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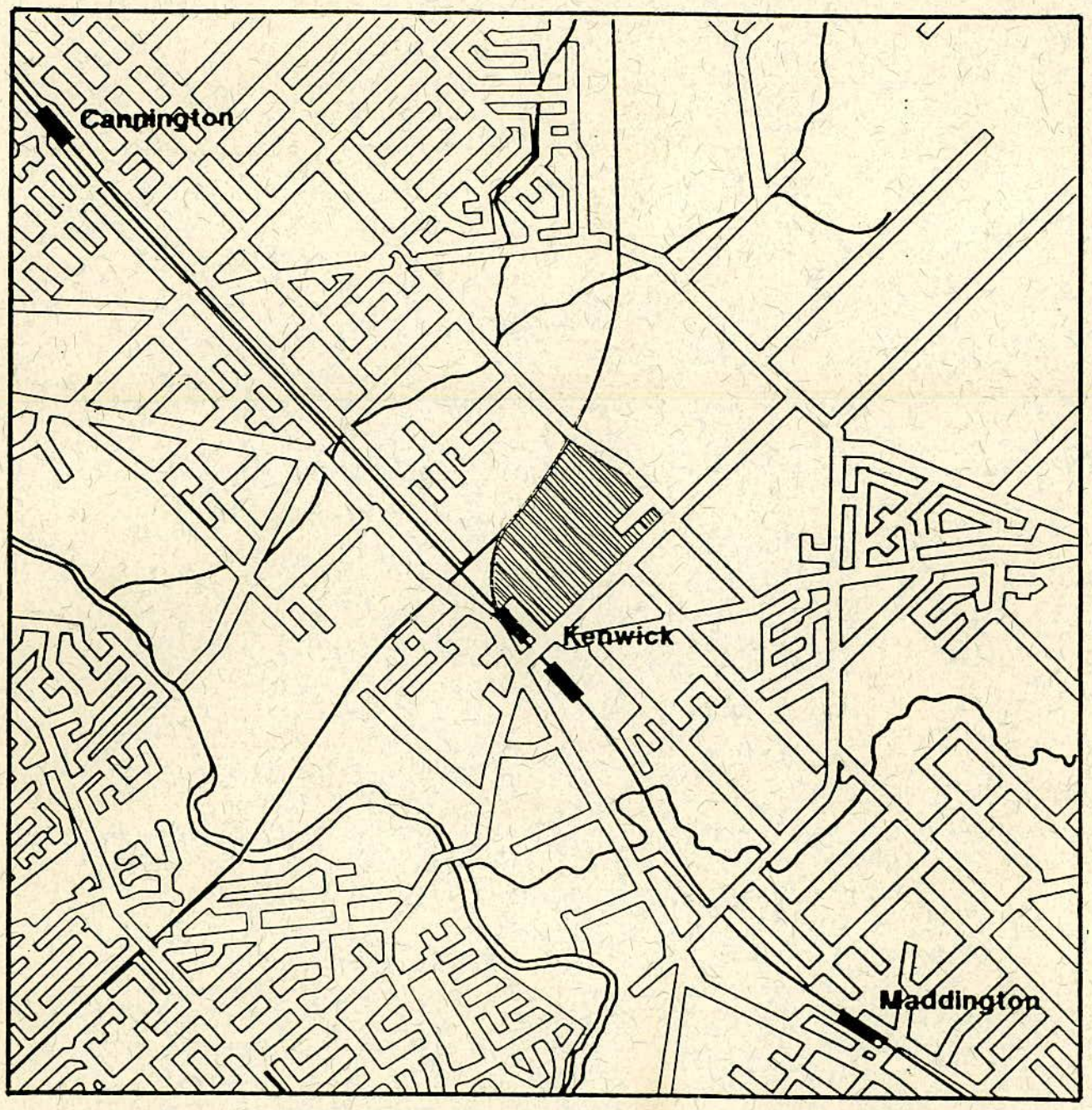
Consultative Environmental Review



PROPOSED URBAN DEVELOPMENT AND WETLAND CONSERVATION ON LOTS 37 AND 47, BRIXTON STREET, KENWICK, CITY OF GOSNELLS

HOMESWEST

Sharley Australia

Consultative Environmental Review

PROPOSED URBAN DEVELOPMENT AND WETLAND CONSERVATION ON LOTS 37 AND 47, BRIXTON STREET, KENWICK, CITY OF GOSNELLS

for

Homeswest

by

Hames Sharley Australia

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Offices also in Adelaide, Melbourne and Auckland

February, 1991
2785

The Brixton Street Wetland in Spring. It is proposed that this Wetland be handed over to the Department of Conservation and Land Management as a Reserve.

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CONSULTATIVE ENVIRONMENTAL REVIEW

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

The Consultative Environment Review (CER) for the proposed Urban Development and Wetland Conservation on Lots 37 and 47 Brixton Road, Kenwick has been prepared in accordance with Western Australian Government procedures. The report will be available for comment for 4 weeks beginning on 15 February, 1991 and finishing on 15 March, 1991.

Comments from government agencies and from the public will assist the EPA to prepare an Assessment Report in which it will make recommendations to Government.

Following receipt of comments from Government agencies and the public, the EPA will discuss the issues raised with the proponent and may ask for further information. The EPA will then prepare its assessment report with recommendations to Government, taking into account issues raised in the public submissions.

The proposal deals with an intention by Homeswest to develop medium density housing adjacent Kenwick Railway Station and to conserve a wetland area by handing it over to the Department of Conservation and Land Management.

WHY WRITE A SUBMISSION?

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

All submissions received will be acknowledged.

DEVELOPING A SUBMISSION

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

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

When making comments on specific proposals in the CER:

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

POINTS TO KEEP IN MIND

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

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section, chapter or recommendation in the CER. If you discuss sections of the CER, keep them distinct and separate, so there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please indicate whether your submission can be quoted in part or full, by the EPA in its Assessment Report.

REMEMBER TO INCLUDE:

YOUR NAME/ADDRESS/DATE

THE CLOSING DATE FOR SUBMISSIONS IS:

15 MARCH, 1991

SUBMISSIONS SHOULD BE ADDRESSED TO:

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

ATTENTION: MR N. WIMBUSH

1. INTRODUCTION

Lots 37 and 47 Brixton Street, Kenwick, in the City of Gosnells, are owned by Homeswest (Figure 1.1). The land is bordered by a railway line along its northern and western edges. Brixton Street forms the eastern boundary and the southern boundary and consists of the backs of the residential properties which face onto Wanaping Road. The land has an area of approximately 20 hectares and is zoned Residential "A" in the City of Gosnells Town Planning Scheme No. 1 (Figure 1.2).

The majority of the land is within 800 metres of the Kenwick Railway Station. It has been identified as having potential for medium density residential development. Once developed, it will more fully utilise the potential of the Perth-Armadale railway line and hence reduce vehicular traffic and energy consumption (Figure 1.3).

The land is presently unused and consists of a flat, low-lying bushland with claypans dominated by *Melaleuca laterita.* These are surrounded by slightly higher ground consisting of sandy clay or lateritic soil containing *Viminaria juncea* scrub, and small sandy rises dominated by *Eucalyptus calophylla* (marri).

A survey report (unpublished) by officers of the Department of Conservation and Land Management (approximately 1984) indicates the presence of two species of rare flora *Aponogeton hexatepalus* (stalked water ribbons) and *Hydrocotyle lemnoides* (aquatic pennywort). The habitat of these species is the claypan area. A third species *Drosera occidentalis* has since been identified (Figure 1.4).

In essence, the proposal for the land is as follows:

- *establish a conservation reserve over the claypan areas which contain the rare plant species (approximately 8 hectares or 43 percent of the site);*
- *develop the reserve by fencing it and establishing basic management requirements;*
- *vesting the reserve in the Department of Conservation and Land Management for ongoing management; and,*
- *developing the balance of the site, approximately 12 hectares, for medium density residential development (Figure 1.5).*

In April 1990, soon after being commissioned, the consultants notified the Environmental Protection Authority, by means of a Proposal Application, that they intended preparing a concept plan for the land. This application led to the decision to assess the proposal formally at the Consultative Environmental Review level.

For the information of the reader, Figure 1.6 sets out both the planning and environmental processes which need to be complied with before any form of development can commence. Both the planning and environmental processes are subject to democratic scrutiny.

This Consultative Environmental Review has followed the Guidelines as set out by the Environmental Protection Authority (Attachment 1.1).

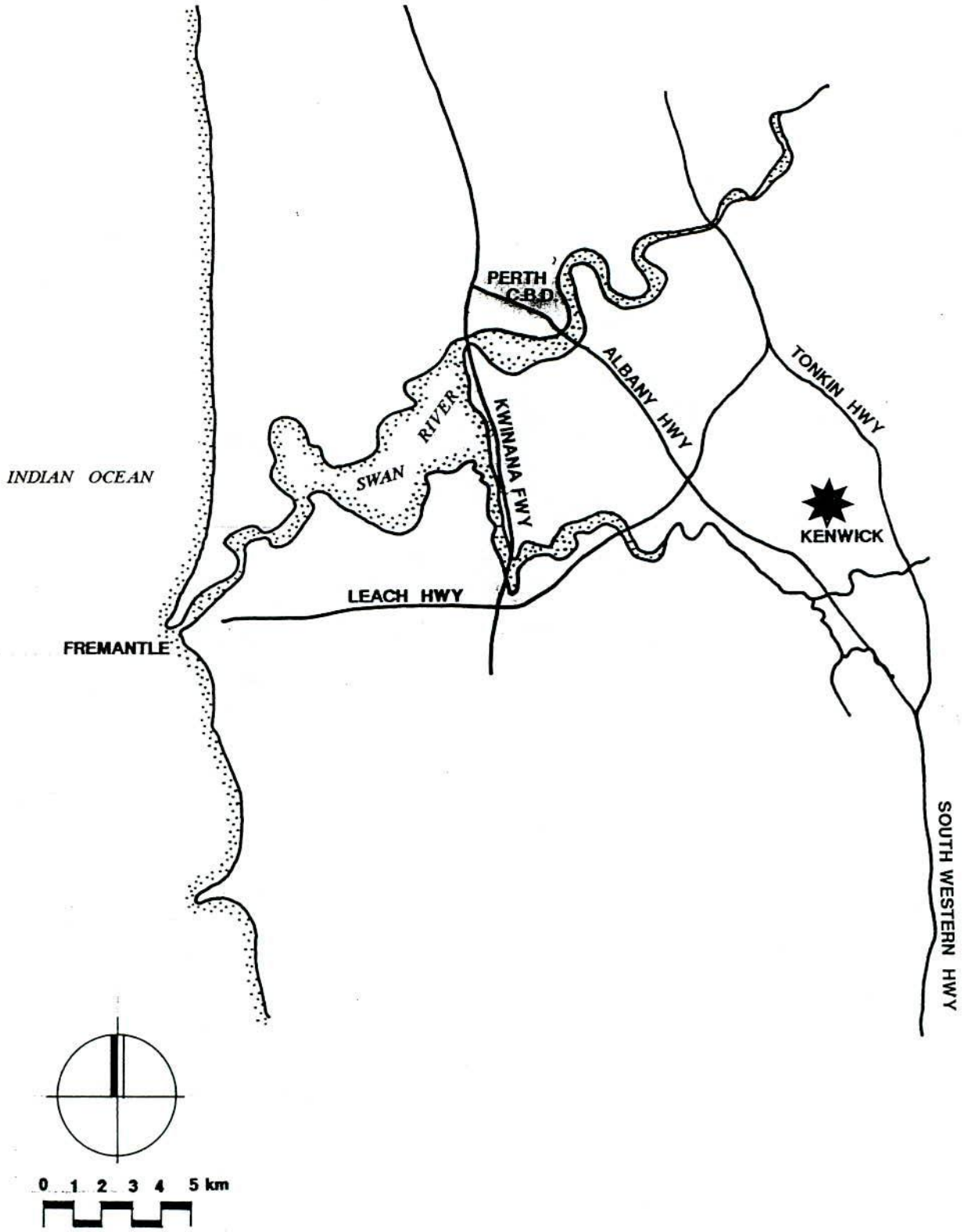
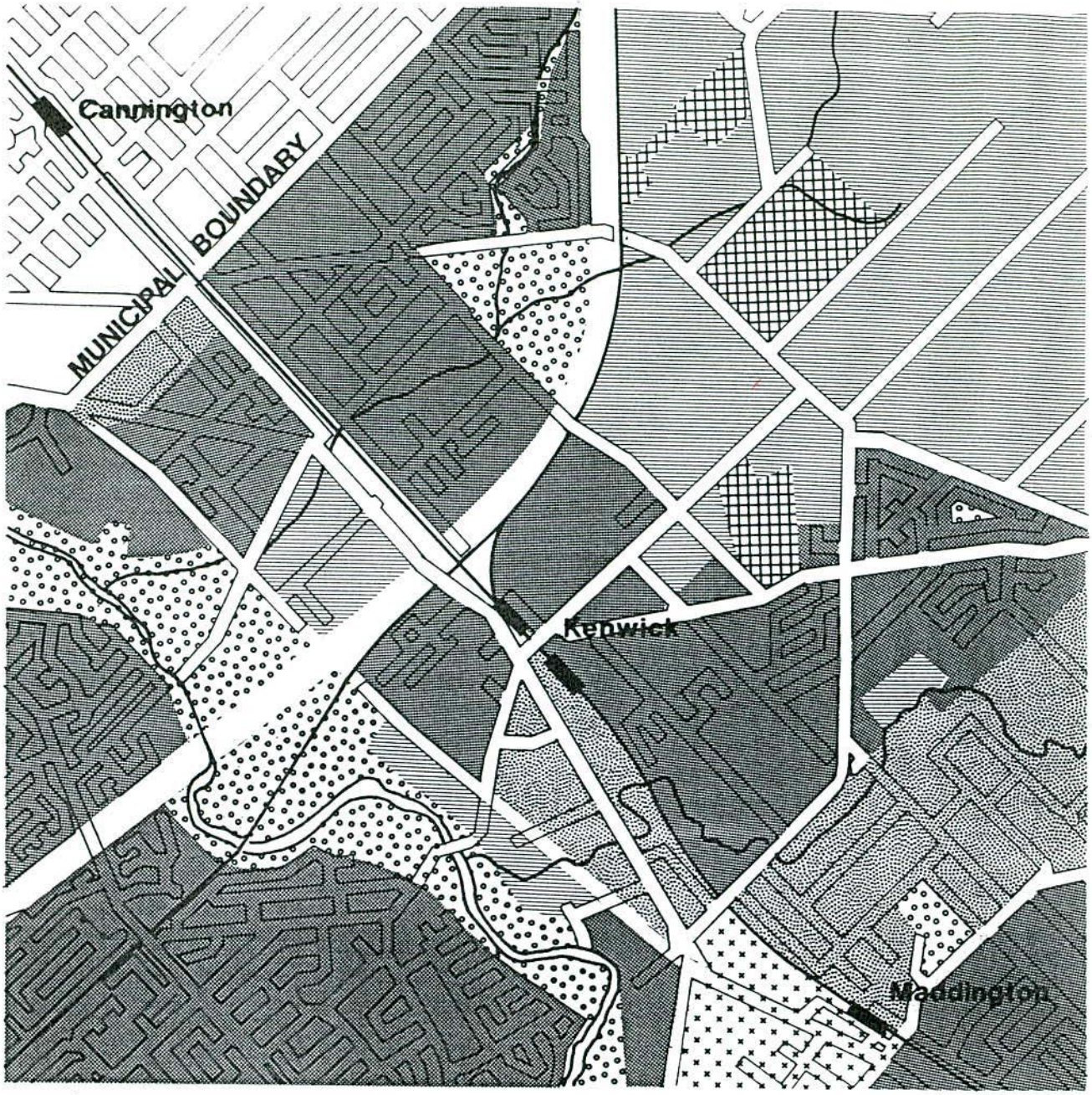
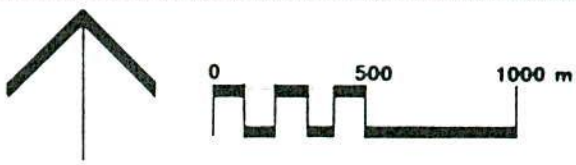


FIGURE 1.1
LOCALITY





SOURCE : CITY OF GOSNELLS ZONE PLAN

PARKS AND RECREATION

RESIDENTIAL

RURAL

PLACES OF ASSEMBLY

COMMERCIAL

INDUSTRIAL

FIGURE 1.2

GENERALISED ZONING IN THE KENWICK AREA

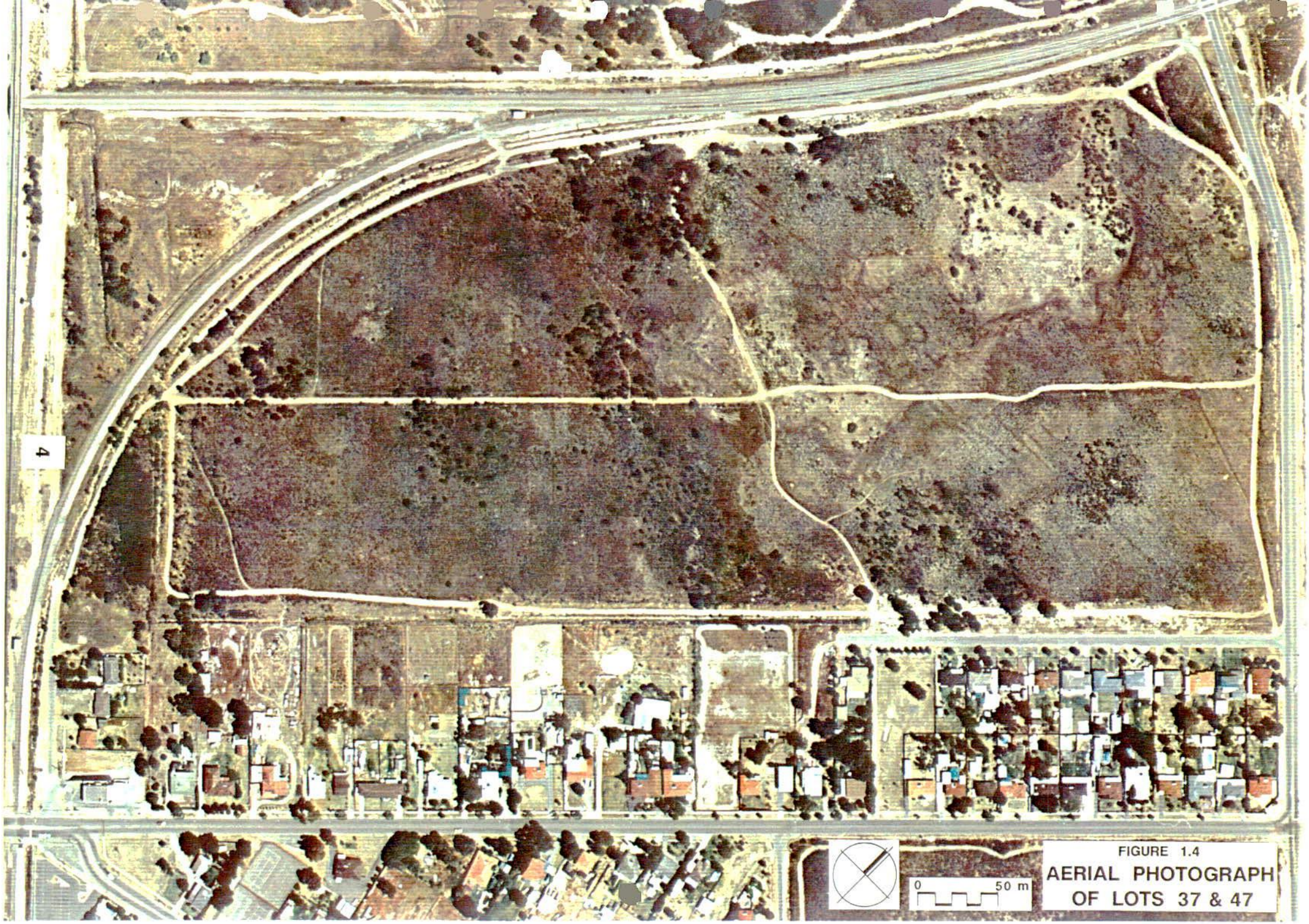
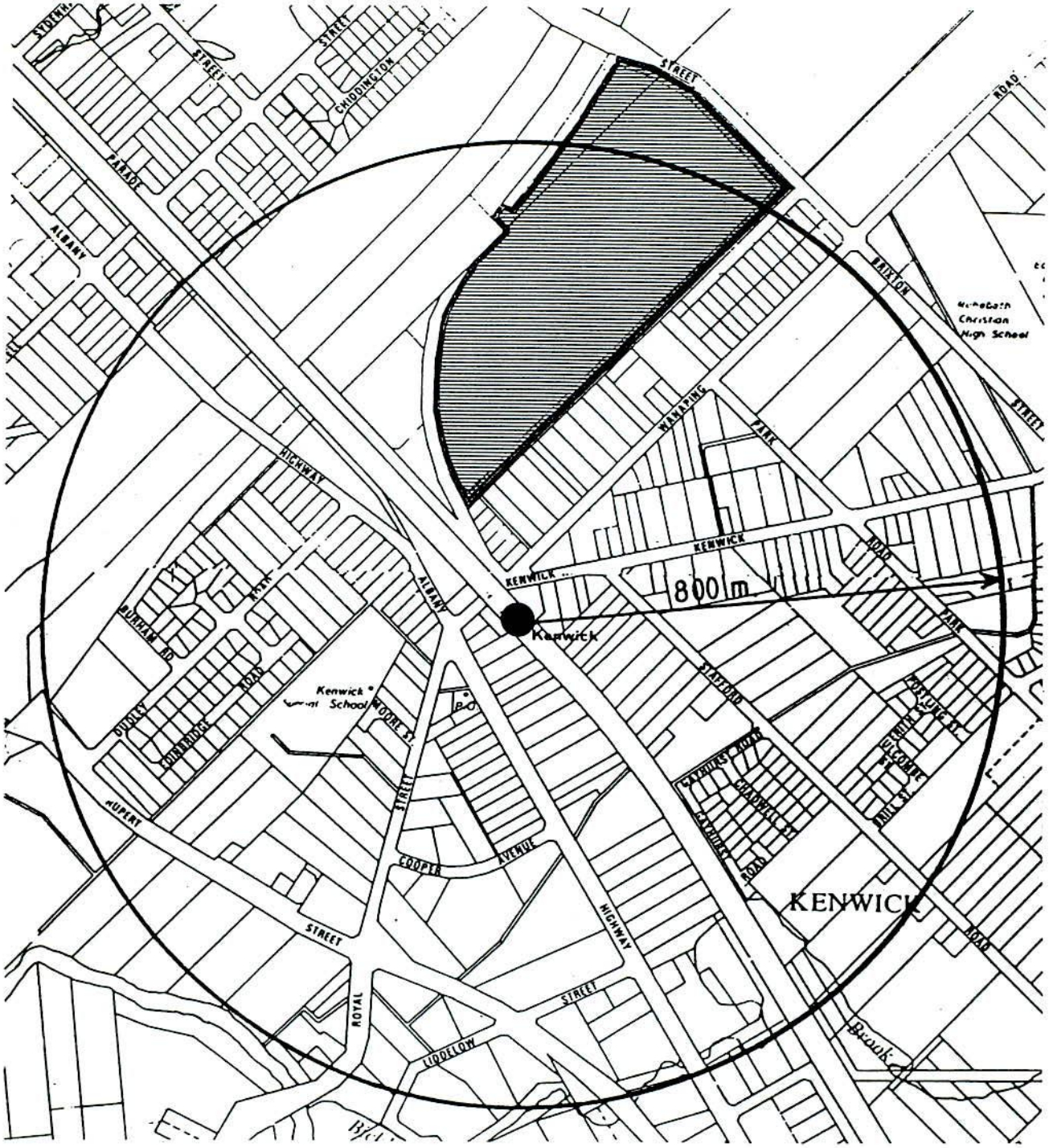


