North-East Corridor Extension Strategy

Western Australian Planning Commission

A submission by the Environmental Protection Authority under Section 16(j) of the Environmental Protection Act

Environmental Protection Authority
Perth, Western Australia
Bulletin 1001
December 2000

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1. Introduction

The *North-East Corridor Extension Strategy* has been prepared by the Western Australian Planning Commission (WAPC) to provide guidance and direction to future development in the Ellen Brook catchment within the Shire of Chittering and the City of Swan (WAPC 2000). The Strategy has been released for a three month public comment period closing 20 November 2000. The area covered by the Strategy is indicated in Figure 1.

The *North-East Corridor Extension Strategy*, hereafter referred to as the draft Strategy, has been developed in consultation with a Steering Committee consisting of representatives of the WAPC, the Ministry for Planning (MfP), the Shire of Chittering, the City of Swan, the Bullsbrook and Chittering Chamber of Commerce, the Water and Rivers Commission (WRC), the Department of Transport, Main Roads Western Australia (MRWA) and the Department of Environmental Protection (DEP). A Community Consultative Group was also established to formulate the collected views of local community groups, and contributed via representation on the Steering Committee.

The draft Strategy identifies environmental constraints which occur in the locality, including land capability, catchment management, areas of high conservation value and air quality. Amongst other objectives, the draft Strategy seeks to "help in resolving planning and environmental issues, in particular nutrient discharges to the Swan River system".

The *Ellen Brook Draft Catchment Management Plan* has been developed in parallel with the draft Strategy and was released by the Ellen Brook Integrated Catchment Group for public comment on 31 October 2000. The Plan follows the collection and analysis of a range of information by the Swan River Trust, the Ministry for Planning, Agriculture Western Australia, the Shire of Chittering and the City of Swan. This information has been utilised in the draft Strategy.

The draft Strategy has identified three scenarios for development in the study area, Options A, B and C, to cater for the estimated 30, 000 people expected to move into the study area after rezonings are implemented around 2021.

The draft Strategy also allocates an area for a Strategic General Industrial Estate at Pearce and identifies two proposed alignments of the Perth-Darwin Highway.

When finalised the Strategy may form the basis of subsequent amendments to the Metropolitan Region Scheme, local town planning schemes, subdivision and development.

The Environmental Protection Authority's (EPA's) advice on the draft Strategy is provided to ensure environmental issues are adequately recognised and integrated into future planning in a sustainable way. Each of the three options, the industrial estate and the Perth-Darwin Highway alignments are commented on in this report.

2. Background

The need for development in the north-east corridor was initially identified in *Planning for the Future of Perth Metropolitan Region* (SPC 1987) and again described in *METROPLAN* (DPUD 1990), a strategic plan for the Perth Metropolitan Region to 2021. This general plan was further detailed in the *North-East Corridor Structure Plan* (SPC 1994) including the development of Ellenbrook and the Swan Valley.

The EPA published comments on the *North-East Corridor Structure Plan* (EPA 1994) which detailed the regional environmental issues of groundwater protection, protection of the Swan-Canning River System, wetlands and air quality, and made recommendations for additional

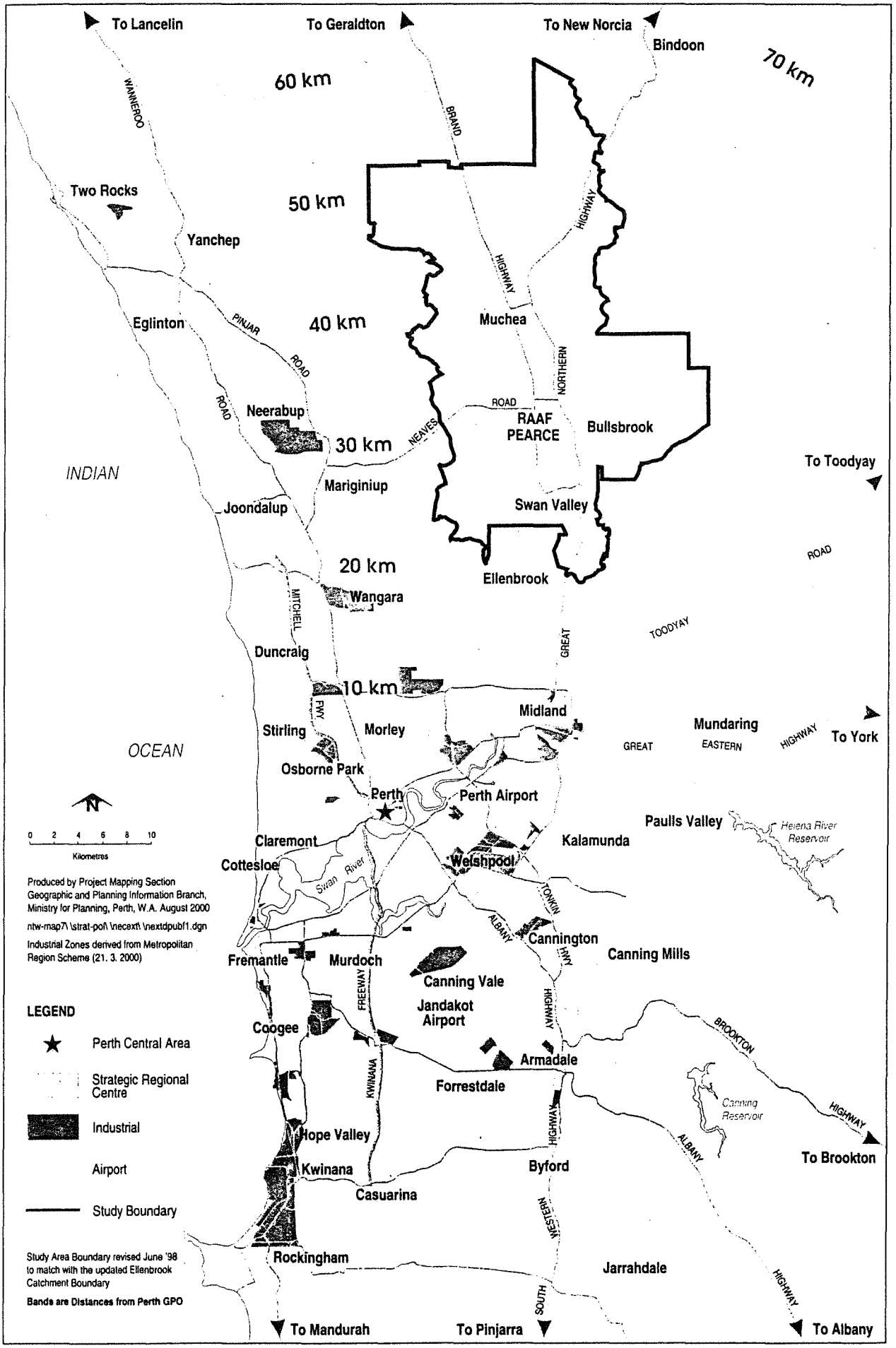

Figure 1. Study Area.

studies to be carried out in understanding the impacts of urban development on these and other environmental components.

The *State Planning Strategy* (WAPC 1997) recommended an extension to the north-east corridor to provide for an urban settlement of 5,000 to 10,000 people in the general vicinity of Bullsbrook, a strategic industrial site, a new town near Bindoon and a possible extension to the combined Strategic Freight and Tourist Road Network.

