Water Authority
of Western Australia

NEERABUP CARABOODA ZONE WATER SUPPLY

CONSULTATIVE ENVIRONMENTAL REVIEW

FOR

PROPOSED NEERABUP ROOFED RESERVOIR AND WATER SUPPLY MAINS

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Water Supply Planning & Design Branch
February 1994

NEERABUP ROOFED RESERVOIRS AND WATER SUPPLY MAINS

CONSULTATIVE ENVIRONMENTAL REVIEW

Invitation to comment

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

The CER proposes the development of a roofed reservoir and water supply mains project in the Water Reserve location †34537 and the southern part of the Neerabup National park.

In accordance with the Environmental Protection Act, a CER has been prepared which describes this proposal and its likely effect on the environment.

The CER is available for public review for up to four weeks from 8/3/1994 closing on 5/4/94.

After receipt of comments from Government agencies and the public, the EPA will prepare an assessment report with recommendations to the Government, taking into account issues raised in public submissions.

Why write a submission?

A submission is a way to provide information, express your opinion and put your suggested action - including alternative approaches.

It is useful if you can suggest ways to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents and may be quoted in full or in part in each report unless specifically marked confidential.

Submissions may be fully or partially utilised in compiling a summary of the issues raised or, where complex or technical issues are raised, a confidential copy of the submission (or part of it) may be sent to the proponent.

The summary of issues raised is normally included in the EPA's assessment report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group or other groups interested in making a submission on similar issues.

Joint submissions may help to reduce the work for an individual or group while increasing the pool of ideas and information.

If you form a small group (up 10 people) you may wish to indicate the names of all participants.

If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the CER or the 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 review document:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable;
- 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 issues raised are clear. A summary of your submission is helpful,
- refer each point to the appropriate section, chapter or recommendation in the review document,
- if you discuss different sections of the review document, keep them distinct and separate, so there is no confusion about which section you are considering,
- attach any factual information you may want to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name
- address
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: 5th April, 1994

Submissions should be addressed to:

Environmental Protection Authority
Westralia Square
141 St Georges Terrace
PERTH WA 6000

Attention: Mr Ron Van Delft

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EXECUTIVE SUMMARY

Development in the North West Corridor has reached the stage that the existing water supply system will not be able to meet consumers' demand in the area in October 1995. For this reason and in the absence of an economically viable alternative solution the Water Authority proposes to construct a roofed reservoir pond within the Neerabup Water Supply Reserve ↑34537.

The proposal entails the construction by 1995 of a roofed reservoir of 128 ML capacity, an earth sump, and the necessary pipelines to and from the pond, and duplication of similar facilities about the year 2007. The proposed pond is to be constructed of internally concrete lined earth embankments below and above natural ground surface. The reservoir roofs will be of steel sheeted construction and colour coated to blend in with the environs. The proposed pipelines will be constructed below ground and will likewise be constructed in stages.

Alternatives considered in the investigation and planning phase included supplying water from other possible sites but these were either cost prohibitive or the site was not available. A decision was made in favour of Neerabup and Carabooda on the basis of a balanced consideration of environmental, social, functional and economical impact. Within the context of this decision two options, namely, reservoirs and tanks were considered, again on the basis of a balanced view on environmental, social, functional and economical impact. The favoured solution is roofed reservoirs.

The Neerabup Water Supply Reserve ↑34537 is situated on high elevated land at the south eastern end of the Neerabup National Park containing vegetation communities of *Dryandra sessilis* scrub/thicket and/or woodland of *Banksia attenuata* and jarrah predominantly. The ground is gently sloping with a northwest/southeast aspect. The potential impact of the proposal are the visual effect from the nearby residences on strategic vantage point, control of die-back free operations and preservation of the National Park. These are reasonably assured by implementing procedures and taking measures to ensure the environment is managed with a meaningful degree of balance. No significant local fauna, flora or ethnographic sites will be endangered as a result of the project. Rehabilitation will be carried out as soon as practicable and in conjunction with CALM and EPA.

1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 Successive West Australian State Government initiatives to bulk release building blocks in Perth's Northwest Corridor have necessitated the Water Authority of Western Australia (Water Authority) to provide water supply services to future consumers to an established standard.

1.1.2 A number of supply options were considered and an approved initial strategy relying on a reservoir at Nowergup was abandoned due to a problem with acquisition of the site. A reviewed strategy incorporates reservoirs at Neerabup and Carabooda.

1.1.3 The reviewed strategy identifies the initial need for a minimum 50 ML storage capacity to be completed in October 1995 at Neerabup Water Reserve ↑34537 catering for 6300 services. An ultimate storage combined capacity of 500 ML is required in 2023 at Neerabup and Carabooda catering for 65 000 services.

1.1.4 Water supplying the storages at Neerabup will be largely from the Quinns borefield, a significant ground water resource within the corridor between the future freeway extension and the coast from Burns Beach Road to just north of Lukin Drive.

1.1.5 Pipelines to and from the Neerabup storages traverse below ground between the Neerabup storages and a treatment plant located west of the Neerabup storages and between the future freeway extension and Marmion Avenue.

1.2 THE PROPOSAL

1.2.1 The Water Authority proposes to construct a 128 ML capacity roofed reservoir (pond) with sump, pipelines to and from the pond for completion by October 1995 and a second similar storage facility in the year 2007 or at such other time as the water demand requires the provision of additional storage on this site.

1.2.2 The proposal includes rehabilitation of disturbed ground outside the ponds and sump within the Water Reserve and within the pipeline corridor.

1.2.3 The proposal is depicted in Figures 1.1, 1.2, 1.3 and 7.3.

1.3 THE PROPONENT

The proponent for the Neerabup reservoir and pipeline projects is the Water Authority of Western Australia, a State Government authority with responsibility for provision of public water supplies throughout the State.

The Water Authority's head office is located at:

John Tonkin Water Centre
629 Newcastle Street
Leederville WA 6007.

The regional office for which the projects are developed is Perth North Region of the Water Authority and located at

8 Davidson Terrace
Joondalup WA 6027.

1.4 STATUTORY FRAMEWORK

The Environmental Protection Authority has determined that formal assessment at the level of a CER is appropriate for the proposal under the Environmental Protection Act, 1986. The EPA guidelines for the study are included in Appendix 1. A four week period is available for public comment after which the EPA will consider the comments received and prepare a report to the Minister for Environment, who will make a decision on the proposal. A final determination will be issued by the Minister after considering all appeals within a set duration.

1.5 LEGISLATIVE CONSIDERATIONS

The following legislation are relevant to the proposed project and will be complied with by the Water Authority:

- Environmental Protection Act 1986
- Conservation and Land Management Act 1984
- Water Authority Act 1984
- Wildlife Conservation Act 1950
- Soil and Land Management Act 1945
- Construction Safety Act 1972
- Bushfires Act 1954
- Occupational Health, Safety and Welfare Act 1984
- Aboriginal Heritage Act 1972
- Health Act 1911

1.6 PUBLIC PARTICIPATION AND CONSULTATION

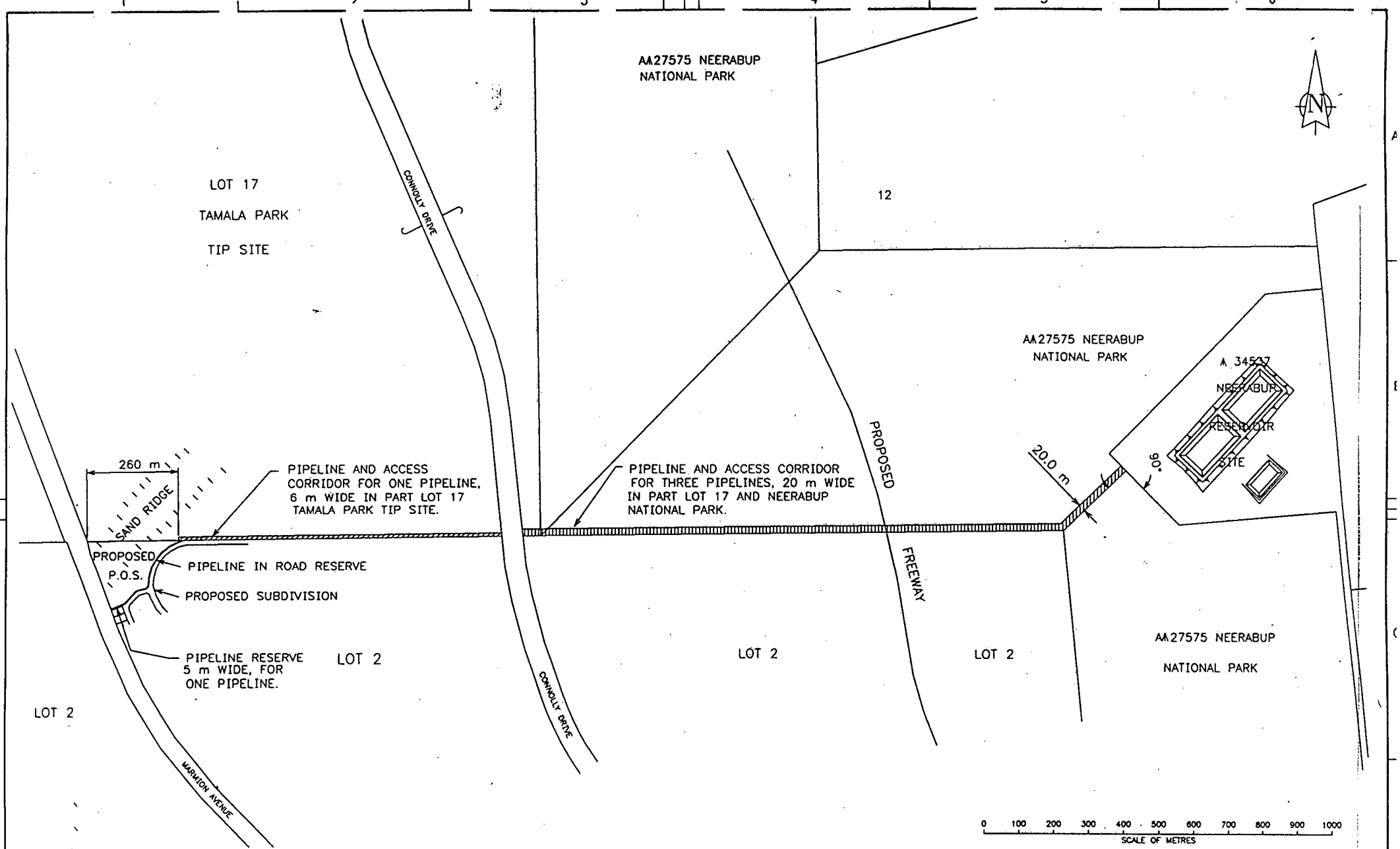
The Water Authority, mindful of the strategic importance of the Water Reserve in the provision of a standard water supply service to the community in the North-West Corridor, as well as its importance as part of the System 6 ecosystem, has keenly agreed to public participation and consultation through the Consultative Environmental Review process.

A site meeting was held with EPA and CALM on 16 Aug '93 to discuss and seek approval to carry out sub-surface geotechnical investigation drilling. Investigation drilling was completed 24 September '93. Present also was representatives from the City of Wanneroo.

Community groups (Friends of Neerabup National Park , Conservation Council of WA, Coalition for Wanneroo's Environment, Urban Bushland Council) were informed of the project in early November '93. A meeting was held with the Community groups and the City of Wanneroo on 14 December '93 at the Water Authority's Water Tower in Joondalup and the Water Reserve †34537. Present at the meeting were Miguel Castillo, Teresa Castillo and David Wake of Quinns Rock Environmental Research Group, Pan Chiang, George Golowyn and Brian Robertson of The Water Authority, Max Head of Friends of Neerabup National Park, Joan Payne of Conservation Council WA, and Paul Nielsen of City of Wanneroo. Papers giving the general intention of the Water Authority were distributed to participants. Views on the proposed project were exchanged and discussions took place at the meeting. (EPA & CALM were unavailable to attend but were sent the preliminary information presented at the meeting.)

Subsequent to the meeting further correspondence took place between QRERG, Friends of Neerabup National Park and the Water Authority.

Opportunities for further public participation on the proposal will be made available during the period open for review of the CER.



