Thomsons Lake Urban Development

Revised South Jandakot Drainage Management Plan

Ministerial Condition 2

Report and Recommendations

of the

Environmental Protection Authority

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Summary

The Environmental Protection Authority has examined a revised plan to drain land in South Jandakot east of Thomsons Lake to enable housing development to proceed. Preparation of an acceptable drainage management plan was a condition of approval for housing development in South Jandakot issued by the Minister for the Environment in 1988.

In May 1989 the Environmental Protection Authority reported on a previous drainage management plan, concluding that the acceptability of the plan had not been demonstrated. The Authority went on to suggest a compromise solution which would allow some houses to be constructed and also ensure that the Jandakot groundwater resource was protected.

The proponent did not support the suggested compromise solution, and has submitted a revised drainage management plan, the main features of which are:

- a local drainage system within the urban area;
- a sub-soil pipe drainage system in the low-lying parts of the urban area; and
- a main drainage pipe from east of Thomsons Lake to Yangebup Lake, and an outlet pipe from Yangebup Lake to Cockburn Sound.

In examining the revised South Jandakot Drainage Management Plan, the Environmental Protection Authority considered the environmental impacts of the proposed drainage scheme, and also the expert advice of the Water Authority, Department of Conservation and Land Management and technical consultants, and extensive public input.

Specifically, the main variables which determine the environmental acceptability of the drainage management plan are the volume of drainage water, the physical impact of the drainage scheme, the impact of drainage water on the Beeliar wetlands, and disposal of the drainage water.

The Department of Conservation and Land Management and the Environmental Protection Authority have concluded that the revised Drainage Management Plan for South Jandakot is acceptable, subject to the recommendations contained in this report.

The Water Authority is generally satisfied with the revised Drainage Management Plan from a technical viewpoint, but has not yet resolved financial aspects of implementation of the drainage scheme. The Water Authority is currently investigating this matter with the proponent, and will advise the Minister for the Environment directly on the outcome of these investigations.

There are a number of specific technical issues which require clarification through further investigations associated with the detailed planning and design of the urban development and drainage scheme. Accordingly, the Authority considers it appropriate that, prior to subdivision proceeding, an Environmental Management Programme is prepared which accommodates the commitments given in the Drainage Management Plan, the recommendations contained in this Report and also the results of the investigations into the issues identified in this Report.

Acceptability of the Drainage Management Plan in regard to its potential impact on the Beeliar wetlands is on the basis that there will be no drainage into the southern Beeliar wetlands once urban development has commenced, other than by the drainage scheme outlined in the Plan. That is, the Authority is opposed to the suggestion in the Plan that development would commence up to two years before the establishment of the South Jandakot Branch Drain and associated pumping stations.

The Authority supports the commitment to fully investigate options for disposal of the drainage water and believes that, until viable alternatives are available, discharge to Cockburn Sound would be environmentally acceptable providing there is no detrimental effect on the beneficial uses of the waters to which discharge is occurring. Specifcally, discharge to Cockburn Sound should not result in localised pollution, or a net increase in the nutrient loading to Cockburn Sound. In regard to the nutrient loading to Cockburn Sound, the proponent must ensure that the nutrient input from an existing source, such as an industrial development, is reduced by an equivalent amount to that being discharged by the drainage scheme.

In regard to the Jandakot groundwater resource, the Environmental Protection Authority considers a conservative approach must be taken to development in its catchment to ensure the resource is protected. The current structure plan for South Jandakot proposes urban development "upstream" of public water supply bores.

The Authority reiterates its position that it does not support urban development on land above the Jandakot groundwater mound between the two lines of public water supply bores.

Recommendation 1

The Environmental Protection Authority concludes that Ministerial Condition 2 for the urban development of the South Jandakot area east of Thomsons Lake has been satisfied subject to the recommendations contained in this Report.

Recommendation 2

The Environmental Protection Authority recommends that prior to subdivision approval of the South Jandakot area being granted, an Environmental Management Programme should be prepared to accommodate the commitments in the revised Drainage Management Plan, the recommendations contained in this report, and the results of the further investigations identified in this Report.

The Environmental Management Programme should establish reporting and review mechanisms for the drainage scheme, and should be to the satisfaction of the Department of Conservation and Land Management, the Water Authority and Environmental Protection Authority.

Recommendation 3

The Environmental Protection Authority recommends that no drainage into the southern Beeliar wetlands be permitted once urban development has commenced other than by the drainage scheme outlined in the Drainage Management Plan.

Recommendation 4

The Environmental Protection Authority recommends that, until viable alternatives are available, discharge to Cockburn Sound would be environmentally acceptable providing there is no detrimental effect on the beneficial uses of the waters to which discharge is occurring. In particular,:

- the discharge should not result in localised pollution; and

- the proponent should ensure that the nutrient input to Cockburn Sound from an existing source, such as one of the industries currently discharging into Cockburn Sound, is reduced by an equivalent amount to that being discharged by the drainage scheme.

Monitoring of both physical and biological parameters of the drainage water and receiving water should be undertaken, and appropriate action taken by the proponent if there is an unacceptable change in water quality which would result in a detrimental effect on the beneficial uses of Cockburn Sound.

The monitoring of the outlet to Cockburn Sound, and reporting of results, should be addressed in the Environmental Management Programme.

1. Introduction

In February 1990 the Department of Planning and Urban Development submitted to the Environmental Protection Authority the revised South Jandakot Drainage Management Plan for consideration. The Drainage Management Plan seeks to address the water management concerns associated with a proposal to rezone land in South Jandakot for urban development (see Figure 1).

The Drainage Management Plan must also be acceptable to the Department of Conservation and Land Management and the Water Authority of Western Australia, and advice was sought by the Authority from those agencies.

The Drainage Management Plan has been publicly available since 26 February 1990, and the Authority also requested an independent engineering consultant review the Plan and provide advice on its acceptability from an engineering viewpoint.

2. Environmental assessment of urban development proposal (1987)

In 1987 the Environmental Protection Authority was asked to assess a proposal by the State Planning Commission (now the Department of Planning and Urban Development) for urban development of land in South Jandakot east of Thomsons Lake (State Planning Commission, 1986). Most of the land had been considered in previous planning studies as part of the "inter-urban wedge", to be excluded from urban development. The land overlays the Jandakot groundwater mound, which is very important for its potential water supply for the Perth metropolitan region, and it interacts with critical wetlands, including the Beeliar wetland chain.

Figure 1 shows the area proposed for urban development by the Department of Planning and Urban Development. Because much of the area is low-lying, a substantial portion of the proposed urban cell would require the installation of an intensive system of drainage to reduce high groundwater levels. A water management strategy was proposed by the Department of Planning and Urban Development involving detention basins, floodways, main drains, sub-soil drainage, a system of buffer lakes, a monitoring programme and recommendations relating to private and public groundwater extraction (Sinclair Knight & Partners and G B Hill & Partners Pty Ltd, 1987).

In its investigation of the South Jandakot urban development proposal, the Environmental Protection Authority had two major concerns:

Impact on groundwater resource

The first concern was the principle of potential impact of housing developments over valuable groundwater supplies. In its 1987 assessment report the Environmental Protection Authority expressed concern at the South Jandakot urban development as a portion of it would be within the main catchment of the Jandakot Public Water Supply Area. Although urban development was considered to be generally undesirable within the main catchment of a public water supply area, the Environmental Protection Authority recognised that the Water Authority was prepared to accept the concept because it regarded urban development as potentially more controllable in terms of impacts on the groundwater quality than likely alternative land uses. Given the evidence available which suggests urban development may be a significant source of groundwater pollution, this conclusion is difficult to explain.

Drainage management

The Environmental Protection Authority's second major concern was that there would be an obvious need to drain all or parts of the area, but there was no detailed proposal available to assess the impact of that drainage, particularly in regard to the Beeliar wetlands and the eventual use and disposal of the drainage waters. The Environmental Protection Authority was requested by the proponents of the South Jandakot development to report on the urban development proposal, but to leave the consideration of a detailed Drainage Management Plan until the issue was further investigated. Although the Environmental Protection Authority acceded to this request, it is now clear that the environmental acceptability of the urban development proposal is contingent upon the drainage proposal which is responsible for a number of significant potential impacts.

Subsequently, the Environmental Protection Authority recommended to the Minister for the Environment that, prior to the initiation of any rezoning proposals to allow for urban development, an environmentally acceptable drainage scheme should be formulated for the South Jandakot area, giving consideration to:

- water levels in the urban area and Thomsons Lake;
- the input of nutrients and toxic contaminants to the groundwater and the wetlands; and
- beneficial use of drainage waters.

The Environmental Protection Authority also made a number of recommendations regarding implementation and management of the scheme (Environmental Protection Authority, 1987).

A copy of the conditions set by the Minister for the Environment for amendment of the Metropolitan Region Scheme as proposed by the Department of Planning and Urban Development, is included in Appendix 1.

3. Environmental assessment of Drainage Management Plan (1989)

In 1988 the Department of Planning and Urban Development advertised an amendment to the Metropolitan Region Scheme to rezone land east of Thomsons Lake from Rural to Urban and Urban Deferred (see Figure 2). That initiative was accompanied by release for public comment of the preliminary plan for management of the drainage