The need for detailed planning in the area has recently become more evident from the degree of development interest, particularly in the southern part of the study area. In late 1999, the Ministry for Planning was aware of proposals that, if implemented, could allow for an additional 75,000 people in this area (WAPC 2000).

3. Status and purpose of the advice

The purpose of this EPA report is to provide advice on the North-East Corridor Extension Strategy. Section 16(j) of the *Environmental Protection Act 1986* (EP Act) empowers the EPA "to publish reports on environmental matters generally". Because the EPA reports publicly its advice can be seen and considered by the public, industry, State and Local Government and other stakeholders.

This report does not constitute a formal assessment under Part IV of the EP Act and does not lead to the setting of legally binding environmental conditions. In compiling this report, the EPA has considered the information in the draft Strategy documents, specialist advice from the DEP and information from other government agencies and the community.

The EPA will take into account the advice set out in this report when determining the level of environmental assessment on subsequent statutory proposals. Specifically, this report makes a number of recommendations which should be considered in finalisation of the Strategy and rezoning, subdivision or development proceeding.

4. Key principles guiding the EPA advice

In considering the draft Strategy the EPA was guided by the following key principles:

Sustainability

The EPA supports the concept of ecologically sustainable development, as set out in the National Strategy for Ecologically Sustainable Development (Commonwealth of Australia 1992), that is "development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends". A core objective of the National Strategy for Ecologically Sustainable Development is to provide for equity within and between generations.

Conservation of biological diversity

The Commonwealth and all State governments have signed the National Strategy for Conservation of Australia's Biological Diversity (Commonwealth of Australia 1996)that establishes the goal of conserving biological diversity and maintaining ecological processes and systems. Maintaining biodiversity is not only about protecting flora and fauna in nature conservation reserves, it is also about wise use of biological resources outside reserves and safeguarding the life-support systems of earth.

Interdependence

Ecological processes are interconnected with physical and biological systems, food webs and natural cycles. Being interconnected and interrelated requires an understanding and appreciation that affecting or managing one part of the environment may affect one or a number of other parts. Research has demonstrated that these interrelated and interdependent systems can be finely balanced.

Precautionary principle

The precautionary principle provides a means of considering environmental impacts and making decisions in a cautious way, where a high value element of the environment might be affected, and there is a lack of knowledge, or insufficient knowledge, or certainty about potential impacts and management of impacts and cumulative effects.

Prevention of pollution

A primary responsibility of the EPA is to make recommendations to prevent pollution of the environment so that alterations to the environment do not cause unacceptable detriment or degradation of the environment and its beneficial uses.

5. Planning Strategy Options

The North-East Corridor Extension Strategy suggests three planning strategy options for settlement over the study area: Options A, B and C.

Option A - New Towns, focuses development into two new towns, while retaining the planned growth of Bullsbrook and rural land and open space in between. Neaves is situated south of Neaves Road and Chittering situated between the Great Northern Highway and the Perth-Darwin Highway, at the northern end of the study area.

Option B - Expanded Towns, focuses development in a nodal manner, by expanding the existing settlements of Bullsbrook, Chittering (as described for Option A), North Bullsbrook and Upper Swan.

Option C - A Rural Living Pattern, provides for four small villages and two rural living areas. The villages are proposed to be situated at Bullsbrook, Neaves, Bullsbrook East and Upper Swan, with rural living at Chittering and Sawpit. In this scenario Bullsbrook would act as the district centre for the other villages and rural living areas.

The Pearce Strategic General Industrial Estate and Perth-Darwin Highway alignments are proposals common to, and influencing the planning of each of the three options. The environmental implications of these proposals have not been discussed in detail in the draft Strategy, however they appear to have significant environmental implications associated with them. The EPA has therefore provided advice in relation to these proposals as described in 7.1 and 7.2 below.

The Pearce Strategic General Industrial Estate, Perth-Darwin Highway alignments and three options are identified in Figure 2.

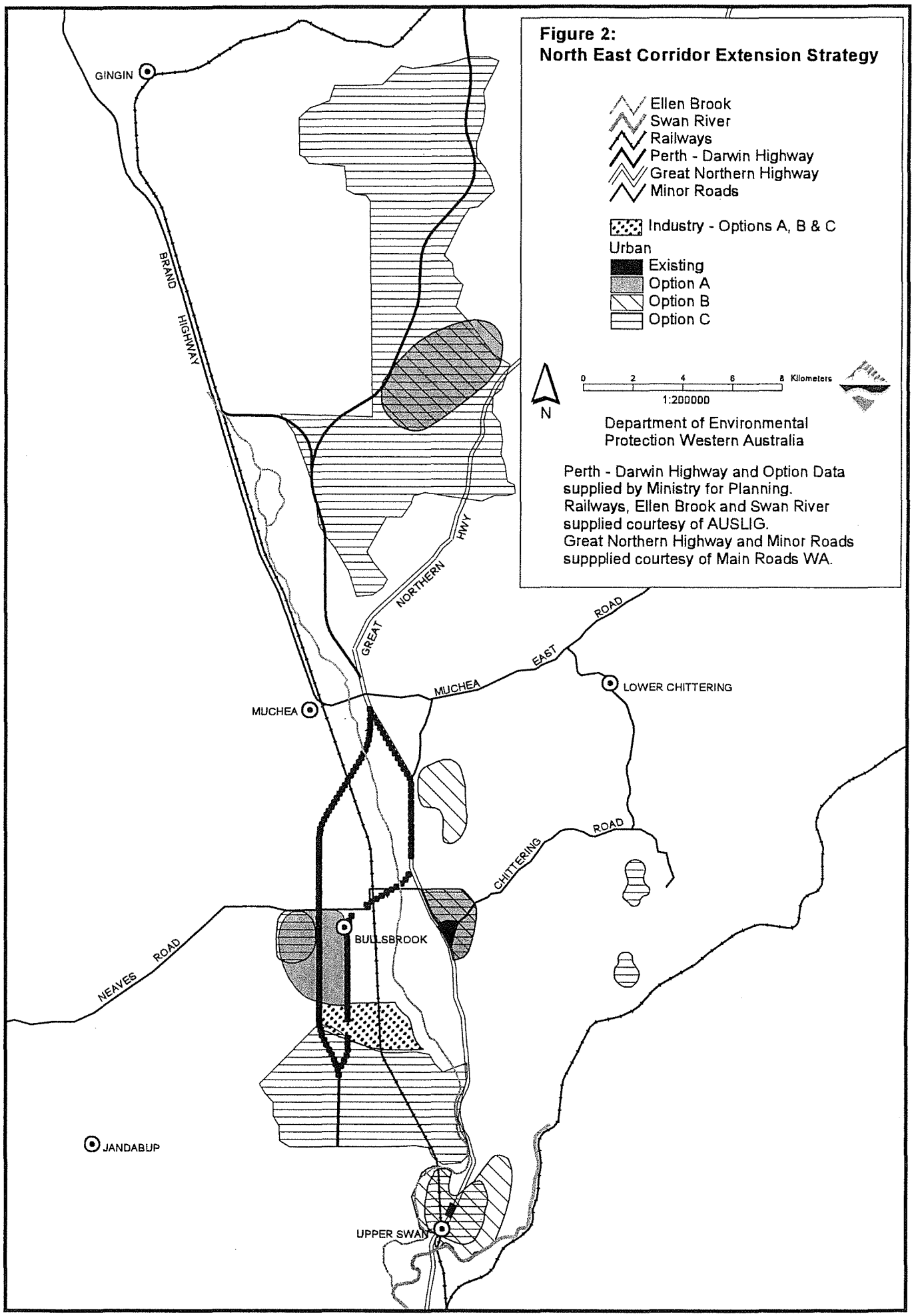

Figure 2. North-East Corridor Extension Strategy - the proposals.