DES REF DATE DRN CHD	Product of Water Supply Planning & Design Branch	RECOMMENDED ENGINEER APPROVED MANAGER W.S. PLANNING & DESIGN	Water Authority of Western Australia	METROPOLITAN WATER SUPPLY NEERABUP RESERVOIR PIPELINE AND ACCESS CORRIDORS MARMION AVENUE TO NEERABUP RESERVOIR	ORIGINAL SHEET SIZE A3	
				FILE / PROJECT / PLAN / CAD: FIGURE 1.1	ISSUE: A	MF

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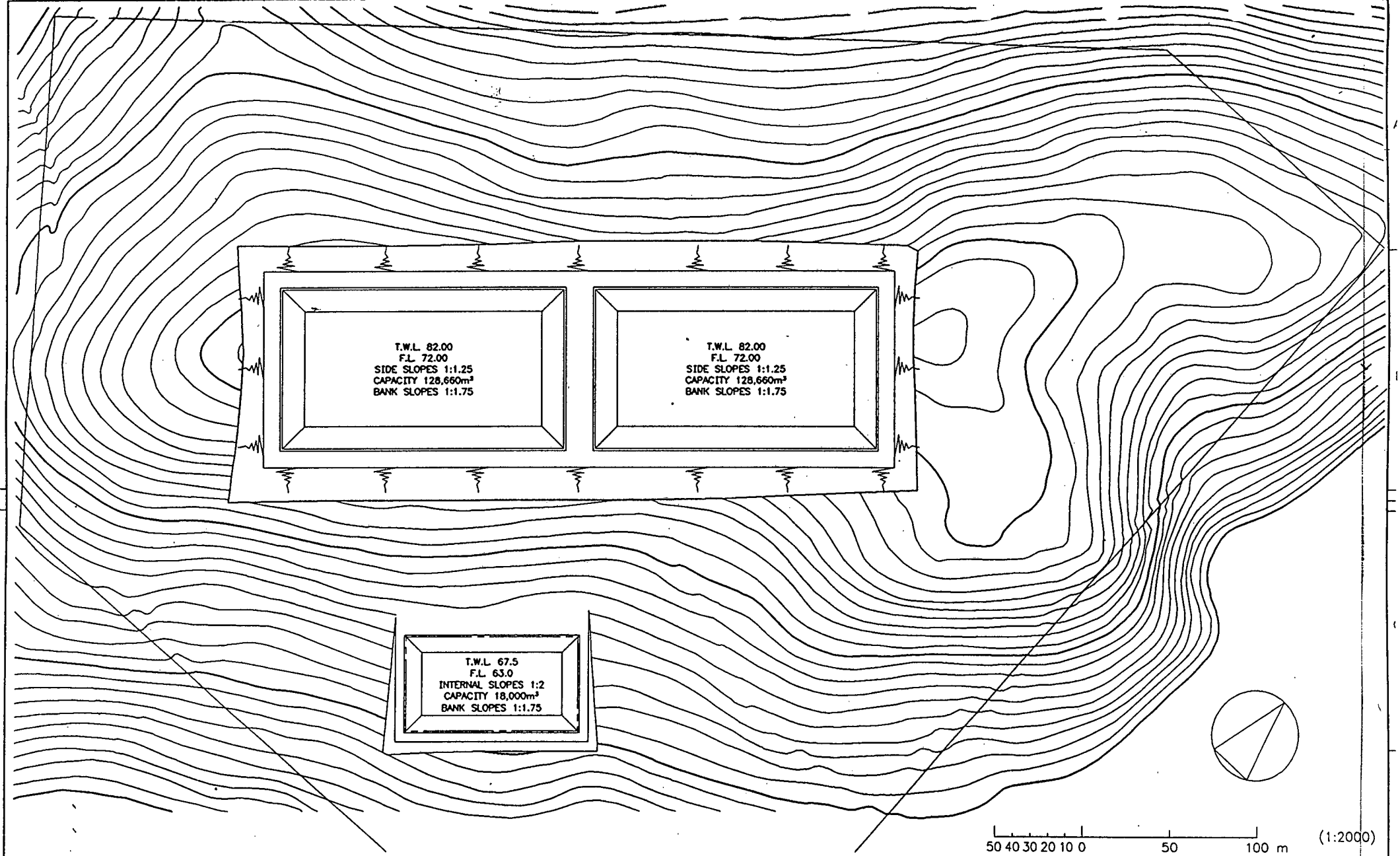

DES REF DATE DRN K.BOSMAN CHD	Product of Water Supply Planning & Design Branch	RECOMMENDED ENGINEER APPROVED MANAGER W.S. PLANNING & DESIGN	Water Authority of Western Australia	METROPOLITAN WATER SUPPLY NEERABUP RESERVOIR SITE PLAN (ROOFS NOT SHOWN)		ORIGINAL SHEET SIZE A3
				FILE / PROJECT / PLAN: FIGURE 1.2 / CAD / ISSUE: A		MF

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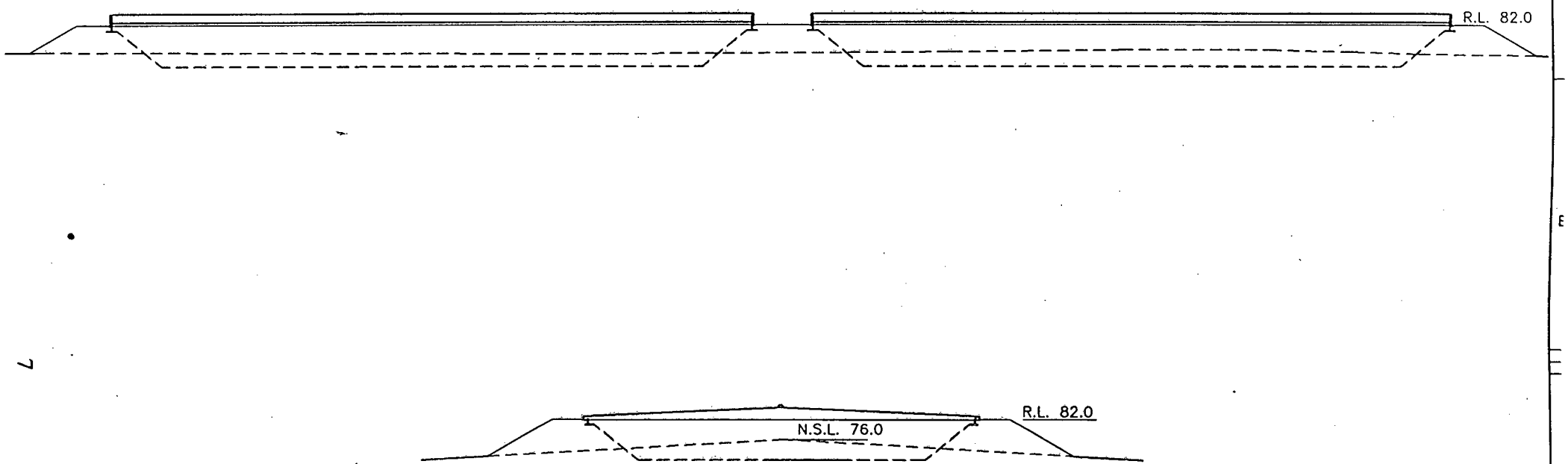

DES REF DATE DRN K.BOSMAN CHD	Product of Water Supply Planning & Design Branch	RECOMMENDED ENGINEER APPROVED MANAGER W.S. PLANNING & DESIGN	Water Authority of Western Australia	METROPOLITAN WATER SUPPLY NEERABUP RESERVOIR TYPICAL ELEVATIONS	ORIGINAL SHEET SIZE A3	
				FILE / PROJECT / PLAN CAD: FIGURE 1.3	ISSUE: A	MF

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2.0 JUSTIFICATION FOR THE PROPOSAL

2.1 The promulgation of the Metropolitan Region Scheme in 1963 and a reappraisal by Town Planning Department of the scheme led to finally "The Corridor Plan" for Perth being "accepted as the preferred way of controlled urban expansion by the State Government".

2.2 The North West Corridor has become one of the fastest growing corridor for expansion within the Perth Metropolitan area. Successive State Government initiatives releasing residential land in bulk has driven the demand for water services to beyond the capacity of the existing system by October 1995. By this time a water storage of 50 ML minimum will be required to serve 6300 services in the area within the Neerabup and Carabooda Zone. By the year 2023 or such other time as dictated by the Corridor growth rate 65 000 services will need to be provided with a water supply service in the zone. This forms part of the commitment to future consumers in the Corridor.

2.3 This commitment has been undertaken by the Water Authority and is represented as part of the planning structure for the North West Corridor by the Metropolitan Region Planning Authority in its October 1977 Planning Structure Report. (Ref. 1).

2.4 Given Neerabup is the only practical site to supply water to this part of the Corridor, the reservoirs option presents itself as having a less damaging visual impact on the environment and is assessed to be more economical than the tanks option. The greater risk of introducing dieback into the area however will be mitigated through the implementation of site dieback control hygiene procedures and measures to be taken to ensure a proper control on the situation.

2.5 The proposal will not diminish the quality of life for communities in the region as the current level of public access will be maintained to the part of the water Reserve ↑34537 outside the reservoir and sump structures.

3.0 EXISTING ENVIRONMENT

3.1 AREA UNDER CONSIDERATION

The area proposed for the water storage is located within Water Reserve ↑34537. The land for the supply and delivery pipelines is located within corridors situated partly in private property, partly in the Neerabup National Park, and partly along the southern boundary of Tamala Park tip site. Refer to Figure 1.1 for details.

3.2 LAND USE PLANNING AND OWNERSHIP

Land within the area of consideration can broadly be divided into four categories. These are:

- Water Reserve ↑34537 - vested in the Water Authority for water supply purposes in February 1977. It is in the southern part of the Neerabup National Park which forms part of the System 6 area. Refers to Fig. 78 of Ref. 3 and Appendix 2.

- Part of Reserve A27575 - vested in the National Parks Authority for National Park forming the southern part of the Neerabup National Park. Proposed freeway through parts of Reserve. Refers to Fig. 78 of Ref. 3 and Appendix 2. Approval to locate the pipelines within this part of the Reserve A27575 was given by CALM in May 1990.

- Lot 17 Tamala Park Tip Site - owned jointly by the City of Wanneroo, City of Stirling and City of Perth and adjoining the south western side of the Neerabup National Park. Currently used as landfill refuse depot. Zoned partly recreational reserve and partly deferred urban.

- Part of Lot 2 - private ownership residential and public open space adjoining south west corner of Lot 17.

3.3 LANDFORMS, SOILS AND HYDROLOGY

The area concerned consists of dune covered Tamala limestone formation and subdued dune topography to the west of the reservoir site. A local ridge composed of calcarenite with loose quartz sand on the upper layers forms the "hill" within the Water Reserve ↑34537 with the highest elevation being at RL 76 A.H.D. (Refers Figure 3.1).

The bulk of the pipeline corridor within Reserve A27575 and Lot 17 are of gently undulating sandy ground at elevation as low as RL 14 A.H.D. The western end of the pipeline corridor consists of undulating dune ridges overlying the Tamala Limestone formation.

No surface water is found in the areas under consideration. The nearest surface water is found in Neerabup Lake to the north, Lake Joondalup and Mariginiup Lake to the south east and Lake Adams to the east. Within Reserve ↑34537 ground water level is found about 16 metres above Australian Height Datum (AHD). Approximately 1.5 km west of the Water Reserve the ground water table is up to 4 metres above AHD.

3.4 FLORA AND FAUNA

Separate surveys were carried out for flora and fauna assessment for the study area. These are recorded in the references 4 and 5 respectively. The summary of the respective reports are included in Appendix 3 and 4. Copies of the reports are freely available to the Public on request.

3.4.1 Flora

A total of 38 families, 94 genera and 126 vascular plant species were recorded on the Water Reserve ↑34537 including the access road reserve to Burns Beach Road and the pipe corridor from the reservoir site to Marmion Avenue. The eight plant communities defined and mapped for the area are recorded in Figure 3 of reference 4. No gazetted rare species or geographically restricted species were recorded in the survey areas. All plant communities are represented elsewhere in other nearby National Parks and Nature Reserves.

3.4.2 Fauna

The area surveyed for fauna is as shown in Figure 3.2. A total of 2 frog species, 11 reptile species and 39 bird species were sighted and are detailed in reference 5. Although further sampling at different seasons would reveal the presence of more species, no vertebrate species known or expected on Reserve ↑34537 is rare or geographically restricted. The White-breasted Robin which is known to be relatively uncommon in the Swan Coastal Plain was sighted in the North-east corner of the Reserve.

3.5 ETHNOGRAPHY AND ARCHAEOLOGY

An Aboriginal Site Survey was carried out by Barbara Dobson, Ken Macintyre, Jacqueline and Garry Quartermaine in September 1993. The summary of the report is attached in Appendix 5. Copies of the report are freely available to the Public on request. The Report on An Ethnographic and Archaeological Survey at Neerabup Reservoir, Pipeline and Access Reserve (Reference 6) was based on museum records and other research papers as well as consultation with Aboriginal leaders in the communities.

It appeared that the Ballaruk and the Nyungar are the two established Aboriginal people who had association with the area under study. According to the spokespersons for these two communities there are no sites of Aboriginal significance within the area under consideration, except an ethnographic/archaeological site previously recorded by the W.A. Museum (W.A. Museum Site No. S02471) on a sand ridge towards the Marmion Street end of the proposed pipeline route.

3.6 COMMUNITY EXPECTATION

Water Reserve ↑34537 is located in an environmentally sensitive area adjoining the Neerabup National Park which forms part of the System 6 ecosystem. Whilst under Recommendations of The Darling System - System 6 Report (Reference 2), the Reserve is considered as having the same significance as a Regional Park due to its close proximity to the Neerabup National Park, the similarity in flora and fauna communities, and its value in passive recreational activities. The Reserve's value as a water supply reserve for the purpose of providing water services to the communities in that part of the North West Corridor is, however, recognised fully by the MRPA, DPUD, Local Authorities and the State Government of Western Australia in the Metropolitan Region Scheme. The vesting of the Reserve ↑34537 in the Water Authority in 1977 is acknowledgment of the responsibility of the Water Authority to provide water services to consumers in the area and re-affirmed in the 1977 North West Corridor Structure Planning (Ref. 8), the 1990 Metroplan (Ref. 9) and again in the 1992 North-West Corridor Structure Plan (Ref. 10). Thus there is a recognition of a balanced approach to land use for water supply purposes in conjunction with upkeeping the areas as an open space.

Within this context there is therefore an expectation by the community that the area under consideration will be protected from environmental damage, that the area will still be accessible to the public for recreational activities, and that water supply facilities will be located on the Reserve.

