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Water Authority of Western Australia



Mt Hampton Water Supply Source

Consultative Environmental Review

Prepared in June 1993 by -

**Halpern
Glick
Maunsell**



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

This Consultative Environmental Review (CER) covers the proposal by the Water Authority of Western Australia to construct a water supply at the Mt Hampton Water & Conservation of Flora & Fauna Reserve (No. 20526), 60km south-west of Southern Cross. In accordance with the Environmental Protection Act a CER has been prepared which describes this proposal and its likely effects on the environment. The CER is available for a public review period of 4 weeks from Monday, 5th July, 1993 and closing on Monday, 2nd August, 1993.

Following 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 the submissions.

Why write a submission?

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

All submissions received by the EPA will be acknowledged. 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 thereof) may be sent to the proponent. The summary of issues raised is normally included in the EPA's assessment report. Submitters would not be identified to the proponent without the submitter's permission.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the 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 CER:

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

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

- . Attempt to list points so that the issues raised are clear. A summary of your submission is helpful.
- . Refer each point to the appropriate section, chapter or recommendation in the CER.
- . If you discuss sections of the CER, keep them distinct and separate, so there is no confusion as to which section you are considering.
- . Attach any factual information you wish to provide and give details of the source. Make sure your information is correct.

Remember to include:

- . your name
- . your address
- . date.

The closing date for submission is Monday, 2nd August, 1993

Submissions should be addressed to:

Chairman
Environmental Protection Authority
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Mr Ron Van Delft

If you have any questions on how to make a submission please phone the Project Officer, Mr Ron Van Delft on (09) 222 7079.

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1. SUMMARY AND CONCLUSIONS

A proposal to store surface runoff from a rock catchment on Mt Hampton, to provide a 'dry season' or 'emergency' water supply for farmers in the Mt Hampton area, has been scheduled for many years. This year funding is available through the Rural Water Strategy that will allow the development of the scheme. Farmers currently obtain water for several months of the year during the dry season by carting supplies from either the Goldfields and Agricultural Water Supply Scheme, 50kms or more away, or from smaller rock catchments. The largest of these is Dulyalbin Rock where water is collected in a 4,500kL storage tank. However, during drought periods some of these rock catchment sources run dry and consequently cartage distances increase. Up to twenty-eight farmers will benefit from an emergency water supply source at Mt Hampton. This is particularly important during the six week seeding period when some farmers need to cart water every day.

Mt Hampton is located 60km south-west of Southern Cross in Reserve No. 20526 which is vested with the National Parks and Nature Conservation Authority and managed for Water and Conservation of Flora and Fauna.

The construction of the Mt Hampton water supply will ultimately entail the harnessing of 18.3ha of rock catchment and the construction of a dam to create a 30,000kL capacity water storage facility. Initially only 12.6ha of rock catchment will be harnessing through the construction of rock drains, a bitumen-lined channel, a dam creating a 20,000kL capacity water storage facility, an inlet area, spillway and silt trap. An existing access track will also be upgraded.

The objective of this CER is to enable the EPA to advise the Government on the environmental acceptability of the proposed ultimate development of a water supply source at Mt Hampton. However, ultimate development of the rock catchment will be dictated by Government approval and water demand.

Construction of Stage 1 of the scheme will be completed by April/May 1994 and will be available for use during the 1994/95 summer. The estimated cost for construction of the 20,000kL dam and development of 12.6ha of rock catchment is \$550,000. As the scheme is being constructed as part of the Rural Water Strategy, it is a requirement that the local community meet one-third of construction costs, either in money or in kind.

The vegetation and flora of the project area have been described. To the west of Mt Hampton the vegetation is dominated by broombush thicket containing some *Casuarina*, *Acacia* and *Melaleuca*. A *Casuarina* thicket dominates the eastern and northern base of Mt Hampton with open grassland containing scattered *Acacia* and *Leptospermum* further out. No rare species of flora have been recorded in the Mt Hampton Reserve. Three priority species, one poorly known and two requiring monitoring, have been recorded but were not observed during the field survey.

Two species of rare fauna and three species of priority fauna are expected to occur at the Mt Hampton Reserve. None of these species were observed during the fauna survey. Prior to construction commencing a rare flora survey will be carried out in spring 1993.

At the time of the site visit three depressions on Mt Hampton contained water. The macroinvertebrate fauna were collected and identified, and determined to be typical of this type of waterbody.

An Aboriginal sites survey was conducted and no ethnographic sites of significance to living Aboriginal people were located within the boundaries of the project area. One archaeological site exists on Mt Hampton but is outside of the area that will be impacted by the development.

The potential environmental impacts of the development are described together with proposals for their management. The most significant impact relates to predicted changes in the composition of the surrounding vegetation through interruption of surface and subsurface water flow originating from Mt Hampton. The greatest impact will be on 7.3ha of *Casuarina* thicket, particularly on the eastern side, and to a lesser extent on the northern and western sides of Mt Hampton. This is predicted to change towards a grassland association containing some shrubs but fewer trees. However, 3ha of *Casuarina* thicket to the south and south-west of the rock will not be affected by the development.

In addition to the above 7.3ha, an area of 2.7ha of *Casuarina* thicket will ultimately be cleared on the eastern side of Mt Hampton to enable the dam, silt trap and bitumen-lined channel to be constructed. The area proposed for construction of the dam (2.2ha) has little understorey due to its current use by the public as a parking and picnicking area. The remaining 0.5ha is densely vegetated. All areas disturbed, that are not required for the successful operation of the scheme, will be rehabilitated with local indigenous species.

Overall the project is expected to have minimal impact on the mammals in the reserve. Water will still be available from the drains and from the numerous rock pools that occur on Mt Hampton. The greatest impact is likely to be on the frog population which abounds near the base of the rock. A reduction in water runoff will result in breeding pools being slower to fill in autumn and drying out earlier in summer. Overall it is expected that the number of frogs will decline around the base of the rock.

A number of commitments are made by the Water Authority with respect to this project.

Of significance is the development and execution of a programme to monitor changes in the structure and species composition of the vegetation surrounding Mt Hampton. No information is currently available to allow the impacts of such a development on the surrounding vegetation to be accurately determined and therefore the information collected will prove valuable in the prediction of impacts of similar future developments.

2. INTRODUCTION

2.1 BACKGROUND

Farmers in the Mt Hampton area currently obtain water from on-farm supplies for most of the year. However, for several months each year farmers must cart water from either the Goldfields and Agricultural Water Supply (G&AWS) Scheme, 50km or more away, or from small rock catchments, the largest being Dulyalbin Rock. Some farmers consider that carting water beyond 30km in one direction is excessive.

A proposal for storing surface runoff from Mt Hampton in a dam has been proposed for many years and this year there is funding available for the project as part of the State Government's Rural Water Strategy. The philosophy of the Rural Water Strategy programme is to provide a "dry season" or "emergency" water supply source in agricultural areas where "on-farm" supplies are unreliable due to climatic or soil conditions. The programme is designed to drought-proof the worst affected areas.

Mt Hampton is centrally located with respect to the farms that rely on carted water. In total twenty-eight farmers would benefit from the development of a water supply at Mt Hampton with the water being available for domestic, livestock, crop spraying and garden use.

The Central Region of the Water Authority of Western Australia (Water Authority) in conjunction with the Department of Agriculture estimate that local farmers within a 40km radius of Mt Hampton who stand to benefit directly from the new supply, will require approximately 7,000kL of water per year. This will provide a 'dry season' or 'emergency' supply for the farmers.

2.2 LOCATION

Mt Hampton is located approximately 60km south-west of Southern Cross (Figure 1) in Reserve No. 20526 managed for Water and Conservation of Flora and Fauna. The reserve is 594ha in area and has been vested in the National Parks and Nature Conservation Authority since 1974.

2.3 SCOPE OF PROPOSED PROJECT

The aim of this CER is to enable the EPA to advise the Government of the environmental acceptability of the proposed ultimate development of a water supply source at Mt Hampton. This would consist of harnessing 18.3ha of rock catchment and the construction of a dam to create a 30,000kL water storage facility.

MT. HAMPTON RESERVE

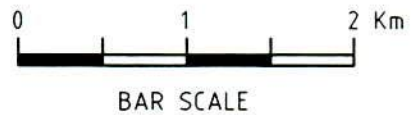
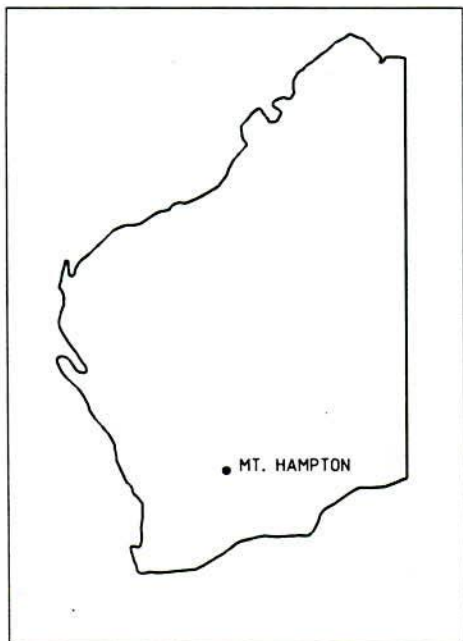


FIGURE 1
LOCATION MAP AND
ADJACENT LAND USE

Initially the construction of the water supply will consist of the following components:

- . the harnessing of 12.6ha of rock catchment through the construction of rock drains and a bitumen-lined channel on the eastern side of Mt Hampton;
- . the construction of an excavated 20,000kL water storage facility and associated inlet area, spillway, silt trap and security fence on the eastern side of Mt Hampton; and
- . upgrading of the existing access track, 860m in length, from Moorine South Road to Mt Hampton.

The future harnessing of an additional 5.7ha of catchment on the western side of the rock together with the possibility of increasing the size of the dam's storage capacity to 30,000kL would occur when the supply could no longer meet the water requirements of farmers.

Details of the project are provided in Section 5.

2.4 TIMING

The design of the dam will be completed by December 1993 and construction will commence after the harvest season in February 1994. It is expected that construction will be completed by April/May 1994. The supply would then be available for use during the 1994/95 summer.

2.5 PROPONENT

Water Authority of Western Australia
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Leederville 6007

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or

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Telephone: (090) 411 644
Facsimile: (090) 412 568

2.6 PURPOSE AND STRUCTURE OF THE CER

The purpose of this CER is to describe the proposed water supply and the existing environment in sufficient detail to allow the potential impacts of the project to be identified and assessed and to allow formulation of proposals for the mitigation and management of such impacts. Descriptions of the environment, both biological and ethnographic, are restricted to the area immediately surrounding Mt Hampton and, where necessary, these descriptions are placed in a local and regional perspective.

Section 3 of this CER outlines the need for the project and provides costs and benefits of the development. Alternative sources of water are discussed in Section 4, Section 5 describes the proposed development and Section 6 describes the existing environment. The potential environmental impacts and their management are identified in Section 7 and a list of the proponent's commitments is provided in Section 8.

EPA guidelines applicable to this CER are provided in Appendix A and flora and fauna species lists are provided in Appendices B to D.

2.7 APPROVALS PROCESS

As part of the assessment process, this CER will be made available for public review. Written submissions from interested or involved groups and from relevant Government agencies will be sought during a four week public review period. At the conclusion of the public review period the EPA will prepare a summary of submissions and provide the proponent with an opportunity to respond to the issues raised. Both the public submissions and the proponent's responses will be incorporated into the EPA's assessment of the proposal. The EPA's assessment report will provide advice to the Minister for the Environment who then sets Ministerial conditions.

In addition to obtaining approval from the Minister, under the Environmental Protection Act (1986), and from the National Parks and Nature Conservation Authority the proposal will have to comply with various other legislation including:

- . Aboriginal Heritage Act (1972-1980);
- . Conservation and Land Management Act (1984); and
- . Water Authority Act (1984).

3. NEED FOR THE DEVELOPMENT

3.1 PROJECT JUSTIFICATION

A Division of Resource Management (DRM) technical report (1988) "Problem Districts for On-Farm Water Supply in South Western Australia", produced by the Department of Agriculture, highlighted the Eastern Wheatbelt district, in which Mt Hampton is located, as a water deficient area. More recent work by the Farm Water Strategy Group shows Mt Hampton to be located in a Zone 5 geographical area, which identifies the area as being water deficient. Government strategy through its WA Drought Consultative Committee aims at providing emergency water supply sources within 40km distance of all farmers in "declared drought affected" areas to provide more reliable sources of water than that available from on-farm supplies. The 40km radii drawn on Figure 2 indicates the areas which the existing emergency sources of water can serve.

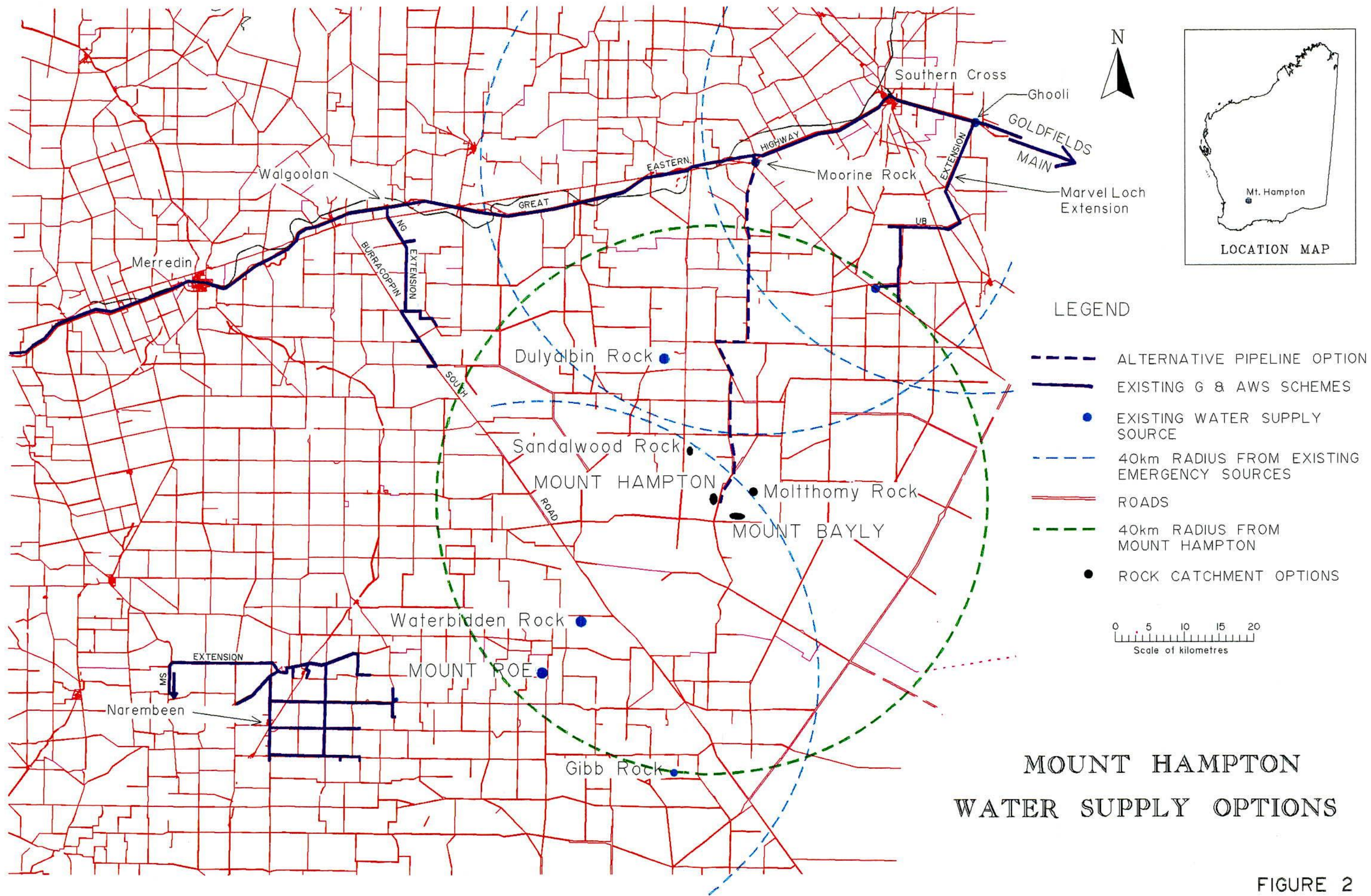
Figure 2 also shows the location of the other water supply sources available to farmers in the area during most years. However, some of these sources cannot be considered as emergency sources as they either run dry during drought periods or others, such as standpipes off the G&AWS Scheme extensions, are unable to deliver water at sufficient rates for farmers to fill their water tankers in a reasonable time. As a consequence, Mt Hampton is required to meet the farmers' water requirements particularly during drought periods.

