Proposed clay excavation, Lot 6 Almeria Parade, Upper Swan

Midland Brick Company Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 608
January, 1992

THE PURPOSE OF THIS REPORT

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

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

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

APPEALS

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

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

ADDRESS

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

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 p.m. on 31 January, 1992.

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Midland Brick Company Pty Ltd propose to excavate clay on Lot 6 Almeria Parade, Upper Swan, west of Great Northern Highway and Ellen Brook Nature Reserve, and about 14km north of Midland.

The deposit of highly plastic clay occurs as a shallow clay pan which would be excavated and rehabilitated to a series of interconnecting dams within a three-year period. The clay would be mined in the dry season and carted to Midland for making bricks.

The Authority has assessed the environmental impact of the proposal by way of a Consultative Environmental Review, in conjunction with other nearby clay excavation proposals which potentially impact on the habitat of the extremely rare and endangered Western Swamp Tortoise (*Pseudemydura umbrina*). The clay excavation proposals are being assessed concurrently by the Environmental Protection Authority, and have been described in a common document. The Consultative Environmental Review was open for public review in October, 1990 and the Authority received ten submissions on the proposals. The proponents held a public open day near the site in December, 1990, at which time further comments were received from some members of the local community.

Ellen Brook Nature Reserve has been especially created by the State Government for the purpose of conserving the tortoise. About 20 to 30 short necked tortoises live in the specially fenced-off Wildlife Sanctuary within the reserve, and they are thought to be the only known population of naturally occurring short necked tortoises in the world. A similar number of tortoises are the subject of a special breeding programme at the Perth Zoo. The population of short necked tortoises at the nearby Twin Swamps Reserve has declined from over 100 animals in 1965, to virtual extinction by 1985.

The Authority has assessed the potential environmental impacts of the proposal, both as described in the Consultative Environmental Review and in response to public submissions.

Major issues

The environmental impact of the clay excavations on all of the tortoise habitat at Ellen Brook Nature Reserve, specifically the area outside the tortoise swamp, required additional details.

In their response to submissions (Appendix 2), Midland Brick has acknowledged this and provided further information necessary to enable the Authority to adequately assess the impact of the clay excavation over the whole of the tortoise habitat area.

Runoff water from the clay excavation could impact upon the habitat of the rare and endangered short necked tortoise.

The Environmental Protection Authority believes that drainage impacts on the tortoise habitat can be managed by the proponent to the benefit of the tortoise, as a result of the following:

- **Midland Brick has given a commitment that, during the mining activity, no silt-laden run-off water would enter the Ellen Brook Nature Reserve from Lot 6;**

- **Midland Brick would construct an earth bund to contain storm water within the site and deflect clean run-off waters away from disturbed areas; and**

  Midland Brick would provide equipment and personnel at its cost to modify the existing drainage system in the catchment, to an agreed and pre-arranged specification, should the Department of Conservation and Land Management so wish.

The proposed drainage modifications have been further strengthened by the Authority's Recommendation 2 in this report for the proponent to prepare and implement a drainage management plan in consultation with appropriate government authorities and to the satisfaction of the Authority, which would enable Midland Brick to:

- **monitor drainage to detect, report on, and manage any drainage impacts on the Wildlife Sanctuary for the Western Swamp Tortoise at Ellen Brook Nature Reserve;**
- **remedy any unacceptable drainage impacts on the Wildlife Sanctuary caused by this proposal;**
- **detain all drainage waters on site during the life of the clay excavation operation, so that they do not enter the Wildlife Sanctuary at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere; and**
- **divert all drainage waters from the eastern end of Lexia Avenue from entering the Wildlife Sanctuary at Ellen Brook Nature Reserve within two years of approval of the proposal, and in so doing, ensure it does not create an unacceptable impact elsewhere.**

These recommendations are in line with expert submissions which indicate that the tortoise would benefit by the elimination of external drainage waters into the reserve, as water requirements for the tortoise habitat could be met by rainfall.

The clay excavations could lead to a more rapid drying up of the winter-wet swamp habitat that is essential for the short necked tortoises to breed in, by draining perched groundwater from the area.

The proponent has documented substantial hydrological data to show that water levels in the main tortoise swamp habitat are predominantly dependant on rainfall, rather than surface flow or a hydraulic connection with other groundwater from outside the area.

The proponent acknowledges that there may be an element of uncertainty with perched groundwater and depressions of surface water within the reserve, particularly when quarrying is close to the boundary of the Wildlife Sanctuary.

The Environmental Protection Authority concludes that, from investigations undertaken and advice given, the proposal by Midland Brick is most unlikely to impact on the groundwater of the tortoise habitat, because of the following factors:

- **The site is unusual in that it appears not to have an overburden layer which would allow the development of a perched groundwater regime;**

  the deposit of clay is relatively small and shallow and would be mined and rehabilitated within three years;

- **the site is elevated some 1 to 2 metres above and situated at least 200 metres from the boundary of the Wildlife Sanctuary; and**

- **The proponent will need to prepare an approved groundwater protection plan prior to the start of operations, as part of the Environmental Management Programme (see Recommendation 3), with the objective of delineating and monitoring any perched groundwater levels and pit seepages, and developing suitable management practices to remedy any potentially unacceptable impacts.**

The clay excavation proponents could assist in the provision of additional habitat area for the short necked tortoise, particularly as many of their excavations are proposed in old habitat areas which would otherwise be difficult and expensive to be rehabilitated for the benefit of the tortoise.

Improvements to the habitat area by mechanical deepening of some areas to provide sufficiently deep swamps for the tortoise to swim and eat in, providing suitable aestivating refuges, and rehabilitating the native vegetation are being investigated. Parts of the current reserve that do not hold water for extended periods each winter may also be deepened and rehabilitated. The fox-proof fence would also need to be extended.

In the company's response to issues raised in submissions, Midland Brick has indicated that it would be prepared to assist in drainage diversion works by providing earthmoving equipment in an equitable arrangement with the other proponents. Midland Brick acknowledges the interest of the Department of Conservation and Land Management in acquiring the eastern portions of nearby lots 12 and 13, which are opposite Lot 6 on the south side of Lexia Avenue and also adjoin the fenced-off Wildlife Sanctuary. Midland Brick own Lot 12 and is endeavouring to arrange a land swap with the owner of Lot 13, such that this area, which contains some remnant vegetation and has suitable soil types, could be added to the tortoise habitat.

The Environmental Protection Authority encourages other companies and individuals who may wish to participate in the recovery and survival of this extremely endangered species of wildlife to liaise with the Department of Conservation and Land Management.

Whether the clay excavations could affect groundwater supplies, particularly if dewatering of the superficial aquifer occurred or there was a major fuel spillage inside a pit, was of concern.

Midland Brick state that exploration drilling and bore monitoring data clearly show that the clay layer to excavated is located more than 2 metres above the permanent water table. Dewatering would not be carried out. Only unlicensed vehicles such as dozers and excavators would be refuelled on site, and no fuel or lubricants would be stored at the clay pit.

The Environmental Protection Authority has recommended that Midland Brick should prepare an approved groundwater protection plan as part of the Environmental Management Programme, in consultation with the Water Authority of Western Australia. The plan should outline procedures to be used by the proponent to protect the quality and quantity of groundwater from the impacts of the clay excavation and earth moving machinery (see Recommendation 3).

After the excavations cease, the resultant end use, such as urban residential, may indirectly lead to extinction of the short necked tortoise

The Environmental Protection Authority previously made recommendations in 1983 that ways and means of providing a protective buffer zone around Ellen Brook Nature Reserve be sought through planning procedures.

The proponent has made the following commitments:

- **to consult with planning authorities to facilitate the derivation of a long term strategic plan for the Upper Swan locality which recognises and accepts the interim priority land use of clay extraction; and**
- **to establish an inter-company liaison mechanism to enable a co-ordinated approach between all three proponents with respect to addressing potential cumulative operational effects and overall rehabilitation goals.**

These commitments have been further strengthened by:

- **the Authority's recommendation in this report for the joint preparation of a regional development, drainage and rehabilitation plan for the locality by all the clay excavation proponents, in consultation with government authorities, and within two years of approval (Recommendation 4).**

The proposed clay excavations could have the potential to impact on the comfort of local residents, through noise, dust and visual impacts, unless managed.

Midland Brick have outlined a number of management strategies which are currently used to minimise noise and dust impacts. The company has stated that it would restrict its operating hours to 6.00am to 5.30pm, Monday to Friday and 6.00am to 1.00pm on Saturdays,with no additional activity outside these hours. Midland Brick propose sequential rehabilitation and screening with vegetation to reduce visual impacts.

The Environmental Protection Authority has recommended that the proponent should prepare, implement and regularly review noise, dust and visual impact management plans as part of the Environmental Management Programme, in consultation with the Shire of Swan and to the satisfaction of the Environmental Protection Authority (see Recommendation 3). The plans should document the company's procedure for handling complaints, including the person responsible within the company for receiving and recording the complaints, for following them up and, if appropriate, for rectifying the cause of the complaint.

The clay pits could become a source of mosquito nuisance or disease to the public, and may represent a danger to young children in the area, unless managed.

The company has stated that public access is presently restricted by boundary fences in good condition and is supplemented by an internal electric fence. A padlocked gate would be provided at the access point. In regard to provision of alternative recreational areas to encourage local children away from the quarry, Midland Brick has held discussions with officers from the Shire of Swan and has committed funds to enhancing facilities which exist within the area.

The Environmental Protection Authority considers that the proponent should liaise with the Shire of Swan and the Department of Conservation and Land Management to ensure that community health and safety issues are catered for in the management and rehabilitation of the clay excavations, and addressed in the Environmental Management Programme (Recommendation 4).

The Swan Valley area is known to have sites of major Aboriginal significance in both archaeological and ethnographic terms.

The Authority advises that the proponent should discuss with the Department of Aboriginal Sites of the West Australian Museum appropriate ways of complying with the provisions of the Aboriginal Heritage Act 1972-80.

The Environmental Protection Authority recognises the very rare status of the short necked Western Swamp tortoise, and the requirement to protect its habitat. Accordingly, the Authority has set a very high onus of proof on this and other nearby quarrying proposals, to demonstrate that there will be no adverse impacts on the tortoises and their habitat. It is only after detailed study that the Authority considers that the proposal would not have any adverse impacts and therefore could proceed.

Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the Authority makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Midland Brick to quarry clay on Lot 6 Almeria Parade, Upper Swan, as outlined in the Consultative Environmental Review and subsequently modified during the process of interaction between the proponent, the Environmental Protection Authority, and government agencies, and those members of the public who were consulted, is environmentally acceptable.

In reaching this conclusion, the Authority identified the main issues requiring detailed consideration as:

- **protection of the habitat of the endangered Western Swamp Tortoise, *Pseudemydura umbrina*, at Ellen Brook Nature Reserve;**
- **management of drainage waters;**
- **protection of groundwater resources;**
- **rehabilitation of the quarried area;**
- **noise, dust, and visual impacts from the quarrying operations; and**
- **public safety and management of mosquito breeding.**

The Environmental Protection Authority considers that these and other issues, such as planning considerations, have been addressed and are manageable, either by changes to the proposal by the proponent during assessment, the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's commitments (Appendix 1) and the Environmental Protection Authority's recommendations in this report. Any approval for the proposal should be for a maximum of five years from the time of commencement.

A drainage management plan should be prepared to protect the habitat of the Western Swamp Tortoise at Ellen Brook Nature Reserve from external surface water drainage impacts affected by this proposal.

Recommendation 2

The Environmental Protection Authority recommends that, prior to the start of quarrying activities and in consultation with the Department of Conservation and Land Management, the Swan River Trust and the Shire of Swan, Midland Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment on advice of the Environmental Protection Authority. This plan should enable the proponent to:

- **monitor drainage to detect, report on, and manage any drainage impacts on the Wildlife Sanctuary for the Western Swamp Tortoise at Ellen Brook Nature Reserve;**

  remedy any unacceptable drainage impacts on the Wildlife Sanctuary caused by this proposal;
- **detain all drainage waters on site during the life of the clay excavation operation, so that they do not enter the Wildlife Sanctuary at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere; and**

- **divert all drainage waters from the eastern end of Lexia Avenue from entering the Wildlife Sanctuary at Ellen Brook Nature Reserve within two years of approval of the proposal, and in so doing, ensure it does not create an unacceptable impact elsewhere.**

The drainage management plan should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority.