FIGURE 1.4
AERIAL PHOTOGRAPH
OF LOTS 37 & 47



HOMESWEST LOTS 37 & 47

KENWICK STATION

FIGURE 1.3

RAILWAY PRECINCT

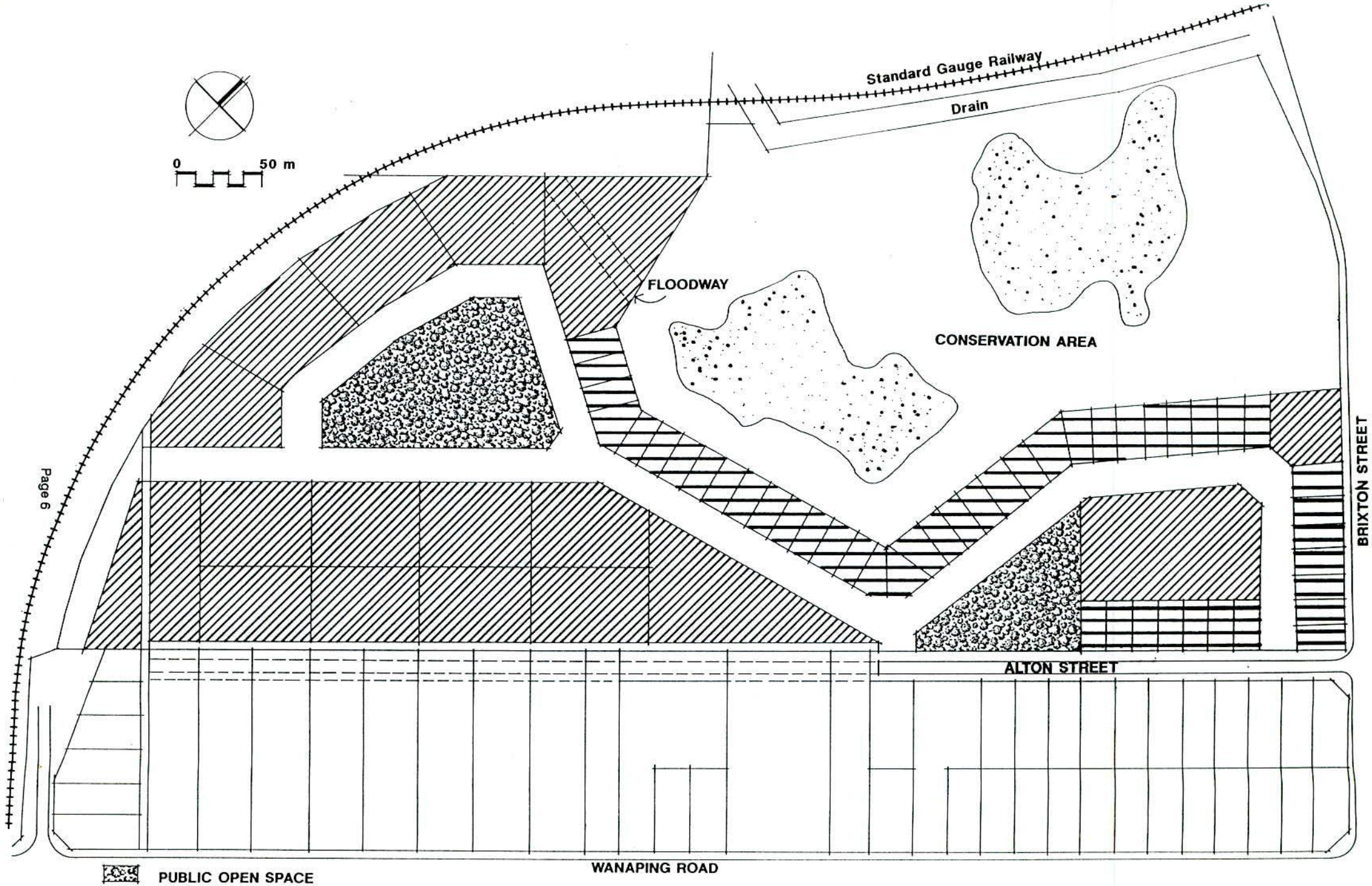


FIGURE 1.5

PRELIMINARY DEVELOPMENT CONCEPT

PLANNING AND ENVIRONMENTAL PROCESS.

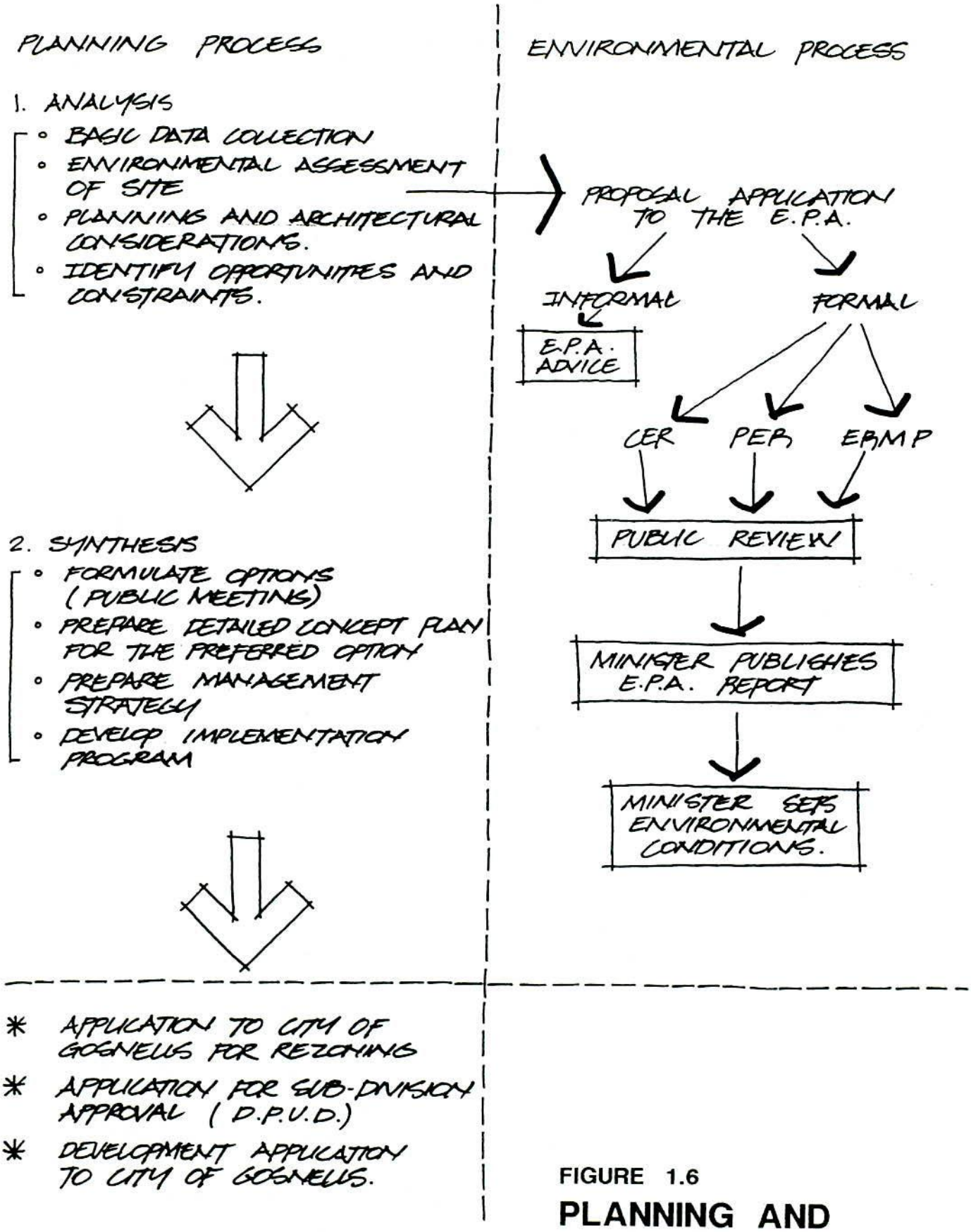


FIGURE 1.6

PLANNING AND ENVIRONMENTAL PROCESS

2. PUBLIC PARTICIPATION AND CONSULTATION

In May 1990 an article appeared in the Comment News (Gosnells Edition) concerning the Homeswest subdivision which contained several incorrect statements (Attachment 2.1). As a result of this article it was decided that a public meeting should be held to explain what was proposed, what work had been done, what facts were known and what the environmental and planning processes entailed.

A public meeting was held at the Kenwick Community Facility at 7.30 p.m. on 20 June, 1990. The agenda for the meeting was as follows:

- *opening by Councillor Pam Morris, J.P., Mayor of the City of Gosnells;*
- *statement by Mr Richard Elliot of Homeswest;*
- *environmental considerations of the site by Mr Rory O'Brien of Hames Sharley Australia;*
- *hydrology and water balance of the site by Mr Paul Holmes of A.G. Consulting Group;*
- *development proposals by Mr Rory O'Brien of Hames Sharley Australia; and,*
- *open forum (question and answer).*

The meeting was advertised in the local community newspaper and a number of people and groups were sent letters inviting them to the meeting. These included:

- *all the City of Gosnells Councillors;*
- *the Wildflower Society of WA;*
- *the Waterbird Conservation Group;*
- *the Wetlands Conservation Society;*
- *the Department of Planning and Urban Development;*
- *the Department of Conservation and Land Management;*
- *Officers of the City of Gosnells; and,*
- *the Environmental Protection Authority.*

The meeting was attended by approximately 100 people. Notes taken at the meeting are in Attachment 2.2.

2.1 Concerns Raised by the Conservation Groups

The Wildflower Society (Inc.) of Western Australia was the only conservation group to respond in writing at the time. A copy of a letter which it sent to several bodies on 31 May, 1990 is attached (Attachment 2.3).

Briefly, the Wildflower Society would like to see the whole area made a conservation reserve for the following reasons:

- *it is urban bushland which needs to be conserved;*

- *the site contains a unique complex of vegetation types; and,*
- *the area contains a broad diversity of species (approximately 300 species).*

A representative of the Wildflower Society attended the Public Meeting on 20 June, 1990 and made the following points:

- *the Society objects to the development;*
- *the site is unique given that other claypans are already drained and filled;*
- *the area has a high number of species;*
- *there are three rare species;*
- *there are seven other significant species;*
- *many species are representatives of other areas eg. Hills; and,*
- *its not possible to protect the rare species in the small area proposed.*

The President of the Waterbird Protection Society addressed the Public Meeting on 20 June, 1990. She described the proposal as "environmental vandalism" as eighty percent of Perth's wetlands are already lost.

It is not certain whether a representative of the Wetlands Conservation Group was at the Public Meeting. The following statement was made at the meeting concerning wetlands:

- *only 1 percent of the wetlands in the area are left - this land should therefore not be lost to development.*

2.2 Measures Proposed by the Proponent to Address Issues

The Proponent believes that the present proposal which embodies both conservation and development does address the issues which have been raised, ie:

- *the proposed conservation area covers the habitats of the three (3) Declared Rare Flora species;*
- *urban bushland will be conserved; and,*
- *the claypan wetlands will be conserved.*

The critical issue in the entire debate is how much surrounding land should be included with the claypans to ensure their long term sustainability. Based on the hydrological study (detailed below) the claypan wetland does not receive water from overland flow but depends on rainfall directly into the pans. For this reason it is considered that a 30 metre setback from the edge of the claypans is adequate to protect them in the long term.

2.3 Comments in Support of the Proposal

It should be noted that several of the comments voiced at the public meeting were in support of the proposal. These were as follows:

- *the area is untidy and not properly managed at present;*
- *if no development takes place, the rare flowers are unlikely to survive anyhow;*
- *development should be allowed;*

- *it is unrealistic not to pursue a balance between conservation and development;*
- *an Alton Street resident said that he had never seen most of the people present at the meeting and that many locals were in favour of the development; and,*
- *development of the site would reduce crime in the area as thieves use the bushland to escape.*

2.4 Contact with Conservation Groups as Part of the Consultative Environmental Review

When the decision was taken to prepare the Consultative Environmental Review, a letter was sent to the three main conservation groups informing them of the intention and offering to meet them if they wished.

To date, the Wildflower Society has not replied. A follow up telephone call resulted in the consultants being asked to contact one of their members. A few attempts to contact this member were unsuccessful.

A telephone call to the representative of the Wetlands Conservation Group resulted in the following points being made:

- *the land should all be reserved;*
- *CALM should do a land-exchange with Homeswest;*
- *the Wetlands Conservation Group does not go along with any form of development;*
- *there is no point in meeting to discuss the matter; and,*
- *the conservation aspect should be ensured.*

A follow up telephone call with the representative of the Waterbird Conservation Group resulted in the following points:

- *the Society is opposed to any development on the site; and,*
- *a reply has been mailed.*

2.5 Discussions with the Department of Conservation and Land Management

The departmental officers contacted were generally helpful despite their preference for a land-exchange. Attempts to obtain some important information on the distribution of the rare plant *Drosera occidentalis* on the site, from one of the officers at Woodvale, were not successful.

In the absence of this information it had to be assumed that this species is distributed throughout the *Viminaria* Heath and that a certain number of examples of this species would be preserved in the proposed conservation area.

2.6 Summary

From the details outlined it is obvious that a concerted effort has been made to obtain public participation in the preparation of this proposal. The public meeting that was held included representatives from a wide range of public and private bodies. Each of these bodies had the opportunity to make statements or provide viewpoints.

The conservation groups are generally opposed to any development on the site. They favour the area being set aside as a reserve and a land-exchange being arranged by Homeswest and CALM.

Despite the large numbers of conservationists which attended the meeting, there were a significant number of people at the meeting who supported the development proposal.

3. BENEFITS OF THE PROPOSAL

The development proposal which entails both the conservation of the claypan wetland and the utilisation of the remainder of the site for medium density residential development has several benefits both to the local community and the broader metropolitan community. The benefits are as follows.

3.1 Conservation of a Wetland Containing Three Species of Rare Plants

This land which is presently zoned for residential development will be set aside as a conservation reserve. The land is presently open, unmanaged bushland. The proposal envisages this land being handed over to the Department of Conservation and Land Management for ongoing management. The Proponent intends to contribute towards the development of the reserve, including fencing, pathways and stormwater drainage.

We believe that this proposal provides the best possibility for the preservation and conservation of the rare plant species.

3.2 Urban Consolidation

This land lies in the centre of one of the Perth Metropolitan Region's urban development corridors. It lies immediately to the east of the Perth-Armadale railway line and is prime land for urban development. This proposal is in keeping with the recommendations of the report, "Planning for the Future of the Perth Metropolitan Region" (1987). The report states:

> *"One of the most important themes of the preferred strategy is the emphasis on urban containment. This finds expression in a more compact urban form, an emphasis given to consolidation and infill in the existing urban area and replacing corridor growth in the more peripheral parts of the region with areas of land closer to employment opportunities and urban facilities in the existing built-up area".*

3.3 Improve the Level of Use of the Perth-Armadale Rail Line

This proposal is in keeping with the Department of Planning and Urban Development's Policy DC 1.6 "Development Near Metropolitan Railway Stations".

A new electric suburban rail system is presently being implemented. This will shorten travel times and improve passenger comfort. Land within 800 metres of rail stations is highly accessible and should be planned to permit as many people as possible to benefit from the rail service and to maximise the patronage of the system.

The majority of Lot 37 falls into the designated "station precinct". The policy goes on to encourage medium to high density residential development as well as commercial, intensive recreation and employment generating development.

The policy calls for a minimum residential density of R40, which is higher than this proposal.

3.4 Energy Conservation

The proposal will encourage the utilisation of the rail system to commuters rather than use of the private motor vehicle.

Recent research by Professor Peter Newman and Dr Jeff Kenworthy of Murdoch University indicate the Metropolitan Perth is a higher consumer of fuel than most other cities in the world. Perth has the highest ratio of cars per 1,000 population of Australian cities (475) and the highest number of car kilometres driven per car (13,891). Conversely, it has the lowest transit ridership of 1.3 trips per kilometre of service of any Australian city.

Research indicates that Perth's outer suburbs use an average of 40,379 MJ per person of petrol per annum.

A specific study of the Perth-Armadale rail line indicated that the Kenwick station had the highest potential number of dwellings in its precinct ie. 2,200 dwellings.

> *"At present it is held up by a number of factors related to the ownership of land and the lack of sewerage. One of the major problems is a 20 hectare Homeswest site adjacent to the station which has three species of rare plants and is earmarked by CALM as a top priority flora conservation area".*
>
> *"Resolution of the impasse which currently exists between Homeswest and CALM is an important step in unlocking a lot of the potential at Kenwick" (Newman, P. et al, 1990).*

3.5 The Provision of Affordable Housing

The cost of housing is increasing at a greater rate than salaries. Over the past few years the Commonwealth and State Governments have undertaken research into providing more affordable housing under the auspices of the "Joint Venture for More Affordable Housing". The research has shown that medium density housing utilising reduced lot sizes, verges and street widths is able to reduce the cost to buyers - especially to younger people, who are less able to afford housing. It is intended to use these principles in this development and to produce more affordable housing (Stokes, J., 1987).

3.6 Assist in the Reduction of Greenhouse Gases

Perth presently generates 2.25 tonnes of carbon dioxide from gasoline (petrol) and 0.48 tonnes of carbon dioxide from diesel per head of population per annum. This is higher than all other Australian, European and Asian cities studied and is only surpassed by a number of American cities (Newman, P., 1990).

If we as a society are going to be responsible about reducing the level of greenhouse gas, which we generate, we need to take every opportunity available. The present proposal which is within walking distance of a rail station will assist in the reduction of greenhouse gases.

3.7 Reduction of Crime in the Area

This benefit emerged at the public meeting held in June. One of the residents of Alton Street spoke in favour of the development on the grounds that the area is sometimes used as a refuge for criminals. They are able to shelter in the bush after robbing houses in the area. Another local resident pointed out that stolen cars are regularly abandoned in the area.

3.8 Summary

The benefits of this development proposal are:

- *the best long term conservation opportunity for three rare plant species;*
- *the conservation of the claypan wetland habitat;*
- *the consolidation of urban development which makes use of existing services in an urban development corridor;*
- *the promotion of better usage of the metropolitan rail network;*
- *the conservation of energy through the reduction of vehicle fuel;*

- *the reduction in Greenhouse Gas emission; and,*
- *the reduction of crime in the immediate area.*

4. ALTERNATIVE DEVELOPMENT POSSIBILITIES

The alternatives range from no development through the present proposal to full development.

The proponent considers that the **no development** option would not be a socially responsible choice for the reasons mentioned above in Section 3. The land has a strategic importance at the centre of an urban development corridor.

Similarly, the **full development** option would not be environmentally responsible as the claypans contain rare plant species and that there are few such claypan wetlands in the State.

The proponent therefore considers that the present proposal which conserves the important claypan wetland plant habitat and develops the remainder of the land which is of social and environmental benefit to the Perth Metropolitan Region is a reasonable approach.

5. THE EXISTING PHYSICAL ENVIRONMENT

The following section describes as thoroughly as possible the physical environment of the Lots 37 and 47, Kenwick.

5.1 Topography

The best available information on the topography of the site is the 1:2,000 series produced by the Department of Land Administration. This serves as a grid of spot heights and contours at one metre intervals (Figure 5.1).

Lots 37 and 47 comprise a relatively flat area. The spot heights range from 5 metres in the west to 6 metres in the east. The 6 metre contour in the east, together with 3 or 4 high spots along Wanaping Road, are the result of sandfill introduced at the time of housing development.

5.2 Geology

The subject lots fall into the Guildford Formation and consist essentially of sandy clays and clayed sands together with other alluvium and colluvium. The Guildford formation is the predominant formation along the edge of the Darling scarp to the west of the Darling fault and is from the Quaternary period (Figure 5.2).

The Quaternary deposits consist of unconsolidated sediments relating to past erosion on the Swan Coastal Plain. They relate to periods of higher and lower sea levels during the Pleistocene and Holocence (D.C.E. 1980).

The Guildford Formation is generally of fluvial origin but does exhibit estuarine and shallow-marine deposits near the base. The Guildford Formation corresponds to the Guildford soil associations. The sediments are usually mottled in shades of brown, orange, yellow and grey and may be laterised and oxidised at the surface.

The implications for the present proposal are that the clay is not a suitable base for urban development and provides instability both for roads and building construction. This fact is probably the reason why this land has not been previously developed. It is general practise to fill such land with at least 60 centimetres of sand fill to provide the required stability over the clay and to reduce the chance of flooding.