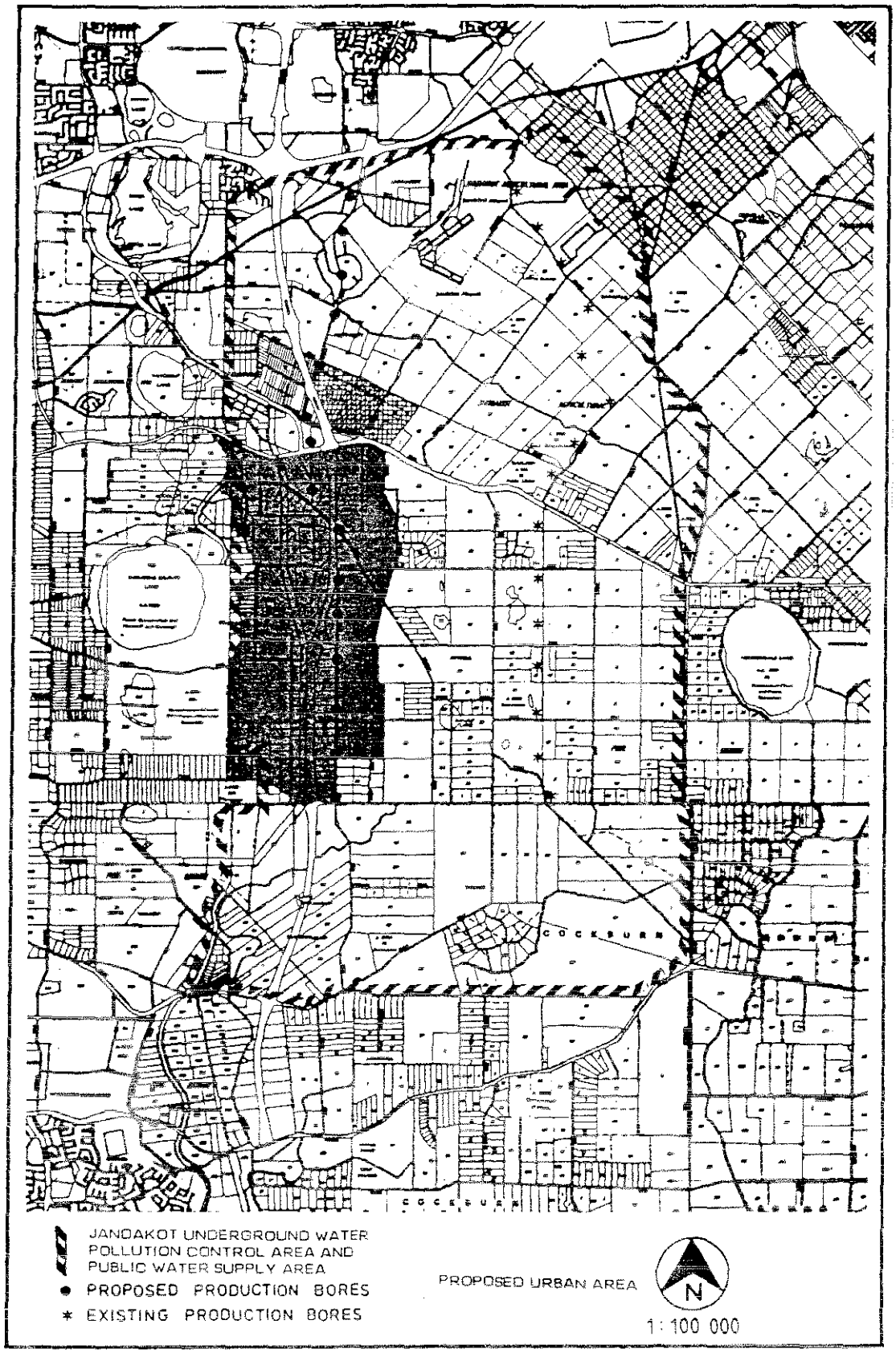

Figure 1: Thomsons Lake urban structure study - preferred option

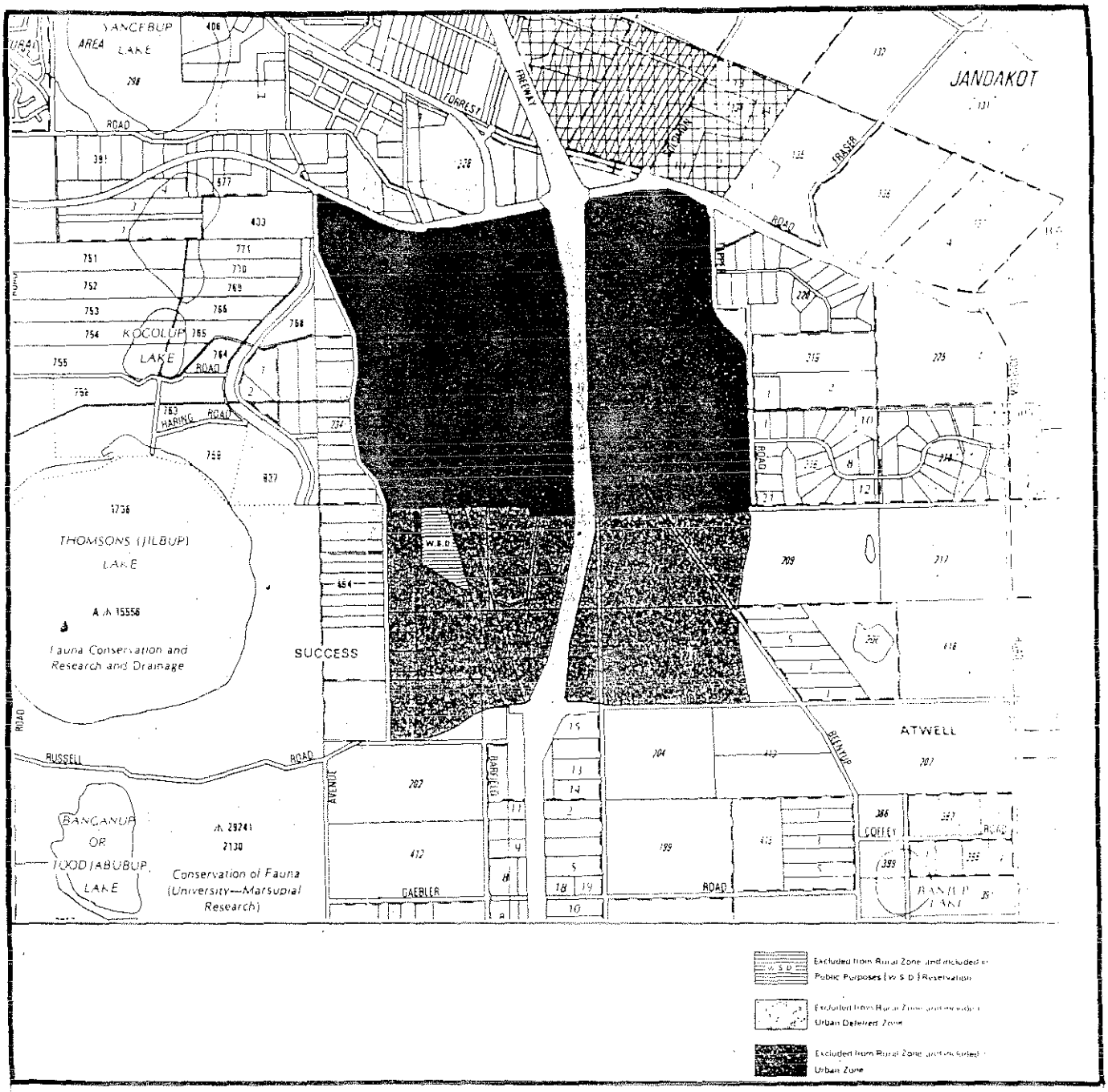

Figure 2: Proposed Metropolitan Region Scheme amendment

waters prepared for the Department of Planning and Urban Development by G B Hill & Partners Pty Ltd (G B Hill & Partners Pty Ltd, 1988). The plan outlined development of the Beeliar Compensating Channel in conjunction with upstream urban drainage.

The Environmental Protection Authority called for public submissions on the drainage scheme to assist it in determining whether the plan could be implemented to the Authority's satisfaction. An independent engineering assessment of the drainage scheme was completed by Wood & Grieve Pty Ltd, and this document was also made available to the public (Wood & Grieve Pty Ltd, 1989).

Acceptability of the Drainage Management Plan depended on many variables (listed below), and also depended on the advice of the Water Authority and of the Department of Conservation and Land Management in areas of their expertise.

Volume of drainage water

The plan envisaged draining away an average of 3.5 million cubic metres of water per annum (5.8 million cubic metres in a wet year) from the South Jandakot development area, representing a substantial volume of valuable water resource.

Impact of drainage scheme

The Beeliar Compensating Channel and associated infrastructure would have been a large physical incursion into areas of environmental sensitivity within the proposed Beeliar Regional Park. This incursion alone would not have been sufficient to recommend against the drainage proposal, but was an important consideration.

Impact of drainage water on wetlands

The drainage water which would have arrived at the Beeliar wetland chain, either by direct surface drainage or indirectly through groundwater recharge, would have been a consequence of extra yield and pollution associated with urban areas. Specifically, the Beeliar wetland water levels would have been altered and wetland water quality affected, and the advice provided to the Environmental Protection Authority was that these impacts would have been unacceptable on specific parts of the Beeliar wetland chain.

Disposal of drainage water

The ultimate receiving environment would have been the ocean through Woodman Point, and this has two negative aspects. Firstly, the obvious waste of large quantities of valuable water resource (mentioned above), and secondly the potential impact on the nearshore environment of 3.5 million cubic metres of fresh water of relatively high concentrations of nitrogen and phosphorus and other pollutants. Investigations by the Authority suggested that, while the nutrient loads per se would not cause direct pollution impacts, such a load of fresh water may cause concern at certain times of the year.

Both the Water Authority and the Department of Conservation and Land Management indicated that the proponent had not demonstrated that the Drainage Management Plan was acceptable.

The Environmental Protection Authority reported to the Minister for the Environment in May 1988 that the proposed Drainage Management Plan was not adequate (Environmental Protection Authority, 1989).

The Environmental Protection Authority went on to provide advice on a possible compromise solution which would result in some housing development proceeding while the environment is protected.

Specifically, the Authority advised that the major problems with the drainage proposal could be ascribed to the eastern one third of the development area which is mostly swampy and under water in winter and would generate up to 70% of the drainage water (see Figure 3). The eastern third is also the most important for potential groundwater abstraction for groundwater supply. The Environmental Protection Authority recommended that the eastern one third of the development area, the land least suitable for development, be excluded, thus resulting in:

- the removal of the issue of the wastage of huge amounts of valuable water resource;
- the protection of the wetlands;
- a drainage proposal of a more manageable scale; and importantly,
- protection of Perth's long-term water supply.

The western third is elevated and has no exceptional drainage problems, and consequently the Authority recommended that urban development could proceed with minimal arrangements for drainage. The central third is less elevated and contains both the Kwinana Freeway and the proposed alignment of the bores for the Water Authority's Stage 2 groundwater abstraction scheme. The Authority recommended that studies be undertaken to delineate areas to the west suitable for urban development and areas to the east which should be excluded and managed for protection of the water resource.

However, the compromise solution suggested by the Environmental Protection Authority was not supported by the proponent, and investigations continued into development of all the land.

4. Revised Drainage Management Plan

A revised Drainage Management Plan for the South Jandakot urban development was submitted by the Department of Planning and Urban Development in February 1990. The principal features of the drainage system are shown on Figure 4. The main components of the drainage system are:

- a local drainage system within the urban area which includes a number of detention basins and buffer lakes to improve both on-site

