

**Ellenbrook urban rezoning, subdivision and
development - Shire of Swan**

Sanwa Vines Pty Ltd, Homeswest, Mt Lawley Pty Ltd

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 642
August 1992**

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of \$10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
18th Floor, Allendale Square
77 St George's Terrace
PERTH WA 6000
CLOSING DATE

Your appeal (with the \$10 fee) must reach the Minister's office no later than 5.00 pm on the date indicated below.

28 AUG 1992

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Summary and recommendations

The Ellenbrook proposal is a major residential development intended to provide for a community of approximately 58,000 people. The project encompasses a site of approximately 1800 hectares in the Ellenbrook, Upper Swan, Belhus locality within the Shire of Swan (see Figure 1). The site is located 20 kilometres north east of Perth City and would accommodate in the region of 20,000 households.

The Ellenbrook site is currently zoned "Rural" under the Metropolitan Region Scheme. A major Scheme amendment seeks to rezone the majority of the site from "Rural" to "Urban Deferred" in order to permit residential development of the site, and to set aside important wetland areas for Parks and Recreation and conservation purposes.

The amendment includes land which is in the ownership of Homeswest, Sanwa Vines Pty Ltd, Multiplex Pty Ltd and Mt Lawley Pty Ltd.

Of these, Homeswest, Sanwa Vines Pty Ltd and Mt Lawley Pty Ltd are the proponents in the Public Environmental Review process.

No development can commence on the land until it has been transferred from the "Urban Deferred Zone" to the "Urban Zone" in the Metropolitan Region Scheme and an appropriate rezoning amendment to the Shire of Swan Town Planning Scheme No. 9 is completed.

A Public Environmental Review document was prepared by the proponents under guidelines issued by the Environmental Protection Authority and was subsequently released for public comment for a period of eight weeks between 20 April 1992 and 15 June 1992. Comments were sought on the proposal from the public, community groups and local and State government authorities.

Environmental assessment and the statutory planning process

The Metropolitan Region Scheme Amendment includes land owned by Multiplex Pty Ltd, located immediately to the south east of the Ellenbrook project. The land owned by Multiplex Pty Ltd is located adjacent to the Ellen Brook watercourse and submissions to this Public Environmental Review indicate the presence of an environmentally significant Mound Spring in the north west of the property. However, the proponents' Public Environmental Review document did not include consideration of the Multiplex land, including the possible Mound Spring.

In view of the difference between the Environmental Protection Authority's assessment of this Ellenbrook proposal (that is the land owned by Homeswest, Sanwa Vines Pty Ltd and Mt Lawley Pty Ltd) and the retention of the land owned by Multiplex Pty Ltd in the Metropolitan Region Scheme Amendment, the Authority had to consider whether a separate assessment should be required for the Multiplex land to run concurrently with the assessment of the Homeswest, Sanwa Vines Pty Ltd and Mt Lawley land. It is understood that Multiplex did not wish to join the other proponents. It was decided that the key environmental issues could be addressed at the stage of proposing the lifting of the 'urban deferred' zoning to 'urban' for a number of reasons including:

- regional water supply and drainage systems could probably function with or without the Multiplex land being involved;
- advice that Multiplex wished to utilise its land for rural purposes as long as possible whereas the other three land holders wished to pursue urban development as a priority;
- noting that a wide buffer between the proposed 'urban deferred' zoning on the Multiplex land and Ellen Brook itself was retained, with the buffer remaining in 'rural zoning';
- noting that no large areas of wetlands were present on the Multiplex land unlike the proposal already under assessment; and
- recognising that the mound springs were important but that their conservation should not require extensive areas of land and hence could be dealt with at the later stage.

However, the environmental issues associated with proposed urban development on the Multiplex land will still require assessment.

There were a number of key issues of concern identified by the public, in submissions, and the Authority in the assessment of the Ellenbrook proposal.

Protection of lakes protected by statutory regulation

A large number of the seasonal wetlands, referred to as the Lexia wetlands, in the north west of the project site are protected by the Environmental Protection (Swan Coastal Plain Wetlands) Regulations 1991. Submissions and the Public Environmental Review report itself indicated the high conservation value of these wetlands.

The Public Environmental Review considered four conservation scenarios for the protection of the Lexia wetlands. The proponents' preferred option was the protection of 90 hectares of representative wetlands.

Of the options proposed, the Environmental Protection Authority considers option three, the protection of all the lakes on the proponents' land, incorporating approximately 450 hectares, is environmentally acceptable and forms the basis for recommendation 2 in this report. The exact area to be set aside for conservation will need to be determined by the appropriate survey.

Protection of rare flora

37 plants of the declared rare flora, *Caladenia huegelii*, were recorded from Sawpit Gully which is a flooded gum community in the north east corner of the project area. The presence of 37 plants of this species at this site represents a significant (31%) proportion of the known plants in the metropolitan area. Their preservation would thus be a major contribution to the conservation of this species in its northern (metropolitan) range. Recommendation 3 provides for the protection of identified declared rare flora

Conservation value of the Ellenbrook development area.

This issue comprises a number of components including:

- protection of flora and fauna, including rare and endangered species and their habitats;
- protection of quality *Banksia* woodland;
- protection of poorly conserved vegetation complexes, namely the Yanga and Southern River complexes;
- protection of wetlands and damplands, and
- protection of a possible Mound Spring located on adjoining land.

The majority of public submissions supported the exclusion of the entire northern portion of the project area from urban development on the basis of its regional conservation significance. The submissions and expert advice provided details to support this view. This area is approximately 950 hectares of land and includes the area of designated 'lakes' known as the Lexia wetlands, an area to the north and north-east of the Vines estate containing damplands and Sawpit Gully and the possible Mound Spring located on the adjoining Multiplex land. The Public Environmental Review provides a more general appraisal of the conservation values of this area and also finds them to be high.

The Authority does not consider that the local and regional conservation issues have been sufficiently addressed in detail at this time for the balance of this part of the land to determine the extent of urban development.

Protection of underground water supplies

The project site is located immediately to the south east of the Gnangara Groundwater Mound. Water is abstracted from the Gnangara Groundwater Mound for domestic, commercial and recreational purposes while a significant portion of the native vegetation also draws from this superficial aquifer.

The 200 hectares of State Forest included by the proponents in the development, is just within the policy area covered by the Environmental Protection Authority's Draft Environmental Protection (Gnangara Mound Crown land groundwater) Policy 1991, and is also a designated Priority 1 source protection area by the Water Authority of Western Australia. Priority 1 source protection areas are the most important for public water supplies and urban development is considered an incompatible use over them. The proponents have included the State Forest as part of the development due to the strategic importance of this land for early stage residential development.

The major environmental concern is the potential for the quality and quantity of groundwater to be affected by the Ellenbrook development, the impacts of which could affect water users 'downgradient'.

The provision of public water supply to the development/Lexia borefield

The proponents propose to supply water to the development on a three stage basis. In the early stages of urban development at Ellenbrook, an initial temporary supply is proposed to some 3,000 lots by installation of three permanent water supply bores into the Marine Sands sediment on the eastern fringe of the proposed Lexia borefield.

The proponents indicate that to supply water to more than 3,000 lots would require the full development, by the Water Authority, of the Lexia borefield together with the installation of a large high level service reservoir, the Gnangara Reservoir, which would be located in the State Forest.

The establishment of the proponents' interim supply has been adequately addressed in this Public Environmental Review subject to more detailed evaluation through the water balance studies. The Water Authority's Lexia Scheme should ensure that potential environmental impacts associated with groundwater abstraction and siting of facilities, such as impacts to wetland water levels, remnant vegetation protection, habitat protection and ecosystem protection are considered and will need to be referred to the Environmental Protection Authority for separate assessment.

Water quality and quantity management

Urbanisation tends to increase water table levels as a result of an increase in impervious surfaces, lower evapotranspiration losses due to the removal of trees and other vegetation and by an importation of scheme water for domestic use within the urban area. To minimise these changes or to lower naturally high water tables to allow development to proceed, drainage systems are installed. Urbanisation is also associated with an increase in nutrient levels in the drainage and groundwater.

Changes in water quality due to increased nutrient levels and other pollutants could have an impact on:

1. the Lexia wetland system;
2. the water resource in the Priority 1 and 2 source protection areas of the Gnangara Mound; and
3. Ellen Brook and the Swan River.

Changes in water levels either up or down could have an impact upon:

1. the Lexia wetland system and surrounding vegetation associations;
2. the natural vegetation on the adjacent Groundwater Mound and the pine plantation of the State Forest; and
3. the Mound Spring located on adjoining private land.

The Environmental Protection Authority considers these potential impacts should be minimised and further studies are required by the proponents to establish specific environmental criteria. Once the environmental criteria have been established a drainage management plan and nutrient

management plan which reflect the environmental criteria should be prepared and subsequently implemented.

