffers around incompatible land uses;
- socio-environmental issues such as heritage and landscape protection; and
- the need for additional detailed environmental research and documentation as part of the preparation of outline development plans and/or local structure plans, water management plans at various levels and rezoning proposals.

Proposals incorporated in the structure plan to address environmental issues include:

- Identification of Bush Forever sites. The majority of Bush Forever sites are existing parks and recreation reserves in the Metropolitan Region Scheme. Some areas are significant wetlands and have been earmarked for open space to be protected or set aside as part of any future development, negotiated outcome or outline development and/or local structure plans.
- The need for water resource management strategies has been identified to establish criteria to meet the objectives and water quality targets set by the Peel Inlet-Harvey Estuary Policy 1992 and the protection of significant wetlands and groundwater resources. These are required to be completed prior to rezoning land in the study area to urban in the Metropolitan Region Scheme and may affect the total land available for urban development.
- Connectivity between remnant areas of bushland and wetland may be achieved in some instances by using the main drains and vegetated edges as multiple use corridors.
- Wetlands shown on the structure plan are from data supplied by the Department of Environment and Conservation and may require modification following on-site inspections. Accordingly, conservation category wetlands and proposed urban use boundaries may change when detailed investigations at the outline development plan/local structure planning stage of planning are undertaken.

Environmental issues to be addressed as part of the preparation of Metropolitan Region Scheme urban rezoning proposals, outline development plans and local structure plans in the Jandakot Structure Plan area include:

- integrated urban water management;
- buffers associated with the Alcoa bauxite residue storage and Kwinana air quality buffer;
- detailed vegetation, fauna and flora studies;
- wetland definition and buffers for conservation and midge or mosquito nuisance;
- noise and vibration buffers;
- water sensitive design;
- buffers to incompatible land uses;
- potential site contamination and acid sulphate soils; and
- key socio-environmental features.

The structure plan

The land use designations shown on the final Jandakot Structure Plan (figure 9) are indicative only and will guide the more detailed planning, environmental and land capability studies to confirm the land use designations and arrangements depicted on the plan. Some areas are within wetland boundaries, subject to flooding and influenced by other environmental and man made constraints and may not be suitable for residential or other urban uses. The final land use outcomes will be determined once further investigations and studies including, but not limited to, the water resource management strategy and the Peel main drain strategic planning project are completed and via more detailed local structure planning.

Principal components of the structure plan

Urban

The structure plan proposes new urban development in the following time frames in the study area: short term – zero to five years; medium term – five to 10 years and long term - 10 years or more. However, these timeframes may change over time as more detailed consideration of issues and structure planning occurs.

Population projections for the study area indicate that none of the precincts would reach their capacity population by 2026. Overall, only about 51 per cent of urban capacity, or 20 000 persons are projected to occupy the proposed urban areas in the structure plan area by 2026. This compares with the Town of Kwinana projected population of 46 000 by 2026.

Urban development is proposed to be based on the principles of Liveable Neighbourhoods, which are indicated on the structure plan. As detailed planning proceeds it is expected that this pattern of urban structuring will be modified to suit local conditions.

The north-south linear structure of the preferred option is not ideal in terms of Liveable Neighbourhood principles. The area does not lend itself to clustering of neighbourhoods, but can achieve reasonable connections between neighbourhoods (Mandogalup, Bertram-Wellard and Wandi-Anketell) in spite of the barrier formed by the freeway.

Linkages to the Perth to Mandurah railway will be good, although some proposed railway stations in the structure plan area are still under consideration at the time of writing. The Kwinana station will provide a major transit location central to the structure plan area. The Casuarina-Wellard precinct is somewhat isolated from the area to the west because there are few points of access across the freeway or to the proposed railway stations.

Retail

New urban areas are proposed to be served by the existing Kwinana town centre as well as the Gateways (Thomsons Lake) regional centre. Local neighbourhood shopping is proposed in five new local centres, which are located on Rowley, Anketell, Thomas, Mortimer and Bertram roads. A new neighbourhood centre is also proposed centrally in Bertram (an existing zoned site).

The need for retail floor space requires definition at the detailed planning stage by retail strategies or outline development and local structure plans. Additional commercial and home-based business opportunities are also encouraged in neighbourhoods.

The Town of Kwinana's district structure plan, the Eastern District Residential Intensification Concept, proposes a district centre (15 000 m2 NLA) located on Anketell Road, east of the Kwinana Freeway

Employment

Four mixed business areas are located in the structure plan area, at the intersections of the Kwinana Freeway and Anketell Road (east and west) and the Kwinana Freeway and Thomas Road (east and west). A small local home business area is proposed in Casuarina adjacent to the Kwinana Freeway. It is envisaged this area will provide some opportunities for businesses to operate from home and for the large lots to accommodate a large garage or storage shed, which would not otherwise be acceptable in a residential area. The area will need to maintain basic residential amenity standards.

The proposed urban areas are projected to generate a resident workforce of about 10 000 persons by 2026. Based on comparable metropolitan region data local employment is assumed to comprise about 10 per cent of the local population. By 2026 an estimated 2000 jobs can be expected in the proposed urban areas to service the population.

Rural

The rural areas in the central and eastern parts of the study area predominantly retain existing use and zoning classifications, as follows:

- Rural-residential: one to four hectare lots.
- Rural living: four hectare minimum lot size.
- Rural: no change. An additional area of rural living is proposed south of Thomas Road in Oakford, between King and Nicholson roads, to consolidate an area of existing four hectare lots and round off this area as the southern transition edge.

Conservation

Environmental protection policy wetlands, conservation category wetlands, resource management and multiple use wetlands are shown on the structure plan based on the information supplied by the Department of Environment and Conservation. The wetlands shown are subject to additional detailed site assessment including definition of conservation area boundaries and buffers. Resource enhancement and multiple use wetland remnants are encouraged to be retained and enhanced where appropriate.

Multiple use corridors are also schematically indicated on the structure plan as open space to suggest the potential for integration of conservation values, drainage requirements, nutrient stripping and open space provision in subsequent detailed planning. These are primarily located on main drainage routes that have some fringe vegetation, which is worthy of retention as open space.
It is intended that significant wetlands will be defined and incorporated in open space at the detailed planning stages.

Bush Forever sites

The majority of Bush Forever sites are existing parks and recreation reserves and the remainder may be subject to negotiated outcomes under the Bush Forever process and outline development planning.

Drainage and groundwater

The use and future management of the drainage system will need to be reviewed in a water resource management strategy. Such a strategy will need to address drainage flow relative to the capacity of the existing drains and the ability to be upgraded, as well as nutrient management in the context of discharge to the Peel-Harvey Estuary, and proximity to the Jandakot Mound and environmental management areas.

Additionally, groundwater levels, provision of detention basins, affect on wetlands and water sensitive design approaches will need to be considered at the detailed planning stages. Guidelines for preparing the Jandakot Water Resource Management Strategy and integrating urban water management in the planning approvals process are provided in Appendix 5.

Roads and transport

The structure plan area is dominated by the Kwinana Freeway, the Perth to Mandurah railway and a number of major east-west roads which link into the freeway and provide connections westward to the Kwinana industrial area. In addition, a chain of north-south streets are proposed to link the proposed new urban areas together and provide local access to facilities. They will also provide access on and off the major east-west roads and thus, access to the Kwinana Freeway and proposed railway stations. This road network will allow for public transport (bus) feeder services between the new urban areas and the railway stations and the Kwinana Town Centre.

School sites

Two high schools and eight primary schools are proposed in the structure plan. Proposed private schools are not identified, as locations will need to be resolved with the relevant local government.

Open space

Existing parks and recreation reservations and other major open space proposals are shown on the structure plan. Other open spaces include drainage routes, significant conservation and environmental protection policy wetlands, some buffers and multiple use corridor connections.

Private land shown as open space in the structure plan is not reserved but is proposed for such use. It will be necessary for the relevant landowners and local government to resolve the precise boundaries and extent of these open spaces through the preparation of outline development and local structure plans.

Constraints

The study area is subject to various constraints not addressed in detail in this structure plan (eg poultry farms or the absence of services). Those constraints were taken as matters that require resolution in the normal manner at later stages of the planning and land development process.

State government policies

The Environmental Protection Authority and Western Australian Planning Commission policies and draft policies will apply in order to separate and buffer incompatible land uses. Incompatible land uses may prevent urban development occurring in buffer areas. On cessation of such uses development could proceed in accordance with the structure plan. Separation distances to residential development are also required from existing gas pipelines passing through the study area.

Prominent landform

The prominent sand ridges in the southern rural areas have been highlighted on the structure plan as an area worthy of further consideration and detailed planning with a view to protection of this landform feature. Sympathetic residential, rural land use and subdivision should be encouraged to keep this feature.

Implementation

To assist in the implementation of the structure plan, a series of guidelines are included relating to urban water management, pre-requisites for the preparation of outline development and local structure plans and rural-residential provisions. The design guidelines include suggestions for environmentally responsive development, water sensitive design, amenity, appropriate interfaces between urban and rural areas, development character, sense of place and rural identity.

There are a number of steps to be taken before development proposed by the structure plan can occur including:

Jandakot Water Resource Management Strategy

A framework for developing the Jandakot Water Resource Management Strategy has been prepared for the structure plan area. It identifies the need for further research to be undertaken as part of the preparation of outline development and local structure plans, in the form of various levels of urban water management plans (refer to appendix 6).

Rezoning under the Metropolitan Region Scheme

Areas designated as short and medium-term urban in the structure plan are to be rezoned to urban deferred, or urban if appropriate.

Following preparation of the water resource management strategy, urban deferred land can be transferred to the urban zone - landowners must demonstrate urban servicing availability, submit an outline development plan and/or local structure plan and an infrastructure provision statement and any other required information.

Infrastructure provision statements

An infrastructure provision statement is a statement by a landowner or group of landowners (acceptable to the relevant authorities and the WAPC) in which the land owner(s) undertake to provide full servicing for the land, make commitments for contributions to appropriate infrastructure items and propose an outline development plan and/or local structure plan, generally in accordance with the Jandakot Structure Plan.

Local government town planning scheme amendments

Implementation of the structure plan will require amendments to the Town of Kwinana and Shire of Serpentine-Jarrahdale town planning schemes to provide for:

- infrastructure contributions as a condition of subdivision;
- council management of contributions;
- authority to acquire land and enter into negotiations to implement proposals;
- expanded infrastructure items;
- requirements for the preparation and approval of outline development plans and/or local structure plans by landowners and/or councils prior to subdivision and land development; and
- detailed financial matters to facilitate development and compensation in a fair and equitable manner.

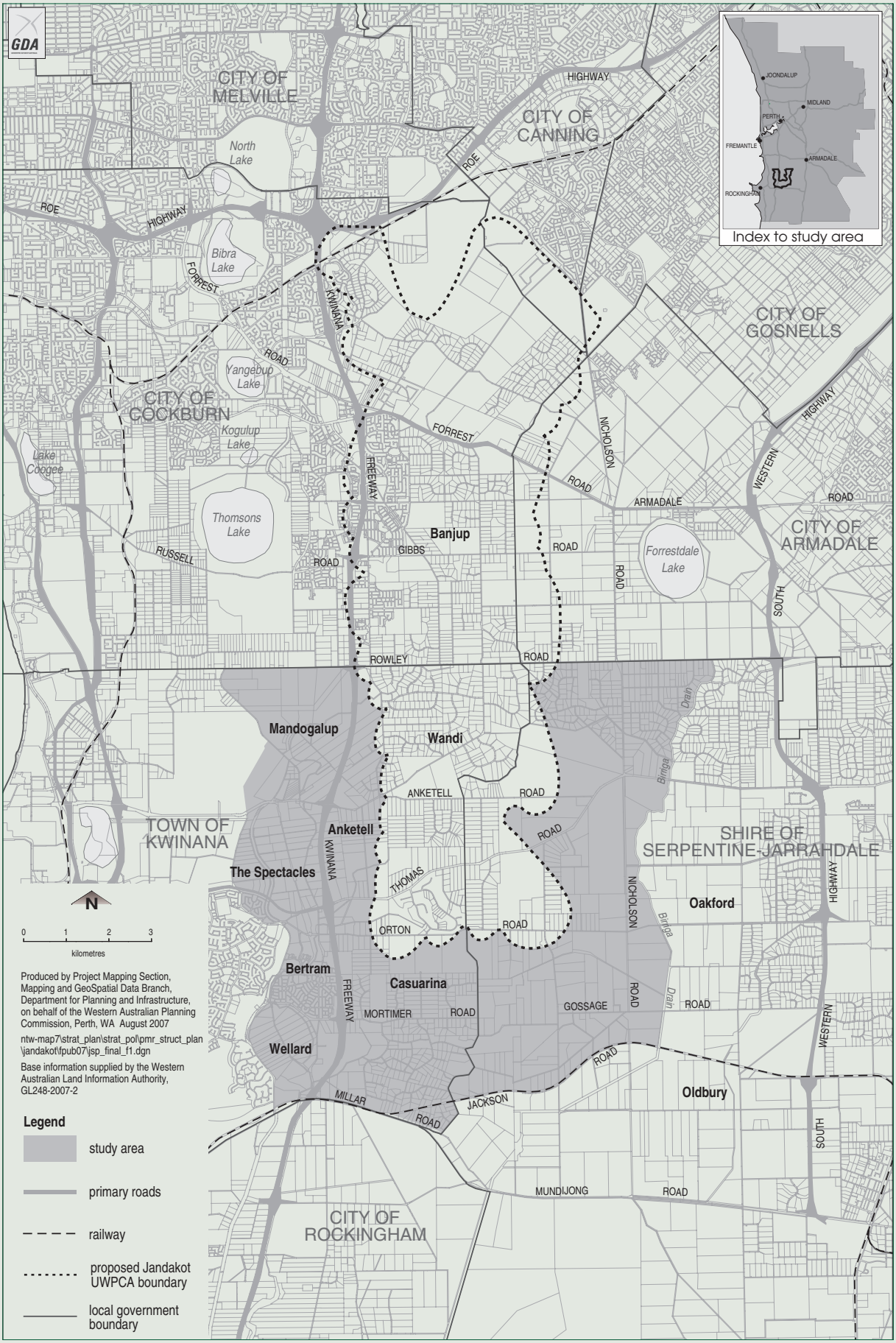
Development approval sequence

The following steps illustrate the general sequence of actions necessary for development in accordance with the structure plan. Further guidance for procedures to be followed is outlined in section 8 - Implementation. Note that not all MRS amendment proposal circumstances will be identical and this is a guide only.

- Jandakot Water Resource Management Strategy investigations occurring;
- MRS rural to urban or urban deferred amendments initiated by Western Australian Planning Commission;
- If a rezoning to Urban is proposed, a Council may request the Commission to carry out a concurrent local scheme amendment under section 126(3) of the Planning and Development Act;
- Metropolitan Region Scheme amendment referred to Environmental Protection Authortiy;

- Jandakot Structure Plan finalised;
- Metropolitan Region Scheme urban or urban deferred amendment finalised;
- local scheme amendment finalised if under Section 126(3);
- Jandakot Water Resource Management Strategy finalised;
- local structure plans prepared incorporating Jandakot Water Resource Management Strategy requirements;
- land transferred from urban deferred to urban zone in Metropolitan Region Scheme;
- if not previously carried out under Section 126(3) a local scheme amendment must be initiated within 3 months of finalisation and local structure plans prepared incorporating Jandakot Water Resource Management Strategy requirements;
- local amendment referred to Environmental Protection Authority;
- local structure plan prepared, including an approved local water management strategy;
- local scheme amendment and local structure plan finalised; and
- urban water management plan prepared and finalised before subdivision approval.

Figure 1 Study area



1
Background

1.1
Purpose of this report

The purpose of this document is to describe a structure plan for the southern section of land immediately surrounding the Jandakot Underground Water Pollution Control Area (JUWPCA) generally comprising the localities of Oakford, Mandogalup, Casuarina, Wellard, Anketell and The Spectacles (figure 1). The structure plan outlines the physical framework for future development including road networks, community facilities, conservation areas and neighbourhoods. In addition, guidance on implementation issues, such as staging, funding of infrastructure and management of key environmental systems (including drainage, nutrients, and wetlands) is provided.

1.2
Need for a structure plan

1.2.1
Jandakot Groundwater Mound

In November 1993 the Legislative Assembly of the Parliament of Western Australia resolved:

"That a select committee be appointed to inquire into and report on to what extent and in what manner development should be permitted on or around groundwater reservoirs in the Perth metropolitan region, with particular regard to protecting underground water supplies while maximising the potential to zone and develop land for its optimum and best use inclusive of urban development".

The select committee report, which was tabled in the Legislative Assembly on 1 December 1994 contained the following relevant recommendations:

"1.2 Department of Planning and Urban Development Water Resources Policy D.C. No. 6.3 should be amended to strengthen groundwater protection mechanisms, be compatible with the Crown Land Environmental Protection Policy and give greater responsibility to Department of Planning and Urban Development to ensure that protection of Perth's water supply is given primacy in the important recharge areas of Gnangara and Jandakot.

4.9 Consideration should be given to the gazetting of a Priority 1 zone on the main recharge area of the Jandakot Mound to cover land held by Government.

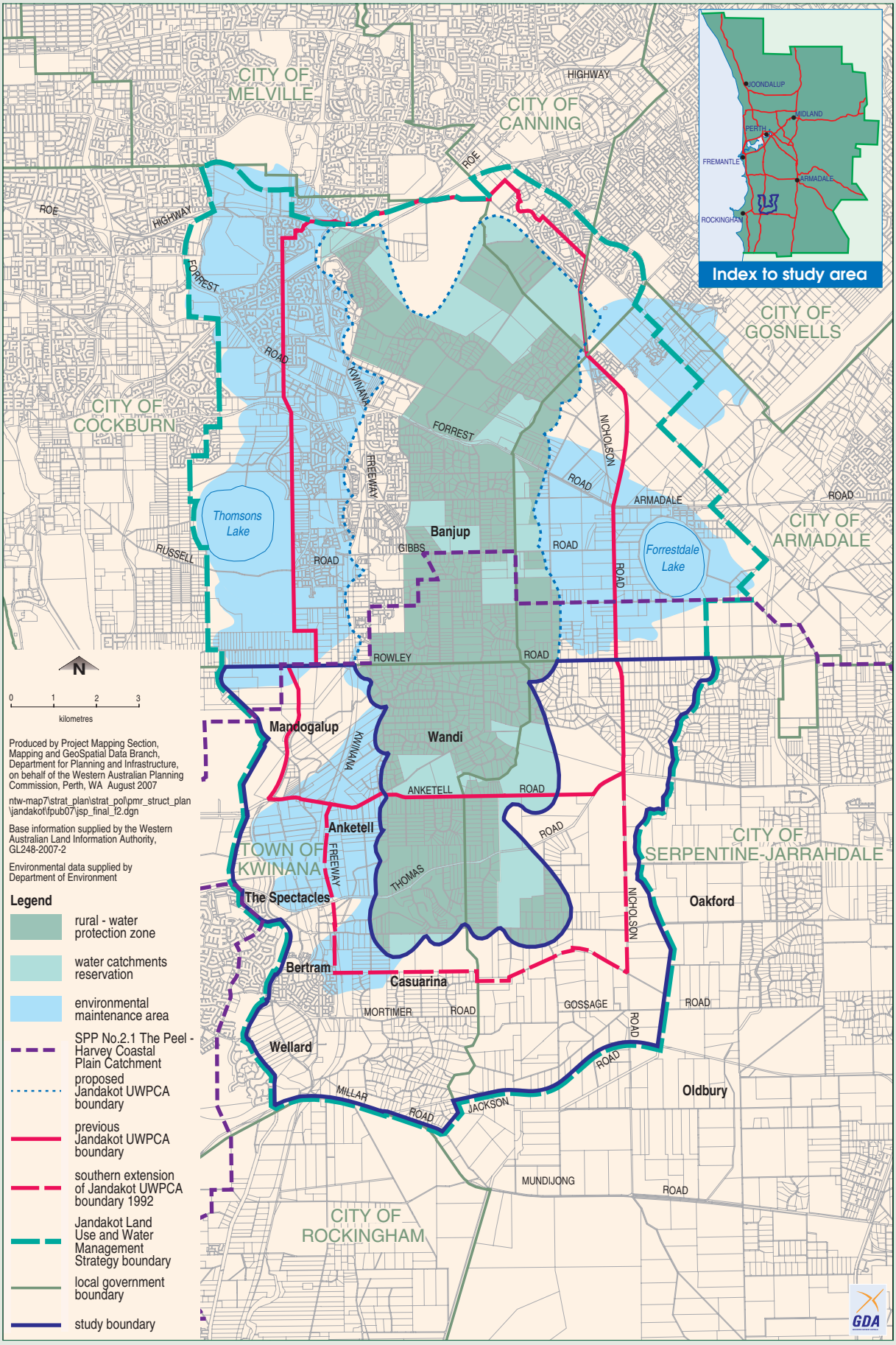
13.1 The town planning schemes developed by local government should be reviewed to ensure they reflect the water protection policies and by-laws developed by the Water Authority (now the Water Corporation and the Department of Environment), the State Planning Commission (now the Western Australian Planning Commission) and the Environmental Protection Authority."

Mindful of the select committee's recommendations, the Western Australian Planning Commission (WAPC) published the Jandakot Land Use and Water Management Strategy (WAPC 1995) (JLUWMS) which affected an area mostly corresponding to the existing and proposed Jandakot Public Water Supply Area.

That strategy noted that one of the key recommendations in the select committee report requires the Water Authority of Western Australia (now the Water Corporation) "... to review its priority groundwater area boundaries to ensure they are based on rigorous scientific evidence." To this end, environmental scientists, Dames and Moore, undertook detailed modelling of the groundwater resource that redefined the Jandakot Groundwater Mound.

This culminated in the publication of WAPC Statement of Planning Policy No.6 - Jandakot Groundwater Protection Policy in June 1998. In very broad terms this has seen the boundary of the original and proposed underground water pollution control area decrease some 1.5 to 2 kilometres in the east and in the west, with much smaller changes north and south (figure 2).

Figure 2 Previous and current Jandakot UWPCA boundaries



With this boundary change, there is an absence of any specific structure planning for the area previously affected by the underground water pollution control area. This structure plan therefore seeks to coordinate and plan the development expectations of the area while balancing environmental constraints, conservation, infrastructure provision, lifestyle, and community and neighbourhood objectives.

1.2.2 Regional population growth

Regional population growth pressures will add to the need for a structure plan to properly manage urbanisation. Population growth by 2031 for Perth and the Peel region is projected to be 2.2 million, or a 52 per cent increase over 2001. On this basis there may be a demand for an additional 375,000 new homes in Perth metropolitan region. (Network City: Community Planning Strategy Perth and Peel 2004)

1.2.3 Infrastructure

The State Government has expended and proposes significant infrastructure investment in the south-west corridor, based on anticipated regional growth, including:

- Kwinana Freeway extensions;
- south west passenger rail service; and
- water and sewerage infrastructure.

To encourage the efficient use of infrastructure there is a clear financial and planning benefit to establish future urban areas in close proximity to the Kwinana Freeway and the future rail line. This approach is consistent with the regional objectives of Metroplan, the Urban Expansion Policy Statement for the Perth Metropolitan Region and Network City: Community Planning Strategy for Perth and Peel.

The structure plan is intended to correlate the regional needs, infrastructure expenditure and lifestyle opportunities that the area can fulfil subject to careful consideration of structure planning criteria.

1.3 Structure plan framework

The structure plan will be used by state and local government agencies as a basis for the long-term planning of the area by:

- providing a prescription for development;
- identifying indicative areas to be set aside as open space;
- identifying environmental and conservation principles and objectives;
- providing for community infrastructure;
- establishing the basis for subsequent Metropolitan Region Scheme (MRS) amendments;
- providing a context for local government town planning scheme amendments;
- identifying future development areas; and
- nominating physical servicing infrastructure requirements.

A district structure plan is being prepared by the Town of Kwinana which is named the Eastern Residential Intensification Concept (ERIC). It focuses on the physical arrangement of urban areas, primary road systems, public transport, neighbourhoods, schools, open space, shopping facilities and major infrastructure. Subsequently, outline development plans and/or local structure plans are prepared by landowners and Council which provide more detail including specific selection and layout of land uses, servicing and definition of environmental areas with an implementation plan.

The Jandakot Structure Plan has no statutory effect. It has been adopted by the WAPC as a basis for amendments to the MRS and for consideration of outline development plans/local structure plans and subsequent subdivision applications on appropriately zoned land.

1.4 Process for adopting the structure plan

Preparation of the structure plan forms part of a larger planning process that involves various policy and statutory processes. Appendices 1 and 2 illustrate these broader planning and development processes.

The preparation and adoption of the structure plan has involved extensive community consultation, technical data collection, and the advice of local and state government agencies.

1.5 Structure plan objectives

The objectives of the structure plan are to:

- identify appropriate short-term and long-term land uses without overriding existing commitments and bearing in mind the select committee's intent;
- prepare planning guidelines for the Jandakot Water Resource Management Strategy (JWRMS); and
- prepare a context and site analysis to assist in any future strategic planning for the area generally.

1.6 Timing

No specific timetable for the implementation or expiration of the structure plan has been identified. The expected timing of development of the main urban areas is indicated in the structure plan as short, medium and long term. The actual development of land will occur according to the priorities set by land owners and the ability of the servicing agencies to provide the essential services required. However, it is necessary to describe the implementation options for development given the fragmented landownership in the study area.

1.7 Water resource management

The structure plan will be supplemented by the JWRMS coordinated by the Department of Environment and Conservation (DEC) and Water Corporation (WC).

The JWRMS will provide specific guidance on issues such as storm water control, drainage, and wetland management. Because the land is constrained, it will be essential that land use and subdivision planning incorporates elements of water sensitive urban design through the application of best management practices. Therefore, planners and developers referring to the structure plan need to be aware that more specific guidance on water management will follow, and that this may result in modifications to aspects of the structure plan in respect of land use and subdivision design. The outcomes of the JWRMS are required to be incorporated into future district and local structure plans through local water management strategies and urban water management plans prior to subdivision approval.

2

Planning framework

The MRS establishes a statutory planning framework for local scheme zones, structure planning, subdivision and development in the Perth metropolitan region.

The 1970 Corridor Plan for Perth did not contemplate urbanisation in the structure plan area - the area was regarded as part of the inter-corridor rural buffer area and formed part of the Jandakot Groundwater Mound.

As with many planning proposals, changes in planning philosophies and preferred land uses occur over time. This process is briefly discussed in the following review of the main planning studies and initiatives that have taken place since 1973 in so far as they may relate to the structure plan area and its planning context.