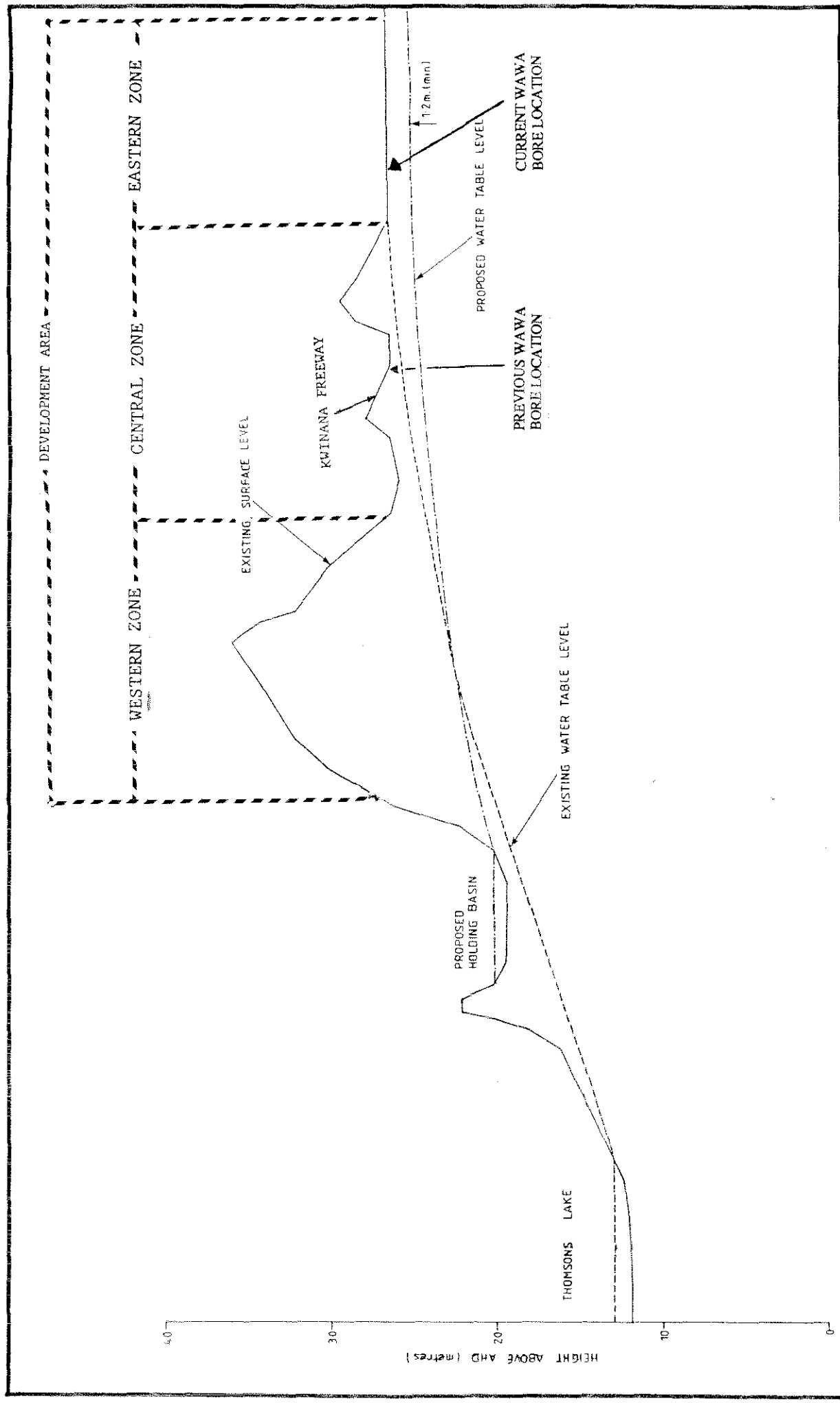

Figure 3: Cross section along Bartram Road

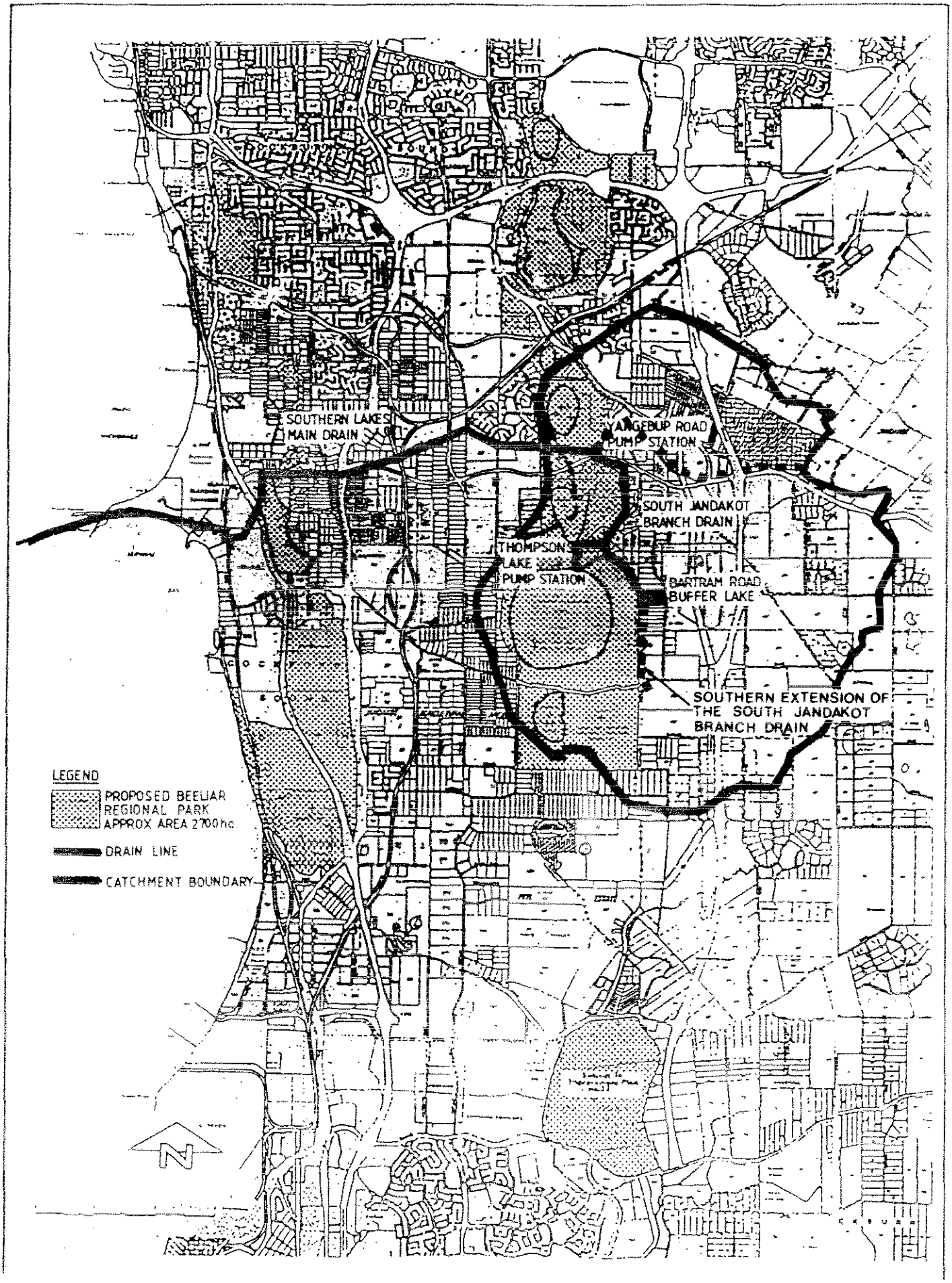

Figure 4: Proposed urban drainage system

recharge and the quality of drainage water passing from the urban area;

- a sub-soil pipe drainage system in the low-lying parts of the urban area to maintain the groundwater table, with the elevation of the sub-soil drains being limited to the current winter water table level; and
- a main drainage system comprising of a pipe drain from east of Thomsons Lake to Yangebup Lake, a pump station servicing Thomsons Lake, a pump station servicing Kogolup and Yangebup Lakes jointly, and an outlet pipe from Yangebup Lake to route excess drainage water from the catchment. The major lakes would be used selectively to provide compensating storage necessary in routing the drainage from the catchment, although the main drain between Thomsons and Yangebup Lakes has been designed to enable the majority of water to be diverted past Thomsons and Kogolup Lakes, and the design of the pumping stations and outlet mains such that environmentally acceptable water levels in the major lakes could be achieved. Also, the outlet system has been developed in a manner which could provide opportunity for utilisation of the excess drainage water.

5. Public and Government submissions

The revised South Jandakot Drainage Management Plan was made available to the public on 26 February 1990. While there has not been a formal public review period, the Environmental Protection Authority did receive a number of submissions from Government agencies and the public.

A total of 33 submissions were received: two from Government departments and 31 from the public. Of the 31 public submissions, 12 were pro forma letters and one enclosed a petition with 321 signatures.

The main issues addressed in the submissions are:

Drainage scheme

- reliance on technical solutions and energy supply
- accuracy of computer modelling and estimates of assimilative capacity of lakes
- removal of pesticides from drainage water
- effectiveness of detention basins and buffer lake for nutrient stripping
- mosquito and midge problem associated with drainage basins and buffer lake
- use of red mud
- location of Thomsons Lake pumping station
- timing of installation in relation to urban development
- protection and management of wetlands in development area
- availability of monitoring programme to the public

Disposal of drainage water

- waste of water resource
- impact on Cockburn Sound

Ongoing monitoring and management

- responsibility

Groundwater

- impact of urban development on quantity and quality of groundwater (eg pesticides, service stations)
- impact of future Water Authority pumping on wetlands in proposed urban area
- impact of relocating Water Authority bores on Special Rural lots to the east

Urban development

- impact on natural habitats
- reservation of woodland and wetlands in proposed urban area
- relocation of 330 kV power line to freeway alignment
- use of 330 kV power line buffer as public open space
- servicing and transport

Others

- population control
- management of pollution problems in Yangebup Lake
- time available to comment on Drainage Management Plan
- management of the northern Beeliar wetlands

The main issues are addressed by the Authority in Sections 8.1 and 8.2 of this Report.

Condition 2 set by the Minister for the Environment requires that finalisation of the proposed rezoning and reservation shall not occur until the Drainage Management Plan has been prepared to the satisfaction of the Environmental Protection Authority, the Water Authority and the Department of Conservation and Land Management. Both the Water Authority and the Department of Conservation and Land Management made detailed submissions to the Authority, copies of which are included in Appendix 3.

The Department of Conservation and Land Management agrees to the revised Drainage Management Plan provided there is clear commitment to the scheme over the full term of implementation of urbanisation. The Department also endorses the role of the Water Authority in managing the main drainage within the proposed Beeliar Regional Park. Specific issues which the Department considers require further attention are responsibility for monitoring and management,

relationship of the first stage of development to the whole of the proposed urban area, impact of the drainage alignment on the Thomsons Lake Nature Reserve and the proposed Beeliar Regional Park, water quantity criteria and the piped link between Yangebup Lake and Kogolup Lake. Although not directly related to the Drainage Management Plan, the Department also indicated the need to identify vegetation worthy of retention in the southern part of the South Jandakot development area.

The Water Authority has advised that, in terms of meeting the requirements of Condition 2 of the Ministerial Conditions, it is not yet satisfied with the Drainage Management Plan because of the need to resolve a number of technical and financial issues. The technical issues relate to clarification of the effluent plume below Jandakot Woolscourers, and monitoring of groundwater downstream of the Bartram Road buffer lake. Also, the Water Authority believes there are significant funding implications in the Plan which must be addressed before it can determine the acceptability of the Drainage Management Plan, and has therefore advised that the Minister's Condition 2 has not been fulfilled.

In regard to the technical issues, the Environmental Protection Authority agrees with the Water Authority's suggestions, and has addressed these issues in Section 8.1 of this Report. However, it is appropriate that the Water Authority liaises directly with the proponent on the outstanding financial issue, and advises the Minister for the Environment of the outcome.

In addition to the Water Authority's submission on the revised Drainage Management Plan, the Authority has also provided earlier advice on a number of specific issues associated with the proposed urban development:

- The currently planned locations for the bores in the Jandakot Groundwater Scheme Stage 2 are based on a number of factors including water level impacts on Beeliar wetlands, impacts on remnant vegetation and seasonal wetlands in proximity to the wellfield, impacts on private bores and summer pasture in Special Rural zones, proximity to industrial zoned land, and tentative structure plans for urban development south of Forrest Road. The location of the proposed bores has been slightly altered from those shown in Figure 20 of the revised Drainage Management Plan; and
- A 500 m buffer zone is recommended for the existing Jandakot Water Treatment Plant on Bartram Road. The buffer, which is required because of chlorine hazard and hydrogen sulphide odours, conflicts with the urban structure plan included in the revised Drainage Management Plan. There is opportunity to reduce the buffer by upgrading and relocating some of the facilities. However, the cost associated with reduction of the buffer zone is estimated to be $1.5 million, a cost which the Water Authority considers should be met by the developer. This issue relates to Ministerial Conditions 5 and 6 (Appendix 1).

6. Independent engineering assessment

The Environmental Protection Authority considered it necessary that an independent engineering assessment of the Drainage Management Plan be undertaken, and Binnie & Partners Pty Ltd, consulting engineers, were approached on this matter.

After reviewing the Drainage Management Plan, Binnie & Partners Pty Ltd provided advice to the Authority on the engineering aspects of the Plan, concluding that the Plan meets its stated objectives from an engineering viewpoint, and in particular:

- The proposed gravity and pressure main drainage system should provide adequate drainage for urban development. However, the detailed design will need to take account of the minimal head available for a gravity system to minimise construction costs. The use of a piped drainage system is supported.
- The drainage system should be capable of meeting the environmental objectives for the Beeliar wetlands. However, the effectiveness of the system is predicated on efficient nutrient removal from detention basins and buffer lakes, including a regular maintenance programme. The likely performance of these facilities as nutrient removal systems needs to be verified as soon as possible, as the engineering options for nutrient removal are likely to be both extensive and expensive.
- Disposal of drainage water to Cockburn Sound is not considered to be a waste of water resources. In the longer term, the drainage required for urban development could result in an improvement in water resources in that recharge to areas such as the Kwinana industrial area may provide a worthwhile benefit.

A copy of Binnie & Partners Pty Ltd's advice is included in Appendix 4.

The Authority notes the first point above, and the second and third points are addressed in Section 8.1 of this Report.

7. NRMC report on drainage issues

NRMC Pty Ltd was contracted by the Environmental Protection Authority to provide advice on a number of issues to assist the Authority in assessing the revised South Jandakot Drainage Management Plan. Specifically, the Authority sought advice on the following:

- water level and water quality objectives for the three southern Beeliar wetlands (Thomsons, Kogolup and Yangebup) appropriate for the protection of these wetlands;
- acceptable frequency, duration and resultant water level of drainage overflow into Thomsons Lake and Kogolup Lake;

- the use of Yangebup Lake as a compensating basin, and consequent management requirements; and
- expected freshwater and nutrient loadings to Cockburn Sound, and also the predicted dilution rate with distance from an outfall under different flow rates.

NRMC Pty Ltd reported to the Authority in January 1990, and a copy of the Executive Summary is included in Appendix 5.

NRMC Pty Ltd made 10 recommendations to the Authority. Recommendations 1, 2, 4, 5, 6 and 7 deal with the management of Thomsons Lake, Kogolup Lake, Yangebup Lake and Little Rush Lake, and are addressed by the Authority in Section 8.1 of this Report. Recommendation 3, which establishes water levels for Thomsons Lake, has been considered by the Department of Conservation and Land Management and the adopted criteria are given in the Department's advice on the Drainage Management Plan (Appendix 4). Recommendation 8 deals with existing problems at Yangebup Lake, a matter which is being investigated by the Environmental Protection Authority. Recommendation 9 deals with discharge of drainage waters to Cockburn Sound and is addressed by the Authority in Section 8.1 of this Report. Recommendation 10 concerns an information programme for future landowners in South Jandakot. The Authority notes the recommendation and forwards it to the proponent and the City of Cockburn for consideration.

8. Environmental assessment of revised Drainage Management Plan

As explained earlier, the two major environmental concerns associated with the urban development proposal at South Jandakot are drainage management and impact on the groundwater resources.

In May 1988 the Environmental Protection Authority reported to the Minister for the Environment that the proposed Drainage Management Plan was not adequate. The Authority went on to provide advice on a possible compromise solution which would result in some housing development proceeding while the environment is protected. In particular, the environmental issues associated with drainage management could have been addressed, and also the groundwater resource would have been protected.