A comprehensive environmental management programme should be prepared to enable the proponent to detect, report on and manage any impacts on the environment, particularly the habitat of the Western Swamp Tortoise at Ellen Brook Nature Reserve.

Recommendation 3

The Environmental Protection Authority recommends that, prior to the start of quarrying activities and following consultation with the appropriate government authorities, Midland Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment on advice of the Environmental Protection Authority. This programme should enable the proponent to detect, report on, and manage any impacts, and remedy any unacceptable impacts on the environment by this proposal, and should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority. Details to be prepared as part of the Environmental Management Programme should include, but not necessarily be limited to:

- **drainage management (see Recommendation 2);**
- **groundwater management and protection;**
- **progressive rehabilitation of the site;**
- **procedures to minimise noise, dust and visual impacts associated with the quarrying and transportation operations;**
- **public safety and mosquito breeding;**
- **periodic reporting of monitoring results, and**
- **consequential changes to project management to remedy unacceptable environmental impacts.**

The timing of the preparation and review of the Environmental Management Programme should be to the satisfaction of the Environmental Protection Authority.

Recommendation 4

The Environmental Protection Authority recommends that Midland Brick should contribute, to the satisfaction of the Environmental Protection Authority, to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, in consultation with the Department of Conservation and Land Management, the Department of Planning and Urban Development, the Shire of Swan, and other current and known proposed clay producers in the area, such that a plan can be prepared within two years of approval of this proposal.

1. Introduction and background

Midland Brick Company Pty Ltd propose to excavate clay on Lot 6 Almeria Parade, Upper Swan, west of Great Northern Highway and Ellen Brook Nature Reserve, and about 14km north of Midland (Figure 1).

An Application for Approval to Commence Development on Lot 6 by Midland Brick Company Pty Ltd (Midland Brick) was referred to the Environmental Protection Authority by the Shire of Swan in June, 1987. The Authority determined that a formal level of assessment was necessary, to allow the Minister for the Environment to set environmental conditions on the project. In addition, four other proposals for the extraction of clay in the immediate vicinity of Ellen Brook Nature Reserve were also referred to the Authority.

In 1989 the Authority advised the proponents of all clay excavation proposals in the vicinity of the habitat of the rare and endangered short necked tortoise at Ellen Brook Nature Reserve that, prior to assessing their individual proposals, a study of the water relationships in the area would need to be undertaken. This work has subsequently been carried out and reported in a joint Consultative Environmental Review (CER) document, which was released for public review in October, 1990. Midland Brick provided more information on their proposal in November, 1991, in response to issues raised by the Authority as a result of the CER process (Appendix 2). Following an on-site meeting in December, 1991, the company provided more detail on the operation, including a commitment to contain all drainage within the site during the excavation period (Appendix 3).

2. The Western Swamp Tortoise

The following section is a brief summary on the Western Swamp Tortoise and factors that have lead to its endangered status. Much of the information is based on submissions by the Zoology Department of the University of Western Australia and the Department of Conservation and Land Management (Wildlife Management Programme No. 6), whose contributions are gratefully acknowledged. The reader is referred to Appendix 4, which provides a useful bibliography on some recent texts.

The Western Swamp Tortoise (*Pseudemydura umbrina*) which is more commonly known as the short necked tortoise, is generally recognised as the most endangered species of vertebrate animal in Australia. Ellen Brook Nature Reserve was declared in 1962, in order to protect one of the two known remaining populations of such tortoises in the world from extinction. The tortoise is only known to exist in the wild today at Ellen Brook Nature Reserve and the Twin Swamps Nature Reserve, 4km to the north.

The Western Swamp Tortoise is easily distinguishable from other fresh water tortoises in Western Australia by its short neck and the fact that it inhabits ephemeral (winter-only) swamps; it does not seem to occur in permanent rivers, creeks, lakes or swamps. The short necked tortoise aestivates (sleeps) in naturally occurring tunnels in the clay gilgai soils during summer and autumn. *Pseudemydura umbrina* is the smallest Australian chelid tortoise. It is the only species in which the female is smaller than the male. Maximum age attained is not known, but is at least 50 years. *Pseudemydura umbrina* is a relict species, apparently little changed since the Miocene (12 to 25 million years ago). The species is so different from other members of its family, Chelidae, that a separate sub-family, the Pseudemydurinae, has been proposed for it.

The population of short necked tortoises at Twin Swamps Reserve declined from over 100 animals in 1965, to virtual extinction by 1985. A specially fenced-off, fox-proof area within the nearby Ellen Brook Nature Reserve, constructed in 1990, now contains the only known, naturally occurring population of such short necked tortoises in the world, consisting of about

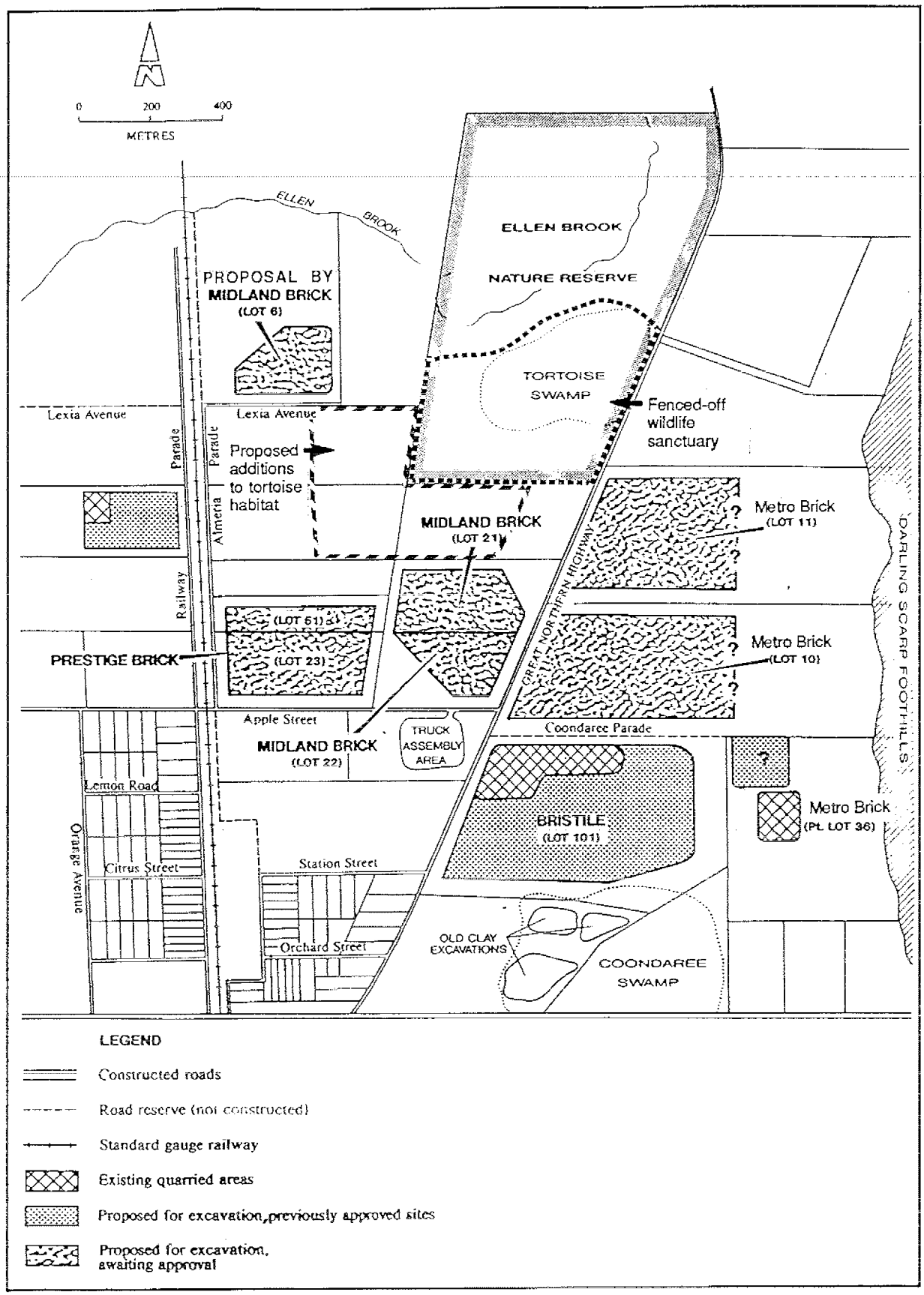


Figure 1. Location of proposal in relation to the Wildlife Sanctuary for the Western Swamp Tortoise at Ellan Brook Reserve and other current and proposed clay excavations.

25 to 30 animals, including about eight adult females. A captive population of about 49 tortoises is held in the Perth Zoo as part of a special breeding programme.

The endangered status of the short necked tortoise is due to a combination of factors, including:

- a small geographic range, with most of the original habitat having been lost to agricultural, urban and industrial uses since European settlement;
- the protected habitat being in only two small nature reserves that are of marginal quality;
- a dependence on:
  - (i) an unusual habitat of winter-wet ephemeral swamps, with suitable aestivating (summer "hibernating") refuges nearby; and
  - (ii) a wholly carnivorous diet of live food which is only available for a short time each year
- low fecundity (fertility) and slow growth rates;
- below average rainfall in the Perth area over the last 30 years, combined with a marginal habitat and prospects for drier climatic conditions in the future; and
- presence of exotic predators, particularly the European fox.

A Management Programme for the Western Swamp Tortoise was launched in November, 1990. The aim of the programme for the next 10 years is to create two viable populations in the wild. This will be achieved with a number of different strategies, including:

- management of the tortoise population (monitoring and a captive breeding programme);
- management of the tortoise reserves to maintain and improve the habitat (water availability and quality, predation, emigration);
- identification, acquisition and rehabilitation or construction of additional habitat (Twin Swamps and Ellen Brook Nature Reserves);
- recognition of the importance of the reserves at all levels of government when development proposals are considered for the area;
- public support, including an educational programme.

In its report titled "Conservation Reserves for Western Australia - the Darling System - System 6" (commonly referred to as the "Red Book") in 1983, the Environmental Protection Authority recommended that ways and means of providing protective buffer areas around both Ellen Brook and Twin Swamps Nature Reserves (M17) be sought through planning procedures.

3. The proposal

3.1 Need for the proposal

The Swan Valley contains deposits of high quality plastic clays used in the manufacture of bricks, pavers and roof tiles. Manufacturing plants have traditionally been located in the Swan Valley, both for ease of access to raw materials and minimisation of transport costs.

The clays of the Swan Valley have specific properties of excellent fired colour, high fired strength, high plasticity and good green binding strength. The material represents the basic bonding agent for all brick and tile products and comprises a minimum of 15% of raw material components.

Expansion of urban and special rural development has effectively sterilised large areas of land for clay excavation. A number of people who have chosen to lead a semi-rural lifestyle in close proximity to the city can be expected to be opposed to clay extraction proposals. As a consequence, brick and tile manufacturers have been forced to seek more of their raw materials further away from their plants.

About 70% of new dwellings in the Perth area use brick and tile construction, compared with about 40% in the Eastern States.. The State Planning Commission estimated in 1987 that there would be a demand for an additional 171,000 houses by 2001. This demand for housing can be expected to be reflected in the rate of clay extraction.

The proposed clay excavations around Ellen Brook Nature Reserve are within areas identified as important resource areas in the Department of Planning and Urban Development's Basic Raw Materials Policy. More recently the Department recognised the need to protect the high quality clay resources north and east of the Upper Swan townsite for brick and tile manufacture in its public discussion paper -"The North-east corridor - planning issues and growth options", released in November, 1991.

3.2 Project description

Lot 6 Almeria Parade is located to the west of the Great Northern Highway and Ellen Brook Nature Reserve, and north of the upper Swan townsite (Figure 1). Midland Brick have a commercial agreement with the owners of Lot 6 to extract clay from the property.