Following consideration of the Public Environmental Review, submissions from the public and Government agencies and the proponents' response to these, the Authority has determined that, there is sufficient information to enable some parts of the project area to be rezoned from "Rural" to "Urban Deferred" in the Metropolitan Region Scheme. The required environmental management can be achieved by a combination of the proponents' commitments and the Authority's recommendations.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal to rezone the land referred to in this report as Ellenbrook, from "Rural" to "Urban Deferred" in the Metropolitan Region Scheme - with the exception of the land which is the subject of recommendations 2, 3, and 4 - could be made environmentally acceptable providing the recommendations in this report are accepted.

In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- protection of significant conservation values on some of the land;
- water quality and quantity management;
- protection of Ellen Brook and the Swan River;
- protection of the Priority 1 Area of the Gnamptara Groundwater Mound;
- protection of lakes, the subject of a statutory regulation, and
- implications of the Lexia Groundwater Scheme.

The Environmental Protection Authority considers that these environmental factors have been addressed adequately by either environmental management commitments given by the proponents, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the project could proceed subject to the Environmental Protection Authority's recommendations in this report and the proponents commitments to environmental management (Appendix 6).

The Public Environmental Review advocates a 90 hectare conservation area to protect the Lexia wetlands. The Authority considers that 'lakes' protected by Regulations and the fringing and surrounding vegetation requires a conservation area of approximately 450 hectares.

Recommendation 2

The Environmental Protection Authority recommends that, prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should set aside for conservation an area of approximately 450 hectares in the north west corner of the project site, as indicated in figure 4, to be vested in the National Parks and Nature Conservation Authority. The final boundary should be determined to meet the requirements of the Minister for the Environment on advice from the Department of Conservation and Land Management and the Department of Planning and Urban Development.

The Authority considers that the Declared Rare Flora, *Caladenia huegelii*, known to exist on the site, should be protected.

Recommendation 3

The Environmental Protection Authority recommends that prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should set aside for conservation the land in the Sawpit Gully area on which the rare orchid, *Caladenia huegelii*, is found, (Figure 4), to be vested in the National Parks and Nature Conservation Authority. The final boundary should be determined to meet the requirements of the Minister for the Environment on advice from the Department of Conservation and Land Management and the Department of Planning and Urban Development.

It is the Authority's opinion that the local and regional conservation values of the northern part of the site have not been determined in detail. The Authority has made specific recommendations in this report for protection of the Lexia wetlands (approximately 450 hectares) and specific declared rare flora in the Sawpit Gully area. However, the Authority considers that in view of the potential high conservation values of some of the balance of the vegetated land (approximately 500ha), the decision to rezone this land to "Urban Deferred" should not proceed until further more detailed environmental investigations have taken place to determine those areas to be set aside for conservation and those areas which could be developed. The studies should include survey for the Western Swamp Tortoise, declared rare and priority species of flora, rare fauna and should re-evaluate the areas local and regional conservation significance.

Recommendation 4

The Authority recommends that prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should undertake a survey to define in detail, the conservation value of the area as indicated in figure 4 of this report, to determine that land which should have its conservation values protected and that which could be developed. This provision, including the implementation of the results, should meet the requirements of the Minister for the Environment on advice from the Environmental Protection Authority, the Department of Conservation and Land Management and the Department of Planning and Urban Development.

The Environmental Protection Authority considers that, urban development could be considered for the area of State Forest No. 65 indicated in the Public Environmental Review subject to the fulfilment of specific criteria. The Authority notes that the Lands and Forests Commission in which the land is vested, and the Water Authority of Western Australia may have additional requirements.

Recommendation 5

The Authority has considered the special circumstances associated with the proposal for removing part of State Forest No 65 land from the Priority 1 Area. It is the Authority's position that urban development is an incompatible land use on Priority 1 groundwater source protection areas.

However, in considering the proposed urban development of the area of State Forest No. 65 on the edge of the Priority 1 area, the Authority took account of the following matters:

- the excision of this land from the Priority 1 Area would assist in the addition of the approximately 450 hectares of wetlands of high conservation value in the north west corner of the property; and

- urbanisation on the area of State Forest No. 65, on the south east edge of the Priority 1 Groundwater area is predicted to have no unacceptable impact on water quality of the balance of the Priority 1 Area.

The Environmental Protection Authority recommends that, urban development on the area of State Forest No. 65 identified in figure 2 of this report could proceed provided that, prior to rezoning of the land to "Urban Deferred" in the Metropolitan Region Scheme:

1. the subject land, presently State Forest No. 65 is excised from State Forest and from the Priority 1 Source Protection Area of the Gnangara Mound; and
2. the total Priority 1 groundwater source protection area for the Gnangara Groundwater Mound is not reduced and its water quality and quantity is maintained.

The fulfilment of these provisions should meet the requirements of the Ministers for the Environment and Water Resources on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Department of Conservation and Land Management and the Department of Planning and Urban Development.

The Environmental Protection Authority considers that the excision of this land and its urban development should not be seen as a precedent.

The Authority considers that the interim water supply proposed is acceptable. However, the implementation of the full Lexia Scheme will require separate environmental assessment prior to its implementation.

Recommendation 6

The Environmental Protection Authority concludes that the proposal to develop part of the Lexia borefield to provide interim water supply, as described in the Public Environmental Review, is environmentally acceptable, subject to recommendations 7 and 8 in this report and recommends that it could proceed subject to meeting the environmental management requirements of the Environmental Protection Authority on advice from the Water Authority of Western Australia.

The Public Environmental Review examines water quality and quantity issues at a broad level. However, the Authority considers that the protection of existing wetland water conditions, vegetation including the State Forest pine plantation, the groundwater and the Swan River requires further detailed studies by the proponents during subsequent stages in the planning process.

Recommendation 7

The Environmental Protection Authority recommends that, prior to lifting of "Urban Deferred" to "Urban" in the Metropolitan Region Scheme, the proponents should establish the following environmental criteria and objectives:

1. Conservation of the Lexia wetlands and any other conservation areas :
 - water level criteria be established, based on historic data and further groundwater modelling, which will ensure the maintenance of minimum, maximum and optimum water levels and seasonal patterns in the wetlands, and

- water quality criteria be established for the wetlands to ensure the maintenance of appropriate water quality, based on existing characteristics;
- 2. Water quality parameters for the protection of Priority 1 and 2 water resource areas;
- 3. Water quality parameters for the minimisation of nutrient export to the Swan River (loads as well as concentrations); and
- 4. Water quantity parameters for the protection of plantations and natural vegetation within the adjacent State Forest and conservation areas.

The fulfilment of these provisions should meet the requirements of the Minister for the Environment on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Swan River Trust, the Department of Conservation and Land Management and the Shire of Swan.

Recommendation 8

The Environmental Protection Authority recommends that, prior to lifting of "Urban Deferred" to "Urban" in the Metropolitan Region Scheme, the proponents prepare and submit detailed Drainage Management and Nutrient Management Plans which comply with the environmental criteria and objectives established by Recommendation 7, and with the relevant Environmental Protection Regulations, to meet the requirements of the the Minister for the Environment on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Swan River Trust and the Shire of Swan.

These Plans should include the development of a comprehensive monitoring, management and reporting programme which should also be implemented to meet the requirements of the Environmental Protection Authority on the advice of the above agencies.

1. Introduction

The Ellenbrook proposal is a major residential development which is to provide for a community of approximately 58,000 people over a fifteen year period. The project encompasses a site of approximately 1800 hectares in the Ellenbrook, Upper Swan, Belhus locality within the Shire of Swan, (see Figure 1). The site is located 20 kilometres north east of Perth City and will accommodate in the region of 20,000 households.

The proponents for the Public Environmental Review are:

- Sanwa Vines Pty Ltd 712ha
- Homeswest 563ha
- Mt Lawley Pty Ltd 320ha.

The proponents have also included, as part of the proposal approximately 200 hectares of State Forest No. 65, (see Figure 2). The pine plantation contains an the oldest pine trees in Western Australia. The State Forest is vested in the Lands and Forest Commission, a statutory body established under the Conservation and Land Management Act.

The existing land use on the site falls largely into two categories:

- an unmanaged plantation of immature pine trees on the Homeswest land in the south, and
- relatively undisturbed bushland on Mt. Lawley Pty Ltd and Sanwa Vines land in the north of the site.

There is a sand quarry near Gnangara Road on the Homeswest land and the 200ha of State Forest incorporates a mature pine plantation which is managed by the Department of Conservation and Land Management.

The project site is located immediately to the south east of the Gnangara Water Mound. The western boundary of the Ellenbrook proposal abuts the boundary of the Priority 1 source protection area for the Gnangara Water Mound and the 200ha area of State Forest is within this Priority 1 area. Priority 1 source protection areas are the most important for public water supply.