However, the proponent did not support the compromise solution suggested by the Environmental Protection Authority, and a revised Drainage Management Plan for the original South Jandakot development area has been submitted.

8.1 Drainage management

The Environmental Protection Authority has reviewed the revised South Jandakot Drainage Management Plan submitted to the Authority in February 1990. The Authority has considered the position of the Water Authority and the Department of Conservation and Land Management, and also taken account of advice received from the engineering and environmental consultants. Issues raised in submissions received from interested groups and individuals have also been addressed.

The Environmental Protection Authority has concluded that the variables associated with the Plan which determine its environmental acceptability have been adequately addressed, subject to the recommendations contained in this Report.

Recommendation 1

The Environmental Protection Authority concludes that Ministerial Condition 2 for the urban development of the South Jandakot area east of Thomsons Lake has been satisfied subject to the recommendations contained in this Report.

The revised Drainage Management Plan is a substantial improvement on earlier documentation in regard to environmental protection, and it also provides a higher level of detail than previously submitted.

However, there remains a number of issues which require clarification, but which are primarily dependent on further investigations associated with the detailed planning and design of the urban development and drainage scheme. Accordingly, the Authority considers it appropriate that, prior to subdivision proceeding, an Environmental Management Programme is prepared which accommodates the commitments given in the revised Drainage Management Plan, the recommendations contained in this Report and also the results of the investigations into the issues identified in this Report. The Environmental Management Programme should incorporate the "operating rules" for implementation of the Plan, including reporting and review mechanisms, and should be prepared in consultation with the Water Authority, Department of Conservation and Land Management, City of Cockburn and Environmental Protection Authority.

Recommendation 2

The Environmental Protection Authority recommends that prior to subdivision approval of the South Jandakot area being granted, an Environmental Management Programme should be prepared to accommodate the commitments in the revised Drainage Management Plan, the recommendations contained in this report, and the results of the further investigations identified in this Report.

The Environmental Management Programme should establish reporting and review mechanisms for the drainage scheme, and should be to the satisfaction of the Department of Conservation and Land Management,

the Water Authority and the Environmental Protection Authority.

The Environmental Management Programme would be used by the proponent and agencies involved (Water Authority, Department of Conservation and Land Management, City of Cockburn) to implement the necessary monitoring and management associated with the drainage scheme. As implementation of the Programme will require substantial co-ordination between the proponent and management agencies, consideration should be given to the need for a committee to guide the monitoring and management process.

The Environmental Protection Authority places a great deal of emphasis on the management of environmental impacts and the monitoring of both the management programme and the impacts to ensure that appropriate steps are taken to ameliorate and minimise adverse affects.

It should be noted that an acceptable Environmental Management Programme should fulfill Ministerial Condition 4 (Appendix 1).

The following specific comments are offered on the variables associated with the revised Drainage Management Plan.

Volume of drainage water

In regard to wastage of a public resource, the previous Plan had the potential to export a large quantity of water from the development area. The potential loss of water resource has been largely overcome by filling the low-lying areas east of the Freeway to one metre above existing winter groundwater table levels, and also maximising future abstraction of groundwater by the Water Authority. This also reduces the environmental impact of the development and contributes to a more reliable urban drainage system. Specifically, the estimated volume of drainage water in an average year has been reduced from 3.45 to 1.6 million cubic metres.

Impact of drainage scheme

The impact of the drainage scheme on the proposed Beeliar Regional Park has been reduced by the inclusion of a piped drainage system rather that an open channel (South Jandakot Branch Drain). Further, both the Department of Conservation and Land Management and the Environmental Protection Authority support the intention to locate the pipe generally along the edge of the proposed Beeliar Regional Park.

While the Drainage Management Plan gives only a concept alignment for the pipe within the proposed Beeliar Regional Park, there are adequate commitments by the proponent in the Drainage Management Plan to consult with relevant agencies during the detailed design and construction of the pipe, particularly in regard to minimising the impact on vegetation.

Two particular issues of concern to the Department of Conservation and Land Management which must be resolved and addressed in the Environmental Management Programme are the need to upgrade the Hammond Road drain in the Thomsons Lake Nature Reserve, and location of the outlet from the Bartram Road buffer lake in relation to the Reserve's perimeter firebreak. One other design issue is minimising the impact of the Thomsons Lake pumping station on the lake itself.

Impact of drainage water on wetlands

The expected impact on the Beeliar wetlands is no longer regarded as unacceptable due to improvements in the design, flexibility and ongoing monitoring associated with the drainage scheme, although specific issues requiring clarification are addressed below. Acceptability of the Drainage Management Plan in regard to its potential impact on the Beeliar wetlands is on the basis that there will be no drainage into the southern Beeliar wetlands once urban development has commenced, other than by the drainage scheme outlined in the Plan. That is, the Authority is opposed to the suggestion in the Plan that development would commence up to two years before the establishment of the South Jandakot Branch Drain and associated pumping stations.

Recommendation 3

The Environmental Protection Authority recommends that no drainage into the southern Beeliar wetlands be permitted once urban development has commenced other than by the drainage scheme outlined in the Drainage Management Plan.

The water level and water quality criteria for Thomsons, Kogolup and Yangebup Lakes have been discussed by the Department of Conservation and Land Management and the environmental consultant, NRMC Pty Ltd. The Department of Conservation and Land Management has formally adopted water level criteria, and these should be included in the Environmental Management Programme. Water quality criteria should be revised, and included in the Environmental Management Programme, as additional information becomes available. Of particular relevance will be the standards being developed by the Australian and New Zealand Environment Council, and confirmation of the assimilative capacity of the wetlands in regard to phosphorus. Of course, ongoing monitoring of the implications of fluctuations in water quality and water levels will lead to a revision of the criteria when appropriate.

The piped link between Yangebup Lake and Kogolup Lake should only allow water to be directed from Kogolup to Yangebup and not in the reverse direction.

The management programme should include bores appropriately positioned to detect the possible development of an effluent plume from the Bartram Road buffer lake. A contingency plan should be in place, in the event that a plume does develop.

Further investigation of the effluent plume below the Jandakot Woolscourers is required to confirm whether the management criteria for Yangebup

Lake could result in undesirable impacts on the Lake and the drainage water. These investigations will be undertaken by the Environmental Protection Authority and the Government agencies involved in the drainage scheme prior to its implementation.

Advice from CSIRO indicates that, if termiticides are applied correctly, contamination of the groundwater and drainage water should not result (Appendix 6). The Environmental Protection Authority notes the commitments given in the Drainage Management Plan on this issue.

The issue of water levels in Little Rush Lake has been raised in both the environmental consultant NRMC Pty Ltd's report and a number of submissions. This matter should be investigated by the agencies responsible for implementation of the South Jandakot Drainage Management Plan.

Disposal of drainage water

The drainage scheme would ultimately discharge on average 3.6 million cubic metres per year from the Yangebup, Thomsons and Kogolup catchments (including approximately 1.6 million cubic metres from the South Jandakot development area). The revised Drainage Management Plan discusses a number of options for dealing with the drainage water, including recharging the drainage water to land west of the catchments, or at Kwinana to increase groundwater availability to industry. However, the option of discharging to Cockburn Sound is favoured by the proponent if a viable land-based disposal scheme cannot be found.

As mentioned previously, disposal to Cockburn Sound has two negative aspects; wasting valuable water resource, and potential impact on the nearshore environment of Cockburn Sound.

As mentioned above, the volume of water to be drained from the South Jandakot development area would be approximately 1.6 million cubic metres in the current Plan. The previous plan estimated 3.45 million cubic metres of water would be drained from the South Jandakot area. In regard to wasting water, the current Plan is certainly less wasteful. However, discharge to Cockburn Sound would still result in the loss of a significant quantity of valuable water resource, and accordingly, is not regarded by the Authority as the most desirable option. The Authority does not concur with the suggestion that simply because the volume of groundwater available to the Water Authority following implementation of the proposed Stage 2 groundwater abstraction scheme would not be reduced as a result of the urban development, discharge of the drainage water to Cockburn Sound would therefore not represent a wastage of public resource.

The Authority fully supports the commitment by the proponent in the Drainage Management Plan that the alternative options for disposal will be investigated fully during the detailed design phase for the drainage outlet. Further, the Authority considers that the viability of alternatives available for disposal of the drainage water should be reviewed regularly following implementation of the drainage scheme. Minimising immediate or eventual nutrient loads to Cockburn Sound should be one of the environmental goals governing the investigations into the options for disposal of the drainage water.

The potential impact on the nearshore environment of Cockburn Sound remains a concern with the current Drainage Management Plan. Cockburn Sound is a valuable recreational asset of the Perth region, and at the same time, is the focus for the region's water-orientated heavy industries and related services. It is also important for commercial and recreational fisheries. This range of activities can only continue if the health and viability of the Sound's ecosystem is protected and enhanced.

Over the past thirty years industrial wastes, treated domestic sewage, groundwater and surface runoff have been discharged into Cockburn Sound. As a consequence (particularly of nutrients contained in these inputs), water quality in this area deteriorated markedly during the 1960's and 1970's, leading to a major loss of seagrass in Cockburn Sound, and deteriorating seagrass meadows on the adjacent Parmelia Bank.

Following recommendations of the Cockburn Sound Study (1976-1979), a substantial reduction in nutrient inputs was achieved. Kwinana Nitrogen Company commissioned a nitrogen scrubber in December 1982, and primary treated sewage effluent, which formerly entered Cockburn Sound off Woodman Point, was diverted in July 1984 into a newly-constructed pipeline and discharged into the open ocean off Cape Peron.

Monitoring programmes indicate that these substantial reductions in nutrients resulted in an immediate improvement in water quality with less frequent algal blooms, and a slowing in the rate of seagrass loss in some areas. However subsequent monitoring programmes suggest that, following this initial improvement in water quality, no further improvement occurred.

Currently, total nutrient loads to Cockburn Sound are still around or in excess of those which prevailed when major areas of seagrass were lost. Furthermore seagrass meadows on east Parmelia Bank, directly adjacent to the proposed drainage water outfall, declined markedly between 1982-1986. Although lime sand mining operations occurred on east Parmelia Bank between 1972-1987, it is unlikely that these operations were solely responsible for the decline in the seagrass and the subsequent mobilisation of sediments and erosion of Parmelia Bank. The historical pollution of this area may also have contributed to this decline.

These events underline the vulnerability of marine communities that have a history of environmental disturbance and suggest that the remaining communities (especially the seagrass meadows) in the Cockburn Sound area are also vulnerable

The Environmental Protection Authority is currently developing an "Environmental Management Strategy for Cockburn Sound and Surrounding Waters", and one of the main objectives of this Strategy will be to define the total amount of pollutants that can be discharged and accepted into

the Sound without adversely affecting its biology and cleanliness, ie its assimilative capacity. Monitoring to date suggests that the assimilative capacity of the Sound is still being exceeded. For this reason, the Authority considers the total nutrient loads currently discharged to the Sound should not increase as a result of any new proposal, including the current proposal.

The proposed drainage scheme would discharge annually on average 3.6 million cubic metres of fresh water (1.6 million cubic metres from the South Jandakot development area) containing an estimated 6000 kg of nitrogen and 1000 kg of phosphorus (4000 kg and 600 kg respectively from the South Jandakot development area).

The Authority accepts that neither the fresh water nor the expected constituent concentrations in the drainage water should result in gross localised pollution of the Sound. However, despite the reported quality of the drainage water being environmentally acceptable, the Environmental Protection Authority requires that, if drainage water is to be discharged to Cockburn Sound, monitoring of both physical and biological parametres of the drainage water and the receiving water should be undertaken to verify the results contained in the Drainage Management Plan and determine the effects of discharge upon biological communities within the marine environment. If there is an unacceptable change in the receiving water quality resulting in pollution, appropriate action should be taken by the proponent.

The Authority also accepts that the annual nutrient loading to Cockburn Sound as a result of the drainage scheme would be small compared to both past and current industrial discharges into the Sound. However, as stated above, the Authority is opposed to any increase in the total nutrient load discharged to Cockburn Sound, no matter how small. Accordingly, discharge to Cockburn Sound would be acceptable providing the proponent could ensure that the nutrient input from an existing source, such as one of the industries currently discharging into Cockburn Sound, was reduced by an equivalent amount.