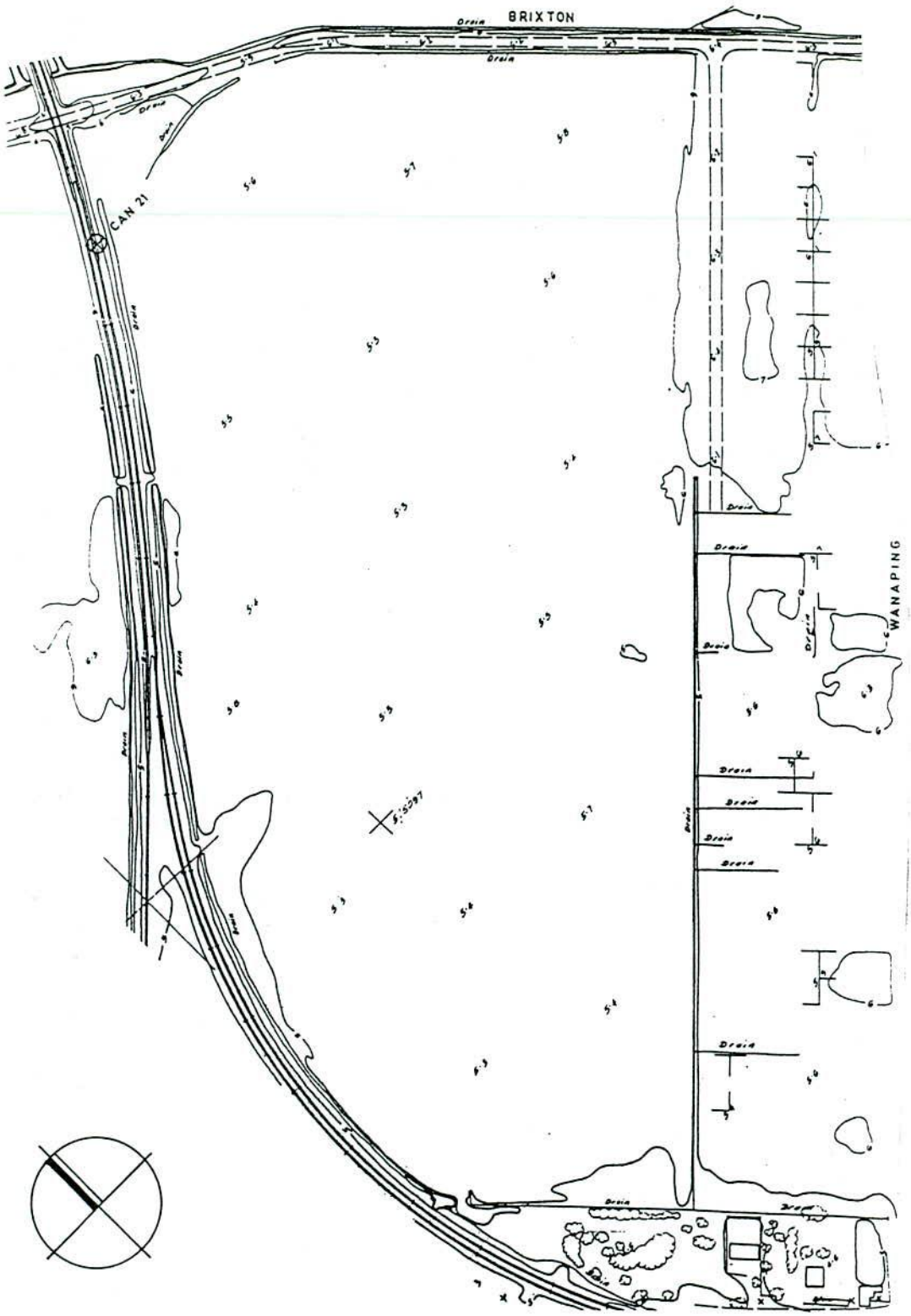
5.3 Landform and Soils

The site is situated on the Guildford deposits which are mainly fluvial. They are described as being a flat plain with yellow duplex soils. Both of these characteristics are confirmed from the topography and the aerial photograph (Figures 1.4 and 5.3).

The Guildford unit of the Swan Coastal Plain comprises the alluvial terrain on the eastern fringe of the plain (D.C.E. 1980).

A series of test pits inspected by A.G. Consultants as part of a hydrological study revealed a complex relationship between the component soils at a micro level. The area in the vicinity of the claypans is generally underlain by silty clay/claystone or clayey siltstone Near to the surface there are lenses of:

- *loam, silty or sandy and sand, with vegetation and roots;*
- *sand;*
- *silt;*

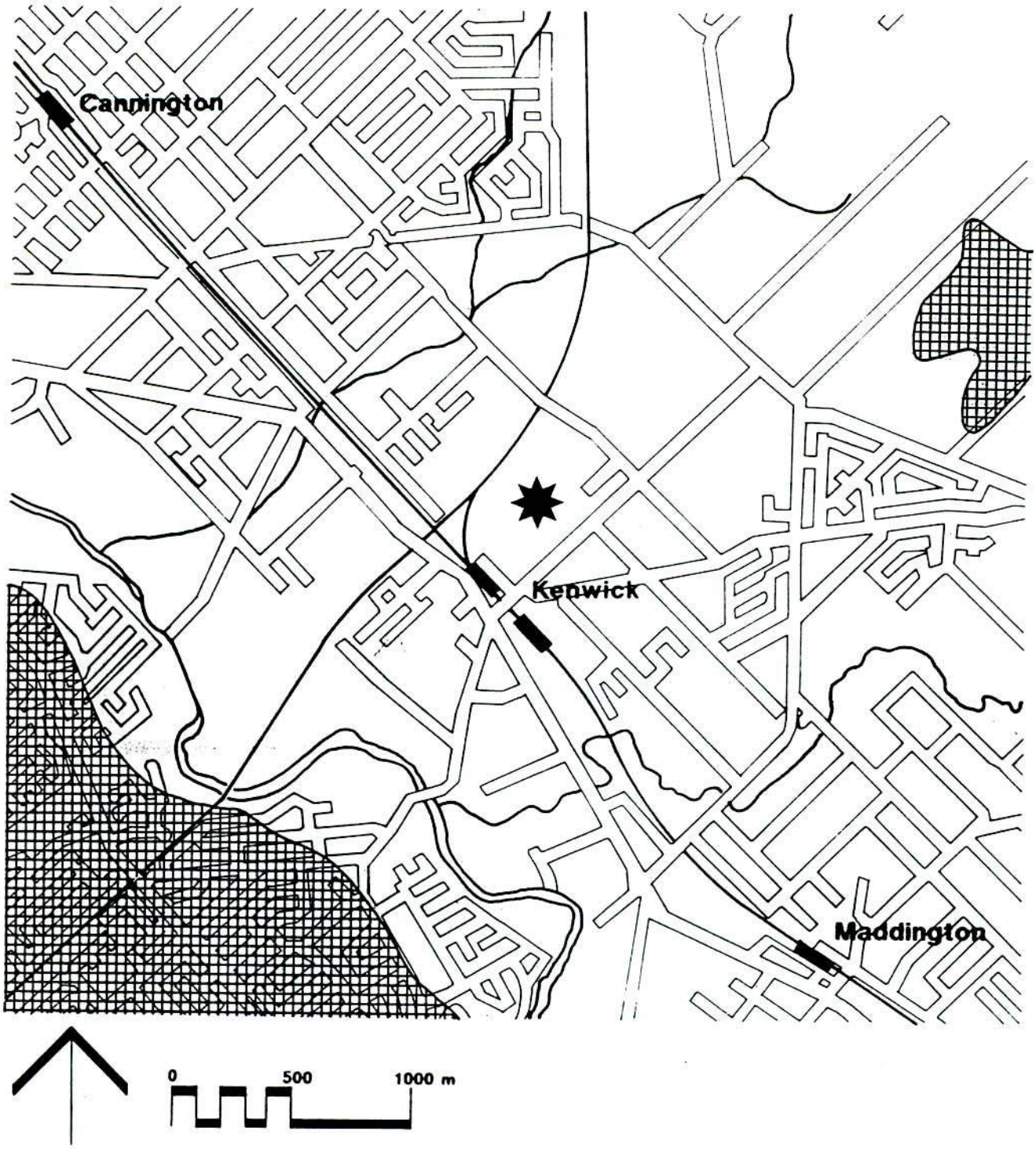


—— CONTOURS @ 1m INTERVALS

5.4 SPOT LEVELS

FIGURE 5.1

TOPOGRAPHY OF THE SITE



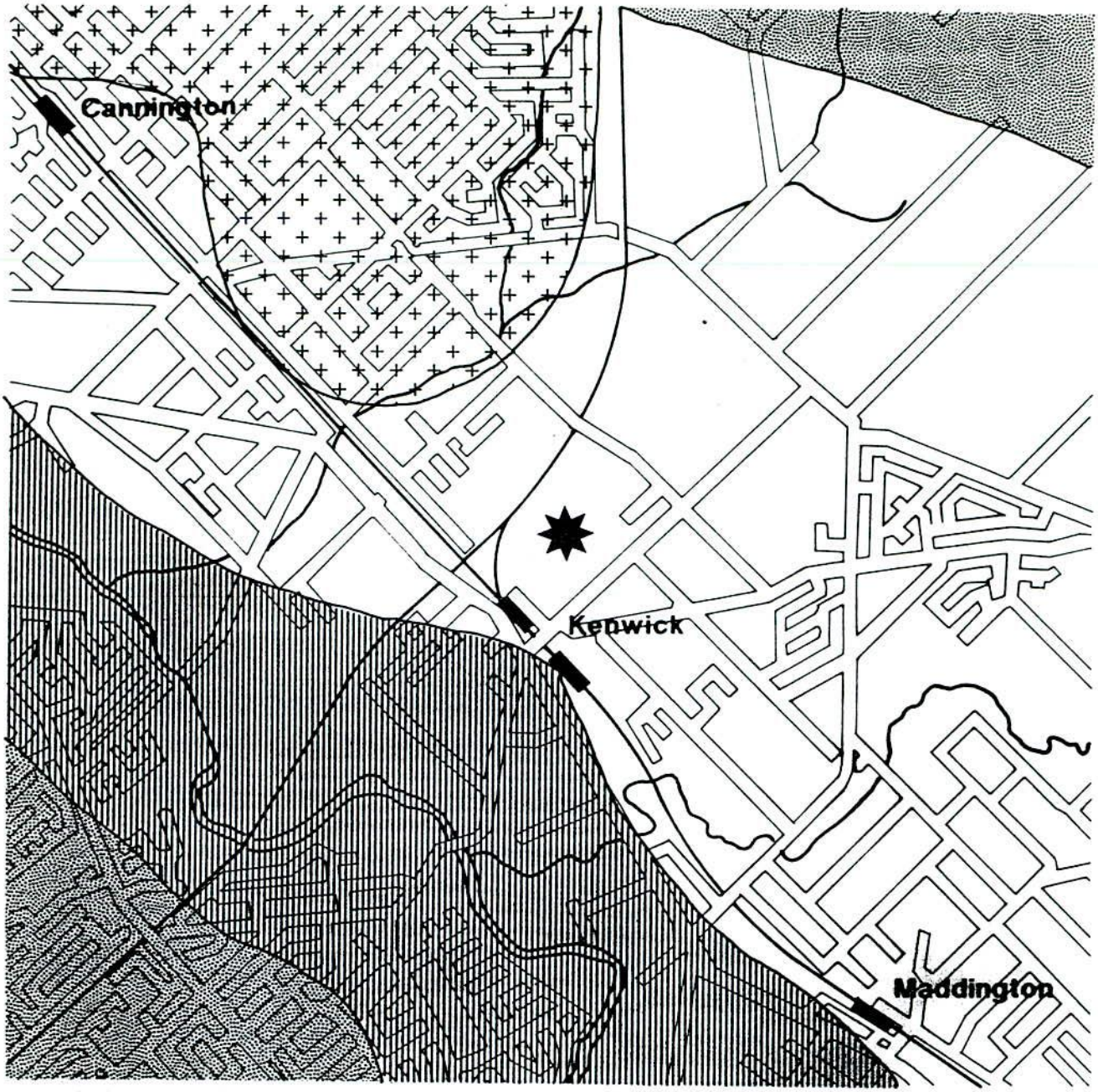
LEGEND

Bassendean sand, white and grey quartz sand.

Guildford formation, sandy clays to clayey sands, includes other alluvium and colluvium.

FIGURE 5.2

GEOLOGY OF THE KENWICK AREA



LEGEND

SOUTHERN RIVER: Sandplain with low dunes and many intervening swamps; iron and humus podzols, peats, and clays.

CANNINGTON: Poorly drained plains with calcareous substrate; yellow duplex soils with minor areas of red and black clays over limestone.

GUILDFORD: Flat plain with medium textured deposits; yellow duplex soils.

SWAN: Alluvial terraces with red earths and duplex soils.

FIGURE 5.3

LANDFORMS & SOILS OF THE KENWICK AREA

- *clay;*
- *sand and clay/claystone (50/50); and,*
- *gravel (laterised).*

In terms of the distribution of soils over the site the main differences are related to the minor variations in topography. Over the ages the finer sediments have been leached out of the higher ground which tends to be sandy and laterised to a greater extent. The lower lying land has accumulated the finer sediments over time and consists of more silt and clay than the higher land.

The implications of these complex variations in soil is the basis of the continued existence of the claypan wetlands. The clays and silts are almost totally impervious to surface water and there is little or no interaction between the surface water and the ground water (see diagrams in Attachment 5.5).

5.4 Vegetation

At a macro-scale the vegetation of the area is part of the Guildford Complex. Broadly this consists of a mixture of open forest to tall open forest of *E. calophylla, E. wandoo, E. marginata* and woodland of *E. wandoo* (Figure 5.4).

It is noted that much of the Guildford Complex has been subject to logging and clearing since European settlement. *E. lonepoolei,* which is now rare in the Guildford Complex, has not been recorded on site. Other remnant plant species that are found on the site include *Kingia australia* and *Xanthorrhoea preissii* (D.C.E. 1980).

At the micro-scale a survey was done of the site in about 1985 by officers of the Department of Conservation and Land Management (Attachment 5.1).

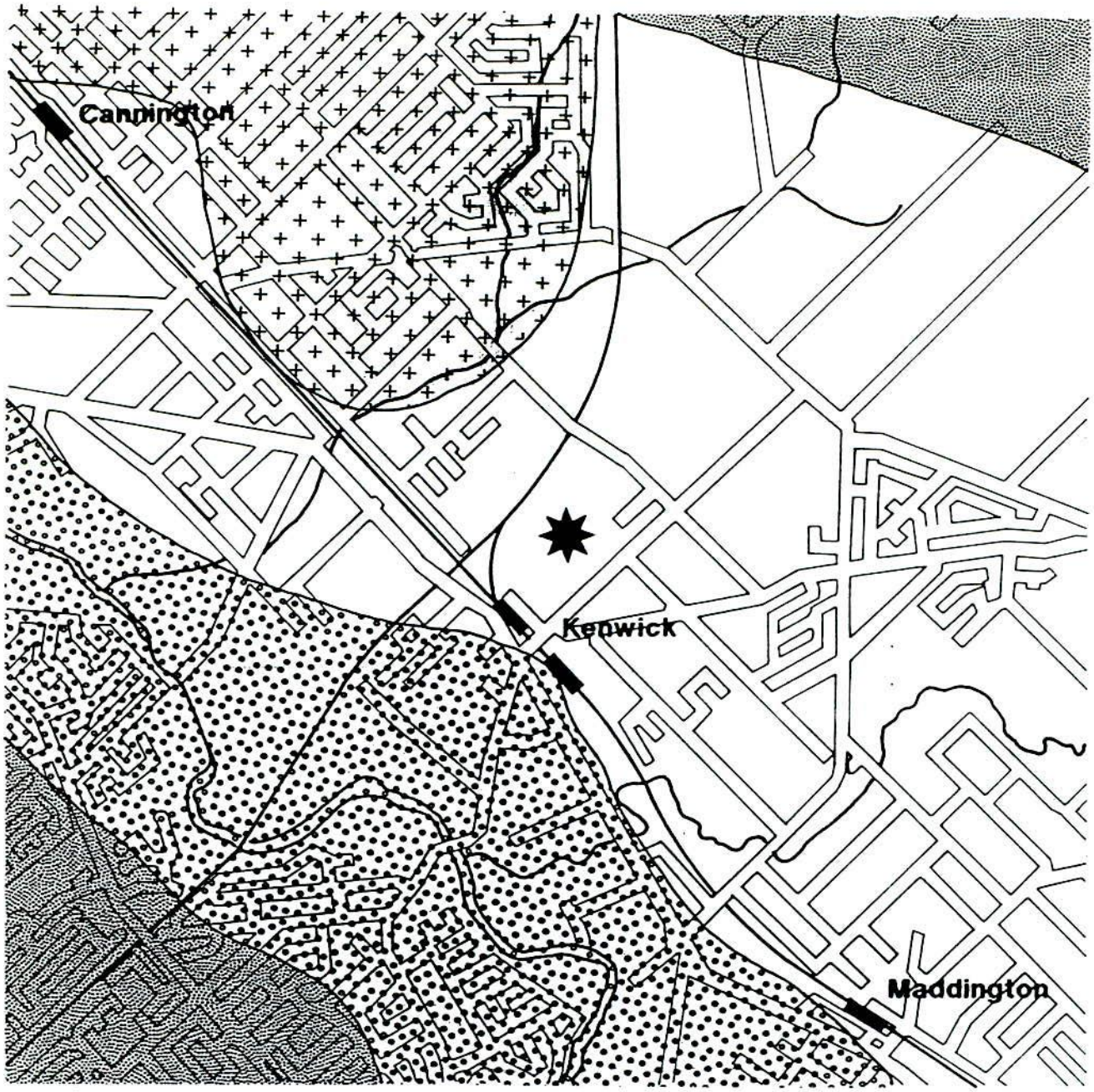
The unpublished report by G.J. Keighery and S.D. Hopper "Brixton Road, Canning Location 10 - Lot 37, Gosnells Shire: Report of Survey", concluded that the site has several floral and biological features which make it one of the most outstanding sites for reservation on the Swan Coastal Plain. The following major points were made.

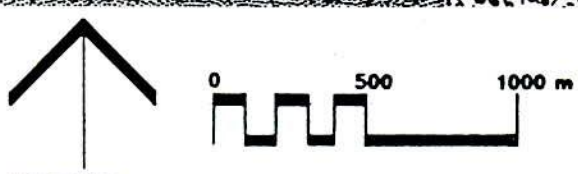
- *"presence of rare flora, including Aponogeton hexatepalus and Hydrocotyle lemnoides;*
- *areas of phytogeographical significance, containing several species at the northern extremities of their known ranges and species normally not present on the coastal plain but able to survive on heavy soils of this site;*
- *Claypan, early spring: floating round leaves are Hydrocotyle lemnoides (aquatic pennywort), emergent inflorescences: Aponogeton hexatepalus (stalked water ribbons).*
- *site of special scientific interest, containing hybridizing populations of Tribonanthes (flannel flowers) and Anigozantlios (Kangaroo Paws);*
- *the claypans themselves are a rare habitat in the Metropolitan region; and,*
- *the area could be a possible re-establishment site for the short-necked Tortoise."*

The report contains a list of 170 species but indicates that a spring and summer listing could result in substantially more. A site inspection report was written in June 1989 after a fire had burned the vegetation on the site. A copy of this report in also attached (Attachment 5.2).

Claypan, early spring: floating round leaves are *Hydrocotyle lemnoides* (aquatic pennywort), emergent inflorescences: *Aponogeton hexatepalus* (stalked water ribbons). .

Aponogeton hexatepalus (stalked water ribbons).





LEGEND

SOUTHERN RIVER COMPLEX : Open woodland of *E. calophylla - E. marginata - Banksia* spp. with fringing woodland of *E. rudis - M. rhaphiophylla* along creek beds.

CANNINGTON COMPLEX : Mosaic of vegetation from adjacent vegetation complexes of Bassendean, Karrakatta, Southern River and Vasse.

SWAN COMPLEX : Fringing woodland of *E. rudis - M. rhaphiophylla* with localized occurrence of low open forest of *C. obesa* and *M. cuticularis*.

GUILDFORD COMPLEX : A mixture of open forest to tall open forest of *E. calophylla - E. wandoo - E. marginata* and woodland of *E. wandoo* (with rare occurrences of *E. lane-poolei*). Minor components include *E. rudis - M. rhaphiophylla*.

FIGURE 5.4

VEGETATION OF THE KENWICK AREA

The spatial distribution of floral communities on Lot 37 has recently been updated by the Department of Conservation and Land Management. The main associations are as follows:

- *Mel. Laterita or open clay;*
- *Pericalymma sedgeland claypan;*
- *Melaleuca low woodland;*
- *Marri woodland;*
- *Viminaria; and,*
- *Disturbed areas.*

These have been plotted (Figure 5.5).

Of the 170 species in the CALM report 17 are exotic. Of these nine occur in the disturbed areas where vehicle tracks have penetrated the site. The remainder occur in the main woodland.

Correspondence from the Western Australian Wildflower Society (Inc.) indicates that a third species of declared rare flora is present on the site ie. *Drosera occidentalis* (*Viminaria* Heath, see photograph). This was not included in the species list compiled by CALM in 1985.

Summary

The conservation value of the site is as follows:

- *the Department of Conservation and Land Management has described this land as the most important unreserved land in the Perth Metropolitan area; and,*
- *the three plant species, Aponogeton hexatepalus, Hydrocotyle lemnoides and Drosera occidentalis are Declared Rare Flora in terms of the Wildlife Conservation Act published in the Government Gazette on 1 June 1990.*

5.5 Fauna

There is a paucity of information on the fauna in the Kenwick area. Previous studies have concentrated on wetlands, rivers and forests but little work has been done on this area.

The W.A. Museum Mammal Department was commissioned to obtain a listing of mammal sighting (Attachment 5.3). Only two species were noted from the Kenwick area, ie. the Southern Brown Bandicoot and Gould's Wattled Bat.

The Museum's reptile register contained nine reptile species from the Kenwick area.