The Public Environmental Review examines and identifies a number of conservation scenarios for important wetlands in the north west of the project site. These are referred to as the Lexia wetlands and are protected by the Environmental Protection (Swan Coastal Plain Wetlands) Regulations 1991. Most have also been identified by the Environmental Protection Authority as Lakes under the Draft Environmental Protection (Swan Coastal Plain Lakes) Policy 1992.

2. Planning context of the site

The State Planning Commission is responsible for long-term planning for the Perth Metropolitan Region. Its principle statutory instrument is the Metropolitan Region Scheme. The Metropolitan Region Scheme lays down guidelines for the zoning of land for various uses.

Metroplan is the new metropolitan strategy for the Perth Region. It is a government statement about the direction development of Perth will take into the next century. Metroplan is supported by a series of strategic policy statements on particular topics as well as Structure Plans for urban growth areas. The Metropolitan Region Scheme together with the policy framework provided by Metroplan are the instruments for implementing regional land use policy.

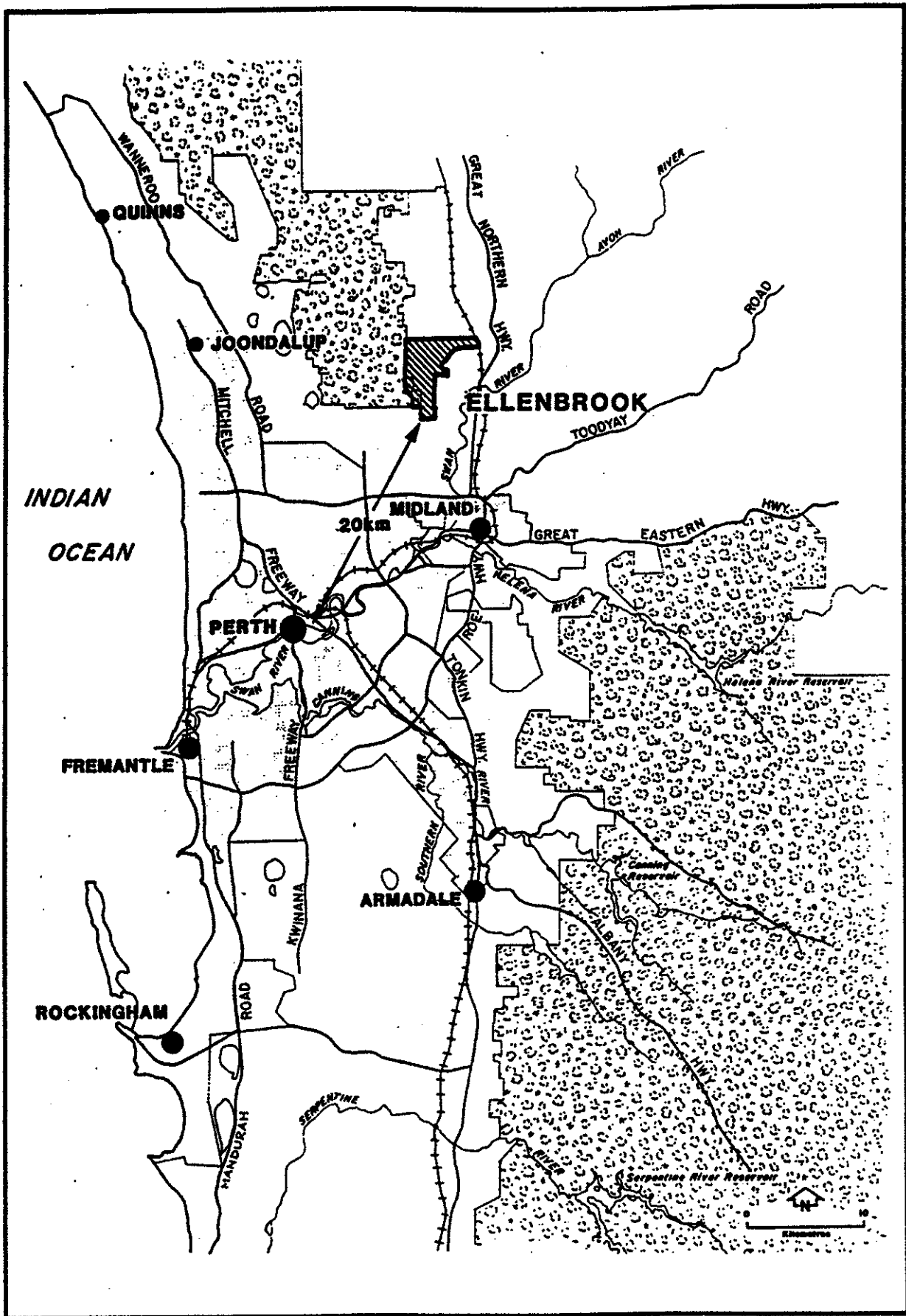


Figure 1. Location map (from Feilman Planning Consultants, PER)

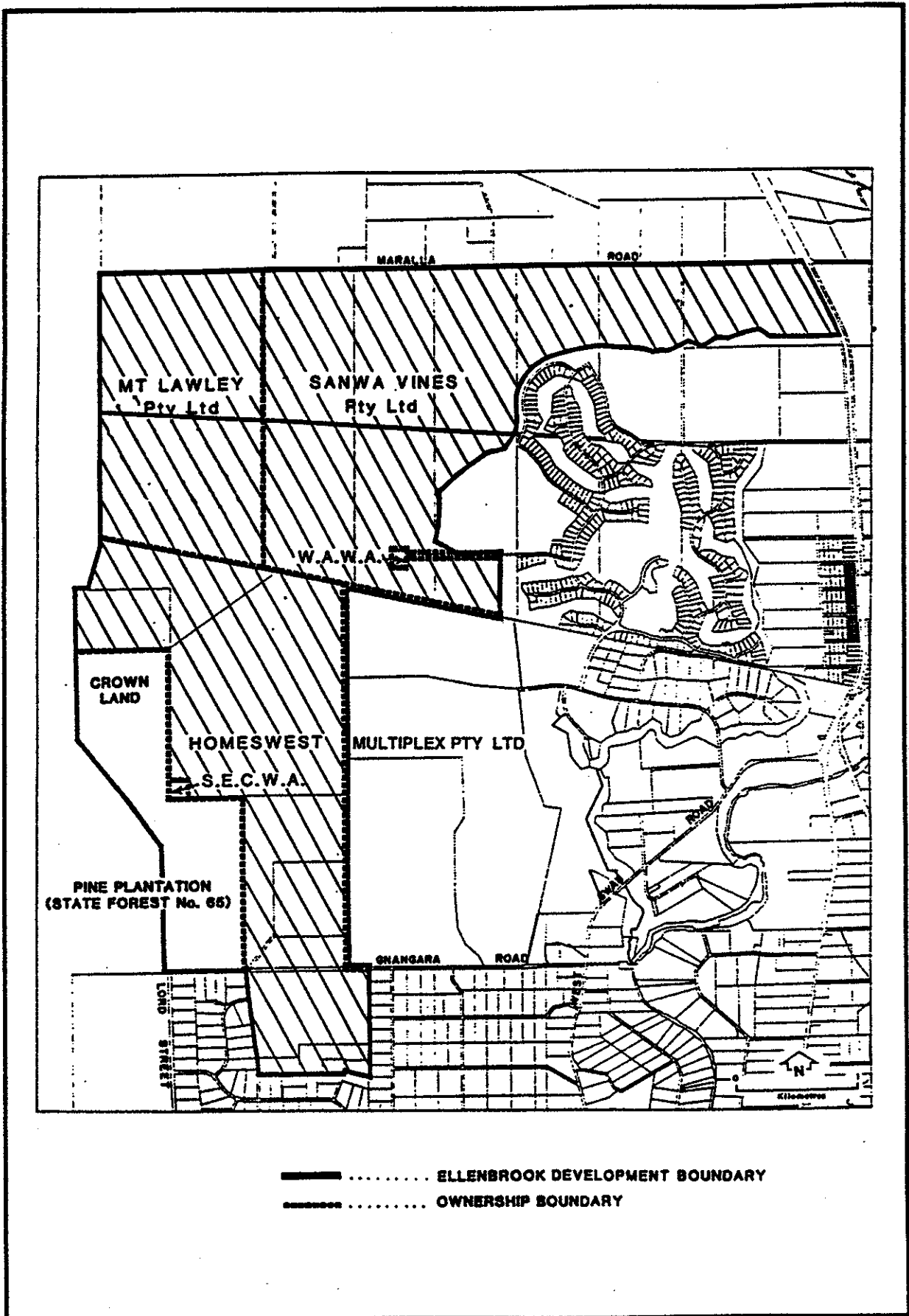


Figure 2. Area proposed for development and land ownership (from Feilman Planning Consultants, PER)

The Department of Planning and Urban Development has also recently released the Urban Expansion Policy Statement, which identifies the Ellenbrook site as "Category A future urban land". Category A land includes those areas most likely to be urbanised in the normal course of developed in the short to medium term.