Recommendation 4

The Environmental Protection Authority recommends that, until viable alternatives are available, discharge to Cockburn Sound would be environmentally acceptable providing there is no detrimental effect on the beneficial uses of the waters to which discharge is occurring. In particular:

- **the discharge should not result in localised pollution; and**
- **the proponent should ensure that the nutrient input to Cockburn Sound from an existing source, such as one of the industries currently discharging into Cockburn Sound, is reduced by an equivalent amount to that being discharged by the drainage scheme.**

Monitoring of both physical and biological parameters of the drainage water and receiving water should be undertaken, and appropriate action taken by the proponent if there is an unacceptable change in water quality which would result in a detrimental effect on the beneficial uses of Cockburn Sound.

The monitoring of the outlet to Cockburn Sound, and reporting of results, should be addressed in the Environmental Management Programme.

8.2 Groundwater protection

In previous reports associated with the South Jandakot Urban Development, the Environmental Protection Authority has expressed its concern regarding urban development over the Jandakot Mound.

In the Environmental Protection Authority's original assessment of the urban development proposal in 1987, it indicated its concern at development within the main catchment of the Jandakot Public Water Supply Area, specifically the intention to allow urban development "upstream" of the proposed public water supply boreline (Figure 1). Since that time, the location of the proposed bores has been shifted east in an attempt to reduce the area of urban development within the catchment of the bores while maintaining the effectiveness of the bores, and the Authority commends the Water Authority and the proponent for this action (Figure 3). However, although there has been significant improvement on this issue, the current structure plan proposes urban development within the catchment of the proposed bores.

The Authority is of the view that a conservative approach must be taken to ensure the quality and quantity of the Jandakot groundwater resource is protected. The porous soils have limited pollution attenuation capabilities, and while considerable knowledge is available about the groundwater, it is generally agreed that substantial research is required before predictions of effects and consequences of defined incidents or trends can be made with any confidence.

There is evidence available which points to levels of contamination of the groundwater occurring from urban development (eg Atwood & Barber, 1989). It is clear that urban development has the potential to contaminate the groundwater and alter recharge to the aquifer. Of course, the actual impact will depend on the design philosophy, level of design and long-term management. However, impacts which reduce groundwater quality are inevitable. Once they occur, remedial action can only marginally improve the situation. Therefore, it is imperative that only developments which do not have an inherent potential to contaminate groundwater should be permitted above the groundwater resource.

The Environmental Protection Authority is currently preparing an Environmental Protection Policy for groundwater, wetlands and associated ecosystems of the Swan Coastal Plain which will provide a

framework within which more specific local environmental protection policies can be developed. Preparation of a policy for the Jandakot Mound has commenced, and it is expected that the policy will more clearly define acceptable land uses and management requirements which will ensure protection of the Jandakot groundwater resource.

Accordingly, the Authority does not accept the argument that, because developments with a greater potential to impact on the groundwater resource have been permitted in the past, proposals for urban development which may pose less of a threat should be regarded as acceptable.

The Authority reiterates its position that it does not support urban development on land above the Jandakot groundwater mound between the two lines of public water supply bores.

9. Conclusion

The Environmental Protection Authority has concluded that the revised Drainage Management Plan for the South Jandakot development is acceptable. In reaching this conclusion, the Authority considered documentation prepared by the proponent, expert advice from the Water Authority and the Department of Conservation and Land Management and technical consultants, and also public input.

The Authority has identified a number of environmental constraints on the drainage scheme, and also issues requiring further investigation, all of which are to be addressed in an Environmental Management Programme to be prepared prior to subdivision of the South Jandakot area.

However, in regard to the Jandakot groundwater resource, the Environmental Protection Authority does not support the current South Jandakot structure plan which proposes urban development "upstream" of public water supply bores. The Authority reiterates its opposition to urban development on land above the Jandakot groundwater mound between the two lines of public water supply bores.

10. References

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Appendix 1

Ministerial conditions

MINISTER FOR ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

THOMSONS LAKE URBAN STRUCTURE STUDY AND SOUTH JANDAKOT DEVELOPMENT WATER RESERVES MANAGEMENT PLAN

STATE PLANNING COMMISSION
(as proponent for the rezoning under the Metropolitan Regional Scheme)

The proposed urban zoning and Parks and Recreation reservation as generally contained in the Thomson Lake Urban Structure Study Option 1 (Map 10) may be implemented, subject to the following conditions:

1. Prior to the initiation of rezoning and reservation proposals, the proponent shall outline, to the satisfaction of the Minister for Environment a proposal for a drainage management plan for the South Jandakot area, which shall establish a package of mechanisms (including monitoring) to control water levels:

   (1) In the proposed urban areas, which is acceptable to the Water Authority of Western Australia.

   (2) In the Thomson Lake open space area and other wetlands within the proposed Beeliar Regional Park, which is acceptable to the Environmental Protection Authority, Department of Conservation and Land Management and the Water Authority of Western Australia;

   this outline of the proposal shall be made available to the public by the proponent, prior to the rezoning being advertised.

...2/

Published on
27 OCT 1988

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2. Finalisation of the proposed rezoning and reservation shall not occur, until the drainage management plan referred to in condition 1 has been prepared to the satisfaction of the Environmental Protection Authority, Water Authority of Western Australia and the Department of Conservation and Land Management.

3. Once the drainage management plan has been prepared and approved, it shall be progressively and adaptively implemented in parallel with each subdivision stage, including monitoring of the effects of each stage of the drainage management plan. This condition is intended to only require that part of the drainage management plan to be implemented which relates to the portion of land to be subdivided and not for the whole drainage plan to be constructed at once.

   Where the Environmental Protection Authority believes that monitoring shows undesirable environmental impacts are occurring, further stages of the proposal shall not proceed, until changes to the drainage management plan, or development proposal are made to the satisfaction of the Environmental Protection Authority.

4. Prior to subdivisional approval being granted, reporting mechanisms (to the satisfaction of the Environmental Protection Authority, Department of Conservation and Land Management and the Water Authority of Western Australia) for monitoring of the drainage management plan shall be established. These should provide for reporting on the progress of the development, the functioning of the drainage plan and the impact on the wetland eco-systems. The reporting shall be as follows:

   . annual reports

   . detailed review of progress after three years, with decisions to be taken at that time on whether or not and under what conditions further subdivision can proceed.

   These reports shall be submitted by the proponent (or any other agency which has accepted this responsibility) for review to:

   . Department of Conservation and Land Management

   . Water Authority of Western Australia

   . Environmental Protection Authority, and

   with advice from these agencies forming the basis for adjustment or continuation of the drainage management plan.

5. (1) Prior to the finalisation of urban rezoning amendments, the proponent shall provide commitments to the satisfaction of the Minister for Environment, for the reduction in hydrogen sulphide levels associated with the Water Treatment Plant of the Water Authority of Western Australia, to levels acceptable to the Environmental Protection Authority.

5. (2) Prior to subdivisional approvals being granted, the level of hydrogen sulphide emitted by the Water Treatment plant must be reduced to a level acceptable to the Environmental Protection Authority.

6. A buffer area, to the satisfaction of the Environmental Protection Authority (within which residential development shall not occur) shall be established around the existing Water Authority of Western Australia water treatment plant.

   This buffer is required to ensure that:

   - no residential development occurs within the one in one million risk contour associated with chlorine use and storage at the plant;

   - no residential development occurs in areas where levels of hydrogen sulphide associated with the plant are unacceptable to the Environmental Protection Authority for residential uses.

7. Monitoring of groundwater quality shall be undertaken within the groundwater control area by the Water Authority of Western Australia. If undesirable levels of pollution are detected the Environmental Protection Authority may impose conditions on future development in the area. If necessary, controls shall be imposed by the Water Authority of Western Australia on land use practices within the existing urban area.

Barry Hodge, MLA
MINISTER FOR ENVIRONMENT

26 [illegible]

Appendix 2

Report and recommendations of the Environmental Protection Authority, May 1989, Bulletin 388 - summary

i. SUMMARY

The Environmental Protection Authority has examined a proposal to drain land in South Jandakot east of Thomsons Lake to enable housing development. The Environmental Protection Authority has concluded that the proponent has not demonstrated that the drainage proposal is acceptable. The Authority has been guided towards this conclusion by reports from various expert groups, including the Water Authority of WA, the Department of Conservation and Land Management, a special Technical Advisory Group established to advise the Environmental Protection Authority, and extensive public input.

The Environmental Protection Authority has concluded that the major problems with the drainage proposal, in particular the potential impacts of drainage water on the environment, can be ascribed to the proposal to drain the eastern one third of the development area. This eastern zone is mostly swampy and under water in winter, and draining it to enable housing development would generate up to 70% of the drainage water from the entire development and lead to most of the potential environmental impacts on the Beeliar wetland chain. Also, the eastern zone is important because of its potential for groundwater abstraction for urban water supply. The Environmental Protection Authority now recommends to Government that this eastern zone be excluded from drainage, and urban development, and land use constraints be applied to protect the water resource.

The western one third of the development area is elevated, and has little exceptional in terms of drainage problems. The Environmental Protection Authority has suggested to Government that this land could be developed quickly, after minimal arrangements for drainage, and that this would accommodate immediate needs to release land for housing.

The central one third of the development area is less elevated above the groundwater, and contains both the Kwinana Freeway alignment and the proposed line of bores for the Jandakot groundwater scheme. The Environmental Protection Authority has recommended that studies involving the State Planning Commission and the Water Authority of WA could soon delineate areas to the west which would be suitable for housing, and areas to the east which should be excluded from housing and managed for protection of the water resource.

The Environmental Protection Authority believes that acceptance of these recommendations would greatly reduce the scale of the drainage problem, would protect the critical environments, and would accelerate the decision-making for future housing developments.

Appendix 3

Water Authority of Western Australia and the Department of Conservation and Land Management's advice to the Environmental Protection Authority on the Revised Drainage Management Plan

9

WATER AUTHORITY of Western Australia

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Chairman
Environmental Protection Authority
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Attention : Mr R A D Sippe

REVISED DRAINAGE MANAGEMENT PLAN - SOUTH JANDAKOT

Thank you for your letter of February 27, 1990 and advice that the Environmental Protection Authority will be reporting to the Minister for Environment on the revised Drainage Management Plan for the South Jandakot Urban Development.

The revised Drainage Management Plan was prepared by G B Hill & Partners for the Department of Planning and Urban Development and although the Water Authority assisted with the preparation of specific parts of the document, the document was not reviewed by the Water Authority before submission to the EPA. As the Authority has agreed to construct, operate and maintain the main drainage facility, the document's proposals and any conditions of approval for implementation still need to be negotiated by the proponents with the Authority. During these negotiations and subsequent detailed planning and design of the facilities, it is expected that some of the proposals in the document may need to be varied.

A thorough review of the document has not been possible in the brief period available, but in general the Drainage Management Plan should be recognised as a significant improvement in planning associated with urban developments in the Perth region that affect water resources, drainage and wetlands. In particular, the document has addressed well most of the issues previously raised by the Authority in its advice of December 21, 1988. As such, the Water Authority supports most of the concepts adopted and believes most major issues have been addressed considering current hydrological knowledge. However, in terms of meeting the requirements of condition 2 of the Ministerial conditions of approval, the Authority can not yet advise that it is satisfied with the Drainage Management Plan because of the need to resolve the following technical and financial issues.

C34454 INFO

An environmental issue that the Authority believes requires further clarification is the effluent plume below Jandakot Woolscourers. When Lake Yangebup water levels are lowered the plume may find its way into the lake at a greater rate than is presently occurring. This factor increases the need for a resolution of the Jandakot Woolscourers waste disposal issue or a reassessment of the proposed levels for Lake Yangebup or both.

A second environmental issue relates to the monitoring of the Bartram Road buffer lake. The monitoring should include bores positioned so as to detect the possible development of an effluent plume. If a plume is detected then the lining of the buffer lake would need upgrading and/or the use of activated alumina initiated as suggested in section 8.2.2.

The Drainage Management Plan suggests that the proposed pump station at Lake Yangebup also control the water level in Kogolup North Lake. This would require a complex control system as the proposed water level in Kogolup North Lake (14.8m) is approximately 1.7m below the water level in Lake Yangebup (16.5m). It would be prudent to anticipate either a small self contained pump system on Kogolup North Lake or a series of weirs so that water flowed through Kogolup South Lake and then to the Thomsons Lake pumping station

Section 8.1.1 proposes operating parameters to control flows into Thompsons Lake from the South Jandakot Branch Drain. These parameters are cumbersome and a simple overflow weir should be adopted. Associated with the operating parameters, section 4.3 indicates that approximately 300,000m^3, the source of which was not identified, could be required 1 year in 8 to supplement flows to Thomsons Lake. It would make better use of the available water resources if this was achieved by increasing the overflow into Thomsons Lake. This would require more pumping by the Thomsons Lake pumping station to control the water levels during a normal winter, but minimise the need for supplementary water. These and a number of other considerations suggest that the diameter of the South Jandakot Branch Drain could be reduced from 1500mm to 1350mm with significant cost reductions while still meeting the environmental criteria.