6. General Environmental Considerations

This section addresses the major environmental issues relevant to the draft Strategy, and the EPA's recommendations on these issues.

The EPA believes regional landuse planning can play a major role in natural resource management and the protection of environmental values. The EPA supports the need for strategic planning in the area.

Strategic planning should be based on sound environmental information, a detailed consideration of the impacts, (locally, regionally and cumulatively), consistency with approved policies and, if necessary, propose detailed management measures which meet appropriate environmental objectives, accompanied by monitoring to ensure objectives are met. Plans should be developed which are sensitive to constraints and realise opportunities. This process should be undertaken in an integrated and coordinated fashion and be finalised before statutory planning (rezoning) and development occurs. The EPA appreciates that it is difficult to achieve this ideal and often this level of detail may only be achieved at later stages of planning. In reality there is always pressure for development and landowners can seek to subdivide their land at any time.

The EPA considers that there are some key environmental issues associated with the land use proposals outlined in the draft Strategy which influence the environmental acceptability of development proposed in the study area. These issues include:

i) Native vegetation;

ii) Specially protected fauna;

iii) Wetlands;

iv) Watercourses;

v) Surface water quality and quantity;

vi) Groundwater quality;

vii) Noise;

viii) Air quality; and

ix) Public risk and hazard - gas pipelines.

It is important to recognise that native vegetation, fauna, wetland and watercourse protection and surface and groundwater quantity and quality are interrelated. It is critical in the management of the catchment and land uses to sustain the processes that support these environmental factors.

The EPA notes that the draft Strategy identifies the majority of these issues and areas of high conservation value and states that "if development is to affect an area of significant conservation value, management measures would be necessary to reduce and control the impact as far as is practicable." However, the EPA considers that, while this is sometimes suitable, environmental impacts can not always be managed and it may be more appropriate to consider alternative sites for such a development. Appropriate planning mechanisms should be implemented to identify areas of high conservation value that should not be considered for development.

6.1 Native vegetation

The study area contains whole or part of 25 regionally significant bushland areas identified in the draft *Perth's Bushplan* (Government of WA 1998). This includes areas of native vegetation in private and government ownership, managed for a variety of purposes.

A general recommendation (5.10) in the draft *Perth's Bushplan* states "that there be a general presumption against clearing bushland containing threatened ecological communities or representation of vegetation complexes of which less than 10 percent remains in the Perth metropolitan Swan Coastal Plain." Within the study area of the draft Strategy this applies to the majority of the remaining vegetation on the heavier soils of the eastern side of the Swan Coastal Plain.

Also contained within the draft Strategy area, but outside of the Swan Coastal Plain portion of the Perth Metropolitan Area, and thereby outside of the study area of *Perth's Bushplan*, a number of bushland areas are contained within CALM managed land and/or System 6 reserves (DCE 1983) and are also considered regionally significant. Examples are the Walyunga National Park, Needonga and Chittering Lakes, and Mound Springs in Muchea.

The study area also contains a number of threatened ecological communities identified by the Department of Conservation and Land Management's Western Australian Threatened Species Unit (English and Blyth 1997). These areas are considered regionally significant.

The EPA recognises that the draft Strategy identifies "remnant native vegetation and bushland, including Declared Rare Flora, priority flora or threatened ecological communities; and national parks or nature reserves" as areas of high conservation value and environmental significance.

The draft Strategy also states that "there should be a general presumption against the clearing of remnant vegetation and where appropriate, a requirement to increase vegetation cover as part of development." This statement is strongly supported by the EPA.

The EPA considers that these areas should be excluded from development through reservation or inclusion in public open space and managed for conservation. It is also recognised that some areas of native vegetation considered worthy of inclusion in the conservation estate, may remain in private ownership. The retention of native vegetation on private lands is also considered advantageous and it is important that development is sensitive to the management of natural habitat. Further assessment and evaluation of remnant vegetation within the study area should be undertaken as part of more detailed planning required ahead of land use changes within the study area.

6.2 Specially protected fauna

The draft Strategy study area contains the two remaining habitats of Australia's most critically endangered vertebrate, the Western Swamp Tortoise (*Pseudemydura umbrina*), at the Twin Swamps Nature Reserve and the Ellen Brook Nature Reserve. This limited available habitat leaves the Western Swamp Tortoise particularly susceptible to impacts from intensification of development in the area, fire, predation by foxes and other predators, and changes in water quality and quantity in the Reserves.

The EPA released the *Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998* (EPA 1998a) in order to address these threats and to aid in protection of the Western Swamp Tortoise's habitat. After much public comment the EPA is currently redrafting the environmental protection policy to outline the principles and objectives for protection of the habitat of the Western Swamp Tortoise.

The draft Strategy identifies "areas thought to be the habitat of Specially Protected (Threatened) Fauna such as the Western Swamp Tortoise" as areas of high conservation value and environmental significance. The EPA stresses the critical importance of the protection of these habitat areas from off-site impacts. An extremely careful approach to land use planning within the surface and groundwater catchments of the nature reserves is crucial, as is the management of other direct impacts resulting from human activities and population pressures.

The Department of Conservation and Land Management is investigating other areas with the potential to provide additional suitable habitat for the Western Swamp Tortoise. The EPA has been notified that the Western Swamp Tortoise Recovery Team is examining locations within the general vicinity of the proposed Neaves townsite that may provide suitable habitat.

6.3 Wetlands

A large portion of the study area, between the Gnangara Mound and the Darling and Dandaragan Plateau, is wetland. These wetlands have been mapped by the V & C Semeniuk Research Group (2000), and are shown to be largely palusplain, with areas of sumpland, floodplain, lakes and dampland.

The EPA places a great importance on the wetlands remaining on the Swan Coastal Plain, considering 80% are estimated to have been lost, and expects the remaining wetlands to be managed according to the principles of ecologically sustainable development regardless of land use or activity (EPA 2000b).

A number of wetlands in the study area are protected from unauthorised filling, excavation, mining, effluent disposal and drainage, under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (Government of Western Australia 1992). This Policy is currently being updated with the recent release for public comment of the draft *Environmental Protection (Swan Coastal Plain Wetlands) Policy 2000* (EPA 2000c).

The EPA recognises that the draft Strategy identifies wetlands, in particular those subject to an Environmental Protection Policy, and conservation category wetlands, as areas of high conservation value and environmental significance.

The EPA recommends that further evaluation of wetlands should be undertaken as part of more detailed planning required ahead of land use changes within the study area. Discrepancies between different datasets as well as errors in wetland classification have been recognised by the WRC and DEP. The EPA considers that the evaluation of wetlands and consideration of future development should be conducted in a manner that is consistent with EPA Bulletin 686 (EPA 1993) and accepted by the WRC. Bulletin 686 provides detailed guidance on how to determine the management category of a wetland from which the management objectives can be determined. These management objectives should then be reflected in any proposal for land use change that may affect the wetlands and their catchments.