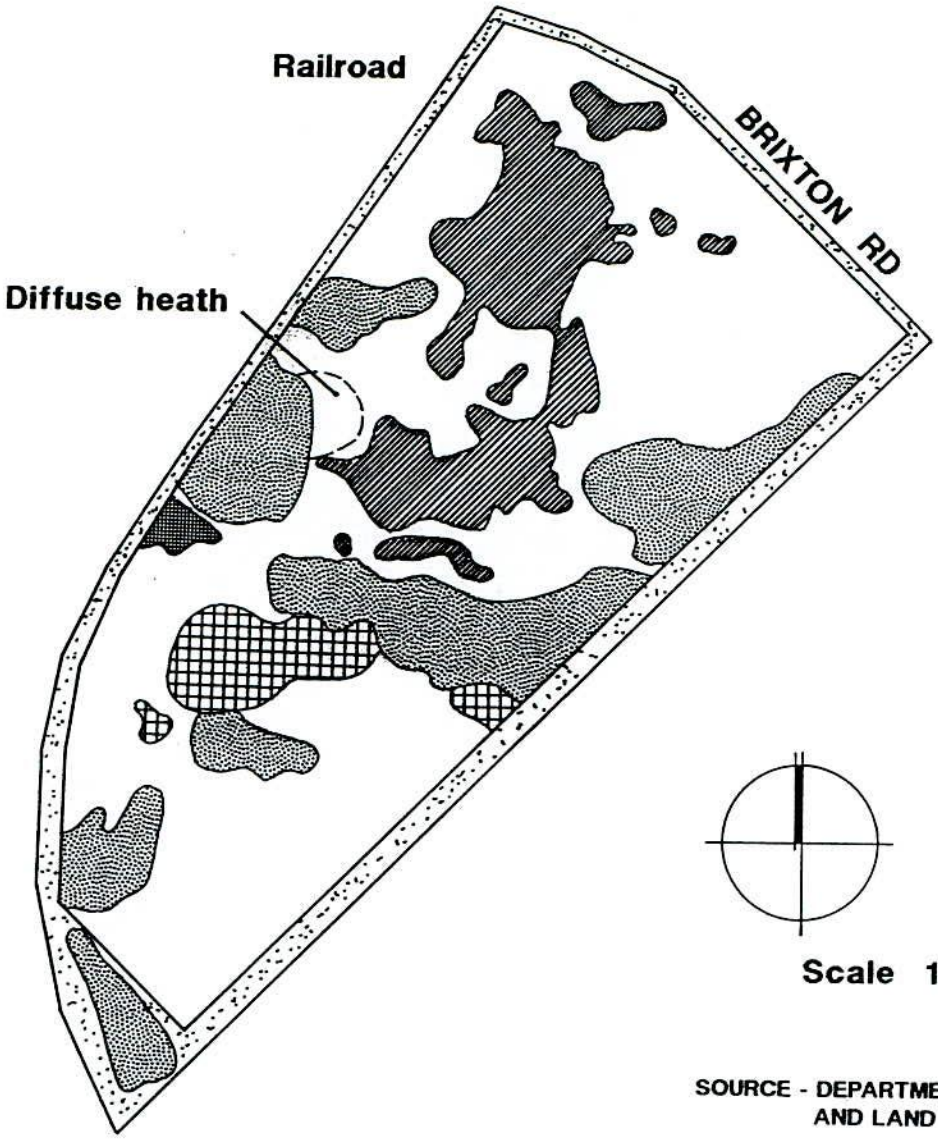
The Museum was questioned at the possible presence of larger mammals on site but this was discounted on the basis of it being open urban bushland. The area is open to domestic and feral animals.

Observations of the wetlands during site inspections did not reveal any waterbirds. This is understandable owing to the lack of protection and the ephemeral nature of the wetland.

Summary

The conservation value of the site is as follows:

- *there have only been a few mammal sightings from the general Kenwick area and ten reptile sighting from the general Kenwick area; and,*



Scale 1:5000

SOURCE - DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

LEGEND

- Mel.laterita or open clay
- Pericalymma sedgeland claypan
- Melaleuca low woodland
- Marri
- Viminaria
- Disturbed

FIGURE 5.5

VEGETATION OF THE SITE

Open Drain which runs along the South East Boundary of Lot 37 (October, 1990)

The *Viminaria* Heath to the East of the Wetland (October, 1990).

- *this area is not considered to have any rare species owing to the fact that it is open urban bushland.*

5.6 Hydrology

The area has in past years been drained to permit urban development. A series of drains remove most of the surface runoff water from the Brixton Street area subcatchment to Yule Brook via Binley Brook. The extension of Binley Brook runs along the south-east boundary of Lot 37 Brixton Street (see photograph). The existing drain is open and is contained in a narrow drainage reserve. It is intended to pipe this drain in the near future. The present drainage of the area is shown in Figure 5.6.

The hydrology of the site has been the subject of two studies by the firm Australian Groundwater Consultants (A.G. Consulting Group Pty Ltd and now AGC Woodward - Clyde).

The first study was prepared jointly for the Department of Conservation and Land Management, Homeswest and the Department of Planning and Urban Development in November 1989 (Attachment 5.4). The main conclusions of the study were as follows:

- *the wetland areas within the Homeswest site are surface water features;*
- *drainage schemes associated with the development should not affect the wetlands;*
- *the development concept would remove 15% of the wetlands catchment, however, a full water balance study would be needed (the development proposal at that time is similar to the present one);*
- *maintain current water regime in wetlands;*
- *direct make-up water into the wetlands;*
- *roof water can be used to make-up;*
- *a drainage system would need to ensure that an optimum volume of make-up water enters the wetland;*
- *an alternative to the make-up water approach would be to retain the entire catchment;*
- *the greatest threat to the wetland is posed by the proposed Brixton Street bridge ie, 30% loss catchment;*
- *make-up water appears the most realistic option;*
- *volume of make-up water would need to be established from a full water balance study; and,*
- *requirements relating to make-up water would need to be established through the design of a drainage system.*

As a result of the above report Hames Sharley commissioned A.G. Consulting Group Pty Ltd in 1990 to undertake a full water balance of the site as part of preparing a detailed design concept for the site. (Attachment 5.5).

This second study considered the wetland in greater detail and differed significantly from the findings of the first report, ie.

- *the primary source of water to the wetlands is rainfall directly onto the actual wetland;*

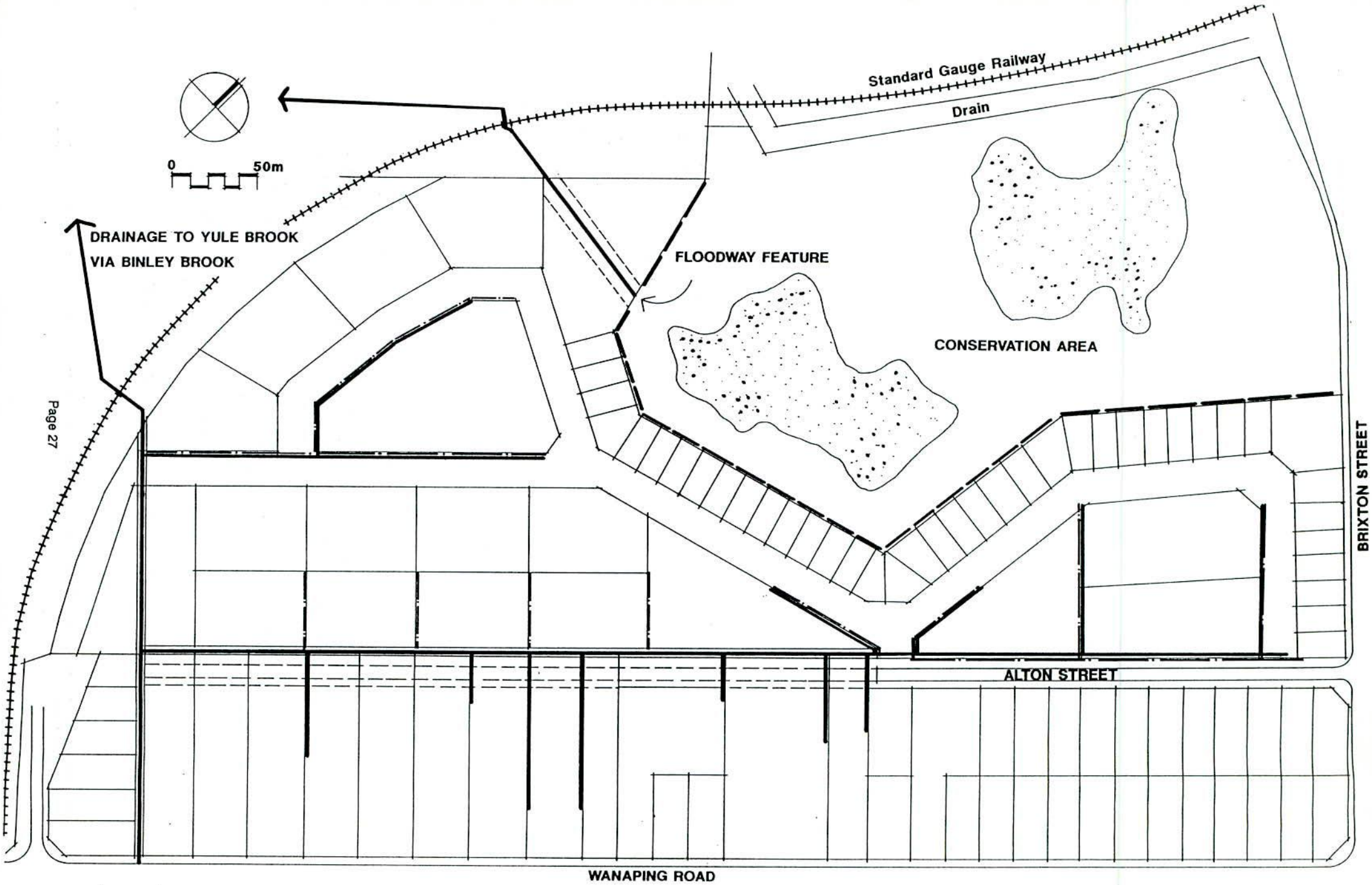


FIGURE 5.6
PRELIMINARY DRAINAGE CONCEPT

- *a severe rain event would result in overland flow from the north and east;*
- *surface drainage is transient as it would drain through the site to the south west;*
- *temporary inundation of the wetland by overland flow is not essential for the maintenance of the wetlands;*
- *assuming the appropriate drainage is installed in the proposed development (to direct flow away from the wetland) the development should have negligible effect on the hydrological status of the wetlands;*
- *the existing graded track, which bisects the site, acts as a barrier to surface water movement; and,*
- *this track could be used as a development boundary.*

The full water balance for the site indicates that the integrity of the wetlands and hence the rare flora depend on rainfall directly onto the wetland. Overland flow is already impeded by a run around the edge of the wetland. No make-up water is necessary.

5.7 Noise Levels

The site has a standard gauge railway line along its western boundary and the Perth-Armadale railway line to the South. The standard gauge does not currently carry heavy traffic but trains do sound their sirens when approaching the Brixton Street level-crossing. The Perth-Armadale rail line will be electrified in the near future, which should result in reduction of noise. The future Roe Freeway will be built to the west of the site. This will generate noise.

A consultation was held with the EPA officer who deals with noise issues. The present noise levels were considered to be acceptable. Future noise levels are difficult to estimate but it was considered that building design along the western edge of the development could be used to reduce noise from the general area.

This approach has been used in Stirling adjacent to the freeway. Double storey buildings are situated backing into the noise source. A rear boundary wall reduces noise at ground level and small windows on the upper storey prevent noise penetration. Such buildings create a noise shadow effect for other buildings on the site.

It is anticipated that a system such as described above will be incorporated into the development to reduce noise.

5.8 Summary

The foregoing description of the physical environment can be summarised as follows:

- *the site is almost flat, the entire site lying between the 5 and 6 metre contour;*
- *the site consists of unconsolidated clays of the Guildford Formation which are unstable for roads and building construction in their present form and need to be filled;*
- *the complex soil structure and impervious nature of the clays is the basis for the continued existence of the claypans;*
- *the vegetation on the site falls into E. calophylla openforest, Viminaria, Melaleuca woodland, Pericalymma sedgeland and Mel. laterita;*
- *three species of Declared Rare Flora occur on the site;*

- *there is little faunal value on the site;*
- *the area has been drained in previous years;*
- *the wetlands are surface features which rely entirely on winter rainfall for their continued survival;*
- *if appropriate drainage is installed the development should have negligible effect on the hydrological status of the wetland; and,*
- *the design of the urban development on the site can be used to reduce noise levels in the subdivision.*

6. SOCIAL ENVIRONMENT

6.1 Current Human Use of the Site

The broad land use of the Kenwick area is shown on Figure 6.1. The development site falls into the south-west corner of a wedge of undeveloped land. It is anticipated that much of this undeveloped land will be developed in the near future. The adjacent block to the north-east is in the process of obtaining development approval at the present time.

The site is currently unused for any permanent human uses. Apart from a network of tracks which are presumably part of a firebreak system there is no development on the site.

There are signs that the site is used on a temporary basis, ie:

- *squatting takes place on the site (see photograph);*
- *dumping and burning of stolen vehicles (see photograph);*
- *stripping of stolen vehicles;*
- *dumping of garden refuse;*
- *trail bike riding; and,*
- *cycling or playing by children.*

6.2 Aboriginal Significance

The Department of Aboriginal Sites of the Western Australian Museum was contacted in relation to determining whether there are any Aboriginal sites on the land. A search of their records revealed no known sites on the land.

The only spiritual Aboriginal site in the City of Gosnells is in the vicinity of the Gosnells Golf Club, several kilometres to the south of Kenwick. This site, a swamp, is fed by a perennial spring which is maintained, according to Aboriginal lore, by the Waugul.

Prior to European settlement the land in the vicinity of the Canning River was inhabited by groups of Aboriginal people who hunted and gathered on a seasonal basis. The men concentrated on hunting or capturing the larger animals and the women dug for roots, collected fruits, seeds, birds eggs, larvae and trapped small animals (City of Gosnells, 1988).

The Aboriginal people led a nomadic way of life based on food availability in various places. The wetlands and river flats of the Canning River were productive (Figure 6.2). They contained waterfowl, tortoises, gilgies and frogs. The surrounding sands yielded macrozamia nuts and blood roots. The Canning River itself was a source of fresh water, rich in fish and crustaceans and on the banks yam patches occurred and kangaroos favoured the open grassy plains as pasture. These plains were carefully managed by the Aboriginal people - burning out the understorey to encourage new growth.

6.3 European Settlement

Europeans settled in the area in the 1830s. Crown grants were made on either side of the Canning River in a series of ribbons. The settlers therefore received fertile red soil on the flood plain as well as large tracts of less fertile clayey or sandy soils further away (Figure 6.3).

European settlement led to immediate conflict with the local Aboriginal people - neither of whom understood the culture of the other. The fixed settlement of the Europeans and introduction of stock and sheep drove off the kangaroos. The Aboriginals responded by spearing sheep and cattle. Retaliation by the settlers resulted in most of the Aboriginal people leaving the area within a decade.

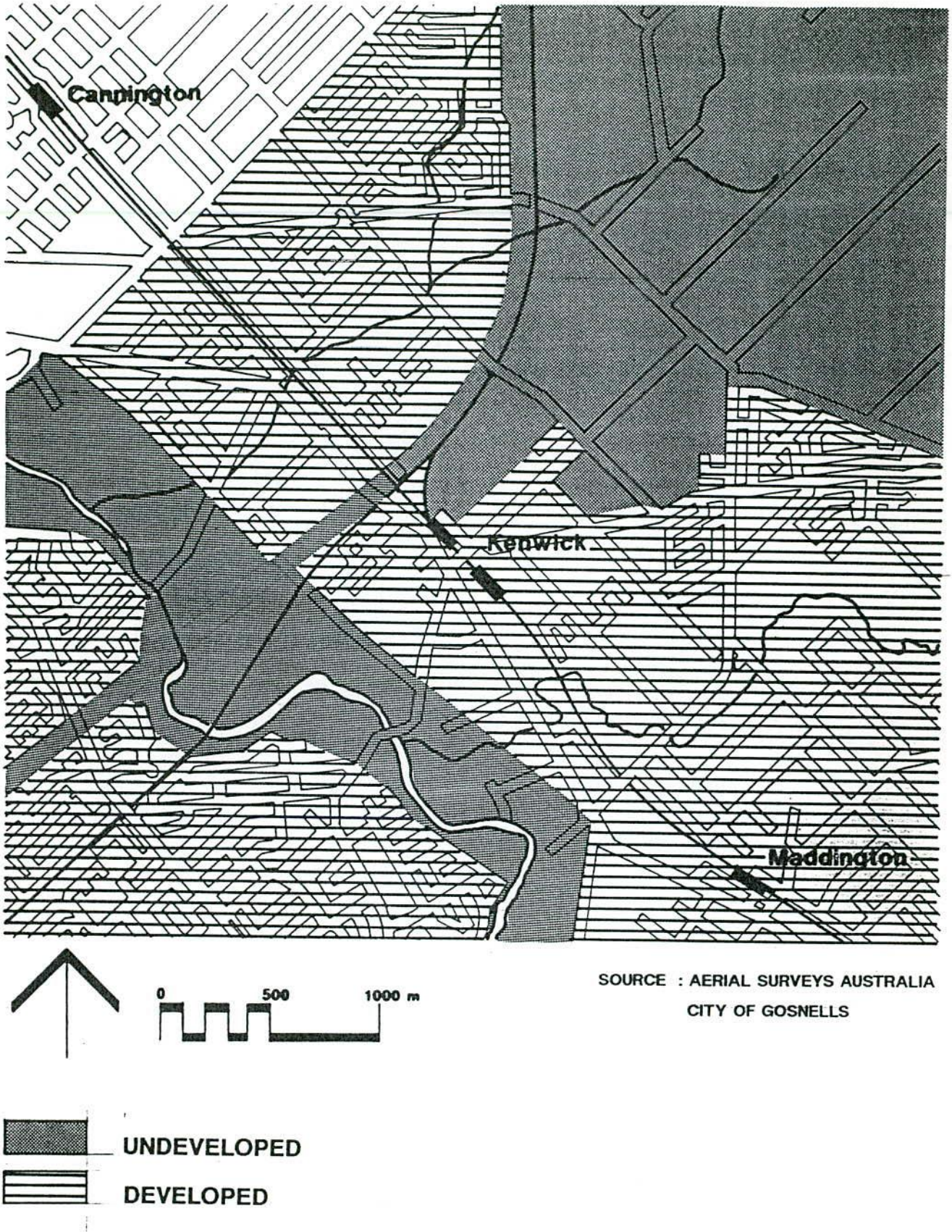


FIGURE 6.1

GENERALISED LAND USE IN THE KENWICK AREA

Squatter Camp on the Site (October, 1990).

One of the Car Bodies disposed of on the Site (October, 1990).

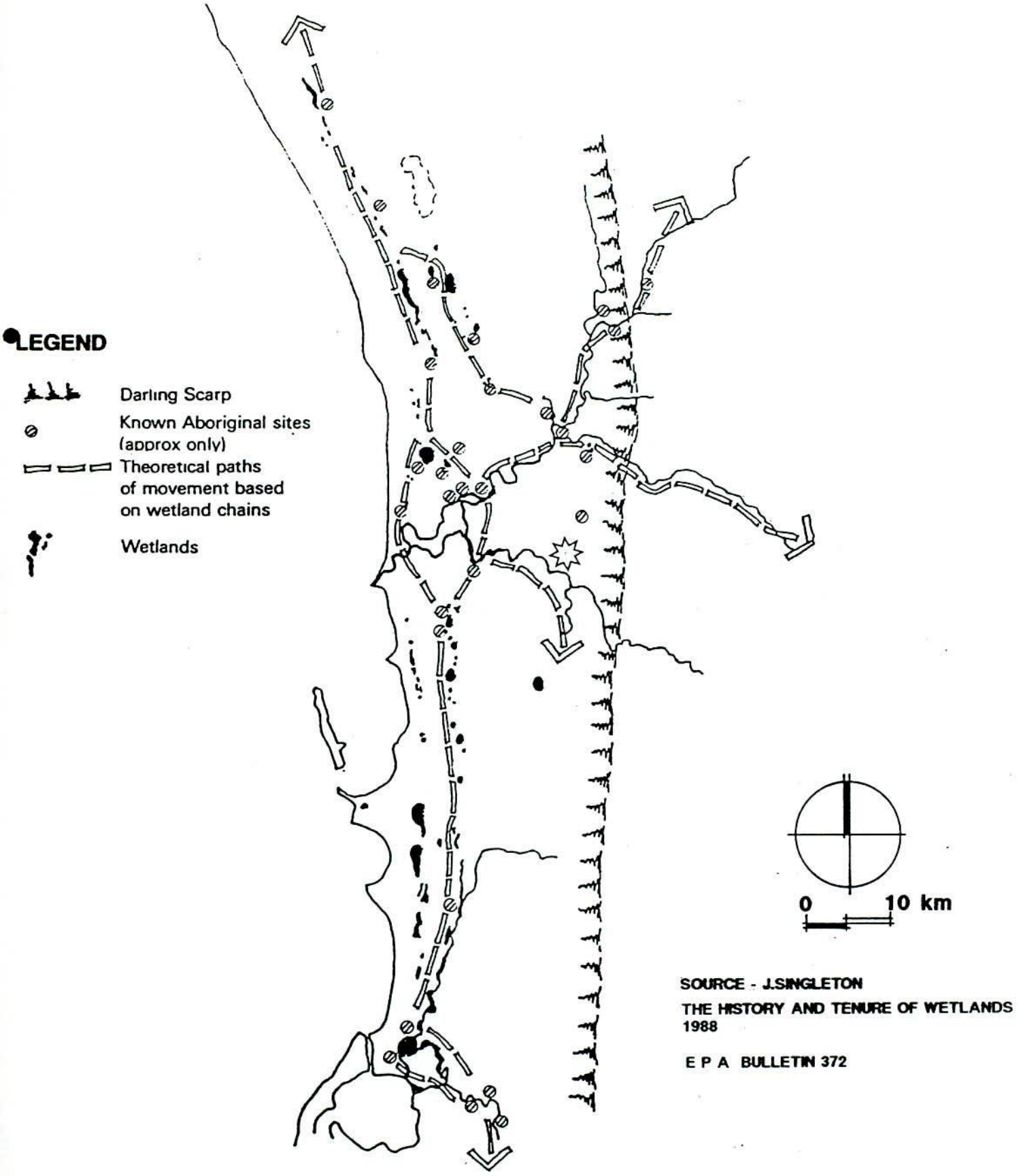


FIGURE 6.2

WETLANDS AND THEORETICAL ABORIGINAL MOVEMENT

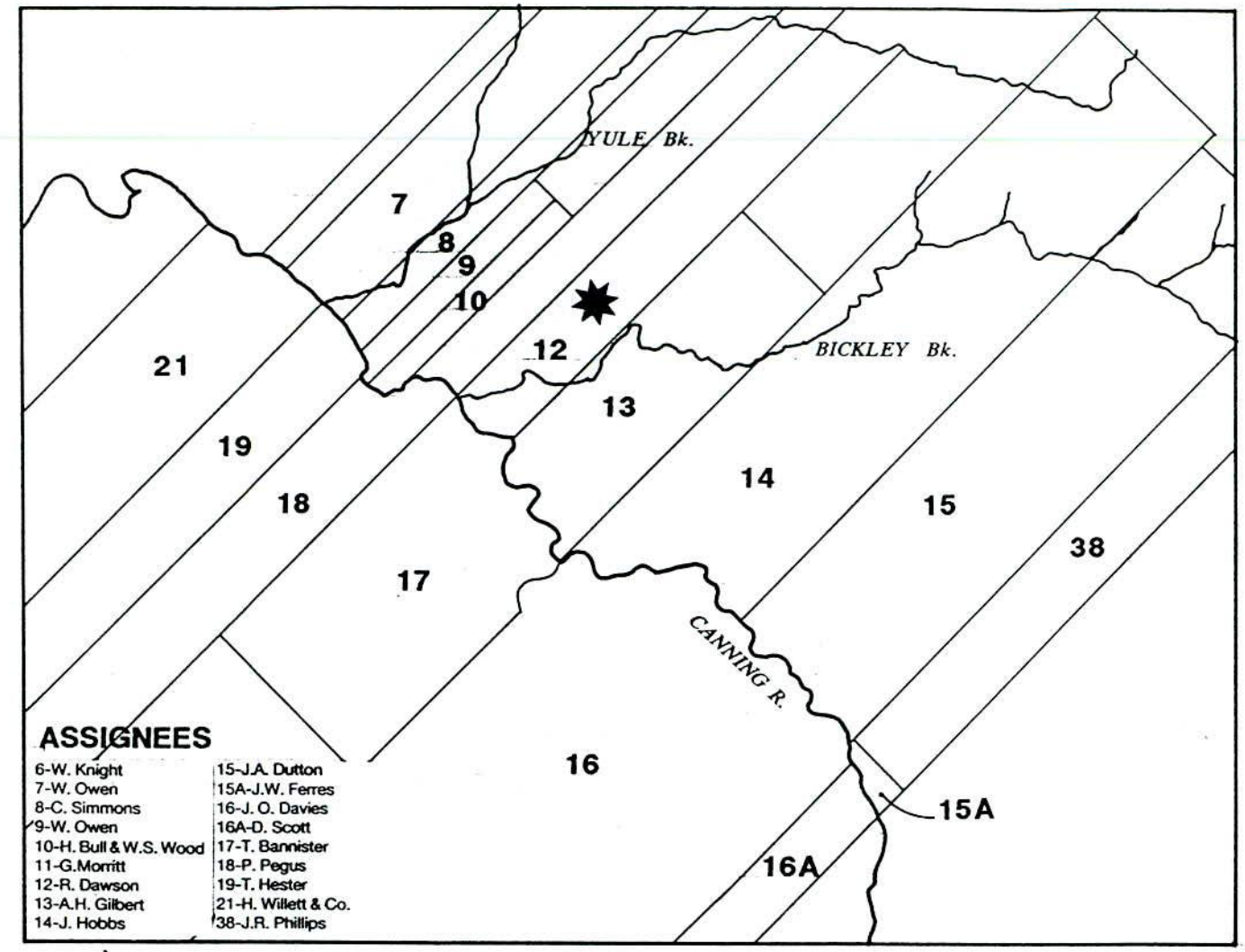


FIGURE 6.3

PATTERN OF EUROPEAN SETTLEMENT IN THE KENWICK AREA

By the mid 1800s Kenwick had become the centre of settlement in the Canning Region. A church, school and post office were built, social activity and sport thrived. By 1890 additional growth had focused activities on Armadale and Kenwick declined as a prominent centre.