A public meeting, held at the Mt Hampton Community Hall on the evening of 4th July 1990, unanimously supported the construction of water storage facilities at Mt Hampton bearing in mind any environmental considerations. A second public meeting was held during October 1992 at which the local community confirmed its commitment to the project and to the proposed funding arrangements (refer Section 3.2 below). Some twenty-eight farmers have now been identified as potentially benefiting from the proposal.

The Department of Agriculture has estimated that local farmers, likely to benefit directly from the Mt Hampton source, will require approximately 7,000kL of water annually.

The majority of the farming community currently cart water for several months of the year with some farmers travelling as far as 50km in one direction. Water can be obtained from the G&AWS Scheme, 50km or more away, or from smaller rock catchments. The largest of these rock catchments is Dulyalbin Rock, 20km NNW of Mt Hampton where runoff is collected in a 4,500kL storage tank. During the six-week seeding period, a round trip is required every day by some farmers. The carting of water is both time-consuming and expensive.

Mt Hampton as a water supply source is strategically located for farmers in the area who have to travel long distances to obtain water from the existing sources (Figure 2).



MOUNT HAMPTON WATER SUPPLY OPTIONS

FIGURE 2

3.2 PROJECT COSTS

To provide a safe yield of 7,000kL annually, development of the source would require the construction of a 20,000kL storage capacity dam and the harnessing of 12.6ha of rock catchment. This is estimated to cost \$550,000.

If demand for water increases, the rock catchment could be increased to 18.3ha, providing a safe yield of almost 10,000kL annually. It is estimated that this work would cost \$20,000.

If additional water was required the storage capacity of the dam could be increased to 30,000kL, providing a safe yield of 11,500kL annually. However, it is estimated that this would cost over \$200,000.

The scheme is being established as part of the Rural Water Strategy and requires that the local community meet one-third of the construction costs. This funding can be met either in money or in kind.

3.3 BENEFITS AT LOCAL AND REGIONAL LEVELS

The Mt Hampton water supply is a renewable resource which currently drains through natural water channels to the groundwater table. The benefits of the proposed dam and rock catchment is that some of this water will be harnessed to meet human and agricultural requirements.

Water from rock catchments is of high quality and is suitable for both human consumption and agricultural use. The local community would therefore benefit from a nearby, reliable, good quality water source.

At regional levels productivity from farming in this area is in the order of \$200/ha/year. A considerable amount of export income is therefore derived from the local agricultural industry.

4. EVALUATION OF ALTERNATIVES

4.1 ALTERNATIVE SOURCES OF WATER

Seven alternative proposals have been evaluated for the supply of water in the Mt Hampton area. All costs quoted in respect of each option include ongoing operating and maintenance costs.

* Groundwater

Meeting the water requirements of farmers using groundwater sources would require two duty and one standby production wells capable of pumping 40kL/day and a 200kL storage tank. Power would be obtained from the 33kVA powerline along Moorine South Road. The estimated cost would be \$450,000 which would include a groundwater investigation programme.

A site investigation by Geological Survey Western Australia, undertaken in February 1993, concluded that the possibility of obtaining a supply of groundwater with a salinity less than 1,500mg/L and a required yield of 40kL/day within 10km of Mt Hampton was poor. None of the farms surrounding Mt Hampton have wells on their properties able to abstract the rates required. Consequently it would appear that a groundwater scheme is impractical.

* Extension of the Goldfields and Agricultural Water Supply (G&AWS) Scheme

The most economical option for the provision of a water supply at Mt Hampton from the G&AWS Scheme would involve the construction of a medium density polyethylene pipeline from the Goldfields main at Moorine Rock, 50km to the north of Mt Hampton (Figure 2).

A pump station would need to be constructed at Moorine Rock and a 200kL storage tank at Mt Hampton. The estimated cost of this option, including headworks charges and ongoing operation and maintenance, is \$1.8M. The expense excludes this option from further consideration.

* Carting Water from G&AWS Scheme

It is not the Water Authority's policy to cart water from the G&AWS Scheme to storages not connected to the scheme unless the area is declared drought-affected.

* Dulyalbin Source

Water from Dulyalbin Rock, 20km NNW of Mt Hampton (Figure 2), is collected in a 4,500kL storage tank. Currently the safe yield is 3,600kL/year and this is harnessed from approximately 60% of the available rock catchment.

The further development of the Dulyalbin Rock source is considered impracticable as a stand-alone option because the maximum amount of water which could be sourced from harnessing the total catchment of this rock is only about 6,000L annually. This would only provide an additional 2,400kL annually out of a total of 7,000kL required. Hence further development of Dulyalbin Rock would not meet the farmers' water requirements.

* **Other Rock Catchments**

Other rocks in the Mt Hampton area include Sandalwood Rock, Moltthomy Rock and Mt Bayly. These rocks are all lower in elevation than Mt Hampton, have more vegetation and are also a lot smaller. As a result less runoff could be channelled into a dam and it would be more difficult and more expensive to harness runoff.

The estimated cost of constructing two 15,000kL capacity dams using two different rock catchments in the Mt Hampton district would be \$850,000. For each rock catchment an area of 9ha would be required and site investigations have shown that there are no rocks in the area that would be suitable for the purpose.

* **Paved Catchment**

The possibility of constructing a bituminised or roaded catchment in cleared farmland, to minimise environmental impacts, has been considered. However, with a mean annual rainfall of approximately 300mm, and assuming a design figure of 200mm is used to determine the safe yield, the catchment options are expensive and would require regular maintenance.

Assuming a runoff coefficient of 0.7 for a bitumen catchment, an area of 12.6ha would be required. The total cost of the catchment, dam and other infrastructure is estimated to be \$2.3M.

A roaded catchment would require 35ha of land, assuming a runoff coefficient of 0.25. It would be contoured and the channels bituminised to maximise runoff and reduce erosion of the catchment. It is estimated that it would cost \$900,000. This estimate takes into account the problems associated with roaded catchments and the turbidity level of water contained in the storage dam, particularly after a major recharge event. The estimate allows for a large silt trap, treatment plant assuming dosing with alum and caustic soda, and a 200kL detention tank. There is also the other consideration that a lot of dust could be generated as a result of a bare-earth catchment.

* **"On-Farm" Storage**

The Department of Agriculture is trying to encourage farmers to use more efficient and cheaper on-farm water supplies, such as better utilisation of roof runoff, so that the quantity of off-farm water required is reduced. This programme is achieving mixed results.

Financial assistance to individual farmers in the form of subsidised loans and grants from Government is limited and it is not Water Authority policy to fund "on farm" supplies.

As a result of previous experience of dam supplies in the area, the farmers appear to be reluctant to spend money on more dams. In a survey carried out by the Department of Agriculture in 1976/77, it was established that almost 50% of dams were dry for 25% of the time. In their survey report it was suggested that based on soil mapping, it would appear that the soil properties to the east of Mt Hampton do not have good prospects for runoff or dam sites.

The more recent DRM technical report (1988), produced by the Department of Agriculture, also highlighted this problem indicating that the area around Mt Hampton would be categorised as water deficient.

4.2 NO DEVELOPMENT OPTION

If the water supply scheme for the farmers around Mt Hampton is not constructed farmers will still have the inconvenience and expense of carting water for up to 50km for several months each year in order to meet domestic, livestock, crop spraying and garden water requirements.

4.3 THE PREFERRED OPTION

The preferred option as broadly described in Section 2.3, and detailed in Section 5, involves development of the rock catchment, a 20,000kL water storage facility, silt trap, spillway and security fence at Mt Hampton for a cost of \$550,000. This represents Stage 1 of an overall development that can be expanded to meet increased demands for water should they arise in the future. This option provides the most practicable, cost effective and socially acceptable means of achieving the desired security of water supply to farms in the area.

Of particular significance in selection of the preferred option is the capital cost of the scheme. Funding arrangements under the Rural Water Supply Scheme require one-third of the cost to be met by the local community and the Mt Hampton supply is the cheapest option. The lower the overall capital cost the less the contribution required from the community. The feasibility of the scheme is therefore closely linked to capital, operating and maintenance costs.

5. THE PROPOSED DEVELOPMENT

5.1 LAYOUT

Stage 1 of the proposal is to initially harness 12.6ha of the Mt Hampton rock catchment using concrete-walled rock drains and a bitumen-lined channel. Water will be directed into an excavated clay-lined dam of 20,000kL capacity. The proposed locations of the drains and dam are illustrated in Figure 3. The drains will be located on the eastern side of the rock and near the base of, Mt Hampton.

The dam will be located in the existing parking area on the eastern side of the rock, as determined by previous soil investigations which indicated that the depth to rock in this location was the greatest. The possibility of relocating the dam closer to Moorine South Road, to avoid clearing some of the vegetation near the base of the rock was considered. However, the site investigations have revealed that such cleared areas surrounding the rock consisted largely of exposed surface rock outcrops. This would make construction of a dam considerably more expensive with the likelihood of blasting being required.

The layout of the ultimate development is also shown in Figure 3.

5.2 CONSTRUCTION TIMETABLE

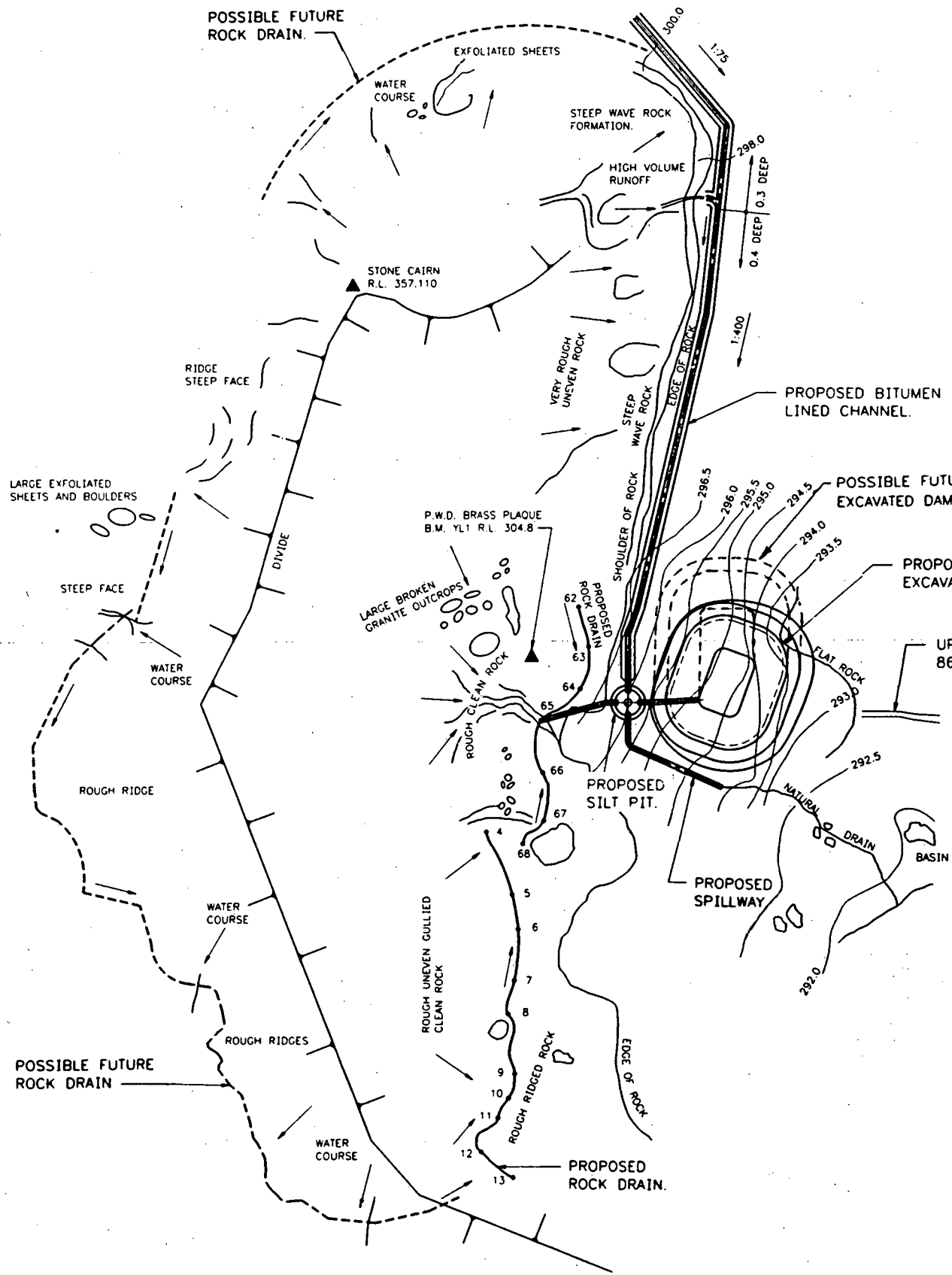
Design of Stage 1 of the water supply scheme will be finalised by December 1993 and construction will commence after the harvest season in February 1994. Construction should be completed by April/May 1994 and the supply will be available for use during the 1994/95 summer.

The timing of the ultimate development will be dictated by the demand for additional water by farmers.

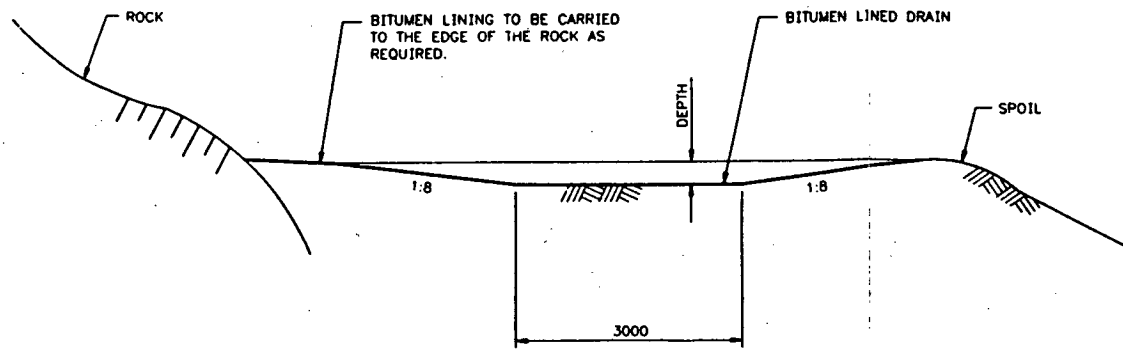
5.3 CONSTRUCTION

5.3.1 Stage 1 Development

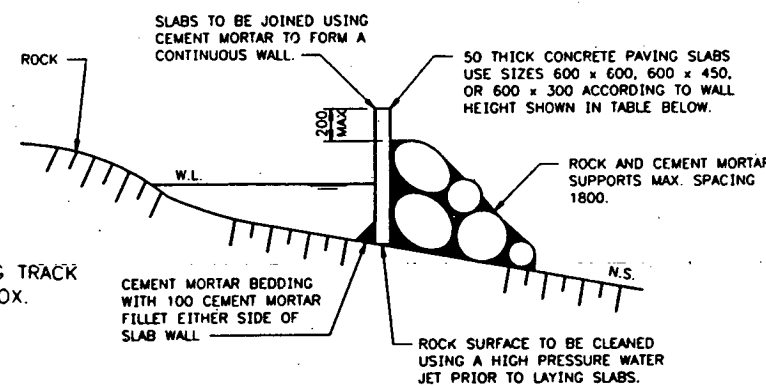
Two rock drains will be located on the south-eastern side of the rock. These will be constructed from 50mm thick concrete slabs joined with cement mortar to form a continuous wall (see Cross-Section, Figure 3). The height of the wall will vary between 300 and 600mm, depending on the location of the drains. The drains would be constructed with a cement mortar bedding and 100mm mortar fillets on either side of the slab wall. The wall will be supported by either rock and cement mortar supports or concrete slabs, spaced at a maximum of 1.8m intervals on the eastern side of the drain wall.