Subject to accepted re-evaluation, the EPA considers that all Conservation category sumpland and dampland wetlands and their buffers should be protected and managed for conservation purposes. These wetlands and their buffers should not be used for drainage purposes or be encroached by roads. The EPA recommends a minimum buffer of 50 metres or 1 m AHD, which ever is largest. The paper "Guidelines for design of effective buffers for wetlands on the Swan Coastal Plain" Davies PM and Lane JAK (1995) should also be used to assist in establishing appropriate wetland buffers. There is also an important need to provide buffers which recognise the potential health and amenity impacts of nuisance insects such as midge and mosquitoes which may be associated with some wetlands. The EPA has produced a Guidance for the Assessment of Environmental Factors on Management of Mosquitoes by Land

Developers (EPA 2000d) which may assist in addressing this issue. The determination of appropriate wetland buffers should occur as part of detailed planning.

6.4 Watercourses

The EPA believes that ecologically viable, vegetated and physically functional multiple use corridors along watercourses are essential to:

- minimise soil erosion, nutrient loss and weed invasion;
- increase stream vegetation cover, reducing water temperatures and increasing dissolved oxygen levels, which are important for improving habitat diversity and improving water quality;
- decompose organic matter;
- remove nutrients through oxidation and biological uptake; and
- provide linkages between area of conservation value and provide habitat for a wide range of terrestrial and aquatic native species, which will in turn add to the amenity of the area (EPA 2000e).

The EPA acknowledges that the draft Strategy identifies watercourses, such as the Ellen Brook, Brockman and Avon Rivers and their associated riparian vegetation, as areas of high conservation value and environmental significance.

There is a need to carefully consider existing watercourses, in particular, tributaries of the Ellen Brook and the Swan River, and their use as multiple use corridors and to include requirements for restoration, revegetation and reservation of an appropriate corridor width. These corridors need to incorporate the watercourse and its floodplain, as well as the riparian, intermediate and dry land zones. The EPA recommends that multiple use corridor widths should be determined and agreed at the local structure planning stage.

The following *minimum* buffer width guidelines are recommended for watercourses on private land where the end use is not for public water supply:

- watercourses - permanent water 50 metres
- watercourses - seasonally flowing 30 metres
- watercourses - flow in response to specific rain events 10 metres.

Measurements should be made from the edge of riparian vegetation or the edge of the 1 in 100 year floodway where the flood plain is wide (EPA 1997). The above buffers are the recommended minimum, and an analysis of slope, soil drainage and fringing vegetation may require greater and variable buffer widths.

6.5 Surface water quantity and quality

Nutrient and drainage management and potential impacts on wetlands, groundwater and the Swan and Canning Rivers are critical issues which require considerable attention prior to changes in land use within the area. While improvements in the water quality of wetlands, groundwater and the Swan and Canning Rivers are expected through improved land use management practices, it is crucial that changes in land use will not lead to unacceptable impacts on groundwater resources, wetlands and the Swan and Canning Rivers. The EPA considers that a precautionary approach should be applied to these issues and that proposals for

changes to land use should not occur until it has been demonstrated that drainage and nutrients can be managed to acceptable levels.

The *Environmental Protection (Swan and Canning Rivers) Policy 1998* presents the position of Government in protection of the catchment and waterways of the Swan and Canning Rivers (Government of Western Australia 1992). It will need to be demonstrated that development proposed within the catchment is consistent with the environmental objectives of the EPP.

The Swan Canning Clean-up Program Action Plan (SCCP) (SRT 1999) was developed to reduce algal blooms in the Swan and Canning Rivers and identifies actions, recommendations and targets for nutrient reduction. The SCCP identifies the Ellen Brook catchment to be the highest contributing catchment of dissolved phosphorus and nitrogen. To assist in managing the Ellen Brook catchment the SCCP recommends control over nutrient-generating and land degrading enterprises, including reduced erosion and incorporation of Water Sensitive Urban Design principles; the use of slow release fertilisers; restoration of watercourses; the construction of artificial wetlands to strip nutrients before the waters reach natural watercourses; and clearing controls. The SCCP recommends that some or all of these options should be included in a comprehensive Catchment Management Plan.

The Ellen Brook Integrated Catchment Group has recently released the Draft Ellen Brook Catchment Management Plan (CMP) for public comment (EBICG 2000). To facilitate the development and implementation of improved land management practices, the CMP divides the catchment into smaller Environmental Management Units (EMUs). These EMUs are defined in terms of drainage subcatchments, wetland associations, geomorphology, soil types, land uses and land management practices. Each EMU is described and assessed for land capability, and land management indicators and strategies are recommended to minimise impacts from that EMU. The CMP also proposes a number of target achievements for implementation over 10 years in reference to management themes identified, identifying the steps to achieve the targets and the people responsible for those steps.

As part of the National Pollutant Inventory, the DEP engaged consultants to develop an inventory of runoff quality, with particular reference to nitrogen and phosphorus loadings, for the Swan-Canning catchment (Acacia Springs Environmental 2000).

This inventory confirms the Ellen Brook catchment to be the highest contributing catchment of nitrogen and phosphorus to the Swan and Canning Rivers system. It must be stressed that this work provides indicative values only and should be used as a decision support tool rather than being viewed as a definitive study, with results for nutrient export likely to be conservative.

Despite considerable attention over the last decade, there still appear to be considerable questions regarding the efficacy of current "best practice" measures to manage drainage and nutrient export from large scale urban and industrial development to acceptable levels over the longer term. Given the nature of the soils and hydrology of the draft Strategy area, it is therefore considered that an innovative and strategic approach to this issue will be necessary for the proposed landuse to be acceptable, with a likelihood that a combination of both "catchment management" and "engineering" measures will be required. This will also require the formulation and implementation of strategies for development, drainage and nutrient export which are tailored to the characteristics of the catchment.

As result of this, the EPA considers that further work needs to be undertaken to demonstrate that the changes in land use proposed can be adequately managed to meet the objectives and targets identified within the SCCP and *Environmental Protection (Swan and Canning Rivers) Policy 1998.*

It is considered that the relatively long timeframe associated with the implementation of the draft Strategy allows for considerable and comprehensive studies and monitoring to be undertaken prior to rezoning.

Proclaimed and proposed surface water pollution control areas

The WRC has published a Water Quality Protection Note on Land Use Compatibility in Public Drinking Water Source Areas (WRC 1999). This outlines the compatibility of different land uses in Priority 1, 2 and 3 areas. Priority 1 (P1) source protection areas are defined to ensure there is no degradation of the water source and are declared over the highest quality drinking water, these areas are typically in Crown ownership and land development is generally not permitted. Priority 2 (P2) source protection areas are defined to ensure there is no increased risk of pollution over land of low intensity development, such as rural. Protection of public water supply sources is a high priority in these areas. Priority 3 (P3) source protection areas are defined to minimise the risk of pollution of the water source and are declared over land where water supply needs coexist with other land uses such as residential, commercial and light industrial development.