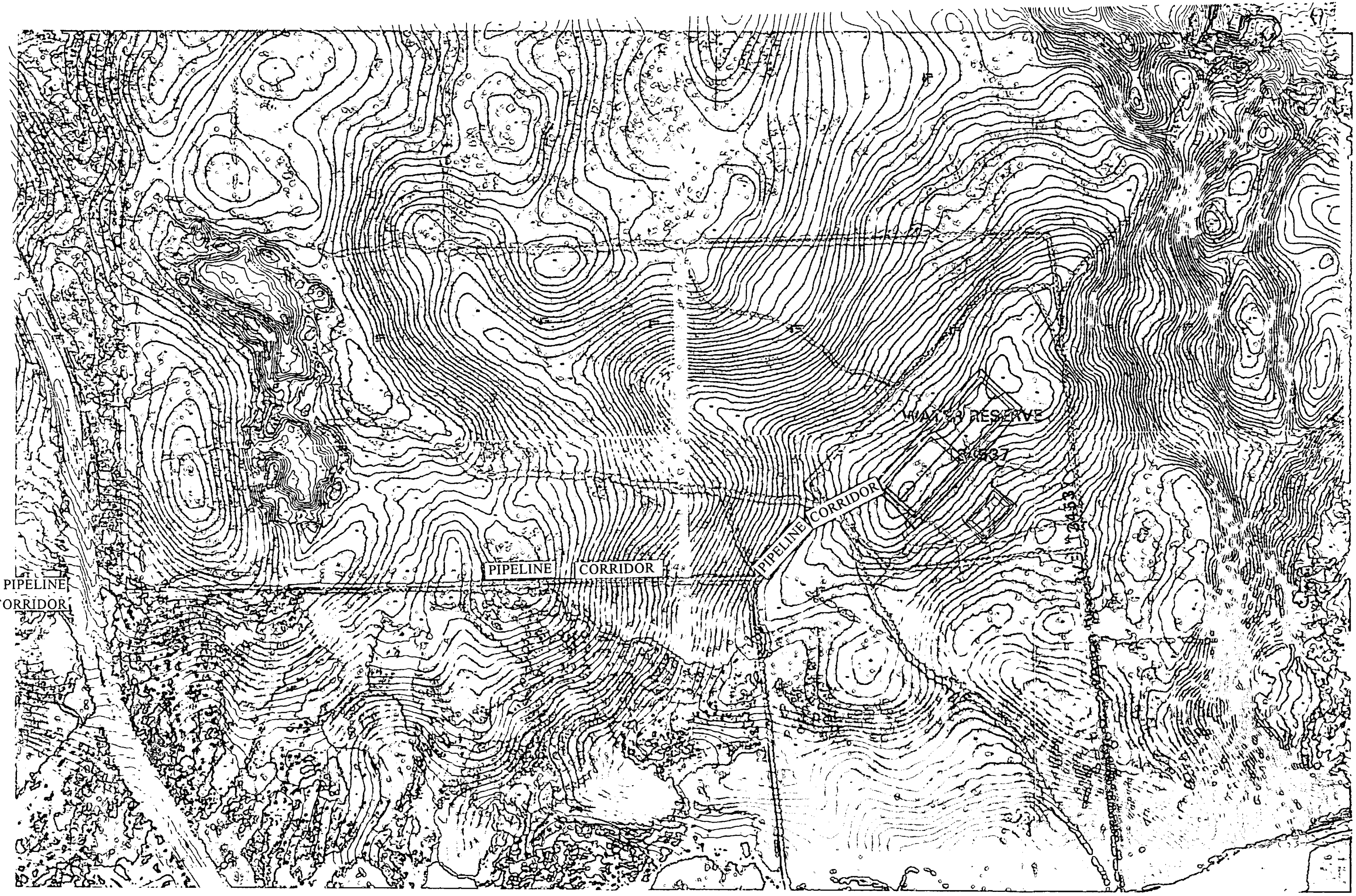
WAITARA RESERVE
PIPELINE
CORRIDOR
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FIGURE 3.1

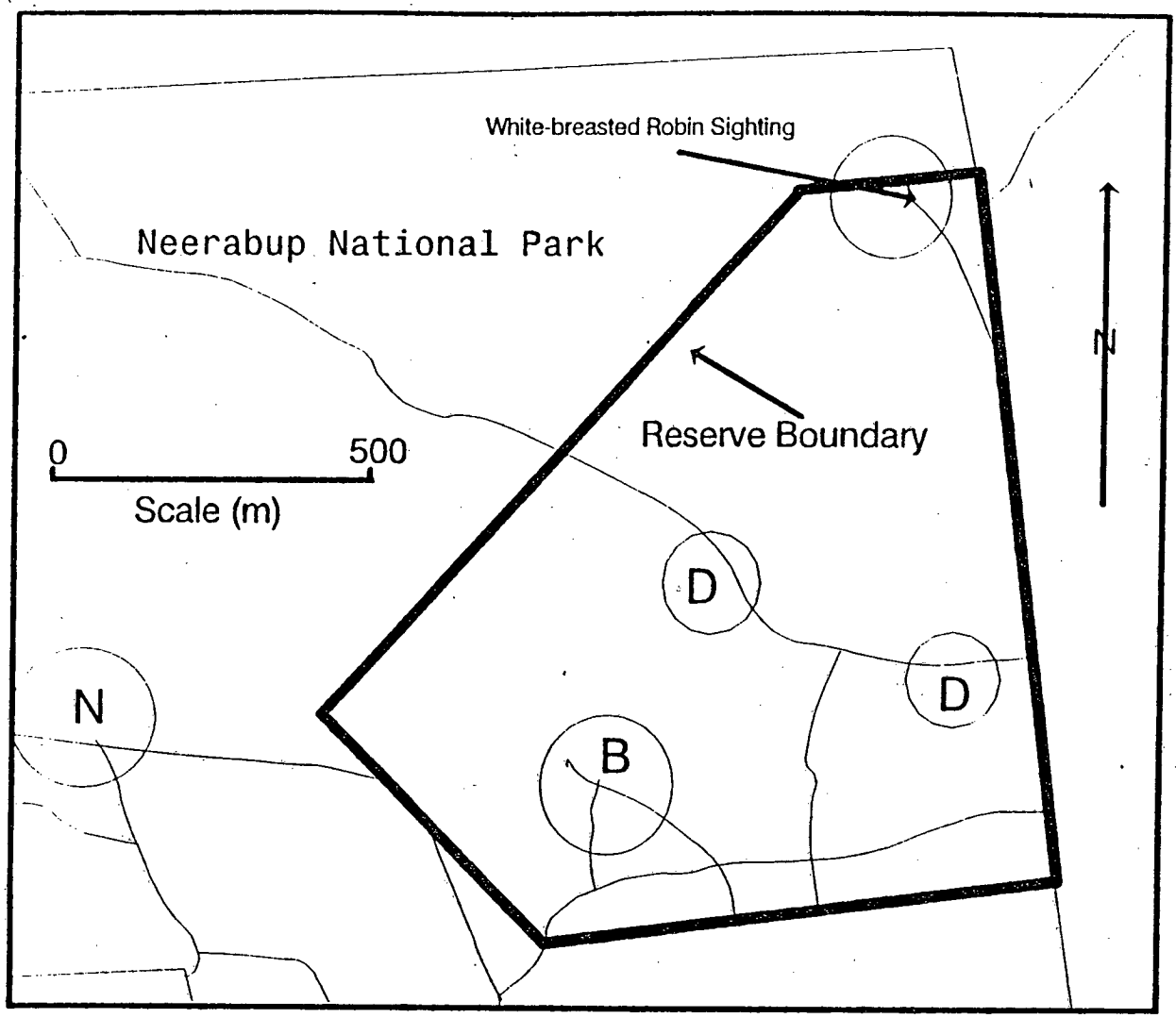


Figure 1: Location of sites (B and D) in water supply reserve ^34537 where detailed fauna sampling was undertaken in October, 1993. Also marked is the site where detailed sampling was carried out in the adjacent part of Neerabup National Park (site N), and the site in reserve ^34537 where the White-breasted Robin was recorded.

EXTRACT FROM REFERENCE 5

FIGURE 3.2

4.0 ALTERNATIVES CONSIDERED

Amongst other things a reservoir site has to satisfy the criteria of elevation and sufficiency in area in relation to the storage required. Few high sites in this part of the North West Corridor will satisfy these conditions. Hence, there are not many alternatives available for consideration in this particular case.

However, the available alternatives considered are:

- Reservoirs in "Hill T" (Nowergup)
- Reservoirs in Neerabup and Carabooda
- Reservoirs in Carabooda only
- Reservoirs in Carabooda and Wanneroo
- Reservoirs in Wanneroo only

4.1 RESERVOIRS IN "HILL T" (NOWERGUP)

"Hill T" was a strategic water supply site since 1977 because of its location, elevation and land form suitability with respect to the growth pattern of the corridor. Supply from Nowergup Reservoir was the cheapest strategy at the time of initial investigation 1989 (Ref. 11). However as the site was a strategic high grade limestone reserve the site was made unavailable to the Water Authority for siting of the reservoir at the direction of the State Government of the day.

4.2 RESERVOIRS IN NEERABUP AND CARABOODA

Neerabup is a strategic water supply location since 1977 in conjunction with Carabooda. This alternative is in fact the next lowest in cost after the Alternative in 4.1 but has now been considered as the preferred strategy since the loss of "Hill T" site. For details, refer to Section 5 and Ref. 12. The Water Authority will adopt this alternative as the supply strategy.

4.3 RESERVOIRS IN CARABOODA ONLY

This strategy costs approximately $13.2 M more than the preferred alternative in 4.2 and therefore not economically acceptable to the Water Authority and the community.

4.4 RESERVOIRS IN CARABOODA AND WANNEROO

This strategy cost approximately $8.6M more than the preferred alternative in 4.2 and therefore not economically acceptable to the Water Authority and the community.

4.5 RESERVOIRS IN WANNEROO ONLY.

This strategy costs approximately $16.5 M more than the preferred alternative in 4.2 if direct injection of coastal bores (refer to clause 1.1.4) at Quinns is permissible based on water quality. However, if this is not feasible the option will then cost effectively $24M more than the preferred option. In addition, there is also a very high likelihood of water quality problems in off-peak seasons due to the long period of retention in the extremely long main.

4.6 OTHER ALTERNATIVES

High level water towers which satisfy elevation requirements are not suitable because of the very limited storage capacity that could be constructed practically and cost effectively. The Joondalup water tower for instance provides storage equivalent to 750 services and at this rate nine such towers would be required to be constructed by end of 1995/96 and 87 required by year 2023. Environmentally this scenario is not a sound choice due to significant visual impact and economically the long term cost is estimated to be about $27M more than the preferred alternative.

5.0 THE PREFERRED STORAGE OPTION

The preferred alternative of supply strategy is from Neerabup and Carabooda sites. Within this alternative two options in the form of storages are available, namely reservoirs (ponds) or tanks. Of these, reservoir storage is the preferred option, because of the lower long term cost to the communities at large and the Water Authority and because of the considered lower visual impact.

5.1 RESERVOIR STORAGES (OPTION 1)

With the reservoir storage option two ponds each of 128 ML capacity will need to be constructed at Neerabup as well as at Carabooda to satisfy the ultimate demand in 2023. The first proposed pond will be constructed by October 1995 and the second in the year 2007. At Carabooda these will need to be constructed in 1999 and 2019.

The ponds will have a nominal floor level at RL. 72.00 and a top water level at RL 82.00 both at Neerabup and Carabooda to satisfy hydraulic requirement and site conditions. Each roofed pond will have a capacity of 128ML and is proposed to have the following geometry and characteristics.

Length at floor level:	136.4m
Width at floor level:	73.4m
Length at top of wall:	161.3m
Width at top of wall:	98.3m
Roof slope:	3° northwest and southeast.
Roof and wall:	Zincalume steel in mist green or river gum colorbond finish externally.
Pond internal lining:	Reinforced/prestressed concrete
Embankment slope:	1 vertical to 1.75 (or 2.0 max) horizontal.

5.2 TANK STORAGES (OPTION 2)

This option requires six tanks, each of 50ML capacity, staged for 1995, 1999, 2002, 2008 2013 and 2021. At Carabooda four tanks each of 60 ML will be required and staged for 1997, 2005, 2017 and 2023.

Tank storages considered will have a floor level at RL 74.50 and a top water level at RL 87.50 at Neerabup. (Tank floor for Carabooda at RL 72.00). All tanks are roofed and each roofed tank proposed to have the following geometry and characteristics:

Tank diameter:	70m
Tank height:	13.5m at Neerabup (15.5m at Carabooda)
Tank capacity:	50ML each at Neerabup (60ML each at Carabooda)
Roof Slope:	3° conical type
Roof:	Zincalume steel in mist green or river gum
Tank Wall:	Steel plates (or prestressed concrete) painted mist green or river gum to suit.
Equipment hoist:	Approx. 2m above tank wall.

This is not the preferred option.

6.0 PROJECT DESCRIPTION

This project consists of the construction of a roofed internally concrete lined pond within constructed earth embankments, a sump constructed of earth embankment within the Reservoir Site, and pipelines from the coastal ground water bore field in the region to the pond, and from the pond via the distribution network to consumers, and associated works such as valving, power supply to site and access to and from the site.

6.1 POND

The first pond is proposed to be constructed from approximately 3m below the existing ground level to a height of 10m above. Thus the embankment height is 6m above the highest point but generally 7m above the plateau level of the ridge. Refers to Figure 1.3.

The earth embankment is constructed of compacted granular material similar to that on site which could either come from the excavation of the future pond No. 2, or imported from external sources that will be tested by CALM to be free of Jarrah die-back infection.

6.2 SUMP

The sump consists of an excavation in the ground to allow unwanted water from cleaning or overflow to discharge and dispose into the ground through natural seepage. The sump has a capacity of 18000m^3 and constructed entirely with excavated materials. Refer to Figure 1.2.

6.3 PIPELINES

East of Connolly Drive two pipelines are connected to the proposed pond 1 near the western corner of the reservoir, one from the ground water treatment plant supplying to the pond (inlet) and the other from the pond to the distribution network (outlet). A third pipeline will be required in the future to handle the increase in consumer demand at the ultimate stage of urban development. West of Connolly Drive one pipeline will be constructed to distribute water to consumers.

All pipelines will be laid generally not less than 750mm below ground.