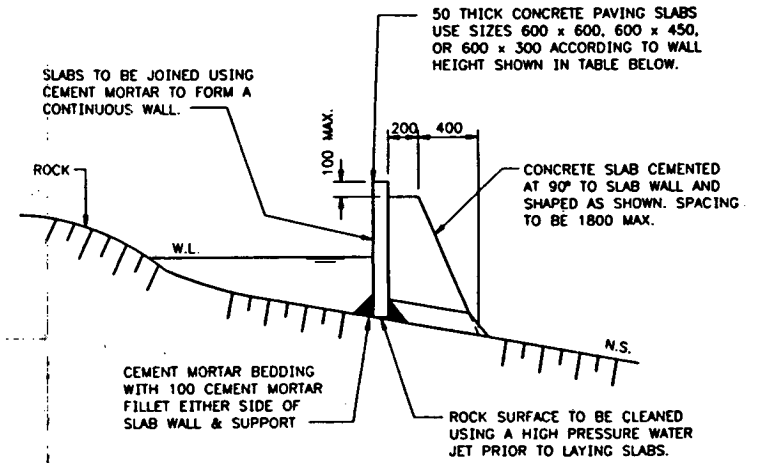
DAM AND CATCHMENT
SCALE ②



BITUMEN DRAIN - TYPICAL SECTION
SCALE ①



ALTERNATIVE 1



ALTERNATIVE 2

ROCK DRAIN - TYPICAL SECTION
DIAGRAMMATIC

STATION	TRAVERSE LENGTH (m)	DISTANCE (m)	R.L.	WALL HEIGHT (mm)
4	73.2	48.7	307.65	600
5	121.9	24.4	308.87	600
6	146.3	36.6	309.48	600
7	182.9	24.4	310.4	600
8	207.3	42.6	311.01	600
9	249.9	18.3	312.07	450
10	268.2	15.3	312.53	450
11	283.5	33.5	313.75	450
12	317	36.6	314.66	300
13	353.6	38.4	303.97	300
62	99.4	24.4	299.70	300
63	61.0	36.6	298.78	300
64	36.6	39.6	297.87	450
65	00	24.4	298.86	450
66	39.6	9.2	299.47	450
67	73.2		299.70	450
68	88.39			

50 40 30 20 10 0 50 100 m (1:2000)

②

1000 500 0 1000 2000 3000 mm (1:50)

①

PRELIMINARY PLAN ONLY
SUBJECT TO ALTERATION
Date: 5-7-91

ISSUE	DATE	GRID	REVISION	DRN	APPD

SURVEY BOOKS 26347 26348 26397 26694 26695 26696	DATUM ASSUMED R.M. YL1 R.L. 304.8	DES REF W6960	DRN G. EDWARDS CHD
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NORTH POINT	Product of Water Supply Design Branch
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RECOMMENDED SUPERVISING ENGINEER	APPROVED MANAGER W.S. DESIGN
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Water Authority
of
Western Australia

Figure 3

MOUNT HAMPTON WATER SUPPLY
20000m³ EXCAVATED DAM
GENERAL ARRANGEMENT

FILE A13314 FC4400	PROJECT W85.500	PLAN CB71-1-2	CAD A	ISSUE A
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ORIGINAL SHEET SIZE
A1
Date: 5-7-91

A 300 to 400mm deep bitumen-lined drainage channel will be located at ground level on the north-eastern edge of the rock (Figure 3). The drain will be 3m wide and the bitumen lining will be laid up to the edge of the rock to prevent water being lost into the ground.

A silt trap will be constructed on the western side of the dam (Figure 4). This will be 18m in diameter and 2m deep. Sides will have a slope of 1 vertical to 2 horizontal (1:2). A spillway on the southern side of the silt trap will carry overflow water into a natural drain during periods when the dam is filled to capacity.

An area of 140mx120m will be cleared to allow the dam to be constructed and most of the soil removed will be used in the construction of the perimeter embankment (Figure 5). The average depth of the dam will be 7.75m allowing maximum water depth of 6.75m. Internal slopes of the dam will be 1:3, and external slopes 1:2. Excavation depths are likely to vary from 5m to 8m across the sloping site but may be varied locally if shallow rock is encountered.

Excavation will be undertaken using front end loaders and scrapers.

The existing 860m long dirt access track will be upgraded with gravel to provide year round access. No new tracks will be constructed in the reserve.

A wire mesh fence will be constructed around the perimeter of the dam and silt trap to protect the water supply from animals and the public. The fence will be 2m high and contain a gate which will be padlocked.

A standpipe connected to the dam outlet pipe will be located outside the fenced compound. The standpipe will be fed from within the water storage via a floating off-take.

5.3.2 Ultimate Development

The extent of the ultimate development is shown in Figure 3. This will consist of increasing the capacity of the dam from 20,000kL to 30,000kL. A further 120mx40m area to the north of the initial development will be cleared to enable the dam to be extended. The wire mesh fence will be extended to enclose the enlarged dam.

Concrete-walled rock drains on the western and northern faces of the rock will be constructed. No modifications to the inlet, spillway or silt pit structures will be required.

5.4 TOPSOIL STRIPPING AND VEGETATION CLEARING

5.4.1 Stage 1 Development

All topsoil and vegetation will be stripped from areas where construction activities will occur, and stockpiled for later use in rehabilitation of the site. The area required is 2.2ha.

5.4.2 Ultimate Development

A further 0.5ha of *Casuarina* thicket will need to be cleared to accommodate expansion of the dam. No vegetation will be cleared to allow for construction of the rock drains.

5.5 WORKFORCE

It is envisaged that a workforce of up to twelve will be required during construction of the project. There will be no accommodation on site other than a portable mess hut. A portable chemical toilet will be used for sanitation.

5.6 WATER REQUIREMENTS

Water that will be required for construction activities and human consumption will be trucked to site. No bores will be sunk on-site.

5.7 OPERATION

The silt trap will remove silt from the water before it enters the dam. It will be cleaned out regularly and the silt that is removed will be distributed over the car park to minimise disturbance to vegetation.

Local farmers will gain access to the standpipe via the existing but upgraded access track. Farmers would bring their own pumps to extract water from the standpipe and consequently there is no requirement for a power supply on site.

5.8 SOURCE OF MATERIALS

Selected materials including gravel and clay used in construction of the water storage that cannot be obtained from the excavated material on site will be obtained from existing borrow pits operated in the area by the Shire of Yilgarn. It is estimated that 100% of the gravel and 30% of the clay will need to be imported. In addition all concrete and bitumen will be imported.

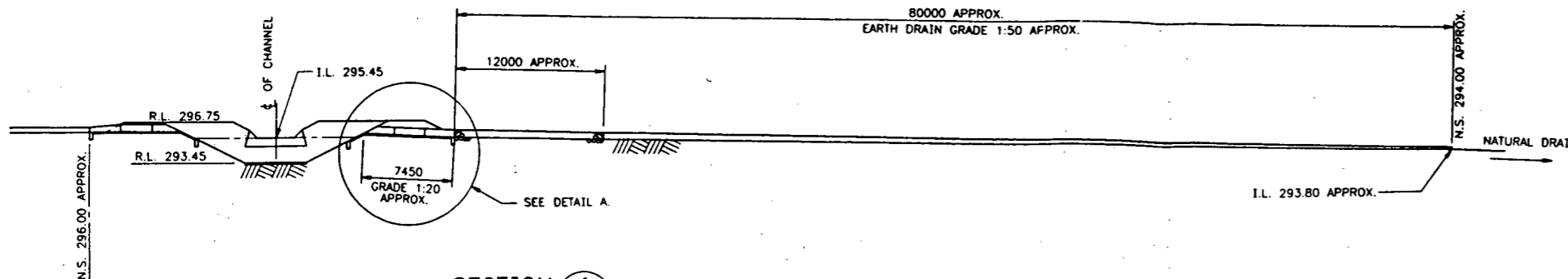
5.9 WASTE DISPOSAL

All waste material generated during construction will be removed to the nearest Shire of Yilgarn landfill site for disposal. Soil that is excavated during dam construction, and which cannot be incorporated into site earthworks, will also be removed. No waste material will be left at the construction site after the dam is completed.

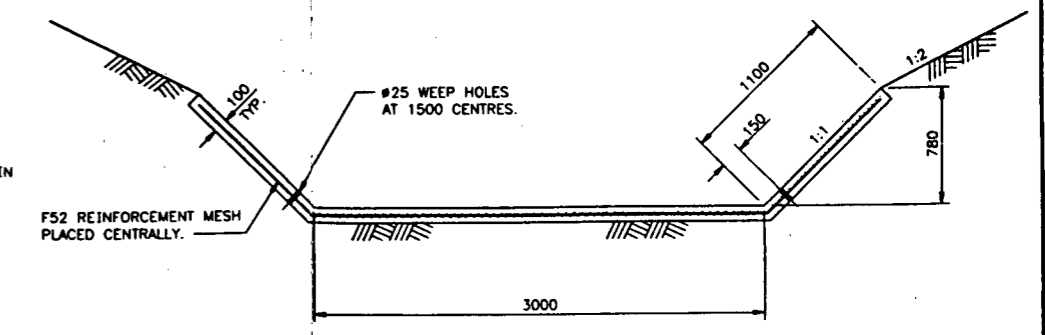
Silt which is removed from the silt trap during routine maintenance will be distributed over the car park area.

5.10 ONGOING MAINTENANCE AND RESPONSIBILITY

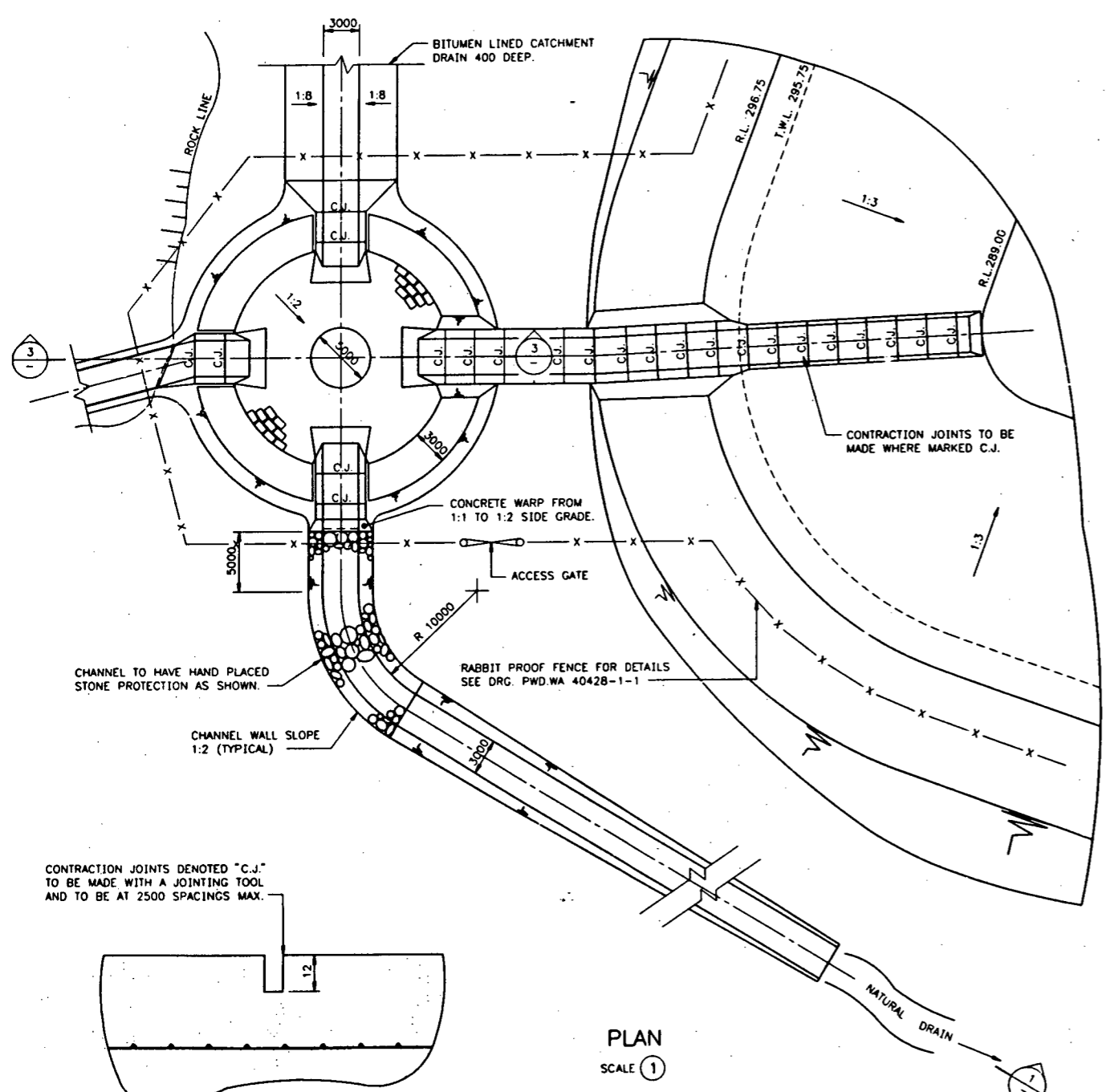
Ongoing maintenance of the water supply scheme will be carried out by the Water Authority or local community, dependent on the outcome of negotiations between both parties regarding operation of the scheme.