There are a number of other concerns with various statements in the Drainage Management Plan such as having the capacity to dry up lake Yangebup and adding nutrient stripping basins to that catchment, neither of which may be economically feasible and need to be resolved.

The Drainage Management Plan has paid most attention to the proposed urban zoned land. As a consequence the urban deferred land, which is primarily the Russel Road catchment, has not been considered in great detail. It is suggested that the present proposal for urban and urban deferred be restricted to the Hird Road and Bartram Road catchments and rezoning of the Russell Road catchment be deferred until a review of the monitoring results has been completed.

If the Drainage Management Plan is approved, implementation will require significant co-ordination between agencies like the Water Authority, EPA, CALM, DPUD, City of Cockburn and the Beelier Park Management Committee. it is suggested that a Committee be established to co-ordinate the implementation and monitoring. The monitoring is expected to be primarily the responsibility of the developer for the first five years at least. Some of the measures suggested may result in significant costs. The responsibility for meeting these costs in the long term (20+ years) should be addressed.

Because the Authority is to construct, operate and maintain the main drainage facility, the EPA's and CALM's requirements will need to be known before the Authority will be able to advise if the final Drainage Management Plan has been prepared to the satisfaction of the Water Authority. The Authority will also need to discuss areas of responsibility with the City of Cockburn and agree funding arrangements with the developers to ensure the Authority is not financially disadvantaged. The Authority suggests that to finalise the Drainage Management Plan, officers from the EPA, CALM, DPUD and the Water Authority meet to resolve the issues raised.

Yours faithfully

W COX
MANAGING DIRECTOR

March 19, 1990

WATER AUTHORITY of Western Australia

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Attn: Ms M Andrews

REVISED DRAINAGE MAINTENANCE PLAN - SOUTH JANDAKOT

Further to my letter of March 19, 1990, a meeting of officers from CALM, EPA and the Water Authority as suggested in my letter, was held on March 21, 1990. This meeting has helped clarify a number of issues and the Authority has been able to complete its review of the document.

The Authority is now able to advise that the document's proposals for the pumping station at Lake Yangebup will be able to control the water level in Kogalup North Lake. It will not be necessary to anticipate either a self contained pump system on Kogalup North Lake, or a series of weirs to the Thompsons Lake pumping station.

It is also clarified that the indication in section 4.3 that approximately 300 000 m^3 could be required 1 year in 8 to supplement flows to Thompsons Lake is part of the Jandakot Groundwater Scheme Stage 2 proposal. Any requirements for this supplementary water and its source will be dealt with in that project, and is not part of the drainage management plan.

The other issues raised in my letter of March 19 are still of concern, but with appropriate confirmation from EPA and CALM, could be resolved. Subject to this confirmation, and any other environmental requirements from EPA and CALM in their comments on the document being acceptable to the Water Authority, the Authority would then be able to be satisfied with the final Drainage Management Plan. I would be pleased to provide further advice when the EPA's report to the Minister for Environment is available.

W J Cox
MANAGING DIRECTOR

March 21, 1990

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Chairman
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Perth

RE: SOUTH JANDAKOT DRAINAGE MANAGEMENT PLAN

Thank you for the opportunity to comment on this plan.

In general the Department agrees to this plan provided that there is a clear commitment to the scheme over the full term of implementation of urbanisation.

The role of the Water Authority of Western Australia in managing the main drainage within the proposed Beeliar Regional Park is endorsed. This emphasises the importance of ensuring that use of our water supplies for environmental purposes is retained.

A number of other specific details are discussed below.

Monitoring

The document provides a clear commitment to a monitoring programme and a flexible approach to management. The importance and early implementation of a suitable monitoring programme and the identification of resources needed, must be stressed.

It is currently not clear as to who is to undertake monitoring and initiate the subsequent actions that might be required, or where the responsibilities for funding lie.

There is an opportunity for our two organisations to establish an expert committee to guide the monitoring process and the assessment of criteria which might be applied to various wetlands. This should be written into the conditions for the project.

Storm Water Events

The Department finds the sections on storm water events and the subsequent pumping rates acceptable in the knowledge that the monitoring programme will allow an on-going assessment of this.

Yangebup Lake - Kogolup Lake Link

Specifically, and in discussions involving consideration of the Beeliar Regional Park, there are concerns about the proposed piped link between Yangebup Lake and North Kogolup (4.6.7). Waters should not be allowed to pass via pipes in this direction unless there has been a substantial improvement in the quality of water in Yangebup Lake.

Conditions

It is recommended that, where appropriate, commitments or recommendations made within the drainage management plan should be given importance by being included within project approval conditions. For example it is suggested that those commitments and recommendations that have been agreed to or suggested in this letter should be transferred to the project conditions.

Perhaps not for direct consideration in assessing this document there is a need to identify vegetation worthy of retention in the southern part of the proposed South Jandakot urban area. In particular, how does this relate to the various studies that are being undertaken on the environmental attributes of the Jandakot Groundwater Mound. As an example, the Department sees as a priority the protection of areas such as that which runs between Bartram Road and Gibbs Road to the east of Beenyup Road.

It may well be that many of the points raised are ones which can be the subject of discussion after the acceptance of the intent of the drainage plan.

.....

for
Syd Shea
Executive Director
12 March 1990

types on a transect from the lake, through fringing reeds, paperbarks, flooded gums, to woodlands of banksia, jarrah/marri and isolated tuarts.

The reserve has a wide range of natural fauna in addition to waterbirds, including a tortoise, 8 species of frog and an excellent representation of aquatic invertebrate fauna.

It has been recognised that the cycle of the lake filling and either drying out or becoming very shallow has contributed to the health of the system. An example of this is in apparently preventing the establishment within the system of the mosquito fish (Gambusia affinis), which is known to be a major predator of aquatic fauna.

When the first proposals were being put forward for development adjoining the Thomsons Lake Nature Reserve there were clear indications that water levels would become both more constant and substantially deeper, thus eliminating the value of the lake to a suite of waterbird species which includes wading birds. CALM did not find this scenario acceptable.

Initial criteria were established, when requested, which set a range of levels dependent upon a broad range of yearly rainfall outcomes. These criteria were established with the condition that they would be subject to review and change in the event of more accurate information becoming available.

The work undertaken by a number of consultants and the Water Authority of WA indicates that a review of the criteria is now appropriate.

The management philosophy in setting lake levels is as follows:

> Lake levels should in general;
> i) reflect the fluctuation in rainfall, both from year to year, and from season to season.
> ii) serve the values that the Nature Reserve is notable for.

There are two provisos which should be borne in mind in assessing current and future objectives and management techniques.

> a) With the possibility of greenhouse induced climate change causing a significant reduction in rainfall in the south-west of Western Australia, it may eventually be necessary to artificially put more water into the lake to ensure that it serves the same range of values as it does now.
> b) In long periods of above average rainfall and given the altered nature of the catchment and water quality,

OBJECTIVE

This objective relates to the management of the wetland within the Thomsons Lake Nature Reserve in the knowledge of its regional and international importance.

The objective is to protect the ecological character of the lake and, in particular, its importance as a waterbird habitat.

Strategies

1. Lake levels must remain linked to the natural course of events associated with the environmental attributes of the catchment. The main determinant of this process is that the link between lake levels and the natural rainfall patterns must be maintained.

2. Lake levels must reflect the natural seasonal patterns. That is highest in winter, dropping over summer and lowest, usually dry, in late summer or autumn. Water levels are not to be held at an artificial and constant level.

3 To minimise sudden rises in water levels due to artificial sources of water. If such rises are in conflict with any of 1 to 3 above, the excess water shall be removed as soon as possible.

4 To prevent any increases in nutrient input into the lake and where possible reduce nutrient input.

5 To prevent where possible the introduction into the lake system pollutants associated with changed adjoining land management practices. This is in particular of relevance to the introduction of petrochemical pollutants (as a result, for example, of an oil spill in the catchment) and heavy metals.

Management Processes

By far the most important consideration with respect to the management of water levels at Thomsons Lake is that there must be a high degree of flexibility built into the total management package so that there is an opportunity to meet objectives.

The system needs to be flexible at this stage because there are a number of unknowns; in particular likely impacts of adjoining development and management criteria which will be developed for the Regional Park.

For example, using average figures, the WAWA model predicts that Thomsons Lake may actually become drier than previously expected but this modelling does not take into consideration the impact of storm events where water from the urban developments is sent to the lake. There is thus the need to ensure that data is available on the likelihood of a storm event and what amount of water is involved such that decisions as to whether the lake needs to be pumped can be made. If a storm event causes the lake level criteria to be exceeded what duration can the criteria be exceeded? As an example this may be important if large numbers of wading birds were using the lake at the time that storm drainage waters were diverted to it.

Thus there need to be a series of management processes operating which can be summarised as:

1. Decision Making

2. Built structures

3. Monitoring and Review

1. Decision Making

As mentioned previously we are currently dealing with a situation where data is urgently required. However it is agreed that the starting point to the whole process should be via the use of the WAWA model to assist the decision making process. Thus within a certain accuracy it should be possible to predict in September or October of each year what the minimum water level will be for the following year. This judgement is based on a system of using the previous 4 years rainfall readings which occur in the catchment.

Once this prediction has been made it is then necessary to look at actual water levels and act accordingly.

This Department is currently working toward the establishment of an expert technical committee which will make decisions on a year to year basis on the criteria and their achievement, management options, monitoring programmes and review. It is intended that a representative of the Water Authority of WA will be on that committee.

Finally it needs to be stated that this correspondence supersede all other statements and correspondence made previously.

.....
for
Syd Shea
Executive Director
23 January 1990

Appendix 4

Review of engineering aspects by Binnie & Partners Pty Ltd

Binnie & Partners PTY LTD
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Our Ref AJG/MS/721/1950

Your Ref

27 February, 1990

The Chairman
Environmental Protection Authority
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For the attention of Mr R Sippe

Dear Mr Sippe,

SOUTH JANDAKOT DRAINAGE MANAGEMENT PLAN
Review of Engineering Aspects

We have pleasure in submitting our report to EPA on the engineering aspects of the above Management Plan in accordance with your Purchase of Advice dated 12 February 1990.

Scope

The Purchase of Advice requested Binnie & Partners Pty Ltd *to provide an independent engineering assessment of the revised Drainage Management Plan for the South Jandakot urban development and advise whether the Drainage Management Plan, as described, would meet the stated objectives of the Plan from an engineering viewpoint.*

The Management Plan is entitled "The South Jandakot Drainage Management Plan" dated January 1990 prepared for the Department of Planning and Urban Development by GB Hill & Partners Pty Ltd in association with the Water Authority of Western Australia.

The principle objectives of the Drainage Plan, as set out in Section 2.2 of the report, are as follows:

i) *to show that the land can be adequately drained for urban development;*

ii) *that the drainage system will be capable of meeting environmental objectives for the Beeliar wetlands;*

iii) *that the drainage required for urban development will not result in a waste of water resources.*

In undertaking this work, we have based our assessment on determining whether the principles of the system have a sound engineering basis. No attempt has been made to review the accuracy of the design quantities and sizes referred to in the Management Plan.

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Noted

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Components of System

The components of the system are as set out in the attached copy of Figure 12 from the report. The system and its proposed design and operation are based on meeting the terms of the three objectives as described below:

Urban Drainage Requirements

i) a local drainage system within the urban area, comprising of pipes, detention basins, open drains and floodways, to convey excess surface runoff from the area,

ii) a sub-soil pipe drainage system in the low lying parts of the urban area to maintain the groundwater table at an acceptable depth below the surface. This pipe system links into the surface drainage system to discharge water away from the area, and

iii) the main drainage system, comprising of a pipe drain from east of Thomsons Lake to Yangebup Lake, a pump station servicing Thomsons Lake, a pump station servicing Kogolup and Yangebup Lakes jointly, and an outlet pipe from Yangebup Lake to route excess drainage water from the catchment. The major lakes will be used selectively to provide compensating storage necessary in routing the drainage from the catchment.