A large proportion of the draft Strategy study area, and the whole or part of each of the proposals identified in Options A, B and C are in a proposed Priority 3 Surface Water Pollution Control Area. Residential and commercial development is compatible with the protection of a Priority 3 water resource, however, industrial development is limited to light industrial land use.

6.6 Groundwater quality

The study area includes part of the Gnangara Mound, Perth's largest source of fresh groundwater. In order to protect the groundwater and environmental features of the Mound a number of underground water pollution control areas have been established and prioritised in order to control landuse at the surface. The Underground Water Pollution Control Area (UWPCA) boundaries are currently subject to review by the Western Australian Planning Commission in conjunction with the Water and Rivers Commission and has been reported in the Gnangara Land Use and Water Management Strategy (GLUWMS) (WAPC & WRC 1999). The key outcomes proposed in GLUWMS are a change in the boundary of the underground water pollution control areas; some changes in Priority allocation; preferred land use and zoning; and an implementation strategy.

The EPA has previously published advice on the GLUWMS report (EPA 1999b). Recommendations by the EPA include the revision of GLUWMS to be consistent with the objectives of the revised *Environmental Protection (Gnangara Mound Crown Land) Policy*; the adoption of a precautionary approach in plotting UWPCA boundaries; the retention of Precinct 29; and consistency with the Gnangara Park Concept Plan.

The WRC's Water Quality Protection Note on Land Use Compatibility in Public Drinking Water Source Areas (1999) also applies to the priority 1, 2 and 3 areas of underground water pollution control areas. However, the EPA recognises that the water resources of the Gnangara Mound have been excluded from any development in the draft Strategy.

Groundwater is also an important contributor to wetlands and rivers. The principles outlined above in relation to nutrient export from surface water are also applicable to groundwater quality, especially in low lying areas where groundwater is often less than 5 metres from the surface. While groundwater contribution to wetlands and rivers often occurs throughout the

year, the quantity of groundwater entering watercourses is substantially less than that of winter surface water runoff (SRT 1999).

The vulnerability of groundwater to become contaminated from surface land uses is determined by a number of physical factors including the depth to the watertable, sediment lithology, climatic factors and the nature of contaminants. Most importantly, where the watertable is close to the surface there is less opportunity for contaminants to be filtered by sediments before reaching the groundwater, and contaminants are filtered to a greater extent by fine-grained sediments such as silt or clay than by coarse-grained sediments such as sand or gravel. The EPA has considered the vulnerability of groundwater to contamination mapping by Appleyard (1993) in the evaluation of the proposals put forward in the draft North-East Corridor Extension Strategy.

6.7 Noise

The two major contributors of noise in the study area are from aircraft noise in the vicinity of the Pearce Airforce Base in Bullsbrook, and from major road and rail routes. Subject to the application of appropriate buffers and noise attenuation in housing and other sensitive premises where necessary, the EPA does not consider this to be a limiting factor in the acceptability of the proposed development areas but an important consideration in the design of development in later planning stages.

Pearce Airforce Base

Noise associated with the Pearce Airforce Base in Bullsbrook, is managed through application of Australian Standard 2021-1994 which classifies Australian Noise Exposure Forecast (ANEF) zones for residential building types as follows:

- Acceptable - Less than 20 ANEF
- Conditional - 20 to 25 ANEF
- Unacceptable - Greater than 25 ANEF

The Standard provides guidance on building construction against aircraft noise in relation to those areas classed as Conditional, but recommends against proceeding with construction in Unacceptable zones.

This is generally applied by the Western Australian Planning Commission in assessment of development proposals, subdivisions and rezonings. Where development is proposed in 'conditional' areas, appropriate building guidelines should be developed and implemented.

Road and rail

The EPA recognises that noise associated with road and rail transportation is one of the most pervasive sources of noise in our community. The mobile and distributed nature of the source means that it is difficult to control through regulations. The *Environmental Protection (Noise) Regulations 1997* define acceptable noise levels for different types of land use. Although the noise criteria are relevant to defining appropriate amenity for land use planning, the regulations specifically exclude road and rail transportation noise.

However, there is a need for consistent noise criteria for transportation noise which can be used as the basis for planning decisions and environmental impact assessments. The EPA's Preliminary Draft Guidance No. 14 Version 3 *Road and Rail Transportation Noise* (DEP 2000) has been developed in consultation with Main Roads Western Australia, Westrail, Department

of Transport and the Ministry for Planning, as part of a possible whole of Government approach to dealing with transportation noise.

The noise criteria in Preliminary Guidance No. 14 which have been developed and the availability of control measures are different in the contexts of: proposed noise-sensitive developments (residences, hospitals and the like) near existing road or railway transportation routes; new transportation infrastructure (road or railway) near existing noise-sensitive premises; and traffic expansion on existing road or railway infrastructure. In all cases, protection of amenity of adjacent land use is required and the "as low as reasonably practicable" principle should apply.

The EPA recommends that the Preliminary Draft Guidance No. 14 be considered in development in the North-East Corridor Extension to:

- achieve acceptable noise levels inside new residences and other noise sensitive premises constructed adjacent to major road or rail transportation routes;
- influence the land use planning process such that road and rail transportation noise is taken into account in the planning, design and construction of new developments;
- ensure that the noise emissions from the road or rail reserve are minimised as far as is practicable through appropriate design;
- ensure that the noise levels inside and outside existing noise-sensitive premises do not exceed acceptable levels;
- ensure that the noise levels inside noise-sensitive premises associated with the proposed traffic meet acceptable levels, or that the degree of increase in noise levels is of low significance; and
- ensure that the noise emissions of the vehicles associated with a specific proposal, for example the proposed industrial site, comply with "best practice".

The EPA recommends that ground vibration resulting from trains passing in close proximity to residences should be managed by the provision of appropriate setbacks.

6.8 Air Quality

Due to its location, rather than necessarily any polluting activity within, the north-east corridor is notably susceptible to air quality problems. Photochemical smog is the main problem, with the geographical setting and meteorological conditions pushing smog into the north-east corridor. During the *Perth Photochemical Smog Study* (1992-1996) (Western Power Corporation & Department of Environmental Protection 1996) regular exceedences of the National Environmental Protection Measure standards for ozone were recorded at the Caversham and Rolling Green monitoring stations.

The Perth Photochemical Smog Study identified two well defined classes of smog-related events associated with the formation of low pressure troughs and temperature inversions. One of these explains the pattern of peak concentrations in the eastern metropolitan area as corresponding to days when the trough moves inland, and recirculates the smog plume back across the metropolitan area where it receives a boost from fresh afternoon emissions.

The Perth Air Quality Management Plan (DEP 2000) identifies a number of strategies and actions for land use and transport planning in order to contribute to the achievement and maintenance of acceptable air quality. In its assessment of Options A, B and C, the EPA has

considered the impact of transport on air quality, including the availability of public transport, distances and trips travelled.

The EPA considers that the dispersed population pattern in the proposed Option C does not meet the objectives of the *Perth Air Quality Management Plan* as it would encourage low development densities that would make the provision of an effective public transport system difficult, and would account for relatively long trips for residents.

The EPA does not consider the air quality issues associated with the proposed developments to be acute. The EPA is nevertheless concerned that population numbers and therefore population exposure is increasing in the portion of Perth's airshed subject to some of the highest photochemical smog levels. There is an increased risk of adverse health effects due to greater population exposure to elevated concentrations.