2.1

Planning for the Future of the Perth Metropolitan Region (1987)

In May 1985, the then Minister for Planning announced the State Government's decision to review the Corridor Plan and the MRS. In November 1987, the document Planning for the Future of the Perth Metropolitan Region was released and one of its conclusions was that the long urban corridors contemplated in the corridor plan were inefficient for servicing and transport.

Further, the corridors were considered socially undesirable given that the outer areas would be remote from employment areas and other facilities found in the inner areas of the Perth metropolitan region.

The Urban Expansion Policy Statement (refer section 2.2) sought to consolidate development in shorter and wider corridors. Accordingly it replaced land previously identified in the outer corridors with land in the rural corridors closer to the core of the Perth metropolitan region.

In the south-west corridor, the strategy recommended additional urban expansion areas at:

- Baldivis, east of Rockingham;
- Kwinana; and
- in the vicinity of Thomsons Lake.

Future residential uses were also contemplated adjacent to the Kwinana Freeway. However, no specific recommendations or target populations were made in relation to this land.

The strategy did acknowledge the need to carefully plan constrained future expansion areas due to water resource protection requirements and protection of intensive rural land uses (ie market gardens and poultry farms).

The strategy was released for public comment and generated a significant number of submissions. The weight of submissions resulted in the rethinking of the strategy in favour of a revised regional strategy, being Metroplan and the Urban Expansion Policy Statement.

2.2

Metroplan and the Urban Expansion Policy Statement (1990)

Following the 1987 Corridor Plan Review, the then Department of Planning and Urban Development (now Department for Planning and Infrastructure) reexamined metropolitan growth patterns. The review resulted in the release of Metroplan - A Planning Strategy for the Perth Metropolitan Region and the Urban Expansion Policy Statement for the Perth Metropolitan Region.

Metroplan was adopted as a structure plan for the Perth metropolitan region. Metroplan retained many of the features of the 1970 Corridor Plan as well as those future urban areas proposed in the 1987 Corridor Plan Review.

The Urban Expansion Policy Statement was intended to provide a detailed description of future urban areas as well as an indication of timing.

Metroplan and the Urban Expansion Policy Statement identified two urban expansion areas in or immediately adjacent to the structure plan area these being Kwinana (east of the Town Centre) and Mandogalup.

The Mandogalup area was identified as a category B expansion area, meaning there were constraints to development. The constraints related to incompatible land uses, namely special rural, small rural holdings and intensive agricultural uses. In total, 270 hectares of category A (unconstrained) and 500 hectares of category B (constrained) land was identified by the Urban Expansion Policy Statement in the structure plan area.

2.3
South-West Corridor Structure Plan (1993)

In 1993 the then Department of Planning and Urban Development approved a regional structure plan over the South-West corridor. The structure plan generally affected land south of the Kwinana to Meadow Springs (immediately north of Mandurah).

The structure plan proposed:

- the extension of urban areas along the coast (including Secret Harbour, Golden Bay and Singleton);
- the extension of the Kwinana Freeway to the Mandurah Bypass Road; and
- a rapid transit route.

The South West Corridor Structure Plan described a number of recommendations for the Jandakot Structure Plan area including the:

- retention of rural land uses (due to the area's agricultural and landscape qualities);
- extension of the Kwinana Freeway to Mandurah; and
- creation of conservation and recreation reserves generally in the vicinity of groundwater and wetlands associated with the Jandakot Groundwater Mound.

2.4
Metropolitan Rural Policy

In December 1995 the then Ministry for Planning adopted the Metropolitan Rural Policy. The purpose of the policy was to examine key issues relating to the future use and development of rural land in the metropolitan area.

The policy stated that rural land was not necessarily viewed as a resource for continued subdivision.

Instead, development and land use should contemplate the role of rural land in respect of:

- conflict between rural land uses (particularly horticultural) and residential uses;
- lifestyle wishes of established rural communities;
- importance of rural uses to protect groundwater supplies; and
- amenity, landscape and environmental values for residents and visitors to Perth.

The policy was not intended to implement a specific plan, rather it sought to address and give weight to specific issues.

In respect of the study area, the policy identified a number of factors:

- that the majority of the rural land had a low or poor capability for agricultural and rural-residential land uses; and
- that the land was characterised by a series of poultry farms and piggeries that may constrain certain land uses.

2.5
MRS Amendment No. 981/33 - Groundwater Protection (1996)

In 1996 the WAPC adopted MRS Amendment No. 981/33. The amendment sought to implement recommendations of the Select Committee on Metropolitan Development and Groundwater Supplies.

The select committee recognised the importance of groundwater in the Perth metropolitan region, specifically the:

- diminishing number of wetlands on the Swan Coastal Plain;
- ecological benefit of protecting remaining groundwater areas;
- impact of development and land use over groundwater mounds; and
- need to protect groundwater for use as potable water to support urban expansion.

The select committee generally recommended the need to protect Priority 1 groundwater areas as well as the need to appropriately map these groundwater areas. To this end, the Water and Rivers Commission (now Department of Water) engaged consultants Dames and Moore to scientifically define the boundaries of the Jandakot Groundwater Mound.

To provide statutory effect to the revised boundaries and to protect public drinking water supplies, Amendment No. 981/33 sought to establish a rural water protection zone over privately owned land, whereas public land would be designated as water catchment reserve. The amendment was advertised for public submissions and gazetted in 1998. Following gazettal of the amendment, the Water and Rivers Commission revised the boundaries of the JUWPCA.

To support the new rural water protection zone, the WAPC adopted *State Planning Policy 2.3* to establish a framework for determining applications in the area.

2.6
Shire of Serpentine-Jarrahdale Rural Strategy (1994)

The Shire of Serpentine-Jarrahdale adopted a rural strategy in April 1994 to provide a framework for the development and subdivision of rural land in the shire.

To this end a series of objectives, preferred uses, minimum lot sizes and development controls for individual precincts in the shire were established for:

- rural living;
- farmlets;
- rural land;
- agricultural protection; and
- rural villages.

The rural strategy also sought to identify alternative rural land use precincts according to the significance of their regional landscape, conservation and basic raw materials.

The westernmost area of the rural strategy affects the structure plan area. The structure plan area is included in the rural policy area where a range of agricultural pursuits is encouraged and a minimum lot size of 40 hectares applies.

Of consequence to the structure plan, the rural strategy recommended the establishment of two rural villages in Oakford and Oldbury respectively. While no specific provisions relating to the rural villages are mentioned, it is anticipated that the rural villages will incorporate the key elements of traditional rural towns with a main street, focused social infrastructure and a gradation of lot sizes.

2.7
Jandakot Land Use and Water Management Strategy (1995)

In 1995, the WAPC released the JLUWMS. The strategy sought to:

- establish a land use plan that reflected the then current urban growth areas adjacent to the Jandakot Public Water Supply Area; and
- recommend policy and statutory mechanisms to protect and manage groundwater resources and environmental factors associated with the public water supply area.

The strategy included:

- those urban areas shown in the Urban Expansion Policy Statement subject to detailed assessment to determine the extent and nature of development;
- the establishment of the Jandakot Botanic Park to protect groundwater, significant wetlands and vegetation;
- designated rural areas over the public water supply area to minimise impact in terms of potential pollution and landscape protection; and
- a moratorium on vegetation clearing.

The document is being implemented through:

- the preparation of the Swan Coastal Plain Wetlands Environment Protection Policy;
- assessment of town planning schemes, subdivision proposals and development applications in accordance with the intent of the strategy; and
- promotion of awareness programs for residents and landowners in the area.

2.8
Town of Kwinana – Special Rural Policy

The Town of Kwinana has prepared and adopted a special rural policy for its existing and future special rural zones. The policy seeks to provide a framework for minimum lot sizes, land use controls and fire management.

The document generally encourages the retention and consolidation of the existing special rural zones in Wellard, Casuarina and Wandi.

2.9
State Planning Policy 2.1 -The Peel-Harvey Coastal Plain Catchment (1992)

The purpose of the policy is to establish a statutory framework to control land uses in the Peel-Harvey catchment to achieve a series of objectives:

- improve the ecological, social, economic and recreational role of the Peel-Harvey catchment;
- minimise the impact to the environment of changes in land uses;
- increase re-vegetation in the catchment; and
- prevent land uses that result in excessive nutrient export into the drainage system.

To achieve these objectives, the statement of planning policy established a series of standards:

- mandatory connection to sewer for particular areas and land uses;
- make land uses that have the potential to negatively impact on the Peel-Harvey Catchment not permitted or discretionary; and
- minimise potential pollutants (such as nitrates and phosphorus) through the preparation of nutrient management plans.

The Environmental Protection Policy (Peel Inlet-Harvey Estuary) of 1992 was also prepared as a complementary mechanism.

The policy includes a model amendment to local government town planning schemes.

2.10
Beeliar and Jandakot Regional Parks (1997)

In 1997, the State Government announced a commitment to introduce legislation to give regional parks legal standing and vesting in the former National Parks and Nature Conservation Authority, now the Conservation Commission of Western Australia. It was established that the coordination of management of eight metropolitan regional parks, including Beeliar and Jandakot Regional Parks (parts of which are in the structure plan area), would be progressively transferred to the DEC, on behalf of the Conservation Commission of Western Australia.

Establishment plans for the Beeliar and Jandakot Regional Parks were released in 1992 and 1995 respectively (Department of Planning and Urban Development, 1992; Ministry for Planning; 1995).

These plans confirmed the establishment of the parks through existing and proposed parks and recreation reservations.

The then Department of Conservation and Land Management (now DEC) prepared the Beeliar Regional Management Plan 2006 and the Jandakot Regional Park Draft Management Plan 2004 – 2013 in liaison with relevant local governments. The plans provide direction for the protection and enhancement of the conservation, recreation and landscape values of the parks.

2.11
State Planning Policy 2.3 Jandakot Groundwater Protection Policy (1998)

The policy contains a table that lists allowable land uses in the rural water protection zone (priority 2) and delineates the water catchments reservation (priority 1). A portion of the structure plan area is designated as priority 3, which requires management plans to be prepared and adopted rather than restrictions for groundwater protection.

The policy establishes a range of objectives and options that can be considered by local governments and planning agencies when assessing applications in the new zone, including:

- protection of vegetation;
- ensuring referral to the Department of Water;
- placing limits on pollution sources, such as stocking rates;
- consideration of drainage water impacts on the Peel-Harvey Estuary; and
- reference to other applicable planning policies.

In addition, the policy recommends a number of changes to local government town planning schemes to provide a consistent approach to determining applications and modifying use class tables to reflect preferred uses and those requiring detailed assessment, referral and/or analysis.

2.12
Bush Forever (2000)

Bush Forever seeks to identify significant remnant vegetation complexes in the Perth metropolitan area that traditionally have been cleared during 100 years of urban development.

It is the intention of Bush Forever to protect approximately 10 per cent of all remaining vegetation complexes for posterity. Where possible, the areas of remnant vegetation have been identified due to their pristine condition, ability to maintain threatened ecological communities, size and availability.

Bush Forever sites have been identified according to the following defined criteria:

- representation of 10 per cent of each key vegetation type;
- protection of rare or threatened ecological communities or species;
- size, shape and condition of the land;
- whether the land contains wetlands that have regionally significant bushland;
- other vegetation values such as linkage and core ecological processes; and
- the social and economic values of a particular land or resource, including land use zoning and the wider financial considerations of government.

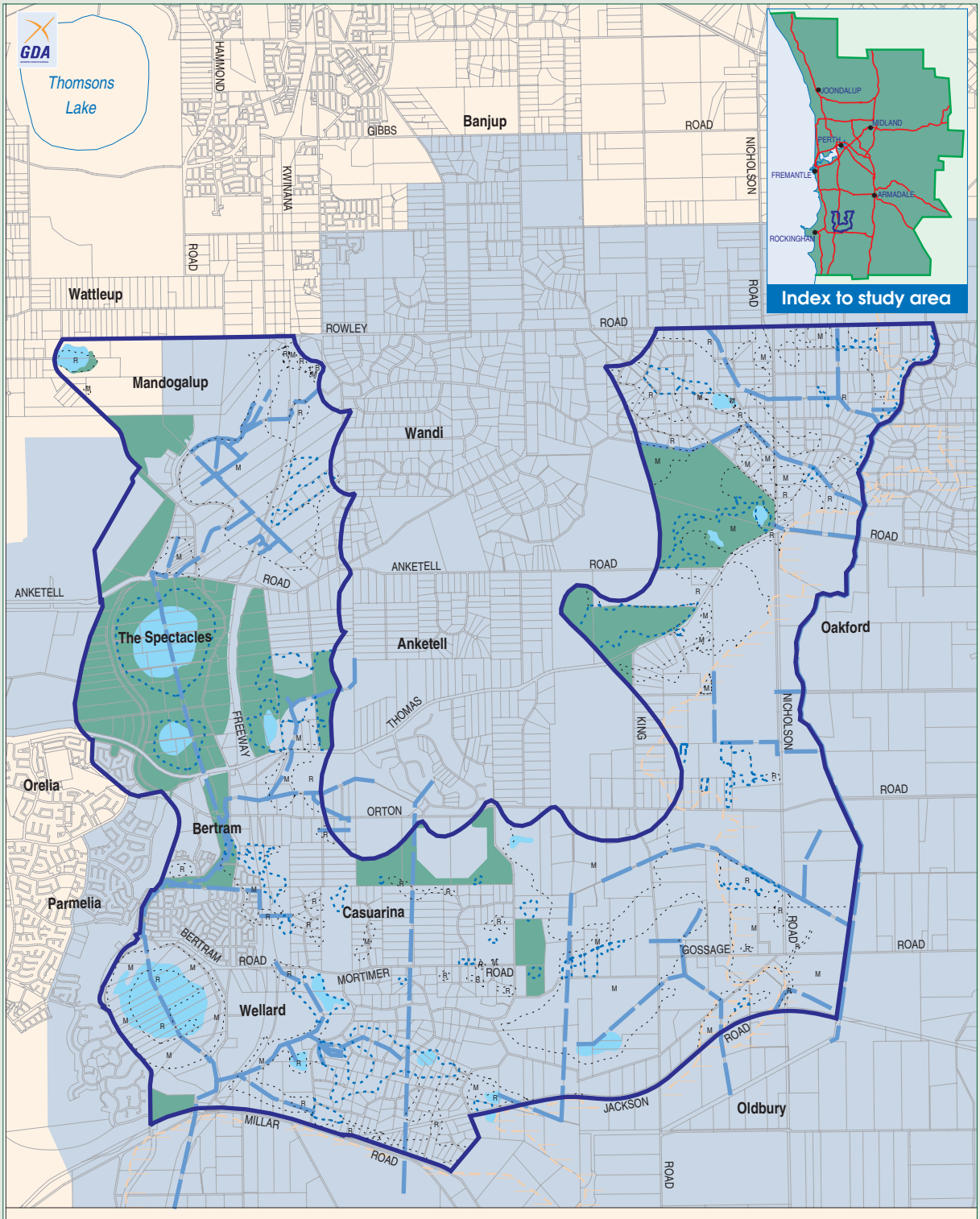
A number of sites have been identified in the structure plan area. The majority of the sites have been identified by previous studies (eg the EPA System 6 document) or included in the Environment Protection (Swan Coastal Plain Lakes) Policy and are existing parks and recreation reserves managed as part of Beeliar and Jandakot Regional Parks.

Bush Forever provides a process for resolution of, and protection mechanisms for, designated sites in private ownership. That process will determine the final outcome in terms of Bush Forever protection. Figure 3 illustrates the location of Perth's Bush Forever sites in the structure plan area.

2.13
Fremantle-Rockingham Industrial Area Regional Strategy (2000)

The Fremantle-Rockingham Industrial Area Regional Strategy (FRIARS) document recognises that the industrial area from Henderson to Rockingham is the State's premier industrial region in terms of port facilities, processing of the State's raw materials, employment and its contribution to the state's economy.

Figure 3 Categories of wetlands, Bush Forever sites and drainage



The strategy seeks to:

- consolidate the area (and its uses) as the premier industrial region for the State;
- define preferred land uses in the structure plan area;
- establish buffer zones for particular uses in the industrial region;
- determine appropriate land uses that can occur in the buffer zones; and
- establish necessary transport links to service the area.

The strategy provides certainty to residents, industry, employees, government and service providers.

Particular aspects of the strategy include:

- removal of conflicting land uses (ie residential);
- providing certainty to buffers;
- removal of the Wattleup townsite; and
- provision of over 800 hectares of general industrial land over the existing Wattleup townsite and a 100 hectare extension of the heavy industry over the Hope Valley area.

2.14

State Planning Policy 2.4 – Basic Raw Materials (2000)

The policy is designed to facilitate the extraction of basic raw materials close to the major markets in the metropolitan region. It is also designed to prevent sensitive development close to basic raw material resources that could otherwise inhibit extraction of the resource. Basic raw materials include sand (including silica sand), clay, hard rock, limestone (including metallurgical limestone), gravel and other construction and road building materials. A ready supply of basic raw materials close to established and developing parts of the metropolitan region is essential in keeping down the costs of land development and contributing to affordable housing.

The policy also recognises the importance of ensuring the extraction of basic raw materials occurs with minimum detriment to the local amenity and environment, and in a manner which allows for future use and development consistent with long-term planning intentions for the area.

The objectives of the policy are to:

- identify the location and extent of known basic raw material resources;
- protect priority resource locations, key extraction areas and extraction areas from being developed for incompatible land uses which could limit future exploitation;
- ensure that the use and development of land for the extraction of basic raw materials does not adversely affect the environment or amenity in the locality of the operation during or after extraction; and
- provide a consistent planning approval process for extractive industry proposals including the early consideration of sequential land uses.

2.15

EPA Guidance Statement No.2 – Risk Assessment and Management: Off-site Hazardous Industrial Plant (2000)

Proposals for industrial development which involve the storage, transportation or processing of hazardous substances can pose risks to employees, the public and the environment. All possible hazardous event outcomes are to be considered and risk management strategies developed to address residual risks. The guidance statement details off-site individual risk criteria for fatalities from hazardous industrial plant.

2.16

State Planning Policy 2.5 – Agricultural and Rural Land Use Planning Policy (2002)

The policy seeks to protect agricultural land through appropriate zoning, including the application of a priority agriculture zone in town planning schemes. The policy outlines the protection and management of natural resources, including water resource areas, integration of land use planning, catchment and water resource management, mineral and basic raw material resource areas and flood risk areas. Local planning strategies and policies are to be undertaken by local governments to reflect the objectives of the state planning policy. Town planning scheme provisions are to avoid land use conflicts.

The four key objectives of the policy are:

- to protect agricultural land resources wherever possible;
- to plan and provide for rural settlement;
- to minimise the potential for land use conflict; and
- to carefully manage natural resources.

Local government is required to:

- identify and appropriately zone agricultural areas of State or regional significance and other agricultural areas;
- identify and appropriately zone areas for rural-residential and rural smallholdings;
- identify and zone appropriately areas of natural resources which require protection from incompatible development;
- provide planning direction for agriculturally associated rural activities or land uses; and
- in the absence of a local planning strategy make recommendations to the WAPC in respect to rural land subdivision having due regard to the objectives of this policy.

2.17

State Sustainability Strategy (2003)

The State Sustainability Strategy is a comprehensive document that meets the needs of current and future generations through integrating environmental protection, social advancement and economic prosperity.

The purpose of the strategy is to illustrate how the State Government will respond to the sustainability agenda by adopting the sustainability framework and highlighting actions across government that give meaning to the framework.

The majority of the strategy document outlines the 42 priority areas for government action in six sections:

- Sustainability and governance
- Contributing to global sustainability
- Sustainable natural resource management
- Sustainability and settlements
- Sustainability and community; and
- Sustainability and business.

For each priority area, opportunities to progress sustainability are identified and government actions to be implemented over the next five to ten years are described. By focusing the strategy on agency activity, the State Government is demonstrating its important leadership role in supporting the transition to a sustainable future. Partnerships are central to the process of sustainability.

Government, business and the community will need to work together to achieve the aims and actions of the strategy.

The implementation of the Jandakot Structure Plan is to be achieved through cooperation between landowners and developers and various government agencies to achieve sustainable development outcomes.

2.18

State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region (Draft) (2004)

The aim of this policy is to provide a statutory policy and implementation framework that will ensure bushland protection and management issues in the Perth metropolitan region are appropriately addressed and integrated with broader land use planning and decision-making, to secure long-term protection of biodiversity and associated environmental values.

This policy is a supplementary policy under the *State Planning Policy 2 – Environment and Natural Resource Policy*. It addresses the protection and management of regionally significant bushland identified for protection. The policy provides a policy and implementation framework for Bush Forever protection areas, thus creating a statutory framework for Bush Forever.

This policy also supports the preparation of local bushland protection strategies by all local governments in the Perth metropolitan area to enable the identification of locally significant bushland sites for protection and management outside Bush Forever protection areas. This is required to be addressed in the preparation of district and local planning strategies.

2.19
State Planning Policy 4.1 – State Industrial Buffer Policy (2004)

The purpose of the policy is to describe the need for buffers associated with particular industrial land uses as well as establishing a framework for assessing and adopting the buffers.

The objectives of the policy are:

- to avoid conflict between industry and essential infrastructure and sensitive land uses;
- to protect industry and essential infrastructure from encroachment by incompatible land uses that would adversely affect their efficient operation;
- to provide for the development of industry and the provision of essential infrastructure in a way that minimises amenity and health effects on, and takes account of risk to, nearby sensitive land uses; and
- to promote compatible uses in areas affected by off-site impacts of industry and infrastructure.

The policy describes:

- the need to avoid land use conflicts;
- a technical definition of a buffer area;
- acceptance of buffer areas by the WAPC; and
- considerations to be taken into account when determining planning proposals in buffer areas.

The planning and air quality buffer for the Kwinana industrial area affects a small section of the western portion of the structure plan area. A buffer distance of one kilometre from the Alcoa bauxite residue storage area has been allocated in this regard (refer Figure 9 - Final Structure Plan). However, an appropriate buffer area for the residue area/s is subject to further consideration in the coming years and may vary from the 1km at a future date, thus affecting the extent of any future urban zone.

2.20
Network City: Community Planning Strategy For Perth And Peel (2004)

Network City highlights the key elements of planning for the future of Perth, Mandurah and Murray. It has been developed in response to the expected growth of the city. In 2001, the population was just under 1.4 million with an additional 63 000 people living further south in the Peel area. In 2031 the population for Perth and Peel is projected to be 2.2 million, or a 52 per cent increase over 2001. On the basis of these population projections there may be a need for an additional 375 000 new homes in the Perth and Peel metropolitan area.

The Network City strategy provides a planning guide to the development of the city and surrounds, including managing the growth of these areas in a sustainable way.

There are three priority actions associated with Network city, these being:

- to foster land use and transport integration to form a Network city;
- to manage urban growth and limit urban sprawl through staging of development; and
- to provide 60 per cent of required dwellings in existing urban areas and 40 per cent in new growth areas.

The key objectives of Network city are:

- to deliver urban growth management;
- to accommodate urban growth primarily in a Network city pattern, incorporating communities;

- to align transport systems and land use to optimise accessibility and amenity;
- to deliver a safe, reliable and energy-efficient transport system that provides travel choices;
- to protect and enhance the natural environment, open spaces and heritage;
- to deliver for all a better quality of life, building on our existing strengths;
- to plan with the communities;
- to ensure employment is created in centres;
- to deliver a city with 'urban' energy, creativity and cultural vitality; and
- to provide a city plan that will be implemented, provide certainty and deliver results.

The key themes of Network city are:

- to manage growth by sharing responsibility between industry, communities and government;
- to make fuller use of urban land;
- to plan with communities;
- to nurture the environment;
- to encourage public over private transport;
- to strengthen local sense of place;
- to develop strategies which deliver local jobs; and
- to provide for affordable housing.

2.21
Liveable Neighbourhoods Community Design Code (WAPC)

Liveable Neighbourhoods seeks to guide the sustainable urban development of new residential areas in Western Australia.

Liveable Neighbourhoods promotes walkable neighbourhoods and a stronger sense of sustainable communities, to be achieved through:

- clustering mixed land uses, employment centres and community facilities in central areas;
- limiting the dependence on car usage in favour of pedestrian and cycle traffic;
- arranging the physical environment to increase social interaction;
- the provision of mixed land uses to maximise local employment, security and access to community facilities;
- the provisions of a range of housing types and lot sizes to cater for diverse lifestyle choices;
- the design and provision of accessible and appropriate movement systems (including public transport); and
- the use of water sensitive urban design principles to retain environmental values.

To demonstrate the above objectives, Liveable Neighbourhoods provides detailed illustrations of desirable urban areas and physical arrangements of land uses.

In addition, Liveable Neighbourhoods seeks to consider cultural and environmental issues and recommends the avoidance of significant environmental constraints and a more comprehensive approach to open space and urban water management. It is considered that the latter issue will have a significant bearing on the south-west corridor.

It is intended that the principles of Liveable Neighbourhoods should be promoted and applied to any new urban areas, including those within the Jandakot Structure Plan.

2.22
Planning Bulletin 61: Urban Stormwater Management (2004)

This planning bulletin provides WAPC guidelines and recommendations for urban stormwater management.

The bulletin recognises the needs for stormwater management in terms of flood prevention and recognises the need for stormwater quality and quantity to be managed prior to reaching a receiving water body. The bulletin also endorses the work of the then Water and Rivers Commission (now Department of Water) in terms of the Manual for Managing Urban Stormwater Quality in Western Australia and Urban Water Management in WA: Principles and Objectives as well as the State Sustainability Strategy, State Water Strategy and WAPC policies on subdivision of land and the Liveable Neighbourhoods policy.

2.23

EPA Position Statement No 4 - Environmental Protection of Wetlands (2004)

Wetlands are widely recognised as important wildlife habitats and as being among the most biologically productive and biologically diverse habitats on the planet. This position statement provides the public and other key stakeholders with a summary of the aspects regarding environmental protection of wetlands in Western Australia that the Environmental Protection Authority (EPA) considers to be important in guiding its decisions and advice to government on matters of environmental protection.

Environmental values and functions of wetlands are defined in the position statement and an explanation as to why these are worthy of protection. It also provides a set of principles for the protection of wetlands.

Natural resource managers, decision makers, land owners and managers can use these when addressing wetland impacts and management. They should be considered by those submitting proposals for environmental impact assessment. They are also valuable for guiding the ongoing management of wetlands and adjacent activities.

2.24

WAPC State Planning Policy 1 – State Planning Framework (2006)

The State Planning Framework is an amalgamation of all planning policies, strategies and guidelines of the State that provides direction on the form and methods of growth and development.