Protection of Beeliar Wetlands

i) the establishment of smaller detention basins, and a number of major buffer lakes within the local drainage system to improve the quality of drainage water passing from the urban area

iii) design of the main drain between Thomsons and Yangebup Lakes to enable the majority of drainage water from the South Jandakot urban area to be diverted past Thomsons Lake and Kogolup Lake

iii) design of the pumping station at Thomsons Lake to pump out any excess drainage water which is discharged to it, and

iv) design of the pumping station servicing Kogolup Lake and Yangebup Lake, and design of the outlet main from the catchment, to control water levels in these lakes to environmentally acceptable levels.

Water Conservation

i) the use of detention basins within the local drainage system to recharge water on site where possible,

ii) limiting the elevation of subsoil drains to the current winter table levels, to ensure that the local groundwater resources are not depleted, and

iii) developing the outlet drainage system from the catchment in a manner which provides opportunity for utilisation of the excess water.

Assessment of System

The components of the system are all commonly used in drainage design. The use of Australian Rainfall & Runoff for the design of drainage facilities is a standard procedure throughout Australia. The use of a five year average recurrence interval (ARI) for local drainage is satisfactory and would be considered as accepted practice.

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Sub-soil Drains

The principle of using slotted pipes for sub-soil drainage is well established and, as pointed out in the report, has been used in many area throughout Perth. The practice is widely and successfully used in eastern Australia. There is a potential for clogging of the media adjacent to the sub-soil drains in the longer term and this requires allowance for long-term maintenance at the design stage. The actual spacings of the sub-soil drains are dependent on the soil conditions in the area being drained. This may vary from location to location within the proposed urban development area and therefore the actual spacings need to be determined on a location by location basis based on the soil properties for that particular location. The Management Plan recognises these points.

It is proposed that the sub-soil drains be installed at the current maximum groundwater level which means that the status quo for groundwater levels should be maintained.

Main Drainage System

The principles of the main drainage system are satisfactory. All drains are piped, which overcomes the potential disadvantage of open drainage with respect to affecting groundwater tables in the area through which they pass.

The main drainage system has been designed to accommodate a one year ARI storm event. Anything in excess of such a storm will be attenuated through the wetlands and lakes systems. The effects of a 100 year ARI storm have been evaluated and a management scheme developed for this rare occurrence. The range of storm events covered is considered acceptable engineering practice.

No details are included in the Management Plan report on relative elevations throughout the length of the drainage system, nor for the areas to be served. Discussions were held with the Water Authority of Western Australia and the consultants, GB Hill & Partners Pty Ltd. A contour plan of the area was reviewed and details were supplied on the preliminary design undertaken of the pipeline system. The extent of work done to date on the details of the system is considered sufficient for the current level of assessment required.

It was clarified that the southern-most area (Russell Road catchment) does not drain through Bartram Road buffer lake, but that another buffer lake is proposed in the vicinity of Gibbs Road. This arrangement is important to ensure that the Russell Road catchment can be served by the main drainage system without having to increase the depth of Bartram Road buffer lake, or conversely, without having to fill large tracts of land in the Russell Road catchment.

Good drainage practice demands that all stormwater drainage pipelines have a free discharge. This means that the downstream control on drainage pipes must be such that the invert level of the pipe is above the downstream control level to ensure that the pipeline can drain freely to avoid potential deposition of solids in the drainage lines. It is quite acceptable for the pipelines to be surcharged under high flow conditions however. The main drainage system has been designed on this principle.

The preliminary details supplied were sufficient to demonstrate the feasibility of the proposed system. It is quite likely that there would be some amendments to these details when a more comprehensive design is undertaken. However, this is unlikely to affect the engineering viability of the system. Rather, it will affect the actual costs of construction, and the extent of areas to be filled. The system must be designed such that detention basins and buffer lakes are above the water table, to avoid potential lowering of the water table beyond the levels intended.

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The detention basins and the Bartram Road buffer lake are an integral part of the main drainage system. These holding basins are important in the overall drainage design to provide short term storage capacity for storm events greater than those for which the pipeline is designed. They also form a critical part of the management of nutrients in the Beeliar wetlands system.

All major drains from the South Jandakot urban area are gravity drains. The southern lakes main drain which is proposed to discharge to Cockburn Sound, is a pressure main from Yangebup Road pump station. The capacity of this pipeline is significantly less than the potential flow from the urban area. When flows are above the capacity of this pressure main, the excess flows will be distributed into the lake system. This will mean the levels in the lakes will rise temporarily above the normally acceptable levels. However, as this is a short term event happening infrequently, it should be considered acceptable.

Protection of Beelier Wetlands

With respect to meeting the environmental objectives for the Beeliar wetlands, the primary issues are diverting excess drainage from the catchment and ensuring that the nutrient loads to the lakes are not excessive. Considerable reliance is placed on the performance of buffer lakes and detention basins in removal of nutrients. The detention basins design is to be based on satisfying water quality criteria rather than the normal flow attenuation. Satisfactory performance is predicated on removal of settled solids with high concentrations of nutrients, heavy metals and pesticides. The report recognises the need for removal of the settled solids as a regular maintenance function. The importance of this management requirement is stressed as carryover of solids into the lakes system is likely to result in a short-term slug discharge of the constituents for which the detention basins have been designed to remove.

The ramifications of these facilities not achieving the required nutrient removal are quite significant. Our Brief does not include for assessment of the likely nutrient removal performance of buffer lakes and detention basins. However, we would comment that in the event of the desired removals not being obtained, the engineering solutions for nutrient removal would be both extensive and expensive.

Drainage Water Disposal

The Management Plan proposes that the stormwater be disposed of by discharge to Cockburn Sound. Reference is made to the possibility of recharge to areas within the Jandakot public water supply area, to the west of Thomsons Lake and to the Kwinana industrial area.

Disposal to Cockburn Sound will mean that less water percolates into the groundwater system than occurs under present conditions. As more of the catchment is developed the proportion discharged to Cockburn Sound will increase. This can only be considered a waste if the water percolating into the groundwater is currently put to some worthwhile use. This does not appear to be the case. It is our understanding that, regardless of future developments, rising groundwater is considered a problem in the area.

Future recharge may provide a worthwhile benefit. The demands on groundwater by industries in the Kwinana industrial area are quite significant and the resources are limited. The report refers to the economics of recharging stormwater into the Kwinana industrial area and suggests that it is an option that should be pursued in the longer term.

The Management Plan encourages assessment of the cost-effectiveness of recharge. We support this view.

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Conclusions

The conclusions from our in-principle assessment of the proposed South Jandakot Drainage Management Plan are as follows:

i) The proposed gravity and pressure main drainage system should provide adequate drainage for urban development. However, the detailed design will need to take account of the minimal head available for a gravity system to minimise construction costs. The use of a piped drainage system is supported.

ii) The drainage system should be capable of meeting the environmental objectives for the Beeliar wetlands. However, the effectiveness of the system is predicated on efficient nutrient removal from detention basins and buffer lakes, including a regular maintenance programme. The likely performance of these facilities as nutrient removal systems needs to be verified as soon as possible, as the engineering options for nutrient removal are likely to be both extensive and expensive.

iii) Disposal of drainage water to Cockburn Sound is not considered to be a waste of water resources. In the longer term, the drainage required for urban development could result in an improvement in water resources in that recharge to areas such as the Kwinana industrial area may provide a worthwhile benefit.

Therefore, it is concluded that the Drainage Management Plan meets the stated objectives of the Plan from an engineering viewpoint.

Please do not hesitate to contact the undersigned if you require clarification of any issues.

Yours sincerely,
BINNIE & PARTNERS PTY LTD

Allen J Gale
Director

Enclosure

Appendix 5

A report to the Environmental Protection Authority on drainage issues by NRMC Pty Ltd - executive summary

EXECUTIVE SUMMARY

NRMC Pty Ltd was contracted by the Environmental Protection Authority to provide advice that would assist the Authority in assessing a revised drainage management plan for the proposed South Jandakot urban area. This Revised Drainage Management Plan is being produced by a Joint Planning Team consisting of the engineering consultants to the developers and the Water Authority. The advice required related to the quantities and qualities of water to be discharged into the three southern wetlands of the Beeliar chain (Thomsons, Kogolup and Yangebup Lakes), the use of Yangebup Lake as a compensating basin and the discharge of drainage waters to Cockburn Sound.

These recommendations are supplied below, in addition to a recommendation on the coverage of drainage schemes and others on matters related to the management of the drainage scheme when it is in place.

The assessment of the previous Drainage Management Plan by a Technical Advisory Group recommended components to be addressed in the Revised Drainage Management Plan. Most of these are going to be addressed in the Revised Drainage Management Plan the problems of Little Rush and and South Lakes are not to be addressed. There is good reason not to address the problems of South Lake in this particular drainage scheme, but :-

RECOMMENDATION ONE

It is recommended that the Environmental Protection Authority require the Joint Planning Team to address the problems of excess water level in Little Rush Lake.

As the Revised Drainage Management Plan will provide a mechanism to effectively control water level in Thomsons Lake there is a need to clarify objectives in water quality management :-

RECOMMENDATION TWO

There is a need to clarify how fluctuations in water level in Thomsons Lake affect those species which make the Reserve a valuable habitat, so that more precise guidelines can be given to the operation of the proposed drainage system.

RECOMMENDATION THREE

It is recommended that the Environmental Protection Authority accept the revised water levels for Thomsons Lake of :-

End of Summer Level (m AHD)	(m depth)	Department of Conservation and Land Management Recommendation (% years of occurence)
<10.8	<-1	0
10.8 - 11.3	dry by January	10
11.3 - 11.8	dry by April	80
>11.8	>1	10

and the following proposals for Kogolup Lake :-

	WINTER/SPRING MAX	SUMMER/AUTUMN MIN
Wet Years (Wettest 10%)	15.8	14.8
Medium Years (Middle 80%)	15.2	14.2
Dry Years (Driest 10%)	14.8	Dry by April

The Environmental Protection Authority should advise the Joint Planning Team that the degree to which the proposed drainage system can maintain levels in the three lakes of 0.5 metre lower than those specified should be addressed in the Revised Drainage Management Plan, without necessarily insisting that these levels are achieved.

RECOMMENDATION FOUR

It is concluded that the design of the South Jandakot Branch Drain and associated urban drainage will more than adequately

control water flows into Thomsons and Kogolup Lakes. The Environmental Protection Authority should require the Water Authority to provide operating rules which are to the satisfaction of the Department of Conservation and Land Management, the City of Cockburn and the authority managing the Beeliar Regional Park to be submitted for approval before the Drain commences operation. These rules should encompass the operation of the South Jandakot Stage 2 well-field. The operations of the drainage system should be reviewed by the above bodies after twelve months of operation and at intervals thereafter and the rules adjusted as necessary.

RECOMMENDATION FIVE

It is recommended that the following criteria be adopted for water quality for the maintenance and preservation of aquatic ecosystems in the study area (based on proposed criteria for marine and estuarine waters):

Parameter	Criterion	Source
Floating and submerged litter	No materials should be present which directly or indirectly have an adverse effect on aquatic organisms.	WG
Barriers	No barrier should be constructed, substances added nor alterations made to the environment which will prevent the normal movement and migratory patterns of organisms to the detriment of their populations or cause changes in the normal water movement pattern which will lead to adverse effects upon them.	WG
Light attenuation Turbidity and Colour	The combined effects of turbidity and colour should not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the natural seasonal norm.	US EPA

Light attenuation in natural wetlands is quite low, due to the presence of gilvin (Wrigley et al, 1988). There is some argument that light attenuation is already too great in wetlands, due to the "pollution" of these wetlands with clear water.

Settleable Matter	Unnatural inputs of settleable material should not cause the formation of deposits	

	which are harmful to aquatic organisms.	Vic EPA (M)
Suspended Solids	Upper limit of 80 mg L^{-1} and depth of compensation point for photosynthetic activity should not be reduced by more than 10% from the natural seasonal norm.	Hart/ USA EPA
Ionic Ratio	The ratios of major ions should not be altered such that this beneficial use is affected.	WG
Dissolved Oxygen	Not to fall below 4.0 ml L^{-1}(5.7 mg L^{-1} for more than 6 consecutive hours, and never to fall below 3.5 ml L^{-1} (5.0 mg L^{-1}).	WG
Nutrients and Other Biostimulants	The loads of nutrients and other biostimulants to receiving waters should not cause excessive or nuisance growths of algae or other aquatic plants, or deleterious reductions in dissolved oxygen concentrations in those waters.	Vic EPA (M)
	TOXICANTS	
	(Elements)	
Arsenic (total)	No single reading to exceed 100 mg L^{-1}. 6 month median not to exceed 8 µg L^{-1}. No more than 20% of readings to exceed 80 µg L^{-1}. No single reading to exceed 500 µg L^{-1}.	Calif (K&S)
Arsenic (III)	6 month median not to exceed 6 µg L^{-1} No more than 20% of readings to exceed 60 µg L^{-1}. No single reading to exceed 350 µg L^{-1}.	WG
Arsenic (V)	6 month median not to exceed 2 µg L^{-1}. No more than 20% of readings to exceed 20 µg L^{-1}. No single reading to exceed 150 µg L^{-1}.	WG
Beryllium	6 month median not to exceed 0.6 µg L^{-1}. No more than 20% of readings to exceed 1 µg L^{-1}.	