The pipelines will be constructed within a east-west pipe corridor as shown in Figures 1.1 and 3.1 and incorporating the fire control strip. A 20 metre wide corridor is required to construct the pipelines between the Water Reserve and Connolly Drive. A 6 metre wide corridor is required for the single pipeline west of Connolly Drive. A change in orientation is proposed near the western end of the pipe corridor before Marmion Avenue to avoid a sand ridge which is known to be of ethnographic significance.

A 3 metre wide unsealed access track is required for access to carry out surveillance and maintenance of the pipelines.

6.4 POWER SUPPLY

Permanent power supply will be required only to operate valves and meters for operational control of the supply system. All cabling will be underground and there will not be any overhead powerlines either from Burns Beach Road to the reservoir site or between the reservoir and the borefield or treatment plant building which is located just north of the pipe reserve between the proposed freeway and Connolly Drive extension.

6.5 VALVE AND METERING PITS

Valves and water flow meters will be installed below ground or housed in concrete pits the top of which will be at approximately the finished ground level. These pits will either have safety rail surround or lids.

6.6 ACCESS

6.6.1 Access to Reservoir site

Access to the reservoir site is via Burns Beach Road near Blue Mountain Drive. This access is required to be a minimal 3 metre wide bitumen surfaced track that will allow maintenance vehicular access following the alignment of the existing fire break along the eastern boundary. A local change in direction at the southern end of the track is planned to enhance the aesthetics by breaking the line of sight as well as to achieve a safe, smooth entrance into Burns Beach Road. A boom gate will be installed to prevent unauthorised vehicular entry but still allow foot traffic access by the public.

6.6.2 Access to Pipe Corridor

Access to the pipe corridor will only be from the reservoir site up to the eastern side of the proposed freeway and from the Connolly Drive extension up to the western side of the freeway. This access track is also located within the firebreak along the southern boundary fence of the pipe corridors except near the western end where the pipe route deviates to avoid the sand ridge which is considered of some ethnographic significance. Consideration will be given to the methods of preventing a "straight-through" sight along the pipe route at Connolly Drive and the future freeway extension. Boom gates or similar access control mechanism will be installed at ends of the corridors.

6.6.3 Access to Pond

Access to the first pond will be via the proposed access road within the site to the pipe corridor and then a bitumen lined earth ramp along the west embankment of the pond. This access will be incorporated as part of the earth embankment of the pond. Refers Figure 7.2.

6.6.4 Access to Sump

Access to the sump will be via the proposed access road and an existing track and an extension to this track as shown in Figure 7.2. Access to the sump will not be sealed.

7.0 CONSTRUCTION

Construction of the reservoir storage involves the following main activities

- clearing
- foundation improvement
- embankment earthworks
- concrete works
- roofing
- pipeworks
- re-vegetation and rehabilitation

Only one pond is proposed to be constructed initially (by end 1995). However excavation will be carried out in the future pond No.2 for construction of the proposed pond No.1 The above works will be carried out such that the disturbed areas within the whole reservoir site will be kept to the minimum possible.

Pre-construction ground investigation drilling was necessary to assess the ground condition. This was approved in September 1993 after on-site discussion with EPA and CALM on the understanding that clearing would be minimum required to conduct the work and that the existing tracks be used where possible. The drill holes locations are shown in Figure 7.1.

7.1 CLEARING

7.1.1 Ground Investigation Clearing

Clearing of vegetation was required to allow the carrying out of survey to locate the pre-construction geotechnical drill holes and construction of the first pond and other permanent works. The Authority intends to carry out minimum clearing that is compatible with proper construction technics.

A field error was made in the survey of the baseline for the pre-construction drill holes and the over-generous widths in clearing the lines of sights have resulted in some damage being done outside the area of the ponds.

In order to rectify the problem the Authority will carry out revegetation of these cleared tracks outside the areas of pond 1 and future pond 2. Those cleared tracks within the future pond 2 area will be treated as part of future pond 2 as in Clause 8.1.2.

7.1.2 Clearing will also be required to allow construction of pond 1 and other permanent works. The extent of necessary clearing will depend on the method of construction of the earthworks which will have a significant cost impact on the project. Two scenarios, detailed below, are possible and the cost impact is depending on the percentage of rock in the in-situ materials.

Scenario A - Construct pond 1 using imported granular material similar to that exist on site. This scenario assumes the necessary fill materials, approximately 110 000m³, would be imported from external source(s). This scenario requires approximately 6.5 ha to be cleared and widening of at least two more existing tracks for earth moving equipment to work within a close-circuit manoeuvre between pond 1 and the sump. Construction of two earth ramps, one of which will be removed after completion of the earthworks. This scenario also cost $600,000 more, in nett present value comparison, than Scenario B. The initial stage fencing on the north side of the pond would be along the cleared survey track containing drill holes 3/93 and 5/93 (Refers to Figures 7.1 & 7.2). Areas within the fenced compound for this scenario but outside the embankment would be revegetated.

Scenario B - construct pond 1 using on-site granular material derived from the excavation of the future pond 2

For this scenario approximately 10.5 Ha of clearing would be required.. Subject to there being no more than 10% of unusable materials (e.g. rock) clearing would be confined to within the areas of the two ponds, and no importation of granular materials would be necessary for the construction of the embankment of pond 1. The excavation level of pond 2 would be at approximately RL 70. Vehicular access to the pond would be along the existing tracks and the pipeline corridor on the south-west of the site. The extent of fencing and rehabilitation are as shown in Figure 7.3. The excavated area for pond 2 would be spread with top soil from stockpiles and seeded for a low vegetation of indigenous shrubs. This scenario is comparatively cheaper by $600,000, on long term cost, than scenario A. This is the favoured scenario.

Should the quantity of un-useable material (eg. rock) from the excavation of the areas prove to be significantly higher than assessed, some granular backfill material approved by CALM will be necessary.

For both scenarios A and B the proposed sump access is common and is shown in Figure 7.3.

Scenario B will be adopted as the construction method for the following reasons:

- The 'major earthwork is confined to within fenced areas thus eliminating the risk of disturbance to other areas.
- It cost less than scenario A in capital cost and long term cost.
- Minimum materials to be disposed of (except for excavated rock) as felled timber could be burnt within the larger area of pond 1 and pond 2.
- Top soil stripped from pond 1 could be retained and re-used in pond 2 and other erroneously cleared tracks for re-vegetation purposes.
- Defer the importation of large quantity of granular backfill material and extra expenditure till 2007 when pond 2 is needed.

- Though larger clearing area is involved, the end result of an intended buffer re-vegetation would provide an effective screening for the area of pond 2.

- Gives better flexibility in the construction of storage.

- Allow excavated soil from pipeline construction to be stockpiled and used in Pond 2.

An eight metre wide clearing for the pipe construction along the pipeline corridor will be required to construct the pipelines.

Nominal clearing may be required to allow the construction/upgrade of the proposed access track to and within the Water Reserve.

All areas cleared will be stripped of 300mm of top soil which will be stockpiled within the cleared survey tracks initially and finally within the cleared pond area.

Tree stumps, roots, trunks and branches of hardwood will be burnt when the meteorological and atmospheric conditions are suitable to do so. This would be closely liaise with CALM. Open burning will only be carried out when concurrence is obtained from the City of Wanneroo, CALM, EPA and/or the Fire Brigade Board.

7.2 FOUNDATION IMPROVEMENT

The area within the proposed pond 1 will require to be improved prior to the construction of the pond lining and roof structures. Improvement entails the densification of the existing sub-surface soil structure to an acceptable standard. This is envisaged to be by excavating the ground to an approximate depth of 4-5m and replace with compacted materials from the excavation of pond 1 and pond 2. It is not anticipated that this process will cause any dust problem as wetting with water will be required in the process.

Any unusable material for backfilling will be disposed off site to an approved site, eg. Tamala park refuse depot.

7.3 EMBANKMENT EARTHWORKS

Earth embankment will be constructed to the approximate size and shape of the pond with either suitable excavated materials and/or granular material imported from an external source. Any materials imported from an external source will be tested by CALM to be free of dieback disease. The earth embankment construction is assessed to be constructed over a six month period. No dust problem is anticipated as soil wetting will be required in the construction process.

Should the importation of materials be required a minor impact may arise from haulage of imported materials for the embankment construction during the embankment construction period. This is limited to a small area on the north east corner of Currambine and if warranted haulage traffic will be directed to use the proposed alignment of Burns Beach Road east of the reservoir site access track, subject to approval of the City of Wanneroo.

7.4 CONCRETE WORKS

Concrete lining of the pond, supports for the roof framings, and associated valve pits etc will be constructed using ready mixed concrete supplied to site on mixer trucks. Any surplus or rejected concrete will be disposed of at designated locations within pond 2 as will the washing down of all concrete trucks and other construction equipment. These locations will be subject to checking for compliance for environmental hygiene and rehabilitated as appropriate at the end of the construction.

No interruption to the local traffic is envisaged from this activity as the concrete casting rate is not likely to result in demands of large quantities within a short time duration.

7.5 WATER AND POWER SUPPLIES FOR CONSTRUCTION

Water Supply for construction will be supplied by constructing a water bore if this proves to be economical. Alternatively, water could be supplied form a connection to the Water Authority reticulation system for the construction of earthworks, concrete works, and for the hygiene requirements of the construction personnel.

Power supply for construction will be by portable generator sets which will comply with DOSHWA requirements for noise abatement.

7.6 ROOFING

A metal roofing and walling in colorbond River Gum or Mist Green finish is included in this project to protect the water quality. The roof has a slope of 3° and should not impose an undue visual impact in the long term although it is visible on high ground from the south (Currumbine) and south west (Kinross). In the short term prior to the revegetation taking effect and during the construction period a uniform skyline would be seen but this would give way to a non uniform silhouette eventually. (Refers to Figure 8.1) Again no interruption to the local traffic is envisaged by roofing construction activities.

7.7 PIPEWORKS

3 pipelines of diameter ranging from 1000mm to 1200mm will be required ultimately for the project. Two of these will be the outlet mains from the ponds. These outlet mains will be constructed separately and staged when the first pipe becomes fully utilised. Economically it is not justifiable to construct the two outlet pipelines together. As stated previously all pipework is below ground when installed. As such there is no interruption to the local traffic nor any visual impact. Pipes haulage from the manufacturer to site will be co-ordinated such that it will not disturb the environment and the residential areas. Traffic density arising from pipe delivery is assessed to be light.

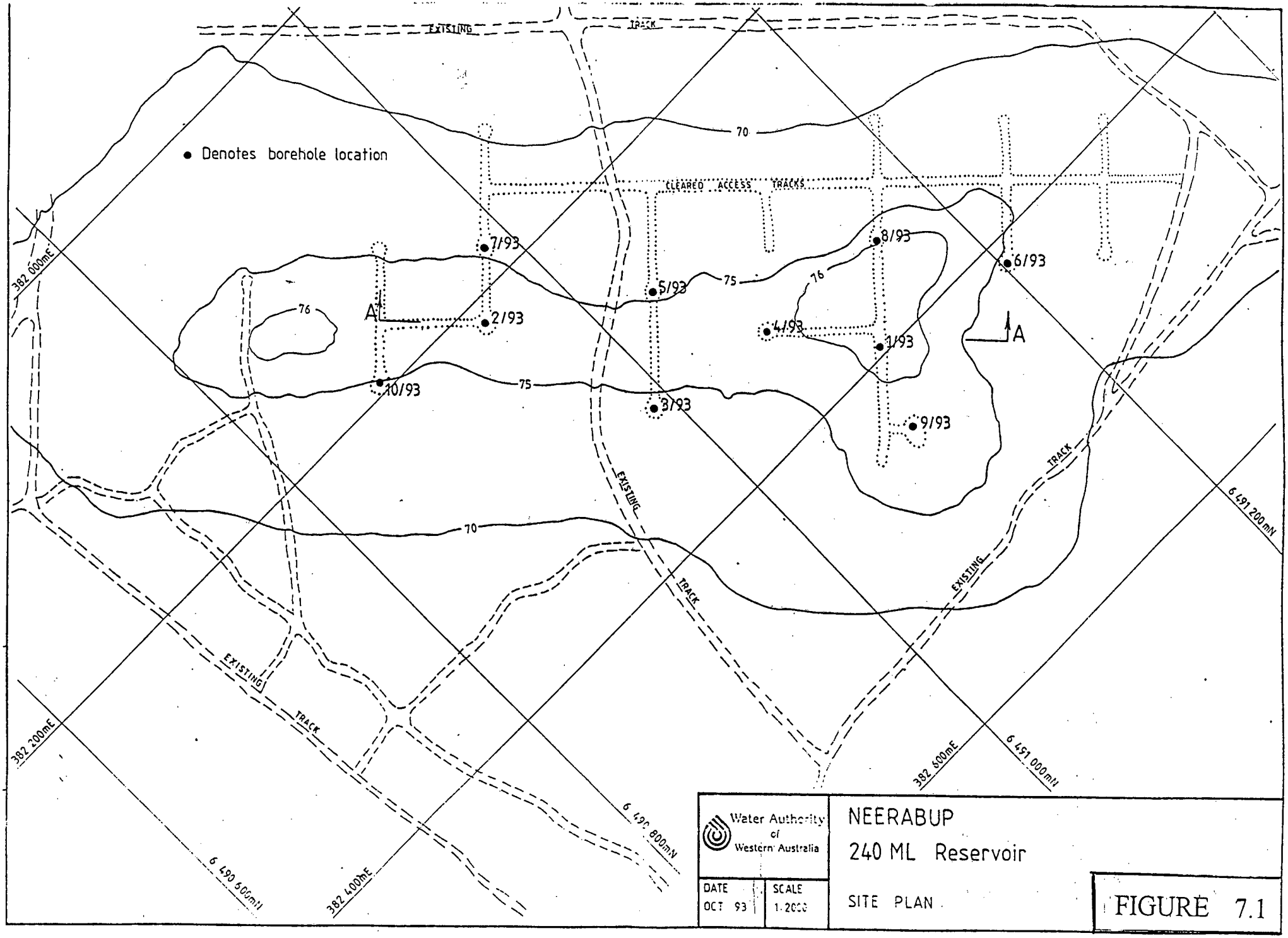
7.8 REVEGETATION AND REHABILITATION

Revegetation is proposed for the disturbed area outside the pond surrounds with the exception of the fire break and access track within the pipe corridors. Revegetation will also be carried out on the outside slope of the embankment. This will be by means of seeding the slope with appropriate indigenous species to aim at quick regeneration and harmony with the local plant community as well as effective restoration of the silhouette. However planting will need to take into account the importance of avoiding tree-root penetration into the pond interior. Subject to confirmation of its cost effectiveness on-site mulching using locally cleared vegetation may be considered for the embankment slopes to achieve a fast visual enhancement on the slopes.