The EPA understands that the draft Strategy recognises the air quality issue and recommends that an air quality study should be undertaken as part of any rezoning process. This study should be conducted to encompass the whole of the draft Strategy study area and include a monitoring study to provide the best estimation of the increased exposure and health risk.

The EPA also recommends that priority be given to the key recommendations of the *Perth Air Quality Management Plan* and that in the implementation of any development the adoption of higher density housing, energy efficiency principles in building design, construction and lifetime operating requirements should be actively encouraged. In addition, home-based employment and business should be actively encouraged in order to minimise inter-regional travel requirements. Regular and effective public transport and provisions for cyclists should be an integral part of the developments.

6.9 Public Risk and Hazard - Gas Pipelines

The Parmelia Natural Gas Pipeline and the Dampier to Bunbury Natural Gas Pipeline traverse the study area. The EPA Draft Guidance No. 50 *Achieving EPA Risk Criteria for development in proximity to existing and proposed High Pressure Gas Transmission Pipeline* (EPA 2000) examines the risk associated with gas pipelines and recommends appropriate buffer distances for sensitive developments, such as hospitals, schools and aged car centres, for residential, and for commercial and industrial developments . Where the two pipelines exist within the same easement, the recommended buffer to sensitive development is 200 metres and to residential development, 60 metres (measured from the centre line of the closest gas pipeline). Where the pipelines are separate, the recommended buffer distances are reduced to 160 and 45 metres respectively.

In the North East Corridor Extension Strategy, the only development proposed in the vicinity of the gas pipelines is the Neaves New Town of Option A and the Neaves Village and Rural Living area of Option C. Any development in the vicinity of the pipelines should be designed to include buffers as described in the EPA Draft Guidance No. 50.

7. Comments on Proposals and Evaluation of Options

This section includes specific comments on the environmental issues associated with each of the key land use proposals and draft Strategy options.

7.1 Pearce Strategic General Industrial Estate

The State Planning Strategy (WAPC 1997) has identified the need to make provision for strategic industrial sites in order to 'provide for the likely growth of downstream processing and value adding industries.' This has been translated via a number of planning documents resulting in the proposed Pearce Strategic General Industrial Estate in the draft Strategy.

While a number of planning factors support its proposed location, the EPA has a number of environmental concerns with the location of the Pearce Strategic Industrial Estate, as follows:

Remnant vegetation

Small remnants of vegetation remain on the proposed site. These remnants have been mapped as the Yanga and Bassendean - North Vegetation Complexes. While 10% of the original extent of the Yanga Vegetation Complex (within the Swan Coastal Plain portion of the Perth Metropolitan area) has been identified in the draft *Perth's Bushplan*, it is unlikely that the 10% goal will be able to be achieved. Therefore, any remnants should be protected from development in the detailed planning of the site.

Protection of specially protected fauna

The Industrial Estate immediately abuts the Policy area of the *Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998* and is located less than a kilometre from the Twin Swamps Nature Reserve. The Industrial Estate is likely to increase vehicle movement and other human pressures in the vicinity of the Twin Swamps Nature Reserve.

Wetland and watercourse protection

The majority of the proposed site for the Industrial Estate is wetland, mapped as palusplain (Semeniuk, 2000), with several watercourses traversing the site and draining into the Ellen Brook. The area also contains a number of wetlands protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992.*

Drainage of the site is into Ellen Brook which is as close as 400 metres at the eastern end.

Surface water quality and quantity

The Acacia Springs Environmental NPI report (2000) shows that parts of the proposed site contribute to extreme export of nitrogen and phosphorus (over 3.0 kg/ha/yr). While it is understood that a change of land use to industrial could improve this situation, it also has the potential to add further problems considering the introduction of other pollutants and existing site conditions.

The whole area is within a proposed Priority 3 Surface Water Pollution Control Area. WRC (1999) define heavy industrial land use to be incompatible with P3, and light or general industrial land use compatible provided the development is "connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy".

Groundwater quality

Although the proposed site is situated off the groundwater mound, it is over an area mapped partly as highly vulnerable and the remainder moderately vulnerable to groundwater contamination (Appleyard 1993). While the mapping is generalised, it gives an indication of the risk associated with situating industrial land use at this proposed site and is reflective of the high water table and sandy soils.

Industrial buffers

In the location of a general industrial site the EPA recommends that the need for the separation of incompatible landuses, consistent with protecting the health and amenity of residents is recognised.

The EPA's Draft Guidance No. 3 *Industrial - Residential Buffer Areas (Separation Distances)* (EPA 1998b) provides recommended buffers for a number of industrial uses. This Draft Guidance is also referred to by the DEP when attaching conditions to Licences and Works Approvals issued under Part V of the EP Act.

Conclusion

The EPA considers that alternative locations for the strategic general industrial site should be examined which do not put remnant vegetation, habitat areas, wetlands or surface and groundwater quality at risk. While it is noted that a number of site selection studies have been undertaken to indicate the approximate location of this site (BSD Consultants 1996 and Sinclair Knight Mertz 1997), the evaluation of the environmental impacts associated with industrial land use is considered to have been minimal. If this particular site is to be further considered, strong demonstration that the above issues can be managed will be necessary before further planning for the site occurs.

It is considered that on evaluation of the environmental impacts associated with industrial land use at the proposed location, the level of management required to make the impacts acceptable would be likely to render the proposal impractical.

7.2 Perth - Darwin Highway

The proposal by Main Roads Western Australia and Ellenbrook Management Pty Ltd for the *Route alignment for Perth to Darwin National Highway and Fast Transit Route, and excision of land from State Forest No. 65 and Priority 1 Source Protection Area for urban development* was formally assessed by the EPA in 1994 (EPA 1994). The routes assessed by the EPA at that time terminated at Muchea. Environmental conditions were documented by the Minister for Environment in Statement No. 370 to address the environmental factors of groundwater protection, urban conservation, wetland protection, pollution and drainage management and noise management. Main Roads Western Australia is legally bound by the conditions outlined in Statement No. 370.

However, the current preferred alignments as represented in Main Roads Western Australia (1999) *Perth-Darwin National Highway (Bullsbrook to Bindoon) Alignment Selection Study Report*, and the draft Strategy appear to differ from that assessed by the EPA in 1994. The EPA did not support the Option 3 alignment of which part equates to the current 'Outer Bullsbrook' route. The EPA's previous assessment and advice (Bulletin No. 754) should be considered in determination of a preferred option and Main Roads Western Australia will need to demonstrate that the issues identified in the EPA report and the Minister for the Environment's conditions will be addressed. Where the route differs from that assessed by the EPA in 1994, the Perth-Darwin Highway is likely to require further assessment by the EPA.

The remainder of the Perth-Darwin Highway, from Muchea north, is yet to be subject to the environmental impact assessment process, and has not yet been referred to the EPA. The Department of Environmental Protection has had input into the current preferred alignment through the Steering Committee for the 'Route alignment Perth-Darwin Highway, Maralla Road Bullsbrook to Calingari Road Bindoon'.

7.3 Evaluation of Options A, B and C

A summary of the major environmental impacts associated with the three options for development, presented in the draft Strategy, is included in Table 1. In view of its comments in Section 7.1 and 7.2 above, the EPA has removed the proposed Pearce Strategic General Industrial Estate and Perth-Darwin Highway alignments from the evaluation of these options and has focussed on the urban and rural living proposals.