As far as it is possible to determine, Lot 37 in Kenwick has always been on the periphery of both Aboriginal use and European settlement. Being on the less fertile (from an agricultural point of view) clayey soil the European settlers would not have found it of much use. It was probably used for grazing by the settlers and as a kangaroo hunting area by the Aboriginal people.

7. PROJECT DESCRIPTION

This section describes the proposal in detail, such as preliminary layout design, services and development. The order of the steps taken coincide with the timing of the stages.

7.1 Establishment of the Conservation Area

7.1.1 Fence the conservation area to isolate it from the remainder of the land and to prevent the entry of machinery.

7.1.2 Construct an effective drainage system to separate the conservation area from the developed area. This will need to be designed to prevent seepage and stormwater from entering the reserve.

7.1.3 Install an overflow drainage system to prevent flooding of the reserve and backflow into the developed area.

7.1.4 Prepare a management plan in conjunction with CALM. This will outline what work is required to restore the conservation area to a pristine condition. An outline of the management plan, highlighting resources, management objectives, management strategies and implementation is attached (Attachment 7.1).

7.1.5 Provide a single entry/exit for the public together with footpaths, educational material and signs. The reserve will be restricted to pedestrians.

7.2 Development of the Remainder of the Land for Urban Development

Once all necessary clearances are obtained, the balance of the land will need to be cleared of all vegetation.

As the land is low lying the entire site will need to be filled with approximately 0.6 metres of clean sand.

Once the filling is completed the services can be installed, ie:

- *roads;*
- *electricity (underground);*
- *sewerage;*
- *stormwater drainage;*
- *street lighting;*
- *gas; and,*
- *Telecom.*

At present the only road connection is onto Brixton Street. The City of Gosnells have indicated that they do not wish to have traffic entering Wanaping Road adjacent to Kenwick Station. It is proposed that the only entry and exit at this point will be pedestrians and cyclists. An alternative access to the site is being considered along Wanaping Road. (As this will require property acquisition it has not been indicated on any of the plans).

The design concept for the development includes a mix of housing types, a mix of tenures and a mix of lot sizes. The overall density is planned to be R30 (approximately 30 dwellings per hectare).

This is in keeping with the policy of the Department of Planning and Urban Development to promote higher density in the metropolitan station precincts.

The fact that Homeswest will be establishing an eight hectare conservation reserve will not obviate the need to provide the standard ten percent of public open space. This will need to be developed to the City of Gosnells standards.

It is proposed to introduce narrow roads, ie. 16 metres and smaller blocks than the standard, ie. between 450 sqm and 650 sqm.

This is intended to reduce the overall development costs and to bring more affordable housing onto the market. In order to achieve the target overall density of R30, a large number of group housing lots will need to be created.

The provision of community facilities in the area has been discussed with officers from the City of Gosnells. It was considered feasible that a small local shopping centre comprising a delicatessen together with a few other local convenience type of outlets could be developed. This will probably be located in relation to the proposed access onto Wanaping Road and has not been shown on the preliminary development proposal plan.

The matter of noise from the standard gauge rail line has been discussed with the relevant officer at the Environmental Protection Authority. It was decided that the best approach would be to design the buildings on the medium density lots to back onto the rail line. By using screening walls and providing small windows on the rail side of double storey buildings noise can effectively be reduced and screened from the developed area.

Landscape guidelines will be prepared for the subdivision and for home developers.

The timing of the development is difficult to estimate. From the flowchart in the introduction the various steps have been indicated. There are several steps which require approvals processes:

- *environmental review process;*
- *concept planning preparation;*
- *subdivision application process; and,*
- *development application process.*

From experience, these processes may take from two to three years.

7.3 Environmental Impacts of the Development

The EPA's guidelines for the preparation of this Review ask for a brief discussion of potential environmental impacts at this point.

The land which the proposal identifies for urban development will be totally modified. The land will be required to be cleared and filled with sand to a depth of 0.6 metres.

It is for this reason that the Proponent has proposed the establishment of an eight hectare conservation reserve which will ensure that all three of the rare plant species are conserved and protected.

8. ENVIRONMENTAL IMPACTS AND MANAGEMENT

This section outlines in detail the environmental impacts which will result from the proposed development.

8.1 Hydrological Impacts

From the hydrological studies it was determined that the claypan wetland depends entirely on rainfall for its continued existence. Some overland water movement into the wetland will occur when the rainfall is heavy but the survival of the wetland does not depend on this. If extremely heavy rain falls, the wetland area will experience localised flooding of up to approximately 30 centimetres before the water runs off into the drains. It is therefore considered that the existing proposal will not alter the long term sustainability of the wetland.

In the developed area, the land will be filled and a drainage system will be constructed to dispose of stormwater.

The environmental impact of the area is therefore minimal. The area is already modified. The impact on the wetlands will not adversely affect the existing situation. The developed area will be modified and will integrate with the existing drainage system.

8.2 Impact on the Flora, Individual Plants and the Habitats

The impacts on the flora in general, individual species and habitats are the most serious:

- *the flora in the development area will be lost. This means that a large area of Viminaria Heath, where there are presumed to be examples of Drosera occidentalis, one of the three Declared Rare Flora species, will be lost; and,*
- *in terms of habitats, the Pericalymma sedgeland claypan and Melaleuca low woodland will be lost in the developed area.*

It must be pointed out however, that the conservation area contains the habitats of all three Declared Rare Flora species and that *Aponogeton hextapalus* and *Hydrocotyle lemnoides* occur entirely within the conservation area and will be protected.

8.3 Impact on the Fauna, Individual Species and Habitats

Little or no detailed scientific study has been done on this site. Evidence from the Museum records indicates the sightings of two small mammal species, one in 1936 and the other in 1966, in the general Kenwick area. Nine snake species have been sighted in the general Kenwick area.

As an area of open urban bushland exposed to domestic and feral animals it is considered that the impact of development will be limited to the elimination of snake habitats.

8.4 Noise Impacts

Railway noise on this site is not as great as many parts of the metropolitan area.

Discussions with the relevant officer at the Environmental Protection Authority indicate that noise can be reduced by development design which will result in noise being screened from most of the site.

8.5 Ethnographic and Archeological Values and Impacts

There are no known Aboriginal sites on this land. The area, being to the north of the Canning River and situated on clay would not have been prime food producing land in pre-settler times.

Areas such as this would have been on the periphery of European settlement in the 1800s. The settlers and Aboriginal people preferred the fertile alluvial soils along the Canning River.

It is therefore believed that there is no environmental impact in this area. A comprehensive survey will be undertaken before development takes place.

8.6 Impact of the Development on Existing Adjacent Residences

This is more of a planning matter than an environmental matter. The proposed development will obviously result in changes in the area which will have positive and negative implications.

Negative aspects are:

- *increased traffic on local roads; and,*
- *greater numbers of people.*

Positive aspects are:

- *improved local shopping in the immediate area;*
- *increased opportunity to subdivide land;*
- *reduced crime in the area through lack of escape routes; and,*
- *increased land values.*

It is assumed that the social impacts will be handled by the local government through their planning and development approvals system and the Department of Planning and Urban Development.

8.7 Summary

The main points to emerge from the examination of impacts are as follows:

- *there is minimal impact on the hydrology of the area;*
- *the greatest impact will be on the flora - apart from the eight hectares to be conserved the remainder will be lost;*
- *the indigenous fauna have long since left the area - snake habitats are the most serious loss in the proposed development area;*
- *noise related problems can be managed by building design and layout;*
- *there would not appear to be any sites of ethnographic or archaeological importance - a detailed survey will be undertaken before any development takes place in terms of the Aboriginal Heritage Act; and,*
- *the social impact on the existing residents will have advantages and disadvantages - it is believed that the advantages outweigh the disadvantages.*

An integrated management program for the area will therefore focus on the rehabilitation of the proposed conservation area, protection of the existing resources while construction is underway and **providing pathways, access points and educational material for the ongoing management of the area.**

9. CONCLUSION

This proposal is a stereotype urban land use conflict. The land has inherent environmental value and is seen by environmentalists to be sacrosanct. The land also has strategic value as part of a railway station precinct and is seen by urban planners and energy conservationists as being valuable developable land.

The analysis has shown that the greatest environmental value lies in the flora of the site. Three species of Declared Rare Flora, and several other priority species, on the Reserve Flora List, (operated by the Department of Conservation and Land Management) are present on the site.

The development proposal hinges on a balanced approach which is to conserve the important claypan wetland, which contains all three Declared Rare Flora, and to develop the remainder for medium density housing.

The Proponent has undertaken to hand over approximately eight hectares of claypan wetland to the Department of Conservation and Land Management to be created as a reserve. In conjunction with CALM the Proponent is willing to contribute towards fencing the land, rehabilitating the degraded areas, providing stormwater drainage, creating pathways in appropriate places and supplying signage and other relevant educational information to assist ongoing management.

The proposal plans to screen off the conservation area from the developed area by backing single residential lots onto the reserve. Drainage will be provided within the developed area to ensure that no water passes from the developed area to the conservation area. The two areas will operated as two separate drainage systems.

The major impact of the proposal is that vegetation and flora in the developed area will be lost.

This area will need to be cleared and filled with approximately 60 centimetres of sand. Although no definitive study exists it is assumed that the development area contains examples of the Declared Rare Flora *Drosera occidentalis*.

Most developments on land which has not previously been developed incur a loss to the environment. The land in question is in the centre of an urban development corridor and has a high value for human use. This proposal contends that a balanced approach which conserves the most important elements of the environmental resources together with the development of the balance of the site for urban purposes is reasonable and acceptable.

10. LIST OF COMMITMENTS

The following commitments have been made by the Proponent.

10.1 The employment of an ethnographer/archeologist to undertake a detailed survey of the site to the satisfaction of the Aboriginal Sites Department of the W.A. Museum.

10.2 Subdivision and amalgamation of Lots 37 and 47 to create a single lot to cover the proposed conservation area.

10.3 Transfer of ownership of the conservation lot to the Department of Conservation and Land Management.

10.4 Contributing towards fencing the proposed conservation reserve in order to limit access and prevent damage or incursion of machines during the construction phase.

10.5 In conjunction with CALM, to prepare a management plan for the reserve along the lines of the outline provided in Attachment.

10.6 The rehabilitation of the proposed conservation reserve area to return it to a pristine state ie. remove roads, remove car bodies, remove squatter rubbish and remove alien plants growing from rubbish tips.

10.7 To provide access to the site at a yet to be finalised location.

10.8 To assist with signs and other educational information to ensure the public is made aware of the significance of the site.

10.9 To generally assist in establishing the reserve as proposed in the management plan.

10.10 To provide a floodway to remove floodwater from the site in a manner acceptable to the City of Gosnells and the Water Authority of Western Australia and the EPA.

10.11 To control dust during development to the satisfaction of the City of Gosnells.

10.12 To position the buildings, adjacent to the railway line, so as to screen noise to the satisfaction of the EPA.

11. REFERENCES

1. *Australian Groundwater Consultants Pty Ltd, 1989: Hydrological Investigations - Homeswest Site - Brixton Street, Kenwick, Report to the Department of Conservation and Land Management.*

2. *AG Consulting Group Pty Ltd, 1990: Lot 37 Brixton Street, Kenwick - Hydrological Investigations, Report for Hames Sharley Australia.*

3. *Department of Conservation and Environment, 1980:* ***Atlas of Natural Resources - Darling System Western Australia,*** *UWA Press.*

4. *Department of Conservation and Land Management, 1989: Brixton Road Canning Location 10 - Lot 37, Gosnells Shire, Inspection Report by A. Brown and D.J. Coates, unpublished.*

5. *Department of Fisheries and Wildlife, undated/approximately 1984: Brixton Road, Canning Location 10 - Lot 37, Gosnells Shire, Department of Survey by G.J. Keighery and S.D. Hopper, unpublished field report.*

6. *Department of Planning and Urban Development,* ***Development Near Metropolitan Railway Stations*** *Policy No. DC 1.6.*

7. *McDonald, G. and W.S. Cooper, 1988:* ***The Gosnells Story,*** *City of Gosnells.*

8. *Newman, P., 1990: Cities, Transport and Greenhouse - Expectations and Practical Solutions.*

9. *Newman, P., J. Kenworthy and T. Lyons, 1990:* ***Transport Energy Conservation - Policies for Australian Cities,*** *Murdoch University Press.*

10. *Singleton, J., 1989: The History and Tenure of Wetlands, in* ***Wetlands in Crisis - What Can Local Government Do?,*** *Bulletin 372, Environmental Protection Authority, Perth, Western Australia.*

11. *State Planning Commission, 1987:* ***Plannning for the Future of the Perth Metropolitan Region,*** *WA Government Printer.*

12. *Stokes, J., 1987: Innovation in Residential Development - the Joint Venture for More Affordable Housing,* ***Australian Planner,*** *Vol. 25 No. 2.*

Attachment 1.1

GUIDELINES FOR THE PREPARATION OF A CONSULTATIVE ENVIRONMENTAL REVIEW (CER) - PROPOSED URBAN DEVELOPMENT ON LOTS 37 AND 47, BRIXTON STREET KENWICK

The following is a guide to the type of information required for the preparation of a CER to enable environmental assessment of the above proposal to be undertaken.

1. Introduction

The Introduction should be a brief overview of the proposal and should include identification of the Proponent and the rationale behind the development. In this case the suitability of the site for medium density urban development due to its location close to the railway and the demand for this type of development could be discussed. Identification of the site location should also be undertaken at this stage.

A discussion of the relevant statutory processes involved including environmental impact assessment and approvals needed through the planning process is also helpful to the reader of the final document.

2. Public Participation and Consultation

A description should be provided of any public participation and consultation activities which may be undertaken. This should include the methods used, the people involved (such as local authorities and conservation groups), the timetable of the activities and the objectives. A summary of concerns raised by these people should be included along with measures proposed by the Proponent to address them.

3. Benefits of the Proposal

This section provides the Proponent with the opportunity to discuss the rationale for the proposal in more detail including benefits to the community if the proposal were to proceed. A discussion of alternatives to the preferred development option (including no development) should also be undertaken.

4. Description of Existing Environment

This section should include a thorough description of the existing physical and social environment in the area. This should include a description of:

Physical Environment

- *topography;*
- *soil types and their distribution over the site;*
- *indigenous and exotic flora on the site and their conservation value on a local and regional scale;*
- *indigenous and exotic fauna on the site and their conservation value on a local and regional scale;*
- *hydrological information (surface and groundwater); and,*
- *noise levels on the site, particularly with regard to the railway line.*

Associations formed between these facets of the physical environment to form the ecosystem as a whole should also be investigated. For example, this could include such techniques as mapping vegetation against soil types and the hydrological system.

Social Environment

- *historical/anthropological significance of the area; and,*
- *current human use of the site.*

5. Project Description

This section should contain a thorough description of the proposal including facets such as proposed development design, the provision of services and timing of the development. This should also include a brief discussion of potential environmental impacts and their management as an integral facet of the proposal.

6. Environmental Impacts and Management

The environmental impacts section should be a thorough discussion of environmental impacts and proposed techniques for their management. The environmental impacts should be discussed in relation to the construction (physical impact of equipment, etc.) and operation (for example the long term management of remnant bushland) phases of the development. Some potential environmental impacts likely on this site are listed below but it should be stressed that this list is a guide only and is not necessarily comprehensive:

- *hydrological impacts including the impact of development on the existing wetland(s) and stormwater disposal;*
- *impacts on the flora and fauna on the site in terms of individual plant and animal losses and loss of habitat;*
- *noise impacts on future residents of the site, particularly from the railway;*
- *ethnographical/archaeological values; and,*
- *impact of the development on existing adjacent residences.*

After the environmental impacts have been identified, integrated management programs and techniques need to be developed to minimise or negate these. To be effective, the management of impacts should be an integral, well planned part of the project as a whole.

7. Conclusion

This should be a synthesis of the overall environmental impact of the proposal and how it has been addressed to make the project environmentally acceptable.

8. Environmental Commitments

When a potential environmental impact is identified, the Proponent should provide an undertaking (Environmental Commitment) to address this potential impact to prevent its occurrence. A commitment should contain the following information:

- *who will do the work;*
- *what is the nature of the work;*
- *to whose satisfaction will the work be carried out;*

- *when the work will be carried out; and,*
- *if appropriate, where the work will be carried out.*

An example of a list of commitments from a recent EPA assessment report is attached for your information.

9. Diagrams/Plans

Detailed plans of the site should be included showing:

- *existing land uses including vegetation areas and types;*
- *adjacent land uses;*
- *residential development layout; and,*
- *roads and services.*

A copy of the finalised guidelines should be incorporated in the CER.

Attachment 2.1

Homeswest planning upsets local greens

Local environmentalists are up in arms over a Homeswest proposal to build medium-density housing in Brixton Street, Kenwick.

By REECE HOGAN

Environmentalist Joan Payne, who is president of the Waterbird Conservation Group, said the land contained rare flora which the Homeswest proposal would jeopardise.

Mrs Payne said the Homeswest proposal was out of line, as the Environmental Protection Authority was carrying out a consultative environmental review on the land.

"The EPA has recognised the significance of the area by calling for the housing proposal to be assessed, with public comment," Mrs Payne said.

"Homeswest has not waited for this consultative process to occur, but has already approached Gosnells City Council with a preliminary concept plan for the area.

"The fact that Homeswest is pushing ahead with its proposals in this cavalier way, without waiting for the public review period, is unethical and an attempt to preempt the public assessment process laid down under the EPA act."

The council confirmed that Homeswest had met it informally last week.

City planner Kelvin Oliver said a Homeswest representative advised council that it was researching the land with the intent to subdivide and develop.

"Homeswest told us they were working with CALM (Conservation and Land Management Department) and the EPA to find out how much land could be developed," Mr Oliver said.

"The research will be carried out over the next couple of months."

Homeswest planner Richard Elliot said the authority was interested in the land because of a State Planning Commission proposal to build a railway station in the precinct.

Mr Elliot said this was a good opportunity for Homeswest to build medium-density housing in the area.

But he added that Homeswest was fully aware of the flora situation and this was why it was researching the area.

"We're trying to find out what extent of land needs to be protected and we're also waiting on the EPA's consultative environmental review," Mr Elliot said.

He said if Homeswest did get the go-ahead to build there would be a mix of housing, including private sector sales.

Meanwhile, CALM planning manager for the metropolitan area Gordon Graham said there were two declared rare aquatic species associated with the clay bottom wetland which would not be at risk.

Mr Graham said a public meeting would be held on June 13, at a venue yet to be decided.

Attachment 2.2

NOTES TAKEN AT A PUBLIC MEETING AT THE KENWICK COMMUNITY FACILITY ON WEDNESDAY 20 JUNE, 1990 AT 7.30 P.M.

The meeting was attended by approximately 100 people. The audience included Mayor of Gosnells and other Councillors, Alex Errington and Gordon Graham (Conservation and Land Management); Nick Wimbush (Environmental Protection Authority); and, Kelvin Oliver (Gosnells Planner).

It was indicated by Mr Port (President of Local Ratepayers Association) that the majority of attendees were NOT locals but representatives of the environmental lobby.

The meeting was addressed by Rory O'Brien (Chairman/Hames Sharley); Richard Elliot (Homeswest); and, Paul Holmes (A.G. Consultants). Discussion time following addresses was conducted in a civil manner and extended for around 1 hours.