2.25

State Planning Policy 3 - Urban Growth and Settlement (2006)

This policy is directed towards creating cities, towns and other places which provide for high levels of employment and economic growth, strong, vibrant and social communities, effective protection of the environment and the prudent use of resources.

2.26

EPA Guidance Statement No 3 – Separation Distances between Industrial and Sensitive Land Uses (2005)

This document provides the generic buffer distances referred to in the State Industrial Buffer Policy 1997. A number of emissions are generated by industrial, commercial and rural activities and infrastructure. These include noise and air emissions (gases, dust and odours). The levels of emissions may at times exceed amenity levels considered acceptable in residential areas and at other sensitive land uses.

The determination of buffer areas is necessary in many situations to avoid or minimise the potential for land use conflict. The separation distances are intended to provide assistance with strategic planning studies and processes. Protection of sensitive land uses from industrial emissions is assisted by the identification of suitable buffers at the strategic and structure planning stages of the land use planning process.

The separation distances outlined in the guidance statement are intended to be used as a tool, supplemented by other appropriate techniques, to assist in the assessment of new industries or new sensitive land uses.

2.27

Wetlands policies

There are several policy documents directly relevant to wetlands in the structure plan area which will affect future urban development.

The most significant are:

The Wetlands Conservation Policy for Western Australia (1997)

This document is an inter-governmental agreement, binding on all agencies. The policy defines wetlands as “Areas of marsh, fen,

peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres".

The document highlights a number of main objectives:

- to prevent the further loss or degradation of valuable wetlands and wetland types, and promote wetland conservation, creation and restoration;
- to include viable representation of all wetland types and key wildlife habitats and associated flora and fauna in a statewide network of appropriately located and managed conservation reserves which ensure the continued survival of species, ecosystems and ecological functions;
- to maintain, in viable wild populations, the species and genetic diversity of wetland-dependent flora and fauna;
- to maintain the abundance of water bird populations, particularly migratory species; and
- to greatly increase community awareness and appreciation of the many values of wetlands, and the importance of sound management of the wetlands and their catchment in the maintenance of those values.

Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 and the Revised Draft Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004.

The Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 applies to those water bodies that, in most cases, exhibited standing water of 1000 square metres or more in area during the first week of December 1991. The policy prohibits filling, mining, pollution, or changing the drainage of wetlands on the Swan Coastal Plain, except where absolutely necessary.

EPA Bulletin 686 - A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area.

This bulletin outlines the EPA's management objectives and specific categories for wetlands on the Swan Coastal Plain, specifically in the near Perth region. It uses a scoring method that takes into account wetland attributes and values. This bulletin is a preliminary guide for categorisation of wetlands and is taken into consideration, together with other wetland information, when the EPA assesses various development scenarios.

Wetlands of the Swan Coastal Plain (Volumes 2a and 2b)

These documents provide a concise and systematic picture of the Swan Coastal Plain's wetland resources, their extent, characteristics, values and some of their management related features. The mapping has been superseded by the Geomorphic Wetlands Swan Coastal Plain dataset maintained by DEC. Figure 3 and figure 9 show wetland information from the DEC dataset. The current dataset must be consulted to ensure the most up-to-date data is used.

- **Water Sensitive Urban (Residential) Design Guidelines for the Perth metropolitan region.**

It is generally a requirement of the DEC that best planning and best management practices be applied in the planning process.

- **A Stormwater Management Manual for Western Australia.**

This manual defines and describes in practical terms, objectives and best management practices for stormwater management systems.

- **Environmental Guidance for Planning and Development. EPA Draft Guidance No.33.**

  These guidelines address environmental issues and their management and include guidelines for wetlands, watercourses, bushland, public water source areas and pollution management.

2.28
Transport matters

Southern Suburbs Railway

The southern suburbs passenger railway and stations at Kwinana and Wellard were under construction at the time of writing and will become operational when the rail service is intended to commence in late 2007.

Current master planning for the railway also suggests stations at Rowley Road (Mandogalup) and Anketell Road (Anketell) within the structure plan area. However, while MRS amendment No. 1032/33 reserved several areas of land in the structure plan area for possible railway stations (figure 9), at the time of writing there was no commitment or envisaged time scale to construct stations at either of these locations. They are subject to further consideration.

3

Physical, planning and social characteristics

As part of the structure plan assessment, a literature review was undertaken to examine the current status of knowledge about the regional environment. The environmental study focussed on the land between Millar Road and Jackson Road to the south and Rowley Road to the north; and McLaughlan and Mandogalup Road to the west and Nicholson Road (approximately) to the east.

3.1 Physical characteristics

3.1.1 Climate

Rainfall and run-off

The distribution of rainfall and occurrence of drought are significant factors in maintenance of the Jandakot Groundwater Mound and its associated wetlands. Rainfall in the study area is about 818 mm per year (as determined at the nearest major centre: Rockingham). The median rainfall at Rockingham is almost identical to the mean, and is about 826 mm. Most rainfall occurs between May and September, with the probability of rainfall being much lower in the other months.

Temperatures

Mean annual maximum temperature at Rockingham is about 23.4oC (highest monthly mean is 30.2oC in February) and mean annual minimum 14.4oC (lowest monthly mean is 10.4oC in July). Temperatures are therefore moderate for most of the year. It is recognised that local temperatures are influenced by the amount of vegetative cover. Local maximum temperatures are lowest in areas of native vegetation where the tree canopy shades the soil, and under-storey vegetation reduces soil temperature and reflected heat. This is particularly so in areas of white or yellow sands as these soils are very reflective.

Dense, multi-layered vegetation also assists in ameliorating minimum temperatures during winter conditions by reducing wind flow and wind speed, and hence wind-chill factor. It is a significant factor in land development that retention of as much tree canopy as possible will help to ameliorate local extremes of temperature.

Humidity and fog

Humidity in the region is moderate to low, with an annual mean of only 19 per cent in the Perth metropolitan area. Evaporation is correspondingly high (annual mean 4.3 mm per day, and up to 7.8 mm per day in January). Owing to the combination of sandy soil structure, low humidity and high evaporation rate, soils dry out quickly after rainfalls.

The occurrence of fog (based on data from Jandakot Airport) is similar to, or slightly less than, that of Perth Airport, ie about 14.5 days per year (Bureau of Meteorology personnel comment.)

Winds and wind management

The important wind features of the structure plan area are that in summer there can be strong easterly winds in the morning and strong sea-breezes in the afternoon. These winds can raise dust during the dry season and can carry gaseous emissions, odours and noise considerable distances, but can also have a cooling effect in summer. These strong winds also have the potential to raise dust from exposed surfaces.

In winter, winds are generally from the north-east, north and north-west, but soils are usually moist at that time and dust-blow is minimal.

Trees form an especially effective wind-barrier as they are semi permeable, and hence create local turbulence and reduce wind speed without usually becoming uprooted. Tree wind barriers, in order to be effective, need to run in a due north-south direction (ie across the wind direction). They also need to have a relatively dense coverage to form an effective wind barrier. Very few suitable existing wind barriers are present, being almost entirely restricted to the patches of remnant vegetation. Planning for development in the area should aim to retain existing trees wherever possible.

3.1.2
Terrain and geomorphology

The structure plan area lies in the Bassendean Dune and Sandplain Geomorphological System as classified by Van Gool (1990). The system is characterised by low relief pleistocene sand dunes (ranging from 10 to 14 metres Australian Height Datum), intervening sandy and clayey swamps, and gentle undulating plains.

Soils are generally leached, grey siliceous sands and may become pale yellow in the dunes (WAPC 1995).

Other than wetlands, there are no steep slopes, major river crossings, or other terrain features, which require special management or present constraints to development.

3.1.3
Soils

There are some areas of Guildford formation soils on the eastern side of the Jandakot Groundwater Mound Gozzard (1983) or Jordan (1986). However, most of the eastern side of the structure plan area is deep Bassendean sand, and the western side Karrakatta or Cottesloe sand derived from Tamala limestone (Dept Agriculture data, Gozzard ibid. and Jordan ibid.).

The soil in most dryland sites is white to grey or yellow sand of uniform or gradational profile. On the wetland margins, the sand is usually leached to grey or white, is intimately mixed with peat or carbonaceous material, and is generally grey to black and mottled in the subsurface.

The soils are identified by Gozzard (ibid.) and Jordan (ibid.) as being of moderate permeability, low corrosion potential, and low to moderate slope stability, with a low to moderate load-bearing capacity.

Most of the soils do not support agriculture or horticulture without intensive management. The soils generally have a poor capacity to absorb nutrients, having low clay and iron content (except in some of the alluvial soils to the east and those with some calcium carbonate to the west). The high organic content of dampland soil assists in trapping nutrients.

Soils mapping by Department of Agriculture and Food Western Australia indicate that there is an area of high quality soils suitable for horticulture just north-east of The Spectacles.

Almost all the rest of the structure plan area has soils that are suitable for vineyards and other agricultural activities but require intensive management to be productive.

In terms of constraints, the issues for the study area are:

- highly friable sandy soils being easily damaged by horses and other livestock and becoming destabilised;
- most of the soil requires intensive management and fertiliser to be viable - this nutrient affects the wetlands and groundwater quality; and
- most of the land could support urbanisation with appropriate engineering, except for some of the larger and deeper wetlands where the cost of development would be high.

These constraints are area-specific and cannot be generalised. They need to be identified and addressed on a case-by-case basis.

3.1.4
Existing drainage

Land drainage in Western Australia is controlled by the Land Drainage Act 1925 for rural areas, and by the Metropolitan Water Authority Act 1982 for the Perth metropolitan area.

The structure plan area lies entirely in the Mundijong Drainage District, one of several rural drainage districts for which the Water Corporation provides rural drainage services under licence from Office of Water Regulation. The drains controlled by Water Corporation are referred to as main drains.

Information on the Mundijong Drainage District was compiled in 1994 by the former Water Authority (English, 1994). The summary below is taken largely from this report, and takes account of changes in administration since that date.

Peel Main drain and Birrega main drain are the principal main drains; both flow in a southerly direction from approximately the northern structure plan boundary at Rowley Road, to beyond the southern structure plan boundary. Both drains are tributaries of the Serpentine River and discharge to the Peel Inlet.

Peel main drain flows through the middle of significant wetlands, including The Spectacles wetland and Bollard Rush wetland (at Bertram Road). An extensive network of smaller open drains, some of which are part of the Water Corporation asset base, feeds these two large open drains. The remainder are either local government road drains, or privately maintained drains. The larger Water Corporation drains are generally in a declared drainage reserve, while smaller drains may be protected in easements.

The drainage system in the structure plan area was established by 1927, to serve the Peel estate group settlement scheme. The scheme extended from north of Keysbrook to Byford and west to within five kilometres of the coast. The area covered is roughly the same as that of the Mundijong drainage district.

These drains were dug to improve crop and pasture production from the relatively fertile, peaty swamps. Hence the route of the Peel main drain was through Banjup Lake, Mandogalup Swamp and The Spectacles to join the Serpentine River. At the same time large areas of land on loamy and clay soils west of Byford were also being settled and a major drain (Birrega drain) was dug through the original course of Birrega Brook, Duck Pond and then south to join Serpentine River. A local network of feeder drains was dug soon after these major drains were completed.

Though largely complete by 1927, the drainage system quickly became silted and many farms were abandoned. Over two-thirds of the drains were abandoned by 1941. After World War II the drainage system was re-excavated and expanded.

Since that time drainage capacity and flow rates have probably increased three-fold, due to deepening and widening of the original drains.

Many drains are heavily infested with weed and grass, but some carry stands of Swamp Paperbark or Flooded Gum and act as partial corridors for fauna. Although of limited conservation significance per se, they are required for horticultural water management, and will be needed for surface drainage if urbanisation occurs in some areas. Thus, they should be protected where possible by minimising vegetation damage upstream and downstream along the drains.

There is also a potential to use the drains as biological filters to reduce nutrient input to downstream areas and to replant drain margins for aesthetic purposes and as wildlife corridors.

3.1.5
Erosion

Based on Gozzard (1983) and Jordan (1986) information, overall erosion risk is moderate for all of the soil types of the structure plan area, but the sand over clay soils to the east, and wetland soils, will be slightly more prone to water erosion problems after disturbance. All soils in the structure plan area are prone to wind-blow when disturbed. Appropriate erosion control measures will be required to maximise stability with all soil types.

3.1.6
Surface water

Surface water exists in the structure plan area only as wetlands (in the broad sense) and as artificial or modified natural drainage lines. The definition of wetlands adopted in this document is “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”. The definition therefore includes waterlogged areas that support wetland vegetation as well as basin wetlands and the drains. There are no rivers, creeks or marine areas.

For the purpose of this structure plan there are a number of wetland groups considered:

- those in designated Bush Forever sites. These are considered protected, or under review for protection, and so are not discussed further in this document, except as Bush Forever sites;
- several lakes protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992. Additional wetlands may be protected under the proposed replacement Swan Coastal Plain wetlands policy;

- conservation wetlands, as identified by the DEC wetland mapping of the Swan Coastal Plain. These wetlands are described in Hill et al (1996) as wetlands that support high levels of attributes and functions that should be preserved;
- resource enhancement and multiple use wetlands, as identified by the DEC wetland mapping of the Swan Coastal Plain, as shown in figure 3; and
- drains, as discussed in section 3.1.4.

3.1.7 Beneficial uses of wetlands

The EPA, in its draft update of the Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 lists some of the beneficial uses of wetlands including their use by local indigenous flora and fauna; the maintenance of biodiversity; and the importance of wetlands as recreational and educational elements of the natural landscape.

Based on the importance of wetlands and the many detrimental influences which affect them in areas that are rapidly becoming urbanised, management policy and methods must include:

- prohibiting activities which destroy or damage wetlands;
- restoration and maintenance of beneficial uses of wetlands wherever possible;
- reducing levels of pollutants; and
- maintaining water level regimes.

Some wetlands are already degraded while others still retain a very high degree of naturalness and are worthy of protection for their conservation values.

3.1.8 Wetlands in a regional context

Wetlands range from highly degraded to moderately good condition to near pristine condition and this is reflected in their management categories.

The DEC has identified a number of Conservation Category Wetlands close to or in the study area that must be taken into consideration during planning. While a number are in Bush Forever sites, those that are not need to be fully protected also.

Maintenance of the regional and local ecology of wetlands is dependent on maintaining water balance and quality, ie the relationship between water inflow from the aquifer or run-off, and water loss from evaporation, extraction by vegetation, and drainage out of the wetland.

Perched wetlands

Some of the wetlands, especially on the eastern side of the structure plan area, are perched, ie they are suspended above the regional water table on clays of low permeability. Some may have a shallow layer of sand overlying the clay at depth.

Unlike wetlands that are exposures of the water table, and therefore maintained by a large aquifer, perched wetlands are especially sensitive to changes in surface run-on and run-off. Their regime of wetting and drying and the period for which they are waterlogged, may be very closely tied to their overall ecology in terms of aquatic invertebrate succession and the plant species, which grow in them.

Long periods of high rainfall or increased run-off can artificially raise the perched groundwater level and keep it high for longer periods, causing anoxic soil conditions and plant death. On the other hand, excavations or earthworks on the edges of perched wetlands can damage the perching layer of clay, leading to failure to fill, or decreased periods of high moisture content. This effect can already be observed in some areas adjacent to linear drains.

Linear drains

The agricultural drains in the structure plan area could act as partial corridors for fauna. Although of limited conservation significance per se, they are required for horticultural water management, and will be needed for surface drainage if urbanisation occurs in some areas. The existing linear drains should be protected where possible by minimising vegetation damage upstream and downstream along the drains.

There is a potential to use the drains as biological filters to reduce nutrient input to downstream areas. Drain margins should be replanted for aesthetic purposes and as wildlife corridors.

Maintaining wetlands

Considering the ecological value of wetlands, the primary aim in any development for agriculture or urbanisation in the structure plan area should be the minimisation of any potentially negative impacts.

Activities which may degrade or destroy wetlands include:

- filling wetlands with rubbish, soil or other materials;
- excavation or mining operations in wetlands;
- discharging water or effluent into wetlands or withdrawal of water or drainage of water from wetlands;
- active recreation in wetlands, such as waterskiing, horse riding and off-road driving;
- permitting stock to enter wetlands for watering and grazing;
- introducing non-local indigenous flora or fauna into wetlands;
- inappropriate burning-off in wetlands; and harvesting of flora or fauna from wetlands.

Principles for their protection are:

- avoidance, where possible, of damage to underlying perching clays;
- that run off should not be led directly into these wetlands for purposes of disposal; and
- leading of run-off away from the wetland margins and construction of infiltration basins as distant as possible from them, so that any increase in water inflow by seepage to the wetlands is evened-out and does not surge.

There will be a need to minimise effects of development-generated contamination such as metals, toxic chemicals, fuel leaks and spills, and in the design of appropriate drainage.

3.1.9
Wetland categories

For the purposes of the structure plan three categories of wetland are recognised for management purposes, namely;

C conservation;

R resource enhancement; and

M multiple use

3.1.10
Buffers around wetlands

Conservation value

In most cases in the structure plan area, the area of land available for protection of a wetland has been determined by previous activities. These activities have destroyed or degraded the surrounding bushland.

The retention and management of vegetated buffers is very important to ensure that healthy wetland ecosystems are maintained and protected.

A wetland buffer zone may perform functions such as:

- reduce surface water run-off from surrounding land into the wetland;
- maintain good water quality in a wetland by reducing sediment, nutrient and pollutant loads in run-off;
- provide feeding and breeding habitat and shelter for wetland fauna;
- contribute to wildlife corridors between the wetland and adjacent wetlands or bushland;
- reduce disturbance of native fauna from surrounding development (for example noise, movement and light from residential development);
- provide a buffer area between residential areas and nuisance insects such as mosquitoes and midges;
- minimise invasion by weed species;
- obscure incompatible scenery from the wetland (for example, housing or industrial development); and
- provide an area for passive recreational activities such as bird watching, photography and bush walking.

The width of buffers around wetlands depends on the type of wetland, surrounding land use, the nature of the adjacent vegetation and topographic characteristics of the wetland margin and should be determined with guidance from the DEC. A useful reference includes Guidelines for Design of Effective Buffers for Wetlands on the Swan Coastal Plain (Davies and Lane 1995). Buffer width and density is discussed in greater detail below.

Midge and mosquito control

Another consideration in favour of buffers around wetlands is the need to protect adjacent developments from the impacts of nuisance midges and mosquitoes, which breed in the wetlands.

Chironomidae (non-biting midges) live as larvae in the bottom debris of ponds, or as adults in the dense vegetated margins of the wetlands. They may be a nuisance at night in urban areas because they are attracted to household and street lights, and may occur in huge numbers. Some species are so small they can pass through normal household fly screens, and so may enter houses.

Ceratopogonidae (biting midges) live in wet sand and mud at lake, stream or damp land margins. They too are active at night and are attracted to light, but have the added disadvantage that they bite. Some people are allergic to the bites and may be severely affected.

Culicidae (mosquito) larvae are active swimmers in any still water (vegetated or not, and regardless of size of wetland). Adult mosquitoes are attracted to humans and animals by the carbon dioxide which is breathed out. Mosquitoes are active in the daytime, and especially on warm nights when there is a gentle breeze blowing from across urban areas towards wetlands. The carbon dioxide from the human population is carried towards the wetland and the mosquitoes follow it to their hosts.

The significance of mosquitoes is greater than that of the midges, which are primarily nuisance insects. Mosquitoes, especially Aedes vigilax and Culex anullirostris, are known carriers of Epidemic Polyarthritis, also known as Ross River Fever. This disease is widespread in the Perth metropolitan and Rockingham areas.

Tabanidae (Horse Fly) larvae prefer shallow, muddy areas either on wetland margins or not. The adults are wide-ranging, daytime-active blood feeders and can be a nuisance in both urban areas and where stock is kept.

The key factors which affect the abundance of these species are:

- whether the wetland is permanent or seasonal;
- variation in the surface level of the exposed water table in the wetland; and
- the width and density of buffer vegetation around the wetland.

It is almost impossible, or at least troublesome and expensive, to control the water levels in wetlands with any degree of precision. Further, the mosquitoes (and other nuisance insects) are an integral part of the wetland ecology. By controlling them, predatory insects, reptiles, birds and mammals, which also occupy the wetland, are deprived of a food source and the ecology of the wetland as a whole is damaged.

Preservation or enhancement of dense vegetation buffers around wetlands is a much less expensive and damaging option than attempting to control water level or application of insecticides. The buffers reduce light penetration from streetlights and house lights at night into the wetlands, discouraging all but a few midges that occur near the margins. They also help to disperse and disrupt carbon dioxide streams and reduce mosquito activity.

Creation of lakes from vegetated wetlands

One of the significant contributing factors to the insect problem is the lack of surrounding vegetation to wetlands that has been cleared. Densely vegetated wetland margins are seen as ugly swamps whereas open water is seen as visually enhancing the adjacent urban areas. The removal of the dense marginal vegetation and excavating wetlands, to improve visual amenity, exacerbates the midge, mosquito and other problems.

It is essential for human health and cost-reduction of insect management that clearing and digging out of wetlands, to create vistas of open water, is resisted in land development areas.

Width and density of buffers

There are no generally accepted standards for the width of buffers, but there is increasing scientific opinion that the buffer should be determined by the surrounding land use and biophysical characteristics (not by a set width).

The DEC will not support the clearing of buffers for short-term visual or financial gain by developers.

The City of Cockburn has adopted a policy, based on analysis of frequency of complaints from residents, to discourage new residential development within 500 metres of wetlands known to have midge problems. If housing is to go within this distance it must be designed to accommodate the midge problem. The City of Cockburn also imposes a caveat on the property, certifying that the owner is aware of, and accepts, the midge problems.

The Town of Kwinana has adopted a 400 metre (non-residential) buffer for the same reasons as the City of Cockburn. A similar approach has been taken by the Department of Defence in New South Wales.

In addition, the wetland groundwater catchment area may extend well beyond a prescribed buffer and may be influenced by development in such a way as to alter the wetland hydrology. In some cases, such as at Lake Richmond, Lake Walyungup and some other lakes in the Rockingham area, even minor changes in wetland hydrology may significantly alter the lake ecology, resulting in loss of biological diversity.

Therefore clearing of buffers for short-term visual or financial gain by developers must be weighed up against long-term loss of biodiversity, amenity and ongoing management expense by the local government.

3.1.11
Groundwater

In the structure plan area the superficial groundwater is generally one to three metres below the surface. However, there are some locations where, because of higher surface topography, the groundwater table is up to 12 metres below surface. The land between Thomas Road and Millar Road is undulating and drainage is poor, becoming waterlogged in the winter months as the water table approaches the surface.

The structure plan area is located at the southern end of the Jandakot Groundwater Mound and so groundwater gradients tend to fall from the north-centre of the area to the west, south and east and drain towards the wetlands.

Groundwater contamination is a potentially significant issue. There are some areas of known contamination and many potential sites such as service stations that may be leaking fuels. There are probably many smaller point sources such as piggeries, chicken farms, and badly managed pesticide storages. There is a potential for contaminated groundwater to be drawn into wetlands from adjacent areas, as well as into private water supply wells.

Regional groundwater boreholes indicate seasonal and annual fluctuations in water table of up to about two metres. Projections in trend lines of groundwater levels indicate a slight rising tendency in mean groundwater levels (Ove Arup, 1999).

Salinity of the superficial groundwater in the structure plan area is fresh, being less than 500 mg/L total dissolved salts in some places (VCSRG, 1998).

VCSRG (1998) for the Kwinana Freeway extensions south of South Street, found that although surface water was fresh, the groundwater in palusplain areas was sometimes saline, with salinity up to 2500 mg/L total dissolved salts. Some exposures of the water table, and some soil seepage also tended to be semi-saline. Over time, there may be some tendency to saline impacts in low-lying areas intensively farmed for long periods.

3.1.12
Vegetation and flora

Vegetation (including regional significance)

Much of the structure plan area and surrounding region has been extensively cleared for farming and horticulture. Only remnant patches of native vegetation remain. Urban development is expanding and so the importance of this remnant vegetation is increased as similar habitats are destroyed. Increase of visitor and recreational use has also had a major impact.

The structure plan area has four basic types of vegetation:

- cleared grasslands used for agriculture on the sandy and alluvial flats east of the study area. These grasslands may have scattered Swamp Paperbark (Melaleuca raphiophylla) or Flooded Gum (Eucalyptus rudis) trees, but mostly these are minimal;
- Banksia attenuata and Banksia menziesii woodland over heath on sand, also mostly cleared for agriculture;
- mixed heath with tuart on the western side; and
- either Melaleuca preissiana (where drier) or Melaleuca raphiophylla (where wetter) with some Flooded Gum, often with understoreys of sedges or pasture land surrounding or occupying the lentic wetlands and linear drains.

Regionally significant vegetation has been reserved for parks and recreation in the MRS and managed by the DEC, as part of the Beeliar and Jandakot Regional Parks and /or as Bush Forever sites (figure 3).

For the purpose of this report, Bush Forever sites have been taken as conservation opportunities and are not subject to planned land use change through the structure plan.

The Wildlife Conservation Act 1950 and statutory provisions relating to declared rare flora and specially protected fauna presently protect some significant wildlife and flora in the study area. These current statutory provisions will affect future rezoning and development proposals. Some significant species and ecological communities also require protection under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Comprehensive surveys to establish the presence of threatened species and communities and establish ecological linkages have not been carried out in the structure plan area. It is therefore recommended that vegetation, flora and fauna surveys be prepared as a pre-requisite to any outline development plan/local structure plans lodged following the adoption of the structure plan.

These studies will ensure that significant flora, fauna and ecological communities, and significant ecological linkages are further identified at a local (district) level as is contemplated by the structure plan.

Identification of significant vegetation, flora and fauna should have regard to guidance in EPA 2004 'Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia' Guidance Statement No 51 and EPA2004 'Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia' Guidance Statement No 56.

Floristic

Species lists of plants recorded in the region are provided in Gibson et al (1994). Numerous significant (declared rare or priority) plant species are recorded from the region.

Several significant plant species, such as all the early-flowering orchids, are short-lived and might not be found during field surveys except by specific survey during spring. Most of the significant species are known to be restricted to damplands and wetlands. By giving remnant bushland and wetlands the highest priority for protection and management, it is likely that most of the significant species can be protected. The approach has been taken in this structure plan area that designated Bush Forever sites are providing protection for most significant plant species.

However, it is also important to make provisions for the protection of ecological values outside Bush Forever protection areas, particularly for declared or rare and priority flora, specially protected and priority fauna and threatened ecological communities.