Revegetation and rehabilitation will be carried out in liaison with and based on the advice of CALM and EPA. The following plants, as advised by CALM, will be planted:

- *Macrozamia riedlei*
- *Jacksonia sternbergiana*
- *Dryandra sessilis*
- *Hibbertia hypericoides*
- *Allocasuarina fraseriana*
- *Acacia saligna*
- *Hakea prostrata*
- *Acacia pulchella*

The distribution and location of these plants will be discussed with CALM so that the most beneficial result is achieved.


EXISTING
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70
Denotes borehole location
CLEARED ACCESS TRACKS
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4/93
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382 200mE
382 400mE
382 600mE
6 491 200mN
6 491 000mN
6 490 800mN
6 490 600mN
EXISTING
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Water Authority of Western Australia
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240 ML Reservoir
SITE PLAN
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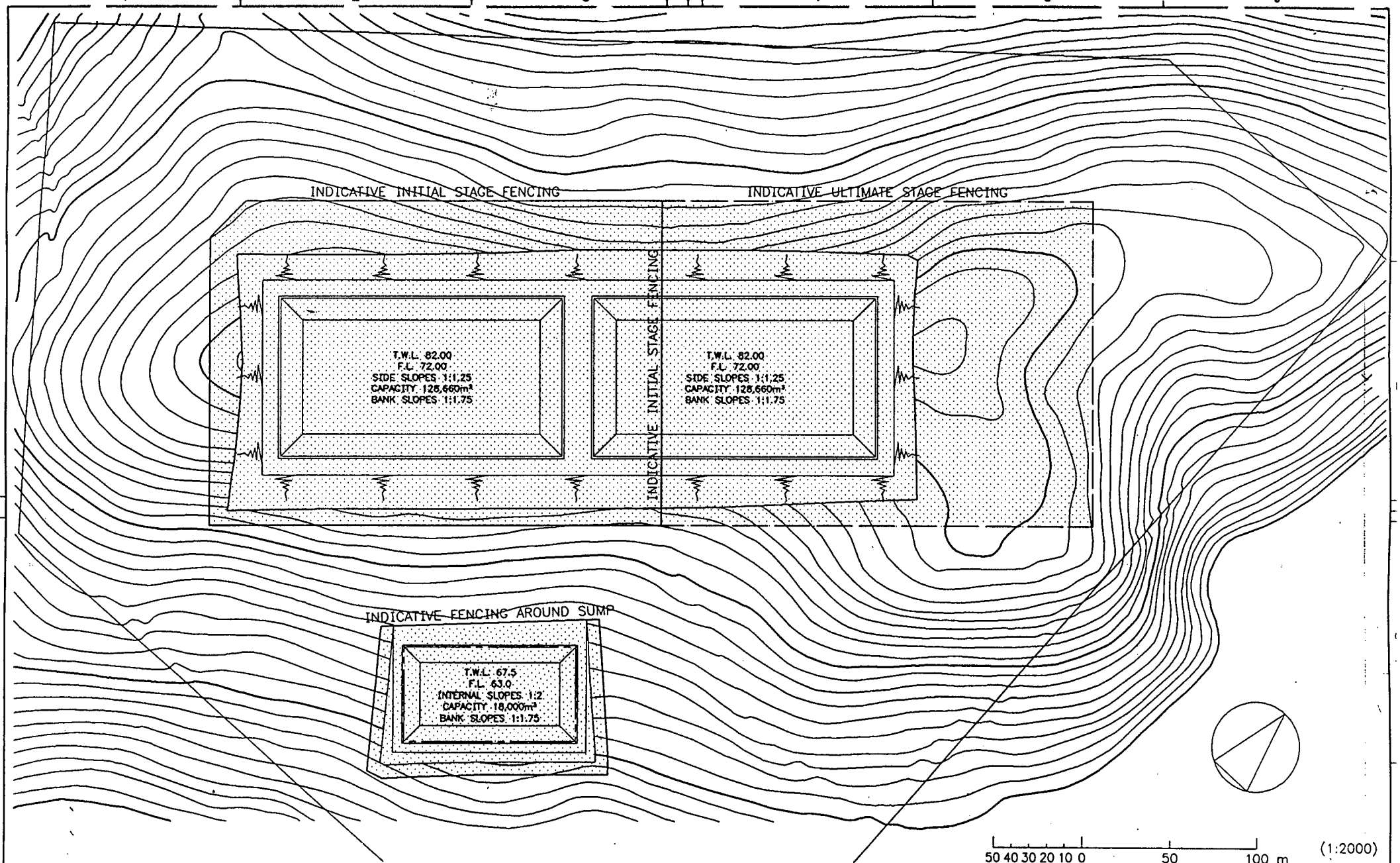
FIGURE 7.1



DES REF DATE DRN K.BOSMAN CHD	Product of Water Supply Planning & Design Branch	RECOMMENDED ENGINEER APPROVED MANAGER W.S. PLANNING & DESIGN	Water Authority of Western Australia	METROPOLITAN WATER SUPPLY NEERABUP RESERVOIR SITE PLAN – FENCING		ORIGINAL SHEET SIZE A3
				FILE	PROJECT	PLAN FIGURE 7.2 CAD ISSUE A MF

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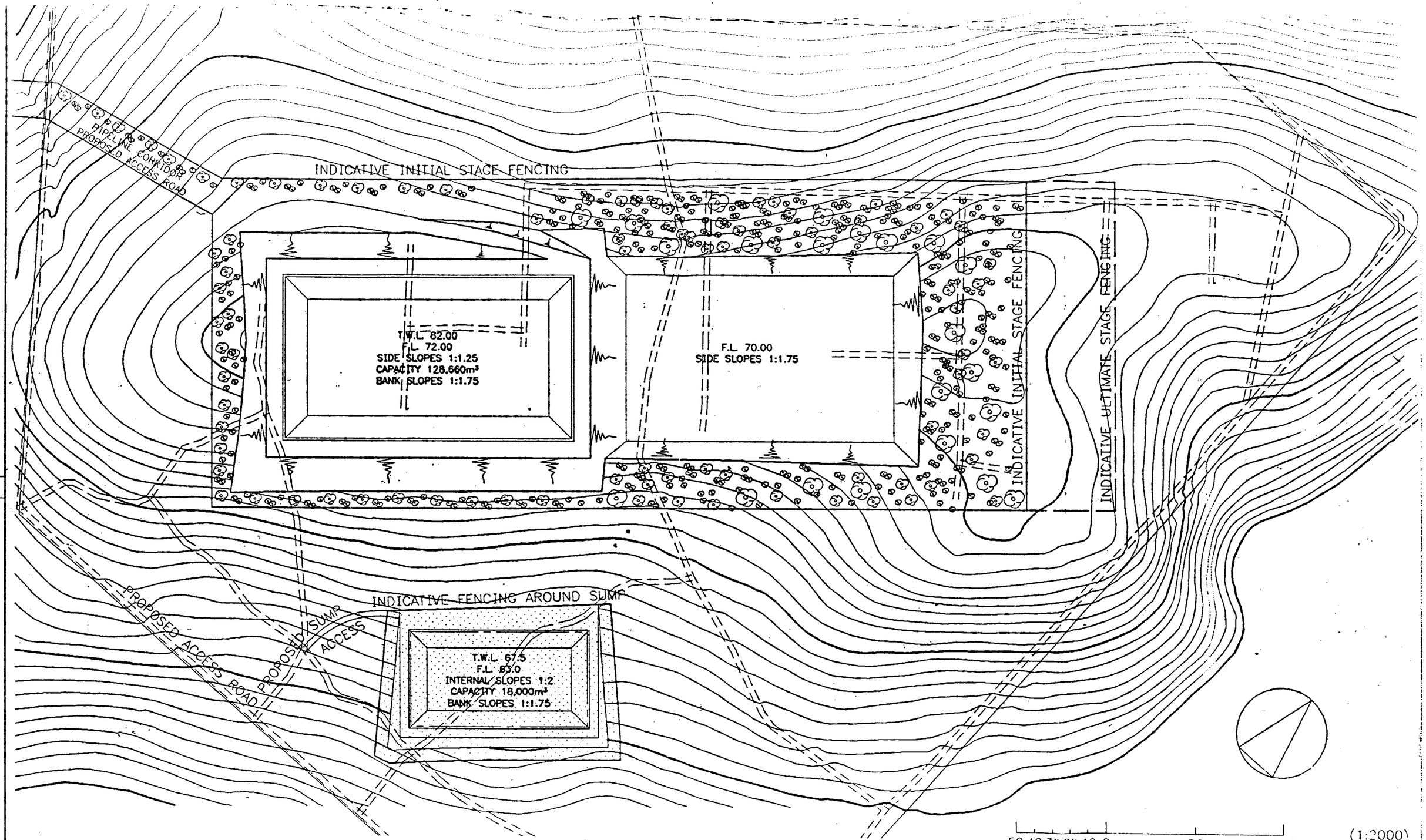

DES REF DATE DRN K.BOSMAN CHD	Product of Water Supply Planning & Design Branch	RECOMMENDED PROPERTY APPROVED MANAGER W.S. PLANNING & DESIGN	Water Authority of Western Australia	METROPOLITAN WATER SUPPLY NEERABUP RESERVOIR SITE PLAN - FENCING		ORIGINAL SHEET SIZE A3
				FILE	PROJECT	PLAN CAD FIGURE 7.3 ISSUE A MI

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8.0 ENVIRONMENTAL IMPACT AND MANAGEMENT

8.1 LAND CLEARING

8.1.1 Impact

Of the Water Reserve area of 29.6 Ha approximately (not including area for the access road reserve), about 12 Ha in total will need to be cleared for construction of pond 1 and associated works. The area occupied by the future pond 2 will require to be cleared again in year 2007 for construction of the second pond.

8.1.2 Management

Every effort will be made to minimise the land clearing. This will be reflected in the works specification which will be strenuously policed.

Burning will be carried out when the meteorological and atmospheric conditions are safe and conducive, and only with the concurrence of CALM, EPA, City of Wanneroo , and/or Fire Brigade Board

Rehabilitation of the embankment slopes and the cleared land that is not occupied by the pond 1 and the future pond 2 will be planned with advice of CALM and put into effect as soon as practicable. Revegetation will be based on the use of indigenous species from either seeds collected from the felled vegetation, mulching or other means using the plant list in clause 7.8.

Rehabilitation of the cleared pond 2 area will be effected by replacement of top soil to encourage regeneration of low vegetation. Light seeding of indigenous shrubs will be effected if considered necessary by CALM and EPA.

8.2 FLORA & FAUNA

8.2.1 Impact

Since slightly less than half of the Water Reserve is disrupted land clearing is not likely to cause any loss of flora and fauna species in the region as a whole. There will be a temporary migration of some of the fauna to outside the site. No flora species will be lost as these are found in other parts within the region.

8.2.2 Management

The management action proposed in clause 8.1.2 will ensure proper rehabilitation of the disrupted areas. Security fences surrounding the construction of the pond and the sump will provide protection of the wild life from construction machinery. Likewise these surrounding fences will secure the ponds from wild life incursion during their operational life. As well, development of the reservoir site will be kept away from the Northern sector so that the risk of disturbance to uncommon birdlife is minimised.

8.3 JARRAH DIEBACK CONTROL

8.3.1 Impact

The adoption of Scenario B for earth works construction for pond 1 as described in Clause 7.1.2 has deferred the need to import large quantity of suitable fill material onto the site until year 2007 when pond 2 is planned to be constructed, provided the amount of un-useable materials (eg rock) is less than 20% approximately. Importation of suitable granular material similar to that on site would be required for economic reasons if this proportion is exceeded. At present jarrah dieback disease is not known to be present within the site. The introduction of materials from external sources and uncontrolled vehicular traffic present a risk of introducing the disease to the area.

8.3.2 Management

Discussion to date with CALM suggests that the risk of die-back disease being brought into the area can be confidently mitigated through a stringent CALM inspection and testing of the material sources prior to and during the material transfer. As well, strict dieback control hygiene practices will be enforced. These will be augmented by limiting vehicular access to site to the minimum practical number, by washing down machinery and vehicles authorised for entry, by controlling the disposal of material to designated areas outside the site.

All the above proposed management action will be put into effect for the construction of the reservoir as well as the pipelines.

For post-construction authorised vehicular access to the reservoir, appropriate CALM procedures will be used as guidance for Water Authority personnel to manage the risk.

8.4 VISUAL IMPACT

8.4.1 Impact

The proposed earth embankments for the ponds are required to be approximately 7 metres above the general level of the surrounding ground for hydraulic reasons. The apex of the reservoir roof is 3.6 metres above the embankment. When constructed these will be visible from the high ground at Currumbine, Kinross, Burns Beach and Neerabup east at Carramar Road.

All pipelines will be constructed below ground and therefore will not present a major impact.

8.4.2 Management

Visual impact due to the metal roof and wall cladding will be reduced by:

- keeping the wall sheet as short as possible. In this case the side wall extends only to about 1 metre above the embankment level. The gable wall height varies to a maximum of 3.6m due to the roof slope.