The excavation would be for clay needed at the Midland brickworks. Midland Brick propose to excavate the clay and rehabilitate the site within three digging seasons (a three-year period), commencing as soon as government approvals are obtained.

The clay deposit is contained within a natural depression on Lot 6 and extends from the surface down to an average depth of 2.8 metres. It would appear that the clay deposit extends south across Lexia Avenue to cover part of Lot 12, which is owned by Midland Brick. The company is currently undertaking an exploration programme to determine the viability of the clay deposit, however any development of the deposit would need to be referred to the Authority for separate assessment.

Top soil from the quarried area would be spread and mixed with sandy soils on the property to improve soil texture and reduce the effects of wind erosion. Some topsoil would be placed around the perimeter of the excavation site to retain drainage of disturbed areas in the first three years of operation.

Midland Brick is committed to progressive rehabilitation of the site. After removal of the clay, the company proposes to shape the area into three interconnected dams and deepen and line the excavations with clay, to allow for the retention of about 4 metres of water (Figure 2). This is expected to enhance the usefulness of the rehabilitated site to the property owners, who may wish to establish an operation for the commercial production of marron or other fresh water fish species. (As this assessment only covers the extraction of the clay, the proponents of such a venture should refer their proposal to the Environmental Protection Authority). Natural drainage from within the property and from Almeria Parade is expected to fill the dams over a period of years.

Trees would be planted around the perimeter of the excavation site, to provide shade and to screen the workings from adjoining properties and road reserves.

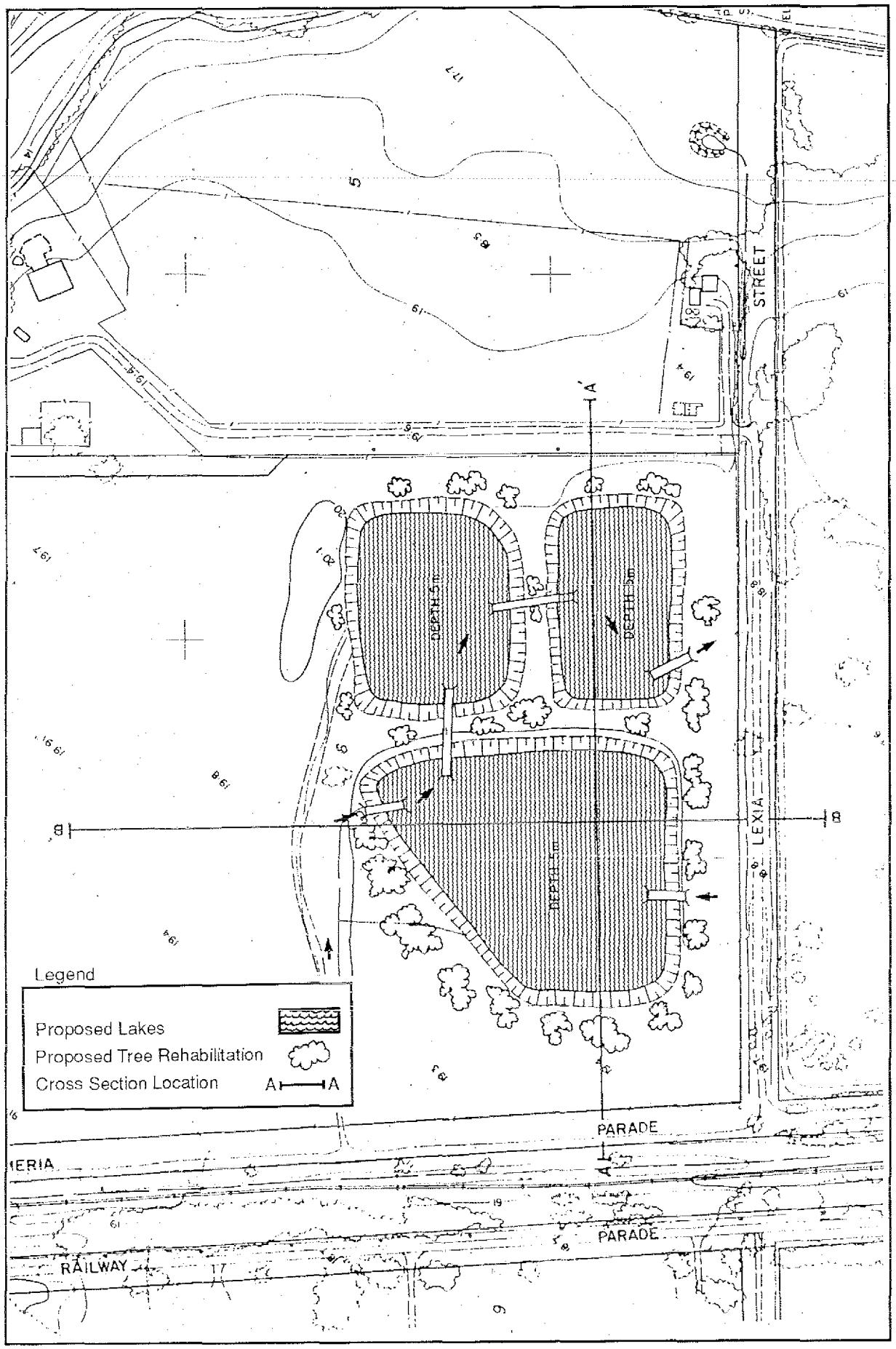


Figure 2. Proposed rehabilitation by Midland Brick of excavation site on lot 6.

The excavation and trucking operation would occur between November and May, within the hours of 6.00am to 5.30pm Monday to Friday, and 6.00am to 1.00pm on Saturdays. Due to the company's need to blend clays from different areas to produce a consistent material, the frequency of truck movements is expected to vary between four and 10 truck loads per hour, for three weeks of every five week excavation cycle. Trucks would access the site from Almeria Parade and travel to Midland brickworks via Apple Street and Great Northern Highway (see Figure 1 of Appendix 2).

4. Existing environment

Lot 6 is mostly cleared and developed for pasture. The proposed quarry area is part of a natural basin which is inundated with up to 300mm of water during the winter months, and provides summer grazing for stock.The property boundary is about 200 metres west of the fenced-off Wildlife Sanctuary at Ellen Brook Nature Reserve.

Ellen Brook Nature Reserve (A27620) is an A Class reserve vested in the National Parks and Nature Conservation Authority and managed by the Department of Conservation and Land Management. Apart from its function in providing a natural habitat for the last remaining population of Western Swamp Tortoises, the reserve has high conservation value because it is particularly rich in aquatic plants and contains a number of rare plants and a variety of invertebrates and fish. Depressions within the fenced-off wildlife area fill up with water in winter and spring. These depressions carry shrubland of robin redbreast bush, sedges and aquatic species including *Chara australis* and *Hydrocotyle lemnoides*. The higher ground between the depressions carries shrubs including *Acacia salinga,* swishbush and stinkwood, and annuals such as sundews *Drosera gigantea* and *Neurachne alopecuroides* and at least fourteen species of orchids.

5. Public consultation

The proponent prepared a Consultative Environmental Review document which was released for public review in October, 1990. Seven Government submissions and three private submissions were received by the Authority.

The clay excavation proposal was amongst about 70 proposals that were selected for expedited assessment at this time. However, due to the complex nature of the clay excavation proposals, the Authority determined that its assessment of the issues was not amenable to the expedited process, and the proposals were removed from the "expedited list".

An open day was held near the site in December, 1990, which was attended by approximately 25 local residents and representatives from the Shire of Swan, the three clay excavation proponents, the Social Impact Unit and the Environmental Protection Authority. Issues of noise, dust, visual impacts and public safety were discussed.

A more detailed submission was recently received from the Department of Planning and Urban Development in July, 1991 in relation to regional planning issues.

6. Environmental impacts and management

6.1 Definition of the habitat of the short necked tortoise

In attempting to address the impact of the clay excavation proposal on the short necked tortoise, the CER was deficient in fully defining the habitat area used by the tortoise. It was understood by the proponent at the time of preparing the CER that the swamp was the principal habitat area which required protection.

The swamp covers only about 30% of the area which the Zoology Department of the University of Western Australia and the Department of Conservation and Land Management now regard as the important habitat area of the short necked tortoise. The actual area used by the tortoise includes all of the nature reserve south and south-east of Ellen Brook, plus the areas of semi-natural vegetation on private property to the south and west of the nature reserve. Although most of the tortoises live in the swamp area, 13% of all tortoises found between 1988 and 1990 were outside the swamp and in or south of the natural drainage channel which passes through the fenced-off area, and south of the swamp.

The proponent has recognised this deficiency in the CER documentation, and has provided further information to the Authority in its response to issues raised in submissions (Appendix 2).

6.2 Impact of surface drainage waters on tortoise habitat

The main factors identified as likely to impact on the tortoise habitat are the quality and quantity of the water in which the tortoises swim and eat.

The proponent has investigated the potential sources of water coming into the swamp. Substantial evidence is presented in the CER, including survey data on ground levels, surface water flow directions, and water qualities (chemical and suspended solids content), to suggest direct rainfall is the main contribution to the water coming into the main swamp habitat area, rather than surface water flowing into the area from outside the reserve.

A natural drainage channel runs through the southern end of the Wildlife Sanctuary and carries runoff waters from Great Northern Highway and farmland to the south, west and east into the reserve (Figure 3). This situation represents a potential risk to the health of the short necked tortoises in the Wildlife Sanctuary and an interference to their movements. Nutrients washed into the reserve could encourage the growth of exotic species over native plants, and may lead to eutrophication of small pools of water when the tortoises are actively feeding in spring. A major truck parking area is located within the catchment of the reserve, at the corner of the highway and Apple Street, and a spillage of petroleum products or other harmful materials could have disastrous consequences for the tortoise. Surface waters emanating from any ground disturbance, such as the proposed clay excavations in the area, could lead to a further deterioration in the quality of drainage water into the reserve, and possibly siltation of the water course.

In their submission to the Authority and in further discussions, both the Zoology Department of the University of Western Australia and the Department of Conservation and Land Management have advised that the tortoise would benefit by the elimination of external drainage waters into the reserve. Water requirements for the reserve would be met by rainfall.

Surface drainage waters from Almeria Parade and Lexia Avenue, including the proposed clay excavation site on Lot 6, presently discharge into the western side of the Wildlife Sanctuary, before discharging into the natural drainage channel and into Ellen Brook.

In their most recent response to the Authority (Appendix 3), Midland Brick estimate that the dams formed as a result of the clay excavation would take between seven and 10 years to fill up, before any discharge could occur towards the Wildlife Sanctuary. Midland Brick has given a commitment that no silt-laden run-off water would enter the Ellen Brook Nature Reserve during quarrying activities on Lot 6. This would be achieved by constructing an earth bund to contain all silt-laden storm water within the site and deflect clean run-off water away from areas disturbed by mining and road transport. The company would also divert or modify the existing drainage system from the Lexia Avenue catchment area (should the Department of Conservation and Land Management wish), and would provide equipment and personnel at its cost to complete this task to an agreed pre-arranged specification. A possible arrangement for the modified drainage emanating from the proposed clay excavations in the area around the Wildlife