3.1.13 Fauna

A list of bird and herpeto fauna species which could occur in the structure plan area, and some comments on regional mammals, is provided in How and Dell (1993), How et al. (1996) and numerous other references. The nearest site where there have been extensive surveys, and where the habitats are similar, is at Jandakot Airport at the northern end of the Jandakot Groundwater Mound. The Jandakot surveys did not find any fauna of outstanding interest despite the presence of a fairly large area of comparatively undisturbed bushland. It is very likely that if any important fauna do occur in the structure plan area, it will be in the larger Bush Forever sites.

Extensive historic clearing and farming, logging, fires, and land degradation have undoubtedly caused the loss of most native resident, habitat-specific, and disturbance-sensitive fauna species. Those that remain are most likely to be migratory, nomadic, resident but able to adapt to disturbed habitat, or are now found only in the least disturbed areas.

There are several important fauna still occurring in the region, but those most commonly encountered are:

Carnaby's Black-cockatoo (Calyptorhynchus latirostris) may have some dependence on pine trees and on remnant marri, as it feeds on the blossoms and nuts. This species, and Baudin's Black-cockatoo (C. baudinii) are listed on Schedule 1 in the Wildlife Conservation (Specially Protected Fauna) Notice 2005: "Fauna is Rare or Likely to be Become Extinct". Both species are White-tailed Black-cockatoos.

Southern Brown Bandicoot or Quenda (Isoodon obesulus fusciventer) has previously been listed on Schedule 1: "Fauna which (see above) is Rare or Likely to Become Extinct", in the Wildlife Conservation (Specially Protected Fauna) Notice 2005. Although it has recently been removed from the schedule, it is being carefully monitored. The species is declining in numbers in the metropolitan area and now consists of disjunctive populations. It is known to be common on road verges and remnant bushland in some near-coastal wetlands. It prefers damper habitats and wetlands.

The Peel Deviation study (Ecologia 1997) also listed Western Long-billed Corella (Cacatua pastinator pastinator); Peregrine Falcon (Falco peregrinus); and the Carpet Python (Morelia spilota imbricata) as possible inhabitants of the region. It also recorded numerous bird species listed under Japan-Australia or China-Australia migratory bird agreements. These are international agreements between Australia, Japan and China to ensure protection of water-bird species that migrate between these countries.

The scarce species Australasian Bittern (Botaurus poiciloptilus) and Freckled Duck (Stictonetta naevosa), could also be present (GHD, 1997). The only reptile of significance that may occur in the area is probably Lerista lineata, which, although not rare, is restricted in its distribution to the southern Swan Coastal Plain (Ric How, W A Museum pers. comm.).

With respect to waterbirds, in particular, recent studies by Bamford (2000) have provided some clear indications on the relative significance of large versus small wetlands in the Jandakot area.

Bamford found that large wetlands supported higher densities of waterbirds than small wetlands in autumn and summer, but densities were very similar in spring, coinciding with the use of the small wetlands for breeding purposes. Bamford found that the smaller wetlands had high densities of birds when the water level was high (good rainfall year) whereas the large wetlands had more birds when water levels were low (lower rainfall years). That being so, waterbird usage of small wetlands may be more sensitive to any environmental changes which may lower maximum water levels, especially in dry years.

Most significant fauna that remain in the area will be in the bushland and wetland areas designated under Bush Forever. Continued use of the remainder for agriculture or urban development should not change the regional fauna significantly, as only common and widespread species are present in the farmland. Where possible, for the purpose of establishing wildlife corridors, local open space could be linked to existing regional open space. Further advice from the DEC should be obtained when preparing outline development plans and local structure plans.

3.1.14
Dieback disease and other pathogens

Dieback Disease (Phytophthora spp) is common and widespread on the Swan Coastal Plain. The disease has the potential to significantly alter remnant vegetation in the study area and must be taken into consideration when addressing the long-term viability of bushland kept for recreation or conservation purposes. For the sake of development principles it should be assumed that all the areas are infected with dieback disease or that the native remnant vegetation is susceptible to dieback disease.

Dieback is uncommon in wetland areas and as such, is not as prevalent in the study area as in the Swan Coastal Plain and Scarp regions. The DEC has provided guidelines for control and management of dieback. It recognises that the introduction of fill is a source for the introduction and spread of dieback, and it is recommended that fill be sourced from dieback free areas.

Hygiene management plans, incorporating dieback and weed management strategies, should be prepared as part of the outline development plan process.

3.2
Areas of conservation significance

3.2.1
Environmental Protection Policy wetlands and other wetlands

Previously discussed in section 2.7 and 3.1.6, environmental protection policy wetlands are protected by the State Government for conservation purposes. The basis for their classification is that they contained an area of at least 1000 m2 of open water on 7 December 1991. Thus, lakes and some wetlands fall into the environmental protection policy classification, whereas many well-vegetated wetlands do not.

The Lakes Environmental Protection Policy was reviewed in 1999 and 2004 with an aim to further improve management and more closely integrate it with the Wetland Conservation Policy 1997. At the time of publication of this document, the revised environmental protection policy had not been finalised.

3.2.2
Bush Forever sites

In some instances, designated Bush Forever sites are freehold land and negotiations are required between landholders and government as to the future status of the land. There are several areas designated in Bush Forever in the structure plan area and these need to be considered as a consequence.

It is beyond the scope of this structure plan to comment on the conservation status of Bush Forever sites outside the existing conservation estate. Accordingly, they will be retained as per the boundaries shown in the final Bush Forever report. A process of integration between Bush Forever proposals and development areas will be dealt with on an area-by-area basis.

3.2.3
Corridors and connectivity

Most of the structure plan area, outside reserves and Bush Forever sites, is cleared completely or has only scattered trees and no large patches of bushland. There are a few large areas of remnant vegetation and most of these are designated for protection under Bush Forever. There is some opportunity to enhance connectivity between the high quality remnants by means of greenbelts or parkways.

Greenbelts are designated, currently non-urban, areas, where future urbanisation might not be allowed to occur (WAPC 1997). The essential difference between greenbelts and other rural areas is that their non-urban status is intended to be permanent and to be actively promoted and protected as the appropriate end use of the land.

By their nature, greenbelts can be in public or private ownership. They can be directed to environmental conservation, protection of landscape (viewscape) amenity, recreation, rural living, agriculture, or even broad acre countryside. They can vary in size from small local parks of a few hectares, to large regional parks. They can be used as buffers to keep urbanisation out of defined areas, or they can be used as belts to contain urbanisation in defined areas.

A linear greenbelt, or parkway, is associated with transport corridors. The parkway concept along major roads through urban areas is an effective tool against perceptions of urban sprawl. It can be effectively used to promote the separate identities of different localities, which are otherwise joined by continuous urban development.

Much of the structure plan area is fragmented, but a potential regional corridor exists connecting Beeliar Regional Park via The Spectacles and Bollard Bulrush Swamp to a number of remnant strips of bushland. Potentially significant ecological linkages have been identified by the Perth Biodiversity project (WALGA).

3.3
Social and environmental investigations

3.3.1
Aboriginal and non-Aboriginal heritage

Archaeology

Aboriginal sites of significance have been found at several locations in the structure plan area. It is a common occurrence to have significant Aboriginal sites and artefact scatters within 500 metres of wetlands, as the indigenous occupants established their camps and lived around these areas (Eddie McDonald, McDonald Hales and Associates, pers. comm.). The most likely places are around swamps, and in sand hills or ridges (see figure 5). Some Aboriginal artefacts have also been identified and recorded in the Bellway sand quarry (Eddie McDonald pers. comm.). Wally's Bridge was named in recognition of the Wally family's prior association with the area (GHD, 1998) and there may be other areas of cultural or association significance deemed worthy of protection.

There have been sufficient Aboriginal artefacts found in the structure plan area to warrant further detailed survey work. It should be noted that approval to disturb some sites has previously been granted by the Aboriginal Cultural Materials Committee under section 18 of the Western Australian Aboriginal Heritage Act 1972 - 1980.

Surveys will be required prior to any earthworks taking place to ensure protection of any material of Aboriginal heritage significance. It is the first preference for sites to be avoided completely. If avoidance of a site is not possible, developers will need to seek permission for use of the relevant land, under section 18 of the Western Australian Aboriginal Heritage Act 1972.

Ethnography

Ethnographic surveys have only been undertaken for small, selected areas associated with individual projects in the structure plan area. Further ethnographic evaluation would be required for any significant development.

Non-Aboriginal heritage

Sites of post-settlement heritage significance are of two types:

- those that fall in areas which will remain under current land use. These sites are protected by individuals, community groups and legislation; and
- those that fall in areas which are proposed for development of some kind. These sites should be identified and appropriately protected as part of the detailed planning process.

In either case they do not form a constraint for structure planning as they are dealt with through due process and existing legislation.

3.3.2
Noise and vibration

Any commercial and/or industrial developments in the structure plan area would need to comply with the Environmental Protection (Noise) Regulations 1997 (although it should be noted that these do not cover traffic noise). These regulations would also apply to extractive industry, market gardens, machinery noise (but not tractors), piggeries, poultry farms and dog kennels. To ensure that the regulations are complied with, suitable buffers may be required between such developments and nearby residential areas.

Noise and vibration will be generated from transport arteries such as the Kwinana Freeway, existing and proposed railways and the proposed Rowley Road upgrade. Noise effects are particularly significant in areas near schools, nursing homes and other noise-sensitive sites. Planning needs to allow for these types of development and provide adequate noise buffers from roads and other noise-generating facilities. Noise at specific sites can be managed using sound-absorbent special road surfacing materials, fences or earth bunding.

Traffic noise received at noise-sensitive sites needs to comply with the Department for Planning and Infrastructure and EPA guidelines. These include the draft state planning policies for road and rail transportation noise and metropolitan freight, the EPA Draft Environmental Guidance for Planning and Development (EPA 2005) Draft EPA Guidance No 33. A combined, comprehensive, government policy is also in preparation.

3.3.3
Dust

Strong easterly winds in summer in the morning and strong sea breezes in the afternoon can raise dust, especially during the dry season. Overall risk from wind erosion is moderate for all of the structure plan area, but the alluvial soils of the eastern part of the area, and the fine peaty material of the wetlands will be more prone to wind-blow, raising fine dust when they are disturbed.

Developments would need to comply with the Prevention of Air Quality Impacts from Land Development Sites Guidance No 18 and latest DEC guidelines. Dust management requirements would also apply to extractive industries, mineral processing, market gardens, piggeries, farms and dog kennels.

3.3.4
Air quality

Air emissions from industry primarily relate to the Kwinana industrial area to the west of the structure plan area. The Environmental Protection (Kwinana) (Atmospheric Wastes) Policy shows Policy Area B as intruding slightly into the north-western margin of the area, just north of The Spectacles. The remainder of the area is in Policy Area C.

Policy Area B is considered a buffer zone for Policy Area A (Industrial) and Policy Area C is considered suitable for rural and residential purposes. Residential use of the buffer is not supported.

The Perth Air Quality Management Plan (DEP 2000) urges that air quality is evaluated in conjunction with the planning of major roads.

Spray drift from pesticides is a consideration when housing areas are adjacent to market gardens. Odour can also arise from poultry farms, piggeries, dog kennels and service stations.

3.3.5
Risk and hazard

The assessment of risk from industry is addressed in the EPA document Guidance for Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant (EPA 2000).

Road accident risk

Main Roads WA has undertaken a detailed study of risks associated with significant accidents on major roads. The nature of crashes described in available statistics indicates that very few crashes are catastrophic in nature and indeed most do not involve even a spill of hazardous material. While crash frequencies are recognised as potentially higher in wet weather, the number of wet days in Perth is low. Concern relating to hazardous spills in wet conditions must address a probability of only 1 in 2000 years.

There are no particular features of the structure plan area that would suggest that risks from traffic usage would be higher than in other areas.

The sandy nature of the soil, especially in the western portion of the structure plan area, present some risk to the water table if spillage did occur.

Other developments

Inconvenience, health issues and environmental damage can arise from sources other than roads. Some non-industrial land uses create hazards that are not always obvious.

Examples are:

- market gardens: odour, noise, dust, spray drift, fertiliser and pesticide contamination;
- piggeries and poultry farms: odour, noise, dust, spray drift, fertiliser and pesticide contamination;
- dog kennels: noise, odour, dust and nutrients; and
- service stations: noise, odour, contamination of groundwater and run-off with fuels, oils and heavy metals.

3.3.6
Site contamination and acid sulphate soils

Some land uses and activities have the potential to be associated with land and groundwater contamination. The presence of acid sulphate soils may also affect potential new land uses. Site investigation and analysis will need to be carried out at the local (detailed) structure planning stage or subdivision stage.

3.4
Hydrological constraints

3.4.1
Environmental management areas

The area of land that covers part of the superficial aquifer that eventually flows into a wetland is called its capture zone.

Land uses in this area can have a significant effect on the wetland by either:

- affecting the quality of the groundwater (and subsequently the wetland) through the export of pollutants especially nutrients; or
- affecting water levels in the wetland through either excessive abstraction of groundwater lowering water levels; excessive clearing of native vegetation (raising water levels) or drainage of excessive surface water directly into the wetlands (raising the water table).

Some wetlands such as those of international, national or regional significance are so important that the catchments require special management. Catchments of these wetlands are called groundwater environmental management areas.

The EPA Groundwater Environmental Management Areas Draft Guidance No 48 (1998) describes how new proposals will be assessed in environmental management area categories A and B, with respect to three different types of land use namely: rural, rural-residential and urban.

The draft guidance on environmental management areas applies throughout the State where environmentally significant wetlands are dominated by groundwater. Specific catchments or environmental management areas are shown as schedules to the document and to date only one schedule has been developed with respect to the Jandakot Groundwater Mound.

Guidance on the management of land in capture zone (environmental management areas) of conservation and high conservation environmental features is also provided.

High conservation (conservation category H) lakes and sumplands have a high degree of naturalness, and the highest protection priority, namely environmental management area category A. Conservation (conservation category C) areas also have a high degree of naturalness, but have been designated to have a lower protection priority than category H, namely environmental management area category B (EPA, 1998). Only category B environmental management areas occur in the structure plan area at Wattleup Lake, and along the western margin extending generally to The Spectacle wetlands and towards Wellard wetland.

The environmental management area boundaries are based on numerical modelling (Dames & Moore, 1996), as part of a review of the groundwater protection priority area boundaries for the Jandakot Groundwater Mound.

The DEC has advised the Department for Planning and Infrastructure the basis for which changes to the environmental management area boundaries will be considered, particularly with respect to the level of monitoring data required to refine the boundary locally.

3.4.2
Shallow depth to groundwater

Much of the structure plan area has a shallow water table depth consistent with its classification as dampland, sumpland or palusplain.

DEC policy on the settings of drainage inverts is that they should be at or above the average annual maximum groundwater level. Average annual maximum groundwater level is typically 0.5 to 1.0 metres below the maximum-recorded groundwater level (WRC, 1996). Land developed for residential purposes will require fill of approximately 1.2 metres above average annual maximum groundwater level, this being a general guideline rather than a statutory requirement.

Changes to the average annual maximum groundwater level are of concern as they may affect wetlands and associated vegetation and other significant vegetation. Further, lowering the groundwater level through artificial drainage may mobilise nutrients in the soil and groundwater, increasing nutrient loads in the Peel-Harvey estuarine system.

3.4.3
Subsoil drain requirements

With urbanisation subsoil drainage systems will be required to prevent water table rise. The inverts should be set at or above average annual maximum groundwater level and the water drained through private or Water Corporation infrastructure prior to being released into the Serpentine River and Peel-Harvey estuary.

3.4.4
Nutrient water quality targets

No computer modelling has been done to assess the impact of water sensitive urban design implementation on the nutrient load on the Peel-Harvey river system.

However modelling has been performed for the Southern River Forrestdale Brookdale Wungong District Structure Plan area which indicated that “full implementation of water sensitive design” has the potential to reduce nutrient export to target figures (Swan River Trust, 1999) as part of the Swan Canning clean-up program. No description is given of the definition of full implementation of water sensitive design. Hence it is not possible to estimate the cost of such implementation.

The nutrient concentration targets for tributaries of the Swan Canning river system includes a 20 year target of 0.1 mg/L for total phosphorus and 1.0 mg/L for total nitrogen.

For the Peel-Harvey river system, to which the structure plan area drains, a target concentration of total phosphorus is implied by the phosphorus load target contained in the Peel-Harvey Estuary (Environmental Protection Policy, 1992). This proposes an environmental quality objective for the Serpentine River of less than 21 tonnes of phosphorus medium load per year.

It appears therefore that implementation of water sensitive design may be capable of controlling the level of nutrient export with that required in the environmental protection policy. However, this needs to be confirmed through the preparation of a water resource management strategy.

3.4.5
Absence of drainage strategy

At present the drainage system is designed for rural land uses rather than urban (section 3.1.4).

The urbanisation of parts of the catchments of these drains will probably lead to increased run-off rates and volume, in excess of the system capacity unless major upgrading is carried out. Such work may involve increasing the flow capacity of existing drains, either by deepening or widening, or the construction of detention basins to attenuate peak flow rates back to the capacity of the drainage system. These basins could be large and few in number, designed to provide subcatchment attenuation and be controlled by a drainage utility, such as the Water Corporation. Alternatively, the basins may be small and numerous, incorporated into each separate subdivision, and ultimately be maintained by a local government.

Urbanisation will also affect water quality in drains. Without water quality management through water sensitive urban design , water quality will deteriorate. If water sensitive urban design is implemented, perhaps with greater regulatory control than is available at present, then water quality is likely to improve compared with existing. This view is consistent with the position taken by the EPA in advice on the Southern River Forrestdale Brookdale Wungong Structure Plan.

The DEC and the Department of Water are charged with strategic drainage planning in Western Australia, and it is anticipated that these government departments will embark on developing such a strategy to address this issue in the structure plan area. It is likely that a suitable strategy will need to be consistent with various state government initiatives including water sensitive urban design, and the Peel-Harvey Catchment Planning Policy.

To a large degree land planning in this area is dependent on strategic drainage planning, and ideally the two functions should occur simultaneously.

Development of a strategic urban drainage strategy is a complex and difficult task, because of the competing objectives of environmental protection and land development, and is essential before any development can occur. This strategy needs to be given priority to ensure that the capital and maintenance costs of an upgraded drainage system are properly allowed for. The DEC and the Department of Water have embarked on this strategy, and future outline development plans and local structure plans will need to suit drainage requirements arising from the study. Depending on several factors, the land area required for appropriate water management facilities including drainage corridors and basins will need to be determined.

3.4.6
Framework for Developing the Jandakot Water Resource Management Plan

Following the completion of the draft Jandakot Structure Plan in 2001, the preparation of a JWRMS was initiated. It was intended that the findings would be used to finalise the structure plan. The JWRMS would then be used as guidance for local area drainage and nutrient plans as part of the preparation of outline development plans and/or local structure plans.

During the course of the preparation of the Jandakot Structure Plan it became apparent that the JWRMS could not be completed in the original form requested due to a substantial gap in understanding of the water resources in the structure plan area. The consultant's view was that insufficient data currently exists to deliver a high quality JWRMS with sufficient technical rigour to satisfy key government stakeholders.

As a result, a Framework for Developing the JWRMS has been prepared and endorsed by the DEC (February, 2005). This framework (Appendix 5) recommends an outline for the preparation of the JWRMS and integration of urban water management and the planning approvals process.

It is considered that further work is required to clearly identify the required outputs of the JWRMS and to put its preparation (estimated finalisation at the time of writing mid 2007) in the context of the planning and development approvals system. This will ensure that best practice urban water management outcomes can be achieved in parallel with the orderly and proper planning of the area.

3.5
Landscape/townscape character

3.5.1
Landform and views

The structure plan area's topography is comprised of ridges and valleys in the west western portion, and a large, relatively flat plain in the eastern portion that extends through to the Serpentine foothills and escarpment. Land contours vary forming areas that are typically six-nine metres and 12-16 metres in the plain, and 25-28 metres on the ridge.

The ridge occurs at the change of landscape from the Bassendean Sands and Spearwood Sands soil units. This ridge area is referred to as the Parmelia Escarpment. The ridge is characterised by bushland with some semi-rural activity. Eastward views of valleys and hills visually associate and unify land on either side of the Kwinana Freeway. Large tracts of regional reserve and market gardening activity provide landscape continuity between the areas, lessening the freeway's visual impact.

The plain has a rural landscape that is more open in character, with grasslands and frequent swampy grounds. The Serpentine foothills provide a dramatic backdrop to the plain, particularly when viewed from the long, straight and narrow rural roads in the east of the structure plan area. The view of the plain from the regional reserve on top of the ridge at Casuarina Road and Coyle Road is particularly bold.

3.5.2
Landmarks and features

The most notable quality of the structure plan area is its unified landscape character of bush and rural countryside. Few landmarks occur in the structure plan area making the scale of the landscape and road network difficult to gauge. Existing features tend to be of local significance only. These include the Birrega drain and distinctive traditional rural tree planting schemes.
The latter is characterised by tree planting grouped around homesteads, with semi-formal tree planting on property boundaries. A mix of exotic and local native tree types is common. This form of planting creates a variety of landscape effects, such as streetscape enclosure through tall or dense screen planting, or streetscape openness with expansive views of the countryside.

High voltage power lines that occur near the Kwinana Freeway visually detract from the attractiveness of the natural and rural environment of the structure plan area.

3.5.3
Subdivision and development

The urban and rural structure of the structure plan area is based upon a local road network, which occurs as an irregular grid spaced at two kilometres intervals. This relatively permeable and legible road network provides a strong, well-connected urban structure that is able to contain a variety of activities and development possibilities.

Landholdings east of Casuarina and Banksia Roads are typically rural in character, relatively large and varying in shape and size (4 ha to over 100 ha). West of Casuarina and Banksia Roads about half of the landholdings have been subdivided into special rural lots of between two and four hectares. Development appears to be ad-hoc without clear urban structuring at the district scale, and they tend to have street systems that do not connect to other local roads.

Although substantial subdivision and associated development has occurred in the area, relatively little visual disruption of structure plan area's landscape continuity has resulted.

The subdivision design principles that appear to have successfully achieved landscape integration include the following:

- the majority of new lots created have been contained deep in the street block generally out of view from the main road, reducing the perceived scale of subdivision;
- irregular road alignments and the occasional use of cul-de-sacs reduce the visual impact of development while maximising development potential;
- rural road profiles used reinforce local streetscape detail and the sense of continuity between new subdivisions and traditional rural streetscapes (ie carriageways do not have kerbs, verges are landscaped with bush scrub and in rural areas tend to contain shallow drains);
- rural fencing is used for visual unobtrusiveness and to maintain open ecological corridors;
- native vegetation is retained or replaced with complementary dense planting; and
- buildings are modelled on traditional homesteads (ie substantially set back from the road, clustered into discrete building complexes, unsightly functional areas are screened from the road and planting for landscape integration).

In contrast, some special rural subdivisions are visually stark and detract from the relatively undeveloped rural imagery of the locality. They are typically denuded of vegetation leaving development and activities exposed to the road. They tend to have rectilinear layouts with several lot frontages onto main roads that make the scale of subdivision seem large.

The cost effectiveness of infrastructure provision is likely to have generated many of the subdivision forms, particularly where large lots have occurred.

Some equestrian related subdivisions have incorporated bridle paths and open space for common use.

West of the Kwinana Freeway is a new suburban subdivision in Bertram that once fully developed will be more closely associated with the town of Kwinana. The subdivision starkly contrasts to the landscape character and imagery of the structure plan's rural areas.

3.5.4
Character of surrounding subdivisions

To the south-west of the structure plan area, south of Wellard Road is a special residential area with lot sizes of 1000-2000 m2. Although it is more densely developed than surrounding rural land, the subdivision provides a bush living atmosphere. The subdivision employs similar design principles to those of special rural subdivisions in the structure plan area (using rural fencing, predominantly rural road profiles, planting for landscape continuity between lots and spaces). The undulating topography of the area, mature treescape and public open space maintained as bushland visually reduce the scale of the subdivision.

East of the structure plan area are large rural landholdings, with some special rural subdivision in the north. Located further east, are the small country townsites of Byford and Mundijong which are proposed to be developed in accordance with Liveable Neighbourhoods principles emphasising water sensitive design to enhance waterways and public open spaces as integrated systems.

Considerable special rural subdivision has occurred in the JUWPCA. It is similar in character to that in the structure plan area, varying in size from two to four hectares in Wandi and Anketell, and one hectare in Casuarina (north of Orton Road).

Many of the larger rural subdivisions have introduced long loop roads that reduce the permeability and legibility of local road networks.

4

Community consultation

4.1 Purpose of community participation

The Department for Planning and Infrastructure, Town of Kwinana and Shire of Serpentine-Jarrahdale have been committed to an open and accountable programme of community consultation throughout the preparation of the structure plan. The community consultation programme recognised that good land use planning requires consideration of all physical factors such as landform and environmental conditions as well as social values and expectations.

The community consultation process has been seen as an effective mechanism for facilitating the flow of information between the decision makers (being the study team and committee) and the community. The process enables decision makers to identify issues (that would not normally be identified from technical data) and incorporate them in a final plan.

4.2 Process of consultation

Community workshops were seen as a desirable mechanism for community participation in the planning process.

Three separate community workshops were held at each level of decision making:

- identification of issues;
- discussion of concepts; and
- adoption of preferred concept.

The first community consultation exercise was held in March 2000 in the Wandi Community Hall. Interested and affected members of the community were invited to attend the workshops through mail distribution and newspaper advertisements.

The first workshop was attended by over 250 members of the community (including residents, land developers, business operators and community groups). The first workshop sought to identify:

- why a new structure plan was required;
- who was preparing the structure plan;
- the process for preparing and adopting a structure plan;
- the objectives of the structure plan; and
- key issues that may affect the structure plan.

During the first workshop members of the community were asked to contribute written comments on key issues, matters that may influence the structure plan and community values.

Community members were asked to respond to the following questions:

- What lifestyle things do you want to keep or improve in the area being planned?
- What opportunities do you see this planning presents?
- What could block or ruin this planning project?

Data for each task was summarised to establish a community workshop issues summary. The summary was used to prepare and assess the structure plan concepts.

The written submissions were categorised under the following headings:

- land suitability;
- infrastructure transport;
- employment;
- lifestyle and streetscape;
- conservation and environment;
- implementation, including compensation; and
- roles, responsibilities and decision making.

The workshop comments were used to guide the preparation of three concepts for the structure plan area.

The second workshop was held on 27 April 2000. The purpose of the workshop was to allow people attending to evaluate the workability of the three concepts.