- keeping the roof slope to 3°. This is the minimum required for water shedding purposes.

- using a River Gum or Mist Green colorbond finished roof and wall sheets to blend in with the native vegetation and eliminate any glare from the metal cladding.

Visual impact due to the newly constructed earth embankment slope will be minimised by seeding the earth embankment with native seeds at the earliest opportunity after earthworks are completed. If mulching using insitu material is economically permissible this could be employed to shorten the period over which the embankment would appear as "bare". Planting of indigenous species in strategic locations will finally result in an acceptable silhouette. .

For this reason as well as for economic reasons the reservoir option is the recommended option in preference over the tank option. Figures 8.1 and 8.2 are computer simulated visual impact comparison of the Reservoir option and Tank option respectively. Figure 8.3 shows a superimposed reservoir and tank presentation for comparison purposes. These presentations are based on viewing from the Water Tower Park, Joondalup and are based on the presence of existing vegetation on the site.

8.5 DUST AND NOISE

8.5.1 Impact

As stated in Clause 7.3 little impact is likely to arise from the project with respect to dust. Although no testing has been carried out at this stage on the effect of noise there does not appear to be sufficient evidence for this to impact on the environment significantly, since as stated in Clause 8.2.2 construction activity will be kept away from the northern sector as much as possible.

8.5.2 Management

Notwithstanding this perception the Water Authority will take actions necessary to keep the noise level within that permissible under DOSHWA Regulations and By-Laws.

8.6 SOCIAL IMPACT

8.6.1 Impact

The reservoir site is located next to the Neerabup National Park and is being used by local community for bush walks and passive recreation purposes. Construction of the reservoir pond will cause some disruption to these users. However only half of the area within the reservoir site is affected during the construction stage, and less than half will be lost for these purposes on fencing the reservoir compound.

As stated in Clause 7.3 road haulage traffic may cause minor disruption to local traffic and/or local activities.

8.6.2 Management

Access by local residents and communities to part of the reservoir site will be maintained both during and after construction of the reservoir. After construction the pond and sump will be fenced of at the base of the embankment for security purposes and to allow for maintenance of a fire break around the reservoir. Black plastic coated link mesh security fencing will be installed to maintain a pleasant environment. No restriction will be placed on public pedestrian access on any area outside the fenced reservoir area or the pipeline corridors. To this end a bitumen access road which prohibits unauthorised vehicular traffic will enhance the use of the area by local community.

With respect to the impact from haulage traffic and in the event a large quantity of import material is required, close liaison will be held with the City of Wanneroo in the planning of the haulage route so that any disturbance will be minimised.

8.7 MANAGEMENT OF WATER RESERVES AND PIPE CORRIDORS

8.7.1 Impact

Perhaps the most concerning aspect, from the local community's point of view, is that the water reserve and pipe corridors within the Neerabup National Park having been developed with ponds and pipelines respectively, would lose its natural character and become alien to the adjoining Neerabup National Park.

8.7.2 Management

In recognition of the need to conserve natural heritage, the Water Authority has agreed to CALM managing the Water Reserves outside the fenced area of the ponds as for the adjoining Neerabup National Park. The agreement will include fire breaks and other necessary action as an integral part of the management for the Neerabup National Park.

NEERABUP RESERVOIR SITE - OPTION 1 RESERVOIRS

Water Authority of Western Australia

VIEW FROM WATER TOWER PARK - JOONDALUP

PRODUCED BY G STALLARD
WWP & D BRANCH - DEC '93
FOR WSP & D BRANCH

FIGURE 8.1

NEERABUP RESERVOIR SITE - OPTION 2 TANKS

Water Authority of Western Australia

VIEW FROM WATER TOWER PARK - JOONDALUP

PRODUCED BY G STALLARD
WWP & D BRANCH - DEC '93
FOR WSP & D BRANCH

FIGURE 8.2

NEERABUP RESERVOIR SITE - COMPARATIVE VIEWS

Water Authority of Western Australia

VIEW FROM WATER TOWER PARK - JOONDALUP

PRODUCED BY G STALLARD
WWP & D BRANCH - DEC '93
FOR WSP & D BRANCH

FIGURE 8.3

9.0 SUMMARY OF COMMITMENTS BY THE WATER AUTHORITY

The Water Authority will undertake the following commitments:

9.1 Rehabilitate those area within Water Reserve ↑34537, and the Neerabup National Park cleared for the investigation and construction of the project by the Water Authority, which are:

- more than 15 metres from the pond roof lines or to the top of the outside embankment slope;
- more than 3 metres either side of the pond security fence
- more than 3 metres outside the sump fence lines
- more than 3 metres outside the pipeline access track or furthest pipeline from the fence;
- more than 4 metres outside the main access road in Water Reserve ↑34537

Rehabilitation will be carried out in accordance with programme developed in conjunction with CALM. These will be carried out as soon as practicable after the construction of earthworks.

9.2 Consult with CALM before clearing commences on the need to save and relocate certain plants which may be deemed practical and worthwhile saving from clearing.

9.3 In conjunction with CALM establish prior to commencement of earthwork external sources of suitable granular material that is free of Jarrah die-back infection. The Water Authority will only import materials from these source(s).

9.4 In conjunction with CALM, develop prior to commencement of clearing a jarrah die back prevention management plan and to put into effect procedures to prevent introduction of the infection during and after the construction.

9.5 An agreement will be made with CALM for the management of the unfenced areas of Water Reserve 34537 and the pipeline reserve within the Neerabup National Park including annual fire breaks as an integral part of the Neerabup National Park management plan.

9.6 Power supply to the reservoir facilities will be installed underground. This work will be carried out during the construction phase.

9.7 Liaise with the Wanneroo City Council prior to commencement of earthworks construction to establish an acceptable arrangement for vehicular traffic access from Burns Beach Road to the reservoir site.

9.8 The roof and wall cladding and accessories for the reservoir roof will be constructed of steel in either "Mist Green" or "River Gum" finish.

9.9 Except for the fenced off areas for the pond and sump, Water Reserve ↑34537 will be left accessible by the public on foot.

9.10 Boom gates will be installed to secure the Reserve from public vehicles. Gate keys will be made available to CALM.

10.0 CONCLUSION

10.1 The growth rate in the Northwest Corridor which has been planned by the MRPA and DPUD in conjunction with all other affected authorities and local governments, and supported by the State Government of Western Australia, dictates that adequate water services to an acceptable standard will be required by end 1995. The Water Authority has taken on this commitment to supply an adequate water services to residential, commercial communities and all other communities from Neerabup for both economical and environmental reasons.

10.2 The Water Authority proposes that a pond, 128ML capacity, be constructed at Water Reserve ↑34537, by end 1995. A second pond will be constructed in 2007.

10.3 The Water Authority is well aware of the probable impact of the project and undertakes to protect the environment as addressed in, and in accordance with Section 9.0 of this report. It believes the project is viable and the adverse impact can be minimised by the responsible action it is committed to in bringing about the satisfactory balanced approach as expected by the community.

GLOSSARY

CALM	Department of Conservation and Land Management
DOSHWA	Department of Occupational Health Safety and Welfare
DPUD	Department of Planning and Urban Development
EPA	Environmental Protection Authority
MRPA	Metropolitan Regional Planning Authority
QRERG	Quinns Rocks Environmental Research Group
AHD	Australian Height Datum
RL	Reduced Level - refers to elevation of a location relative to a fixed datum.
SMSL	State Mean Sea Level

REFERENCES

1. "Planning Structure for the North-West Corridor" October 1977. The Metropolitan Region Planning Authority, Perth Western Australia.

2. "Conservation Reserves for Western Australia as Recommended by the Environmental Protection Authority - 1983. The Darling System - System 6 Part I : General Principles and Recommendations" Department of Conservation and Environment Western Australia.

3. "Conservation Reserves for Western Australia as Recommended by the Environmental Protection Authority - 1983. The Darling System - System 6 Part II: Recommendations for Specific Localities". Department of Conservation and Environment, Western Australia.

4. "Botanical Studies in Neerabup National Park (A 27575) and Water Supply Reserve (34537, 9538)" - E.M. Mattiske & Associates.

5. "Fauna Studies in Water Supply Reserve 34537, Adjacent to Neerabup National Park" - Dept of Conservation and Land Management.

6. "Aboriginal Site Survey. Report on an Ethnographic and Archaeological Survey at Neerabup Reservoir, Pipeline and Access Reserve" - Barbara Dobson, Ken Macintyre, Jacqueline Harris and Gary Quartermaine.

7. "Red Book Status Report (1993) Report 15 On The Implementation of Conservation of Reserves for Western Australia" - Environmental Protection Authority Western Australia.

8. "Planning Structure for The North-West Corridor" - The Metropolitan Region Planning Authority, Perth, Western Australia.

9. "Metroplan. A Planning Strategy for the Perth Metropolitan Region: - Department of Planning and Urban Development.

10. "North-West Corridor Structure Plan (North of Hepburn Avenue)" - March 1992 Department of Planning and Urban Development.

11. "Evaluation of The Nowergup and Neerabup Reservoir Sites for Servicing The North-West Corridor" March 1989. Water Authority of Western Australia.

12. "Carabooda-Neerabup Water Supply Scheme - Approved Design" November 1993 Water Authority of Western Australia.

APPENDIX 1

CER GUIDELINES BY EPA

CONSTRUCTION OF RESERVOIR AND ASSOCIATED PIPEWORK, WATER SUPPLY RESERVE 34537, WITHIN NEERABUP NATIONAL PARK (827)

CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES

1 Introduction

These Guidelines identify issues that should be addressed within the Consultative Environmental Review. They are not intended to be exhaustive and the proponent may consider that other issues should also be included in the document.

1.1 Purpose of an Consultative Environmental Review (CER)

The primary function of an CER is to provide the basis for the Environmental Protection Authority to provide advice to the Government (through the Minister for the Environment) on protecting the environment. An additional function is to communicate clearly with the public so that Environmental Protection Authority can obtain informed public comment. As such, environmental impact assessment is quite deliberately a public process. The CER should set out the series of decisions taken to develop this proposal at this place and time and why, and for each impact describe any environmental management steps the proponent believes would avoid, mitigate or ameliorate that impact.

The CER should focus on the major issues and anticipate the questions that members of the public will raise. Data describing the environment should be directly related to the discussion of the potential impacts of the proposal. Both should then relate directly to the actions proposed to manage those impacts.

The CER is intended to be a brief document; its purpose should be explained, and the contents should be concise and accurate as well as being readily understood by interested members of the public. Specialist information and technical description should be included where it assists in the understanding of the proposal. It may be appropriate to include ancillary or lengthy information in technical appendices. A glossary may be useful to assist the public to understand technical issues or terminology.

1.1.1 Format of the CER

It should be noted that the guidelines are not intended to convey the Authority's wishes with respect to the format of the document. Excepting a requirement for an overview summary, a summary of the commitments and some information on how to make a submission at the front of the document, the format is a matter for the proponent. The overview summary should include a brief summary of:

- salient features of the proposal;
- reasons for the proposal;
- investigations undertaken and proposed;
- alternatives considered;
- description of receiving environment;
- analysis of potential impacts and their significance;
- environmental monitoring, management, safeguards and commitments as to proposed mitigation of any significant environmental impacts; and
- conclusions.

A copy of these guidelines should appear as an appendix in the CER.

1.2 Key issues

The Environmental Protection Authority has identified the following key issues:

- relationship of proposal to existing public proposals (Eg System 6, North West Corridor planning, management of Neerabup National Park);
- visual impacts;
- flora conservation;
- impacts from provision of services (Eg access, water pipelines, power) to the site; and
- construction impacts.

It may be appropriate to refer to the geotechnical investigations to demonstrate how the Water Authority of Western Australia has managed impacts to date.

2 Guidelines to address the key issues

2.1 Relationship of proposal to community expectations

A number of documents outline community expectations for the Water Supply Reserve and the land surrounding the reserve. These documents include the System 6 Red Book, the North West Corridor Structure Plan, the Neerabup National Park Management Plan (currently in preparation) and Department of Land Administration reserve purposes and vestings.

The relationship of this proposal and its inter-relationship to these documents should be described.

Measures proposed to ensure community expectations are met should be outlined.

2.2 Visual impacts

The visual impacts of the preferred proposal should be analysed.

Particular reference should be made to impacts from vantage points (if any) within Neerabup National Park. The visual impacts from vantage points outside the park should be also considered.

Measures proposed to reduce visual impacts should be described.

2.3 Flora

The regional significance of vegetation communities which would need to be cleared should be briefly described.

The following issues should also be considered;

- preventing introduction and spread of dieback;
- weeds, with particular reference to measures to ensure introduced plant species which could become weeds in Neerabup National Park are not introduced;
- techniques and species used for rehabilitation of cleared areas;
- the status of vegetation on and adjacent to the water supply reserve in terms of fire frequency; and
- minimisation of clearing requirements associated with construction of proposed water storage facilities, pipelines and other services such as access roads.

2.4 Impacts from provision of services (Eg access, water pipelines, power) to the site

The proposed services to be provided to the site should be described, with particular reference to the proposed route and potential for adverse impacts. The document should make reference to measures proposed to manage impacts as already discussed at the on-site meeting held on 16 August 1993 (Eg. Access onto access roads within the reserve being restricted to Water Authority personnel; power likely to be underground for reasons including reduced fire hazard and visual impact etc).

Particular reference should be made to the pipeline proposed to be constructed through Neerabup National Park, and to the control of vehicular access on roads and cleared areas. Measures to ensure the site is adequately rehabilitated should be described.

2.5 Construction impacts.

Construction impacts and their management should be outlined. Construction impacts include dust, noise, litter and spoil management from trenching operations.