Ellenbrook is part of the North East Corridor. Metroplan and the Urban Expansion Policy Statement identify the proposed North East Corridor as one of the major initiatives which will be necessary to satisfy the current and future demand for residential land within the Perth metropolitan area. Accordingly, the Department of Planning and Urban Development are producing a Structure Plan for the North East Corridor and have also commissioned an environmental study to provide guidance on the protection of environmental, conservation and landscape values in the corridor. The Authority understands that both the Structure plan and environmental study have not yet been completed.

The Ellenbrook site is currently zoned "Rural" under the Metropolitan Region Scheme. A Scheme amendment seeks to rezone the majority of the site from "Rural" to "Urban Deferred" in order to permit residential development of the site, and to set aside some of the important wetland areas for Parks and Recreation and conservation purposes.

The Urban Deferred Zone applies to land which is physically and locationally suitable for urban development, but which requires comprehensive planning and servicing before development can take place. The amendment includes land which is in the ownership of Homeswest, Sanwa Vines Pty Ltd, Multiplex Pty Ltd and Mt Lawley Pty Ltd.

Of these, Homeswest, Sanwa Vines Pty Ltd and Mt Lawley Pty Ltd are proponents in the Public Environmental Review process. Multiplex is not.

The land owned by Multiplex Pty Ltd, located immediately to the south east of the Ellenbrook project is adjacent to the Ellen Brook watercourse which ultimately discharges into the Swan River. Submissions to this Public Environmental Review also indicate the presence of an environmentally significant Mound Spring in the north west of the Multiplex land.

In view of the difference between the Environmental Protection Authority's assessment of this Ellenbrook proposal (that is the land owned by Homeswest, Sanwa Vines Pty Ltd and Mt Lawley Pty Ltd) and the retention of the land owned by Multiplex Pty Ltd in the Metropolitan Region Scheme Amendment, the Authority had to consider whether a separate assessment should be required for the Multiplex land to run concurrently with the assessment of the Homeswest, Sanwa Vines Pty Ltd and Mt Lawley land. It is understood that Multiplex did not wish to join the other proponents. It was decided that the key environmental issues could be addressed at the stage of proposing the lifting of the 'urban deferred' zoning to 'urban' for a number of reasons including:

- regional water supply and drainage systems could probably function with or without the Multiplex land being involved;
- advice that Multiplex wished to utilise its land for rural purposes as long as possible whereas the other three land holders wished to pursue urban development as a priority;
- noting that a wide buffer between the proposed 'urban deferred' zoning on the Multiplex land and Ellen Brook itself was retained, with the buffer remaining in 'rural zoning';
- noting that no large areas of wetlands were present on the Multiplex land unlike the proposal already under assessment; and
- recognising that the mound springs were important but that their conservation should not require extensive areas of land and hence could be dealt with at the later stage.

However, the environmental issues associated with proposed urban development on the Multiplex land will still require assessment.

The Metropolitan Planning Council under delegated power from the State Planning Commission has determined that the proposed Ellenbrook rezoning constitutes a substantial amendment to the Metropolitan Region Scheme. The amendment has been advertised for ninety

(90) days and the State Planning Commission has considered submissions. The Metropolitan Planning Council must make recommendations to the Hon. Minister for Planning regarding the proposed rezoning. However, for the rezoning amendment to come into effect, it will require the Governor's approval and be laid before both Houses of Parliament.

In view of the high regional conservation value of the subject land, it is highly desirable that decisions made by the planning process on future zoning of this land are made within the context of the environmental assessment provided by the Public Environmental Review process. In relation to land within the north east corridor, including land to be rezoned in the current amendment but not examined in this Public Environmental Review, the Department of Planning and Urban Development's own Environmental Audit study when completed, could provide some guidance.

3. Submissions received

3.1 General

Comments were sought on the proposal from the public, community groups and local and State Government Authorities. The proponents Public Environmental Review document was available for public comment for a period of eight weeks between 20 April 1992 and 15 June 1992.

There were 734 submissions received, within the following categories;

- 672 'form' submissions (51 types);
- 40 individual letter submissions;
- 16 submissions from groups and organisations, and
- 6 submissions from interested state and local government agencies.

The principle issues raised are as follows:

- protection of significant conservation values;
- protection of designated 'lakes';
- effect on fauna and flora values;
- water quality management and protection to the groundwater, wetlands, Ellen Brook and the Swan River;
- water quantity management and protection to the groundwater, wetlands, Ellen Brook and the Swan River, and
- the protection of the Priority 1 area of the Gngangara Water Mound.

The Environmental Protection Authority's summarised list of issues raised through the public review phase and the proponents response to those issues are included with this report. Conservation values, wetlands and other general environmental issues and the proponents' response to them are presented in Appendix 1. Water quality and quantity issues and the proponents response to them are presented in Appendix 2.

The Authority has included consideration of the submissions received and the proponents response as part of the assessment.

3.2 Public submissions

The emphasis throughout the majority of submissions was, to highlight apparent inadequacies in the assessment of specific issues, by the proponents. In particular, the issues raised were primarily concerned with the largely natural and undisturbed northern portion of the project site,

including a Mound Spring located on adjoining private land. The large response by the community and the considerable amount of detail provided, especially on conservation aspects, was appreciated by the Environmental Protection Authority. The key points have been incorporated into the body of this report. The major issues of concern are listed in the previous section and are set out in detail in Appendices 1 and 2.

Some submissions included specific work on the flora and fauna of the area. (Much of the information provided was encapsulated by the Department of Conservation and Land Management in the Department's submission which is included as Appendix 3 of this Report.) There was a strong preference by the public for the undisturbed land in the northern part of the site, including a Mound Spring located on adjoining private land, to be excluded from urban development and set aside for conservation.

3.3 Government submissions

The advice of the Department of Conservation and Land Management, the Water Authority of Western Australia, the Swan River Trust, and the Departments of Aboriginal Sites and Natural Science from the Western Australian Museum provided information used during the project assessment. The Water Authority and the Swan River Trust submissions are included as Appendix 4 and 5 of this Report.

4. Environmental impacts and their management

4.1 General

Following consideration of the Public Environmental Review, submissions from the public and Government agencies and the proponents' response to these, the Authority has determined that there is sufficient information to enable some parts of the project area to be rezoned from "Rural" to "Urban Deferred" in the Metropolitan Region Scheme. The required environmental management can be achieved by a combination of the proponents' commitments and the Authority's recommendations.

Recommendation 1

The Environmental Protection Authority has concluded that the proposal to rezone the land referred to in this report as Ellenbrook, from "Rural" to "Urban Deferred" in the Metropolitan Region Scheme - with the exception of the land which is the subject of recommendations 2, 3, and 4 - could be made environmentally acceptable providing the recommendations in this report are accepted.

In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- protection of significant conservation values on some of the land;
- water quality and quantity management;
- protection of Ellen Brook and the Swan River;
- protection of the Priority 1 Area of the Gnangara Groundwater Mound;
- protection of lakes, the subject of a statutory regulation, and
- implications of the Lexia Groundwater Scheme.

The Environmental Protection Authority considers that these environmental factors have been addressed adequately by either environmental management commitments given by the proponents, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the project could proceed subject to the Environmental Protection Authority's recommendations in this report and the proponents' commitments to environmental management (Appendix 6).

The Authority's experience is that it is common for details of a proposal to alter through the detailed design and construction phase. In many cases alterations are not environmentally significant or have a positive effect on the environmental performance of the project. The Authority believes that such non-substantial changes, and especially those which improve environmental performance and protection, should be provided for.

The Authority believes that if the proposal has not been substantially commenced within five years of the date of this report then such approval should lapse. After that time, further consideration of the proposal should only occur following a new referral to the Authority.

4.2 Urban conservation

In 1972, the Environmental Protection Authority began a major study into the need to set aside special areas for conservation and recreation within Western Australia. The State was divided into 12 regions or systems, each based on geography, ecology and human activities. One of these regions is System Six, the Darling System, which includes the highly populated areas around Perth. System Six covers the most intensively used part of the State where land values are high and competition for differing land use is often intense. The study's objective was to define those parts of the region which should be kept mainly natural.

The Environmental Protection Authority's conservation efforts on the Swan Coastal Plain are based primarily on the System Six Study. This study identified 209 metropolitan and country areas of regional conservation significance and/or regional representation of biological and physical values on the Swan Coastal Plain and made recommendations for their management.

The Authority believes the integrity of System Six Recommendation areas should not be further compromised and defends them strongly.

This does not necessarily mean that all areas outside System Six Recommendations are not environmentally significant, but rather that decisions on the use of these areas should normally be the primary responsibility of the planning process, both at the State and local level. The Ellenbrook site is not affected by the recommendations contained within the System Six report.

However, areas subject to development proposals which are outside of System Six Recommendations but have potentially very high conservation values, such as at Brixton Street, Kenwick and Ellenbrook, are viewed carefully by the Authority. The Environmental Protection Authority recommended that, proposed development on Lots 37 and 47 Brixton Street, Kenwick, be found environmentally unacceptable because the land is considered to be of special conservation significance (EPA Bulletin 577). Decisions by the Authority to protect land outside System Six are the exception.