The matters raised, in order presented, were as follows:

1. *P.O.S. - with medium density housing there will be a high demand on P.O.S. and on any conservation reserve.*

2. *Timing - how long before development commences (2-3 years)?*

3. *Proposal is environmental vandalism - destroying a wetland - 80 percent of Perth's wetlands already lost.*

4. *Density Coding - what is Homeswest seeking (average R30)?*

5. *Development Costs - contends high and development not visible.*

6. *Management of the Conservation Area - housing near wetland will create pressure - how arrange to ensure no weed, pet infestation?*

7. *Access to schools - difficult - area out of way.*

8. *Pressure on wildlife.*

9. *Economic driven - Homeswest principally trying to make a profit out of the land (Homeswest strives to achieve a balance between economic/people objectives).*

10. *Darling Range Group - wetland preservation essential.*

11. *Area proposed for conservation - too small, not self sustaining, not viable unit - unique site - Bob Dickson.*

12. *Wildflower Society - objects to proposal for a variety of reasons - unsuited to urban development, unique site given that other claypans are already drained and filled, high number of species - at least four (4) vegetation types which also merge into each other, species diversity is rich (equivalent to Kings Park - 350). Many species not commonly found, three (3) rare species, seven (7) other significant species, many species representative of other areas, eg. Hills. Not possible to protect within the small area proposed.*

13. *Scruffy area - not properly managed at present. How will flowers be protected as urban pressures mount?*

14. *Homeswest land becomes more important for protection given proposal to develop land to the north.*

15. *Why is there a need to develop the land when lots in adjoining subdivision are not selling? (Market conditions).*

16. *No school facilities - pointless to house people in such an obscure location.*

17. *Mayor of Gosnells asked to comment - too early for Council consideration. Council will consider following the environmental investigations.*

18. *Fauna - apparent sitings of bandicoots, echidnas.*

19. *Loss of Wetlands - 1 percent of original wetlands of the areas left. This land should not be lost to development.*

20. *Density development - bring increased level of crime.*

21. *Population increases were causing land which should not be developed, to be opened up. Australia should halt immigration.*

22. *Lot sizes - concern over small lots and density of development.*

23. *Unique site - not two but four endangered species and other diversity of flora.*

24. *Government needs a stronger decentralisation policy to avoid use of land such as this.*

25. *Development of the land was environmental ignorance.*

26. *Alex Errington (Conservation and Land Management) put CALM's attitude re: retention of whole site and preference for a land exchange.*

27. *Need to consider transporting of plants eg. Purdies donkey orchid.*

28. *Purdies donkey orchid - question mark over success of transplanting.*

29. *Management of conservation area - density housing near conservation area would bring pressures - pets, fertiliser, weeds, etc., - could not be controlled hence development should not be allowed.*

30. *Development should be allowed - pressure will come from other developments unrealistic not to pursue balance between housing and conservation.*

31. *Alton Street Resident - half people at meeting he had never seen before, many locals in favour of development.*

32. *Woodlupine Creek - what impact had the deepening of the drain (PH - claypans rainfall fed).*

33. *Scruffy site - a dump - one man's flowers is another man's weeds - develop site.*

R.R. Elliot
Planner - Urban Development

20 June, 1990

Attachment 2.3

WESTERN AUSTRALIAN
Wildflower Society (Inc.)

31 May 1990.

The Minister for the Environment, Leader of the House in the Legislative Assembly,
18 Floor, Allendale Square,
77 St George's Terrace,
PERTH. W.A. 6000.

Dear Minister,

RE: BRIXTON STREET WETLANDS (LOTS 37 AND 47 BRIXTON STREET, KENWICK).

The Western Australian Wildflower Society, (Inc.), has been concerned, for some time, for the future of the Brixton Street Wetlands. The Society has written to the Environmental Protection Authority (16 November, 1989) and the Minister for the Environment (10 May 1990) about these Wetlands. A copy of the first letter may have been sent to you. The second letter briefly outlines the conservation value of the Wetlands to support a request that the assessment level, determined by the Environmental Protection Authority, be raised.

The Wildflower Society would like this whole area to be made a conservation reserve as it is:

1. URBAN BUSHLAND:
A vital part of our country's heritage is the bush. Urban bushland is becoming more rare every year. Most adults in Western Australia who grew up in W.A. fondly remember the bush down the corner. This may not be an experience their children will share. Any remaining bushland needs to be conserved for future generations to experience the wonder of life in the bush.

2. A UNIQUE COMPLEX OF VEGETATION TYPES:
Our governments "Environmental Charter" gave a commitment to preserving a diversity of vegetation types. The complex of soils and degree of water logging in this small area have resulted in at least four vegetation types; Marri (Eucalyptus calophylla), Woodland, Viminaria Heath, Astartea Heath and a Claypan Community. The last two of

these vegetation types are rare and the combination of types is very unusual. The Claypan Community is a unique vegetation type found only on the Swan Coastal Plain. In all other known possible locations for this vegetation type drainage or flooding and clearing have occurred. This vegetation type needs to be protected from such degradation.

The development proposal has indicated that the majority of this vegetation type will be conserved, development occurring in the remainder of the area. Such a proposal is like the current preservation of the Barracks Arch. The Claypan Community is one part of a complex landscape. Preservation of such a small area will increase the edge effect (consequently the invasion of weeds and disease), rubbish dumping, fertilizer drift, drainage and/or flooding. Our position is that the area is already very small and the total area needs to be conserved.

3. SPECIES DIVERSITY:

This small area contains over 300 species of plants, a number comparable with those species in Kings Park, a much larger area.

This diverse assemblage of species contains:

(a) Three species of Declared Rare Flora:

Aponogeton hexatepalus	(Claypan Community)
Drosera occidentalis	(Viminaria Heath)
Hydrocotyle lemnoides	(Claypan Community)

(b) Priority Species from the Reserve Flora List (species being considered for declaration:)

Priority 1.

Hydatella dioica	(Claypan Community)
Schoenus andrewsii	(Viminaria Heath)
Stylidiun utricularioides	(Viminaria Heath)

Priority 3.

Arthotium junceum	(Claypan Community)
Philydella drummondii	(Viminaria Heath)
Thysanotus arbuscula	(Interface Marri Woodland and Viminaria Heath)
Villarsia submersa	(Claypan Community)

All of these species are dependant on the influx of water each winter for their survival and come from all vegetation types.

(c) Species at the northern or southern ends of their range.

(d) Species of scientific interest. Thbridizing Kangaroo Paws (Anigozanthus manglesii and A.vindis) and Flannel Flowers (Tribononthes) are found in the area.

(e) Species yet to be described that should be placed on the Priority List, a Trichocline, a Wurmbea, and Erodium and a Tribonanthes.

The Society is deeply concerned about all bush in our urban environment, but as you no doubt now understand, we are especially concerned about the future of this unique piece of bush. We look forward to the declaration of the whole area as an A-Class Reserve vested in the appropriate Government Authority.

Yours sincerely,

B. Dewar

for Mary Gray,
For the Western Australian Wildflower Society,(Inc.)

Copy to:

The Premier, Ministry of the Premier and Cabinet, 197 St George's Terrace, Perth, 6000. W.A.

The Chairman, Environmental Protection Authority, 1 Mount Street, Perth. 6000. W.A.

The Executive Officer, Homeswest, 99 Plain Street, East Perth.

The Shire Clerk, City of Gosnells, 2120 Albany Highway, Gosnells, 6110.

The Senior Consultant, Hames Sharley Australia, 300 Rokeby Road, Subiaco, 6008.

Attachment 5.1

BRIXTON ROAD

CANNING LOCATION 10 - LOT 37, GOSNELLS, SHIRE

Report of Survey

G.J. Keighery and S.D. Hopper

MAJOR POINTS

Brixton Road site has several floral and biological features which make it one of the most outstanding sites for reservation on the Swan Coastal Plain.

1. Presence of rare flora, including Aponogeton hexatepalus and Hydrocotyle lemnoides.

2. Area of phytogeographical significance, containing several species at the northern extremities of their known ranges and species normally not present on the coastal plain but able to survive on heavy soils of this site.

3. Site of special scientific interest, containing hybridizing populations of Tribonanthes (flannel flowers) and Anigozanthos (Kangaroo Paws).

4. The claypans themselves are a rare habitat in the Metropolitan region.

5. The area could be a possible re-establishment site for the Short-necked Tortoise.

Description of the Site

The region consists of a series of interconnected claypans, dominated by Melaleuca laterita, which are inundated during winter and spring. These claypans are surrounded by higher ground, with sandy clay or lateritic soil carrying Viminaria juncea scrub, and a small sandy rise dominated by Eucalyptus calophylla (Marri).

The 170 species currently recorded from the area, are listed under these regions in the Appendix I. Further collecting, especially during spring and summer should greatly increase this listing, especially as the nearby Yule Brook Reserve which has been collected on since 1949 has a species list of over 370 (Speck and Baird, 1984). However, the lists are already significantly different despite the proximity of the areas.

Rare Flora

The claypans of Brixton Road, contain two species of gazetted rare flora, namely Aponogeton hexatepalus and Hydrocotyle lemnoides. Both are present in substantial numbers in this region. The Aponogeton population is the

largest known, and the species is currently not recorded from any nature reserve.

Phytogeographical Significance

Several orchid species (Caladenia ferruginea, Caladenia longicauda ssp. nov. and Thelymitra villosa) occuring here, are at the northern limits of their known ranges.

Because of the high water table and clayey soils the area supports many species normally associated with the lateritic or granitic soils of the northern jarrah forest and Darling Scarp. These species include: Lomandra micrantha, Anigozanthos bicolor (photo 6), Hakea erinacea, Grevillea bipinnatifida, Stirlingia tenuifolia and Synaphea acutiloba (photo 8).

Site of Special Scientific Interest

Apart from the scientific value of preserving rare flora, a rare habitat and outlying populations the site contains co-occurring populations of several related species which are of considerable genetic and taxonomic importance.

Several species of closely related spider orchids are found here (Caladenia ferruginea, Caladenia longicauda and Caladenia pectinata), and the sole known co-occurrence of the Star of Bethlehem Lilies (Calectasia cyanea and Calestasia grandiflora) (photo 9). These populations are of considerable significance in assessing taxonomic status of these plants.

Secondly, several well known species have hybridising populations at Brixton Road Tribonanthes australis x Tribonanthes brachypetala (photo 10); Tribonanthes australis x Tribonanthes variabilis; Anigozanthos bicolor x Anigozanthos manglesi : Anigozanthos manglesii x Anigozanthos viridis). The Tribonanthes hybrids are unique to Brixton Road, and have not been studied in detail, they are of considerable value for evolutionary studies in the genus, and should be preserved.

Rare Habitat

Melaleuca laterita swamps and claypans were once common on the poorly drained flatlands of the northern Swan Coastal Plain, edging the Darling Scarp. Most of this habitat type is now cleared. One of the few surviving sites is J.R. and B. Martyn Reserve, north of Midland.

Brixton Road is essentially similar to this reserve, in containing claypans which support a diverse annual herbfield. However, it is more extensive and is bordered by Viminaria scrub and Marri woodland. Hence, Brixton Road has a different flora.

Several species (currently not gazetted as rare) occuring in the claypans at Brixton Road deserve special note.

Schoenus capillifolius: only recorded from Brixton Road, and J.R. and B. Martyn Reserve (photo 11).

Eleeocharis sp. (GK 5180): only known from Brixton Road (photo 12)

Eryngium sp. I: Presently only known from Brixton Road. Previously only known from a collection made at Midland in 1905, and presumed extinct (photo 13).

Eryngium sp. II: previously only known from a degraded railroad reserve north of Serpentine. Its co-occurrence with Eryngium sp. I is of considerable interest.

It is unlikely that any of these species will be able to survive elsewhere on the Swan Coastal Plain, because of the clearing of their restricted habitat.

References

Speck, N.H. and Baird, A.M. (1984) "Vegetation of Yule Brook Reserve near Perth, Western Australia." Journ. Roy. Soc. West. Aust.66: 147-162.

APPENDIX I - SPECIES LIST, LOT 37

A. Marri Woodland

Neurachne alopecuroides
*Briza minor
*Briza maxima
*Aira cupiana
*Eharhta calycina
Stipa trichophylla
Lepidosperma tenue
Mesomaelaena tetragona
Schoenus grandiflorus
Schoenus benthamianus
Tetraria octandra
Loxocarya fasiculata
Burchardia umbellata
Burchardia multiflora
Laxmannia sessiliflora
Laxmania squarrosa
Lomandra caespitosa
Haemodorum laxum
Haemodorum spicatum
Anigozanthos manglesii
Patersonia occidentalis
*Romulea rosea
Xanthorrhoea preissii
Caladenia longicauda
Caladenia pectinata
Caladenia deformis
Diuris longifolia (early flowering race, otherwise only on Darling Plateau)
Thelymitra crinita
Lyperanthus serratus
Dryandra nivea
Hakea prostrata (erect form)
Nuytsia floribunda
Daviesia incrassata

Dillwynia af cinerascens
Gompholobium aristatum
Gompholobium marginatum
Acacia pulchella
Acacia saligna
Kennedia prostrata
Ptilotus drummondii
Ptilotus manglesii
*Silene gallica
Hibbertia hypericoides
Hypocalymma robustum
Eucalyptus calophylla
Tripterococcus brunonis
Dampiera linearis
Scaevola sp.
Goodenia caerulea
Helipterum cotula
*Hypochaeris radiata
Senecio minimus
*Sonchus oleraceus

B. Edges Woodland/Swamp

Cyathochaeta avenacea
Schoenus bifidus
Phylydrella pygmaea
Lomandra micrantha (normally on Darling Plateau)
Lomandra odora
Kingia australis
Anigozanthos bicolor
Anigozanthos bicolor x A. manglesii
Anigozanthos viridis
Anigozanthos viridis x A. manglesii
Haemodorum simplex
Haemodorum sparsiflorum
Tribonanthes australis
Tribonanthes brachypetala (normally Darling Scarp)
Tribonanthes brachypetala x australis
Conostylis setigera

Patersonia humilis
Caladenia ferruginea
Caladenia huegelii
Caladenia longicauda ssp. nova
Thelymitra villosa
Thelymitraz flexuosa
Drosera gigantea
Drosera glanduligera
Drosera erythrorhiza
Homalosciadium homalocarpum

Note: this area also contains a population of an undescribed genus of Moss (family; Amblystegiaceae), normally confined to the Darling Scarp.

C. Viminaria Scrub

Schoenus sp (GK 5185)
Leptocarpus canus
Leptocarpus co-angustatus
Acanthocarpus preissii
Agrostocrinum scabrum (north Jarrah forrest, and scarp form)
Borya aff. nitida
Calectasia cyanea
Calectasia grandiflora
Chaemascilla corymbosa
Thysanotus patersonii
Thysanotus asper
Diuris laxiflora
Conospermum huegelii
Grevillea bipinnatifida
Hakea erinacea (Darling plateau species)
Hakea lissocarpha
Hakea candolleana
Hakea ?gilbertii
Hakea trifurcata
Hakea undulata
Hakea varia

Isopogon asper
Isopogon roseus
Petrophile longifolia
Petrophile divaricata
Synaphea sp
Synaphea acutiloba (Scarp species)
Stirlingia tenuifolia
Acacia lasiocarpa
Eutaxia sp
Kunzea recurva
Pericalymma elliptica
Calytrix aurea
Verticordia densiflora
Verticordia huegelii
Pimelea imbricata var gracillimum
Stylidium brunonianum
Stylidium calcaratum
Stylidium cannaliculatum
Goodenia filiformis
Trichocline sp

D. Melaleuca swamp

Agrostis aemulu
Amphipogon amphipogonoides
Lepilaena australis
Aponogeton hexatepalus
Amarthria gracilis
Eleocharis acuta
Eleocharis sp (GK 5180)
Baumea sp (GK 5178)
Chorizandra enodis
Isolepis marginatus
Schoenus capillifolius
Centrolepis inconspicua
Centrolepis glabra
Centrolepis hummillima
Centrolepis polygyna
Brizula muelleri

Brizula drummondii
Aphelia cyperoides
Hydatella dioicia
Trithuria bibracteata
Trithuria submersa
Juncus bufonis
Juncus holoschoenus
Wurmbaea dioica ssp alba (swamp form)
Tribonanthes variabilis
T. variabilis x T. australis
Crassula natans
Cassytha glabella
Pimelea imbricata var gracillima
Astartea ef. fasicularis
Myriophyllum propinquum
Hydrocotyle diantha
Hydrocotyle lemnoides
Eryngium sp I
Eryngium sp II
Polypomphylx multifida
Polypomphylx tenella
Ultricularia hookeri
Anthotium humile var junciforme
Isotoma pusilla
Isoetopsis graminifolia

E. Tracks:

* Agropyron disticha
*Eragrostis japonica
-Eragrostis curvula
*Lagurus ovatus
*Watsonia sp
*Oxalis pres-capae
*Oxalis polyphylla
*Oxalis purpurea
*Conyza canadensis

TOTALS: 170 (17 introduced)

Attachment 5.2

BRIXTON ROAD

CANNING LOCATION 10 - LOT 37, GOSNELLS SHIRE

INSPECTION REPORT 20.6.89

A. BROWN AND D.J. COATES

Much of the site has been recently burnt during early Autumn this year. Wetter sedge dominated clay flats on the north western side (adjacent to the railway) remain unburnt. These contain most of the known habitat for Declared Rare Flora Aponogeton hexatapalus and Hydrocotyle lemnoides. However, where these species have been burnt A. hexatapalus is growing vigorously from underground root stock and in full flower. H. lemnoides has germinated from seed and is also growing well forming, in some instances, a dense covering over the claypan floor.

The site is not very wet at this stage with very little surface water present.

The whole area is regenerating well with many annuals and herbs showing active growth. Some of these are now flowering such as various Drosera species, Eriochilus "helonomos" ined., Tribonanthes australis and Burchardia umbellata. Woody shrubs such as Dryandra nivea are actively resprouting from lignotubers and rhizomes. Kingia australis is in bud and Xanthorrhea preissii resprouting.

Increased rubbish dumping was noted in parts of the site indicating a definite need to close access tracks at the southern and eastern boundaries.

The biological significance and conservation value of the area has not changed from the original survey carried out

in 1984 (see attached). It still remains one of the most significant conservation sites in the metropolitan area and there is no doubt the area could be managed as both a conservation reserve and educational facility.

Attachment 5.3

SUMMARISED DATA FROM PRINTOUT OF MAMMALS AND REPTILES FROM THE WESTERN AUSTRALIAN MUSEUM FOR THE KENWICK AREA

	MAMMALS	*DATE*
1.	*Southern Brown Bandicoot (Isoodon Obesulus)*	*1936*
2.	*Gould's Wattled Bat (Chalinolobus Gouldii)*	*1966*
	REPTILES	
1.	*Notechis Scutatus Occidentalis*	-
2.	*Pseudechis Australis*	-
3.	*Pseudonaja Affinis Affinis*	-
4.	*Vermicella Bimaculata*	-
5.	*Vermicella Semifasciata*	-
6.	*Underwoodisaurus Milii*	-
7.	*Lialis Burtonis (2 sightings)*	-
8.	*Leiolopisma Trilineatum (4 sightings)*	*1962*
9.	*Ramphotyphlops Australis (2 sightings)*	*1960/1963*

Attachment 5.4

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

2284/1

NOVEMBER 1989

HYDROLOGICAL INVESTIGATIONS
HOMESWEST SITE BRIXTON STREET
KENWICK

INDEX

APPENDICES

1 INTRODUCTION

Homeswest proposes to develop a site in Brixton Street, Kenwick for residential purposes. The site includes wetland areas which contain rare and endangered species of vegetation. The development concept proposed by Homeswest provides for retention of the wetland areas, although there is still concern about maintaining the hydrological integrity of the wetlands following development. To assist decision-making on the development proposal, the Department of Conservation and Land Management (CALM) has requested Australian Groundwater Consultants Pty Limited to conduct a brief hydrological examination of the Homeswest site and surrounding area. The study brief is included as Appendix I.

Site inspection was undertaken to map drainage and inspect water bores. A discussion was also held with the engineering consultant Wood and Grieve which has undertaken some recent development related work in the area. Reference was also made to the following reports provided by CALM. These reports relate to the development of land adjacent to the Homeswest site.

> Feilman Planning Consultants (September 1989) 'Proposed Subdivision Lot 48 and Pt Lot 35 Brixton Street, Kenwick. Planning Report for St Josephs Properties Pty Ltd and Dudley and Dwyer Limited'.
>
> Wood and Grieve Engineers (September 1989) 'Servicing Lots 48 and Pt Lot 35 Brixton Street, Kenwick, for St Josephs Properties Pty Ltd and Dudley and Dwyer Ltd'.

2 SITE INVESTIGATION

2.1 Location

The total Homeswest site includes Lot 37, Lot 47, Pt 34 and Pt 36, zoned Urban in the Metropolitan Region Scheme, and Residential A under Council's Scheme. Lots 37 and 47 have a 350 m frontage to Brixton Road, as indicated on the accompanying plans. The Midland-Fremantle railway forms the north-western boundary of the project site, while the Midland-Armadale railway and unimproved Staplehurst Street form its south-western boundary.

The approximate area of the total site is 24 hectares.

The wetland areas containing the rare and endangered vegetation are entirely within Lot 37, although their localised catchment extends into the adjoining Lot 47. Lot 37 comprises 19 ha of the total site area.

2.2 Soils

Within the Homeswest site, the substrate is a thin veneer of silty to clayey sand (between 0.01 m to 0.4 m thickness) overlying Guildford Formation clay and sandy clay. Soils of the Guildford Formation occur to a depth of about 12 m below ground level. The Guildford Formation in turn overlies Osborne Formation sands and silts. Logs of two auger holes dug on Lot 37 are presented in Appendix II of this report.

Occasional lenses (or possibly layers) of clayey sand and sand are present within the Guildford Formation, intersection occurring at depths between 7 and 12 m below ground level in sewerage line trenches on the adjacent Lot 46 and some nearby water bores.

Soils of the Guildford Formation also underlie much of Lots 106, Pt 35 and Pt 48 to the north of the Homeswest site.

2.3 Groundwater Levels

A site inspection was conducted on 7 November 1989 during dry weather. Unfortunately water bores could not be inspected as landholders were absent. However, some indication of groundwater level may be determined from Water Authority records, auger holes, and inspection of drains.

Groundwater static water levels are about 1.3 m below ground level under the Homeswest site, deepening to approximately 1.5 m in and adjacent to the deeper drains.