The EPA considers the Neaves townsite and village in Options A and C to be inappropriate, mainly due to the proportion of wetlands and watercourses at the site, very high nutrient export potential within the area, very high groundwater vulnerability to contamination and potential habitat for Western Swamp Tortoise population establishment.

Option C is considered unfavourable overall due to the potential sprawl of rural living development over the corridor which could contribute to the air quality problems. Option C is also likely to lead to a relatively larger area of clearing of remnant vegetation considered valuable for biodiversity and nutrient retention properties. The proposed Sawpit rural living area is likely to have considerable impacts on the Western Swamp Tortoise habitat at Ellen Brook Nature Reserve by increasing population density in the surface water catchment of the wetlands providing habitat.

Following an examination of the environmental impacts associated with each of the three options proposed (refer Table 1), the EPA's preference lies with Option B, provided additional considerations are accounted for in delineating the boundaries of development and management of environmental impacts associated with the proposed expansion of the Upper Swan townsite.

The proposed expanded Upper Swan townsite could lead to considerable impacts on the Western Swamp Tortoise Habitat and regionally significant vegetation associated with the Ellen Brook and Ellen Brook Nature Reserve. Setbacks from the Western Swamp Tortoise habitat, Ellen Brook and the Swan River, and careful drainage and nutrient management would be required in managing the expansion of the existing town. CALM has indicated a buffer of about 1 kilometre to be necessary from the reserves providing habitat for the Western Swamp Tortoise, for urban development. This may alter the size of the area able to be developed in an environmentally acceptable manner. Additional growth could be provided for in the area of Chittering where a townsite is proposed in Option B, and where there are fewer environmental constraints for urban development and supplementary rural living.

It should be noted however, that development intensification at Bullsbrook and Chittering will need to demonstrate that nutrient and drainage can be managed effectively in the long term.

8. Future role of the EPA

The EPA has a statutory role when it considers referrals (scheme amendments, subdivisions and development proposals), pursuant to Section 38 and 48A of the Environmental Protection Act.

The rezoning of land within the area to facilitate development will require referral to the EPA under Section 48A of the Environmental Protection Act. Additionally, subdivision proposals for existing zoned land not previously assessed by the EPA may be referred by the WAPC under Section 38 of the Act.

Currently, the majority of the proposal areas in the Perth Metropolitan Region are zoned rural and would require rezoning to either industrial or urban under the Metropolitan Region Scheme (MRS). In the Shire of Chittering and City of Swan town planning schemes the majority of the

Table 1. Evaluation of Options A, B and C

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Remnant vegetation	Maintain the abundance, species diversity and geographic distribution of vegetation.	Neaves	largely cleared, some remnants Bassendean North and Yanga vegetation complexes, no TECs recorded		largely cleared, some remnants, Bassendean North vegetation complex, no TECs recorded
		Chittering	about 1/4 vegetated, Mogumber South vegetation complex, no TECs recorded	about 1/4 vegetated, Mogumber South vegetation complex, no TECs recorded	includes some large remnants, part of Nature Reserve in north, Mogumber South, Moondah, Yalanbee in Low Rainfall, Karamel South and Reagan vegetation complexes, TECs recorded in southern area
		Bullsbrook	include Perth's Bushplan site 88, 89 and 294 including TEC, some additional remnants	include Perth's Bushplan site 88, 89 and 294 including TEC, some additional remnants	include Perth's Bushplan site 88, 89 and 294 including TEC, some additional remnants
		Bullsbrook North		Perth's Bushplan sites 292, 291 additional remnants Reagan vegetation complex, TEC located in adjacent Bullsbrook Nature Reserve	

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Remnant vegetation		Upper Swan		includes parts of Perth's Bushplan sites 301, 300, 302, Ellen Brook Nature Reserve (incl. TECs)	adjacent to Perth's Bushplan sites 301, 300, Ellen Brook Nature Reserve (incl. TECs)
		Bullsbrook East			northern area 3/4 vegetated, southern area 1/3 vegetated, Helena in Low to Medium Rainfall and Yalanbee in Low Rainfall vegetation complexes, no TECs recorded
		Sawpit			includes Perth's Bushplan sites 399, 298, 13, 400 (Twin Swamps Nature Reserve, TECs), 296 and adjacent to 300 and 301 other remnants Bassendean North, Bassendean North Transition and Yanga vegetation complexes
Fauna	Maintain the abundance, species diversity, geographic distribution of fauna and protect Specially	Neaves	potential habitat for Western Swamp Tortoise populations		potential habitat for Western Swamp Tortoise populations
		Chittering	no known direct impacts on fauna	no known direct impacts on fauna	no known direct impacts on fauna

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Fauna	Protected (Threatened) Fauna consistent with the provisions of the Wildlife Conservation Act 1950.	Bullsbrook	no known direct impacts on fauna	no known direct impacts on fauna	no known direct impacts on fauna
		Bullsbrook North		no known direct impacts on fauna	
		Upper Swan		includes policy area of the Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998	includes policy area of the Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998
		Bullsbrook East			no known direct impacts on fauna
		Sawpit			includes policy area of the Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998
Wetlands	Maintain the integrity, functions and environmental values of wetlands	Neaves	Over half of area wetland - palusplain and floodplain some conservation (C) management category some EPP lakes at southern end		one third of area wetland, mostly floodplain, some palusplain, C, R and M
		Chittering	no wetlands mapped	no wetlands mapped	very few wetlands, some palusplain and sumpland, C and R

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Wetlands		Bullsbrook	some palusplain, C and resource enhancement (R)	some palusplain, C and R	some palusplain, C and R
		Bullsbrook North		some palusplain at north and west fringes, R and multiple use (M)	
		Upper Swan		two thirds wetlands including floodplain, palusplain, sumpland of C, M and R, EPP lakes	almost all wetland including floodplain, palusplain, sumpland of C, M and R, EPP lakes
		Bullsbrook East			no wetlands mapped
		Sawpit			largely wetlands including palusplain, sumpland, dampland, floodplain C, M and R EPP lakes scattered throughout
Watercourses	Maintain the integrity, functions and environmental values of the watercourses	Neaves	several creeklines and artificial channels draining into Ellen Brook		some creeklines draining into Ellen Brook
		Chittering	no watercourses mapped	no watercourses mapped	some creeklines draining into Chandala and Ellen Brooks
		Bullsbrook	artificial channel	artificial channel	artificial channel
		Bullsbrook North		creekline at northern fringe draining into Ellen Brook	
		Upper Swan		creeklines draining into Ellen Brook and Swan River	creeklines draining into Ellen Brook and Swan River