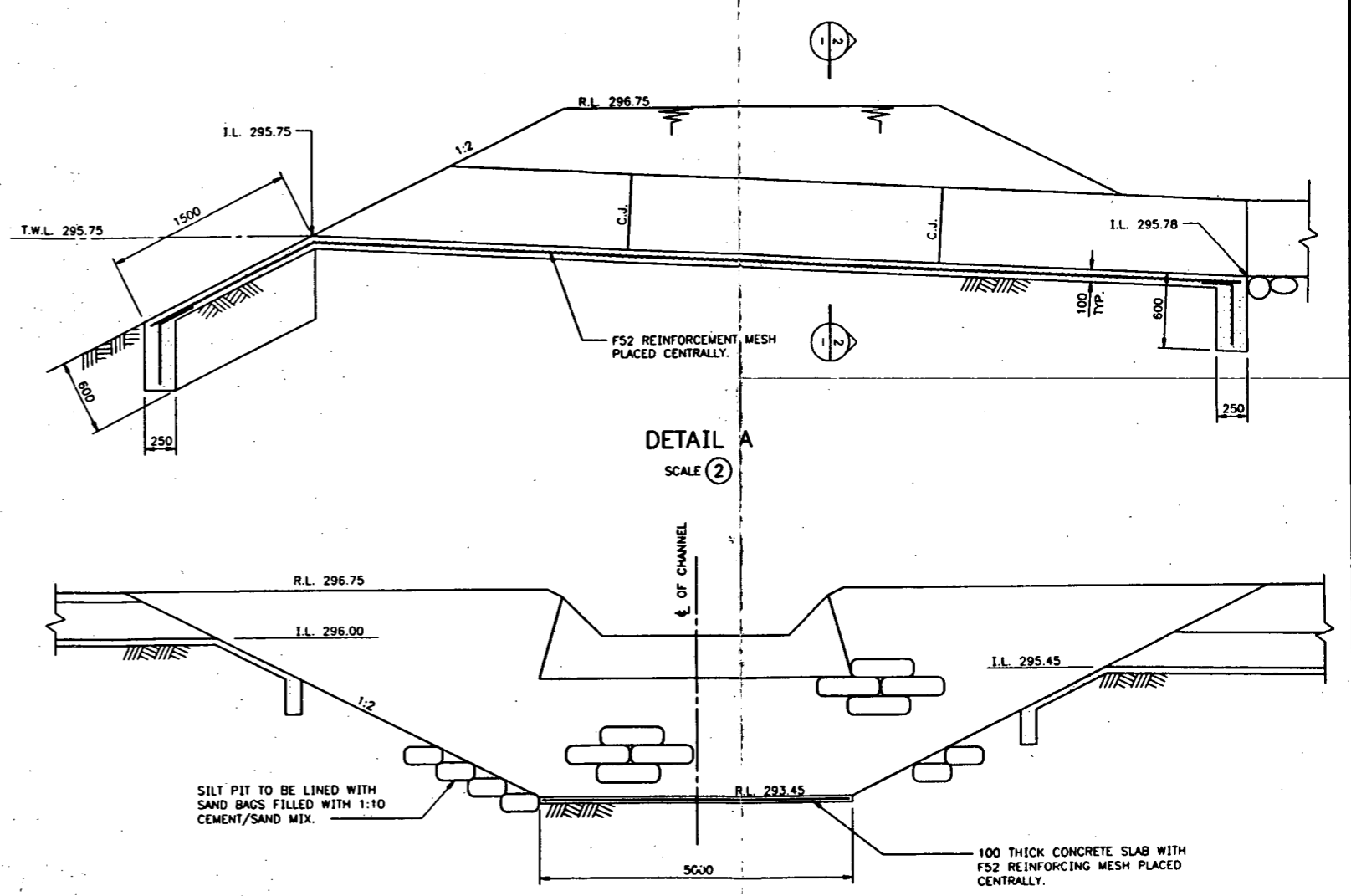
SECTION 1
SCALE 1



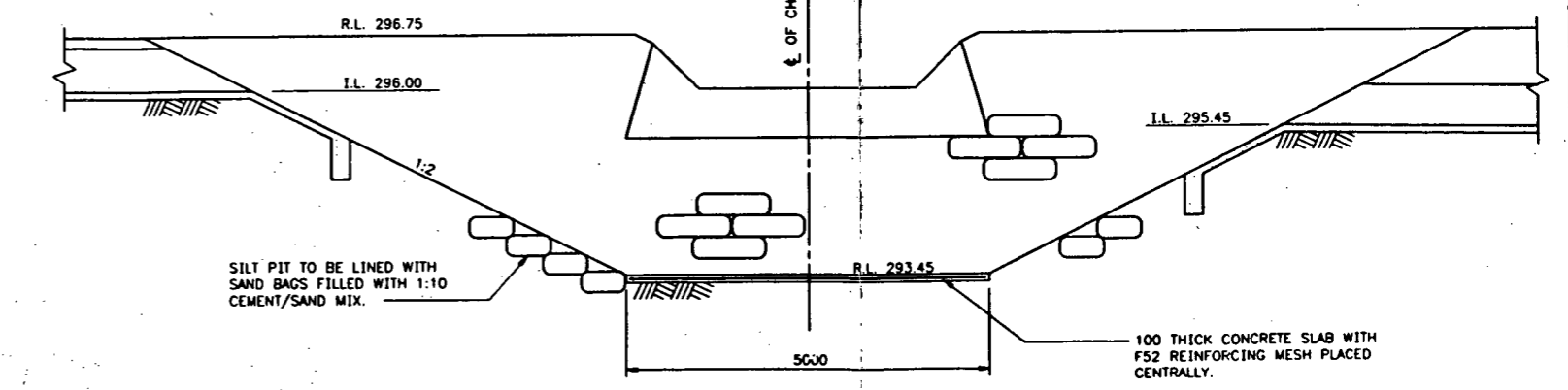
SECTION 2
SCALE 2



PLAN
SCALE 1



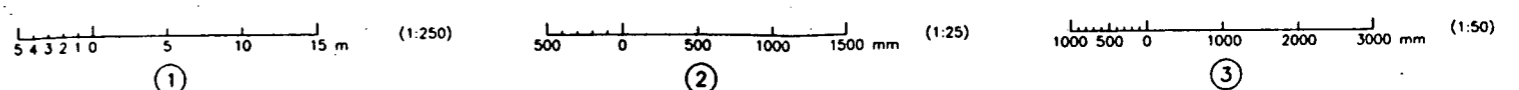
DETAIL A
SCALE 2



SECTION 3
SCALE 3

PRELIMINARY PLAN ONLY
SUBJECT TO ALTERATION
Date: 5-7-91

- NOTES
- 1 CONCRETE TO BE GRADE N20 AND PLACED IN ACCORDANCE WITH A.S. 3600
 - 2 REINFORCING MESH TO BE IN ACCORDANCE WITH A.S.1304 PLACED CENTRALLY WITH MIN. LAP 300 AND MIN. END COVER 50.



CONTRACTION JOINT DETAIL
DIAGRAMMATIC

ISSUE		DATE	GRID	REVISION	DRN	APPD	26347	26348	26397	26694	26695	26696	DATUM AHD	DES REF W6960	DES CND DRN G.EDWARDS CHD	NORTH POINT	RECOMMENDED	SUPERVISING ENGINEER	APPROVED	MANAGER W.S. DESIGN	Water Authority of Western Australia	MOUNT HAMPTON WATER SUPPLY 20000m ³ EXCAVATED DAM DETAILS OF SPILLWAY & SILT PIT	FILE FO4400 A13314	PROJECT WB5.500	PLAN CB71-2-3	CAD A	ISSUE A	ORIGINAL SHEET SIZE A1 WF 8-7-91
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RABBIT PROOF FENCE FOR DETAILS
SEE DRG PWD.WA 40428-1-1

INLET CHANNEL FOR DETAILS
SEE DRG. CB71-2-2.

ANCHOR POINT FOR FLOATING OUTLET
FOR DETAILS SEE DRG. CB71-2-4.

5000 WIDE x 300 DEEP
DRAIN AROUND OUTER
EDGE OF BANK.

GRAVEL LINING

R.L. 296.50

R.L. 296.75

T.W.L. 295.75

STRIPPED SURFACE

BENCHING - SELECTED
IMPERVIOUS FILL

COMPACTED FILL

TYPICAL SECTION OF BANK

SCALE ①

Ø457 HALF ROUND R.C. PIPE
PLACED DOWN EMBANKMENT &
STONE PROTECTED AT BASE

LINE	X CO-ORDINATE	LINE	Y CO-ORDINATE
B	777.24	2	685.80
C	762.00	3	670.56
D	746.76	4	655.32
E	731.52	5	640.08
F	716.28	6	624.84
G	701.04	7	609.60
H	685.80	8	594.36
J	670.56	9	579.12
K	655.32		

NOTE: X & Y CO-ORDINATES TAKEN FROM
GRID SHOWN IN L.B. 26348.

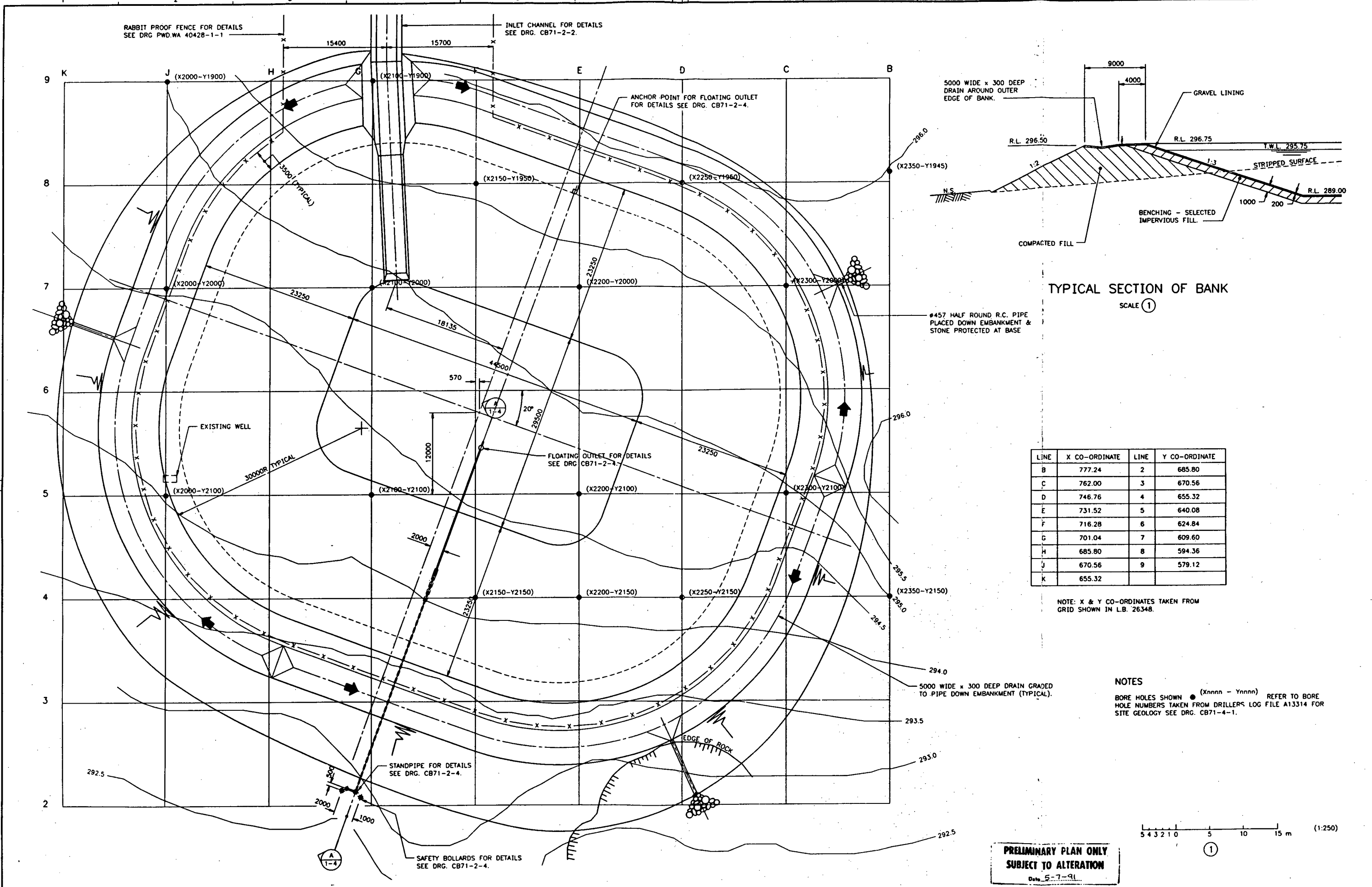
NOTES

BORE HOLES SHOWN ● (Xnnnn - Ynnnn) REFER TO BORE
HOLE NUMBERS TAKEN FROM DRILLERS LOG FILE A13314 FOR
SITE GEOLOGY SEE DRG. CB71-4-1.

5 4 3 2 1 0 5 10 15 m (1:250)

PRELIMINARY PLAN ONLY
SUBJECT TO ALTERATION

Date 5-7-91



ISSUE	DATE	GRID	REVISION	DRN	APPD	SURVEY BOOKS 26347 26348 26397 26694 26695 26696	DATUM AHD DES REF W6960	DES CHD DRN G. EDWARDS CHD	NORTH POINT 	RECOMMENDED SUPERVISING ENGINEER APPROVED MANAGER W.S. DESIGN	Water Authority of Western Australia	MOUNT HAMPTON WATER SUPPLY 20000m ³ EXCAVATED DAM DETAILS OF DAM	Figure 5	ORIGINAL SHEET SIZE A1
Product of Water Supply Design Branch	FILE F04400 A13314	PROJECT W85.500	PLAN CB71-2-1	CAD A	ISSUE A	WF 8-7-91	WS\440\2000L\DETAIL1 02/07/91							

6. EXISTING ENVIRONMENT

6.1 PHYSICAL ENVIRONMENT

6.1.1 Land Tenure

Mt Hampton is located in Reserve No. 20526 which is managed for Water and Conservation of Flora and Fauna. The reserve has an area of 594ha and is vested with the National Parks and Nature Conservation Authority (NPNCA). Between 1930 and 1974 the reserve was vested solely with the Minister for Water Supply, Sewerage and Drainage as a Water reserve since it had been identified as containing a good rock catchment. In 1971 the Department of Fisheries and Fauna approached the Department of Lands and Survey requesting that the reserve be set aside solely for conservation of flora and fauna. This request was subsequently forwarded to the Public Works Department who objected to the proposal, due to the potential of the reserve as a rock catchment, but agreed to the purpose of the reserve being extended to include Conservation of Flora and Fauna.

To the west and north of the Mt Hampton Reserve is Reserve No. 32995 which is 1,886ha in area and managed for Conservation of Flora and Fauna (Figure 1).

Surrounding these reserves is land which has been cleared for wheat and sheep farming.

6.1.2 Climate

Rainfall and temperature have not been recorded at the Mt Hampton Reserve but the average annual rainfall at Southern Cross (60km north-east of the reserve) is approximately 290mm. Rain falls mainly in the winter months and is usually reliable. Summer rain is unreliable but there can be sporadic heavy falls from thunderstorms.

High maximum temperatures occur regularly in summer and light frosts are experienced at night in winter.

The region is on the boundary of a dry, warm Mediterranean climatic region (the wheatbelt) and the semi-desert climatic region which lies further to the north and east (Beard, 1972).

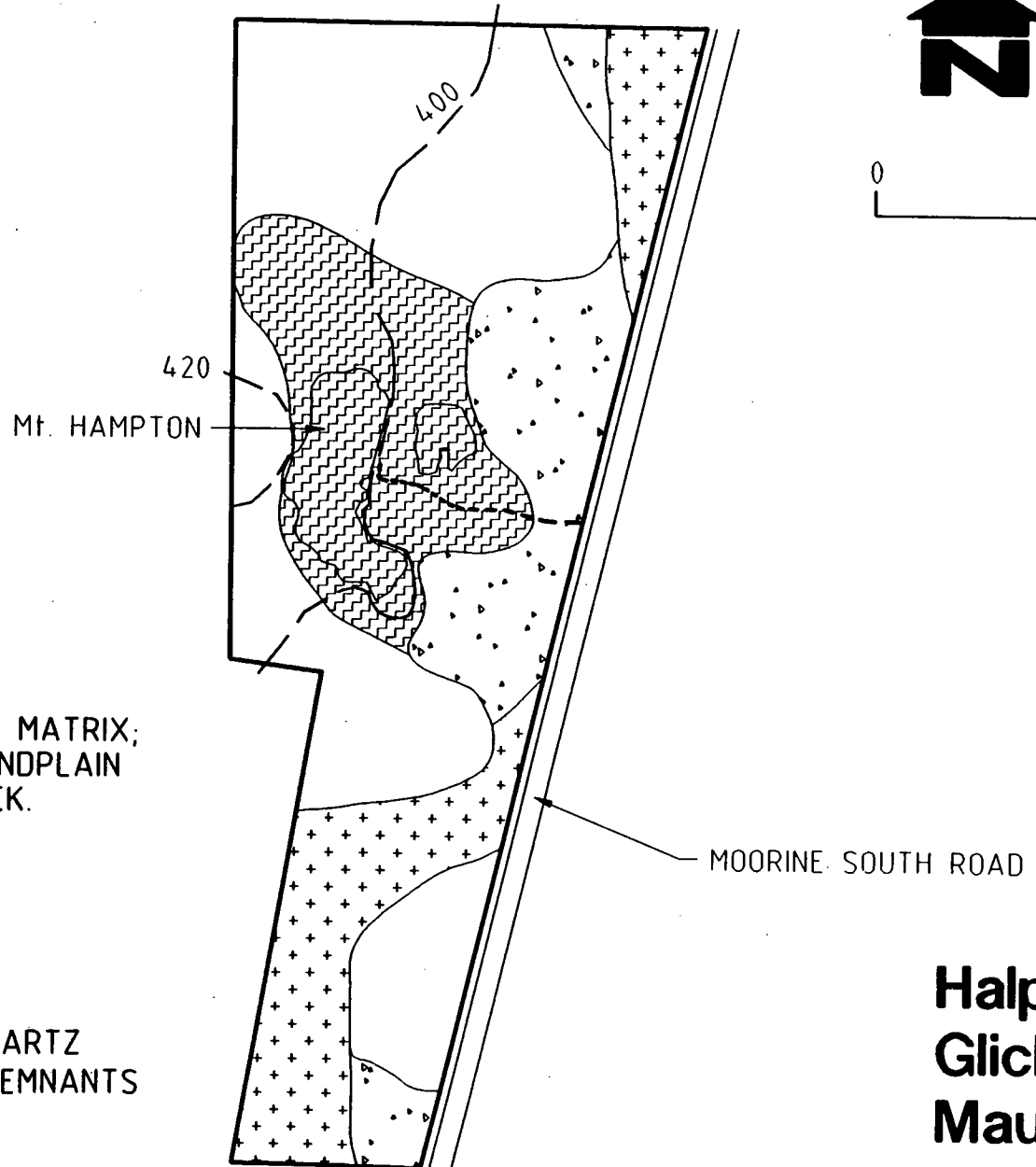
6.1.3 Topography

The area surrounding Mt Hampton consists of a gently undulating plateau with Mt Hampton lying between the 400m and 420m contours (Figure 6).

MT. HAMPTON RESERVE SOILS

KEY

- RESERVE BOUNDARY.
- - - EXISTING ACCESS TRACK
- LATERITE; LIMONITE NODULES IN CEMENTED MATRIX; GRADES UPWARD INTO TERTIARY SANDPLAIN AND DOWNWARD INTO WEATHERED BEDROCK.
- SANDY LOAM ALLUVIAL WASH.
- AGMATITE ROCK; GRANOBlastic OR GNEISSIC PALAEOSOME
- CLAY, SILT, SAND; BUFF OR RED, WITH QUARTZ FRAGMENTS AND CALCAREOUS NODULES; REMNANTS OF EXTENSIVE TERTIARY SANDPLAIN.
- 400 - - - CONTOURS



**Halpern
Glick
Maunsell**



FIGURE 6

Mt Hampton itself is a granite tor (mass of rock) rising to 457m above sea level. Although Mt Hampton is one of a number of granite outcrops in the study area its size makes it unique. Mt Hampton is approximately 1.2km long by 0.4km at its widest point and is by far the largest outcrop. This and other granite tors are a product of intensive granitisation (Beard, 1972).