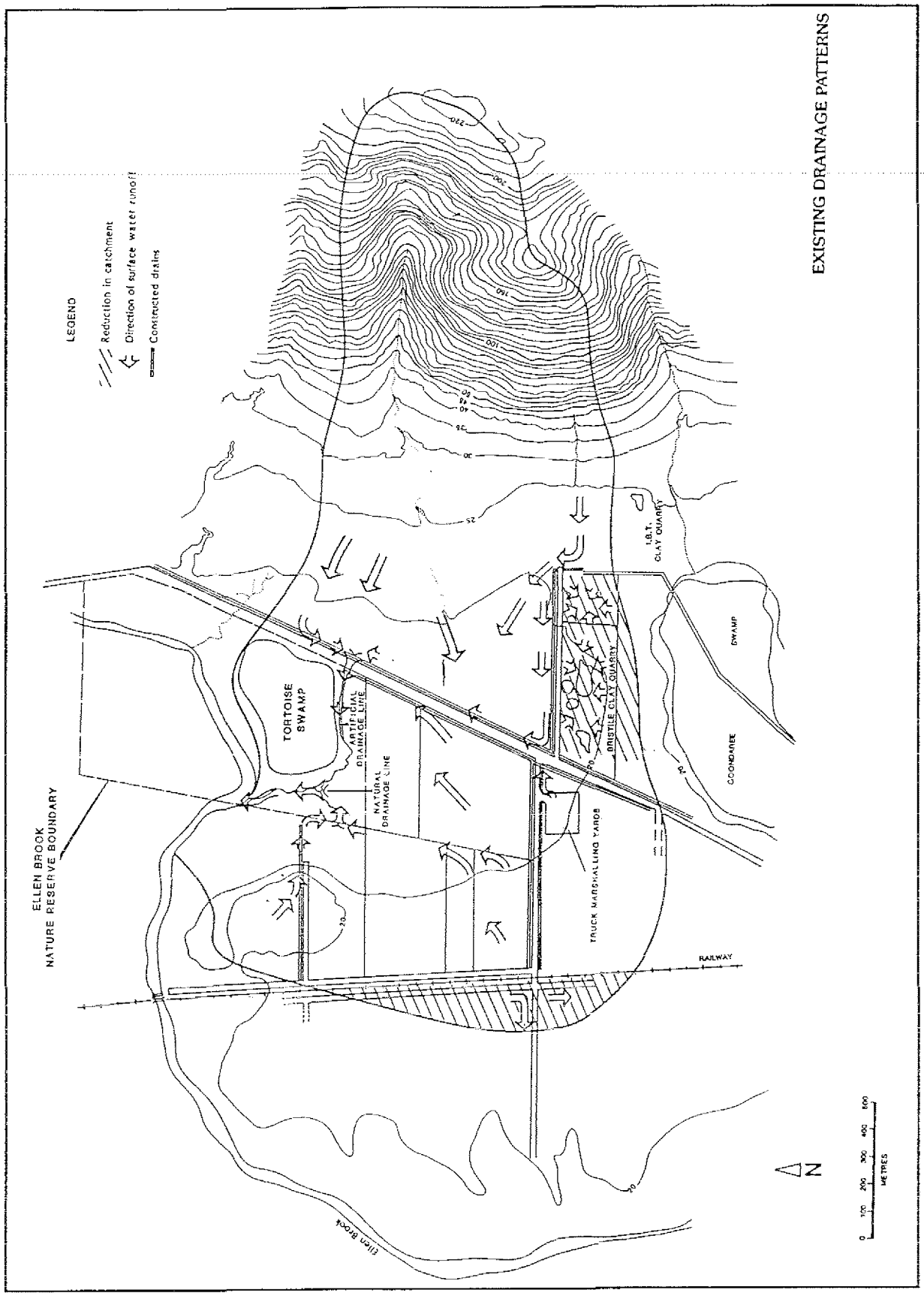


Figure 3. Existing drainage patterns into Ellen Brook Nature Reserve

Sanctuary is shown in Figure 4, but is subject to further discussion with affected parties (refer to section 6.6 and Recommendation 4)

The Environmental Protection Authority believes that all clay excavation proponents in the vicinity of the Ellen Brook Nature Reserve should carry out appropriate modifications to the drainage systems with which their proposals interact, to ensure that the habitat of the Western Swamp Tortoise is protected. The Authority considers that Midland Brick's drainage modifications are consistent with the objectives of protecting the habitat of the tortoise. However, to ensure that the long term drainage works are carried out in a suitable time frame that meshes with the preparation of new habitat areas by the Department of Conservation and Land Management on the reserve and any proposed extensions, the Authority believes this work should be carried out within two years of approval of the proposal (see Recommendations 2 and 3) and in consultation with the Department of Conservation and Land Management, the Swan River Trust and the Shire of Swan.

6.3 Groundwater impacts on tortoise habitat

The Environmental Protection Authority is concerned that excavations around the tortoise habitat area could lead to a more rapid drying up of the wet areas which represent essential feeding environments for the tortoise.

The proponent has investigated and reported on the depth of the water table and the presence and extent of perched groundwater, which are the two principal aspects of the groundwater regime that are likely to impact on the hydrology of the tortoise habitat.

As mentioned in Section 6.2, the proponent has been able to establish with a reasonable degree of certainty that water levels in the main swamp habitat are principally dependant on rainfall. The proponent concludes that the main groundwater aquifer is not a source of water for the swamp, based on the observation that regional groundwater levels, which approximate the water levels in the nearby Ellen Brook in summer, are always significantly lower than the swamp water levels. This conclusion is supported by the fact that water levels in the swamp are maintained long after rainfall has ceased, presumably due to impervious clay sediments at the base of the swamp which prevent rapid movement of the water through the profile and into the superficial aquifer, thus precluding a direct hydraulic connection between the two.

Of less certainty is the impact of clay excavations on the perched water table within the Wildlife Sanctuary and any future extensions. Should there be a link between the perched water table and water levels in the swamp or other tortoise habitat, then a nearby clay excavation could potentially lead to a reduction in the wet area available to the tortoise by interfering with the subsurface water flow. In Figure 11 of the CER, the proponents have noted the presence of perched groundwater in the area. During winter and into spring the groundwater can sit above the layer of plastic clay, which (in most areas) commences about three to four metres below the surface. It is generally a temporary occurrence which dissipates relatively quickly via evaporation and infiltration. The perched water is not continuous, tending to occur in lenses or pockets within shallow sediments above the clay. In the environmental report provided to the Authority on Part Lot 36 operations in 1989, monitoring of two bores in the perched groundwater over a 12-month period showed a wide variation in water levels, with one bore maintaining a level between 16.8 and 18.4 metres, whereas the other bore fluctuated between 11.8 and 18.4 metres (ground level 23.5 and 20.8 metres AHD respectively). Of significance was the monitoring of the clay pit, which showed that there was no shallow seepage back into the pit. Groundwater levels in the vicinity of Lot 6 fluctuate between 6.8 and 7.8 metres below the surface.

Based on topographical information, the proponent considers that the main swamp habitat is an isolated clay pan that is not hydraulically linked to adjoining land. The swamp is cut off to the north by Ellen Brook and to the south and west by the drain through the reserve. There is the the possibility of some sub-surface hydraulic link between land to the east (which was probably

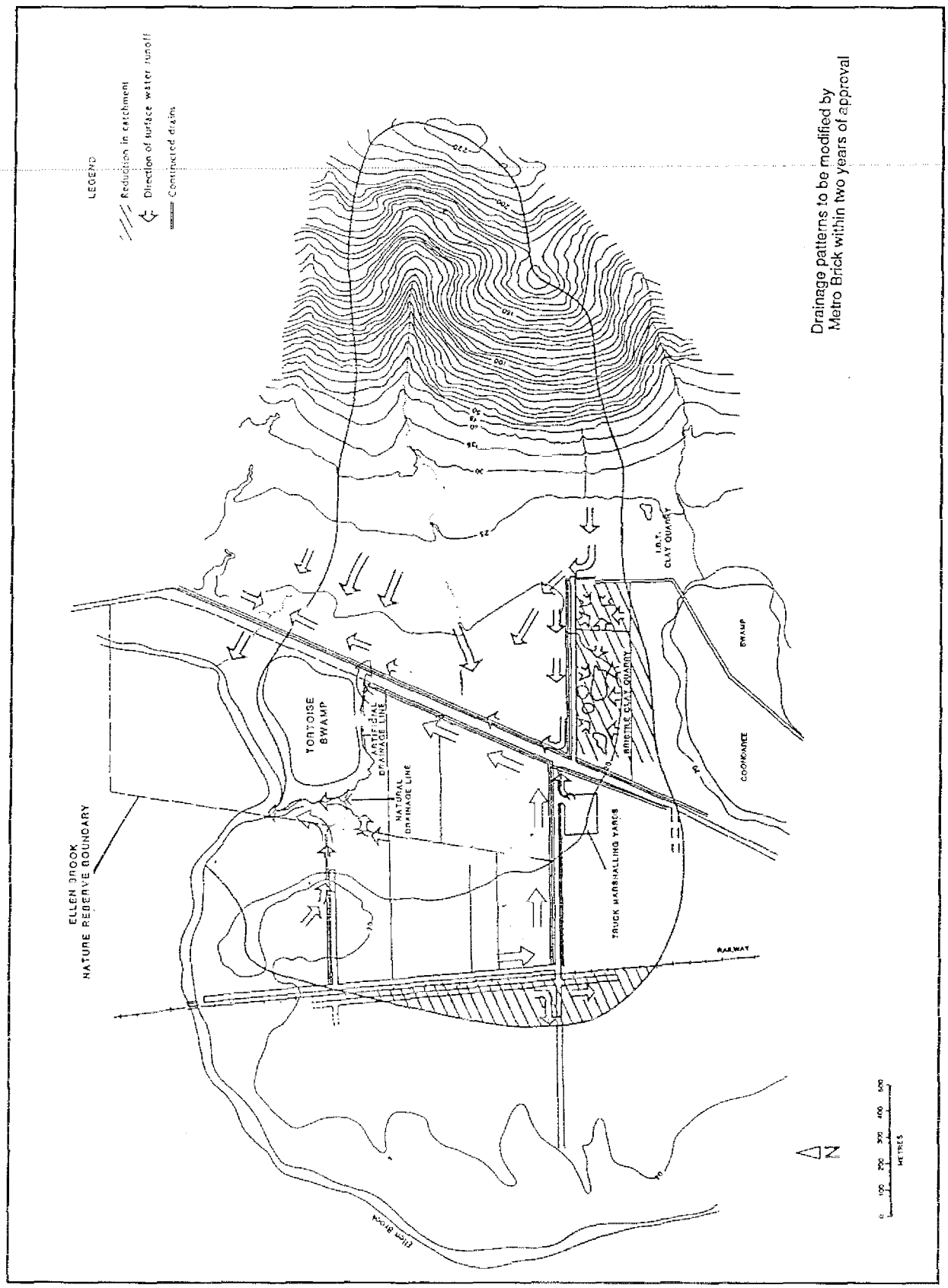


Figure 4. Possible arrangements for the modified drainage emanating from the proposed clay excavations in the area around the Wildlife Sanctuary within 2 years of approval.

originally part of the tortoise habitat prior to clearing), although the potential for this is low, based on the nature of sediments at the base of the swamp, and the probability of compaction during construction of the highway which would have formed a barrier to sub-surface flow in the direction of the swamp.

The Water Authority of WA has submitted that the proponents' conclusions in the joint CER about the groundwater relationships with the swamp may be an over-simplification of the hydrology of the area. The CER shows the perched groundwater upstream is higher than the the swamp level. The Water Authority considers that, while the nature reserve drain intercepts some groundwater flowing from the south east, it is probable that the groundwater system provides upward pressure to the swamp, thereby limiting the infiltration of water from the swamp to the groundwater system. The Geological Survey of WA has agreed with the proponent in that interception of the perched groundwater by the quarrying should have no effect.

Of concern to the Authority are the impacts that the clay excavations might have on tortoise habitat areas outside the swamp area, but within the fenced-off reserve, particularly as these impacts were not addressed in detail by the proponent in the CER. However, the Environmental Protection Authority considers that the proposals by Midland Brick and other clay excavation proponents are most unlikely to impact on the groundwater of the tortoise habitat, provided that stringent controls and management procedures are adopted. These include a no-quarrying buffer of 100 metres around the boundaries of the Wildlife Sanctuary and preparation and implementation of Environmental Management Programmes (which include staged quarrying strategies, drainage water management, groundwater protection, and rehabilitation plans) - refer to EPA Bulletin 604.

Based on drill data and topographical information, the proponent considers that its proposed excavation on Lot 6 is situated in a discontinuous clay deposit in an isolated clay pan which is not hydraulically linked to the fenced-off Wildlife Sanctuary. The site is unusual in that it does not have an overburden layer which could allow the development of a perched groundwater regime in the area around it. Furthermore, the excavation for clay would be to less than three metres below the surface and the site is elevated some one to two metres above and situated at least 200 metres from the boundary of the Wildlife Sanctuary.