It is because that some of the land within the Ellenbrook proposal has such high conservation value that it is essential that decisions on whether or not, - and if so how, the land should be developed, should await expert advice provided by the Environmental Protection Authority's environmental assessment process.

4.3 Protected 'lakes' (wetlands)

There is a growing view in the community, that the remaining wetlands of the Swan Coastal Plain are essential for the maintenance of ecological systems and the time has been reached where strong action needs to be taken to protect them (EPA June 1990).

The Environmental Protection Authority has prepared a draft policy to protect up to 3000 lakes and wetlands between Moore River and Dunsborough. Under the Draft Environmental Protection (Swan Coastal Plain Lakes) Policy 1992, nominated lakes will be protected from unauthorised filling, mining, pollution and changes to surface drainage unless exempted by the Minister for the Environment. In the meantime, the Environmental Protection (Swan Coastal Plain Wetlands) Regulations 1991 were gazetted on the 28 March 1991. These Regulations provide interim protection.

A large number of the seasonal wetlands referred to as the Lexia wetlands in the north west of the project site are designated lakes under this policy and are therefore subject to protection through the Regulation (see Figure 3). It is important to note that development around designated lakes is not restricted provided the requirements of the Policy and Regulation are accommodated. However, the proponents in considering this option, concluded that the large areal extent and proximity of the Lexia wetlands would result in only small and awkwardly shaped areas being available for development between individual wetlands and therefore did not consider this a viable option.

The Public Environmental Review considers four conservation scenarios for the protection of the Lexia wetlands (see Figure 3).

The first includes the complete Lexia wetland system and covers over 400 hectares of the proponents' land as well as about 90ha immediately to the north containing four wetlands not owned by the proponents'.

The second scenario is limited to those wetlands which have been identified as 'lakes' under the Environmental Protection Authority's Draft Environmental Protection (Swan Coastal Plain Lakes) Policy and also includes one 'lake' on land to the north, not owned by the proponents.

The third scenario only includes those 'lakes' within the proponents' land and includes an area of approximately 450 hectares.

The fourth scenario and the proponents' preferred conservation option in the Public Environmental Review involves the preservation of a 90ha area of the Lexia wetlands. The remaining lakes would be filled or used as part of the overall drainage management for the site.

Scenarios one and two include land not owned by the proponents, and have been discounted by the Authority.

Scenario four does not set aside from development all the lakes protected under the regulation. In addition the cost and management rationale put forward in support of this option within the Public Environmental Review has been questioned by the Department of Conservation and Land Management.

In regard to the conservation scenarios put forward by the proponents for protection of the Lexia wetlands, the Environmental Protection Authority considers option three, the protection of all the 'lakes' on the proponents' land, incorporating an area of approximately 450 hectares is environmentally acceptable. The exact boundary, and hence area to be set aside for conservation will need to be determined by the appropriate survey.

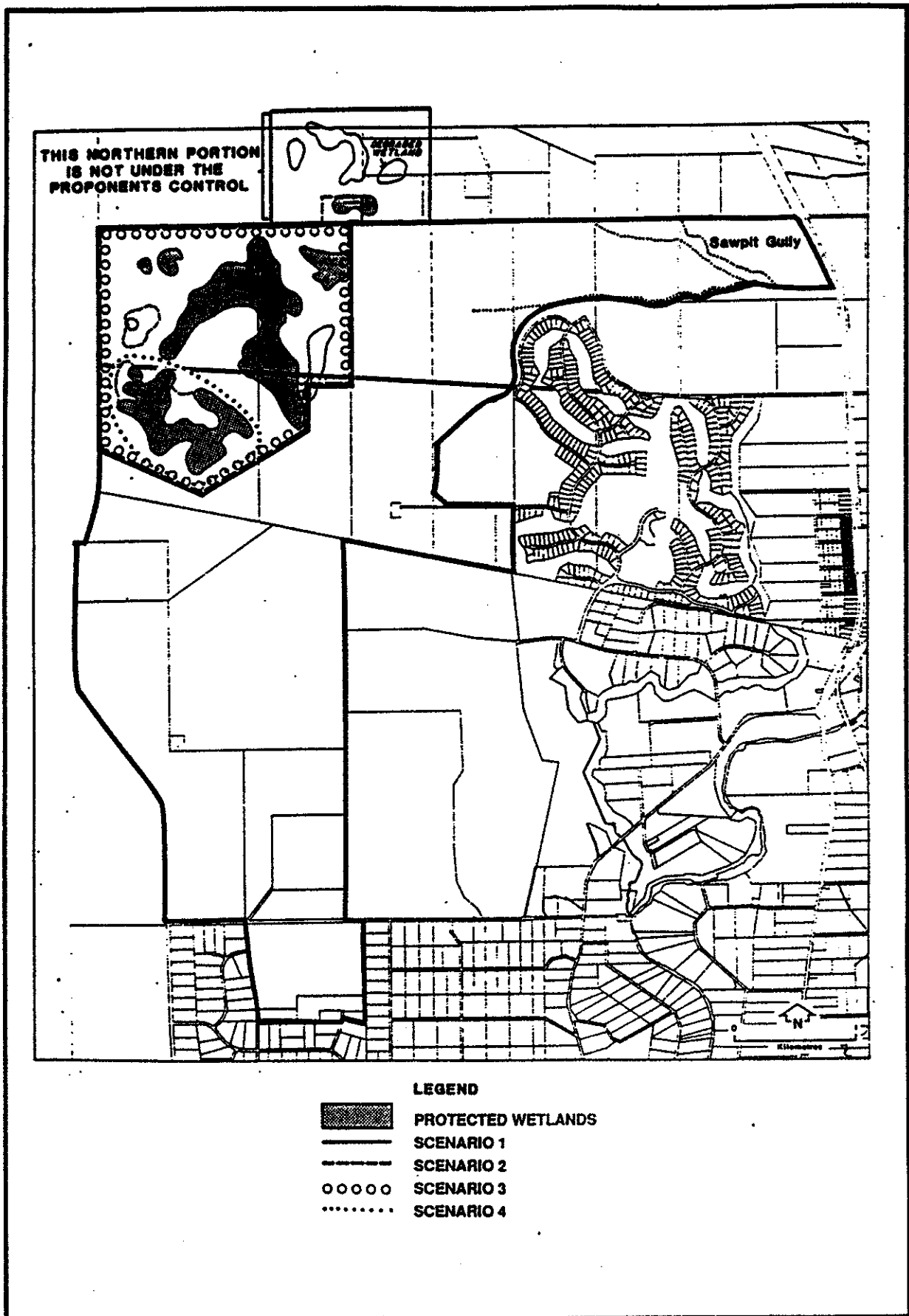


Figure 3. Wetland conservation areas (from Feilman Planning Consultants, PER)

Recommendation 2

The Environmental Protection Authority recommends that, prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should set aside for conservation an area of approximately 450 hectares in the north west corner of the project site, as indicated in figure 4, to be vested in the National Parks and Nature Conservation Authority. The final boundary should be determined to meet the requirements of the Minister for the Environment on advice from the Department of Conservation and Land Management and the Department of Planning and Urban Development.

4.4 Declared rare flora

Declared rare flora are protected by the Wildlife Conservation Act which is administered by the Department of Conservation and Land Management.

No Gazetted Rare (Declared Rare) Flora were found by the proponents in the Banksia woodlands. However, 37 plants of the declared rare flora, *Caladenia huegelii*, were recorded from Sawpit Gully which is a flooded gum community in the north east corner of the project area. The presence of 37 plants of this species at this site represents a significant (31%) proportion of the known plants in the metropolitan area. Their preservation would thus be a major contribution to the conservation of this species in its northern (metropolitan) range.

The proponents have made a commitment to protect this rare orchid within the development, (see Appendix 6).

The proposal to protect the *C huegelii* population would therefore need to be properly overseen by the Department of Conservation and Land Management.

Recommendation 3

The Environmental Protection Authority recommends that prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should set aside for conservation the land in the Sawpit Gully area on which the rare orchid, *Caladenia huegelii*, is found, (Figure 4), to be vested in the National Parks and Nature Conservation Authority. The final boundary should be determined to meet the requirements of the Minister for the Environment on advice from the Department of Conservation and Land Management and the Department of Planning and Urban Development.

4.5 Conservation values of the Ellenbrook land

4.5.1 From the Public Environmental Review report

The proponents indicate that an area of native vegetation covers approximately 58% of the area proposed for development.

The most widespread native vegetation in the project area is *Banksia* low open woodland. The density of the woodland and abundance of key species within it varies through the project area. The *Banksia* woodland vegetation is mostly in good condition and shows limited evidence of direct disturbance. A variety of understorey vegetation types, characteristic of *Banksia* woodlands, are found through the site and two priority species, *Cartonema philydroides* and *Conostephium minus*, were found. The proponents indicate there are several areas of dieback disease (*Phytophthora cinnamomi*) and evidence that the whole area is under threat from dieback infection.