	No single reading to exceed 5 μg L^{-1}.	WG/Vic EPA.
Boron	6 month median not to exceed 7 mg L^{-1}. No more than 20% of readings to exceed 10 mg L^{-1}. No single reading to exceed 20 mg L^{-1}.	WG/UK
Cadmium	6 month median not to exceed 3 μg L^{-1}.No single reading to exceed 8 μg L^{-1}.	Calif (K&S)
Chromium (total)	6 month median not to exceed 2 μg L^{-1}. No single reading to exceed 7 μg L^{-1}.	Calif.(K&S)
Chromium (VI)	6 month median not to exceed 0.5 μg L^{-1}.No single reading to exceed 1.5 μg L^{-1}.	WG
Copper	6 month median not to exceed 5 μg L^{-1}. No single reading to exceed 40 μg L^{-1}.	Calif (K&S)
Iron	6 month median not to exceed 1 mg L^{-1}. No more than 20% of readings to exceed 2 mg L^{-1}. No single reading to exceed 5 mg L^{-1}.	WG/UK
Lead	6 month median not to exceed 8 μg L^{-1}. No more than 20% of readings to exceed 80 μg L^{-1}. No single reading to exceed 200 μg L^{-1}.	Calif (K&S)
Manganese	6 month median not to exceed 100 μg L^{-1}. No more than 20% of readings to exceed 200 μg L^{-1}. No single reading to exceed 500 μg L^{-1}.	WG
Mercury	6 month median not to exceed 0.14 μg L^{-1}. No more than 20% of readings to exceed 1.4 μg L^{-1}. No single reading to exceed 3 μg L^{-1}.	Calif (K&S)
Nickel	6 month median not to exceed 8 μg L^{-1}. No more than 20% of	

	readings to exceed 75 µg L^{-1}. No single reading to exceed 200 µg L^{-1}.	USEPA/WG
Zinc	6 month median not to exceed 20 µg L^{-1}. No more than 20% of readings to exceed 100 µg L^{-1}. No single reading to exceed 200 µg L^{-1}.	Calif (K&S)
	HYDROCARBONS:	
Fuel oil	Not to exceed 3 µg L^{-1}	WG
Kerosene	Not to exceed 5 µg L^{-1}	WG
Crude oil	Not to exceed 10 µg L^{-1}	WG
	TOTAL FUEL OIL:	
Crude oil and kerosene	Not to exceed 10 µg L^{-1}	WG
Soluble Aromatics	Not to exceed 1 µg L^{-1}	WG
	(OTHER TOXICANTS):	
Ammonia (expressed as Nitrogen)	Not to exceed 600 µg L^{-1}	Calif (K&L)
Fluoride	Not to exceed 2 mg L^{-1}	WG
Hydrogen Sulphide	Not to exceed 2 µg L^{-1}	USEPA
Other Toxic Substances	No material should be present in an amount exceeding 0.01 of the 96-hour LD50 value for the test organism.	WG
General Provision	Should any individual species or component of the ecosystem be known to have lower tolerances than those specified in the above criteria, then these levels should be those used in setting water quality objectives.	Vic EPA (M)

The drainage waters from the development area should receive a screen for the above substances, organochlorines, organophosphates, carbamates and pyrethroids when the monitoring programme is commenced, after twelve months and at intervals thereafter. The results of these screening tests should be considered by the Environmental Protection Authority to determine if further action is required. Every attempt should be made to screen for a wide range of substances at commencement and at regular intervals. At the same time the monitoring should not accumulate information, which is either

not acted upon, or never analysed for trends to determine if significant problems will arise if any identified trends continue. The monitoring programme should be regularly reviewed to determine if resources are being wasted on analyses performed that are unnecessary.

RECOMMENDATION SIX

As part of the monitoring procedure for the proposed South Jandakot Drainage scheme, the Environmental Protection Authority should request that external surface and sub-surface drainage of nutrients are estimated to demonstrate that the lakes are not receiving an excessive nutrient load. The Environmental Protection Authority should request the Joint Planning Team to plan to achieve external phosphorus loadings of less than 18 kg P year-1 for Little Rush Lake, 156 kg P year-1 for Yangebup Lake, 88 kg P year-1 for Kogolup Lake and 506 kg P year-1 for Thomsons Lake.

RECOMMENDATION SEVEN

It is recommended that the Environmental Protection Authority approve of a pump station that will achieve water levels in Yangebup Lake of 16.5 m AHD in winter and 15.5 m AHD in summer and that the Environmental Protection Authority require a report from the managing authority (presumably the authority managing the Beeliar Regional Park) on the management of lake water levels after 12 months of operation.

RECOMMENDATION EIGHT

It is recommended that the Environmental Protection Authority recommend that further action be taken to alleviate the problems of Yangebup Lake.

RECOMMENDATION NINE

It is the opinion of those experts consulted that the discharged drainage waters will be mixed to the extent that nutrient concentrations will be at local ambient levels by the time this water reaches the surface of Cockburn Sound and that, as a consequence, no algal blooms will occur.

RECOMMENDATION TEN

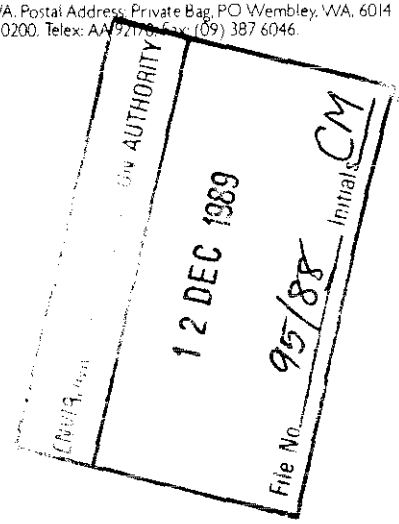
It is recommended that the Environmental Protection Authority request that the developers and the Water Authority plan for an extension programme to inform landowners in the South Jandakot Development Area and the Jandakot Public Water Supply Area of the hazards to the groundwater and the wetlands. The information programme should contain descriptions of drainage management and actions by householders to ensure that the groundwaters and the wetlands remain unpolluted.

Appendix 6

CSIRO's advice to the Environmental Protection Authority regarding the use of cyclodiene termiticides

CSIRO
AUSTRALIA

Division of Water Resources
Perth Laboratory
Underwood Ave, Floreat Park, WA. Postal Address: Private Bag, PO Wembley, WA, 6014
Telephone: (09) 387 0200. Telex: AA92178. Fax: (09) 387 6046.



Ref: YW96

11th December, 1989

EPA
1 Mount Street
PERTH WA 6000

Attn: Mr B.A. Carbon

Dear Barry

Re. your letter on the effects of use of cyclodiene termiticides in the South Jandakot urban development.

On the basis of past mobility studies of organochlorines in Bassendean Sands it is unlikely that contamination of groundwater will occur by leaching of the soil.

The only way organochlorines will reach groundwater and surface water is through movement with soil particles and through the vapour phase.

Particularly in the case of heptachlor considerable movement through the vapour phase can occur in moist/wet soils.

As I have not seen the development proposal and associated drainage management plan all I can suggest at this stage is not to allow the use of Heptachlor (or Chlordane which always contains Heptachlor) but to consider Aldrin or Dieldrin only.

More detailed information can only be given after a study of the development proposal and possibly some simple computer modelling. If you require this, a short consultancy would have to be agreed upon with CSIRO.

Yours sincerely

Robert Gerritse

RG:hg

031823 INFO

This Department is currently working toward the establishment of an expert technical committee which will make decisions on a year to year basis on the criteria and their achievement, management options, monitoring programmes and review. It is intended that a representative of the Water Authority of WA will be on that committee.

Finally it needs to be stated that this correspondence supersede all other statements and correspondence made previously.

.....
for
Syd Shea
Executive Director
23 January 1990

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WATER AUTHORITY of Western Australia

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Your Ref
Our Ref 95/88
Enquiries D20757
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420 2552

Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attn: Ms M Andrews

REVISED DRAINAGE MAINTENANCE PLAN - SOUTH JANDAKOT

Further to my letter of March 19, 1990, a meeting of officers from CALM, EPA and the Water Authority as suggested in my letter, was held on March 21, 1990. This meeting has helped clarify a number of issues and the Authority has been able to complete its review of the document.

The Authority is now able to advise that the document's proposals for the pumping station at Lake Yangebup will be able to control the water level in Kogalup North Lake. It will not be necessary to anticipate either a self contained pump system on Kogalup North Lake, or a series of weirs to the Thompsons Lake pumping station.

It is also clarified that the indication in section 4.3 that approximately 300 000 m^3 could be required 1 year in 8 to supplement flows to Thompsons Lake is part of the Jandakot Groundwater Scheme Stage 2 proposal. Any requirements for this supplementary water and its source will be dealt with in that project, and is not part of the drainage management plan.

The other issues raised in my letter of March 19 are still of concern, but with appropriate confirmation from EPA and CALM, could be resolved. Subject to this confirmation, and any other environmental requirements from EPA and CALM in their comments on the document being acceptable to the Water Authority, the Authority would then be able to be satisfied with the final Drainage Management Plan. I would be pleased to provide further advice when the EPA's report to the Minister for Environment is available.

W J Cox
MANAGING DIRECTOR

March 21, 1990

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WATER AUTHORITY of Western Australia

Your Ref 95/88
Our Ref D20757
Enquiries M Taylor
Tele Direct 420 2552

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Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention : Mr R A D Sippe

REVISED DRAINAGE MANAGEMENT PLAN - SOUTH JANDAKOT

Thank you for your letter of February 27, 1990 and advice that the Environmental Protection Authority will be reporting to the Minister for Environment on the revised Drainage Management Plan for the South Jandakot Urban Development.

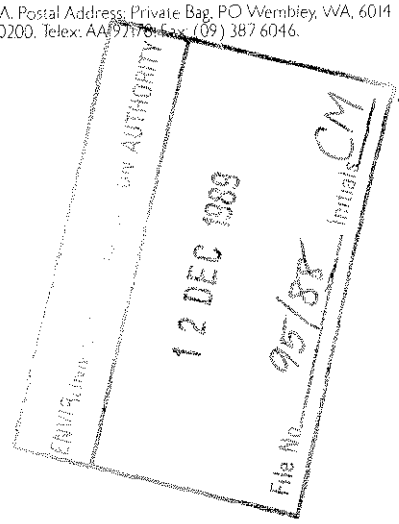
The revised Drainage Management Plan was prepared by G B Hill & Partners for the Department of Planning and Urban Development and although the Water Authority assisted with the preparation of specific parts of the document, the document was not reviewed by the Water Authority before submission to the EPA. As the Authority has agreed to construct, operate and maintain the main drainage facility, the document's proposals and any conditions of approval for implementation still need to be negotiated by the proponents with the Authority. During these negotiations and subsequent detailed planning and design of the facilities, it is expected that some of the proposals in the document may need to be varied.

A thorough review of the document has not been possible in the brief period available, but in general the Drainage Management Plan should be recognised as a significant improvement in planning associated with urban developments in the Perth region that affect water resources, drainage and wetlands. In particular, the document has addressed well most of the issues previously raised by the Authority in its advice of December 21, 1988. As such, the Water Authority supports most of the concepts adopted and believes most major issues have been addressed considering current hydrological knowledge. However, in terms of meeting the requirements of condition 2 of the Ministerial conditions of approval, the Authority can not yet advise that it is satisfied with the Drainage Management Plan because of the need to resolve the following technical and financial issues.

C 34454 INFO

CSIRO
AUSTRALIA

Division of Water Resources
Perth Laboratory
Underwood Ave, Floreat Park, WA. Postal Address: Private Bag, PO Wembley, WA, 6014
Telephone: (09) 387 0200. Telex: AA92178 Fax: (09) 387 6046.



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Robert Gerritse

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