Each of the concepts had been produced following a review of the comments made at the first workshop.

Following a brief introduction to the work, and an explanation of Liveable Neighbourhoods, the large group formed into five smaller local groups comprising people from the north-west, north-east, Wandi (x2) and south-west (Wellard-Casuarina). Each of the groups had a facilitator from the study team. Other planning team members were used as specialists to any group that required them.

In the local groups the facilitators explained the three concepts, answered questions, managed concerns and called upon specialist advice as needed. The study team also assisted the local groups with their task:

"Thinking of yourselves, your great grandchildren, and considering the concepts in light of what the community recommended (at the first workshop), the briefing on Liveable Neighbourhoods, make two recommendations:

i With regard to your local area; and

ii With regard to the plan overall".

The challenge was to get people to think of now and the future, and to think of their own local area and that of others.

The third workshop was held on 6 July 2000 at the Wandi Community Hall. The attendance was less than the previous two workshops, however over 100 people did attend. The workshop formed into five smaller groups, each lead by a member of the study team.

The facilitator explained the main features of the preferred concept and the groups addressed the following questions:

- What do you like about the concept?
- Does it follow your suggestions from the previous workshop?
- What aspects could you and future generations not live with?

Copies of the workshop outcomes were circulated to recorded participants of each of the workshops.

4.3 Community brief (value, goal setting and challenges)

Seven key headings were identified to summarise the raw data from the community. The key headings were used to list the values, objectives and challenges of preparing and implementing the structure plan. (section 4.2)

The list of values, objectives and challenges were used to establish assessment criteria for the preparation of the structure plan. The assessment criteria have been used throughout the preparation of the structure plan so that the final structure plan maintains faith with the initial and ongoing expectations of the community.

These assessment criteria have been used to establish a brief for developing the final structure plan.

4.4 Formal public comment

The WAPC published the draft Jandakot Structure Plan for public comment in October 2001. The consultation period ran from October to December 2001 and was subsequently extended until the end of January 2002 to allow the Town of Kwinana and the Shire of Serpentine-Jarrahdale to consider responses for referral to the WAPC.

The Jandakot Structure Plan steering committee met on 27 May 2005 and considered a report that dealt with 51 submissions and suggested changes and recommendations under several headings. Of the submissions, 23 were from landowners, nine were from state government agencies, nine were from businesses representing public organisations and community groups, two were from community groups themselves and two were from local government authorities.

Most submissions commented favourably on the planning process and were supportive of the draft structure plan. Several land owners objected to specific issues, such as the location of a proposed high school site on their land. Several submissions objected to the structure plan area boundary and requested that changes be made to increase the amount of future urban land.

A major change that was made was the revision of school site locations. The steering committee decided not to amend the boundary of the structure plan or the Jandakot water protection zone.

5
Implications for structure planning

The purpose of part five of this report is to identify and discuss issues that will affect the structure plan area.

Each of the issues has been identified through detailed technical assessment and community workshops:

- Liveable Neighbourhoods
- environment
- water resource management
- infrastructure
- constraints
- potentials
- site context analysis

It is intended that each of the issues will be adopted as the minimum prerequisites for planning and development in the structure plan area. Moreover, the issues will be used as a basis for understanding how the structure plan may be implemented.

5.1
Liveable Neighbourhoods - Urban Design

The urban design overview and the response of residents attending the first community workshop suggest that the retention of the existing semi-rural landscape, lifestyle and imagery are important planning and design considerations for the structure plan area. In this context, any changes in land use that include new development would need to discreetly fit into the landscape, enhance the environment and provide community benefit. The extent to which this could occur would depend on the MRS and local scheme zoning and detailed structure planning.

Apart from urban residential areas, development that is appropriate for the structure plan area is likely to be rural village form that responds to the rural and natural environment of the area and appears to be small scale with landscape transition and flow.

However, the opportunities and constraints of the structure plan area will determine development, to a large extent. In some areas, significant neighbourhood clustering may be difficult to achieve, thus potentially affecting the viability and provision of services and facilities. Coordinated development is also likely to be affected by the fragmented land ownership and piecemeal subdivision pattern of lots and streets in the area.

A better connected street system would need to be created in order to achieve a sufficiently permeable and walkable environment.

5.2
Environment

A series of environmental issues relating to the structure plan were raised in section 3 of this report. The following is a summary of the key issues that affect the structure plan area.

It is expected that all of the following issues will be addressed as part of the preparation of the outline development plans and/or local structure plans:

- preparation of local water management strategies consistent with the JWRMS;
- buffers associated with the Alcoa bauxite residue storage and Kwinana air quality buffer;
- flora and fauna (including flora and fauna management plans, disease audit, dieback hygiene management and weed management plans);
- greenways and any other significant environmental features;
- buffers and management mechanisms for uses that may detrimentally affect residential and sensitive land uses (eg quarries, land fill sites, market gardens, high pressure gas pipelines, poultry farms, piggeries and rural industries);
- contaminated sites and acid sulphate soils;

- wetlands (documentation should identify the type of wetland and make appropriate recommendations in accordance with its management classification, for example, conservation category wetlands and lakes should be protected with an adequate buffer and excluded from receiving stormwater drainage, whereas a multiple use wetland may be incorporated in open space areas and utilised for drainage as part of a water sensitive urban design plan);
- buffers relating to noise and vibration associated with major roads or rail networks;
- buffers associated with midges or mosquitoes; and
- preparation of design guidelines and landscape protection guidelines relating to future rural and urban development - such guidelines should describe land use, lot densities, neighbourhood design principles and other related factors (in particular, the design guidelines should address transitional development between low intensity land uses (ie Wandi Special Rural zones), conservation areas and more intensive land uses).

5.3
Water resource management

An integrated urban water resource management strategy for the structure plan area cannot be completed without substantial further data and work. The strategy is called the JWRMS and a framework for developing it has been prepared to ensure appropriate information is available at each stage of the planning approval process (refer Appendix 5).

5.3.1
Water sensitive design methods

In 2004, the former Department of Environment published the Stormwater Management Manual for Western Australia that includes best management practices. The effectiveness of the present level of adoption of water sensitive design in the land development process has not been fully monitored and documented.

A strengthening of commitment at both the State and local government levels, together with more regulatory controls to ensure desirable outcomes are achieved, will be necessary.

5.3.2
Guidelines for land management

Land management guidelines for water quality protection in the structure plan area should be consistent with the Environmental Protection (Peel-Harvey Estuary) Policy, *State Planning Policy 2.1 Peel-Harvey Coastal Plain Catchment* and the latest criteria for water quality jointly agreed by the relevant authorities.

The JLUWMS (1995) recommended the preparation of drainage and nutrient management plans for urban areas and listed issues to be dealt with including:

- minimise fertiliser sources and incorporate nutrient stripping features into drainage systems;
- control stormwater by creating artificial wetlands and maximising local recharge;
- control groundwater levels through subsoil drainage and other mechanisms (eg plantations scale, tree planting); and
- dispose of surplus drainage water to areas where no adverse affect should result either by ocean outfall or redirect into areas where additional groundwater is acceptable.

These recommendations should be addressed in the JWRMS, including the need to set targets for water quality consistent with the Peel-Harvey Environmental Planning Policy, with monitoring and reporting of performance, together with contingency measures should monitoring indicate failure relative to criteria.

5.4
Infrastructure

5.4.1
Roads

Freight routes

Thomas, Anketell and King Roads, and the Kwinana Freeway are designated primary freight routes that traverse the structure plan area. Rowley Road west of the freeway is proposed as a future primary freight route.

Road hierarchy

The existing major roads (Thomas Road west of Kwinana Freeway) will be retained in the structure plan. The function of the important regional roads will be also retained in the hierarchy. These are Thomas Road (east of Kwinana Freeway), Mortimer Road and Anketell Road (west of Kwinana Freeway). Other major roads such as Rowley Road, Orton Road, Bertram Road, Wellard Road, King Road, Nicholson Road, Gossage Road, Jackson Road and Mortimer Road will perform the function of district distributor roads.

No direct connection to the Kwinana Freeway is intended from roads that will be created in the structure plan.

It is not intended to close or divert any of the existing roads in the structure plan area. It will be necessary to plan the location of the local distributor roads through the residential cells. Where possible these would be established on the existing road alignment. Where no roads exist, the local roads should be aligned along existing allotment boundaries.

Details of the layout of each individual urban cell will be the subject of outline development plans and/or local structure plans. The local distributor roads shown in the Structure Plan are indicative only and the final alignments will be the subject of detailed design of the residential cell.

5.4.2
Passenger and freight rail

The structure plan area is presently traversed by a single freight-line that services the South-West of Western Australia via Kwinana and Fremantle. The line extends east-west across the study area and connects to the south-west line (Armadale and Pinjarra).

A southern suburbs passenger rail line connecting Perth to Mandurah is under construction. The rail line will principally run along the Kwinana Freeway alignment then deviate through Kwinana and Leda to Rockingham and south to Mandurah.

5.4.3
Electricity supply

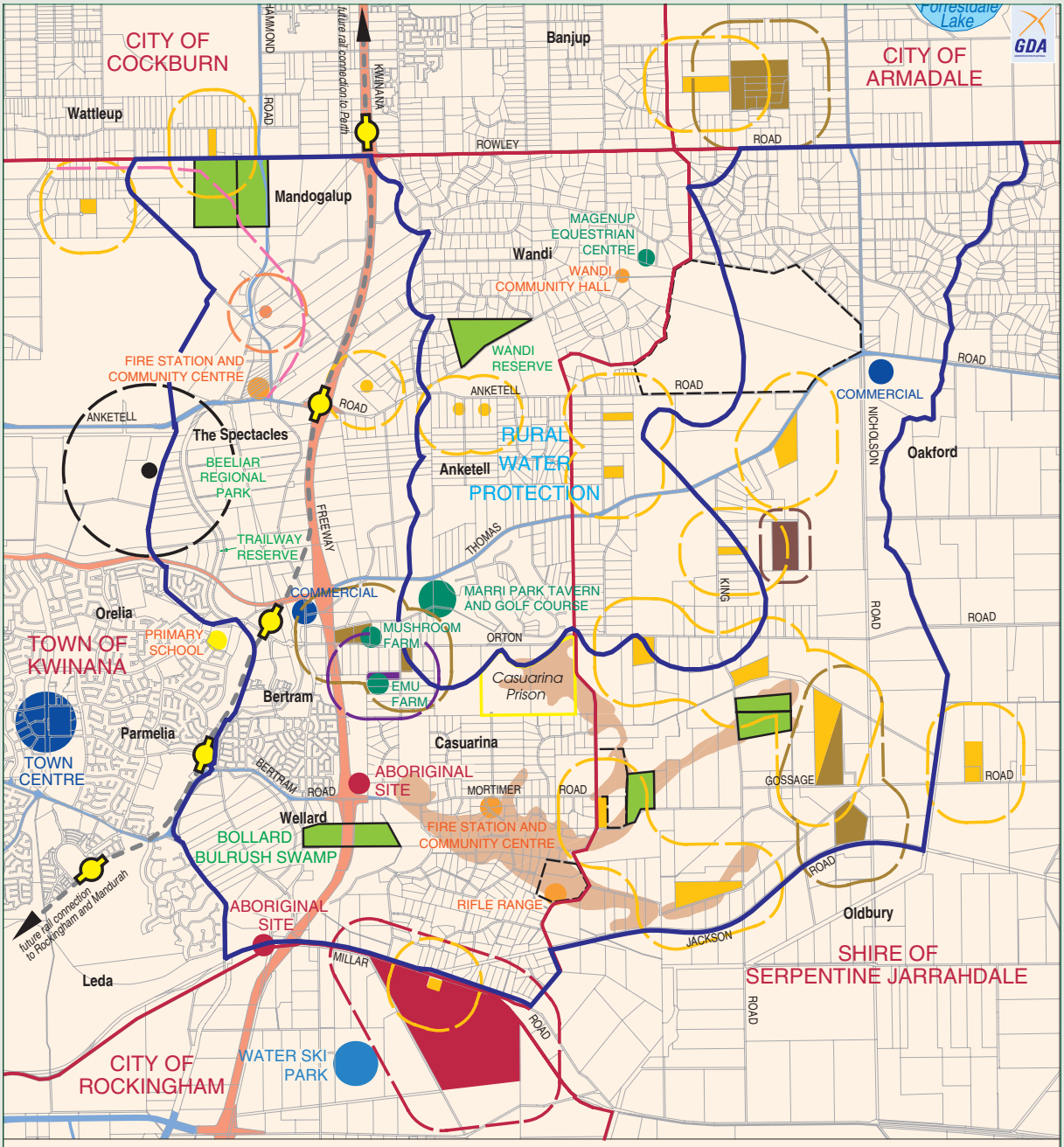
Electricity supply is currently available for rural developments in the structure plan area but the installation of transformers may be required for more intensified development of urban areas.

5.4.4
Water supply

Water supplies can be provided to the proposed urban and rural residential areas within the following constraints:

- west of the freeway (north) – included in the boundary for the Thomsons Lake scheme area;
- west of the freeway (south) – included in the Medina Gravity and High Level scheme area;
- east of freeway – from Millar Road to Anketell Road. The Medina gravity scheme can be extended to include the proposed developments immediately to the east of the freeway - and for booster pump stations in the booster areas will be required (20 metres by 20 metres nominal area); and
- east of freeway – north of Anketell Road. Requires further investigation but it appears likely that the area can be supplied from the Thomsons Lake scheme, provided that some distribution mains are increased in capacity near the freeway. A small area just north of Anketell Road is on high ground and may need to be included in the booster zone just south of Anketell Road, the probable extension of the Medina gravity scheme.

Figure 4 Context analysis - land use constraints and social infrastructure



Legend

- poultry farm/ 500 m buffer
- piggeries and mushroom/ farm 500 m buffer
- animal processing/ 500 m buffer
- feedlots/ 500 m buffer
- wastewater treatment/ site 1000 m buffer
- dairy/500 m buffer
- composting facility/ 150 m buffer
- prominent landform
- planned railway and station
- Alcoa bauxite residue storage 1000 m buffer
- primary regional road
- other regional road
- local government boundary
- study boundary

Basic raw materials

- sand resource
- extraction area - areas of existing extractive industry operation
- tenement expired

N

0 1 2 3

kilometres

Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA August 2007

ntw-map7\strat_plan\strat_pol\pmr_struct_plan\ jandakot\fpub07\jsp_final_f5.dgn

Base information supplied by the Western Australian Land Information Authority, GL248-2007-2

Note: 1 Not all uses requiring buffers to residential development have been identified (eg. market gardens, dog kennels).
2 The buffers shown are indicative only and are subject to specific site studies.

5.4.5
Wastewater

In general, the areas shown as planned urban and rural-residential can be provided with wastewater services.

- east and west of the freeway, north of Anketell Road has been allowed for in the Water Corporation's current planning for the Thomsons Lake sewer district 174.
- west of the freeway between Thomas Road and Millar Road has been allowed for in the current wastewater scheme planning for the Kwinana sewer district 042.
- east of the freeway between Anketell Road and Millar Road, preliminary investigations indicate that several pump stations and final pressure main into the Kwinana sewer district will be required to service this area.

5.5
Constraints

A series of constraint maps were produced. The first category is considered to be Primary Constraints. These are constraints which are not subject to discretion or negotiation for alternative land use and are therefore regarded as being fixed constraints.

They include:

- rural-water protection zone and priority 2 areas;
- Kwinana air quality buffer (final designation);
- Bush Forever sites;
- conservation category wetlands and lakes subject to an environmental protection policy (these may require on-site boundary and buffer definition);
- parks and recreation reserves under the Metropolitan Regional Scheme;
- known Aboriginal sites;
- existing trunk services (power and gas); and
- Alcoa bauxite residue storage buffer(final designation).

It should be noted that risk management to protect residential development and places where people congregate is required adjoining high pressure gas pipelines. Guidelines for off site individual risk are setout in the EPA's Guidance No 2 Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant (2000). A buffer each side of the centreline of the Dampier to Bunbury Gas pipeline is needed (and a greater setback for sensitive land uses such as schools and hospitals) as this pipeline passes through the structure plan area.

Other constraints are termed secondary constraints. These secondary constraints were identified on the constraints plans but are not regarded as fixed. Nevertheless they are constraints, which in the case of incompatible land uses, would require removal, modification or relocation prior to allowing for any alternative land use or development potential for the land affected.

- Buffer zones for incompatible land use (poultry farms, piggeries, mushroom farms, wastewater treatment plants, feedlots, animal processing, works processing, waste disposal and the like).
- Sand extraction areas (temporary constraint while resources extracted).
- High quality land for horticulture.
- Class two land for horticulture (suitable for vineyards).

Buffer requirements for certain land uses are recommended in the EPA's Guidance No 3 Separation Distances between Industrial and Sensitive Land Uses. Poultry farms are subject to *State Planning Policy 4.3 Poultry Farms.*

A third category of features was also mapped, these included:

- palusplain
- topography
- sumplands and damplands
- drainage channels
- soils and geology
- groundwater environmental management areas.

The Constraints Land Use plan (figure 4) shows the location of some land uses that are incompatible with residential development.

A composite constraints plan was produced, which over-laid the constraints onto the same plan. From this constraint composite, it was possible to identify land which is seriously constrained for development or change of land use, land affected by secondary constraints or land which was unconstrained. Land affected by the land use constraints would not be suitable for residential and/or urban development until the incompatible land use ceases and the buffer constraint removed.

5.5.1 Land use

The structure plan area may be divided into five segments for discussion purposes: North-west area - Mandogalup and Anketell

The portion of Mandogalup west of the freeway is a mixture of horticulture and market gardens and vacant land, much of which is well treed. West of Mandogalup is the Alcoa bauxite residue storage area. In between Anketell Road and Thomas Road, west of the freeway, The Spectacles is a significant conservation area. On the eastern side of the freeway, north of Anketell Road and generally west of Lyon Road, the land is mixed market gardening and vacant but treed land. Between Anketell Road and Thomas Road there are a variety of lot sizes, some rural activities and some vacant treed land. The freeway is a major physical divider for this area but makes it very accessible.

This area is affected by the constraints of buffers due to incompatible land uses including the Alcoa bauxite residue storage area, sand and mineral extraction, powerlines, Alinta Gas pipeline, poultry farms and a number of wetlands.

The buffer associated with the Alcoa bauxite residue storage area poses a significant timing constraint to the potential for land use change and in particular, urban development. Urban development is only supported in areas not affected by the buffer, as finally determined. In areas impacted by the buffer, urban development should be deferred until the buffer is no longer required due to changes to the storage area and/or scientific review supports buffer reduction.

The exact extent of the buffer will be subject to further monitoring and consideration prior to its final extent being set. This will effect the extent of MRS urban rezonings.

South-west area – Wellard and Casuarina.

The area west of the freeway between Thomas Road and the existing rail line is a mixture of vacant land, rural land, conservation wetlands and areas under urbanisation.

East of the freeway much of the land is in rural holdings and there are also some vacant well treed areas. This area is also subject to the impact of powerlines and buffer areas for poultry farms and the mushroom farming together with the extractive industries buffers. The Casuarina Prison is also located east of the Freeway on Orton Road. Special rural landholdings occur adjoining and east of the freeway.

Oldbury

This area is in the south-east of the structure plan area and is typically large rural landholdings with significant impact from the buffers of poultry farms and extractive industries.

Oakford

Oakford is situated in the north-eastern sector of the structure plan area and is crossed by Thomas Road and Nicholson Road. The northern area is substantially special rural landholdings and the southern area between Thomas Road and Orton Road is predominantly large rural landholdings. These are primarily cleared pasture land.

While there are some land use buffer areas for poultry and extractive industries affecting this area, the major impact is powerlines.

Wandi

Wandi is surrounded by, and is not, strictly speaking, in the study area with the exception of the area west of Lyon Road. However, it is difficult to consider the adjoining lands without considering Wandi.

This area south of Rowley Road through to Warton Road is substantially a mixture of special rural landholdings and large open spaces with native vegetation. This area is also subject to various land use buffers of poultry farms and extractive industries and is mainly in the rural–water protection zone and priority 2 area (except land adjoining the freeway).

5.5.2
Zoning

The overall existing zoning position may be summarised as follows:

- Mandogalup – rural
- Anketell/east of freeway – rural and special rural
- Wellard and Bertram – residential and urban
- Casuarina – rural and special rural
- Oldbury – predominantly rural
- Oakford – rural and special rural
- Wandi – mainly special rural.

Significant regional road reservations cross the area, particularly the Kwinana Freeway, Thomas Road, Rowley Road and Mundijong Road and Miller Road in the south. Nicholson Road, Hammond Road and Mandogalup Road are also regional roads. East of the structure plan area, Tonkin Highway is proposed to be extended to the south in the future.

5.5.3
Existing potential for site contamination

A constraint on future land use may result from existing activities which cause site contamination. Common causes of site contamination in non-industrial areas may be market gardens, flower growing, cattle feed lots, piggeries, chicken farms and improperly managed sewerage systems. Contamination resulting from these land uses may include nutrient contamination, high biological oxygen demand, bacterial contamination of ground or surface waters and pesticides.

Service stations, mechanical workshops and farm workshops may result in hydrocarbon solvent, fuel and heavy metal contamination. Hardware stores and farm chemical storage areas may result in pesticide and herbicide contamination. Landfill can result in all of the above.

5.5.4
Other constraints

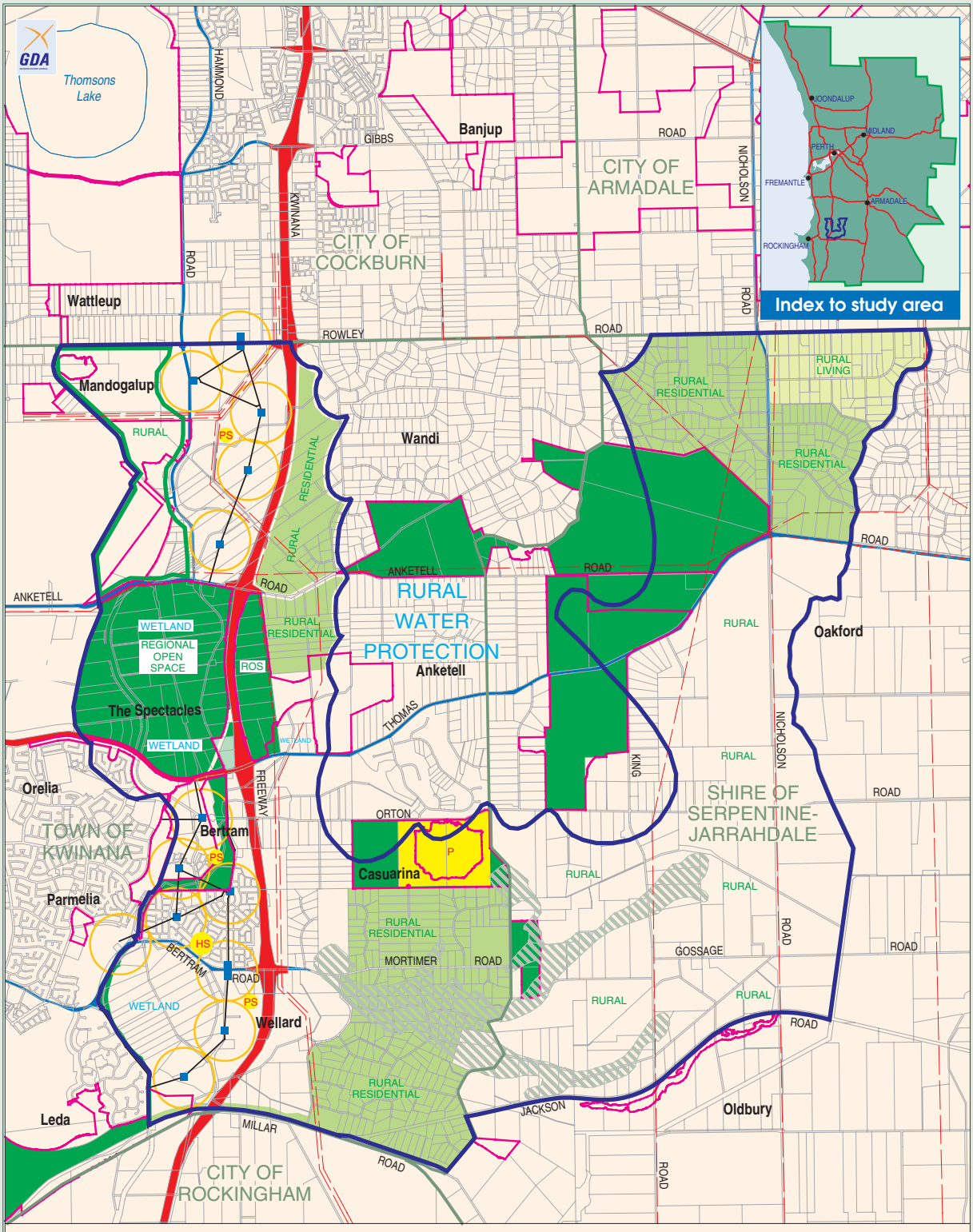
The major potential for change of land use and/or development in the structure plan area is on unconstrained land.

Other land may be constrained by buffers to incompatible land uses or palusplain which requires special attention to drainage and nutrient management.

With regard to existing land use buffer areas, the potential for change of land use or development can only be achieved on the cessation or relocation of the land use with which the buffer is associated. Therefore this potential must not be regarded as immediate but potentially achievable over the longer term. Some land uses existing in the area which require buffers, such as mushroom farming, are major employers and regard themselves as permanent land uses. In such instances it may be more appropriate to negotiate the removal of those aspects of the use which create the need for the buffer or to define a more precise buffer based upon detailed assessment.

The palusplain area, situated in the eastern part of the structure plan area, is not under pressure for change of land use (other than some special rural proposals), nor is it well located for freeway access. It therefore has reduced potential for change of land use and development.

Figure 5 Concept 1 - community consultation



6
Structure plan concepts

As part of preparing and developing a structure plan, a number of structure plan concepts were produced.

The concepts incorporated a number of alternative land use and design proposals based on:

- varying or definitive expectations of the community;
- environmental and site planning considerations (including drainage, landscape assessment);
- servicing issues; and
- current urban and community design principles.

Three concepts were prepared for consideration by the community and the steering committee. Each concept was described and evaluated at the second community workshop held in April 2000. A description of the community consideration and participation exercise is provided in section 4.

None of the concepts were presented as a preferred concept. To this end, each concept contained a number of possible land use and design elements in separate plans, as follows:

6.1
Concept 1

Concept 1 primarily sought to consolidate urban areas west of the Kwinana Freeway. These urban areas were identified generally west of the Kwinana Freeway and in the eastern section of Mandogalup. The remainder of the area would remain generally as is (figure 5).