Other issues current during the construction phase, such as maintaining site security during construction (to prevent illegal firewood gathering) and ensuring clearing occurs as only proposed, should be discussed.

3 Evaluation of alternatives

A discussion of alternatives should be given whenever appropriate. For example the rationale for choosing either tanks or a reservoir and for having two pipelines leaving the reservoir should be detailed.

The rationale for choosing certain alternatives should be clear.

4 Public participation and consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the Consultative Environmental Review. It should describe the activities undertaken, the dates, the groups or individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management for the proposal which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with through other departments or procedures, outside the Environmental Protection Authority process, these can be noted and referenced here.

5 Summary of commitments

The commitments being made by the proponent to protect the environment should be clearly defined and separately listed. Where an environmental problem has the potential to occur, there should be a commitment to rectify it. They should be numbered and ordered into pre, during and post construction and take the form of:

(a) **WHO** will do the work;

(b) **WHAT** the work is;

(c) **WHEN** the work will be carried out; and

(d) **TO WHOSE REQUIREMENTS** the work will be carried out.

All actionable and auditable commitments made in the body of the document should be numbered and summarised in this list.

6 References

All references used in the Consultative Environmental Review should be listed. These references need to be available to the public through normal sources.

APPENDIX 2

EXTRACT OF REPORT 13 (OCTOBER 1983)

THE DARLING SYSTEM - SYSTEM 6

PART I : General Principles and Recommendations

PART II: Recommendations for Specific Localities

Conservation Reserves

for Western Australia

as recommended by the Environmental Protection Authority — 1983

THE DARLING SYSTEM - SYSTEM 6

Part I: General Principles and Recommendations

Report 13
October, 1983

Department of Conservation and Environment
Western Australia

5.3 Regional Parks

The concept of Regional Open Space introduced to Western Australia by Stephenson and Hepburn in 1955[18] was intended to provide for the protection of open space of regional significance. They gave as examples:

i) ocean beaches
ii) rivers and their foreshores
iii) areas of landscape value
iv) picnic areas, camping rounds, tourist cabin areas etc.
v) nature reservations
vi) central parks (e.g. Kings Park, Bold Park)
vii) zoological gardens
viii) motor parkways (i.e. scenic drive areas)
ix) open country

Planning procedures such as those discussed in Chapter 4 tend to produce concentrations or nodes of open space in the more attractive areas, often connecting along such linear natural features as rivers, foreshores and beaches. The concept clearly involves private as well as public land, with National Parks often forming the core of the major concentrations of open space of regional significance (Figure 1).

There is, of course, a definitional problem of when open space is regional in character, as distinct from a local amenity. If regional, in the sense of attracting users from beyond the locality, then there is a case for external funding, whether through direct government grant or by some form of regional rating system. Whatever the means of funding adopted, there are administrative advantages in the clear recognition of the areas to which they are appropriate and applicable.

Recommendation

15. Areas identified through planning procedures as open space of regional significance should, where appropriate, be designated as Regional Parks.

5.4 Coordination of Management

Management of the system of regional open space involves both conservation and provision for public access, it requires the coordination of the activities of the government agencies and other holders of land affected, and it may call for technical advice and financial assistance to owners and managing agencies which require them. If it affects privately owned land, and our earlier Recommendation 14 suggests that it should, then it implies constraints on development or incentives to ensure compatible management. It could also involve negotiation to provide managed access to private land or provision for passage through it. This is not so revolutionary as it may seem, since the public will inevitably attempt to reach attractive features, especially if in rural areas. Managed access, directed to where it will do least harm, would thus be in the interests of owners as well as the public. Again, there may be a case for financial compensation or assistance to owners in return for the acceptance of constraints or for maintenance made necessary by public use of the land.

There will be thus a variety of tenure, ownership and management agencies in a Regional Park with, in most cases, a substantial proportion of publicly owned land, some of it presently classified as National Park or recreation reserve. It will be necessary to define management objectives for each Regional Park and its component parts, designated for differing primary purposes, taking account of its role in relation to others; leading then to the identification of the most suitable managing agencies for each component, and a recognition of the need for coordination of their activities.

There would appear to be advantages in giving these functions to a body with appropriate expertise and experience on the ground. The National Parks Authority, with its capability in the management of natural areas while permitting use and enjoyment by the public, is immediately indicated.

Recommendation

16. The National Parks Authority should be given the responsibility for coordinating the planning and management of areas identified as Regional Parks, and for the following functions:
    i) the provision of technical and other advice to managing agencies and owners;
    ii) an examination of the present funding and coordination of development programmes.

These changes to the role of the National Parks Authority may require some legislative changes.

5.5 Staffing and Funding for Management

The number of staff and funds required for the management of open space areas are presently inadequate, and have also failed to grow with the increase in the amount of land set aside for this purpose. For example, in 1968 the National Parks Authority (then Board) employed about forty rangers and ancillary staff to manage 3 500 ha of National Parks. By 1982 the area of National Parks increased over a thousand fold to 4.4 million ha and was accompanied by only a doubling in staff numbers together with a decreasing trend in the discounted Treasury Grants for management purposes.

The additional roles proposed in 5.4 above for the National Parks Authority in coordinating management of regional parks and providing technical support and advice to other managers will make even further demands.

Recommendation

17. The Government should give urgent consideration to providing adequate staffing and funding for the National Parks Authority and other agencies concerned with management of parks and reserves.

Chapter 6

CONCLUSION

The main purpose of the System 6 Study was to ensure that the remaining opportunities for the conservation of natural areas in the area of System 6 were recognised, and to recommend ways and means of setting them aside for their protection after proper consideration of competing uses.

In submitting our recommendations to the Government for its consideration, we recognise the immense amount of work of those participating in the Study, not only the members of the several committees, but also all the organisations, groups, and individuals who made submissions. These submissions were always informative, and often constructive.

It has not been possible to accept all the proposals made, even some of those strongly supported by the constituent committees, and published in the Report of the Study.[1] In many cases this was because they involved broad issues of resource planning, management and inventory, properly the concern of other authorities and agencies, or under study elsewhere. Consideration of them is a matter for the type of town and country planning which we argue for in Chapter 4. In three main areas — conservation in State Forest, Land Act reservation and public planning — there are problems of lack of information for decision making, and in the means by which options for the future may be kept open.

Postponement of decisions for lack of information carries the implication that the information will be sought, so that the position will in some way be capable of resolution in the future. There are a number of areas where better inventory is required, some of which were remedied during the course of the Study with the production of the System 6 Atlas.[19]

It is recognised that inventory, particularly detailed inventory, is costly. Yet its lack, at some appropriate level of detail, may also have considerable disadvantages. A telling example of this problem is the lack of inventory for the fauna of the Darling Range. Opposition to a proposed development may be generated when intensive investigation, preceding a major project, finds species assumed to be rare because they were previously unrecorded.

A number of agencies have resource inventory responsibilities, including the Mines Department, Department of Agriculture, Forests Department, W.A. Wildlife Authority, W.A. Museum, and the Water Supply Authorities. Some coordination of their contribution to the resource data base for land use planning is probably needed. It will no doubt be a consideration during the development of the Western Australian Conservation Strategy which has the objective of integrating conservation and development.

We endorse, in principle, the Recreation Areas Strategy Plan proposed in the Study Report[1], and recommend accordingly below. It essentially is a survey of the resources available in System 6 for recreation in natural surroundings in relation to estimated demands.

Recommendations

18. A coordinating committee responsible for the land resource inventory required for planning purposes should be established.

19. A Recreation Areas Strategy Plan should be undertaken by the Department for Youth Sport and Recreation, giving priority to Systems 1, 2 and 6. It should include:

    i) a survey of the recreational resources available

    ii) an assessment of current and likely future demands.

During the Study many submissions and the recommendations of the Tourism and Recreation Committee urged fewer restrictions on the use of catchments and reservoirs for public recreation. There was also concern about potential adverse effects of water supply development, due to inundation of scenic landscapes and ecosystems by reservoirs, and the ecological consequences of lowering of water tables following groundwater extraction. However, the Western Australian Water Resources Council, a statutory body since early 1983 is now moving towards the development of broader water use policies. These include conservation and recreation as beneficial uses of water as well as the traditional ones of water supply protection and delivery. We expect that the Council will give consideration to the Green Book recommendations on recreational use of catchments and reservoirs, and its proposals for classification of river valleys on similar lines to USA's Wild and Scenic Rivers Act[20].

Finally, we restate the four main issues recognised during the Study:

- the importance of the jarrah forest ecosystem, much of it in State Forest and uncleared;
- the scarcity of uncleared land outside of the State Forest, and the consequent difficulty of finding additional land for reservation under the Land Act for conservation and public recreation;
- the importance, therefore, of public planning procedures in the form of town and country planning to provide for conservation of nature, and for public recreation in natural surroundings, outside of the system of Land Act reserves and State Forest;
- the need to provide adequate management to protect conservation, amenity and other land values, based on proper resource inventory and allocation of responsibilities.

The recommendations developed in principle here in Part I are applied in detail to a large number of specific locations in Part II.

Conservation Reserves

for Western Australia

as recommended by the
Environmental Protection Authority – 1983

THE DARLING SYSTEM – SYSTEM 6

Part II: Recommendations for Specific Localities

Report 13
October, 1983

Department of Conservation and Environment
Western Australia

M5.3 That the purpose of Reserve C33784 be amended to Conservation of Flora and Fauna, and Water, and that the Reserve be vested in the W.A. Wildlife Authority.

M5.4 That Reserve C31241 be classified as Class A.

M5.5 That the Commonwealth of Australia retain as much uncleared land within the Gingin Airfield as possible.

M6 NEERABUP NATIONAL PARK

The recommended area is situated just north of Lake Joondalup, extending along the west side of Wanneroo Road and comprises part of Reserve A27575, for National Park, and A24581, for Sanctuary for Fauna, both vested in the National Parks Authority; C33608, for Government Requirements, vested in the SEC; C21771, for Sanitary Site, not vested; part of Reserve C34537, for Water Supply, vested in the Minister for Water Resources; Reserve C13713, for Camping, and Reserves C25252 and C25253, for Quarry, all vested in the Shire of Wanneroo; Reserve C8398, for Access to Lake Nowergup, not vested; lot 4 and part of lots I, 2 and 5 (Location 1149), part of Location 1708, lots 12 and 14 (Location 998), lots 18 and 29 and part of lots 2 and 17 (Location 1370), and lot II and part of lot 9 (proposed as a caravan park) of Location 107, all privately owned freehold land (Figure 78). Most of the area has been "reserved" for Parks and Recreation under the Metropolitan Region Scheme.

Neerabup National Park is close to the Underground Water Pollution Control and Public Water Supply Areas. The coastal strip is a potential source of groundwater supply and future MWA groundwater extraction will probably affect water levels. There are SEC lines in the area, and water mains and gas pipelines are proposed. The proposed Neerabup Reservoir may affect the area. There are proposals to adjust the boundaries of the Park to allow the Mitchell Freeway to run along its western boundary, and in one place it is proposed to build the Freeway within the Park. The proposed south-eastern extension of the Park has high-grade limestone potential and is covered by a number of mineral claims. The south-west area (lot 17) may be affected by a proposed rubbish disposal site which is subject to an Environmental Review and Management Programme. Lot 17 may be suitable for inclusion in the Park if it is properly rehabilitated.

The vegetation in the National Park north of Quinns Road is low woodland and open-woodland of sheoak, banksia, Christmas tree and pricklybark. There are a few patches of jarrah and one of tuart and a very diverse understorey of hakea, scrub sheoak, one-sided bottlebrush and prickly moses. Most of the heath is on an extensive area of limestone hills lying west of Wanneroo Road and comprises mainly wattle, cockies' tongues and blackboy. Reserve A24581 contains Lake Nowergup, the western part being fringed with jointed twig rush with bulrushes occurring on the northern shore. Bordering the sedgeland is woodland of flooded gum and swamp banksia. There is some low open-forest of paperbark, particularly in the south of the Reserve. The eastern and northern banks of the lake contain isolated pockets of seasonally inundated land which form an ideal habitat for birds.

Vegetation in the Park south of Quinns Road is mainly woodland of jarrah associated with sheoak, slender banksia and Menzies' banksia. There is also some open-woodland of tuart, and some limited occurrences of pricklybark and marri.

East of Lake Neerabup land has been acquired by the Crown to protect three sites of scientific and historical importance: Orchestra Shell Cave, Murray Cave, and the remains of Perth's earliest lime pits and kilns.

The area's value as a remnant of the natural landscape is enhanced by its position alongside Wanneroo Road where it is highly visible to passing motorists.

The Park is valuable in providing for recreational activities such as picnicking, walking and nature study. Recreational pressure is likely to increase as urban growth continues, the Park forming a long north-south strip which will be readily accessible to many residents of the North-West Corridor.

The area constitutes open space of regional significance (see Figure 1, Chapter 4) because of its high conservation and recreation value and its proximity to Perth residential areas.

The long narrow shape of the Park makes management difficult and in particular poses problems in the development of recreational facilities. These problems could be partially alleviated by the addition to the Park of the two areas to the south-east and south-west proposed by the MRPA for "reservation" in the North-West Corridor Planning Structure. The addition of the two areas would also give the Park improved representation of the local ecosystems.

Recommendations:

M6.1 That our general recommendations on planning and management of Regional Parks be applied to this area (see Recommendations 15 and 16, Chapter 5).