The proponents concluded that there are no assemblages of species which are recognised as being particularly unusual and the species composition and structure of the *Banksia* woodlands are very similar to Melaleuca Park conservation area, 12km to the north west of Ellenbrook and at Whiteman Park.

The seasonal, Lexia wetlands, located in the north western part of the project area, are considered by the proponents to be distinguishable from each other due to variations in the flora.

In the Sawpit Area, in the north-east of the project site there are no wetlands of the Lexia type. Rather, the low lying ground is represented by "damp woodlands" (damplands) which grade into dry woodlands towards higher ground.

The north eastern corner of the Sawpit Area contains Sawpit Gully, a drainage line which overlies Guildford Clay soils. The proponents indicate that Sawpit Gully contains the Declared Rare Flora, *Caladenia huegellii*, which is an orchid and the Priority Three species, *Cartonema philydroides*.

The proponents summarise that "...There is no evidence that the woodland or wetlands at Ellenbrook are in any way floristically unique, or that they contain assemblages or individual species which are of great significance. The value of the Ellenbrook wetland area lies in the fact that most of the similar habitats of the Swan Coastal Plain are destroyed or heavily degraded."

Other than the Southern Brown Bandicoot, the proponents indicates that no species of rare fauna are known to exist in the area. The last two remaining habitats of the rare Western Swamp Tortoise are located north east of the Ellenbrook development in two nature reserves (Twin Swamps Reserve and Ellen Brook Reserve). The proponents evaluated the likelihood of the tortoise being found in the wetlands in the project area and discounted this likelihood as the habitat types were thought to be unsuitable.

4.5.2 From the submissions

The majority of public submissions supported the exclusion of the entire northern portion of the project area from urban development. This generally included, the area of designated 'lakes' known as the Lexia wetlands, an area to the north and north-east of the Vines estate containing damplands and Sawpit Gully and a possible Mound Spring located on adjoining private land. The total area incorporated approximately 950 hectares of land. Recommendations relating to the designated 'lakes' have already been made in this report. However decisions relating to the remaining, approximately 500ha, of the proponents' land are less clear-cut.

Submissions on the Public Environmental Review indicate the potential environmental values for this area could be locally and regionally significant. The Department of Conservation and Land Management in its submission indicates that much of the land in question straddles a major change-over zone on the Swan Coastal Plain, from the sandy Bassendean soils to the

heavier fluviatile soils of the eastern side of the plain. Much of the area consists of the Southern river and Yanga vegetation complexes. These two complexes were 91% cleared in 1986, and are only poorly represented in conservation reserves. This is particularly so for the Yanga, of which less than 1% is contained in conservation reserves.

The Authority received a submission on the proposal from Dr. G Kuchling, Principal Investigator, Western Swamp Tortoise Recovery Team which is attached as Appendix 7 to this report. The following text contains extracts from Dr Kuchling's submission.

The proposed development will affect some of the least degraded wetlands outside the Ellen Brook and Twin Swamps Nature Reserves in the general area of distribution of the critically endangered Western Swamp Tortoise *Pseudemydura umbrina*. Whilst the Lexia wetlands do not offer good habitat for *P umbrina*, the areas of ephemeral wetlands of the Joel type and the areas which are called "damplands" in the Public Environmental Review are of potential value for the Western Swamp Tortoise. In particular, the ephemeral swamps in the catchment area north and north east of the Vines resort golf course which drain into the Sawpit Gully offer swamp habitats which are very similar to parts of Twin Swamps Nature Reserve.

In three aspects the area is of possible importance for the Western Swamp Tortoise:

1. it is possible that a population of the Western Swamp Tortoise *Pseudemydura umbrina*, persists, maybe at low density;
2. the area may be a refuge for displaced specimens from surrounding areas which have been cleared; and
3. it is, apart from Ellen Brook and Twin Swamps Nature Reserves, one of the last patches of un-cleared and un-degraded swamp habitat in the range of the Western Swamp Tortoise which, in the long term could be used as a re-introduction site for captive bred animals (although, at present, this is not part of the ten year recovery plan for the species).

In order to properly evaluate the first two aspects of the importance of the area for the Western Swamp Tortoise, it will be necessary to conduct a specific survey.

Other fauna of concern due to its listing in Schedule 1 of the Wildlife Conservation Act 1950 as "fauna that is likely to become extinct, or is rare" is the southern brown bandicoot (*Isoodon obesulus*). The southern brown bandicoot occurs in the northern section of the Ellenbrook area, and the proponents indicate the bandicoots prefer the ecotones between the wetlands and adjacent woodlands.

4.5.3 The Environmental Protection Authority's view

The Authority has made grounds for specific recommendations in this report for protection of the Lexia wetlands, however, the Authority does not consider that the local and regional conservation issues have been addressed in sufficient detail for this part of the vegetated land (approximately 500ha), to determine the extent of urban development. Some issues requiring further more detailed survey include the Western Swamp Tortoise, declared rare and priority species of flora, rare fauna and a re-evaluation of the areas local and regional conservation significance.

The area of land adjoining the Ellenbrook site, containing a possible Mound Spring is not subject to specific recommendations in this report. The Authority recognises that the Mound Spring is important but that its conservation should not require extensive areas of land and hence could be dealt with at the later stage. However, potential impacts to the Mound Spring arising from the Ellenbrook development should be avoided through management of water quality and quantity effects.

The environmental issues associated with proposed urban development on the Multiplex land will still require assessment.

Recommendation 4

The Authority recommends that prior to rezoning to "Urban Deferred" in the Metropolitan Region Scheme, the proponents should undertake a survey to define in detail, the conservation value of the area as indicated in figure 4 of this report, to determine that land which should have its conservation values protected and that which could be developed. This provision, including the implementation of the results, should meet the requirements of the Minister for the Environment on advice from the Environmental Protection Authority, the Department of Conservation and Land Management and the Department of Planning and Urban Development.

4.6 Priority 1 source protection area of the Gnangara Groundwater Mound/State Forest No. 65

The Gnangara Mound is a large mound of groundwater beneath the deep sandy soil north of Perth. The Gnangara Mound is an unconfined aquifer, which has its upper boundary, or water table, at the ground surface. The groundwater contained within the Mound originates from direct infiltration of rainfall. Recharge of the aquifer by rainfall leads to a build-up of water, forming mounds of groundwater in the sediments. The groundwater flows at very slow rates generally outward from the centre of the Mound, under the action of gravity since the water table is higher than sea level. Groundwater flows generally towards east or south east in the project area and discharges to Ellen Brook, a tributary of the Swan River, or to drainages which discharge to Ellen Brook.

Water is abstracted from the Gnangara Groundwater Mound for domestic, commercial and recreational purposes while a significant portion of the native vegetation also draws from this superficial aquifer.

All land use developments, whether urban, industrial, recreation or agricultural, have the potential to contaminate the groundwater and alter recharge to the aquifers. In order to protect groundwater under the Crown and State-owned land on the Gnangara Mound for public water supply and the surrounding environment, the Environmental Protection Authority has formulated the Draft Environmental Protection (Gnangara Mound Crown land groundwater) Policy 1991. The Draft indicates that the Gnangara Mound "...is an extremely important source of water for public water supply-it is essential for Perth's existence-and supports many valuable wetlands."

The Ellenbrook development site is located immediately to the south east of the Gnangara Groundwater Mound. However, the 200 hectares of State Forest included by the proponents' in the development, is within the policy area covered by the draft Policy, and is also within the Priority 1 source protection area, classified by the Water Authority of Western Australia. Priority 1 source protection areas are the most important for public water supplies and urban development is considered an incompatible use over them.

Some parts of the Ellenbrook development area are also within Priority 2 source protection areas where urban development is not a preferred land use, but if properly managed, may be acceptable.