Given all the above factors, the Environmental Protection Authority considers that excavation of clay on Lot 6 is most unlikely to interfere with the perched groundwater regime in the vicinity of the Wildlife Sanctuary. Recommendations for a 100 metre no-quarrying buffer and a staged quarrying strategy are not considered necessary for this proposal. However, the Authority considers that the proponent should prepare an approved groundwater protection plan, as part of the Environmental Management Programme, prior to excavation and in consultation with the Department of Conservation and Land Management, the Water Authority of WA, and the Geological Survey of WA (see Recommendation 4). The plan should be implemented to the satisfaction of the Environmental Protection Authority, with the objective of delineating and monitoring any perched groundwater levels and pit seepages, combined with suitable management practices to remedy any potentially unacceptable impacts.

6.4 Rehabilitation

Midland Brick is committed to introduce sequential rehabilitation of previously worked areas as soon as practicable, and in accordance with the rehabilitation objectives developed in consultation with Planning Authorities and the landowner (ie in respect of leasehold arrangements).

The Environmental Protection Authority considers that the proponent should prepare an approved rehabilitation plan as part of the Environmental Management Programme, prior to excavation and in consultation with the Shire of Swan and the Department of Conservation and Land Management. The plan should be implemented to the satisfaction of the Environmental Protection Authority.

6.5 Provision of additional tortoise habitat

In the CER, Midland Brick has suggested that there may be some difficulty in re-establishing the existing tortoise habitat following excavation of the clay. The clay pans that the tortoises inhabit only hold water in winter, compared with clay quarries which are substantially deeper and tend to have water in them all year. Additionally the soil profile is significantly altered in the excavation process. The proponent has suggested that it might be more cost-effective and practical to expand the tortoise habitat by recovering adjoining land that may have previously supported the tortoises and rehabilitate the area to its original form.

The Department of Conservation and Land Management has also indicated that, under the current proposals for rehabilitation to a series of lakes or dams, the excavated sites in the area would be of no value to the tortoise. Any such site would need to be gazetted as a Nature Reserve if it was to be restocked with the short necked tortoise, and it could be expensive to construct to specific standards and manage to the benefit of the tortoise.

An extension to the existing (fenced-off) Wildlife Sanctuary is regarded by the Department of Conservation and Land Management and the Zoology Department of the University of Western Australia as one of the best ways to help increase the numbers of short necked tortoises in the wild. Earthworks to isolate the reserve and divert the existing drainage waters to an area outside the reserve is considered essential to improving and protecting the quality of water in the current and future habitat areas. Recontouring of some areas within the existing or extended reserve would be required.

In their response to issues raised in submissions (Appendix 2), Midland Brick has indicated that it would be prepared to assist in drainage diversion works by providing earthmoving equipment in an equitable arrangement with the other proponents. Midland Brick acknowledges the interest of the Department of Conservation and Land Management in acquiring the eastern portions of nearby Lots 12 and 13, which are opposite Lot 6 on the south side of Lexia Avenue and also adjoin the fenced-off Wildlife Sanctuary. Midland Brick own Lot 12 and is endeavouring to arrange a land swap with the owner of Lot 13, such that this area, which contains some remnant vegetation and has suitable soil types, could be added to the tortoise habitat.

The Environmental Protection Authority notes the intention of Midland Brick to assist with the provision of additional habitat for the short necked tortoise, and encourages other companies and individuals who may wish to participate in the recovery and survival of this extremely endangered species of wildlife to liaise with the Department of Conservation and Land Management

6.6 Regional development, drainage and rehabilitation

The Authority notes that a large extent of land is likely to be affected by future proposals for clay extraction in the area between the Swan River and Ellen Brook. These clay excavations are within an important resource area identified by the Department of Planning and Urban Development in its Basic Raw Materials Policy for the State.

In its submission to the Authority, the Department of Planning and Urban Development has indicated the following:

- any structure plan for the locality would reflect the need to protect the clay resource areas from incompatible developments;
- only limited future urban development will occur in the Upper Swan locality, due to the need to protect the clay resource, and the remoteness of the area from the existing sewerage system;

- the Department would most likely not support the subdivision of existing rural lots in the immediate locality of the clay excavations into "Special Rural" sized lots, as this would lead to more intensive uses that would be incompatible with the clay excavation operations and possibly prejudice future long term planning options for the locality; and
- it would be appropriate for the proponents of the different excavation proposals to prepare a comprehensive long-term rehabilitation/development strategy for the locality, in consultation with the Swan Shire Council, Environmental Protection Authority and the Department of Planning and Urban Development. The strategy could be based on transforming the excavation sites into a wetland system surrounded by compatible recreation and tourism developments.

The Authority notes the proponent's commitment to consult with planning authorities to facilitate the derivation of a long-term strategic plan for the Upper Swan locality which recognises and accepts the interim priority land use of clay extraction. Midland Brick is also committed to establishing an inter-company liaison mechanism to enable a coordinated approach between all three proponents with respect to addressing potential cumulative operational effects and overall rehabilitation goals.

The Authority considers that the proponents of all clay excavations in the Upper Swan locality, including Midland Brick, should jointly prepare a regional development, drainage and rehabilitation plan for the locality, and the objectives of the plan should include the protection of the habitat of the Western Swamp Tortoise (see Recommendation 4).

6.7 Groundwater impacts generally

The proposed clay excavations are situated in the Swan Groundwater Area. In the area east of the Great Northern Highway, the Leederville Formation, which is a major aquifer for the Perth area and an important source for private users, is recharged directly from the Superficial Formation.

The Water Authority of WA has submitted that a groundwater licence would be required by the proponents of clay excavations to draw groundwater. Pollution of the Leederville Formation by contaminants such as diesel fuel would be impossible to clean up and could render parts of the aquifer unusable. The Water Authority has indicated that safeguards should be built into the clay excavations to prevent water pollution, and fuels and oils should not be stored inside the catchment area. The Water Authority indicated that excavation and dewatering activities could cause drawdown in the local water table and affect up to six neighbouring private wells. The proponents should monitor private shallow wells and make good any supplies if they were affected.

The main superficial groundwater aquifer is situated about seven metres below the surface, and well below the level of the plastic clay which the proponent wishes to excavate (maximum of four metres). In the CER, the proponent also points out that it is uncommon for clay excavation to occur below the water table because of logistical difficulties. Excavation of wet plastic clay is extremely difficult, and the proponent would be required to continuously dewater the pit to successfully excavate below the water table. In addition, this clay is generally of inferior quality and would need to be blended with higher quality clay to be of use.

In response to issues raised (Appendix 2), Midland Brick have stated that dewatering of the groundwater would not be conducted. Water for dust suppression purposes would be normally be loaded at Midland (brickworks) and trucked to the clay pits. Some water might be extracted from the company's storage ponds at Copley Road, but only when there is a surplus requiring disposal. The only equipment to be refuelled on site would be unlicensed machines such as excavators, dozers and scrapers. All wastes would be returned to Midland for disposal and no fuels or lubricants would be stored at the clay pits.

The Environmental Protection Authority considers that Midland Brick should prepare an approved groundwater protection plan as part of the Environmental Management Programme, in consultation with the Water Authority of Western Australia, prior to the extraction of clay on Lot 6. The plan should outline procedures to be used by the proponent to protect the quality and quantity of groundwater from the impacts of the clay excavation and earth moving machinery. The plan should be implemented and reviewed regularly to the satisfaction of the Environmental Protection Authority (see Recommendation 4).

6.8 Noise, dust and visual impacts

The proposed clay excavations in the area have the potential to impact on the comfort of local residents, through noise, dust, and visual impacts.

The noise environment of the Upper Swan locality is already influenced by a number of non-rural activities. These include the standard gauge railway, the Great Northern Highway, the truck marshalling yard, and the existing clay excavations in the area. Noise would be generated at the quarry sites when overburden and clay are excavated, and along trucking routes when the clay is moved off-site. In the CER, the proponents indicate that the excavation season encompasses the summer months, for up to 12 hours per day, 6 days per week, although it is unlikely that all proponents would be operating at the one time for this period.

The excavation and trucking operation would occur between November and May, within the hours of 6.00am to 5.30pm Monday to Friday, and 6.00am to 1.00pm on Saturdays. Due to the company's need to blend clays from different areas to produce a consistent material, the frequency of truck movements is expected to vary between four and 10 truck loads per hour, for three weeks of every five week excavation cycle. Trucks would access the site from Almeria Parade and travel to Midland brickworks via Apple Street and Great Northern Highway (see Figure 1 of Appendix 2).

The clay excavation proponents recognise that noise control and minimisation is a prerequisite to community acceptance and would incorporate a range of routine management practices to reduce the potential for noise disturbance, including:

- strategic placement of both topsoil and overburden stockpiles to shield nearby residences from noise generated from within the quarries;
- ensuring that only licensed vehicles are utilised and that they are adequately maintained to comply with relevant noise level regulations;
- location of driveways to the quarries at points which are optimally positioned to minimise noise disturbance to nearby residences from the effects of trucks braking, turning and accelerating;
- careful inventory management of clay stockpiles and logistics of storage at each plant to ensure that the number of excavations and trucking campaigns is minimised during each excavation season; and
- introduction of a co-ordinated approach to the timing of individual campaigns at the various quarries, if necessary, to avoid excessive truck movements on local roads.

The proponents recognise the potential for dust pollution from the quarry sites, particularly as much of the activity would occur in the drier summer months. North-easterly winds, which would tend to transport dust in the direction of the Upper Swan townsite, are quite strong and frequent during this time. When the clay is dry, dust pollution could occur from worked surfaces within the pits, unsealed access tracks, and stockpiles of clay, overburden and topsoil.

However, previous clay excavation experience by the proponents in the area indicates that dust is unlikely to be a problem, due to various factors which include:

- when freshly dug, the clay retains some moisture and is therefore not mobile, tending to stick together;
- most of the proposed excavations are accessed directly off sealed roads, and would not require long service roads;
- major sources of dust are easily controlled using a watering truck;
- stockpiles of overburden and topsoil tend to be self-sealing once exposed to rain, although hydro-mulching is a viable option; and
- the sequential rehabilitation programme, which minimises the area left open at any one time, and is generally a standard condition on excavation licences issued by the Shire of Swan.

To some extent, the noise impacts on Midland Brick's proposed excavation on Lot 6 are reduced by distance from most residences. The more densely populated Upper Swan townsite is located about 1km south of of Lot 6. The nearest residence is located on the adjoining Lot 5, some 200 metres from the proposed excavation site. Seven residences are within 500 metres and 16 residences within 1km.

In their response to submissions, Midland Brick indicate that it is their intention to operate the clay quarry within noise and dust limits which can be tolerated by the local community with minimal inconvenience. Midland Brick is aware of public sensitivities regarding noise and dust issues in the area around the corner of Apple Street and Almeria Parade. The company has developed management practices over the years of operating in this area from a nearby clay quarry in Railway Parade, which are designed to prevent undue disturbance to the Upper Swan community. These practices include:

- rigid adherence to track watering and road washdown at the entrance to each site; and
- restriction of haulage operation hours and the limiting of truck speeds to 30km/hr within 200 metres of the main intersection.

The most likely source of dust emissions is from working areas and the access track when traversed by trucks and machinery. The company considers it essential to wet haul roads and work areas to control the dust situation. In the past, the company has not found it necessary to use hydro-mulching to control dust. Apart from the topsoil to be removed prior to mining, there is no overburden to be moved and stockpiled, hence dust from this source at Lot 6 is considered by the company not likely to become a major issue.

To minimise the impact of the proposal on the area, the company has stated that every effort would be made to complete clay removal from Lot 6 within three excavation seasons. Furthermore, full scale development of their other clay excavation proposal at Lots 21 and 22 Apple Street would be delayed until removal was complete.

Midland Brick has identified their Raw Materials Manager as the person responsible for the monitoring and management of environmental impacts associated with the proposal, including the contact person for the public and government departments, management of public complaints, and compliance with conditions and commitments. The company has stated that about four weeks prior to the start of operations it would notify the Environmental Protection Authority, the Shire of Swan and local residents living within 500 metres of the site boundary who may be potentially affected by the proposal.