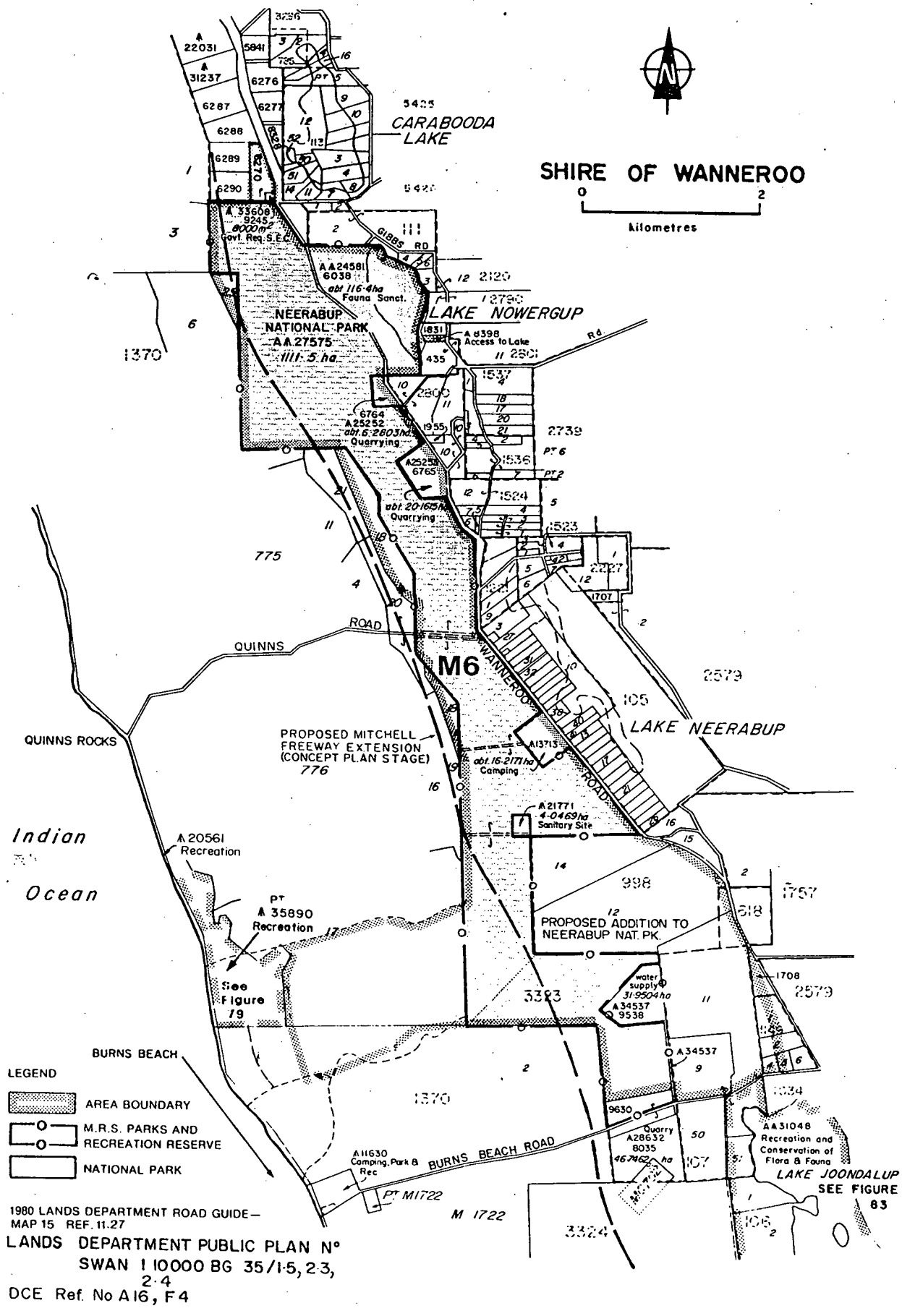

Figure 78

A2-7

M6.2 That the respective purposes of Reserves C13713, C25252 and C25253 be amended to Parkland and Water.

M6.3 That the Metropolitan Region Planning Authority consider "reserving" those portions within the recommended area not already "reserved" for Parks and Recreation under the Metropolitan Region Scheme.

M7 LAKES JOONDALUP AND GOOLLELAL

The recommended area is situated west of Wanneroo Road, is approximately 24km long with an average width of about lkm, and comprises Reserves A31048, for Recreation and Conservation of Flora and Fauna, vested in the W.A. Wildlife Authority and the Shire of Waneroo; A21708, for Protection of Flora and Fauna, not vested; and Wanneroo Estate lots 7 and 8, owned by the MRPA **(Lake Joondalup)**; Reserves C28544 and C34617, for Recreation, C32768, C33204, C33206 and C35577 for Public Recreation, and part of Reserve C834 for Camping and Recreation, all vested in the Shire of Wanneroo; and C21176, for Forestry Purposes (Pine Seed Orchard), vested in the Conservator of Forests, and lots 9 and 51 (Perthshire Location 107), part of lot 2 (Perthshire Location 106), lot I (Perthshire Location 101), lot I (Perthshire Location 108), part of Perthshire Location 109, Locations 2369 and 2512, lots 30 and 7 (Location 3154), part of Location 1513, part of lots 3 and 4, lots 73 and 505 (Wanneroo Estate lot 10), lot 34 (Wanneroo Estate lot 11), lot 25 (Wanneroo Estate lot 12), lot 4 (Wanneroo Estate lot 13) lots 34 and 35 (Wanneroo Estate lot 14), lots 20 and 22, 28, 29 (Location 1034) and lot 2 (Location 3211), all owned by the MRPA; part of Locations 9809 and 2734, part of Perthshire Location 110, lot 36 (Wanneroo Estate lot 15), lots I, 7, 8 (Wanneroo Estate lot 16), lot 26 (Wanneroo Estate lot 12), Locations 2701 and 2595, lots 31 and 40 (Location 6078), part of Location 3211, lots 23, 24, 25 (Location 1034), privately owned freehold land; part of lease MT67, and vacant Crown land **(land surrounding Lake Joondalup)**; and lots 6, 9 to 14, 23, 26, 29, 30, 37 to 40, 42 to 46, 48 to 56, 58 to 62, 64, 65, 69, 70, 72, 73, 74, 76, 80 to 82 (Perthshire Location 103), lot 15 (Perthshire Location 114) and part of Perthshire Location II4, lots I, 2, 18 to 20 (Location 587), lots 9, 10, 25, 50 and part of lots 5 to 8 and 24 (Location 709), lots 16, 17, 21, 22 and part of lot 100 (Location E1), freehold land mainly owned by the MRPA **(Lake Goollelal and surrounding land)** (Figure 79). The area is "reserved" for Parks and Recreation under the Metropolitan Region Scheme.

The area is included in the MRPA's North-West Corridor Planning Structure. The Town Planning Department has prepared a design concept for the area, which has been approved in principle by the MRPA and provides for the recreational use of Lake Goollelal and the management of the swamps and Lake Joondalup for conservation.

Water levels and vegetation in the area of Lakes Joondalup and Goollelal are likely to be affected by storm water drainage inflow and private groundwater extraction. The area will be affected by existing MWA works and possibly in the future by further works. There are also SEC lines in the area.

Lake Joondalup is a large freshwater lake. Beds of sedge occur in the lake and near its edge. The water is densely populated with benthic stoneworts. Woodland of paperbark borders fringing sedge communities and flooded gum is common in places. The wetland vegetation is surrounded by open-forest and woodland of tuart, marri, jarrah and banksia, although much of this has been cleared.

The lake is outstanding for the number and variety of water-birds it supports, including some species which are rare elsewhere in the Metropolitan Region such as the straw-necked ibis, white ibis and blue-winged shoveller. Many hundreds of birds of different species use the lake as a summer drought refuge.

Beenyup and Wallubuenup Swamps and Lake Goollelal lie to the south of Lake Joondalup and drain into it.

The area's importance for recreation is likely to increase as urban growth in the North-West Corridor continues, with available recreational activities including picnicking, walking, nature study and possibly aquatic pursuits.

The area constitutes open space of regional significance (see Figure 1, Chapter 4) because of its high conservation and recreation values and because it is a large open space resource within a rapidly growing urban corridor.

The Lake Joondalup Region Open Space Joint Management Committee is responsible for the management of the whole area. However, it is considered that both technical and financial assistance could enhance its management.

Important management considerations include: protecting wetlands and other areas of high conservation value; making recreation a priority use for Lake Goolelal; making conservation of flora and fauna a priority use for Lake Joondalup and other wetlands; and allowing only those recreational activities which are compatible with the conservation of flora and fauna.

APPENDIX 3

SUMMARY OF

BOTANTICAL STUDIES IN NEERABUP NATIONAL PARK (↑34537,9538)

COPY OF THIS REPORT IS FREELY AVAILABLE ON REQUEST TO:

MR PAN CHIANG
JOHN TONKIN WATER CENTRE
LEEDERVILLE
PH:09-420 2160

BOTANICAL STUDIES IN NEERABUP NATIONAL PARK (A^27575) AND WATER SUPPLY RESERVE (^34537, 9538)

Prepared for: Water Authority of Western Australia

Prepared by: E.M.Mattiske & Associates.

March, 1990.

1. SUMMARY

E.M.Mattiske & Associates were commissioned by the Water Authority of Western Australia to undertake botanical studies at the proposed reservoir site at Neerabup National Park (A^27575) and the Water Supply Reserve (^34537, 9538).

The Access Road (included in ^34537), the Water Supply Reserve (^34537, 9538) and the proposed Pipeline Reserve (20 metres width) were included in the survey.

A total of 38 families, 94 genera and 126 vascular plant species were recorded on the site inspections on June 26 and October 23, 1989. Of these species, 23 were introduced. It is estimated that more than 75% of the flora for the immediate areas was collected.

No gazetted rare species were recorded during the survey.

A total of 8 plant community types were defined and mapped in the survey area. The plant community types reflect the range of local soil conditions. The scrub communities were dominated by species of the families Proteaceae, Papilionaceae and Mimosaceae. Local variations in the scrub composition appeared to relate to the time since the last fires and the depth of sand over the limestone outcropping. The deeper sands support a range of woodlands and low open forests ranging from open woodlands of Tuart (*Eucalyptus gomphocephala*) on the yellow sands (particularly in areas associated with limestone at depth) to low open forests of mixed Jarrah (*Eucalyptus marginata*) - *Banksia* spp. communities on the pale-yellow (leached) sands. In general the heaths were relatively low in species richness, while the sands supported a larger number of plant species.

All plant communities are represented elsewhere in other nearby National Parks and Nature Reserves. Nevertheless there have been increasing pressures placed on Neerabup National Park. Consequently care will need to be taken in relation to the location of the proposed Pipeline Reserve and the need to minimise reduce the impact of any proposed earthworks and construction.

APPENDIX 4

SUMMARY OF

FAUNA STUDIES IN WATER SUPPLY RESERVE ↑34536,

ADJACENT TO NEERABUP NATIONAL PARK

COPY OF THIS REPORT IS FREELY AVAILABLE ON REQUEST TO:

MR PAN CHIANG
JOHN TONKIN WATER CENTRE
LEEDERVILLE
PH:09-420 2160

FAUNA STUDIES IN WATER SUPPLY RESERVE A34537, ADJACENT TO NEERABUP NATIONAL PARK.

Prepared for: Water Authority of Western Australia

Prepared by: Dept of Conservation and Land Management

October, 1993.

1. SUMMARY

The Department of Conservation and Land Management (CALM) carried out a fauna survey of reserve A34537 in October 1993 for the Water Authority of Western Australia (WAWA) . As part of CALM's wildlife survey and management role, some additional sampling was also done in an adjacent part of Neerabup National Park.

A total of two amphibian species, 11 reptile, seven mammal (three native and three introduced) and 38 bird species were recorded in the water reserve. An additional three reptile, three bird, one native and one introduced mammal species were recorded in adjacent parts of Neerabup National Park; these species probably also occur in the water reserve.

No declared rare or threatened species were found. Two bird species recorded (White-breasted Robin and Golden Whistler) are scarce to rare on the Swan Coastal Plain, and it is recommended that consideration be given to maintaining the habitat of these two species which occur in the north-eastern part of the reserve.

The vertebrate animal communities present are very similar to those known from Yanchep National Park, although more species are known from individual sites in Yanchep due to sampling in both spring and autumn.

All species recorded are represented in conservation reserves, although the White-breasted Robin and Golden Whistler may not occur in conservation reserves on the Swan Coastal Plain. Because there are increasing pressures on the habitats represented in the water reserve, it is recommended that steps are taken to minimise the effects of earthworks and construction for the proposed water supply facility.

APPENDIX 5

SUMMARY OF REPORT

ON AN

ETHNOGRAPHIC AND ARCHAEOLOGICAL SURVEY AT

NEERABUP RESERVOIR, PIPELINE AND ACCESS RESERVE

COPY OF THIS REPORT IS FREELY AVAILABLE ON REQUEST TO:

MR PAN CHIANG
JOHN TONKIN WATER CENTRE
LEEDERVILLE
PH:09-420 2160

REPORT ON AN ETHNOGRAPHIC AND ARCHAEOLOGICAL SURVEY AT NEERABUP RESERVOIR, PIPELINE AND ACCESS RESERVE

Prepared for the Water Authority of Western Australia

By Barbara Dobson, Ken Macintyre,
Jacqueline Harris and Gary Quartermaine

September, 1993

REPORT ON AN ETHNOGRAPHIC AND ARCHAEOLOGICAL SURVEY AT THE PROPOSED NEERABUP RESERVOIR, PIPELINE AND ACCESS RESERVE

ABSTRACT

An Aboriginal site survey of the proposed Neerabup Reservoir, pipeline and access reserve was commissioned by the Water Authority of Western Australia. The ethnographic component of the survey was conducted in September 1993 by Ken Macintyre and Dr Barbara Dobson for Macintyre Dobson and Associates Pty Ltd. The archaeological component of the survey was conducted in September 1993 by Jacqueline Harris for Quartermaine Consultants.

One previously recorded ethnographic/archaeological site (W.A. Museum site number S 02471) located at the western end of the Project Area was noted, and recommendations were made by the Aboriginal consultants to divert the pipeline to avoid this site. No other ethnographic or archaeological sites were located in the Project Area.