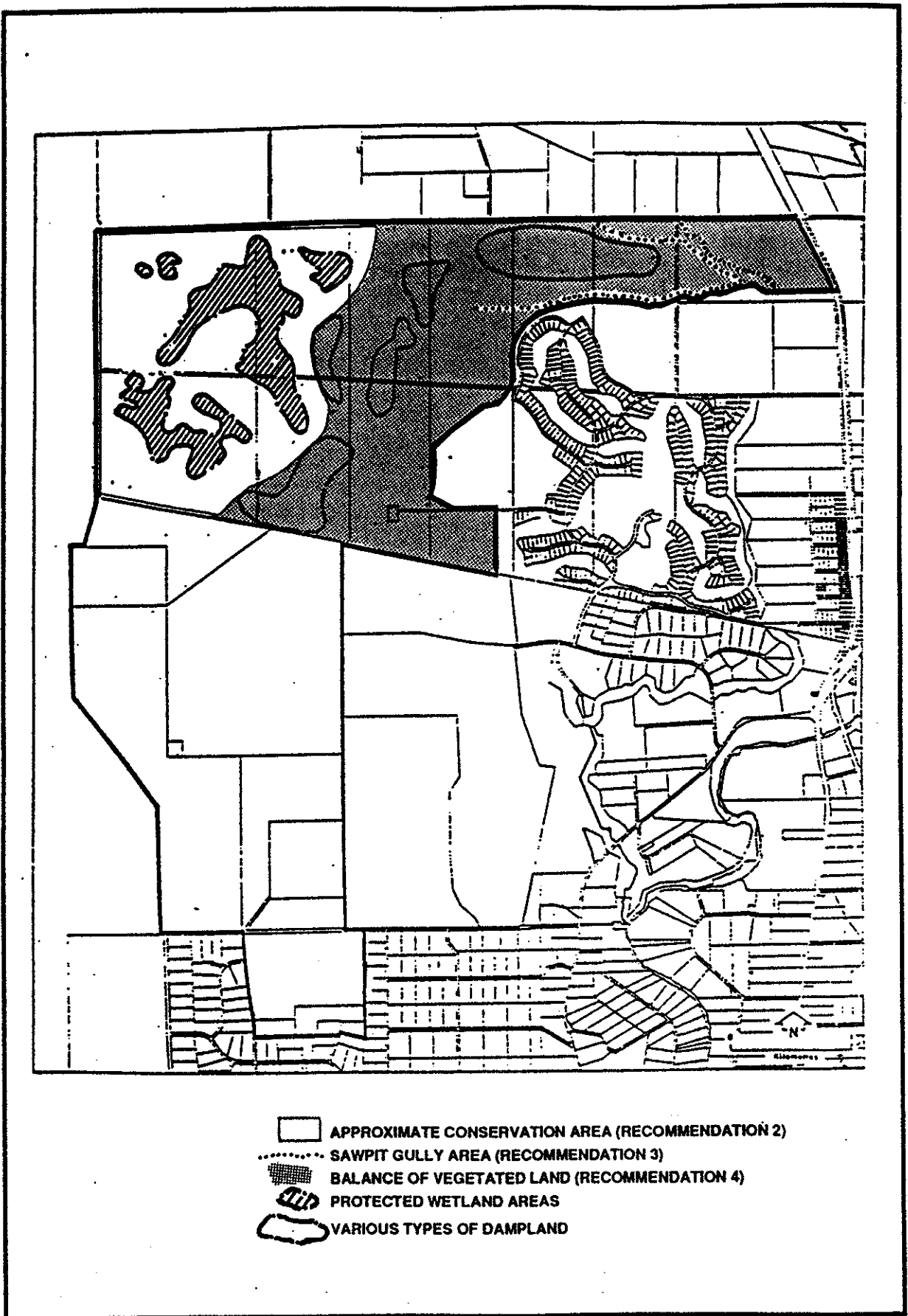


Figure 4. Areas of conservation value the subject of recommendations in this report

The major environmental concern is the potential for the quality and quantity of groundwater to be affected by the Ellenbrook development, the impacts of which could affect water users 'downgradient'. Under current proposals, both the Lexia and Mirrabooka East borefields could experience a decline in water quality as a result of the Ellenbrook urbanisation. However, this may not represent a constraint with appropriate management provisions.

The proponents have included the State forest as it more favourably meets development of the Ellenbrook site in the early stages due to its road frontage, transport and marketing advantages. In view of the case put forward for inclusion of this land, the Authority is prepared to consider residential development on this area providing, the requirements of the draft Policy are satisfied, namely:

- (a) the total policy area is not reduced; and
- (b) the proposed change is referred to the Environmental Protection Authority, and has the support of the Water Authority of WA and the State Planning Commission.

The Water Authority in its submission has indicated that it would agree to a change in the boundary of the Priority One Source Area if an equivalent area of land on the Gngangara Mound was included in an exchange. The Environmental Protection Authority considers, without establishing precedent, that, urban development would not be considered environmentally unacceptable on the area of State Forest No. 65 indicated in the Public Environmental Review provided that prior to rezoning of the land to "Urban Deferred" in the Metropolitan Region Scheme:

- the area is to be removed from the Priority 1 groundwater protection area; and
- the total policy area is not reduced and its water quality and quantity is maintained.

The Authority notes that the Lands and Forests Commission in which the land is vested, and the Water Authority of Western Australia may have additional requirements.

Recommendation 5

The Authority has considered the special circumstances associated with the proposal for removing part of State Forest No 65 land from the Priority 1 Area. It is the Authority's position that urban development is an incompatible land use on Priority 1 groundwater source protection areas.

However, in considering the proposed urban development of the area of State Forest No. 65 on the edge of the Priority 1 area, the Authority took account of the following matters:

- the excision of this land from the Priority 1 Area would assist in the addition of the approximately 450 hectares of wetlands of high conservation value in the north west corner of the property; and
- urbanisation on the area of State Forest No. 65, on the south east edge of the Priority 1 Groundwater area is predicted to have no unacceptable impact on water quality of the balance of the Priority 1 Area.

The Environmental Protection Authority recommends that, urban development on the area of State Forest No. 65 identified in figure 2 of this report could proceed provided that, prior to rezoning of the land to "Urban Deferred" in the Metropolitan Region Scheme:

1. the subject land, presently State Forest No. 65 is excised from State Forest and from the Priority 1 Source Protection Area of the Gngangara Mound; and
2. the total Priority 1 groundwater source protection area for the Gngangara Groundwater Mound is not reduced and its water quality and quantity is maintained.

The fulfilment of these provisions should meet the requirements of the Ministers for the Environment and Water Resources on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Department of Conservation and Land Management and the Department of Planning and Urban Development.

The Environmental Protection Authority considers that the excision of this land and its urban development should not be seen as a precedent.

4.7 Water supply/Lexia borefield

The Lexia area has been identified as having potential for groundwater development for Public Water Supply. The Water Authority submitted a Notice of Intent for the Lexia Groundwater Scheme to the Environmental Protection Authority in April 1985. This groundwater scheme proposal comprises a total of 12 shallow groundwater bores located within the Wanneroo Public Water Supply Area (PWSA) drawing an average of 420,000 kL/annum/bore and three deep bores (intersecting the Marine Sands) to the east of the Wanneroo PWSA drawing an average of 500,000 kL/annum/bore. The Lexia borefield is generally located immediately to the west of the Ellenbrook site within the State Forest. Assessment of the Notice of Intent never was completed.

The provision of an adequate water supply is an essential requirement for any urban development. The proponents propose to supply water to the development on a three stage basis. In the early stages of urban development at Ellenbrook, an initial temporary supply is proposed to some 3,000 lots by installation of three permanent water supply bores in to the Marine Sands sediment on the eastern fringe of the proposed Lexia borefield. The proponents considers it is likely these bores will be located within the development site and that a temporary treatment plant will be installed.

The proponents indicates that to supply water to more than 3,000 lots will require the full development, by the Water Authority, of the Lexia borefield together with the installation of a large high level service reservoir, the Gngangara Reservoir, which will be located in the State Forest. The Water Authority in their submission indicated that for supply in excess of 3,000 lots it would also be necessary to commence the staged construction of the permanent Lexia Groundwater Treatment Plant. In addition, land above 50-60 metres depending upon distance from the proposed Gngangara reservoir will require a high level supply from an elevated tank to be located on high ground, south-west of the existing Vines summit tank.

The establishment of the Water Authority's Lexia Scheme, including the reservoir and treatment plant will require separate environmental impact assessment to ensure potential environmental impacts associated with groundwater abstraction and siting of these facilities, such as wetland protection, remnant vegetation protection, habitat protection and ecosystem protection are considered. The preparation of the environmental review is the responsibility of the Water Authority of Western Australia and should be completed prior to commencement of the Scheme.

Water supply in excess of 10,000 lots up to the ultimate development envisaged, in excess of 20,000 lots, is proposed to be extended from the Mirrabooka Reservoir via a large diameter trunk main direct to the reservoir located in the State Forest. The proposal to provide water from this source, depending upon the alignment location, will also require referral to the Environmental Protection Authority to determine the appropriate level of environmental assessment.

The Water Authority has indicated that the provision of water as described above is generally consistent with the proposed supply concept. However, the Water Authority has also indicated that there are some omissions and inconsistencies which will require further negotiations between the Water Authority and the proponents.

Recommendation 6

The Environmental Protection Authority concludes that the proposal to develop part of the Lexia borefield to provide interim water supply, as described in the Public Environmental Review, is environmentally acceptable, subject to recommendations 7 and 8 in this report and recommends that it could proceed subject to meeting the environmental management requirements of the Environmental Protection Authority on advice from the Water Authority of Western Australia.