The principal elements of concept 1 were:

- retention of rural land in the eastern portion of the structure plan area;
- limited expansion of the existing special rural (or rural-residential) west to the Kwinana Freeway;
- urban areas west of the Kwinana Freeway; and
- retention of rural industries (eg poultry farms and mushroom farm) east of the freeway (ie no intensive development in buffer areas).

6.2
Concept 2

Concept 2 also proposed extensive urban areas west of the Kwinana Freeway (consistent with concept 1). Additional urban areas were identified in the linear band of land immediately east of the freeway and west of the existing special rural area of Wandi (figure 6).

The principal elements of concept 2 were:

- urban villages immediately east of the Kwinana Freeway – excluding land affected by environmental constraints;
- urban villages to be established as groups of three to four to support a primary school and local centre;
- incompatible land uses encouraged to relocate through the incentives of urban zoning;
- rural-residential and rural living to be retained and expanded upon in the east of the study area; and
- urban areas west of the Kwinana Freeway.

6.3
Concept 3

Concept 3 generally sought to identify the maximum extent of urban land. To this end, the concept proposed an extension of urban areas eastward into the locality of Casuarina as well as those areas of urban proposed by concept 2. Furthermore, the plan identified two rural villages in the east of the structure plan area (figure 7).

Figure 6 Concept 2 - community consultation

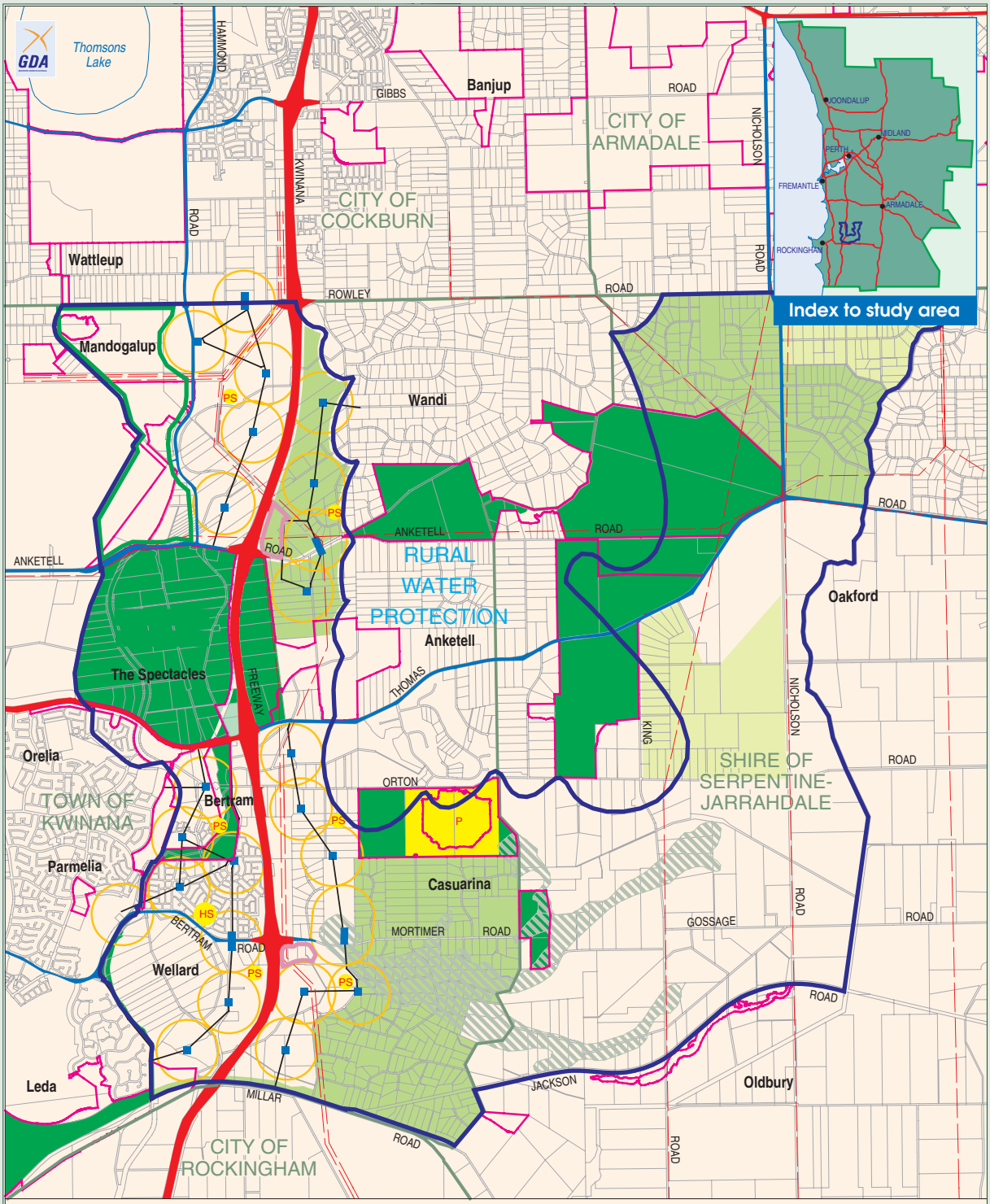
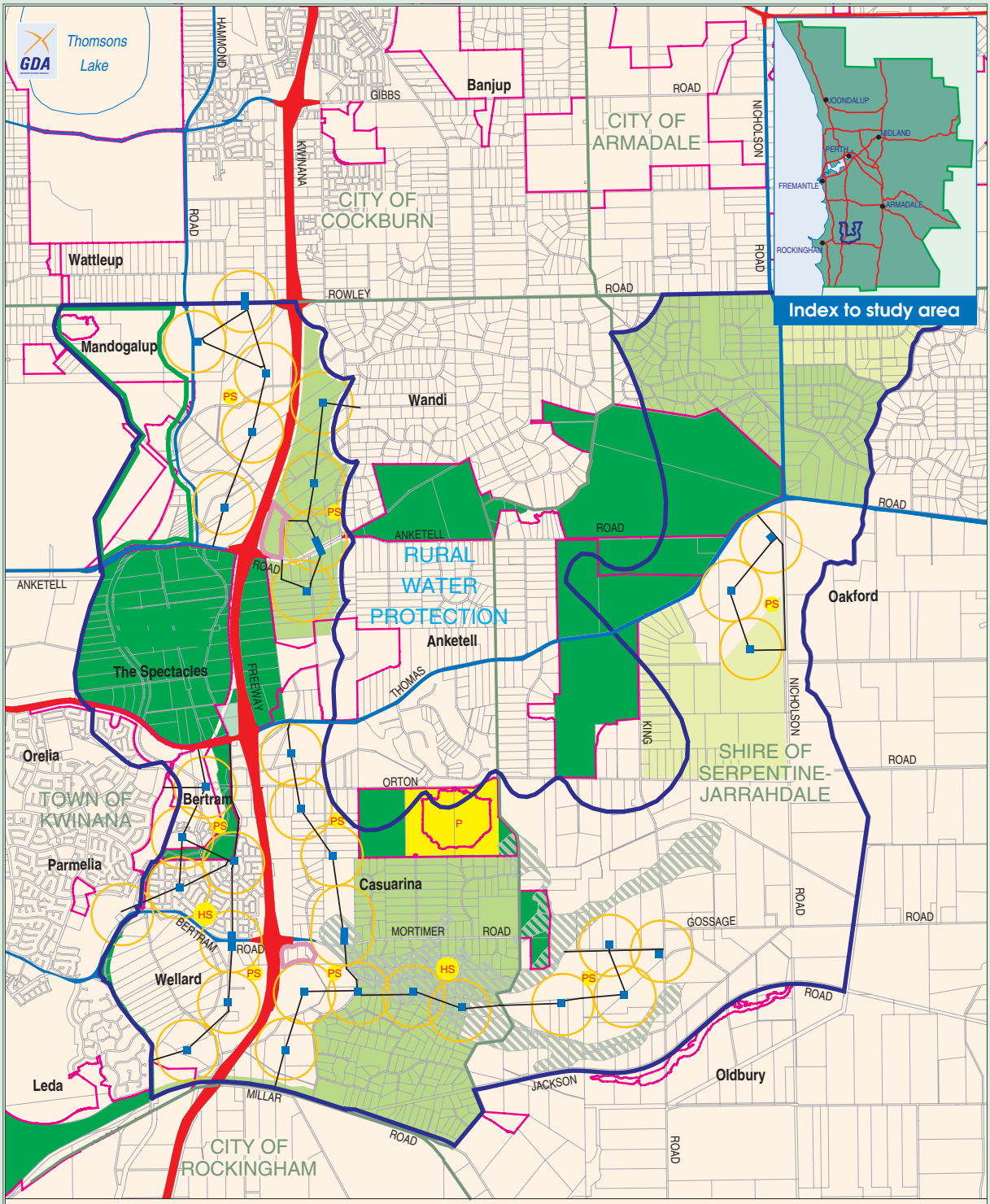


Figure 7 Concept 3 - community consultation



The principal elements of concept 3 were:

- same level of urban neighbourhoods shown in concept 2;
- extension of neighbourhoods shown in concept 2 eastward into the locality of Casuarina;
- introduction of two rural villages in accordance with the recommendations of the Shire of Serpentine-Jarrahdale local rural strategy;
- the northernmost rural village to be located generally in the vicinity of Thomas and Nicholson Roads;
- the southern rural village to be discreetly located in a ridge in the locality of Oldbury; and
- all villages east of the freeway to be collectively serviced by a high school.

6.4 Community workshop recommendations

As discussed in section 4, each of the concepts were introduced to the second community workshop held in April 2000. Members of the community were invited to provide comment and recommendations on each of the concepts. These recommendations and comments were used to formulate a draft structure plan for further comment by the community and steering committee.

6.5 Preferred concept plan - summary

After completing the three concepts and consideration by the steering committee and community, a preferred concept for the structure plan area was prepared. The concept plan was based on detailed technical investigations as well as those comments and recommendations provided from the steering committee and the community.

A description of the concept plan (figure 8) is provided under the following headings:

6.5.1 Conservation areas

All areas of environmental significance are to be protected from further development by the concept plan.

These areas include:

- system 6 areas (now primarily reserved for parks and recreation under the MRS);
- conservation category and other significant wetlands;
- environmental protection policy wetlands; and
- Bush Forever sites.

For the most part, these areas are individually identified on the concept plan. How this land is to be zoned or reserved is described in section 7.

6.5.2 Groundwater protection zone

The land shown as rural-water protection zone under the MRS is not proposed for change under the concept plan. While technically outside the structure plan area, regard has been given to this zone in the context of the preparation of the concept plan. Therefore, these areas will remain special rural.

Further planning decisions for these areas will be made by the WAPC, Town of Kwinana and the Shire of Serpentine-Jarrahdale using:

- local government town planning schemes;
- Peel Inlet – Harvey Estuary Environmental Protection Policy (1992) and *State Planning Policy 2.1 Peel-Harvey Coastal Plain Catchment (1992)*; and
- the Rural Water Protection Zone – State Planning Policy 2.3 Jandakot Groundwater Protection Policy (1998)

Existing reserved areas in the JUWPCA will remain unchanged.

6.5.3
Urban development - west

The concept plan identifies extensive areas of urban development west of the Kwinana Freeway – generally in Mandogalup and east of the Kwinana town centre.

The area of urban development has been defined by various physical constraints, including:

- the Kwinana air quality buffer and buffers to the Alcoa bauxite residue storage;
- conservation category wetlands;
- environmental protection policy wetlands;
- high voltage transmission towers; and
- Bush Forever sites and areas identified as parks and recreation reserves under the MRS.

Neighbourhood units (shown as 400 metre radius circles) were shown on the plan to demonstrate how the areas of urban development could seek to achieve the recommendations of Liveable Neighbourhoods.

Lifestyle and urban design objectives:

- establishment of walkable neighbourhoods;
- orientation around central core; and
- focus on transportation links to Kwinana Freeway.

6.5.4
Urban villages - east

It is proposed to establish urban villages east of the Kwinana Freeway immediately west of the Wandi special rural area. The urban villages are proposed to be developed in a linear band running north-south.

The urban villages are proposed to develop with a range of residential and composite land uses (eg home business areas) and lot sizes. These alternative types of land uses and lot sizes are the consequence of providing a transition between the adjoining special rural area and the proposed urban villages.

The transitional treatments include:

- linear connection of neighbourhoods with landscapes using tree retention and ecological corridors; and
- a border of larger residential sized lots (for example 2000 m2) between the special rural zones and urban villages.

The linear arrangement of the neighbourhoods enables a central transport link to be established. This transport link will allow residents to readily access primary schools, local centres and more importantly, public transport nodes associated with the Kwinana Freeway (eg rail and bus).

Given the potential impact on the groundwater mound and associated areas of remnant vegetation, this area will require detailed planning to ensure integrated urban water management and open space issues are carefully considered.

Lifestyle and urban design objectives of the urban villages:

- a transition in lot sizes between different areas;
- passive landscape treatments entering into neighbourhood cells, consistent with adjacent special rural zones;
- establishment of walkable neighbourhoods;
- orientation around central core;
- focus on central transport link; and
- drainage and landscape functions such as treed drains and road-side swale drains to be used rather than conventional drainage.

6.5.5
Rural-residential

The expansion of rural-residential (or special rural) subdivision and development has been proposed in a limited area east of the Kwinana Freeway (west of Wandi). These minor extensions of the area are viewed as a desirable transitional buffer between the urban villages and the Wandi special rural areas.

Lifestyle and urban design objectives of rural-residential development:

- retention of larger special rural lots;
- act as buffer to future urban areas;
- tree protection and rehabilitation requirements; and
- flora and fauna wildlife corridors.

6.5.6
Composite land uses

Constrained areas, such as those affected by industrial buffers and high voltage transmission towers and lines, have been included in composite zones (such as multiple-use and home-based business zones). Subject to satisfactorily addressing residential amenity issues, these composite types of zones are viewed as a mechanism for ensuring that constrained land may be put to compatible uses which reflects the proximity of the land to transport routes (such as the Kwinana Freeway), and urban infrastructure. It is anticipated that memorials will be placed on titles alerting prospective purchasers to the existence of amenity controls.

6.5.7
Rural living

The Shire of Serpentine-Jarrahdale and affected landowners have recommended the retention of existing rural living areas in the east of the structure plan area. These areas are intended to be retained for hobby scale rural uses (such as horse training and agistment) which are not typically permitted in special rural zones.

Land capability investigations also indicate that the land immediately south of the intersection of Thomas and Nicholson Roads has a high capability to support a range of rural land uses (generally west of the palusplain landform). This area is identified as for rural living only if it is associated with rural economic enterprises.

Lifestyle and urban design objectives of rural living areas:

- creation of lots that may accommodate various rural pursuits (eg horse agistment, trotting and training facilities and horticultural pursuits);
- tree protection areas;
- limited restrictions on stocking; and
- minimum four hectare lot size.

6.5.8
Rural village - Oakford

A rural village was proposed in the draft Jandakot Structure Plan based upon the Shire of Serpentine-Jarrahdale Rural Strategy (1994). The proposed village was recognised as being subject to servicing and environmental constraints and would first be required to demonstrate how it can be efficiently serviced by transport, water, wastewater disposal and energy infrastructure. It is considered that urban development at Oakford is not achievable in the short to medium term.

6.6
Implementation issues – preferred concept plan

6.6.1
Timing and staging

Preliminary investigations anticipate the following development timetable:

- Bartram and Wellard – 10 years (extension to existing Kwinana infrastructure);
- Casuarina – 5-10 years (north/east extension to Wellard);
- Mandogalup – 10 + years (extension of northern urban front);
- Mandogalup – 15 + years (affected by Alcoa bauxite residue storage);
- Wandi and Anketell – 15 + years (service extension from north); and
- Oakford Village – 15 + years.

However, actual development times may vary depending on changing planning circumstances, infrastructure availability, landowner intentions and demand for residential land.

Specific servicing issues can be investigated upon finalisation of the structure plan. It is anticipated that such investigations will follow the preparation of an overall water resource management strategy.

6.6.2
Local government implementation

The structure plan proposes a number of land uses which are a departure from current local government town planning schemes and rural strategies. It is recommended that changes could occur as part of the Town of Kwinana and Shire of Serpentine-Jarrahdale town planning scheme review and various scheme amendments over time.

These land use changes can be implemented as follows:

Shire of Serpentine-Jarrahdale:

- introduction of rural living zone;
- introduction of rural village zone;
- modification to rural strategy; and
- possible urban deferred or urban classification of rural villages under MRS.

Town of Kwinana:

- district structure plan;
- various urban deferred or urban zoning changes under the MRS; and
- introduction of new zones (eg home-business zone) and rezoning outline development plan and local structure plan areas.

6.6.3
Land uses requiring buffers (constraints)

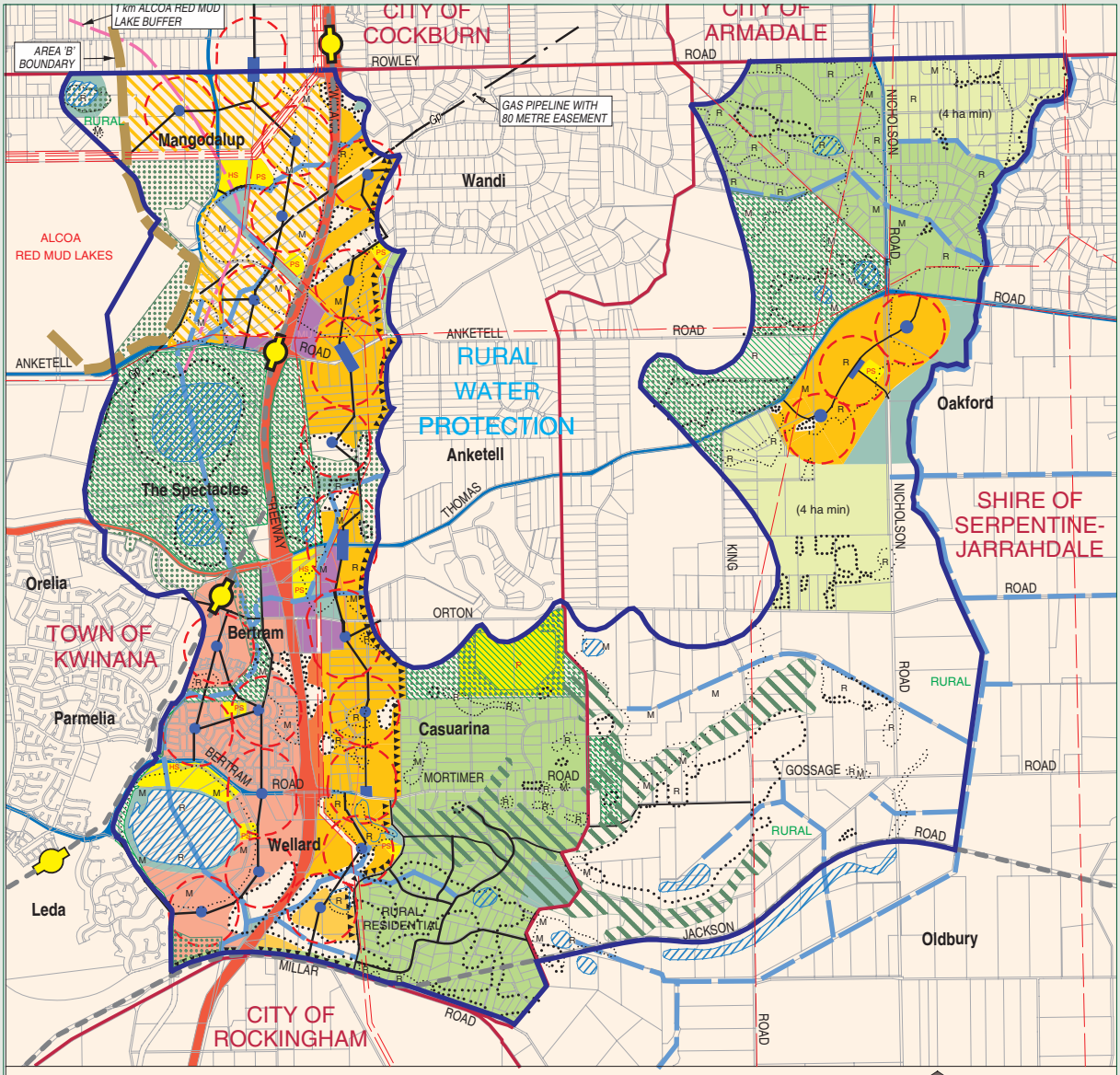
The structure plan anticipates the timely relocation and/or cessation of land uses which constrain long-term development (such as poultry farms etc.). However, it is acknowledged that many of the land use constraints (including the mushroom farm) provide employment opportunities for the local community and should be accommodated where appropriate.

The use of pro-active mechanisms for relocation and/or cessation of incompatible uses are encouraged, namely:

- timing and staging of development to provide certainty for operators, adjoining landowners and developers;
- local governments limiting approval periods, which reflect the timing and staging for future development without unnecessary affect on the commercial viability of existing operators;
- preparation of scientifically defined buffer distances as part of district structure plans, outline development plans and local structure plans; and
- establishing an equitable framework for receiving developer contributions towards the cost of relocation and/or cessation of constraining land uses. This should be dealt with in local government town planning scheme amendments in accordance with the WAPC developer contributions policy.

The WAPC's existing poultry farm policy will be applied in relation to existing incompatible poultry farms.

Figure 8 Preferred concept - community consultation



LEGEND

- short-term urban
- medium-term urban
- long-term urban
- centres
- home business
- mixed use
- rural
- community facilities
- HS high school
- P prison
- PS primary school
- rural-living
- rural-residential
- open space
- parks and recreation reservation
- Bush Forever protection area
- EPP wetlands
- R M resource enhancement and multiple use wetlands
- conservation category wetlands
- landform/landscape protection
- urban transition
- primary regional road
- other regional road
- Gp gas pipeline
- planned railway and station
- Kwinana air pollution boundary
- powerline
- walkable catchment
- drainage
- environmental management areas category B
- local government boundary
- study boundary

N

0 500 1000 1500 2000 2500

Metres

Produced by Project Mapping Section, Mapping and GeoSpatial Data Branch, Department for Planning and Infrastructure, on behalf of the Western Australian Planning Commission, Perth, WA August 2007

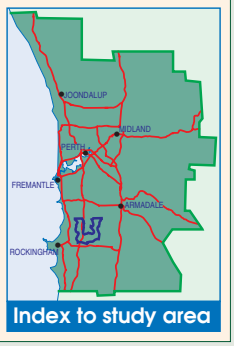
ntw-map7\strat_plan\strat_pol\pmr_struct_plan \jandakot\fpub07\jsp_final_f9.dgn

Base information supplied by the Western Australian Land Information Authority, GL248-2007-2

Geomorphic wetland management data supplied by Department of Environment and Conservation, WA

Original Figure supplied by Turner Master Planners Aust.

GDA



7

Description of the structure plan

7.1 Development potential

The Jandakot Groundwater Mound and the Kwinana industrial area limit the potential for urban land use in this part of the south-west corridor due to the possible impacts of development upon groundwater resources and the extent of the Kwinana air quality buffer. Development potential of the area has also been limited by the low lying nature of much of the structure plan area relative to the water table and the existing special rural or large lot rural-residential land use.

The presence of many wetlands and a drainage system feeding into the Peel-Harvey Estuary has further compounded the limitations on use of the area.

Removal of the structure plan area from the Jandakot Public Water Supply Area and its exclusion from the rural-water protection zone has provided the opportunity to test the development constraints and review the optimum future land use of this area. This review has had regard to the various existing studies and reports on this location and has generally concluded as follows.

The development potential of the western portion of the study area takes the following issues into account:

- Its location which represents a logical extension of the urban development corridor extending southward from Jandakot.
- Its regional accessibility due to the Kwinana Freeway and Perth-Mandurah railway passing through the eastern part of the structure plan area. These transport facilities are major public infrastructure investments which should be used, as far as possible, by development of the adjoining land for compatible uses.
- That the Kwinana townsite abuts the structure plan area, providing a good range of district level services including administration and government services, shops, educational facilities and other community services. An expanded population in the area may use these services. The structure plan area also forms a logical eastward extension of the existing Kwinana townsite.
- Kwinana's industrial land use will continue to affect the western flank of the structure plan area and influence the extent and timing of urban development in Mandogalup.
- The rural-water protection zone of Wandi and Casuarina (outside the structure plan area) will remain a rural-residential area with strict controls on effluent disposal, drainage and land use. As such it has no additional development potential.
- That the structure plan area is situated in the Peel-Harvey Estuary drainage catchment and is subject to particular requirements relating to integrated urban water management and export of nutrients. Unless appropriate standards can be achieved with new development this environmental constraint will restrict potential development in the structure plan area. An integrated urban water management strategy will be required for the structure plan area.
- Wetlands throughout the structure plan area will require appropriate protection and conservation. These will require additional study and assessment, thereby influencing development potential (including environmental management areas).
- Regionally significant bushland (as identified under Bush Forever), will be protected. The protection of key ecological linkages, significant flora and fauna, and threatened ecological communities will be determined by site specific studies.
- The rural area predominantly located centrally and the already subdivided and developed land to the east, provides an impediment to urban development. Much of this land is low lying and more appropriate for rural use, as it does not have the location advantages of proximity to the transport corridor and is distant from services.
- planning for provision of utility services (such as water, sewerage, gas and power) needs to be incorporated into forward infrastructure planning for the area.

The land use designations shown on the final Jandakot Structure Plan (figure 9) are indicative only and will guide the more detailed planning, environmental and land capability studies to confirm the land use designations and arrangements depicted on the plan. Some areas are in wetland boundaries, subject to flooding and influenced by other environmental and man made constraints and therefore may not be suitable for residential or other urban uses. The final land use outcomes will be determined once further investigations and studies including, but not limited to, the JWRMS and the Peel Main Drain Strategic Planning Project are completed and via more detailed local structure planning.

7.2 Main features of the structure plan

7.2.1 Urban expansion potential

The ultimate land use for the structure plan area involves the proposed urban expansion of Kwinana and a corridor of urban development extending on both sides of the freeway from Millar Road in the south to Rowley Road in the north. Long term potential for a small rural village is identified in Oakford, near the corner of Thomas and Nicholson Roads. Drainage considerations and wetland boundary definition may affect the development areas and therefore the development potential of the urban areas.