6.1.4 Geology

Mt Hampton Reserve forms part of the ancient continental shield of Western Australia. It is underlain by granite which is believed to have invaded pre-existing Archaean sedimentary rocks approximately 2,600 million years ago (Beard, 1972).

6.1.5 Soils

Gee (1982) mapped the soil in the project area as shown in Figure 6. The reserve is dominated to the north and south-west by laterite consisting of limonite (hydrated iron oxides and iron hydroxides) nodules in cemented matrix grading upward into clean yellow to white sand containing scattered limonite nodules. The sand is a remnant of an extensive tertiary sandplain. The laterite below the sand grades downward into weathered bedrock. The eastern side of the reserve contains buff or red clay, silt and sand with quartz fragments and calcareous nodules mainly in colluvial (weathered) deposits. A sandy loam occurs in the north-eastern and southern portions of the reserve.

6.1.6 Hydrology and Hydrogeology

Fluviatile (river-like) sediments, possibly of tertiary age occur in a palaeo-drainage area approximately 1km to the south of Mt Hampton. Although several ephemeral lakes occur in this area (Martin, 1993) they are not reliant on water from Mt Hampton for their filling.

During periods of rain, water runs off Mt Hampton onto the surrounding plain. Two well defined drainage lines occur at the northern and southern ends of the rock, flowing eastward (Figure 7). Other minor drainage lines flow to the east and west of the rock. Numerous depressions occur over the surface of the rock and after rain shallow pools form. These vary in size up to a maximum of 4mx4m and 200mm deep. Most, however, are relatively small.

Groundwater occurs in the weathered profile, where the bedrock is fractured and also in sediments. It is recharged by rainfall infiltration and local runoff from rock outcrops. Groundwater discharge occurs through evapo-transpiration and the direction of groundwater flow tends to be controlled by the local topography.

MT. HAMPTON RESERVE VEGETATION ASSOCIATIONS

KEY

- RESERVE BOUNDARY
- - - EXISTING ACCESS TRACK
- SOUTHERN LIMIT OF ROCK DRAINS
- DRAINAGE LINE
- GRANITE ROCK
- ▨ CASUARINA THICKET
- ▩ OPEN GRASSLAND WITH ACACIA AND LEPTOSPERMUM
- ▧ SCLEROPHYLL WOODLAND WITH EUCALYPTUS SALMONOPHOLIA AND LOXOPHLEBA
- BROOMBUSH THICKET CASUARINA, ACACIA, MELALEUCA.
- 4 QUADRATS
- A ABORIGINAL SITE S2680

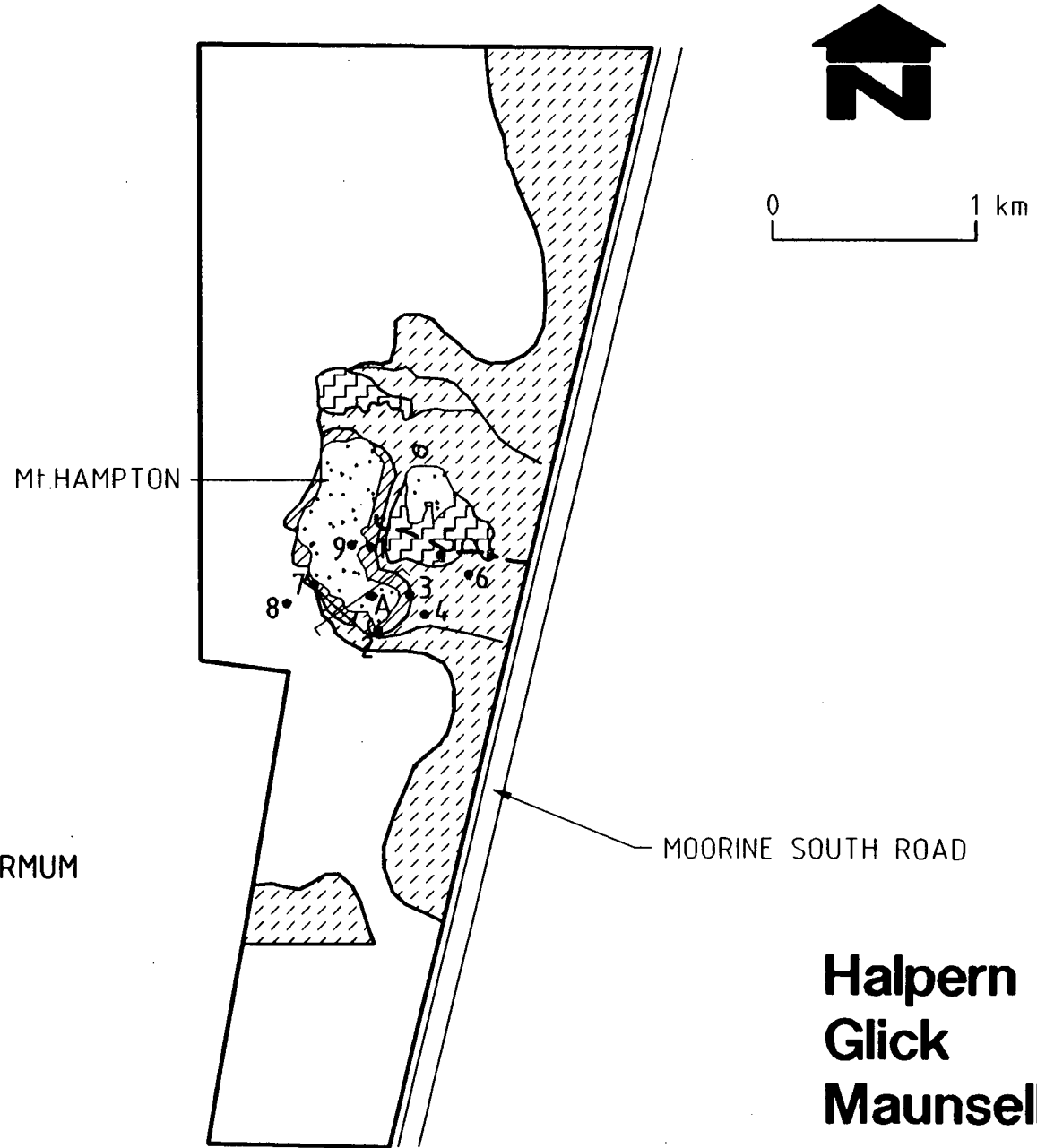


FIGURE 7

**Halpern
Glick
Maunsell**



The salinity of the groundwater increases towards the lower landscape elevations. Locally, areas of enhanced recharge may result in a reduction of groundwater salinity. The salinity of groundwater taken from a bore 3km to the south of Mt Hampton (Martin, 1993) was greater than 6,000mg/L and the salinity of a bore 4.5km to the north was 12,000mg/L. A 7m deep well near the base of Mt Hampton has a salinity of approximately 50mg/L (Martin, 1993) however, the supply is small being derived only from seepage. Information on the seasonal variations in groundwater quality are unavailable.

6.2 BIOLOGICAL ENVIRONMENT

6.2.1 Vegetation and Flora

6.2.1.1 Vegetation Systems

The project area lies in the Skeleton Rock vegetation system (Beard, 1972), part of the Avon Botanical District (Beard, 1980). A vegetation system consists of a particular series of plant communities recurring in a catenary sequence or mosaic pattern linked to topographic, pedologic (soil) and/or geological features (Beard, 1972). A vegetation system is a subdivision of a botanical district.

The Skeleton Rock system has affinities with the adjoining Moorine Rock, Moorabbin and Hyden vegetation systems and occurs on high-lying country forming part of a watershed. The country consists of residual sandplains with a vegetation of scrub-heath and thicket. On the remainder of the land in shallow valleys the vegetation is mallee, frequently with patches of woodland.

6.2.1.2 Vegetation Associations

Beard (1972) defined the vegetation to the north, south and west of Mt Hampton as broombush thicket on sandplain containing *Casuarina*, *Acacia* and *Melaleuca* species. To the east of the rock and close to the northern and southern edges he mapped the vegetation as sclerophyll woodland containing *Eucalyptus salubris* and *E. salmonophloia*.

A vegetation base map was prepared from a 1983 aerial photograph which was the most recent photograph available. A vegetation survey was then conducted during April 1993, the vegetation associations were verified and a species list was prepared. Nine 10mx10m quadrats were also established to provide more detailed descriptions of the vegetation and their locations are shown in Figure 7. Detailed descriptions of these quadrats have been provided to the Water Authority and these will serve as baseline information for future monitoring of impacts.

Casuarina thicket occurs predominantly along the eastern and northern base of Mt Hampton to a maximum width of approximately 100m. Open grassland containing scattered wattle (*Acacia*) and tea tree *Leptospermum* occurs to the east and north of the *Casuarina* thicket (Figure 7). Sclerophyll woodland is encountered further east of the rock. Some *Casuarina* thicket occurs along the southern and south-western edges of Mt Hampton with a thin band also occurring along the western edge. In total, *Casuarina* thicket occupies approximately 13ha around Mt Hampton.

On the western side of the rock the vegetation is dominated by broombush thicket containing some *Casuarina*, *Acacia* and *Melaleuca*.

Limited vegetation occurs on the rock and this will be unaffected by the development.

6.2.1.3 Flora

A total of 49 plant species were identified during the vegetation survey (Appendix B). Five were identified only to genus level due to a lack of the flowers and fruit necessary to complete identification. Species from seventeen families were identified with the dominant families being:

Mimosaceae (wattles), 8 species

Myrtaceae (includes Eucalypts), 14 species including 6 *Melaleuca* species

Dr Steve Hopper, Director of Kings Park, has conducted some informal surveys of Mt Bayly (5km to the south-east) and Mt Hampton. Although these surveys were not comprehensive Dr Hopper has provided species lists for these two rocks. These lists can be found in Appendix C. His surveys did not reveal the presence of any declared rare or priority listed species.

6.2.1.4 Declared Rare and Priority Species of Flora

No rare species of flora have been recorded in the Mt Hampton Reserve, although three priority species have been recorded. CALM places species on the priority list if they are poorly known or require monitoring. *Drosera graniticola* is a poorly known species and *Dryandra shanklandiorum* and *Verticordia pulchella* are both species which require monitoring.

A further survey of Mt Hampton will be conducted in spring 1993 to search for rare and priority species.

6.2.1.5 Dieback

No dieback was observed in the reserve during the field survey.

6.2.2 Fauna

6.2.2.1 Vertebrate Fauna

The fauna of the Mt Hampton Reserve lies at the boundary between the Eyrean and Bassian sub-region described by Serventy and Whittell (1976). A review of the literature (Western Australian Museum 1985, 1988) and the WA Museum's fauna database indicate that 86 species of birds, 25 species of mammals (including 5 introduced mammals), 69 species of reptiles and 9 species of amphibians can be expected to occur in the general area around Mt Hampton.

As few field surveys have been undertaken in the area a four-day fauna survey was conducted at Mt Hampton Reserve in late April 1993. CALM assisted in the survey. A combination of Elliott traps, pitfall traps and opportunistic sightings including spotlighting were used.

Trapping was confined to the *Casuarina* thicket as this is the vegetation association which will be most noticeably affected. In total there were 113 trap nights.

The survey resulted in the recording of 5 species of mammals, 14 species of birds, 8 species of amphibians and 4 species of reptiles.

Appendix D lists the vertebrate species recorded during the field trip and from the CALM survey and other fauna expected in the project area. Trap sites are shown in Appendix D, Figure D1.

6.2.2.2 Rare and Priority Species of Fauna

Species listed as rare under Schedule 1 of the Wildlife Conservation Act 1950 and expected to occur in the project area include:

- . Western Quoll (*Dasyurus geoffroii*)
- . Crested Shrike-tit (*Falcunculus frontatus*)

Those species expected to occur at Mt Hampton Reserve and also gazetted as priority species under Schedule 2 of the Wildlife Conservation Act are:

- . Carnaby's Black Cockatoo (*Calyptorhynchus laterostris*)
- . Ramsay's Python (*Aspidites ramsayi*)
- . Carpet Python (*Morelia spilota*).

None of these species were recorded at the reserve during the fauna survey.

6.2.2.3 Introduced Species

Signs of Rabbit (*Oryctolagus cuniculus*) were seen throughout the project area and fox (*Vulpes vulpes*), Feral Cat (*Felis catus*) and Wild Dog (*Canis familiaris*) are expected to occur. Twenty-one House Mouse (*Mus domesticus*) were trapped during the fauna survey involving 113 trap-nights.

6.2.2.4 Aquatic Macroinvertebrate Fauna

Aquatic fauna samples were collected from three rock pools present on Mt Hampton in April 1993 (Appendix D, Figure D1).

The macroinvertebrate fauna found in the three rock pools were identified by Dr Jenny Davis (Murdoch University) and a species list is presented at the end of Appendix D. The following discussion is extracted from her report.

It is difficult to determine how rare or common some of the species are because there is so little information on waterbodies in this region, or for that matter, most of the semi-arid and arid regions of Western Australia. All the species recorded are known from other waterbodies with no new species being collected.

The life history strategies of the fauna that were recorded are typical of this type of waterbody. Many of the organisms present are capable of flight (or their adult forms are) and so they can disperse easily from drying waterbodies and quickly recolonise filling ponds. Aquatic beetles are often associated with temporary freshwaters in arid Australia and they are well represented in the samples. The midges, mosquitoes, water boatmen, backswimmers and dragonflies which were recorded at these pools are all capable of flight. The other type of organism to be found in these pools are those which enter a dormant phase when the pools dry, usually as desiccation resistant eggs. Eggs are produced in large numbers as the pool dries and hatching does not occur until the pool refills. The conchostracans or clam shrimps recorded from Pool 3 exhibit this type of life history strategy.

The fact that a fairly diverse range of species of insects, in addition to the conchostracans are present in the pools suggest that they are not short lived ephemeral waterbodies but rather that water was present for some time (ie months rather than weeks). Very temporary bodies of freshwater would usually contain only a small number of species such as Clam Shrimps and Fairy Shrimps (Jenny Davis pers. comm.).

Two of the rock pools (1 and 3) are above the proposed rock drain and consequently will be unaffected by the development. Pool 2 is at the base of the rock and will receive less water from runoff once the drain is constructed.

6.2.3 Conservation Significance

Mt Hampton is one of a number of granite outcrops that occur in the study area. Others which occur within a 40km radius of Mt Hampton include Mt Bayly, Mt Roe, Dulyalbin Rock, Sandalwood Rock, Moltthomy Rock and Waterbidden Rock. Mt Hampton's uniqueness is in its size.

The Mt Hampton Reserve contains remnant vegetation in a region where large scale clearing has taken place. There are a large number of these small reserves throughout the wheatbelt and it is only in recent years that concern has arisen for the viability of the plants and animals in these areas. In isolation many of these reserves are too small for conserving representative samples of natural wheatbelt vegetation.

Work that has been undertaken to date in the wheatbelt (Dr Steve Hopper, pers. comm.) suggests that vegetation within 20 to 30m of rock outcrops can be quite variable. This is due primarily to the reliance of a particular vegetation association on water runoff from the rock. Within these associations the presence of rare flora is often unpredictable and it is for this reason that a rare flora survey will be undertaken in Spring 1993 prior to any construction activities commencing. At Mt Hampton the size of the rock and the associated increased runoff results in the *Casuarina* thicket being up to 100m wide.

It is known that some species of flora have their distributions restricted to granite outcrops (Dr Steve Hopper, pers. comm.). Mt Hampton has little vegetation cover and the vegetation that does occur on the rock will not be affected by the development.

Within the Mt Hampton Reserve and the adjacent reserve (Reserve No. 32995) of 1,886ha, significant stands of *Casuarina* are only found in the area immediately surrounding Mt Hampton, a total of approximately 13ha. Of this 13ha, 3ha will be unaffected by the development, a further 2.7ha will ultimately need to be cleared and the remaining 7.3ha will be affected to a varying degree.

Although it is unlikely that any fauna species are reliant on this vegetation association for their survival the local significance of loss or modification to the association is difficult to determine.

Casuarina thicket does occur around other rock outcrops in the area (eg Mt Bayly) but its distribution is usually limited to within 20 to 30m of the rock, depending on the runoff. Due to its association with rock outcrops, *Casuarina* thicket is not a common vegetation type, regionally.