4.8 Water quality and quantity

The change in land use from a rural or a natural area to an urban one can have a significant effect on the natural surface and groundwater regime. Surface water runoff or drainage characteristics change, resulting in changes to the groundwater balance. Urbanisation, through nutrient run-off also affects the quality of both surface and groundwater. An area of concern with the Ellenbrook development is the potential for nutrients in urban drainage water being discharged into Ellen Brook and ultimately the Swan River.

Current estimates indicate that, on average, Ellen Brook contributes 21 tonnes of phosphorus per year to the Swan River which itself receives an average estimated total of 58 tonnes per year. Ellen Brook is the highest contributor of phosphorus load to the Swan River. Ellen Brook contributes an average load of 57 tonnes of nitrogen to the Swan River which receives an average annual loading of 494 tonnes of nitrogen. Ellen Brook is the second highest contributor of nitrogen.

Urbanisation tends to increase water table levels as a result of an increase in impervious surfaces, lower evapotranspiration losses due to the removal of trees and other vegetation and by an importation of scheme water for domestic use within the urban area. To minimise these changes or to lower naturally high water tables to allow development to proceed, drainage systems are installed.

Changes in water quality due to increased nutrient levels and other pollutants could have an impact on:

1. the conservation values of the Lexia wetland system;
2. the water resource in the Priority 1 and 2 source protection areas of the Gngara Mound;
3. Ellen Brook and the Swan River and the potential contribution to increased algal growth and deterioration of water quality in these waterways; and
4. the possible Mound Spring on adjoining private land.

Changes in water levels either up or down could have an impact upon:

1. the conservation values of the Lexia wetland system and surrounding vegetation associations;
2. the natural vegetation on the adjacent Groundwater Mound and the pine plantation of the State Forest;
3. the amount of water available for abstraction; and
4. the conservation value of the possible Mound Spring on adjoining private land.

The Environmental Protection Authority considers these potential impacts should be minimised. In particular, the following criteria should be established and maintained:

1. the management objective for the Lexia wetlands is to maintain and enhance natural attributes and functions. In the case of the Lexia wetlands, the maintenance of minimum, maximum and optimum water levels based on historical data is therefore necessary to reflect the management objectives. Water quality in the wetlands must also be defined.

The conservation value of these wetlands and the associated *Banksia* woodlands is high. Accordingly, the Environmental Protection Authority considers that the water levels and water quality within these wetlands should be maintained according to their existing seasonal patterns.

2. The State Forest pine plantation managed by the Department of Conservation and Land management should not sustain tree decline or deaths.
3. There should be no contamination or reduction in the water quality or quantity of Priority 1 and 2 groundwater source protection areas.
4. There should be no increase in nutrient levels to Ellen Brook and ultimately the Swan River arising from development of Ellenbrook.
5. The possible Mound Spring on adjoining private land not be affected.

The Ellenbrook development will give rise to a need for particular drainage and nutrient management strategies. The drainage management measures proposed at Ellenbrook involve a combination of infiltration basins, wet detention basins (ie: basins which maintain a permanent pool of water) and artificial wetlands. Artificial wetlands are particularly relevant in situations where there is a high water table. Both of the latter techniques are becoming widely accepted as a "best management practice" for urban stormwater control. It is the Authority's view that the incorporation of best management practices and techniques of water sensitive urban design into the detailed subdivision design will enhance nutrient, particularly phosphorus removal and is encouraged.

The Public Environmental Review addresses water quality and quantity at a regional level. This level is not sufficient to enable housing development to proceed on the site and further work needs to be done to establish the detailed environmental criteria prior to the lifting of "Urban Deferred" to "Urban" in the Metropolitan Region Scheme.

Recommendation 7

The Environmental Protection Authority recommends that, prior to lifting of "Urban Deferred" to "Urban" in the Metropolitan Region Scheme, the proponents should establish the following environmental criteria and objectives:

1. Conservation of the Lexia wetlands and any other conservation areas :
 - water level criteria be established, based on historic data and further groundwater modelling, which will ensure the maintenance of minimum, maximum and optimum water levels and seasonal patterns in the wetlands, and
 - water quality criteria be established for the wetlands to ensure the maintenance of appropriate water quality, based on existing characteristics;
2. Water quality parameters for the protection of Priority 1 and 2 water resource areas;
3. Water quality parameters for the minimisation of nutrient export to the Swan River (loads as well as concentrations); and
4. Water quantity parameters for the protection of plantations and natural vegetation within the adjacent State Forest and conservation areas.

The fulfilment of these provisions should meet the requirements of the Minister for the Environment on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Swan River Trust, the Department of Conservation and Land Management and the Shire of Swan.

Recommendation 8

The Environmental Protection Authority recommends that, prior to lifting of "Urban Deferred" to "Urban" in the Metropolitan Region Scheme, the proponents prepare and submit detailed Drainage Management and Nutrient Management Plans which comply with the environmental criteria and objectives established by Recommendation 7, and with the relevant Environmental Protection Regulations, to meet the requirements of the the Minister for the Environment on advice from the Environmental Protection Authority, the Water Authority of Western Australia, the Swan River Trust and the Shire of Swan.

These Plans should include the development of a comprehensive monitoring, management and reporting programme which should also be implemented to meet the requirements of the Environmental Protection Authority on the advice of the above agencies.

4.9 Air Quality

The issue of urban air quality for the Ellenbrook site needs to be considered at two levels. Air quality issues which arise from nearby sources and broader air quality issues such as photochemical smog and haze, which must be considered on a regional basis.

The broader issue of air quality for the Perth Metropolitan area, particularly the Foothills and North East corridor is of concern to the Environmental Protection Authority. A three year air shed study for the Perth Metropolitan area is presently being undertaken and the results may assist in the future planning for Perth. However, it is the Authority's view that planning and development in these corridors could proceed during the course of the air shed study. Whilst this is a fundamental issue, it is not considered by the Authority that the Ellenbrook development should be withheld pending results of the study. The implications of the air shed study on planning for the Perth Metropolitan Area will need to be fully examined upon the completion of that study.

Air quality issues arising from the nearby sources primarily include an inconvenience factor for neighbours living close to the operation of the commercial forest plantation. The Department of Conservation and Land Management indicates that prescribed burning must be undertaken to protect the plantation.

4.10 Future services

The site is located in the vicinity of two major roads - Gnangara Road and West Swan Road, and can be accessed from the north, east and south. Major new roads and improvements to existing roads are likely to be implemented to service the area as a consequence of the development of the North East Corridor, proposed by the Department of Planning and Urban Development.

It is intended by the planning agencies that in the long term the Perth - Darwin highway will go through the Shire of Swan to connect with the Reid or Roe Highways. The North East Corridor Planning Issues and Growth Options public discussion paper released by the Department of Planning and Urban Development in October 1991 identified two options from which a preferred route would be chosen. The option considered most favourable was the construction of a new National Highway along the eastern side of the standard gauge railway line in Middle Swan.

However, following public comment this option was discounted and route options further to the west of the Swan Valley were considered to require further investigation. It is the Authority's view that the Priority 1 area of the Gnangara groundwater mound and the Lexia wetlands pose major constraints to any proposed transport corridors and any proposed

developments with the potential to impact upon them would require detailed environmental investigation.

The Public Environmental Review indicates that all lots in the development will be connected to sewerage, which will input to the proposed Ellenbrook Main Pump Station to be located on Gngangara Road. In the short to medium term on site treatment is proposed. The long term outlet for the sewerage will be the proposed Alkimos Wastewater Treatment Plant. The details associated with the location and operation of sewerage treatment works and infrastructure is not provided in the report. Accordingly, if environmental concerns arise with the establishment of these facilities then separate environmental assessment may be undertaken by the Authority at the appropriate time.

4.11 Mining activities to the west of the site

There is a silica sand mining lease area adjacent to the western boundary of the Ellenbrook project area, within the State Forest No. 65, and including rural land to the north of Ellenbrook. However, existing excavation operations are some distance from the boundary of the Ellenbrook project area. Should the sand mining operations move to areas close to the Lexia wetlands, and therefore have the potential to affect the conservation values of the wetlands, then separate environmental assessment of the proposed mining operations may be undertaken by the Authority at the appropriate time. It is the understanding of the Authority that the Department of Mines would refer any such proposal to the Authority as a matter of course.

5. Conclusion

The Environmental Protection Authority considers that the environmental impacts associated with the Ellenbrook proposal, as identified in this assessment report are manageable, subject to the recommendations made in this assessment report and the commitments made by the proponents.

6. References

- Ellenbrook Management Pty Ltd (April 1992), Ellenbrook Development Public Environmental Review, Vols 1, 2, 3, 4, 5.
- Environmental Protection Authority (1990, Bulletin 374), A Guide to Wetland Management in Perth
- Environmental Protection Authority (1990,), Protection of the Groundwater, Wetlands and Associated Ecosystems of the Swan Coastal Plain, A public discussion paper.
- Water Authority of Western Australia (May 1987), Perth Urban Water Balance Study Volume 1