7.2.2 Timetable for urban development

The structure plan proposes the following timeframes for commencement of urban development: immediate to short term – zero to five years, medium term – five to 10 years and long term – more than 10 years. However, as mentioned earlier, these timeframes may vary depending on evolving circumstances over time.

The land use designations and urban areas shown on the final Jandakot Structure Plan are conceptual only. Some parts of these urban areas are potentially subject to flooding and may not be suitable for residential development. The situation will be clarified once further investigations and studies are completed and via more detailed local structure planning.

The area, estimated capacity populations, population growth projections for the year 2026 and percentage estimated to be occupied by 2026 are shown in Table 1 for proposed urban areas in the structure plan.

Population projections for the structure plan area indicated that none of these localities will reach their capacity population by 2026. Overall, only about 51 per cent of urban capacity, or 22 010 persons are projected to occupy the proposed urban areas in the study area by 2026 (this excludes the rural areas). This compares with the Town of Kwinana projected population of 46 000 by 2026.

A breakdown of the projected growth for each locality by 2026 is shown in table 2.

Table 1 Population capacity

Locality	Area (ha)	Capacity population	2026 population	2026-% Area occupied
Area 1: Mandogalup (North of Anketell Road)	360	9 840	5 400	55%
Area 2: Bertram /Wellard (west of the Kwinana Freeway)	360	9 840	4 880	50%
Area 3: Wandi /Anketell (north of Thomas Road, east of Kwinana Freeway)	230	6 300	2 910	46%
Area 4: Casuarina /Wellard (Thomas Road, east of Kwinana Freeway)	300	8 190	4 990	60%

Note: capacity population subject to detailed planning and environmental studies

Figure 9 Final structure plan

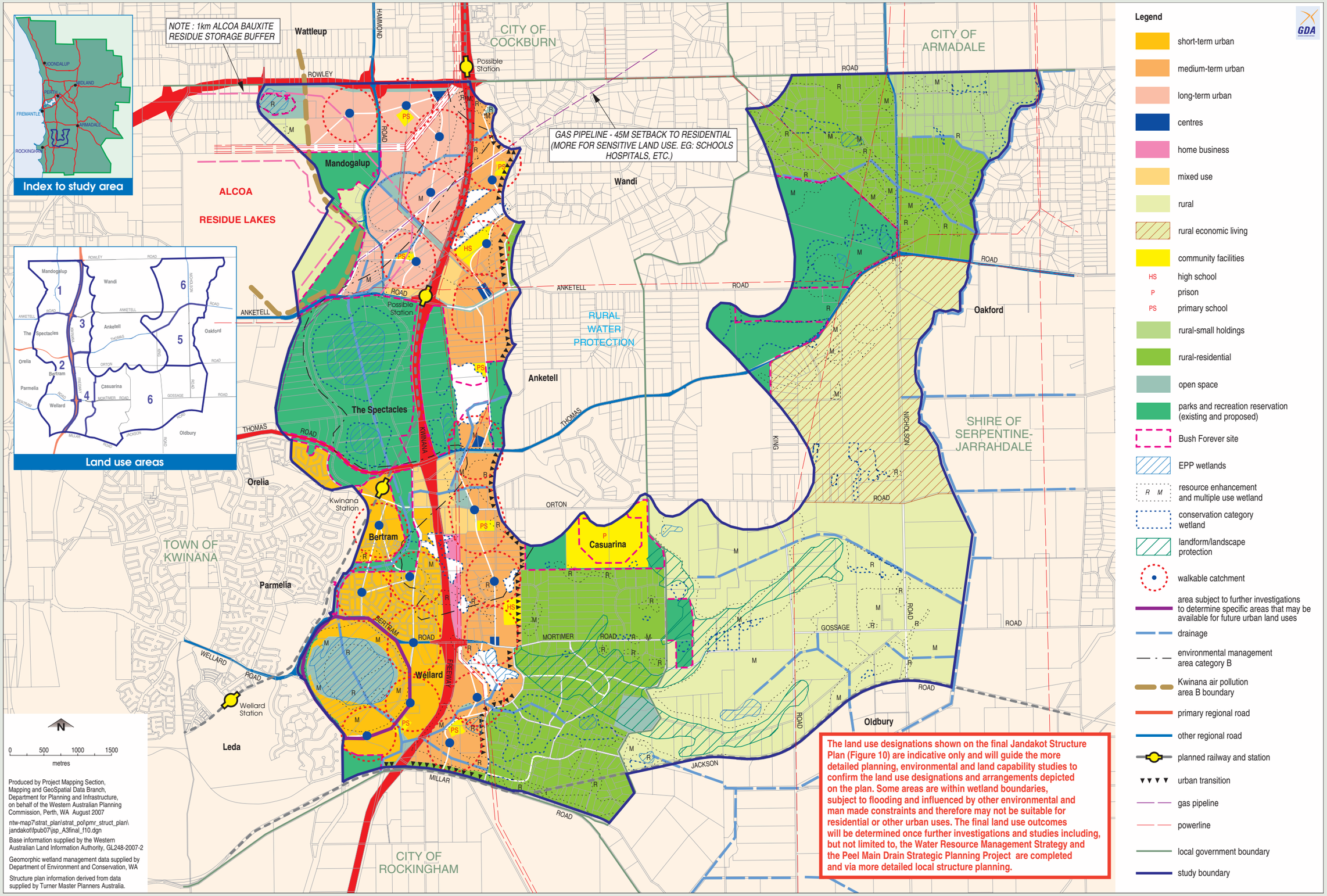


Table 2 Population and dwelling numbers

Locality	Estimated dwellings capacity	Estimated population capacity
Mandogalup (north of Anketell Rd)	4 000	9 840
Bertram/Wellard (west of freeway)	4 000	9 840
Wandi/Anketell (north of Thomas Road)	2 560	6 300
Casuarina/Wellard (east of freeway)	3 330	8 190
Oakford Village	1 880	4 580
Balance of rural (including Wandi)	1 050	2 725
Total - Urban	**15 770**	**38 750**
Total - Urban and Rural	**16 820**	**41 475**

7.2.3 Workforce and employment

The five urban areas proposed in the structure plan area are projected to generate a resident workforce of about 10 000 persons by 2026. The resident workforce is assumed to comprise about 10 per cent of the local population based on comparable metropolitan region data. Thus, by 2026 an estimated 2000 jobs can be expected in the proposed urban areas to service the population. Efforts to encourage higher local employment may modify this projection. However, experience elsewhere tends to support the projection assumption.

The structure plan provides opportunities for local jobs and employment by proposing local neighbourhood centres and mixed use zones in the urban areas.

Mixed use zones for commercial showrooms and light industry are proposed at:

- Mandogalup and Wandi - Anketell Road east and west of the freeway;
- Bertram - Thomas Road and Johnson Road; and
- Casuarina - Orton Road (existing mushroom farm and adjoining area).

An additional home business area is proposed adjoining, and east of the freeway in Casuarina, between Mortimer and Orton Roads. This area is proposed as large lots accommodating both residences and a business, workshop, storage or garaging premises for those businesses that are not of a significant industrial nature, but are too large, or are otherwise incompatible with normal residential areas.

7.2.4 Education facilities

Recommendations for eight primary school sites and two high school sites in the study area are reflected in the structure plan. Private school sites are not shown. The final disposition and number of school sites will evolve in the context of the capacity of the existing Kwinana High School and development patterns.

7.2.5 Retailing

The structure plan area relates to the Kwinana town centre for district level shopping facilities, but is also served by the regional centres of Rockingham and the Thomson's Lake Gateways Centre. It is noted that the additional urban areas proposed in the structure plan will ultimately take the Town of Kwinana population to in excess of 50 000 persons (46 000 by 2026). While that is the lower end of the population criterion for a regional centre under the WAPC Metropolitan Centres Policy, the likelihood is that this additional population will make Kwinana's Hub Shopping Centre a healthier district centre rather than justifying any upgrading to a regional centre.

Local retailing and/or other community facilities are proposed at the centre of Liveable Neighbourhoods shown on the structure plan and local centres are situated at the junction of the major connecting roads namely:

- Rowley Road (west of freeway)
- Anketell Road (east of freeway)
- Thomas Road (east of freeway)
- Mortimer Road (east of freeway).

A new neighbourhood centre is also proposed centrally in Bertram (an existing zoned site).

The centres shown on the structure plan are schematic only and will require further definition at the detailed planning stage. Retail floor space needs for these locations will be determined under the detailed retail component of local government planning strategies.

Local centres shown straddling or fronting regional roads are intended to develop off the secondary roads and not have direct access to the regional road. This also applies to Anketell Road, which is a heavy-haulage route.

7.2.6
Wetlands

Environmental protection policy lakes, conservation category wetlands, resource management and multiple use wetlands are shown on the structure plan based on information supplied by the DEC. The wetlands shown are subject to additional detailed site assessment including definition of conservation area boundaries and buffers. Resource enhancement and multiple use wetland remnants are encouraged to be retained and enhanced where appropriate.

Multiple use corridors are also schematically indicated on the structure plan as linear open space or main drain alignments to suggest the potential for integration of conservation, drainage, nutrient stripping and open space in subsequent detailed planning. These are primarily located on main drainage routes that have fringe vegetation which is worthy of retention as open space.

Some environmental protection policy lakes and conservation category wetlands are shown on the structure plan as open space but others are not. It is intended that significant wetlands not included in open space will be protected at the detailed planning stage.

7.2.7
Significant natural areas

Bush Forever sites are shown on the structure plan based on the final Bush Forever outcomes. These sites do not affect urbanisation proposals because they have been excluded from the structure planning process.

When preparing outline development plans and/or local structure plans, rezonings and subdivisions, additional environmental research is needed to establish the presence of significant species, ecological communities and linkages to be protected.

7.2.8
Drainage and groundwater

Main drains and other drains are shown on the structure plan. The drainage system, established to serve rural land use and urbanisation of the catchments of these drains, is predicted to lead to increased run-off rates and volumes in excess of the existing system capacity. The main drains are under the control and management of the Water Corporation and the Department of Water is responsible for strategic drainage issues. The use and future management of the drainage system will need to be reviewed in the JWRMS. The water resource management strategy will need to address drainage flow relative to the capacity of the existing drains and their ability to be upgraded. Nutrient management in the context of discharge to the Peel-Harvey Estuary, proximity to the Jandakot Groundwater Mound and environmental management areas will need to be considered. Additionally, groundwater levels, provision of detention basins, affect on wetlands and water sensitive design approaches will also need to be considered.

The framework for the JWRMS is outlined in Appendix 5 and indicates the issues to be dealt with prior to development of proposed urban land in the structure plan area.

7.2.9
Rural areas

The rural areas in the central and eastern parts of the structure plan area are predominantly retained under their existing use and/or zoning classifications:

- rural-residential - one to four hectare lots;
- rural-living - four hectare minimum lot size; and
- rural - no change.

An additional area of rural living is proposed south of Thomas Road at Oakford , between King and Nicholson Roads to confirm an area of existing four hectare lots and round off this area.

The north-eastern edge of this rural living area may need to be adjusted if the potential Oakford Village does not proceed.

7.2.10
Landform and landscape protection

The prominent sand ridges in the southern rural areas have been highlighted on the structure plan as an area worthy of further consideration and detailed planning with a view to protection of this landform feature. Compatible residential, rural land use and subdivision should be encouraged to keep this feature.

7.2.11
Roads and transport

The study area is dominated by the Kwinana Freeway and southern suburbs railway and a number of major east-west roads which link into the freeway and provide connections westward to the Kwinana Industrial Area. These include Rowley Road, Anketell Road, Thomas Road and Mundijong Road (south of the structure plan area). In addition, in the proposed new urban areas, north-south collector and/or integrator roads are proposed to link these areas together and provide local access to facilities. They also provide access on and off the major east-west roads and thus, access to the Kwinana Freeway and the proposed railway stations.

This will establish the potential for the public transport (bus) feeder services between the new urban areas and the railway stations and the Kwinana town centre.

7.3
Development and urban design intent

7.3.1
Structure plan and guidelines

The structure plan seeks to achieve contained, environmentally responsive urban development and reinforced rural amenity outside proposed urban areas. It provides a development and policy framework that incorporates these concerns at a number of different levels to ensure well-integrated development. At the broader scale, the structure plan outlines key development areas, land uses and infrastructure such as road connections.

To assist in the implementation of the structure plan, a series of guidelines relating to urban water management, pre-requisites for the MRS and town planning scheme rezonings and ultimately the preparation of outline development plans and/or local structure plans have been prepared.

Guidelines relating to urban design are outlined in the WAPC's Liveable Neighbourhood document.

The guidelines include environmentally responsive development, water sensitive design, amenity, appropriate interfaces between urban and rural areas, development character, sense of place and rural identity.

Coordinated action between government agencies, developers and the community is required to realise the development potential of the structure plan. In support of this objective, a holistic understanding of the structure plan should be actively promoted to these sectors, while commitment by government authorities should be affirmed through coherent planning and decision making.

Development and design responses to the structure plan should reflect the intent to generate an integrated townscape. Priority should be given to establishing urban structures and amenity frameworks that produce coherent and attractive townscape development. This requires collaborative action between public and private sectors, coordinated development interest and investment resources.

Developers may need to modify their development and marketing approaches, to invest in the streetscape design of prominent movement and activity areas such as main roads and public spaces, rather than the conventional entry statements to estates. For government agencies, greater participation in the development and design process may be required, including public policy and works that consolidate investment into the urban framework. The community should actively participate in the design and decision making process to ensure that townscape development satisfies their needs and that the evolving character of place is appropriate according to the existing context.

7.3.2
Urban structure issues

The north-south linear structure of the structure plan is not ideal in terms of Liveable Neighbourhood principles. The area did not lend itself to clustering of neighbourhoods, but can achieve reasonable connections between neighbourhoods in spite of the barrier provided by the freeway. Linkages to the railway will be good depending on which stations are ultimately constructed.

Mandogalup-Wandi (north of Anketell Road)

That part of Mandogalup eventually deemed to be affected by the final delineation of the Alcoa bauxite residue storage buffer is subject to a deferred development timetable.

The Mandogalup area has longer-term potential as an area that can support a more sustainable transit orientated approach to development. This would be subject to the outcome of further consideration of train station locations being undertaken at the time of writing. Depending on the final location of stations, the potential then exists to create a cluster neighbourhood with an acceptable degree of connectivity in the Mandogalup-Wandi precinct.

Anketell (east of freeway between Anketell and Thomas Road)

The principal benefit of the proposed ribbon of development along the east side of the freeway would be to provide an extra area of up-stream catchment for the potential transit orientated cluster of neighbourhoods previously described, although in this respect, only the larger northern portion would be of value. However, without a rationalisation of the future Mandogalup and Anketell railway stations, the area east of the freeway will have only limited benefit to the surrounding urban structure.

Bertram-Wellard (south of Thomas Road and west of freeway)

The proposed urban areas south of Thomas Road and west of Kwinana Freeway (Bertram-Wellard Precincts) and to the east of the Kwinana Freeway (Casuarina) provide an opportunity to:

- strengthen the patronage of the existing centres in the surrounding areas of Kwinana, Orelia and Parmelia; and to the north in the City of Cockburn;
- activate new employment generating commercial opportunities in the existing areas;
- support the rail stations at Kwinana and Wellard with transit-oriented development; and
- support the proposed Wellard village centre.

Development occurring at Wellard is in a form that maximises its association with the railway station. Similarly structure planning is progressing for the area immediately adjacent to the proposed Thomas Road station, and the area around the proposed future South Parmelia station.

Casuarina- Wellard (south of Thomas Road and east of freeway)

The proposed urban area east of the Kwinana Freeway (Casuarina-Wellard Precinct) is somewhat isolated from the area in the west because there are few points of access across the freeway or to the proposed train stations. As a result, the eastern Casuarina-Wellard precinct will provide limited support to, or gain little benefit from, the wider Kwinana area.

7.3.3
Development and urban design

The structure plan proposes:

- urban development along the Kwinana Freeway;
- a small rural village in Oakford; and
- a reinforced rural character in the east of the study area.

Urban development along Kwinana Freeway

Development along the Kwinana Freeway is intended to occur as contained urban development that is well-integrated into the landscape. While the urban structure and development character differs from one side of the freeway to the other, association between the two areas is important for general community integration and townscape transition, from urban in the west to rural in the east.

West of the freeway, the urban development edge is completed at Kwinana and Mandogalup. An extensive network of parks and recreation reservations and open spaces define neighbourhood clusters, and provide opportunity to relate the character of urban development to the natural environment. Development in this part should integrate with existing urban development.

East of the freeway, urban development is proposed along the freeway in a form that can be visually contained through design integration into the landscape and local character when appropriate. There should be clear transition between urban and rural areas through visual and functional interfaces. Various forms of interfaces include the landscape flow between urban and rural areas, lots that provide visual, amenity and functional transition between the two areas and the streetscape design of main roads and other aspects.

Urban design for both areas should aim to make urban development seem small scale and visually unobtrusive, where possible and depending on circumstances. The linear linkage of neighbourhoods along the freeway provides significant scope to achieve this design objective. A large bush and rural perimeter occurs along most neighbourhoods, providing a landscape backdrop that can be accentuated in the design of new urban areas. Green linkages, including parkland and multiple use corridors and roads, through their orientation and design treatment, should reinforce visual connections that make the countryside seem closer to the urban environment.

When viewed from main roads, only limited exposure to urban development occurs at neighbourhood units that adjoin the freeway. Through appropriate urban design, the main roads are envisaged to become landscape and community integrators. Small town centres, located on main roads, are particularly important to achieving a high standard of visual and functional amenity that supports community interaction. Landscape continuity and a high standard of visual amenity is important to achieve along the full length of the main road, from freeway intersections, the adjoining mixed use and home business zones, residential, through to rural areas. Open space parkways are proposed east of the freeway on Anketell Road and Thomas Road. These provide green links between the conservation reserves in the locality.

The view of urban development from the freeway is similarly important to generating positive urban imagery. The undulating topography of land adjoining the freeway, including the freeway earth bunds, provides opportunity for landscaping that visually softens the scale of urban development.

Reinforced rural character

A strengthened rural context is proposed for the eastern section of the structure plan area. Environmental improvement strategies and rural subdivision guidelines that enhance rural character, and a range of rural zones are envisaged.

The environmental improvement schemes and initiatives would primarily be incentive based (through rates concessions and development bonuses), to encourage landowners to maintain and enhance natural and rural landscapes. In particular, landscape and landform protection of the ridge (in the south-east of the area) is encouraged because of its prominence as a rural landscape feature. Enhanced rural landscapes on main roads, the retention and rehabilitation of wetlands and aspects of environmental value are also encouraged. Design guidelines for rural subdivision promote subdivisions that are integrated into the rural landscape and minimally affect environmental amenity.

Rural-residential zoned land (one to two hectare lots) and some additional rural living zoned land (two to four hectare lots) are provided to diversify the use scope of the area. Rural-residential zones are consolidated in areas adjoining proposed urban zones, to intensify the population catchment close to urban centres. This can potentially help secure rural land from future urban expansion, due to the difficulty of coordinating development on resulting smaller rural lots and fragmented land ownerships. A rural-living zone, south of the Oakford Rural Village is proposed to accommodate rural activities that require medium-large sized lots.

Development adjacent to conservation reserves and MRS reservations

The interface between future development will need to be carefully considered. It is anticipated that the transitional design principles described in the WAPC's Liveable Neighbourhoods document should be adopted for development adjacent to conservation and reserved areas. Such design issues should be addressed at the outline development plan/local structure plan stage.

8
Implementation

The preparation of the JWRMS (primarily by the DEC, Water Corporation and Department of Water), is a prerequisite to the finalisation of urban zonings in the structure plan area.

A fundamental principle that is proposed is the cost sharing of facilities and infrastructure in localities or larger precincts. Due to the projected timeframe for development, the implementation strategy may be divided into five or 10 year programmes in each new urban area, although earlier timeframes are possible.

Development is dependent upon removal of many physical and legal constraints in the area and a coordinated approach to servicing land. A frontal development pattern is recommended to facilitate economic and efficient development.

8.1
Urban development

Town planning schemes or other mechanisms to force the consolidation of land for development are not recommended. Preferably, the landowner role will involve the use of joint ventures and arrangements with other landowners to overcome difficulties associated with fragmented land ownership.

In the event that an owner does not wish to develop and as a result creates an impediment to the planning and development of adjoining lands, mechanisms need to be in place to achieve the following:

- enabling a landowner to continue existing enjoyment of their property;
- transferring those parts of the land necessary for the adjoining development by agreement or acquisition by the local government;
- where acquisition of a property is associated with the provision of headworks infrastructure, the ability to recoup such costs plus interest upon the eventual development of the land. This approach is proposed to accommodate those owners who wish to remain on their existing properties. However, there is a cost associated with that privilege if adjoining development is delayed and costs are incurred as a result;
- paying costs of acquisition and construction of necessary road linkages, open space and services from an infrastructure fund created for the area; and
- incorporating special enabling provisions in local government town planning schemes to facilitate this action. The local government should be empowered to act in these matters under their town planning schemes.

8.2
Financial arrangements

The financial arrangements require detailed evaluation through an amendment to the local government town planning schemes.

The principles for such arrangements are as follows:

- Local government town planning scheme amendments initiated to provide for infrastructure contributions by subdividers as a condition to be imposed by the WAPC.
- Local governments are empowered to collect and manage the payment of such contributions and to act as banker for infrastructure and works.
- Local governments are empowered to acquire land and enter into agreements to facilitate development and to expend funds.

Infrastructure to be provided through local government town planning scheme amendments should include:

- public open space
- conservation sites
- community facilities
- regional road upgrading contributions
- 50 per cent local (existing) road upgrading contributions
- acquisition of land for implementation of the structure plan
- payment of utility services extensions as above
- management costs
- the infrastructure costs considered necessary to implement the structure plan as per WAPC Planning Bulletin No 18 – Developer Contributions for Infrastructure.

Constraints to development (ie poultry farms and services provided by other authorities) are not included in these infrastructure arrangements. This is on the principle that where there is an authority responsible for the specific item then the local government should not be involved. For example, Water Corporation is responsible for water supply and sewerage and Western Power should be responsible for power supply. Poultry farms are not a government responsibility and their future should be privately negotiated.

Public school sites will be set aside (and acquired as necessary) through the subdivision process. School sites should be reserved under the MRS (high schools) or local government town planning schemes (primary school sites).

All costs are paid by developers upon subdivision and landowners not developing do not incur up-front costs.

All acquisitions shall be based upon fair market value and shall be allocated to properties in a fair and equitable manner. Resumption shall be a last resort, failing negotiated agreement.

8.3 Strategic and statutory planning processes for urban development

The recommendations of the Jandakot Structure Plan may be initiated by local governments as warranted because they are not dependent on other issues. However, urban areas require detailed implementation measures. These are outlined below.

8.3.1 Introduction

These recommendations outline the strategic and statutory processes leading to:

- the rezoning of land in the structure plan area to urban deferred and urban in the MRS;
- the rezoning of land to a residential zone in the Town of Kwinana local town planning scheme;
- the preparation of the various levels of structure planning for the subject land;
- finalisation of the JWRMS and the incorporation of its requirements into structure planning; and
- the referral of the above at required stages to the EPA.

These processes are shown in Appendix 1. A summary of the major components of the process is at Appendix 2.

Statutory processes are those required by state planning and environmental legislation and the Town of Kwinana district zoning scheme and are required to occur regardless of their inclusion in the appendices to this document. That is, any applicable statutory requirements not included in this document must still be complied with regardless of their not being included.

Appendix 3 lists the WAPC criteria for lifting urban deferment and the associated information requirements.

8.3.2
Purpose

The purpose of setting out these processes is to ensure that all parties involved in the development process for the structure plan area are aware of their roles and in particular when the drainage requirements of the Water Corporation, DEC and the Department of Water are taken into account in planning.

8.3.3
Coverage

The process in Appendix 1 will apply to the land east of the Kwinana Freeway and Mandogalup. However, urban zoning at Mandogalup is also awaiting resolution of the Alcoa buffer in addition to water resource issues.

Similarly, the Oakford area shown in the structure plan requires resolution of various issues before it can commence any planning processes.

Wellard and Bertram (west of the Freeway) are already zoned urban and detailed structure planning and water resource planning are proceeding in consultation with the Water Corporation, DEC and Department of Water.

8.3.4
Timing and dates

The timing and order of events in the planning processes may be subject to change if the circumstances at a future date suggest alternatives are appropriate and provided the overall objective of appropriate incorporation of water management requirements to the satisfaction of the Water Corporation, DEC and the Department of Water are maintained. As the planning processes proceed, future timing and dates will be able to be estimated more accurately.

8.3.5
WAPC Draft State Planning Policy 2.9 Water Resources

It is intended that the Jandakot Structure Plan is consistent with the WAPC's draft *State Planning Policy 2.9 Water Resources* which states (inter alia):

- the term water resources includes stormwater and wastewater;
- ". . . it is expected that planning strategies, schemes and decision-making will identify and, where appropriate, include provisions to protect water resources.";
- land use planning used in conjunction with other mechanisms can assist in protecting, conserving, managing and enhancing the State's water resources;
- the activities of State Government agencies should be integrated and coordinated in relation to water resources and the use and development of land; and
- one of the state planning policy measures is that local and regional planning strategies, structure plans, schemes and subdivisions and any other planning decisions and instruments should take into account (amongst other things) total water cycle management and water sensitive urban design principles; and
- when water resources are a consideration in land use planning, they should preferably be considered first in a strategic context reflecting wider sustainability processes to assist in later detailed decision making and incorporation into planning strategies and structure plans.

In terms of implementation of drainage requirements from the JWRMS in subdivision and development in the structure plan area, the following is particularly relevant:

- implementation of the state planning policy ". . . will primarily be through local planning strategies and town planning schemes. . ." and the processing of zoning, subdivision and development applications; and
- " local government is the key agency in the implementation of this policy".

The last two points above are important as, although the need for water resource studies and requirements can be referred to at various stages of the planning process, it is the incorporation of studies and requirements in local structure planning which directly results in their implementation in subdivision approvals given by the WAPC.

8.3.6
Levels of structure planning

There are several levels of structure planning referred to in this document. These are explained in Appendix 4.

8.4
Explanatory Notes for Appendix 1

Column A notes

Jandakot Structure Plan

A1 The Jandakot Structure Plan includes the relevant information and requirements of the Water Corporation, DEC and the Department of Water for completion of the JWRMS (Appendix 5)

A2 The Jandakot Structure Plan requires preparation of outline development plans and/or local structure plans prior to transferring land in the structure plan area from urban deferred to urban. The outline development/local structure plans are required to incorporate the relevant outcomes of the JWRMS.