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Watercourses		Bullsbrook East			some creeklines draining into Brockman and Swan Rivers
		Sawpit			creeklines and artificial channels draining into Ellen Brook
Surface water quality and quantity	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent Environmental Protection (Swan and Canning Rivers) Policy 1998 and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy	Neaves	whole area proposed Priority 3 Surface Water Control Area, very high nutrient export modelled		whole area proposed Priority 3 Surface Water Control Area, very high nutrient export modelled
		Chittering	whole area proposed Priority 3 Surface Water Control Area, relatively low nutrient export modelled	whole area proposed Priority 3 Surface Water Control Area, relatively low nutrient export modelled	two thirds proposed Priority 3 Surface Water Control Area, relatively low nutrient export modelled
		Bullsbrook	whole area proposed Priority 3 Surface Water Control Area, high nutrient export modelled	whole area proposed Priority 3 Surface Water Control Area, high nutrient export modelled	whole area proposed Priority 3 Surface Water Control Area, high nutrient export modelled
		Bullsbrook North		whole area proposed Priority 3 Surface Water Control Area, medium to high nutrient modelled	
		Upper Swan		about half proposed Priority 3 Surface Water Control Area, high nutrient export modelled	about half proposed Priority 3 Surface Water Control Area, high nutrient export modelled

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Surface water quality and quantity		Bullsbrook East			largely proposed Priority 3 Surface Water Control Area, nutrient export not modelled from this area, expected to be relatively low
		Sawpit			largely proposed Priority 3 Surface Water Control Area, high to very high nutrient export modelled
Groundwater quality	Maintain the quantity of groundwater so that existing and potential uses, including ecosystem maintenance, are protected	Neaves	not on groundwater mound, very high vulnerability	not on groundwater mound, very high vulnerability	
		Chittering	not on groundwater mound, very low vulnerability	not on groundwater mound, very low vulnerability	not on groundwater mound, very low and some moderate vulnerability
		Bullsbrook	not on groundwater mound, moderate and very low vulnerability	not on groundwater mound, moderate and very low vulnerability	not on groundwater mound, moderate and very low vulnerability
		Bullsbrook North		not on groundwater mound, moderate and very low vulnerability	
		Upper Swan		not on groundwater mound, moderate vulnerability	not on groundwater mound, moderate vulnerability
		Bullsbrook East			not on groundwater mound, low vulnerability

ENVIRONMENTAL FACTOR	EPA OBJECTIVE	LOCATION	OPTION		
			Option A New Towns	**Option B Expanded Towns**	**Option C Rural Living**
Groundwater quality		Sawpit			small western parts proposed Priority 3 UWPCA, very high, high and moderate vulnerability
Noise	Protect the amenity of nearby residents from noise and vibration impacts by ensuring that noise meets acceptable standards and where applicable, the criteria in the Environmental Protection (Noise)Regulations 1997	Neaves	Perth-Darwin Highway		Perth-Darwin Highway
		Chittering	Perth-Darwin Highway, Great Northern Highway	Perth-Darwin Highway, Great Northern Highway	Perth-Darwin Highway, Great Northern Highway
		Bullsbrook	Aircraft noise, Great Northern Highway	Aircraft noise, Great Northern Highway	Aircraft noise
		Bullsbrook North		no major impacts	
		Upper Swan		Great Northern Highway, Perth-Geraldton Railway	Great Northern Highway, Perth-Geraldton Railway
		Bullsbrook East			no major impacts
		Sawpit			no major impacts

proposed development areas are also zoned Rural, with some areas of Special Development, Community, Public Utilities, Rural Residential and Special Use zones. The majority of areas would require rezoning under the town planning schemes to conform with any MRS amendments.

9. Conclusion and recommendations

The north-east corridor extension study area is highly constrained by a number of environmental issues including native vegetation, wetlands and watercourses, the habitat of the critically endangered Western Swamp Tortoise, catchment management, groundwater protection, and air quality.

The EPA has considered the broad environmental impacts associated with the proposed Pearce Strategic General Industrial Estate, the Perth-Darwin Highway and the three proposed options for urban development.

9.1 Pearce Strategic General Industrial Site

The EPA has strong reservations with the existing site and suggests alternative sites should be investigated. While it is noted that a number of site selection studies have been undertaken to indicate the approximate location of this site (BSD Consultants 1996 and Sinclair Knight Mertz 1997), the evaluation of the environmental impacts associated with industrial land use is considered minimal.

In summary, the proposed Pearce Strategic Industrial Site could have the potential to pollute groundwater feeding into nearby wetlands and watercourses, contribute to nutrient and pollution problems of the Ellen Brook catchment and thus the Swan and Canning Rivers system.

It is considered that on evaluation of the environmental impacts associated with industrial land use at the proposed location, the level of management required to make the impacts acceptable would be likely to render the proposal impractical.

9.2 Perth-Darwin Highway

The EPA's previous assessment and advice (Bulletin No. 754) should be considered in the determination of a preferred alignment for the Perth-Darwin Highway. Main Roads Western Australia will need to demonstrate that the issues identified in the EPA report and the Minister for the Environment's conditions will be addressed. The differing route, from Maralla Road to Muchea is likely to require further assessment by the EPA.

The portion of the Perth-Darwin Highway, from Muchea north, is yet to be subject to the environmental impact assessment process, and has not yet been referred to the EPA.

9.3 Consideration of options

The EPA considers that, while it is in general agreement with the preferred Option B as outlined in the draft Strategy, there are several critical environmental issues which require further attention before the landuse changes proposed in the draft Strategy can be considered fully acceptable. These issues are significant, particularly those relating to the impacts of the proposed development on nutrient export and hydrology as well as Perth's Bushplan sites and threatened ecological communities. Consequently, the EPA considers that it will be necessary

to demonstrate that the land use changes proposed can be suitably modified or managed to meet EPA and WA Government objectives prior to rezoning and development.

In particular, the EPA recommends the following issues be addressed as a matter of priority:

- demonstration that nutrient and drainage can be adequately managed in the intensification of land use, consistent with the *Environmental Protection (Swan and Canning Rivers) Policy 1998* and the Swan Canning Clean-up Program Action Plan;
- demonstration that threats associated with increased human activity and population pressures in proximity to the Western Swamp Tortoise habitat areas will not affect the Western Swamp Tortoise population consistent with the *Second Draft Environmental Protection (Western Swamp Tortoise Habitat) Policy 1998*;
- the proposed expansion of Upper Swan to be carefully considered to adequately buffer and manage potential impacts on the Ellen Brook, the Ellen Brook Nature Reserve and the Swan River;
- protection of conservation areas through reservation or public open space; and
- protection of regionally significant bushland and threatened ecological communities in private ownership.

In addition to this, the EPA recommends that a number of other issues are addressed as part of more detailed planning which is required to be undertaken in the implementation of the draft Strategy. These issues include the following:

- further assessment, evaluation and delineation of conservation category wetlands;
- protection of conservation category wetlands and their buffers;
- management and restoration of watercourses;
- an air quality assessment;
- application of the Australian Standard 2021-1994 in areas subject to aircraft noise and development of building guidelines for development in 'conditional' areas; and
- assessment and management of noise and vibration impacts from road and rail to meet acceptable standards.

The EPA does not support Options A and C presented in the draft Strategy. The proposed Neaves townsite of Option A is located in an area with a high proportion of wetlands and watercourses, very high groundwater vulnerability to contamination, very high nutrient export potential within the area and has the potential to provide habitat for the Western Swamp Tortoise.

Option C, in addition to proposing urban development at Neaves, could contribute to the air quality problems due to the potential sprawl of rural living development over the corridor. Option C is also likely to lead to a relatively larger area of clearing of remnant vegetation considered valuable for biodiversity and nutrient retention properties, and increases density in the surface water catchment of the Western Swamp Tortoise habitat at Ellen Brook Nature Reserve.

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