The flat terrain of the area, coupled with the extensive clearing of vegetation in the past, means that the proposed clay excavations would be visible to local residents and traffic. The proponent points out that the flat terrain could be advantageous to some extent, in that the pit faces would be generally excluded from view because they would be below ground level. However the proponent recognises the potential of the excavations to impair visual quality of the area in the short to medium term, and that there is a need to incorporate some landscape planning during the operational life of the the quarry, in addition to the final rehabilitation plan. Midland Brick have indicated that trees would be planted around the perimeter of the excavation site, to provide shade and to screen the workings from adjoining properties and road reserves.

The Environmental Protection Authority considers that noise, dust and visual impacts from Midland Brick's proposed clay operation on Lot 6 are likely to be manageable to the extent that they do not cause an unacceptable impact on the environment. In order that these impacts are monitored and managed correctly, the Authority believes the proponent should prepare, implement and regularly review noise, dust and visual impact management plans as part of the Environmental Management Programme, in consultation with the Shire of Swan and to the satisfaction of the Environmental Protection Authority (see Recommendation 4). The plans should document the company's procedure for handling complaints, including the person responsible within the company for receiving and recording the complaints, for following them up and, if appropriate, for rectifying the cause of the complaint.

6.9 Public safety and mosquito breeding management

Some of the clay pits would be in close proximity to residences, particularly the Upper Swan townsite, and could be left open with deep expanses of water prior to final rehabilitation. The pits could become a source of mosquito nuisance or disease to the public, and may represent a danger to young children in the area.

In response to these issues, the Midland Brick indicate that they have had discussions with the health surveyor from the Shire of Swan. To preclude mosquito breeding, it has been recommended to the company that they maintain relatively sharp edges in the rehabilitated pits and that the sides are free of vegetation, to minimise the area of sheltered water that the mosquitos breed in. According to the proponent, this would be readily accomplished in the clay pits during their operational life.

The company has stated that public access is presently restricted by boundary fences in good condition and is supplemented by an internal electric fence. A padlocked gate would be provided at the access point. In regard to provision of alternative recreational areas to encourage local children away from the quarry, Midland Brick has held discussions with officers from the Shire of Swan and has committed funds to enhancing facilities which exist within the area.

The Environmental Protection Authority is concerned that the subsequent lake development does not create a public nuisance, and considers that the proponent should liaise with the Shire of Swan and the Department of Conservation and Land Management to ensure that these issues are addressed in the Environmental Management Programme.

6.10 Aboriginal sites

Through a literature search the proponent identified an Aboriginal site of archaeological significance which is located about two kilometres away, on the north side of the Swan River and near the Great northern Highway bridge. However a register search at the Department of Aboriginal Sites of the Western Australian Museum has shown there are no recorded sites for the proposed quarry areas around Ellen Brook Nature Reserve.

The Department of Aboriginal Sites has advised the Authority that the Swan Valley area is known to have sites of major Aboriginal significance, in both archaeological and ethnographic terms. The Department of Aboriginal Sites has suggested that a survey of such sites should be carried out prior to approval, and it may also be desirable to carry out some monitoring of subsurface material during excavation.

The Authority suggests that the proponent discuss with the Department of Aboriginal Sites of the West Australian Museum appropriate ways of complying with the provisions of the Aboriginal Heritage Act 1972-80.

7. Conclusions and recommendations

The Environmental Protection Authority recognises the very rare status of the short necked tortoise, and the requirement to protect its habitat. Accordingly, the Authority has set a very high onus of proof on this and other nearby quarrying proposals, to demonstrate that there will be no adverse impacts on the tortoises and their habitat. It is only after detailed study that the Authority considers that the proposal would not have any adverse impacts and therefore could proceed

Based on its assessment of the proposal and additional information provided by the proponent in response to questions raised as a result of the assessment process, the Authority makes the following conclusions and recommendations:

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Midland Brick to quarry clay on Lot 6, Almeria Parade, Upper Swan, as outlined in the Consultative Environmental Review and subsequently modified during the process of interaction between the proponent, the Environmental Protection Authority, and government agencies, and those members of the public who were consulted, is environmentally acceptable.

In reaching this conclusion, the Authority identified the main issues requiring detailed consideration as:

- **protection of the habitat of the endangered Western Swamp Tortoise, *Pseudemydura umbrina*, at Ellen Brook Nature Reserve;**
- **management of drainage waters;**
- **protection of groundwater resources;**
- **rehabilitation of the quarried area;**
- **noise, dust, and visual impacts from the quarrying operations; and**
- **public safety and management of mosquito breeding.**

The Environmental Protection Authority considers that these and other issues, such as planning considerations, have been addressed and are manageable, either by changes to the proposal by the proponent during assessment, the environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations in this report.

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed, subject to the proponent's commitments (Appendix 1) and the Environmental Protection Authority's recommendations in this report. Any approval for the proposal should be for a maximum of five years from the time of commencement.

A drainage management plan should be prepared to protect the habitat of the Western Swamp Tortoise at Ellen Brook Nature Reserve from external surface water drainage impacts affected by this proposal.

Recommendation 2

The Environmental Protection Authority recommends that, prior to the start of quarrying activities and in consultation with the Department of Conservation and Land Management, the Swan River Trust and the Shire of Swan, Midland Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment on advice of the Environmental Protection Authority. This plan should enable the proponent to:

- **monitor drainage to detect, report on, and manage any drainage impacts on the Wildlife Sanctuary for the Western Swamp Tortoise at Ellen Brook Nature Reserve;**
- **remedy any unacceptable drainage impacts on the Wildlife Sanctuary caused by this proposal;**
- **detain all drainage waters on site during the life of the clay excavation operation, so that they do not enter the Wildlife Sanctuary at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere; and**
- **divert all drainage waters from the eastern end of Lexia Avenue from entering the Wildlife Sanctuary at Ellen Brook Nature Reserve within two years of approval of the proposal, and in so doing, ensure it does not create an unacceptable impact elsewhere.**

The drainage management plan should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority.

A comprehensive environmental management programme should be prepared to enable the proponent to detect, report on and manage any impacts on the environment, particularly the habitat of the Western Swamp Tortoise at Ellen Brook Nature Reserve.

Recommendation 3

The Environmental Protection Authority recommends that, prior to the start of quarrying activities and following consultation with the appropriate government authorities, Midland Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment on advice of the Environmental Protection Authority. This programme should enable the proponent to detect, report on, and manage any impacts, and remedy any unacceptable impacts on the environment by this proposal, and should be implemented and periodically reviewed to the satisfaction of the Environmental Protection Authority. Details to be prepared as part of the Environmental Management Programme should include, but not necessarily be limited to:

- **drainage management (see Recommendation 2);**
- **groundwater management and protection;**
- **progressive rehabilitation of the site;**
- **procedures to minimise noise, dust and visual impacts associated with the quarrying and transportation operations;**
- **public safety and mosquito breeding;**
- **periodic reporting of monitoring results, and**
- **consequential changes to project management to remedy unacceptable environmental impacts.**

The timing of the preparation and review of the Environmental Management Programme should be to the satisfaction of the Environmental Protection Authority.

Recommendation 4

The Environmental Protection Authority recommends that Midland Brick should contribute, to the satisfaction of the Environmental Protection Authority, to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, in consultation with the Department of Conservation and Land Management, the Department of Planning and Urban Development, the Shire of Swan, and other current and known proposed clay producers in the area, such that a plan can be prepared within two years of approval of this proposal.

The Authority considers that any approval for the proposal based on this assessment should be limited to five years. Accordingly, if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Authority.

The Authority notes that during the detailed implementation of proposals, it is often necessary to make minor and non-substantial changes to the designs and specification which have been examined as part of the Authority's assessment. The Authority considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

Appendix 1

Environmental management commitments by Midland Brick Pty Ltd

The proponent hereby commits itself to the overall environmental management and rehabilitation philosophy outlined in the Consultative Environmental Review and subsequent modifications as outlined in Appendices 2 and 3 of this report. In specific terms, this means the proponent will;

(i) Consult with Planning Authorities to facilitate the derivation of a long term strategic plan for the locality which recognises and accepts the interim priority land use of clay extraction.

(ii) Establish an inter-company liaison mechanism to enable a co-ordinated approach between all three proponents with respect to addressing potential cumulative operational effects and overall rehabilitation goals.

(iii) Implement the management techniques described in both Sections 5 and 6 of the CER to ensure that adverse effects are not experienced in relation to:

- potential visual intrusion for residents at Upper Swan and through-traffic on Great Northern Highway;
- potential noise and dust disturbance of the residents at Upper Swan, particularly near the road junction of Apple Street and Almeria Parade;
- potential erosion of working areas and stockpiles and consequent silt transport to local drainage; and
- dewatering of accumulated rainfall and (perhaps) groundwater seepage from the working area of the pit which may be necessary to allow excavation to proceed.

(iv) Implement routine surveillance of the quarries at regular intervals throughout the year to assess the critical parameters identified in the monitoring program.

(v) Comply with excavation licence conditions negotiated with the Shire of Swan and in consultation with the Environmental Protection Authority.

(vi) Introduce sequential rehabilitation of previously worked area ass soon as practicable in accordance with the rehabilitation objectives developed in consultation with Planning Authorities and the landowner (ie. in respect of leasehold arrangements).

(vii) During the mining activity, no silt-laden run-off water will enter the Ellen Brook Nature Reserve from Lot 6.

(viii) Undertake progressive restoration of the pits during the clay excavation at the site, to the greatest extent possible.

(ix) Prepare an Environmental Monitoring and Management Programme to the satisfaction of the Environmental Protection Authority prior to commencement of operations at the site.

Appendix 2

Proponent's response to issues raised in public submissions

MIDLAND BRICK COMPANY PTY LTD
LOT 6 ALMERIA PARADE

Responses to Questions and Comments in Relation to Proposed Clay Excavations near Ellen Brook Nature Reserve (EBNR).

Preamble

The following responses have been prepared in order to meet the requirements of the formal assessment process for our proposed clay excavations at Upper Swan. The company is confident that the principal issues have been satisfactorily addressed to enable on-going assessment and approval of this quarry operation.

Our responses follow the same format and numbering sequence as the EPA list.

Noise, Dust, Visual and Safety Issues

Q1. What are the numbers of residences and people living in residences (approximately) within:

(i) 100 metres
(ii) 500 metres
(iii) 1000 metres

of the boundaries of each clay mining proposal?

The following 'house counts' have been interpreted from aerial photography flown on 4/1/91 (scale 1:20,000). For Lot 6 Almeria Parade, the actual number of houses in the 1,000 metres category may be slightly higher because the aerial photography obtained only extended approximately 700 metres north of this site. However, the density of residential development in this area is known to be low.

		Lot 6 Almeria Parade
(i)	0 - 100m	1
(ii)	100 - 500m	7
(iii)	500 - 1,000m	16

Midland Brick has been operating clay quarries in the Upper Swan area for many years without public opposition. The company has been very receptive to feedback from local residents and believes that the operational experience which has been accumulated enables a confident approach to these additional proposals.

For comparative purposes, a similar house count has been conducted for the company's clay excavation area between Copley Road and the Swan River:

0 - 100m	4 houses
100 - 500m	49 houses
500 - 1,000m	103 houses

On the basis of these figures, this site would be rated as more sensitive than the Almeria Parade proposal. However, excavation has been in progress in this latter area for the last 8 years without undue disturbance to the nearest neighbours.

Q2. What noise and dust limits will the proponents be operating to - refer to page 45 in the CER. Will monitoring be done to ensure operations are within these limits? How many trucks per hour are likely to operate from the quarries each hour? What are the dominant wind directions and velocities for the area during the proposed times of mining? How is this likely to affect nearby residences or major traffic routes, with respect to noise and dust impacts?- P46.

(i) Noise and Dust Limits

It is the intention of Midland Brick to operate this clay quarry within noise and dust limits which can be tolerated by the local community with minimal inconvenience. The company believes that its vast experience in the Upper Swan locality, coupled with the fact that

excavation and transport operations are conducted with company equipment operated by employees (i.e. as opposed to transient contractors), will be of benefit in ensuring the operations are conducted within acceptable limits.