Aquatic fauna were collected from three rock pools on Mt Hampton. The species identified were described as having typical life histories through being either capable of flight, and therefore able to disperse from a drying waterbody, or having a dormant phase which is resistant to desiccation. No new species were collected. Studies (eg Bayly 1982; Fairbridge 1945) suggest that some species may have restricted distributions. This observation is in part due to a paucity of information available on the aquatic fauna of granite outcrops over a wide area.

No rare or priority species of fauna were recorded from Mt Hampton Reserve during the site visit and the species recorded are not restricted to the reserve.

The presence of a permanent source of water in the reserve could increase usage of the reserve by the public. The construction of a fence around the dam and silt trap will not prevent some members of the public from accessing the water supply. At this stage it is impossible to gauge the magnitude of increased public use.

6.3 HUMAN ENVIRONMENT

6.3.1 Aboriginal Sites

An Aboriginal sites survey was conducted at Mt Hampton in May 1993 (Macintyre et al., 1993). No ethnographic sites of significance to living Aboriginal people were located within the boundaries of the project area.

One archaeological site was found to exist on the rock itself. This site, WA Museum No. S26801, (Figure 7) is considered to be of moderate significance and comprises a rock shelter containing an ochre painting about 1m high and 3.5m long. In the sediment on the floor of the cave is some evidence of recent fires and apart from a small amount of European graffiti the shelter is relatively undisturbed.

6.3.2 Post European Settlement

*** Land Use**

Much of the arable land around Mt Hampton has been cleared for wheat and sheep farming and about thirty farmers live in the vicinity. A wheat bin and small school are located about 8km to the north along Moorine South Road. There are no mines in the vicinity of the reserve, the closest being to the north-east around Southern Cross and to the south-east near Bounty.

The reserve has been used for watering stock (in the early years of settlement), recreation, walking, nature study, picnicking and possibly camping although this is now discouraged. A car park exists at the end of the access track on the eastern side of the rock and a litter bin has been placed here. Some additional tracks have developed on the eastern side of the rock to the south of the car park. No information is available on the level of public usage of the reserve but it is probably not great.

An old 7m deep well is located on the eastern side of the rock. At the time of the site visit it was partially filled with debris and consequently unable to provide water. This well is not recorded on the Register of Heritage Places held by the Heritage Commission.

* **Local Government**

The project area lies in the Shire of Yilgarn whose offices are located at Southern Cross.

6.4 PUBLIC PARTICIPATION

A dam at Mt Hampton has been under consideration since the 1970s but because of difficulties with funding it has not proceeded.

At the suggestion of the Mt Hampton Progress Association a letter was sent (6th November 1989) by the Secretary of the Association to the Minister for Water Resources WA, Mr Ernie Bridge. Mr Bridge advised the Progress Association (30th November 1989) that the Mt Hampton proposal would be funded under the Rural Water Strategy.

A public meeting of farmers likely to be affected by the development was held at the Mt Hampton Community Hall on the evening of 4th July 1990. Twenty-three farmers were originally identified to be affected by the development. The meeting unanimously supported the proposal bearing in mind environmental considerations and appointed Cr Bruce Harvey as Project Co-ordinator liaising with the Water Authority.

A further public meeting was held with the local community and the Shire at Mt Hampton on 13th October 1992. Although the community was worried about the high estimated cost of the project they expressed their acceptance and commitment to the project. The Shire Clerk, Mr Ian Fitzgerald, confirmed in a letter to the Water Authority on 9th November 1992 that the community and Council contribution to the project would be to a maximum of \$200,000, in either cash or kind.

During the field work in late April 1993 a meeting was held with Cr Harvey to further discuss the project. Cr Harvey emphasised that the project had unanimous support from the local farming community. No specific environmental or social issues were raised that required addressing.

Discussions have also been held with CALM on the proposed site investigations and CALM assisted with the flora and fauna survey during the April fieldwork.

Twenty-eight farmers have now been identified as potentially benefiting from the scheme.

7. POTENTIAL ENVIRONMENTAL IMPACTS AND THEIR MANAGEMENT

A review of the environmental consequences of the development has been undertaken. The following items have been identified as being potential concerns and these will be addressed individually in this section.

7.1 IDENTIFICATION OF ISSUES

7.1.1 Construction Phase

- . Vegetation clearing for Stage 1 Development
- . Vegetation clearing for the ultimate development
- . Introduction of dieback
- . Introduction of weeds
- . Noise and vibration
- . Dust
- . Aboriginal sites
- . Disturbance to the well
- . Removal of construction wastes

7.1.2 Operation Phase

- . Increased erosion
- . Reduction in water entering the groundwater
- . Reduction in water available to vegetation
- . Impacts on terrestrial and aquatic fauna
- . Impacts on recreational users
- . Impact on the aesthetic appreciation of the area
- . Increased vehicle traffic on local roads
- . Ongoing maintenance and responsibility
- . Disposal of silt

7.2 MANAGEMENT OF POTENTIAL ENVIRONMENTAL IMPACTS

7.2.1 Construction Phase

- * Vegetation Clearing for Stage 1 Development (see Commitments 8.1.1, 8.1.2, 8.2.1, 8.2.2, 8.3.1)

Prior to construction commencing the site will be surveyed for the presence of rare flora. The survey will occur in Spring 1993. If rare flora are found then Ministerial permission to disturb identified specimens would be obtained prior to their removal.

Approximately 1.7ha (approximately 140mx120m) of *Casuarina* thicket will be cleared to enable the dam to be constructed. This area currently has little understorey due to its use for parking and picnicking by the public. An additional 0.25ha will be cleared to accommodate the silt trap and a further 0.25ha to allow for construction of the bitumen-lined channel which will collect water from north of the dam. In total 2.2ha (or 17%) of the *Casuarina* thicket will be cleared.

All clearing will be conducted in conjunction with CALM who will be notified prior to construction activities commencing. All areas disturbed during construction, and that are not required for the successful operation of the scheme, will be rehabilitated using local indigenous flora. Topsoil and vegetation that was stripped prior to construction will be spread over the areas to be rehabilitated.

Vegetation on the rock will not require clearing.

- * **Vegetation for the Ultimate Development (see Commitments 8.1.1, 8.1.2, 8.2.1, 8.2.2, 8.3.1)**

A further 0.5ha (approximately 140mx40m) of *Casuarina* thicket will be cleared to enable the dam to be extended. All clearing will be carried out in accordance with the above commitments.

- * **Introduction of Dieback (see Commitments 8.1.3, 8.2.3)**

No dieback was evident at the reserve in April 1993 and dieback will not be introduced to the reserve during construction activities. Prior to entering the nature reserve all equipment will be washed down following procedures listed in the CALM Dieback Hygiene Manual.

All construction materials will be obtained from dieback free sources. The sources will be inspected by a botanist prior to the removal of any materials.

- * **Introduction of Weeds (see Commitments 8.1.3, 8.2.3)**

No declared weeds have been recorded in the reserve and measures will be taken to ensure that no weeds will be introduced to the reserve by machinery. All equipment will be washed down prior to entry into the reserve.

- * **Noise and Vibration (see Commitments 8.2.4, 8.2.5)**

The nearest residence lies 2.5km to the south-east of the dam site, another lies 5km further north. The physical distance between the construction site and the nearest residence will attenuate the noise to negligible levels.

It is not anticipated that any rock blasting will be required but if this is necessary residents will be warned of the timing of any blasting. Again, separation distances are expected to be sufficient to ensure no problems arise from blasting.

In the unlikely event of noise levels proving to be a problem, the Water Authority is obligated under the noise abatement statutes of Western Australia (Environmental Protection Act, 1986) to devise corrective action.

It is expected that construction noise will result in fauna temporarily avoiding the area. This disturbance is unavoidable but only temporary in nature.

* **Dust (see Commitments 8.2.6)**

Dust generation during construction will be minimised during construction by watering areas of activity as required. Again, separation distances to nearby residences will ameliorate social impacts related to dust generation.

* **Aboriginal Sites (see Commitments 8.2.7, 8.2.8)**

The only Aboriginal site of significance known to exist at Mt Hampton is located outside of the areas that will be impacted during construction.

Project personnel will be informed that they must report any archaeological material encountered during ground disturbance as outlined under Section 15 of the Aboriginal Heritage Act 1972-80. They will also be informed that access to the identified archaeological site at Mt Hampton will not be permitted to protect it from further disturbance.

* **Disturbance to the Well**

The well located to the east of Mt Hampton will be filled in during construction of the dam. This well is in poor condition and is not recorded on the Register of Heritage Places and therefore its removal is not considered to be of significance.

* **Removal of Construction Wastes (see Commitment 8.2.9)**

The Water Authority envisages the production of a quantity of inert construction debris that will require disposal off-site. All debris will be removed to the nearest Shire of Yilgarn landfill.

Soil and vegetation that is stripped during dam construction, and which cannot be used in on-site earthworks such as dam walls or for rehabilitation, will be removed from the reserve.

No soil will be deposited, within the reserve, outside of the areas that are proposed for clearing.

7.2.2 Operation Phase

* Increased Erosion

No increase in erosion is anticipated as drains will be lined with bitumen where necessary to prevent scour.

The storage capacity of the dam will ensure that overflow of water to the existing natural drainage channel via the spillway will be minimal and only likely to occur during the wettest years.

* Reduction in Water Entering the Groundwater

The construction of the drains and dam will reduce the volume of water entering local aquifers.

Groundwater is not extracted in the vicinity of Mt Hampton in any quantity and consequently there is no requirement to maintain a supply for human usage. Similarly, there are no wetlands fed by shallow aquifers that might be adversely affected.

Reduction in infiltration will, however, directly affect vegetation (and indirectly fauna) as discussed in the next section.

* Reduction in Water Available to Vegetation (see Commitments 8.1.1, 8.3.3)

It is expected that 3ha (or 23%) of *Casuarina* thicket occurring along the southern and south-western base of the rock will be unaffected by the scheme (Figure 7). Approximately 4ha of rock catchment will remain below the drains to supply water to vegetation in this area.

Ultimately the construction of the rock drains and bitumen-lined channel will result in approximately 7.3ha (or 56%) of the *Casuarina* thicket downstream of the drains being deprived of all or some of the water originating from surface flow from the rock. Direct infiltration from rainfall will still result. However, since the vegetation associations surrounding the rock occur, at least in part, as a result of this surface flow it is expected that the composition of the vegetation associations below the rock will change. It is predicted that the *Casuarina* thicket and those areas along drainage lines (Figure 7) will gradually change towards a grassland association containing fewer trees and possibly some shrubs such as *Acacia ? linophylla* and *Leptospermum ? erubescens*. These changes will occur in a progressive manner starting in areas furthest from the rock. However, it is still expected that some *Casuarina* will remain immediately adjacent to Mt Hampton, particularly in areas south of the dam, and on the western side of Mt Hampton where the drains are constructed further up the face of the rock, enabling some runoff to occur.

Within the reserve the *Casuarina* thicket is restricted to an area immediately surrounding Mt Hampton. Regionally, however, this vegetation association is represented in other reserves, although still largely confined to areas surrounding rock outcrops.

Due to the absence of information on the effects that developments such as this may have on the surrounding vegetation, the Water Authority proposes to monitor changes in the structure and species composition of the vegetation annually for a period of three years. After three years, the monitoring programme will be renewed and the spacing of further monitoring determined following discussions with CALM. Control sites will be established at Mt Bayly to allow comparison to be made. A field survey will be conducted in spring of each year with the results being reported on an annual basis to CALM. The results obtained can then be used to predict impacts of similar future developments.

Vegetation occurring on the rock above the drains will be unaffected by the development.

During Spring 1993 a rare flora survey will be conducted of the area to be impacted. If rare flora are found, CALM will be notified and their advice followed in the implementation of management measures. Ministerial approval will be sought if removal of rare flora is required.

* **Impacts on Terrestrial and Aquatic Fauna (see Commitment 8.3.1)**

Construction of the dam, silt trap and bitumen-lined channel will ultimately require the removal of 2.7ha (or 21%) of the *Casuarina* thicket. A further 7.3ha will be affected due to changes in the composition of the vegetation resulting from an interruption of surface water flow. The impact on fauna of loss or modification to the *Casuarina* vegetation association is difficult to determine. It is unlikely that any species of mammals are reliant on this association for their survival. Physical removal of the vegetation and a change towards a more open grassland association will, however, place added pressure on the smaller mammals through an increase in predation. Fewer nesting sites will also be available to birds.

Although large mammals will be prevented from drinking from the dam and silt trap by the construction of a fence they will still have access to the rock pools and drains for a supply of water. Small mammals and reptiles will have access to the dam and silt trap through the mesh fence. Logs placed in the dam and silt trap will assist the smaller animals in accessing water and provide them with a means of escape should they fall in.

The construction of a water storage dam in the project area will provide birds with a more reliable water source.

The interruption of surface flow from the rock will have a negative impact on the frog population which abounds near the base of the rock. The decline in the amount of water reaching the base of the rock means that frogs will no longer be able to rely on runoff from the eastern side of Mt Hampton to create pools in which breeding can take place. Rock pools beneath the drains will also be slower to fill with water which may reduce the number of frogs supported by these pools. Overall it is expected that the number of frogs will decline around the base of the rock.

Rock pools will still form on Mt Hampton above the drains and rock pools below the drains will fill in wet weather. It is not expected, therefore, that the project will have any effect on aquatic invertebrates.

All areas disturbed during construction, and that are not required for the successful operation of the project, will be rehabilitated with local indigenous species.

* **Impacts on Recreational Users (see Commitment 8.2.10)**

Mt Hampton Reserve has been used by the public for picnicking and recreation over the years and construction of the dam will not prevent these activities. In consultation with CALM a car park will be formally marked out by logs to prevent uncontrolled vehicle access to the reserve. The public will not have access to the dam.

* **Impact on the Aesthetic Appreciation of the Area**

The rock drains and dam will not be visible from Moorine South Road and consequently the project will not impact on the aesthetic qualities of the area.

The project will affect the aesthetic qualities of a portion of the reserve but this is unavoidable. The value of the water supply to the continued viability of farming in the area is deemed to outweigh this impact.

* **Increased Vehicle Traffic on Local Roads**

After construction there will be an increase in the number of vehicles using Moorine South Road to access the water supply but as residences are set well back from this road noise from vehicles should not be a problem to residents.

* **Ongoing Maintenance and Responsibility (see Commitment 8.3.2)**

Ongoing maintenance of the water supply scheme will be carried out by the Water Authority or local community, dependent on the outcome of negotiations between both parties regarding operation of the scheme. This maintenance will also cover the removal of any dead trees from the impacted area.

* **Disposal of Silt (see Commitment 8.3.4)**

Silt removed from the silt trap will be spread over the car park.

8. PROPONENT'S COMMITMENTS

The following commitments are made by the Water Authority with respect to this project:

8.1 PRECONSTRUCTION

8.1.1 A rare flora survey will be conducted in Spring 1993 to the satisfaction of CALM. Ministerial approval will be sought should the removal of rare flora be required.

8.1.2 CALM will be notified prior to commencement of construction.

8.1.3 To ensure that declared weeds and dieback are not introduced to the reserve a botanist will be required to inspect the sources of construction materials, particularly gravel and clay.

8.2 DURING CONSTRUCTION

8.2.1 Vegetation clearing will be kept to a minimum. Clearing will be restricted to an area of approximately 2.2ha (ultimately 2.7ha) which will allow for the construction and operation of the dam, silt trap and bitumen-lined channel.

8.2.2 Vegetation clearing will be conducted in consultation with CALM.

8.2.3 The site supervisor will ensure that all activities are undertaken according to CALM dieback hygiene procedures to prevent the introduction of fungal diseases and weeds into the reserve. This will be done to the satisfaction of CALM.

8.2.4 If construction noise levels prove to be a problem on local properties, the Water Authority recognises its obligation to devise corrective action under the noise abatement statutes of Western Australia. This will be to the satisfaction of the EPA.

8.2.5 Local residents will be advised personally by mail or telephone should blasting be required.

8.2.6 Dust control measures will be undertaken as required or as directed by the EPA.

-
- 8.2.7 The site supervisor will inform construction workers that any archaeological material encountered during ground disturbance must be reported as outlined under Section 15 of the Aboriginal Heritage Act, 1972-80. This commitment will be carried out to the satisfaction of the site supervisor and the Department of Aboriginal Sites WA Museum.
- 8.2.8 The site supervisor will ensure the Aboriginal site at Mt Hampton will not be disturbed by the Water Authority or its contractors during construction.
- 8.2.9 All construction debris, and soil and vegetation which cannot be used in on-site earthworks or for rehabilitation, will be removed and disposed of at the nearest Shire of Yilgarn landfill site. No soil will be deposited within the reserve outside the areas that will be cleared to allow construction activities to occur.
- 8.2.10 The public car park at Mt Hampton will be formalised to prevent uncontrolled vehicle access to the reserve. This will be to the satisfaction of CALM.