To the northwest, in Lots 106, Pt 35 and 48 (between Bickley Road and Brixton Street), groundwater levels are a little more shallow. From inspection of drains, groundwater levels vary from 1.1 m to 0.9 m below ground level, with water table swamps occurring in Lots 106, Pt 35 and Kenwick Swamp near Boundary Road.

3 DISCUSSION

The brief provided poses a number of specific questions and these are addressed hereunder.

What are the drainage patterns, into, and out of the whole area?

Drainage patterns have been identified at the regional scale (Figure 1).

The site is part of low lying flat land between Yule and Bickley Brooks. Water table swamps, and depressions seasonally filled with water are evident.

Drainage is westward as illustrated on Figure 1, towards Yule Brook, a Water Authority drain and stream collecting runoff from an extensive foothills catchment. Runoff from the foothills between Yule and Bickley Brooks (Figure 1) is probably redirected south or north by Tonkin Highway and other roads.

Surface runoff from the eastern part of the catchment is towards Kenwick Swamp (Figure 2), the low ground between Brixton Street and Bickley Road, and Lot 37. As it moves west and southwest, runoff is intercepted by a drain (clogged with vegetation and debris) on the north-eastern side of the levee formed by Brixton Street (Figure 2). This drain directs runoff towards Yule Brook.

A clogged, shallow drain dug sub parallel to Brixton Street, between Wanaping and Kenwick Roads, may allow flow also towards Yule Brook.

Whilst most runoff is directed by the Brixton Street levee to Yule Brook, a culvert under Brixton Street may allow some runoff into a very shallow clogged drain along side Alton Street. Thus, **some** runoff from the land to the north east of Lot 37 may find its way into Lot 37, via this culvert.

Surface runoff from Wanaping Road and Brixton Street is intercepted by a deep drain on the south-east boundary of Lot 37 (Figure 2). This drain also intercepts surface runoff from Lot 37, and discharges via culverts into the Binley Brook Branch Drain, and thence into Yule Brook to the south of Albany Highway (see Figure 2). Surface runoff within Lot 37 is via an ill defined intermittent 'stream' with associated depressions (ie the wetland areas of interest).

An approximate catchment and drainage area is sketched on Figure 1 at 1:50 000 scale with the more detailed drain and stream pattern on Figure 2 (1:5 000 scale). Lots 37 and those lots between Bickley Road and Brixton Street (Lots 106, Pt 35, Pt 48, Pt 243) have a catchment area of approximately 2.5 km^2. The catchment area for Lot 37 appears to be largely internal, due to the presence of the Brixton Street levee. Just how much 'outside' water finds its way into Lot 37 via the culvert under Brixton Street is unknown, although the size and elevation of the culvert pipe suggest that such contribution is not large.

What are the sources of water to the damp flats and the seasonal wetland; especially, is groundwater involved?

Kenwick Swamp, situated adjacent to Bickley and Boundary Roads, is a water table swamp. Swampy ground in Lots 106 and Pt 35 between Bickley Road and Brixton Street contains bullrushes (Typha) and may also be a water table swamp.

The damp flats and depressions within Lot 37 do not intersect the water table. They either lie within pre-existing natural drainage (Figure 2) or in natural hollows over a clayey substrate. The wetlands receive water via surface runoff from the northern portions of Lots 37 and 47, and possibly from the culvert under Brixton Street. Exactly if and how water from the culvert under Brixton Street drains to the depressions is unclear as the land is very flat.

Refer to Figure 2 for the approximate catchment area of these wetlands.

What changes to water levels, drainage patterns, or water quality, might result from -

i) development on parts of the 19 ha block itself?

ii) proposed developments to the north east and north west of the block?

The development concept proposed by Homeswest is illustrated on Figure 3, which also shows present drains. It is evident that there will be a change to local surface runoff patterns within Lot 37 in the event of development as proposed by Homeswest.

As previously indicated, the wetlands within the Homeswest site are sustained by surface runoff from the northern portions of Lots 37 and 47. Under the development concept proposed by Homeswest, about 15% of the catchment area of the wetlands within Lot 37 would be developed. This is a very approximate figure only, as the actual extent of the catchment is difficult to determine because of the flatness of the site. Clearly, this would result in some reduction of water input to the wetlands. However, without undertaking a full water balance for the wetlands, quantification of this reduction is not possible. Nevertheless, because of the characteristics of the catchment, the amount of water being lost to the wetlands would be less than the actual proportion of the catchment to be removed through development.

Water quality changes may occur, although such changes cannot be quantified at this stage. Typically, however, there would be some deterioration in the quality of runoff water from Lot 37 following development, potential pollutants including petroleum products from vehicles, detergents, herbicides and pesticides used by residents. It is assumed that the proposed development would be sewered, thereby obviating sewage as a source of potential pollutants.

It is expected that groundwater levels will be little affected by development in Lot 37 alone. Historically, drainage construction in this area has not significantly altered groundwater levels. Accordingly, the establishment of drains within and at the perimeter of the site should have minimal impact on groundwater levels, although the magnitude of any changes cannot be quantified at this stage.

Proposals for adjoining lands include development of a low lying wetland area. This area will need to be filled to approximately RL 6.5 AHD, with a drain constructed along the boundary between Pt Lot 35 and Lot 106 (Figure 3). This drain would discharge to the drain on the north-east side of Brixton Street and thence to Yule Brook. Under these arrangements, there appears little need to lower groundwater levels in this area.

Development proposals for the adjoining area also include a scheme whereby drainage from the Brentwood-Bickley Road area would be routed along the south-east boundary of Lot 37 (Alton Street), and thence to the Binley Brook Branch Drain. Such a scheme would require extension of the present drain along Alton Road. There would be no impact from this drain on runoff within Lot 37, as it is merely carrying water from elsewhere and unless topographic gradients within the south-eastern part of Lot 37 were modified, would not be collecting drainage from Lot 37. However, the scheme includes a compensation basin in the south-western extremity of the site (see Figure 3) in an area that Homeswest proposes for open space. This and other basins are intended as compensating areas for runoff from more intense storm events (ie greater than 5 year recurrence intervals).

It is concluded that runoff and site drainage from adjacent development will have little impact on Lot 37. Provided drains and compensation basins conducting runoff from the Brentwood-Bickley Road area are properly designed and constructed, the drain along Alton Street should not overtop, thereby threatening the wetlands or development within the Homeswest site.

Any possible lowering of groundwater levels in surrounding areas (for example by dewatering or pumping), even if affecting groundwater levels under Lot 37, will have no effect on the surface fed depressions. Deep rooted trees may be affected, although most would be removed as a direct consequence of the proposed development.

Although detailed design work has not been completed, indications are that approximately 30% of the catchment area of the wetlands within the Homeswest site will be required to accommodate embankments associated with the bridging of Brixton Street over the railway line and Roe Highway. The potential loss of water to the wetlands as a result of embankment construction would be of far greater significance than that associated with residential development proposed by Homeswest. Obviously, a full water balance would be needed to determine what the effects of embankment construction would be.

Is it feasible to minimise or eliminate the hydrological impacts affecting the portions of the site containing the rare plant species which could result from residential development over the balance of the site and nearby land?

What options are there for controlling the hydrology of the land containing the rare plant species so as to minimise or eliminate the impact of nearby residential development upon that land?

As indicated, the wetlands within the Homeswest site are localised surface water features. Any threat to the hydrological integrity of the wetlands will, therefore, arise from development within the Homeswest site rather than beyond the site.

Under the development concept proposed by Homeswest, some of the wetlands' catchment area would be lost and there would obviously be a consequent reduction (albeit small) in water input to the wetlands.

To determine the actual volume of make up water that would be needed to compensate for the loss of catchment area, a full water balance would need to be undertaken. However, it is clear that surface runoff from the proposed development would considerably exceed the volume of water currently reaching the wetlands from that part of the catchment affected by the development proposal. The opportunity to supplement the wetlands with runoff water from the development therefore exists.

If this option was to be pursued, however, only non-polluted roof water (as distinct from general surface drainage) should be used. Roof water should be sufficient to compensate for the lost area of catchment and would not carry the range of pollutants contained in normal surface runoff from residential lands. However, it is again stressed that the volume of make up water actually needed would have to be clearly established. Also, a drainage system that would deliver this quantity of roof water, while directing excess roof water and general surface drainage elsewhere, would need to be designed and installed as part of the development. This is essential because of the sensitivity of the rare and endangered species to water level changes and the consequent need to maintain the present water regime in the wetland areas.

Other sources of make up water could also be used, although the roof water would inevitably be a less potentially polluting supply.

Another alternative for addressing the hydrological impacts from the proposed development would be to modify the actual development concept so as to maintain the wetlands' current catchment area. This would probably be the simplest way of maintaining the hydrological integrity of the wetlands. Additionally, redesign of the development concept would be desirable from the point of view of establishing a more substantial physical buffer between the wetlands and the residential area. It is necessary to acknowledge, however, that the redesign envisaged here would inevitably reduce the area available for development.

The greatest potential threat to the wetlands is from alteration of their catchment associated with the bridging of Brixton Street over the railway line and Roe Highway. This work is understood to be totally independent of the Homeswest development proposals, being required to maintain Brixton Street as an important through route following construction of Roe Highway. While it may be possible to lessen the impact of the bridgeworks on the wetlands' catchment through redesign (eg by eliminating the embankments and extending the actual bridge) costs would be considerably (perhaps prohibitively) higher.

The provision of make up water would be the only other option for addressing the effects of the bridge works on the wetlands within the Homeswest site.

Again, the actual amount of make up water required would need to be established from a full water balance. Roof water from the Homeswest development may yield sufficient make up water. If not, other sources would be available, but would be of lesser quality. Appropriate drainage systems would also be needed to ensure satisfactory distribution of the make up water within the catchment, and that any excess water would be directed elsewhere.

4 CONCLUSIONS

Based on the investigations undertaken, the conclusions reached are as follows -

- The wetland areas within the Homeswest site are purely surface water features fed mostly by a limited catchment within the total Homeswest site, and possibly some contribution from the north-east via the culvert under Brixton Street.

- Present indications are that drainage schemes associated with broader development proposals in this area should not affect the hydrology of the wetlands within the Homeswest site. To achieve this objective, the drainage systems installed as part of the broader development proposals would need to avoid dewatering the Homeswest site or discharging water onto the site.

- The development concept for the Homeswest site would remove approximately 15% of the wetlands' catchment area and, therefore, would reduce the amount of water entering the wetlands, although a full water balance would be needed to determine the proportional reduction.

- Maintaining the current water regime in the wetlands is essential because of the sensitivity of the rare and endangered vegetation to water level changes.

- Make up water will, therefore, need to be directed to the wetlands, although the specific volume of such water cannot be determined without undertaking a full water balance.

- While various sources of make up water could be used, roof water from development within the Homeswest site would be the most appropriate supply because of its low pollution potential.

- The drainage system installed as part of development at the Homeswest site would need to ensure that only the required portion of roof water was directed to the wetlands, and that excess roof water and general surface drainage was directed elsewhere.

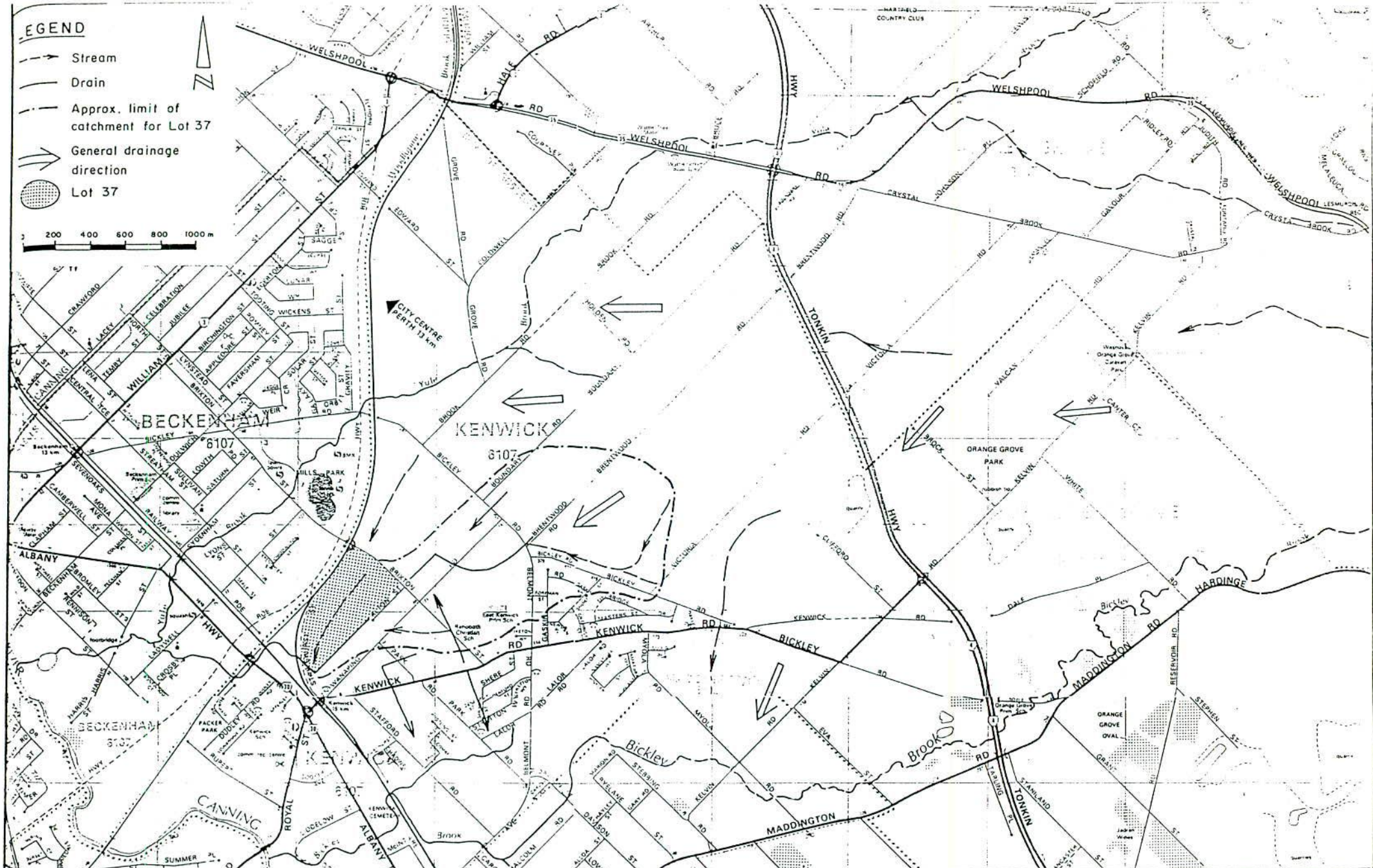
- As an alternative to manipulating drainage within the development to compensate for the loss of catchment area, the design concept could be modified to simply retain the current catchment area in its entirety.

- The greatest threat to the hydrological integrity of the wetlands within the Homeswest site is posed by proposed bridge works on Brixton Street which would lead to the loss of approximately 30% of their catchment area.

- While this threat could be lessened through redesign of the bridge works, provision of make up water to compensate for the loss of catchment appears the most realistic amelioration option.

- The volume of make up water required would need to be established from a full water balance and the sources selected accordingly (again, roof water would be the preferred source).

- Particular requirements relating to the delivery of make up water to the catchment area would need to be established, and a drainage system capable of satisfying these requirements designed and installed.



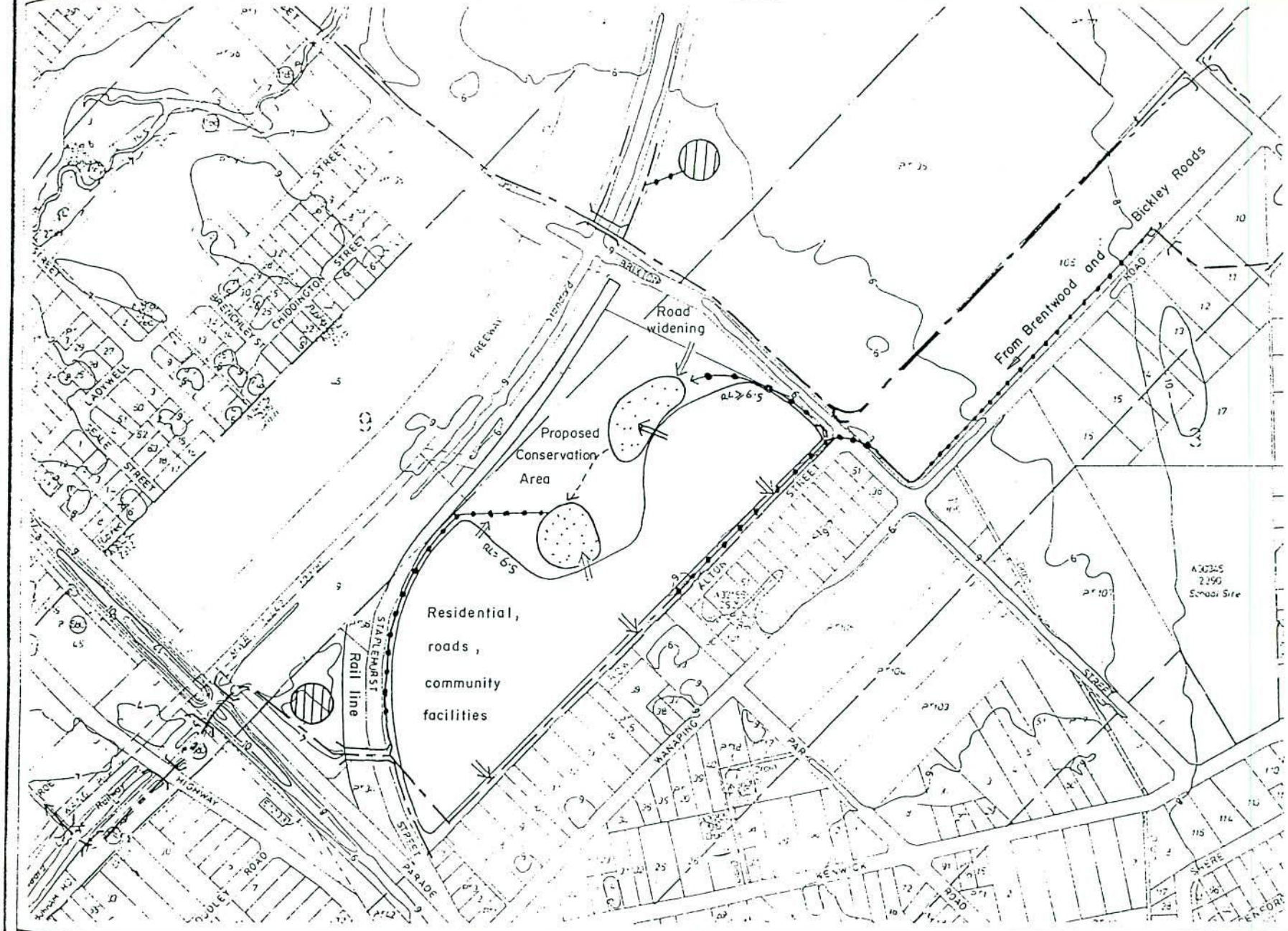
REV.	DESCRIPTION	DRAWN DATE	CHECKED DATE

IR VISION

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

CATCHMENT AND DRAINAGE LOT 37, BRIXTON STREET

DATE November, 1989 | DWG 2284 - 1 | FIGURE 1



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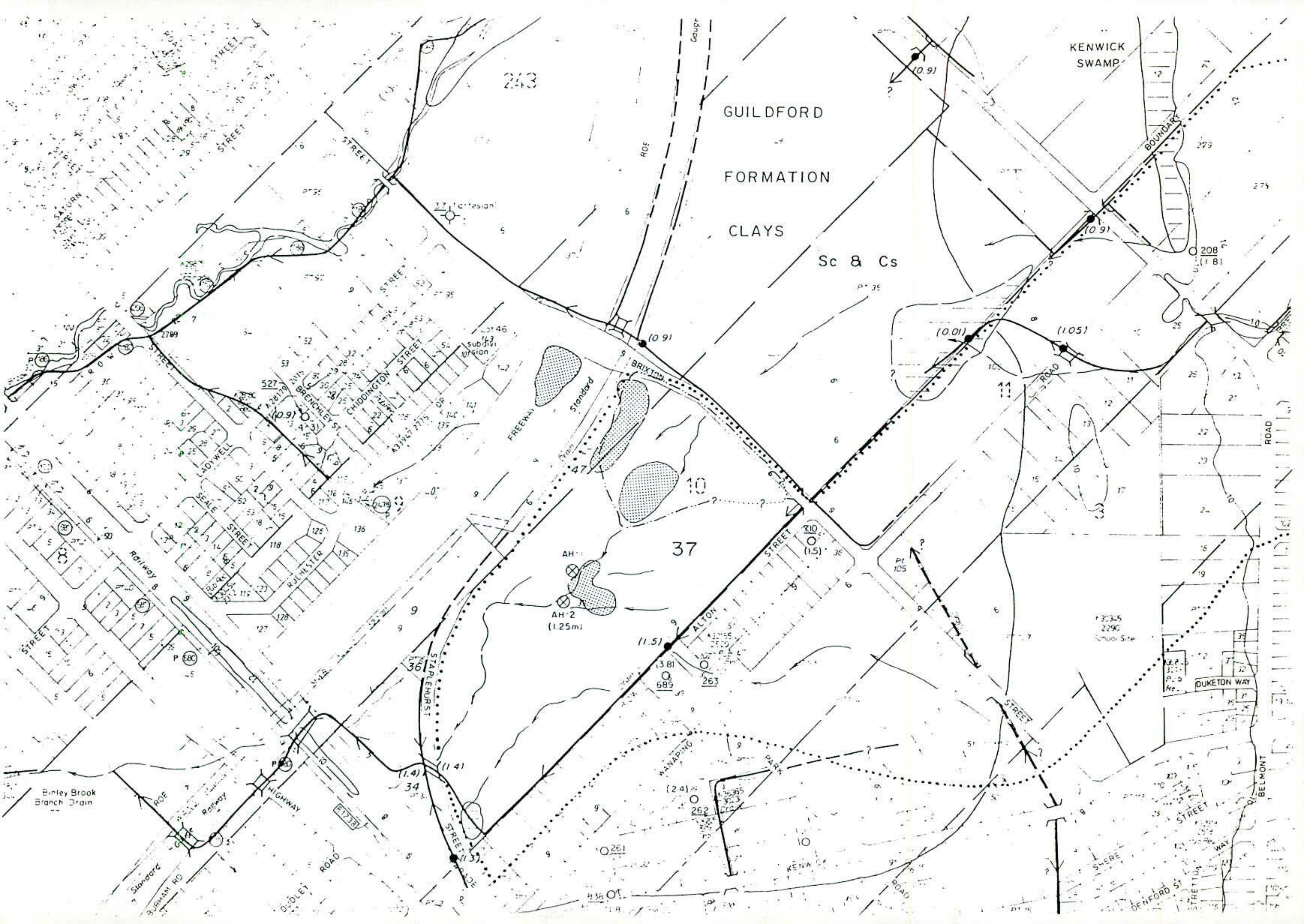
	DESCRIPTION	Drawn Date	Chk'd Date	

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED
300 ALBANY HIGHWAY, VICTORIA PARK, W.A. 6100. (091) 362 4322

LOT 37 BRIXTON STREET
POSSIBLE DRAINAGE FROM DEVELOPMENT

Date November, 1989 | Dwg. 2284 - 3 | Fig. 3



KENWICK SWAMP
GUILDFORD FORMATION CLAYS
Sc & Cs
243
37
10
11
ROE
FREEWAY
BRIXTON
STAPLEHURST
ALTON
STREET
BOUNDARY
ROAD
CHIDDINGTON
BRENCHLEY ST
LADYWELL
SEALE
ROCHESTER
SATURN
Railway
HIGHWAY
Birley Brook Branch Drain
BURNHAM RD
DUDLEY
WANAPING
PARK
DUKETON WAY
BELMONT
DENFORD ST
AH-1
AH-2
(1.25m)
School Site

Attachment 5.5

HAMES SHARLEY AUSTRALIA

2337/1

AUGUST 1990

LOT 37 BRIXTON STREET KENWICK
HYDROLOGICAL INVESTIGATIONS

AC CONSULTING GROUP PTY LTD

CONTENTS

1 INTRODUCTION

In late 1989, Australian Groundwater Consultants, now A G Consulting Group (AGC), was engaged jointly by the Department of Conservation and Land Management, Department of Planning and Urban Development, and Homeswest, to undertake a brief hydrological review of Lot 37 Brixton Street, Kenwick.