Infrastructure provision statements are also required. This is a statement by a landowner or group of landowners, acceptable to the relevant authorities and WAPC, in which the landowner undertakes to provide full servicing for the land, makes commitments for contributions for appropriate infrastructure and proposes a local structure plan or outline development plan, generally in accordance with the structure plan.

Column B notes

Jandakot Water Resource Management Strategy

B1 The framework for preparing the JWRMS (by the Water Corporation and DEC) is in Appendix 5.

B2 Interim results prior to finalisation of the JWRMS may allow work on drainage requirements for structure planning to proceed.

Column C notes

Metropolitan Region Scheme

C1 A document explaining the amendment and discussing submissions received on it called the Report on Submissions is put before Parliament, which may choose to debate the amendment. If no debate occurs after 12 days the amendment takes effect. The report on submissions is placed in the Department for Planning and Infrastructure library.

C2 Relevant agencies eg Water Corporation, DEC and Department of Water need to consider at this stage whether outstanding issues have been addressed to their satisfaction and/or that satisfactory arrangements are in place to deal with them in the remaining stages of the planning process.

Column D notes

Town of Kwinana

D1 The Eastern Residential Intensification Concept is a Town of Kwinana district structure plan which provides more planning detail and discussion of issues than in the Jandakot Structure Plan.

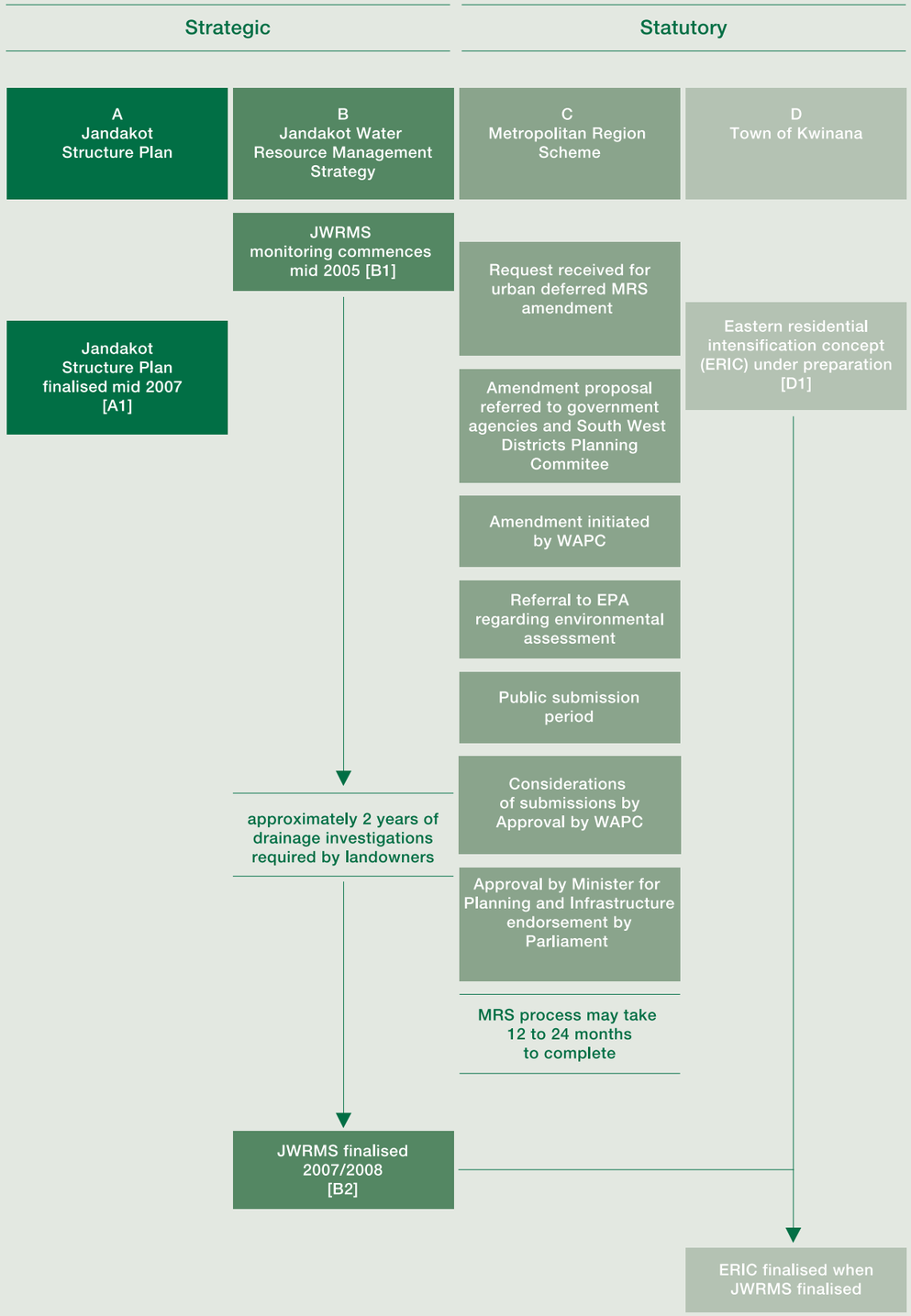
D2 Section 126(3) of the Planning and Development Act 2005 provides for Councils to request a concurrent local scheme amendment in relation to land proposed to be zoned urban in the MRS.

D3 If Section 126(3) is not utilised, the local government is required to initiate an amendment to its local scheme within three months of the urban zone becoming effective. The zone chosen must be consistent with the urban zone.

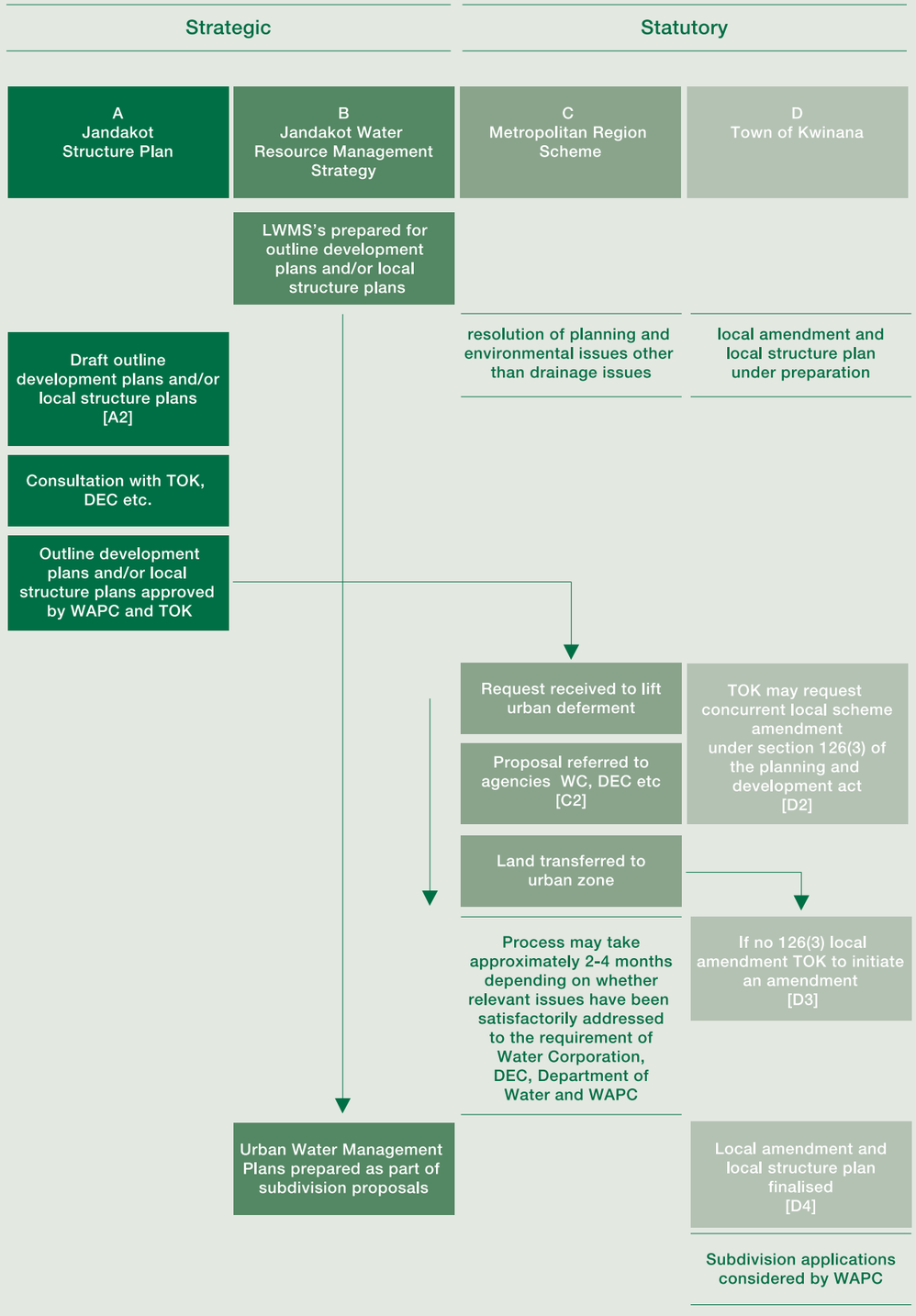
D4 Local structure planning is required to incorporate the relevant outcomes of the JWRMS. The local structure plan is usually advertised with the local scheme amendment.

Appendix 1 Integration of drainage and planning requirements for proposed MRS urban zones

Stage 1 To finalisation of JWRMS and urban deferred zone



Stage 2 To urban zoning and finalisation of structure planning



Appendix 2 East of Freeway and Mandogalup summary of planning process

Stage 1

MRS rural to urban deferred amendment initiated by WAPC

↓

MRS amendment referred to EPA

↓

Jandakot Water Resource Management Strategy investigations underway

↓

Jandakot Structure Plan finalised

↓

MRS urban deferred amendment finalised

↓

Jandakot Water Resource Management Strategy finalised

Stage 2

Outline development plans and/or structure plans prepared incorporating Jandakot Water Resource Management Strategy and other planning and environmental requirements

↓

Request to lift urban deferment - possible concurrent local scheme amendment section 126(3) Planning and Development Act

↓

MRS amendment referred to EPA and Water Corporation

↓

Land transferred from urban deferred to urban zone in MRS

↓

Local scheme amendment finalised if under 126(3) otherwise initiated by council. Local structure plans prepared incorporating JWRMS and other planning and environmental requirements

↓

Local scheme amendment and local structure plan finalised

↓

Subdivision applications received and considered by WAPC

Appendix 3 WAPC guidelines for lifting urban deferment

Criteria

1 The land is capable of being provided with essential services. Agreement has been reached between developers and service providers with regard to staging and financing of services.

2 Planning is sufficiently advanced to depict an acceptable overall design to guide future development.

3 The proposed urban development represents a logical progression of development.

4 Regional requirement (eg regional roads, open space, and public purposes) have been satisfied or provision made for them.

5 Any constraints to urban development can be satisfactorily addressed.

Information requirements

1

Justification:

- clear description, explanation and justification for the proposed change;
- evidence that the change is a logical extension of urban development (in terms of development of nearby properties and provision of existing infrastructure services); and
- details of the characteristics of the land and its proposed use.

2

Land and ownership:

- land to which the amendment applies, ownership details, plans of the subject land and other features as appropriate; and
- extent of agreement of landowners.

3

Natural environment:

- accurate description of the land including the natural environment;
- description of physical conditions of the land;
- identification of means by which natural features will be protected; and
- identification of environmental issues, that may impact on future development (eg noise, water catchment, contaminated land and air pollution.

4

Services:

- information regarding how water, drainage, sewer, power and other optional services will service the land;
- information regarding the servicing of the area by road including information regarding how the development will be accommodated in the regional road system; and
- information regarding the planned availability of public transport.

5

Employment:

- where the land is remote from a developed urban front, an employment strategy.

6

Public uses:

- details regarding the areas required for schools, public utilities and community facilities.

7

Consultation:

- details regarding any consultations undertaken with relevant service providers and agreement reached.

Appendix 4 Levels of structure planning

1
Jandakot Structure Plan

A regional level structure plan showing major land uses to guide decision making by State and Local government and landowners. Prepared by the WAPC in consultation with stakeholder groups.

2
Town of Kwinana district structure plan - Eastern Residential Intensification Concept (ERIC)

A district level structure plan providing more detailed planning information. This plan is being prepared by the Town of Kwinana to provide more detail than is contained in the Jandakot Structure Plan.

3
Outline development plans/local structure plans

The WAPC Criteria For Lifting Urban Deferment require that appropriate advancement of planning to guide future development has occurred prior to the lifting of urban deferment occurring. In the case of the Jandakot Structure Plan these criteria will be fulfilled by the preparation of outline development plans and/or local structure plans and infrastructure provision statements.

The outline development plans/local structure plans can only be finalised after appropriate information from the JWRMS and any other studies as appropriate are available. This level of planning must incorporate urban water management measures in order that a reasonably accurate layout of the various urban land uses can be set out. The plans should indicate land required for urban water management purposes, residential land, public open space, conservation areas and buffers, schools and commercial areas etc. Subdivision applications will be expected to be consistent with the approved plans.

Appendix 5 Framework for integrating urban water resource management and the planning process

The following guidelines integrate land and water planning to ensure that the necessary information is available at the appropriate time in the planning process. Information requirements stipulated in these guidelines do not constrain the DEC from requesting additional information where it is considered necessary to address a specific environmental issue.

A summary of the framework is shown in Attachment 1 to this Appendix.

Specific actions to be taken at each of the five key stages follows. The stages are for guidance, are not necessarily consecutive and may change according to changing circumstances in the future, subject to agreement from relevant agencies.

Stage 1

Regional land and water planning

Finalisation of the Jandakot Structure Plan ;

Preparation of the JWRMS including:

- development of water quantity and quality management objectives;
- broad description of constraints to water management in the structure plan area due to existing infrastructure, existing land uses, possible groundwater pollution plumes and groundwater capture zones of significant wetlands and other groundwater dependent ecosystems;

regional surface and groundwater investigations, modelling and analysis to provide:

- groundwater level fluctuations over time to determine safe areas for development;
- hydrogeological parameters of the Jandakot Structure Plan area and relevant catchments, including regional groundwater flow directions and flux, likely impacts of development on significant groundwater dependent ecosystems;
- an assessment of regional groundwater quality, including resident catchment and aquifer conditions and role of wetlands in water quality improvement; and
- an assessment of the recommended land use scenario in the structure plan based on the above elements and any suggested modifications;

1 refinement of the conceptual stormwater management map in the Framework for Developing the JWRMS (Department of Environment, 2005);

2 strategies and responsibilities for local surface and groundwater monitoring, both pre and post development including data analysis, presentation and reporting mechanisms;

3 identification of best management practices, for potable water usage, groundwater management and stormwater management in the study area in a total water cycle context;

4 implementation framework including monitoring and technical review of the JWRMS identifying funding and ongoing maintenance responsibilities; and

5 strategies and recommendations for planning precincts to guide and control land uses and development where necessary.

Stage 2

Statutory change of land use (MRS amendment)

- rezoning to urban deferred;
- completion of JWRMS including the stormwater management strategy;
- lifting of urban deferred zone. Information to be included in the outline development plans/local structure plans relating to urban water management includes:

  1 description of existing surface and groundwater management infrastructure and natural systems (including wetlands), and its impact groundwater levels;

  2 identification of groundwater dependent ecosystems and an assessment of the likely impact of changes in groundwater levels on groundwater dependent ecosystems ;

  3 broad assessment of the requirement for land form modification based on the above points,

  4 identification of the capacity of the receiving infrastructure and downstream environment to adapt to the post development water balance;

  5 discussion of existing shallow groundwater quality based on the findings of the JWRMS and an assessment of past land use, soil types and nutrient pathways; and

  6 the conceptual stormwater management plan for the area including consideration of the ability of the system to meet the targets in the JWRMS and Peel-Harvey Environmental Protection Policy.

Stage 3

Local scheme land use change (town planning scheme amendment)

Support of proposed land use change provided by existing outline development plans/local structure plans (as outlined in stage 2) and local water management strategy (LWMS) (see stage 4).

Stage 4

Local structure plan - local land and water planning

The local structure plan is to incorporate a local water management strategy consistent with the findings of the JWRMS. The LWRMS should address the following:

- principles, objectives and requirements of the draft Water Resources *State Planning Policy 2.9 (WAPC, 2004)*, Liveable Neighbourhoods and the Decision Process for Stormwater Management supported by the Stormwater Management Manual for WA (Department of Environment);
- design objectives relating to performance of the development with regards to potable water consumption, groundwater quantity, groundwater quality, stormwater quantity and stormwater quality. These should be consistent with (or better than) the objectives in the JWRMS;
- existing site characteristics such as geology, hydrogeology and groundwater characteristics in more detail than the JWRMS;
- site constraints and opportunities (such as groundwater dependent ecosystems, remnant vegetation, landscape and landform);
- conceptual urban water management system, including:

1 identification of land required for storage and retention and the stormwater management conveyance system;

2 identification of appropriate best management practices for management of water quality and quantity and indicative drawings of possible treatment trains and design approaches;

3 map of existing groundwater levels and any proposed controlled maximum groundwater level; and

4 mechanisms to conserve potable water (including those relating to development design and construction);

5 issues to be addressed at subdivision stage (included in an urban water management plan);

6 recommended monitoring framework; and

7 proposed implementation of strategy including roles, responsibilities and funding for monitoring and maintenance.

Stage 5

Subdivision

Subdivision applications to be accompanied by an urban water management plan which forms part of the application submitted for consideration by the WAPC.

The urban water management plan should address:

- compliance with the design objectives in the LWRMS. Demonstration of compliance should be achieved through appropriate assessment tools, calculations or assessments;
- detailed stormwater management design including the size, location and design of public open space areas, integrating flood management capability;
- specific structural and non-structural best management practices and treatment trains;
- protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages;
- management of groundwater contamination (hot spots) and other specific site conditions including use of living streams, soil amendment, vegetated soil filters or vegetated swales and buffers;
- management of groundwater levels;
- management of subdivisional works (to ensure no impact on regional conservation areas and management of dust);
- management of mosquitoes and midges;
- monitoring program and/or contribution; and
- implementation plan including roles, responsibilities, funding and maintenance arrangements.

Appendix 5 Attachment 1 - Framework summary for urban water management in the structure plan area

Stage 1

Finalise Jandakot Structure Plan (including Jandakot Water Resource Management Strategy Framework)

- principles from WR State Planning Policy
- objectives
- targets from DoE 2005

Supporting information

Modified framework for urban water managament in Jandakot Structure Plan area

Stage 2

MRS Amd to Urban deferred, then Urban

- identify issues to be addressed at later stages
- Urban deferred amendment to occur concurrently with development of Jandakot Water Resource Management Strategy
- require preparation of outline development plan /local structure plan & finalisation of Jandakot Water Resource Management Strategy prior to lifting Urban deferred

Supporting information

Regional information in Jandakot Water Resource Management Strategy – groundwater & surface water monitoring and modeling (both quantity & quality)
Demonstration of "lifting criteria"

Stage 3

TPS Amendment

- require consistency with Jandakot Water Resource Management Strategy
- require local structure plan incorporating urban water management strategy and its requirements
- advertise concurrently with LSP

Supporting information

- Results of monitoring for:
- ecological health
- stormwater pollutant loads
- groundwater recharge

Stage 4

Local structure plan (incorporating UWMS)

- design objectives
- suite of possible best management strategies & BPPs
- conceptual stormwater management system (treatment train approach)– depicted in diagrams
- identify sufficient land for urban water management
- recommended monitoring framework

Supporting information

- Affects on groundwater dependent ecosystems , consideration of environmental water resources and identification of buffers
- desktop historical land use assessment
- hydrologic information/ Flood modelling
- water balance (refer Table A)

Stage 5

Subdivision (incorporating UWMP)

- compliance with design objectives
- site conditions – management of hot spots and other contamination
- specific best management practices and drainage design
- monitoring and maintenance
- arrangements

Supporting information

- nutrient levels & pollutant pathways
- waterway and wetland protection measures
- groundwater levels and management (refer Table B)

Appendix 5 Attachment 2 - Local structure plan - Local land and water planning

Environmental water Requirements for groundwater dependent ecosystems and ecological health	• consider findings of Jandakot Water Resource Management Strategy and provide more detailed assessment where necessary; • identify and map buffers for wetlands and waterways; and • where groundwater dependent ecosystems are of regional significance, ecological health monitoring is recommended prior to and subsequent to development.
Desktop historical land use assessment	• discussion of previous land use and likely impacts on the quality of surface runoff and shallow groundwater and how this will be addressed by the proposed system; and • consideration should be given to acid sulphate soils.
Water balance modelling	• Identify predevelopment and post development water balances to inform the assessment of options for reducing the need to import potable water.
Surface water modelling	• flood plain modelling to determine minimum building levels, setbacks for development, and receiving water levels; and • drainage modelling to determine the land requirements and flood ways needed to cope with major storms (one in ten year and one in 100 year) based on receiving water constraints.
Groundwater monitoring and modelling (primarily for high water table areas)	• consider potential impacts on groundwater dependent ecosystems; • assess base flow groundwater quantity; • explore potential for use of shallow groundwater for a non-potable source; • assess potential for short-term mobilisation of nutrients and contaminants resulting from development works as well as long-term impacts on groundwater quality from development; • establish acceptability of location of drains and flood storage areas; • provide support for proposed controlled maximum groundwater level where required.
Monitoring of flows in existing drains	• May be required to establish current constraints (ie one in one hundred year flows). Used for later subdivision planning.

Note: At least 12 months monitoring is suggested to establish accurate baselines and to support recommendations, particularly for groundwater levels.

Appendix 6 Technical Investigations for urban water management plans

Management of groundwater dependent ecosystems and other natural areas	• consider findings of Jandakot Water Resource Management Strategy and provide more detailed assessment where necessary • identify and map buffers for wetlands and waterways • where groundwater dependent ecosystems are of regional significance, ecological health monitoring is recommended prior to and subsequent to development.
Site investigations	• more detailed soil and site characteristics (geomorphology, topography, soils) • further field investigations for contamination or acid sulfate soils where required, consistent with Department of Environment and Conservation guidelines
Groundwater monitoring and modelling	• identify nutrient levels and pollutant pathways relating to background levels and hot spots • map groundwater level contours, existing and proposed • identify floor level heights (and fill requirements) • assess requirement for subsoil drainage
Surface water modelling	• flow monitoring of existing surface water streams to establish current constraints • identify infiltration rates and proposed impervious areas • identify how to attenuate post development flows to maintain pre-development flows • modelling of up to one in one hundred year ARI event to determine capability for retention/detention and water quality treatment at source • modelling of minor and major stormwater systems to identify and size flow paths (via pipes or overland flow) and required flood detention volumes. • refinement of one in 100 year flood way if required

Appendix 7 Interim approach for development in Wellard West

Stage 1

Lifting of UD

- supported by outline development plans /local structure plans
- seek comment from key agencies
- future development to be consistent with Jandakot structure plan and Town of Kwinana district structure plan

Supporting information

- agreement from key agencies
- meet all lifting criteria

Stage 2

Finalise JSP (including JWMS Framework and Interim approach)

- principles from Water Corporation State Planning Policy
- objectives
- targets from Department of Environment 2005

Supporting information

interim approach for urban water management for Wellard West

Stage 3

TPS Amendment

- zone to require preparation of outline development plans / local structure plans with specific requirements including urban water management strategy
- advertise with local structure plan

Supporting information

- preliminary groundwater and surface water modeling (both quantity and quality)
- assessment of conceptual stormwater management system

Stage 4

Local structure plan (incorporating urban water management strategy)

- design objectives
- suite of possible best management practices & BPPs
- conceptual stormwater management system (treatment train approach)– depicted in diagrams
- consideration of preliminary regional information
- identify sufficient land for urban water management
- recommended monitoring framework

Supporting information

- preliminary regional results
- impacts on groundwater dependent ecosystems, consideration of environmental water resources and identification of buffers
- desktop historical land use assessment
- hydrologic information/ flood modelling
- water balance

Stage 5

Subdivision (incorporating urban water management plan)

- compliance with design objectives
- site conditions – management of hot spots and other contamination
- specific best management practices and drainage design
- Monitoring and maintenance arrangements

Supporting information

- nutrient levels and pollutant pathways
- waterway and wetland protection measures
- groundwater levels and management

Appendix 8 Proposed work required for preparation of Jandakot Water Resource Management Strategy

	Elements of the Jandakot Land Use and Water Management Strategy	Task/investigation required	Time required	Timing for action	Responsibility
1	Development of Water quantity and quality management objectives;	As stated	4 weeks	Immediate (concurrent)	Department of Environment and Conservation
2	Broad description of constraints to water management in the study area. The status of wetlands needs to be established and direction given on the potential for them to be used as detention storages. Existing water quality data in the development area should be reviewed for adequacy.	Current and historical land use assessment, plume mapping	4 weeks	Immediate (concurrent)	Department of Environment and Conservation
3	Monitoring requirements for developers established, based on the information they will be expected to provide in order to produce acceptable water management strategies as part of local structure planning.		4 weeks	Immediate (concurrent)	Department of Environment and Conservation
4	Groundwater monitoring	Bores for monitoring groundwater levels and water quality.	18-24 months monitoring	After step 3	Developers
5	Groundwater modelling	Modelling based on historical data to establish the water level ranges currently experienced across the area – especially by wetlands and vegetated areas under climate scenarios.	4-6 months	After step 1	Water Corporation (with input & review by Department of Environment and Conservation)
6	Review and approval of groundwater model	Modelling based on historical data to establish the water level ranges currently experienced across the area – especially by wetlands and vegetated areas under climate scenarios.	2 Weeks	After step 5	Department of Environment and Conservation

	Elements of the Jandakot Land Use and Water Management Strategy	Task/investigation required	Time required	Timing for action	Responsibility
7	Surface Water modelling	To establish the drainage strategy for the area, subject to refinement as land planning information changes.	6 months	After steps 2 & 6	Water Corporation (with input & review by Department of Environment and Conservation)
8	Review and approval		2 Weeks	After step 7	Department of Environment and Conservation
9	Water quality management	Based on an understanding of pathways (afforded by activities such as monitoring) and the groundwater and surface water modelling. Identify with Department of Environment and Conservation if any water quality treatment facilities are required to be incorporated into the arterial drainage system.	4 Months	After step 8	Water Corporation / Department of Environment and Conservation / local government
10	Finalise Jandakot Land Use and Water Management Strategy		6 Months	After step 8	Department of Environment and Conservation

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