8.3 POST CONSTRUCTION

- 8.3.1 All disturbed areas not required for the successful and safe operation of the water supply will be rehabilitated with local indigenous species. This will be carried out to the satisfaction of CALM.
- 8.3.2 Ongoing maintenance for the water supply scheme will be carried out by the Water Authority or local community, dependent on the outcome of negotiations between both parties regarding operation of the scheme. This maintenance will also cover the removal of any dead trees in the impacted area.
- 8.3.3 Once the results of the rare flora survey in spring 1993 are obtained, a vegetation monitoring programme will be developed in consultation with CALM and submitted to the EPA for their consideration and endorsement. Monitoring and reporting of the findings to CALM and the EPA will be conducted on an annual basis for the first three years with the spacing of further monitoring determined following discussions with CALM.
- 8.3.4 Disposal of any silt removed from the silt trap will be confined to the area of the car park.

9. ACKNOWLEDGEMENTS

Our thanks are extended to the following individuals and organisations for assistance during the preparation of this CER:

- . CALM Narrogin Regional and District Office, particularly David Mitchell and John Edwards, for assistance with the fauna survey
- . CALM Merredin District Office for provision of background information of the reserve
- . John Dell of the Western Australian Museum
- . Professor Ron Wooller of Murdoch University
- . Nora Cooper of the Western Australian Museum for assistance with mammal identification
- . Ray Cranfield of the Western Australian Herbarium for identification of many of the plants
- . Dr Ken Atkins of CALM for provision of records relating to rare and priority fauna species at and in the vicinity of Mt Hampton
- . Dr Keith Morris of CALM for information regarding *Pseudomys occidentalis*, the Western Mouse.

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APPENDIX A

EPA GUIDELINES

GUIDELINES FOR THE CONSULTATIVE ENVIRONMENTAL REVIEW FOR THE PROPOSED WATER CATCHMENT AND DAM DEVELOPMENT, MT HAMPTON

Overview

In Western Australia, all environmental reviews are about protecting the environment, which for this proposal means that the environmental values associated with Mt Hampton are protected.

These Guidelines have been prepared in response to a proposal forwarded to the Environmental Protection Authority (EPA) by the Water Authority of Western Australia to develop a water supply source at or near Mt Hampton rock. This proposal involves the construction of a dam to store water collected from Mt Hampton Rock.

The primary purpose of the Consultative Environmental Review (CER) is to provide information on the proposal to the EPA within a local framework. The Authority will assess this information and then provide advice to the Government on the environmental acceptability of the proposal. An additional function of the CER is to communicate clearly with the public so that the EPA can obtain informed public comment. As such, environmental impact assessment is quite deliberately a public process. It also seeks to inform decision makers, to identify risks and minimise adverse environmental impacts, to achieve environmentally sound proposals through research, management and monitoring, and to manage potential conflict through the provision of the means for effective public participation.

It is the responsibility of the proponent to design and implement a proposal which protects the environment and to present this proposal for review by all interested members of the public. The proponent should describe what is proposed, discuss the potential environmental impacts of the proposal, and then describe how these environmental impacts are going to be managed so that the environment is protected.

These Guidelines have been prepared to assist the proponent in identifying issues which should be addressed within the CER. They are not intended to be exhaustive, and the proponent may consider that other issues should also be considered within the document.

The discussion in the CER should be concise, accurate, and easily understood. Specialist information should be included where it assists in the understanding of technical aspects of the proposal. A copy of these Guidelines should be included in the CER.

Objectives of the CER

The CER should have the following objectives :

- to place this proposal in the context of the local environment;
- to explain the issues and decisions which led to the choice of this proposal at this place at this time;
- discuss the need for the proposal, including potential benefits of proposed dredging;
- to set out the environmental impacts that the proposal may have; and

- for each impact, to describe any environmental management steps the proponent believes would avoid, mitigate or ameliorate that impact.

The CER should focus on the major issues for the area and anticipate the questions that members of the public may 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.

1. Justification

- justification for the proposed dam;
- an evaluation of alternative water supply options including discussion of previously identified alternatives (such as the construction of dams at other locations, utilising groundwater sources, water supply from existing Goldfields main, paved catchments (as for example exists at Lake Grace), increased 'on-farm' storage), and associated constraints ;
- number of people expected to utilise water from the proposed dam over what area (i.e. 50, 100 sq kms) and expected frequency of use; and
- justification of preferred site. Discussion should make reference to the scale of the proposed dam and degree of modification proposed to existing rock catchment .

2. Proposal

This should include a discussion of the following points:

- brief history of previous water supply options in the area;
- precise dam construction details;
- source of dam construction materials;
- proposed use for water (domestic, agricultural);
- details of any associated infrastructure (including power supply, fencelines);
- proposed vehicle access roads;
- status of land tenure on dam site and adjoining catchment area;
- anticipated construction timetable;
- identification of decision making authorities; and
- any plans for future expansion of dam or catchment area.

3. Existing Environment

- local geology including local / regional significance of rocky outcrops;
- flora and fauna (including invertebrate fauna) which may be affected by proposed dam construction;
- local hydrology and hydrogeology, including drainage characteristics,
- existing water quality (salinity, nutrients), seasonal variation in quality, quantity;
- surrounding land use / management;
- existing public use of the area;
- existing recreational use if the area ;
- description of existing communities in the vicinity of the proposed development; and
- documentation of historical, archaeological and ethnographic sites.

4. Key Environmental Impacts and Management

The potential impacts for the proposed dam construction during the construction period, and long term impacts should be addressed. For each of these impacts, please give consideration to the duration and area of impact, the probability and reversibility of potential impacts, and the importance of the values which may be affected.

To address this issue it may be useful to create a model linking the existing ecosystem with potential impacts of the dam, for example movement of nutrients from rocks; impact of proposed dam on drainage around the base of the rocks.

The following specific issues should be addressed:

- impact on existing recreational users;
- impact on flora and fauna through construction of dam, and spillway; clearing vegetation around the base of Mt Hampton; and modification of catchment area through increased vehicle use as a result of development and associated facilities;
- impact of modification of drainage on existing vegetation, and islands of vegetation located in patches on the Rock itself;
- impact on remaining stands of remnant vegetation (in both a local and regional context);
- effect on groundwater catchment downstream of dam;
- potential erosion effects as a result of channelling water through drains from rocky catchment and dam into the spillway and overflow into the existing natural watercourse; and
- impact on the aesthetic appreciation of the area.

5. Public Participation and consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. It should describe the activities previously undertaken or proposed to be undertaken by the Water Authority of Western Australia to promote public awareness and support for the proposal, the dates, groups and individuals involved, and the objectives of the activities.

Cross reference should be made with the description of the environmental management for the proposal which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures, outside the Environmental Protection Authority process, these can be noted and referenced here.

6. Detailed list of environmental commitments

The commitments 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 take the form of:

- (a). who will do the work (including the baseline data, and who will monitor potential effects);
- (b). what the work is;
- (c). when the work will be undertaken; and
- (d). to whose satisfaction 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.

APPENDIX B

FLORA LIST OF MT HAMPTON RESERVE

COMPILED DURING FIELD VISIT, MAY 1993

ADIANTACEAE

Cheilanthes austrotenuifolia

CUPRESSACEAE

Callitris preissii

POACEAE

Pentaschistis airoides
Spartochloa scirpoidea
Stipa elegantissima
Stipa trichophylla

CYPERACEAE

Lepidosperma longitudinale
Lepidosperma sp.
Lepidosperma viscidum
Lepidosperma vicosum

RESTIONACEAE

Ecdeioclea monostachya

DASYPOGONACEAE

Lomandra effusa

PHORMIACEAE

Dianella revoluta
Stypandra glauca

ANTHERICACEAE

Borya constricta
Borya sp.
Thysanotus manglesianus

CASUARINACEAE

Allocasuarina corniculata
Allocasuarina ?huegeliana
Casuarina obesa

PROTEACEAE

Grevillea puniculata

MIMOSACEAE

Acacia hemiteles
Acacia lasiocalyx
Acacia linophylla
Acacia merrallii
Acacia microbotrya
Acacia nyssophylla

Acacia steedmanii
Acacia sp.

SAPINDACEAE

Dodonaea viscosa subsp. *angustissima*

MYRTACEAE

Calothamnus quadrifidus
Eucalyptus loxophleba subsp. *lissophloia*
Eucalyptus salmonophloia
Kunzea pulchella
Leptospermum erubescens
Leptospermum roei
Leptospermum sp.
Melaleuca acuminata
Melaleuca eleuterostachya
Melaleuca laxiflora
Melaleuca macronychia subsp. *macronychia*
Melaleuca sp.
Melaleuca uncinata
Myrtaceae sp.
Thryptomene ?australis

MYOPORACEAE

Eromphila sp.

LOBELIACEAE

Isotoma petraea

ASTERACEAE

Podotheca sp.
Olearia axillaris var. *erimicola*

XANTHORRHOEACEAE

Xanthorrhoea preissii

APPENDIX C

**FLORA LISTS
OF MT HAMPTON AND MT BAYLY RESERVES**

COMPILED BY DR STEVE HOPPER OF KINGS PARK BOARD

FLORA NOTED ON MT HAMPTON - Dr S.D. HOPPER
5/9/1984
(not a comprehensive list)

Acacia lasiocalyx
Acacia steedmanii
Allocasuarina huegeliana
Borya sphaerocephala
Caladenia dimidia
Caladenia roei
Calothamnus quadrifidus
Cyanicula (Caladenia) amplexans
Diuris corymbosa
Dodonaea sp.
Eucalyptus salmonophloia
Isotoma petraea
Kunzea pulchella
Leptospermum erubescens
Melaleuca elliptica
Microtis unifolia
Pterostylis aff. *nana*
Stypandra glauca
Thelymitra nuda
Thryptomene australis

FLORA OF MT BAYLY RESERVE (No. 28323 - Dr S.D. HOPPER
17/9/1988
(not a comprehensive list)

Acacia acuminata
Acacia assimilis
Acacia erinacea
Acacia hemiteles
Acacia lasiocalyx
Acacia steedmanii
Allocasuarina acutivalvis
Allocasuarina campestris
Allocasuarina huegeliana
Alyxia buxifolia
Arctotheca calendula
Borya sphaerocephala
Caladenia dimidia
Caladenia incensa
Caladenia roei
Caladenia saccharata
Callitris verrucosa
Calothamnus gilesii
Calothamnus quadrifidus
Calytrix sp.
Cheilanthes austrotenuifolia
Cyanicula (Caladenia) amplexans

Dianella revoluta
Diuris corymbosa
Dodonaea sp.
Drakonorchis mesocera
Drosera ? bulbosa
Drosera glanduligera
Drosera stolonifera subsp. *rupicola*
Eremophila drummondii
Eucalyptus leptopoda
Eucalyptus loxophleba subsp. *lissophloia*
Eucalyptus petraea
Eucalyptus rigidula
Eucalyptus salmonophloia
Eucalyptus salubris
Eucalyptus aff. *transcontinentalis*
Glossostigma
Grevillea paradoxa
Hibbertia ? eatonii
Hibbertia glomerosa
Isoetes australis
Kunzea pulchella
Lepidosperma ? viscida
Leptospermum erubescens
Microtis unifolia
Melaleuca elliptica
Nicotiana sp.
Podolepis sp.
Prasophyllum ringens
Pterostylis recurva
Pterostylis aff. *nana*
Pterostylis aff. *rufa*
Rhagodia sp.
Santalum spicatum
Spartochloa scirpoidea
Stackhousia huegelii
Stylidium ecorne
Stylidium petiolare
Stylidium sp.
Thelymitra nuda
Thryptomene australis
Trachymene ornata
Ursinia anthemoides

APPENDIX D

**FAUNA SPECIES RECORDED
AND/OR EXPECTED
AT MT HAMPTON RESERVE**

VERTEBRATE SPECIES WHICH WERE RECORDED IN APRIL 1993 OR ARE
EXPECTED TO OCCUR AT THE MOUNT HAMPTON RESERVE

KEY

- 1 GRANITE ROCK
- 2 ALLOCASUARINA THICKET AND WOODLAND
- 3 GRASSLAND
- 4 SCLEROPHYLL WOODLAND
- 5 BROOMBUSH HEATH
- E Species expected in this vegetation type
- A Mainly recorded as aerial species and expected in the study area.
- R Species recorded during 1993 site visit
- 6 Number of species trapped during 1993 site visit.
- I Introduced species
- * Rare or priority species

VERTEBRATE SPECIES WHICH WERE RECORDED IN APRIL 1993 OR ARE
EXPECTED TO OCCUR AT THE MOUNT HAMPTON RESERVE

SCIENTIFIC NAME	COMMON NAME	VEGETATION TYPES				
		1	2	3	4	5
MAMMALS						
TACHYGLOSSIDAE						
Tachyglossus aculeatus	Echidna		E	E	E	E
DASYURIDAE						
Dasyurus geoffroii (*)	Western Quoll	E	E	E	E	E
Sminthopsis crassicaudata	Fat-tailed Dunnart		E	E	E	E
S. granulipes	White tailed Dunnart		E	E	E	E
S. dollichura			R	E	E	E
S. gilberti			E	E	E	E
BURRAMYIDAE						
Cercartetus concinnus	Pygmy-possum			E	E	E
MACROPODIDAE						
Macropus fuliginosus	Western Grey Kangaroo	E	E	E	R	R
M. irma	Western Brush Wallaby	E	E	E	E	R
M. robustus	Common Walleroo (Euro)	E	E	E	E	E
MOLOSSIDAE						
Mormopterus planiceps	Little Mastiff Bat	E	E	E	E	E
Tadarida australis	White-striped Mastiff Bat	E	R	E	E	E
VESPERTILIONIDAE						
Chalinolobus gouldii	Gould's Wattled Bat	E	E	E	E	E
Eptesicus regulus	King River Bat	E	E	E	E	E
Nyctophilus geoffroyi	Lesser Long-eared Bat	E	E	E	E	E
N. major		E	E	E	E	E
Scotorepens balstoni	Western Broad-nosed Bat	E	E	E	E	E
MURIDAE						
Mus domesticus (I)	House mouse	E	21	E	E	E
Notomys mitchellii	Mitchell's Hopping Mouse			E	E	E
Pseudomys albocinereus	Ash-grey Mouse			E	E	E
P. bolami				E	E	E
CANIDAE						
Canis familiaris (I)	Dog	E	E	E	E	E
Vulpes vulpes (I)	Fox	E	E	E	E	E

FELIDAE		1	2	3	4	5
Felis catus (I)	Cat	E	E	E	E	E
LEPORIDAE						
Oryctolagus cuniculus (I)	Rabbit	R	R	R	R	R
<hr/>						
TOTAL NUMBER OF SPECIES		16	21	25	25	25
TOTAL NUMBER OF TRAP		0	113	0	0	0
NIGHTS						
<hr/>						

BIRDS		1	2	3	4	5
CASUARIIDAE						
<i>Dromaius novaehollandiae</i>	Emu	R	E	E	E	R
ACCIPITRIDAE						
<i>Lophoictinia isura</i>	Square-tailed Kite	A	A	A	A	A
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	A	A	A	A	A
<i>Aquila audax</i>	Wedge-tailed Eagle	A	A	A	A	A
<i>Aquila morphnoides</i>	Little Eagle	A	A	A	A	A
FALCONIDAE						
<i>Falco peregrinus</i>	Peregrine Falcon	A	A	A	A	A
<i>Falco longipennis</i>	Australian Hobby	A	A	A	A	A
<i>F. berigora</i>	Brown Falcon	A	A	A	A	A
<i>F. cenchroides</i>	Australian Kestrel	A	A	A	A	A
MEGAPODIIDAE						
<i>Leipoa ocellata</i>	Mallee Fowl				E	
TURNICIDAE						
<i>Turnix velox</i>	Little Button-quail			E	E	E
OTDIDAE						
<i>Otis australis</i>	Australian Bustard			E	E	E
COLUMBIDAE						
<i>Phaps chalcoptera</i>	Common Bronzewing		R	E	E	E
PSITTACIDAE						
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet		E		E	
<i>Polytelis anthopeplus</i>	Regent Parrot		E		E	
<i>Platycercus zonarius</i>	Ring-necked parrot	E	R	R	R	R
<i>Neophema elegans</i>	Elegant parrot			E	E	
<i>Calyptorhynchus magnificus</i>	Red-tailed Cockatoo		E		E	
<i>C. latirostris</i> (*)	Carnaby's Cockatoo		E	E	E	E
<i>Cacatua roseicapilla</i>	Galah		E	E	E	E
CUCULIDAE						
<i>Cuculus flabelliformis</i>	Fan-tailed Cuckoo		E		R	
<i>Cuculus pallidus</i>	Pallid Cuckoo		E		E	
<i>Chrysococcyx osculans</i>	Black-eared cuckoo		E		E	
<i>C. basalis</i>	Horsefield's Bronze Cuckoo		E		E	
STRIGIDAE						
<i>Ninox novaeseelandiae</i>	Southern Boobook		E		E	
PODARGIDAE						
<i>Podargus strigoides</i>	Tawny Frogmouth		E		E	
AEGOTHELIDAE						
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		E	E	E	
CAPRIMULGIDAE						
<i>Eurostopodus argus</i>	Spotted Nightjar		E	E	E	