Homeswest was proposing to develop Lot 37 for residential purposes. The site includes wetland areas which contain species of Declared Rare Flora. The development concept proposed by Homeswest provided for the retention of the wetland areas, although there was still concern about maintaining the hydrological integrity of the wetlands following development.

The review undertaken by AGC was premised on the development concept proposed by Homeswest and was intended to provide information on whether the wetlands containing the Declared Rare Flora could be sustained hydrologically in the event that development was to occur. Basically, AGC's conclusions from this review were -

- the wetlands were purely surface water features (ie not fed by groundwater inflow);

- while development as proposed did appear to impinge upon the surface catchment of the wetlands, with appropriate drainage management, the hydrological integrity of the wetlands could be maintained;

- a full water balance for the wetlands would need to be prepared as a basis for further decisions about the development programme.

AGC has now been engaged by Homeswest to undertake further hydrological investigations at the Brixton Street site to assist in refining the development proposal for Lot 37.

2 DISCUSSION

A series of test pits was excavated at the site as shown on Figure 1. The pits were accurately levelled in to give both surface and subsurface gradients. The results from the test pits are summarised on Figure 2.

The test pits showed that -

- the wetland area is underlain by hard clay with a conductivity estimated at between 0.1 and 1 mm/day;
- surface water had not penetrated beyond about 0.3 m through the surficial layers into the underlying clays;
- the wetland is effectively isolated from interflow from the south east of the site by a clay rise on the perimeter of the wetland;
- both surface and subsurface gradients are minimal.

Visual inspection of the site showed -

- no evidence of surface flow/drainage to the wetland areas;
- that the graded track running from the north east to the south west of the site is bunded on both sides and is acting as a barrier to surface drainage.

Meteorological data for the area was analysed and showed that, on average, rainfall exceeded pan evaporation from May through to August (see Figure 3).

A brief water balance was conducted for the site. Data for the period 1960-1988 was analysed, and the results are summarized on Figure 4. The water balance assumed that there was no contribution from surface runoff, that seepage occurred at a rate of 1 mm/day, and that evaporation takes place at potential open water rates. The water balance showed that, with no contribution from surface or interflow, the wetlands would have been inundated in every year from 1960-1988 (for a period of between 3 and 7 months) from rainfall alone.

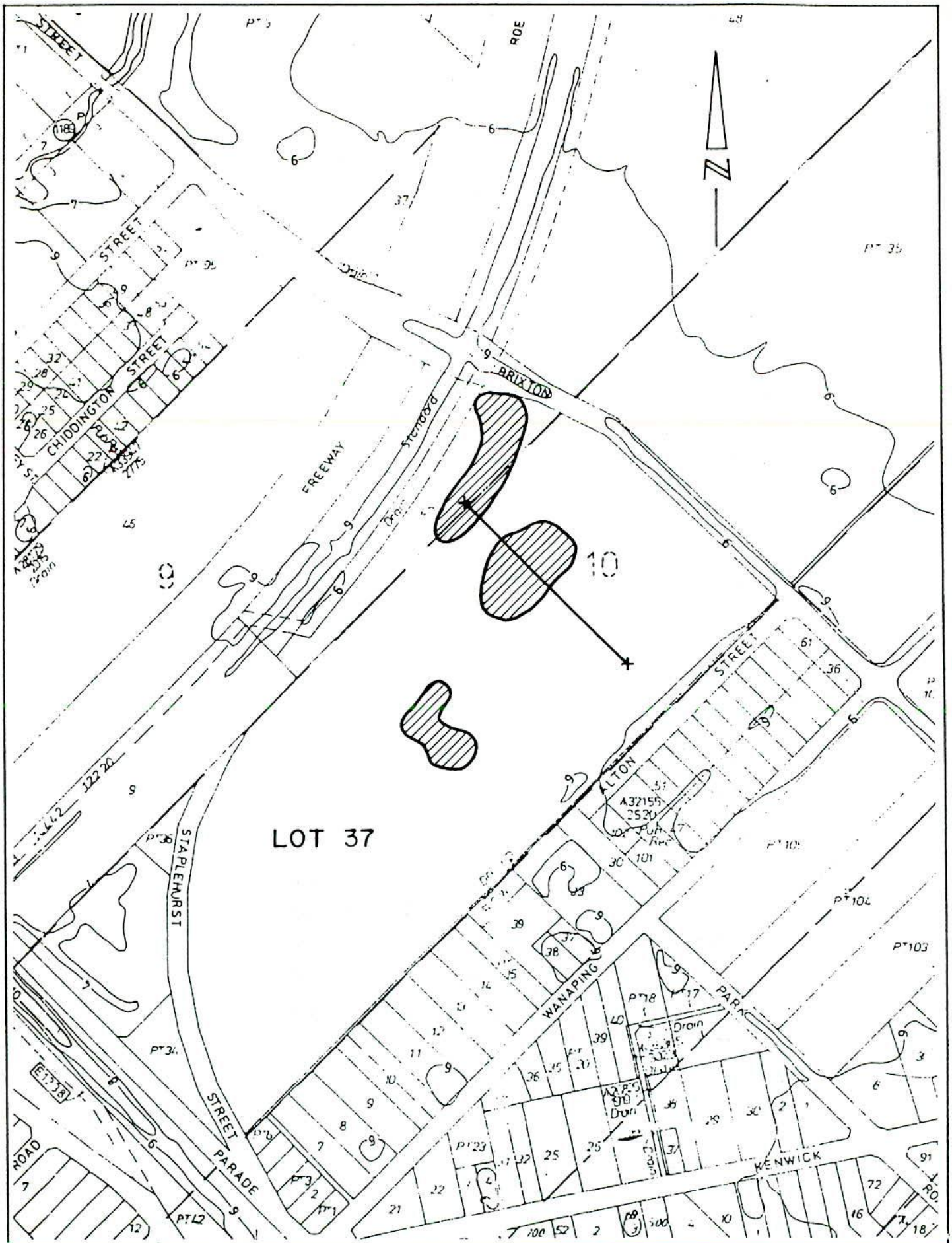
Inspection of aerial photography for the same period (ie 1960-1988), much of which was flown in the May-June period, confirmed that the transition from dry to wet conditions within the wetlands occurred as suggested by the water balance.

3 CONCLUSION

The primary source of water to the wetland areas within Lot 37 is rainfall directly onto the actual wetland sites. If a rain event was severe enough to promote overland flow, surface waters from the northern and eastern portions of Lot 37 would drain into the wetland areas. However, this would constitute a transient water input to the wetlands as the flow would continue to drain through the site to the south west. The temporary inundation of the wetland areas by surface water draining from other parts of Lot 37 is not a prerequisite for the maintenance of the wetland areas.

Subject to the establishment of an appropriate drainage system within the Homeswest development (the objective being to direct drainage flow from the developed area away from the wetlands), the development of the site surrounding the wetland areas should have negligible effect on the hydrological status of the wetlands. Also, in terms of defining what portion of Lot 37 could be developed whilst maintaining the wetlands, from a hydrological viewpoint, the graded north-east to south-west track already acts as a barrier to surface water movement into the wetlands and would, therefore, constitute an appropriate boundary.

More precise refinement of the development concept for Lot 37, including definition of the boundary between development and the open space encompassing the wetlands and specification of post-development drainage requirements, would necessitate the excavatioon of further test pits throughout the wetland areas, and a detailed topographic survey of the overall site.



Wetland Areas

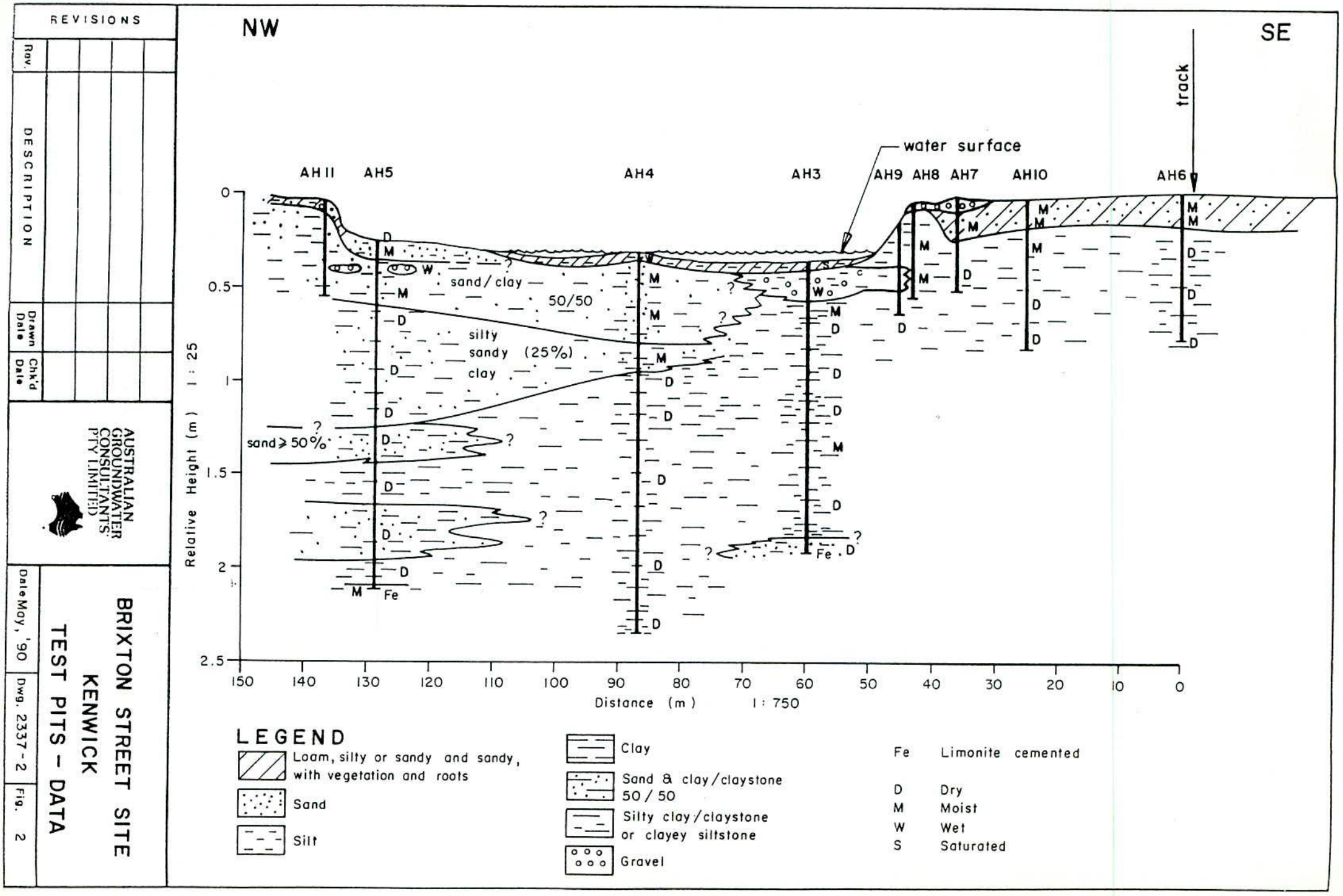
Test Pit Transect

SCALE 1 : 5000

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

BRIXTON STREET KENWICK SITE TEST PIT – TRANSECT

Date Aug. '90	Dwg. 2337-1	Fig. 1



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Rev.				
DESCRIPTION				
Drawn Date				
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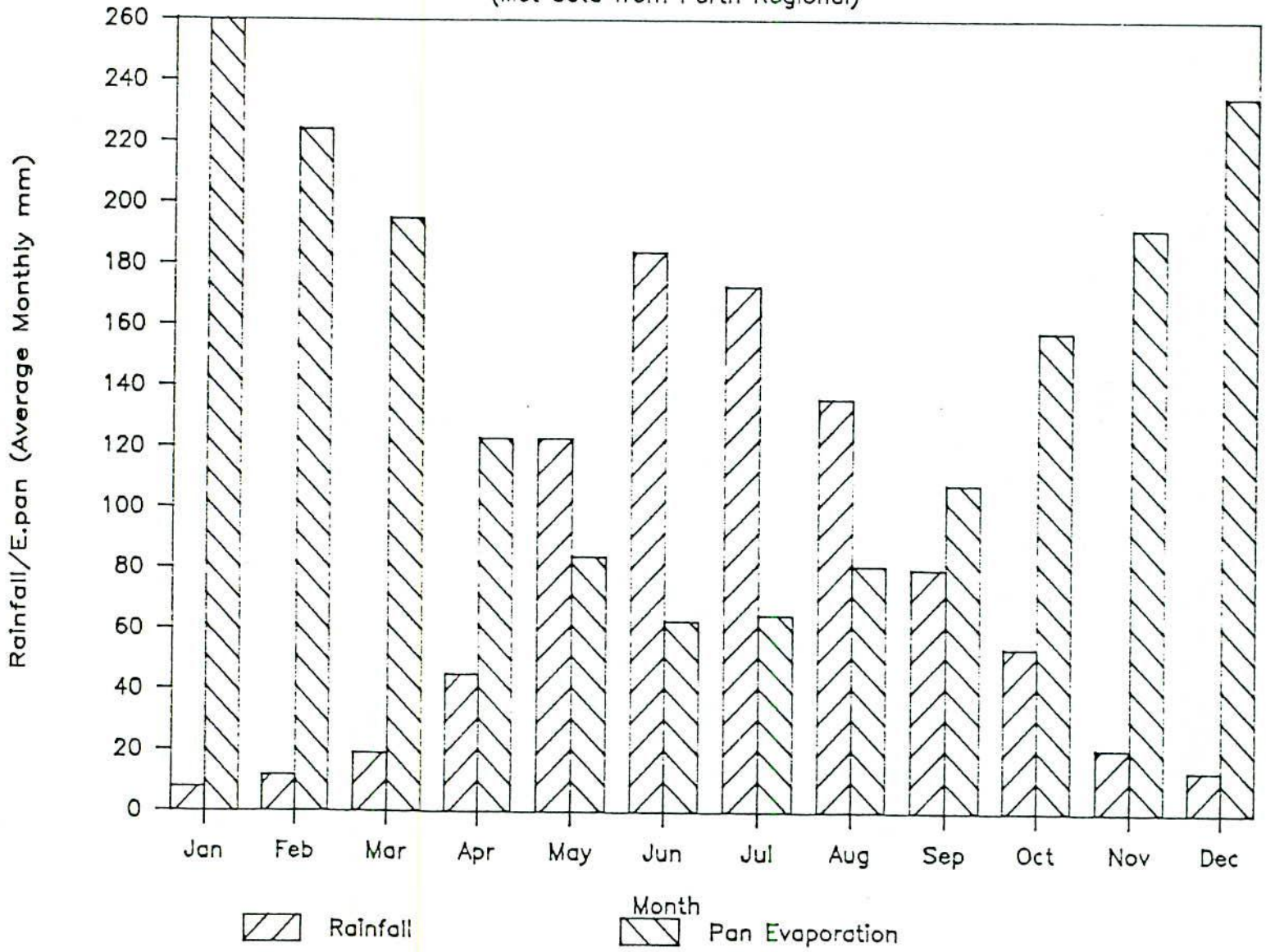
AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED

BRIXTON STREET SITE
KENWICK
TEST PITS – DATA

Date May, '90
Dwg. 2337-2
Fig. 2

Kenwick Water Balance

(Met data from Perth Regional)



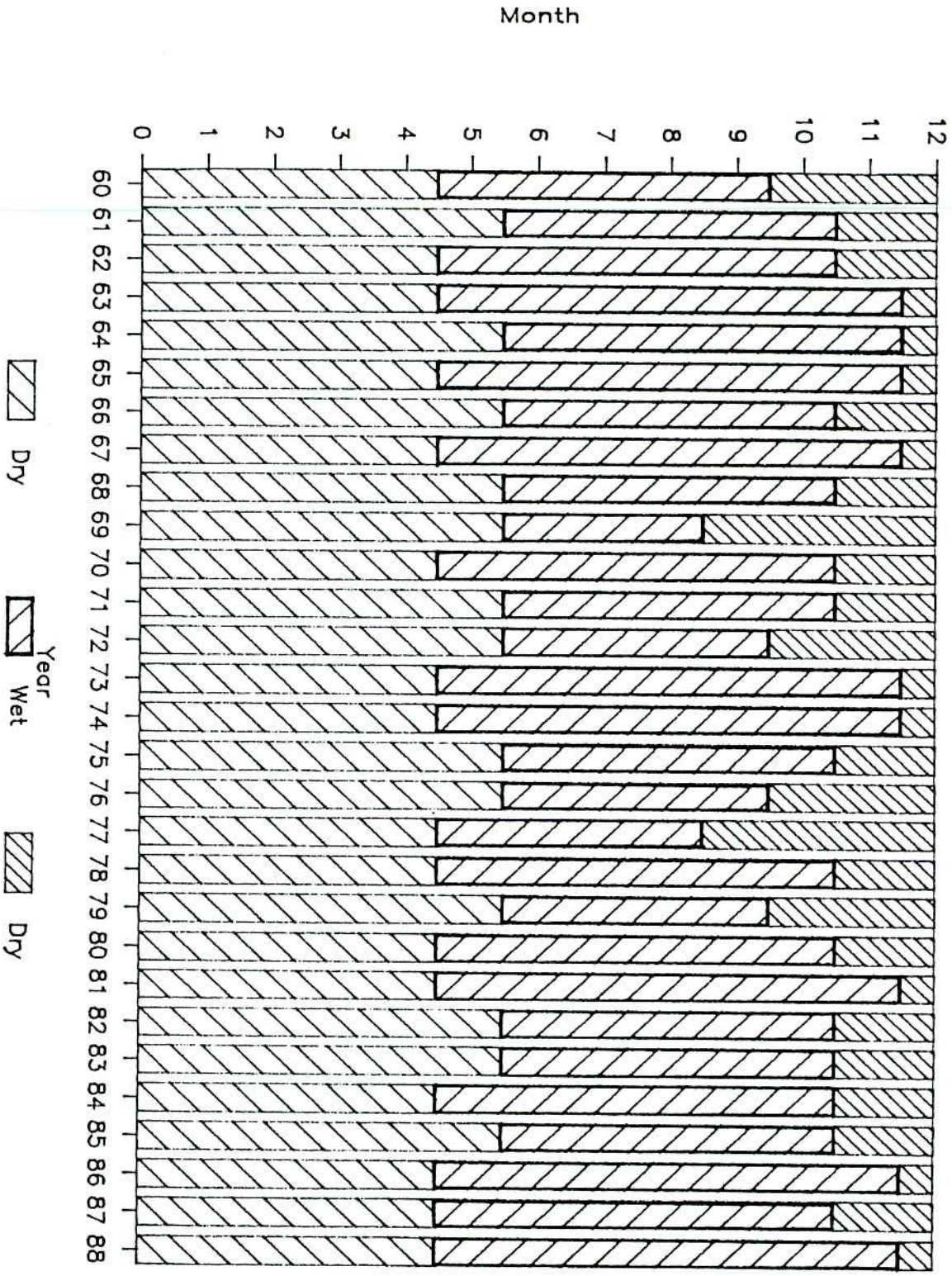
Brixton St, Kenwick
Hydrological Study
Meteorological Data

Date: May 90
Dwg: 2337 - 3
Fig: 3

AUSTRALIAN GROUNDWATER CONSULTANTS PTY. LIMITED

Rev.	DESCRIPTION	Drawn Date	Chk'd Date

REVISIONS



Kenwick Water Balance

REVISIONS				
Rev.	DESCRIPTION	Drawn Date	Chk'd Date	

AUSTRALIAN GROUNDWATER CONSULTANTS PTY. LIMITED

Brixton St, Kenwick
Hydrological Study
Water Balance

Date:	Dwg:	Fig:
May 90	2337 - 4	4

Attachment 7.1

OUTLINE OF POSSIBLE RESERVE MANAGEMENT PLAN FOR THE BRIXTON STREET WETLANDS

1. *Introduction*

2. *Resource Information and Values of the Area:*

   - *Location;*
   - *Planning Considerations;*
   - *History;*
   - *Past Use;*
   - *Physical Features;*
   - *Hydrology;*
   - *Vegetation;*
   - *Fauna;*
   - *Landscape;*
   - *Fire; and,*
   - *Past Management.*

3. *Management Objectives:*

   - *Conservation High Priority;*
   - *Conservation and Recreation; and,*
   - *Recreation.*

4. *Management Strategies:*

   - *Strategies for each concern, ie. water levels, fire, weeds, signs, etc.*

5. *Implementation:*

   - *Program of actions to achieve objectives.*