Operation of the Almeria Parade site will involve trucks passing in close proximity to the residential area at the corner of Apple Street and Railway Parade. The company will rigorously adhere to specific management techniques that are designed to prevent undue noise and dust disturbance on the Upper Swan community. The principal techniques include:

- Rigid adherence to access track watering and road washdown at the entrance to each site.

- Restriction of haulage truck operations to the hours of 6.00am to 5.30pm (Mondays to Saturdays) and limiting the speed of trucks to 30km/hr within a 200m distance of the Apple St/Railway Pde. intersections.

Notification of neighbours who may potentially be affected would be conducted by the company approximately four weeks prior to the commencement of operations. This would involve a 'letter-drop' to all residences within 500 metres of the site's boundaries advising the following information:

- The nature of the work and the period(s) over which the excavation campaigns are proposed to be conducted;

- The company's objectives in terms of minimising noise and dust emissions to within realistic and achievable levels;

- The contact details of the appropriate company officer to whom any concerns or objections should be raised.

The Shire of Swan and the EPA would also be advised of the impending programme as it is acknowledged that some residents may prefer not to liaise directly with the company.

(ii) Truck Movements

The duration of activities in any excavation season and number of truck loads removed from the Upper Swan sites on any day will vary in accordance with the characteristics of the materials encountered during the mining operation and demand for raw materials to supply bricks. Also, to achieve the desired clay consistency it is necessary to simultaneously extract similar sedimentary formations at other pits and blend these materials at our Midland complex. As a general rule, between 4 and 10 truck loads per hour will be required from these locations at random for an average of approximately three weeks of each five week cycle during the period 1 November to 1 June.

To minimise the impact on this district every effort will be made to complete clay removal from Lot 6 Almeria Parade within three excavation seasons (full scale development of Lots 21/22 Apple Street will be delayed until this has been achieved).

(iii) Wind Data

Wind frequency analyses (speed and direction) have been obtained from the Bureau of Meteorology for wind data recorded at the nearby Department of Agriculture's Upper Swan Research Station. These monthly analyses were first produced for this station in April 1991. Summary statistics are presented in Tables 1, 2 and 3.

Consideration of the data in Tables 1 and 2 reveals that:

- From the perspective of wind direction analysis, May is the worst month because the prevailing morning wind is north-easterly, although the wind speeds at this time of the year are generally lighter.

- From the perspective of wind speed analysis, the period December to March has a relatively higher frequency of stronger north-easterly winds, but only in the morning.

- December and April may be considered as the optimum months (October and November are also favourable but it is unlikely that access would be possible due to wet soil conditions). Obviously, soil moisture content would be higher early in the excavation season, with a consequent reduced dust generation risk.

From Table 3 it is clear that the period December to March is characterised by relatively frequent and strong easterly winds in the mornings and, in February and March, these winds are also more common in the afternoons. Fortunately, the residential density due west of the site in the immediate vicinity is extremely low.

Table 1

Analysis of North-Easterly Winds During Potential Excavation Season

North-Easterlies		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Morning winds	% Occurrence	13	13	14	15	15	19	17	30
(0900 hrs)	Wind Strength:								
	% moderate 11-20km/hr	32	32	43	32	32	38	35	27
	% Strong, >20km/hr	8	16	21	32	26	22	12	10
Afternoon Winds	% Occurrence	4	2	3	4	4	5	5	10
(1500 hrs)	Wind Strength:								
	% moderate, 11-20km/hr	29	50	33	25	25	23	20	29
	% Strong, >20km/hr	0	0	0	0	0	0	20	0

Table 2

Prevailing Wind Directions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Morning	E,NE	E,SW	E,SW	E,SW	E	E, NE	E,Calm	NE
Afternoon	SW	SW	SW	SW	SW	SW	SW	SW, W

Notes: Prevailing wind (or winds) defined as % occurrence equal to 30% or more. Where two wind directions are given, each component wind has less than 30% occurrence, but are the two most frequent wind directions.

Table 3

Analysis of Easterly Winds During Potential Excavation Season

Easterlies		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Morning Winds	% Occurrence	20	21	26	28	38	29	20	12
(0900 hrs)	Wind Strength:								
	% Moderate, 11-20km/hr	36	30	34	39	32	24	30	24
	% Strong, >20km/hr	41	44	38	39	45	52	45	40
Afternoon Winds	% Occurrence	10	10	9	12	18	18	15	12
(1500 hrs)	Wind Strength:								
	% Moderate, 11-20km/hr	30	32	36	33	33	39	27	25
	% Strong, >20km/hr	20	21	12	17	28	22	20	17

Q3. **With the removal of overburden, have the proponents considered the use of alternative (quieter) machinery to bulldozers e.g. scrapers, in an effort to reduce noise levels? -P42.**

There is no overburden at this site and Midland Brick will employ hydraulic excavators to load the clay into trucks. Dozers will be used to recontour the site during progressive rehabilitation because they are more suitable for this purpose and the site is too small for the economic use of scrapers.

Q4. **What are the transport routes and access points for each site? Have the proponents considered the potential noise and dust impacts on residents in their selection?**

The access point and transport route for this excavation proposal is shown on Figure 1. The objectives in selection of access are to avoid passing through built-up areas via secondary roads, keep to existing sealed roads as far as possible and to enter Great Northern Highway via approved intersections.

Q5. **Mining and trucking activities should be restricted to something less than daylight hours. Are the proponents prepared to commit to specific operating days and hours, to allay any concerns of affected residents?-P42 & 53. Could the life of each pit be reduced by excavating for longer periods of time?**

Midland Brick proposes to operate this quarry between the hours of 6:00am to 5:30pm. A reduction in operating hours would tend to reduce the efficiency of mining under the company's existing operational regime at the Works.

Whilst the Almeria Parade site is relatively sensitive because of the transport route via Apple Street (the corner closest to the residential area), it should be noted that the company has been operating past this corner since 1981. Indeed, the previous operations west of Railway Parade (refer to Figure 1) were more sensitive because trucks utilised the Railway Parade/Apple Street intersection and had to cross the railway, which tends to 'rattle' the trucks. During the first five years, operating times were between 5:30am - 5:00pm. Following minor complaints, these times were changed to 6:00am - 5:30pm from about 1985 and this has apparently been acceptable to local residents.

Q6. Most of the clay pits are within reasonable proximity to residences and are likely to be left open for a considerable period of time, prior to final rehabilitation. Are the pits likely to be a breeding ground for mosquitos and any other public health nuisance? If so, how are these impacts to be managed? The presence of large expanses of water could also attract younger members of the population. What measures do the proponents intend carrying out to exclude and discourage children and other members of the public from using the area? Are the proponents prepared to assist the local community in providing alternative recreation areas (e.g. parks) for children away from the site?

Discussions have been held with a health surveyor from the Shire of Swan in relation to the mosquito issue. There is recognised potential for open water areas to be a breeding ground for mosquitos wherever there is sufficient shelter to prevent wind-induced turbulence of the water's surface.

To preclude mosquito breeding activity, the Shire's health surveyor recommends that the pits are maintained with relatively sharp edges (i.e. no shallow water areas where small pools may form as water levels decline in summer) and the sides are maintained clear of vegetation which would otherwise provide sheltered water. This will be readily accomplished in the clay pits during their operational life.

Ultimately, the lakes formed during the rehabilitation programme will be re-contoured at the sides to minimise mosquito breeding risk. The lakes could also be stocked with fish, as is the case at Ballajura Lakes Estate, to predate on mosquito larvae (although this would be at the owner's discretion).

To exclude public access (especially children) to the site, a padlocked gate will be provided at the access point. The existing boundary fence is in good condition and is supplemented by an internal electrified wire, which provides adequate security.

Midland Brick has held discussions with officers from the Shire of Swan and funds have been committed to enhancing facilities which exist within the residential area.

Short-Necked Tortoise Habitat Generally

Q7. **Only 20 to 30 short-necked tortoises exist in the EBNR. The Zoo considers that this number is critically low for the survival of the population. It is understood that only minor environmental disturbances have caused the virtual loss of the whole tortoise population at the Twin Swamps Reserve, estimated in the mid-1960's to be over 100. There is insufficient evidence in the CER to conclusively show that the proposed operations will have no impact on the last surviving short necked tortoises (see conflicting statements on P30, 38, 39).**

Whilst it would appear that on the balance of probabilities there is negligible risk to the tortoise swamp habitat from the proposed clay excavations, in the Upper Swan locality, it is accepted that there is insufficient evidence to remove all uncertainty in close proximity to the Nature Reserve. The principal element of uncertainty rests with the shallow, perched groundwater regime and the degree of hydraulic connection between surface water in 'depressions' within the tortoise habitat area and any sub-surface water that may be present. In this regard, the extent of lateral continuity of the shallow groundwater needs to be clarified on a case-by-case basis for each of the excavation sites.

The clay deposit at Lot 6 occurs at the surface and incident rainfall drains as surface flow to the local drainage system along Lexia Avenue. The fact that this site does not have an overburden layer which could allow development of a perched groundwater regime indicates that there is negligible risk of affecting the nearby tortoise habitat.

Q8. **A major problem with the CER is that discussion of the habitat of the tortoise is confined to the swamp (a restricted clay pan area) which covers only about 30% of the important habitat area of the short necked tortoise. 13% of all tortoises found between 1988 and 1990 were outside the swamp and in or south of the drain.**

The conclusions drawn in the CER relate mainly to the clay pan swamp because the hydrological data collected indicates strongly that this area is isolated from external hydrological influences other than direct rainfall. It was understood at the time that this clay pan was the principal habitat which required protection.

Given the fact that tortoises exist outside of this clay pan (data which we have only recently been made aware) and that the nature reserve is presently being expanded to encompass additional land to the south and west, then there is a clear change in emphasis in terms of current habitat protection requirements.

Q9. **An extension to the existing (fenced-off) reserve may be required to help increase the numbers of short necked tortoises. Earthworks to close and divert the existing drain to an area outside the reserve is essential to improving and protecting the quality of water in the habitat area. Recontouring of some areas within the existing or extended reserve may be required. To what degree and how might the proponents be prepared to assist CALM in this regard?**

Midland Brick would be prepared to assist in drain diversion works etc. by providing earthmoving equipment in an equitable arrangement with the other proponents.

In regard to extending the existing (fenced-off) reserve, CALM has an interest in acquiring a portion of land owned by Midland Brick that is adjacent to the reserve, as well as some land owned by another landholder. Midland Brick is endeavouring to arrange a land swap which will facilitate achievement of CALM's objectives for expansion of the reserve.

Q10. **Is the Lot 6, Almeria Parade deposit part of the original habitat occupied by the short necked tortoise? What is the potential for excavation of this site to impact on the habitat of the tortoise?**

The Lot 6 Almeria Parade deposit was quite likely part of the original habitat occupied by the short-necked tortoise in the Upper Swan area. It is assumed that the original tortoise habitat was relatively extensive in comparison to the present habitat within the nature reserve (see response to question 11, below).

Excavation of Lot 6 Almeria Parade is not considered to pose a threat to existing tortoise habitat because the Lot 6 deposit is an isolated clay pan; it is not a continuous deposit that is linked to the nature reserve. It has been further isolated by drainage works associated with road construction and land subdivision for agricultural pursuits.

Q11. Figure 8 shows most of the estimated original swamp habitat (for short necked tortoises) lies east of the swamp. What is the basis for this delineation? Why is this are not favoured as a logical extension of the habitat for the short necked tortoise as opposed to land south and west of the current fenced off area?

In Figure 8 of the CER, the basis for delineation of the 'original' swamp habitat is essentially arbitrary, in that it stems from the present natural hydrological boundaries of the residual clay pan area. The remnant clay pan is bounded to the north by slightly elevated land on the edge of Ellen Brook and to the west/south-west by a natural drainage channel. Therefore, it was considered logical to assume that this habitat area originally extended to the east and south, on low-lying terrain where surface ponding still occurs today.

The probability that additional tortoise habitat originally existed on land further to the south and south-west of the nature reserve is also acknowledged and indeed, much of the land encompassed by the 20 metre topographical contour on Figure 8 could have supported suitable habitat for the short-necked tortoise. It is low-lying and would have been poorly drained prior to establishment of the existing drainage system. The original vegetation would have prevented rapid loss of surface water to Ellen Brook, thus maintaining pools of water in the spring months which is an important time for the tortoises.