		1	2	3	4	5
MEROPIDAE						
Merops ornatus	Rainbow Bee-eater		E	E	E	E
HIRUNDINIDAE						
Hirundo nigricans	Tree Martin	A	A	A	A	A
MOTACILLIDAE						
Anthus novaeseelandiae	Richard's Pipit			E		
CAMPEPHAGIDAE						
Coracina novaehollandiae						
Lalage sueurii	White-winged Triller		E		E	
PACHYCEPHALIDAE						
Microeca leucophaea	Jacky Winter		E		E	
Petroica cuculata	Hooded Robin		E		E	
P. goodenovii	Red-capped Robin		R		E	
Eopsaltria australis	Yellow Robin		E		E	
Pachycephala pectoralis	Golden Whistler		R		E	
P. rufiventris	Rufous Whistler		R		E	
P. inornata	Gilbert's Whistler		E	E	E	
Colluricincla harmonica	Grey Shrike-thrush		R		R	
Falcunculus frontatus (*)	Shrike-tit		E		E	
Oreoica gutturalis	Crested Bellbird		E		R	
MONARCHIDAE						
Rhipidura fuliginosa	Grey Fantail		R	E	E	
R. leucophrys	Willie Wagtail		E	E	E	E
ORTHONYCHIDAE						
Cinclosoma castanotum	Chestnut Quail-thrush		E	E	E	
Drymodes brunneopygius	Southern Scrub-robin		E	E	E	
Pomatostomus superciliosus	White-browed Babbler		E		E	
ACANTHIZIDAE						
Gerygone fusca	Western Warbler		E	E	E	
Smicromnis brevirostris	Weebill		E	E	E	
Acanthiza apicalis	Broad-tailed Thornbill	E	R	E	E	E
A. chrysorrhoa	Yellow-rumped thornbill	E	E	E	E	E
A. uropygialis	Chestnut-rumped Thornbill	E	E	E	E	
Sericornis frontalis	White-browed Scrub- wren	E	E	E	E	E
S. fuliginosus	Calamanthus	E	E	E	E	E
Pyrrholaemus brunneus	Redthroat	E	E	E	E	E
MALURIDAE						
Malurus leucopterus	White-winged fairy wren	E	E	E	E	E
M. pulcherrimus	Blue-breasted Fairy- wren	E	E	E	E	E
M. splendens	Splendid Fairy-wren					

		1	2	3	4	5
DAPHOENOSITTIDAE						
Daphoenositta chrysoptera	Australian Sittella		E		E	
CLIMACTERIDAE						
Climacteris rufa	Rufous Tree-creeper		E		E	
DIDAEIDAE						
Dicaeum hirundinaceum	Mistletoebird		E		E	
ZOSTEROPIDAE						
Zosterops lateralis	Grey-breasted Silvereye	E	E	E	E	E
PARDALOTIDAE						
Pardalotus punctatus	Spotted pardalote		E		E	
P. striatus	Striated Pardalote		E		E	
MELIPHAGIDAE						
Lichmera indistincta	Brown Honeyeater	E	E	E	E	E
Meliphaga virescens	Singing Honeyeater	E	E	E	E	E
M. cratitia	Purple-gaped Honeyeater	E	E	E	E	E
M. leucotis	White-eared Honeyeater	E	E	E	E	E
Melithreptus brevirostris	Brown-headed Honeyeater	E	E	E	E	E
Phylidonyris albifrons	White-fronted Honeyeater	E	E	E	E	E
Manorina flavigula	Yellow-throated Miner	E	E	E	E	E
Acanthagenys rufogularis	Spiny-checked Honeyeater	E		E		E
A. carunculata	Red-wattle-bird	E	E	E	E	E
Epthianura albifrons	White-fronted chat	E		E	E	E
PLOGEIDAE						
Poephila guttata	Zebra Finch	E	E	E	E	E
GRALLINIDAE						
Grallina cyanoleuca	Magpie-lark	E	E	E	E	E
ARTAMIDAE						
Artamus cinerereus	Black-faced Wood-swallow	E	E	E	E	E
A. cyanopterus	Dusky Wood-swallow	E	R	E	E	E
A. minor	Little Wood-swallow	E	E	E	E	E
CRACTICIDAE						
Cracticus torquatus	Grey Butcherbird	E	E	E	E	
C. nigrogularis	Pied Butcherbird.	E	R	E	E	
C. tibicen	Magpie	E	E	R	E	E
Strepera versicolor	Grey Currawong	E	R	E	E	E

CORVIDAE		1	2	3	4	5
Corvus bennetti	Little Crow	E	E	E	E	E
C. coronoides	Australian Raven	E	E	R	R	E
<hr/>						
TOTAL NUMBER OF NATIVE SPECIES		42	78	59	83	46
<hr/>						

AMPHIBIANS		1	2	3	4	5
LEPTODACTYLIDAE		R				
Crinia pseudinsignifera		10				
Heleioporus albopunctatus		E	13			
Limnodynastes dorsalis	Banjo Frog	E	88	E	E	E
Myobatrachus gouldii	Turtle Frog		3	E	E	E
N. albipes		E	1			
N. kunapalari			9	E	E	E
N. pelobatoides	Humming Frog	E				
Pseudophryne guentheri			93	E	E	E
P. occidentalis			1	E	E	E
TOTAL NUMBER OF SPECIES		5	6	5	5	5
TOTAL NUMBER OF TRAP		0	113	0	0	0
NIGHTS						

REPTILES	1	2	3	4	5
GEKKONIDAE					
Crendactylus o. ocellatus	R	E	E	E	E
Diplodactylus assimilis		E		E	E
D. granariensis	E	E		E	E
D. intermedius	E	E		E	E
D. maini	E	E		E	
D. pulcher	E	E	E	E	E
D. spinigerus	E	E	E	E	E
Gehyra variegata	R	E	E	E	E
Heteronotia binoei	E	E	E	E	E
Nephrurus stellatus	E		E	E	E
Oedura reticulata	E			E	
Phyllodactylus m. marmortus	R	E	E	E	E
Phyllurus milli	E	R	E	E	E
PYGOPODIDAE					
Delma fraseri	E	E	E	E	E
Lialis burtonis		E	E	E	E
Pygopus lepidopus			R	E	E
AGAMIDAE					
Ctenophorus cristatus				E	
C. isolepis citrinus			E		
C. maculatus griseus					E
C. ornatus	R				
C. reticulatus			E	E	E
C. salinarum			E	E	E
C. scutulatus				E	
Moloch horridus				E	E
Pogona m. minor		E	E	E	E
Tympanocryptis adelaidensis			E	E	E
chapmani					
Tympanocryptis cephal			E	E	E
SCINCIDAE					
Cryptoblepharus plagiocephalus	E	E	E	E	E
Ctenotus atlas	E	E	E	E	E
C. impar	E	E	E	E	E
C. schomburgkii	E	E	E	E	E
C. xenopleura	E	E	E	E	E
Egernia richardii	E	E	E	E	E
E. depressa	E	E	E	E	E
E. inornata	E	E	E	E	E
E. multisutata bos	E	E	E	E	E
Hemiergus i. initialis	E	E	E	E	E
H. peronii	E	E	E	E	E
Lerista distinguenda	E	E	E	E	E
L. gerrardii	E	E	E	E	E
L. macropisthopus	E	E	E	E	E
L. muelleri	E	E	E	E	E
L. p. picturata	E	E	E	E	E
Menetia greyii	E	E	E	E	E
Morethia butleri	E	E	E	E	E
M. obscura	E	E	E	E	E
Omolepida branchialis	E	E	E	E	E

		1	2	3	4	5
<i>Tiliqua occipitalis</i>		E	E	E	E	E
<i>T. rugosa</i>	Bobtail	E	E	E	E	E
VARANIDAE						
<i>Varanus gouldii</i>	Bungarra	E	E	E	E	E
<i>V. rosenbergi</i>		E	E	E	E	E
<i>V. tristis tristis</i>		E	E	E	E	E
TYPHLOPIDAE						
<i>Ramphotyphlops australis</i>		E	E	E	E	E
<i>R. bituberculatus</i>		E	E	E	E	E
<i>R. waitii</i>		E	E	E	E	E
BOIDAE						
<i>Morelia ramsayi</i> (*)	Ramsey's Python	E	E	E	E	E
<i>Morelia spilota</i> (*)	Carpet Python	E	E	E	E	E
ELAPIDAE						
<i>Denisonia atriceps</i>	Lake Cronin Snake	E	E	E	E	E
<i>D. fasciata</i>	Rosen's Snake	E	E	E	E	E
<i>Notechis curtus</i>	Bardick	E	E	E	E	E
<i>Pseudonaja affinis</i>	Dugite	E	E	E	E	E
<i>P. australis</i>	Mulga Snake	E	E	E	E	E
<i>P. modesta</i>	Ringed Brown Snake	E	E	E	E	E
<i>P. nuchalis</i>	Gwardar	E	E	E	E	E
<i>Rhinoplocephalus gouldii</i>	Gould's Snake	E	E	E	E	E
<i>R. nigriceps</i>	Black Banded Snake	E	E	E	E	E
<i>Vermicella bertholdii</i>	Jan's Banded Snake	E	E	E	E	E
<i>V. bimaculata</i>	Blacknaped Snake	E	E	E	E	E
<i>V. semifasciata</i>	Southern Shovel- Nosed Snake	E	E	E	E	E

TOTAL NUMBER OF SPECIES	57	56	59	66	63
TOTAL NUMBER OF TRAP NIGHTS	0	113	0	0	0

AQUATIC MACROINVERTEBRATES

Pool		1	2	3
CRUSTACEA				
Conchostraca				
Lynceus sp.	Clam shrimps			3
INSECTA				
Hemiptera				
Corixidae				
Agraptocortixa sp.	Water Boatman		1	4
Micronecta robusta	Water Boatman			6
Notonectidae				
Anisops sp.	Backswimmer			2
Coleoptera				
Dytiscidae				
Platynectes sp. larva	Aquatic beetle larva			2
Sternopriscus sp adult	Aquatic beetle	5		
Sternopriscus sp larva	Aquatic beetle larva	1		
Hydrophilidae				
Hydrophilid sp. adult	Aquatic beetle		2	
Odonata				
Anisoptera				
Anisopteran sp. juvenile*	Dragonfly larva		1	
Diptera				
Chironomidae				
Larval species 1	Midge larva	2		
Larval species 2	Midge larva	1		
Larval species 3	Midge larva			4
Culicidae				
Culex sp larva	Mosquito larva		100	
			+	
Culex sp. pupa	Mosquito pupa		50	
			+	
TOTAL NUMBER OF SPECIES		4	5	6

* Too imature to identify to family or species

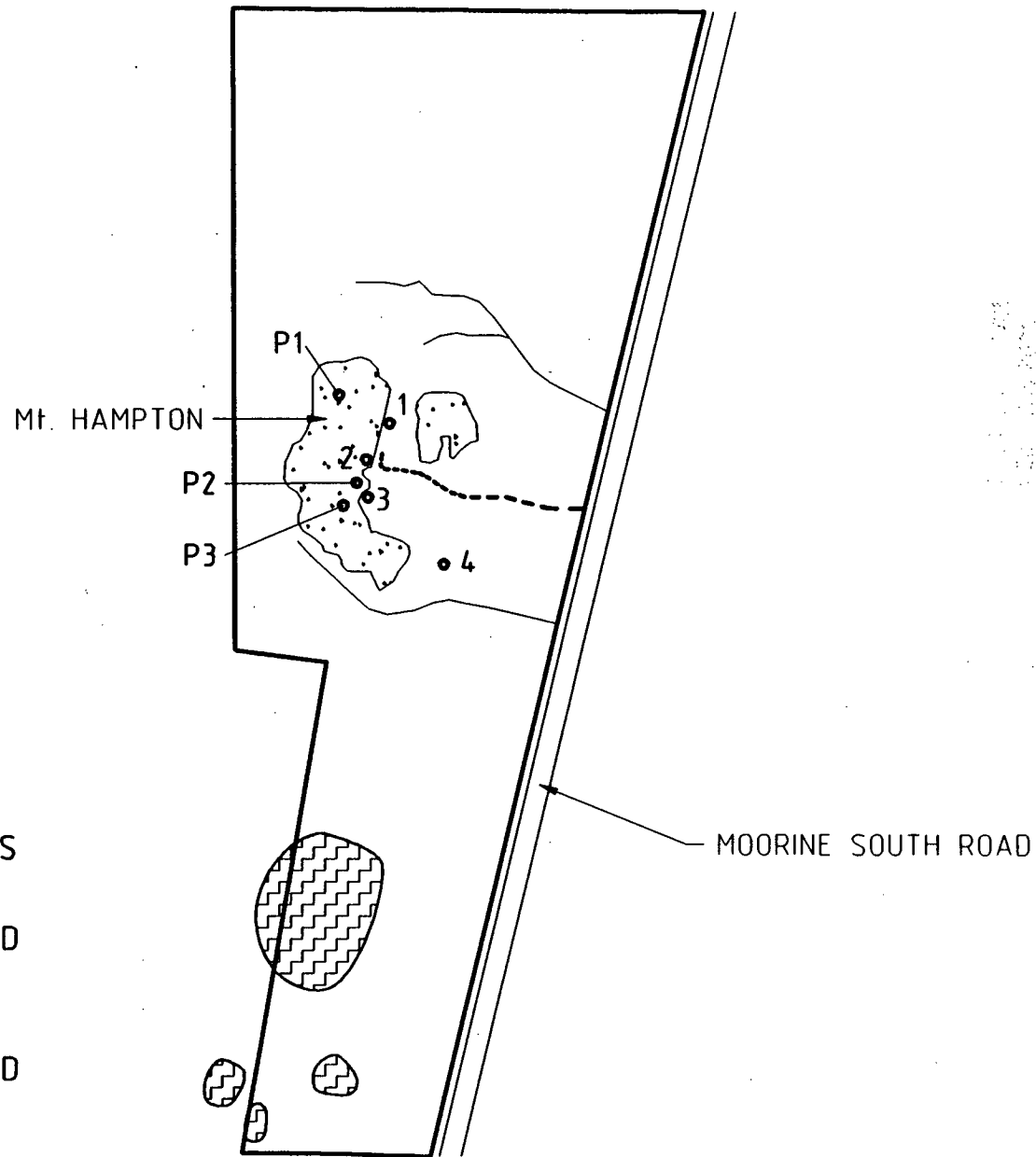
*The location of pools 1 to 3 are shown in figure E1.

LIBRARY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WESTRALIA SQUARE
141 ST. GEORGES TERRACE, PERTH

MT. HAMPTON RESERVE FAUNA SURVEY SITES

KEY

- RESERVE BOUNDARY
- - - EXISTING ACCESS TRACK
- ▨ WETLANDS
- ▧ OLD DRY LAKES
- MT. HAMPTON
- ~ DRAINAGE LINES
- 1 11 ELLIOTT TRAPS
- 2 2 LINES OF 6 PITFALL TRAPS
- 3 6 PITFALL TRAPS
2 LARGE ELLIOTT TRAPS AND
3 SMALL ELLIOTT TRAPS
- 4 6 PITFALL TRAPS
2 LARGE ELLIOTT TRAPS AND
3 SMALL ELLIOTT TRAPS
- P1 - P3 AQUATIC FAUNA
SAMPLING POINTS



0 1 km

**Halpern
Glick
Maunsell**



FIGURE D1