It is assumed that land to the east of the nature reserve is not favoured by CALM as an extension of the habitat because of the position of Great Northern Highway. Land to the south and west, which is presently being targeted for inclusion within the nature reserve, has the advantages of:

- some native vegetation is still present in these areas, and
- there are no physical barriers (outside CALM's control) to inclusion of these areas within the nature reserve.

Surface Water Impacts on Tortoise Habitat

Q12. Since the tortoise is well known to inhabit the drain and area to the south of the swamp, any deterioration in water quality of the habitat could potentially lead to the extinction of the sub-population which inhabits the area. What steps can the proponents take to ensure that discharged pit water and run-off water from the clay excavations does not enter the habitat of the tortoise?-P47.

To ensure that discharged pit water and runoff water from the site does not enter the tortoise habitat (existing and proposed), Midland Brick propose to modify drainage patterns at the site wherever there is a risk that surface water from disturbed areas would flow onto tortoise habitat. This could be achieved by conducting appropriate drainage diversions, in consultation with CALM, to ensure that runoff is directed to areas which do not represent potential tortoise habitat.

In view of the changes that are proposed for the nature reserve (e.g. drainage diversions and expansion of the reserve area with the new areas to be recontoured), it is premature to consider detailed drainage management requirements for each excavation proposal. Drainage management will be resolved prior to excavation, in accordance with the requirements of the EMMP (refer to question 34).

Q13. What options are there for diversion of the drainage channel away from EBNR, if it is necessary to close it off to ensure the survival of the short-necked tortoise? Could the proponents assist in this regard?-Fig.6.

Apparently, CALM is now keen to have the drainage channel through the nature reserve diverted away from the EBNR. There are basically two options available for consideration:

- Diversion of the drain through private property on the southern and western sides of the nature reserve;

- Diversion of the drain along the eastern side of Great Northern Highway to discharge into Ellen Brook, around the north-eastern corner of the tortoise habitat.

The latter option appears to be the most economic and practical of the three alternatives on the basis of distances involved and engineering and logistical constraints. The cooperation of the Main Roads Department would be required with respect to such aspects as utilisation of the road reserve for drainage purposes and design/installation of appropriate culverts underneath Great Northern Highway.

Midland Brick would be prepared to assist in drain construction by offering earthmoving machinery similarly to the offer under question 9 above.

Q14. Does WAWA still consider Ellen Brook as a potential source of domestic water? If so, where is it likely to be dammed? Would damming upstream affect the tortoise habitat?-P23.

The Water Authority still considers Ellen Brook as a potential source of domestic water (Mauger, G.: Planning Future Sources for Perth's Water Supply - 1989 Revision). It is a currently preferred option, although further investigation is required. The most likely implementation date is post 2012.

A preliminary dam site, as indicated in the above planning document, is located near to the confluence of Ellen Brook and the Swan River. It would only be a pipehead dam and the constraints of nearby residential land suggests that the dam height would need to be relatively low. (Pipehead dams are designed to inject water directly into the reticulation system, with or without treatment and therefore only function during the winter months. They are not water storages for the summer period).

The Water Authority would need to demonstrate that the proposal would not affect the tortoise habitat.

Ground Water Impacts on Short-Necked Tortoise Habitat

Q15. What data has been used to show the presence and depths of perched water tables and groundwater table levels?-P26. Does the perched groundwater sit on the plastic clay zone to be mined? If it does, won't the mining of clay

cause these perched groundwater pockets or lenses to drain into the excavation? If such a scenario is possible and happens, wouldn't this affect the water levels in the current and future tortoise habitat areas?

Groundwater data has been collected from numerous monitor bores installed during a number of studies conducted in the area since November 1986 (refer to Table 1 in the CER). Prior to about mid-1989, investigations at each of the proposed excavation sites were conducted in isolation and monitoring has not been conducted on a continuous basis at each site. Monitor bores (simple tube piezometers) were installed and generally only monitored for one season to establish the principal groundwater characteristics such as relative depths of the main groundwater table, perched groundwater and the target clay layer.

The only long term records available are from two Water Authority monitor bores near to Ellen Brook, in the vicinity of Lexia Avenue. (See Figure 2 for approximate locations). Up-dated hydrographs have recently been obtained from the Water Authority (Figures 3 and 4).

Figure 3 (Bore A) shows that the permanent water table is at about 12 metres AHD in the vicinity of Lexia Avenue and has fluctuated within a 1.0 metre range during the eight year period 1979 to 1987. Seasonal fluctuations as little as 0.4m have been recorded. Well EE9 (Figure 4) exhibits larger fluctuations in water level which probably reflects its proximity to Ellen Brook and interaction with winter flood levels in the watercourse.

The locations of monitor bores installed by Midland Brick are shown on Figure 5, along with dates of installation and the initial monitoring period. Only shallow bores were installed at Lot 6 Almeria Parade because excavation at this site will be restricted to a shallow depth and there is already a deep Water Authority bore at this site. The bore logs generally recorded strong 'grey' clay from the surface to about 3.5 metres, with the exception of Bore 9 which has 1.5 metres of coarse sand overlying the clay. Midland Brick's initial exploratory drilling encountered permeable coarse sands underlying this deposit.

The shallow monitor bores demonstrated that this deposit does not contain perched

groundwater as they were essentially dry holes. This is consistent with the nature of the clay, which would tend to act as a strong 'aquitard'. Sediments at the base of Bore 8 were moist initially, but the bore did not contain 'free-standing' water.

If, in the process of clay mining, the excavation intersects a shallow zone of water-bearing sediments, then it is acknowledged that water would most likely drain into the excavation. However, this would only affect water levels in the current and future tortoise habitat areas if the following circumstances apply:

- that surface water levels in the tortoise habitat areas are maintained or augmented by the presence of shallow groundwater (rainfall could be the sole source of ponded water);

- that the shallow groundwater is continuous from the habitat areas to the clay excavation site.

Experience with existing clay pits in the locality strongly suggests that large 'bodies' of perched groundwater are very much the exception. This is supported by the monitor bore data.

Q16. Land east and south of the EBNR could be hydraulically linked to the tortoise habitat area. For example, data presented on P35 and Figure 11 shows a potential link between the perched water tables and the current and future tortoise habitat areas, and Figure 12 shows the perched groundwater level is higher than the tortoise swamp. Without more conclusive data to show that the water levels in the habitat areas are independent of the proposed excavations, then any mining east and south of the current and proposed extensions to the tortoise habitats should be progressed with great caution. Are the proponents prepared to make a commitment not to mine within a specified distance from the reserve without further investigations and the approval of EPA?

It is noted that CALM has suggested an arbitrary distance of 100 metres as a buffer zone for the nature reserve, where clay quarrying should not occur unless proven to pose no risk to the tortoise habitat.

The proposed excavation area on Lot 6 is more than 100 metres from the existing nature reserve boundary ('fox-proof' fence). However, the proposed extensions to the reserve may mean that a portion of Lot 6 would be within 100 metres of the new habitat. This excavation will most likely be completed in 2-3 years. It is expected that monitoring of the first year of operation at this site will confirm that there is no possible impact on the tortoise habitat (existing or future).

Q17. To assist EPA's assessment of likely impacts on the short necked tortoises' habitats, could the proponents provide a cross-section showing the perched and permanent water table levels relative to the water levels in the swamp, reserve, creeks and drain.-P.28.

A schematic cross-section is provided in Figure 6 (see Figure 5 for the approximate location).

Q18. Mining should stay 1 to 2 metres above the water table and the proponents should be prepared to make a commitment to this effect. Groundwater table levels need to be established prior to mining to ensure this doesn't happen.

The exploratory drilling and the monitor bore data clearly show that the clay layer to be mined is located more than two metres above the permanent water table (Figure 6).

Q19. Detail on the presence and lateral continuity of the perched water table seems critical in achieving an understanding of the hydrology of the tortoise habitat area. Is there more data than that presented in Figure 11 that could assist EPA in evaluating these proposals?

Additional data from the groundwater investigations conducted by Midland Brick is provided under question 15 above and on Figures 5 and 6.

Q20. Has there been coring of the swamp to substantiate the claim that clayey sediments of the swamp represent a strong aquitard?-P39.

No coring of the swamp has been conducted. The claim that the clayey sediments represent a strong aquitard is based on direct observation of the strong, grey clay in the

swamp and the fact that it 'holds' water so effectively once rainfall has ceased. Note that the swamp is bounded by 'drainage-depressions' on the northern side (Ellen Brook) and to the west, south-west and south (nature reserve drain). If the swamp sediments were not a strong aquitard and did allow water to infiltrate into the sub-surface, then water levels would be observed to decline more rapidly via:

- vertical sub-surface drainage to the underlying deep water table, or
- horizontal sub-surface drainage to the adjacent 'drainage-depressions'.

Q21. What is the source of water for dust suppression and does this affect other water users in the area?

Most water for dust control is loaded at Midland where there is a fast-fill facility (1 fill per 5 minutes) and trucked to the clay pits. Water is sometimes extracted from the company's Copley Road storage ponds, but only when there is a surplus requiring disposal.

Impacts on Other Water Users

Q22. The superficial aquifers of the area directly recharge the Leederville Formation, which is an important source of water for both private and public water supply. What measures will the proponents take (and commit to) to ensure diesel or oil spillage does not contaminate the aquifer?

The only equipment which needs to be refuelled on site are unlicensed machines, e.g. excavators, dozers and scrapers. All licenced vehicles are refuelled at Midland. Midland Brick's fuel truck is fitted with vacuum extraction equipment and all wastes are returned to Midland for disposal. No fuel or lubricants are stored at the clay pits.

Q23. Do the proponents intend to monitor private well levels prior, during and after mining the area to gauge and manage the impact of dewatering of the pits?

No. Dewatering of groundwater will not be conducted.

Rehabilitation

Q24. What are the proposed and potential long term uses for the site after excavations are complete? Who will be consulted and to whose satisfaction will the work be carried out?

Midland Brick's clay extraction proposal is on land that is privately owned and leased to the company. Accordingly, rehabilitation of the sites will be to the satisfaction of the present landholders in line with existing agreements, as well as to the satisfaction of the Shire of Swan under the terms of the excavation licence (pending).

Q25. Given a swell factor of 35% for over-burden, how quickly does the material settle down to a stable surface following rehabilitation of the pit? What restrictions on land use are there after rehabilitation of the pits?

Experience with other restored pits indicates that the backfilled overburden provides suitable foundations for agricultural purposes in approximately 12 months. The land would not be suitable for building purposes in this time unless stringent compaction specifications were adhered to during the backfilling process. Without compaction, it may take many years (5-10) before backfilled areas could be used for building upon, although it is believed to offer suitable foundations in the long term.

Q26. Midland Brick's proposal on the corner of Apple Street and Great Northern Highway is not considered short term (8 years!) and, being close to the highway, is exposed to constant observation by the public. The area may require special rehabilitation treatment, such as sequential rehabilitation after excavation, screens of trees and strategically placed overburden stockpiles, to minimise visual impacts-P17.

Not relevant to this proposal.

Q27. Do the proponents intend to hydro-mulch overburden stockpiles which are not put back (rehabilitated) in the same season to minimise dust and visual impacts?-P46.

Midland Brick has not found it necessary to use hydro-mulching to control dust and the company has generally operated on the principle of returning overburden to the excavation within the shortest possible time. As there is no overburden to be removed prior to clay excavation at Lot 6, this issue is not relevant at this site.

It is mainly vehicle movement which 'powders' the ground surface and causes dust emissions, therefore wetting of haul roads and work areas is essential to control this situation.

Q28. EPA would prefer a commitment from proponents to progressively restore the pits to a landform with an enhanced aesthetic appeal, to the satisfaction of EPA.

Midland Brick is committed to undertake progressive restoration of the pits during clay excavation at this site, to the greatest extent possible.

Q29. Some setback requirements near property boundaries could possibly be eliminated in a regional rehabilitation scheme, to allow efficient utilisation of the clay resource and rehabilitation to wetlands-P58. What pro-active work have the proponents carried out to introduce a regional rehabilitation strategy for the areas being mined in the Upper Swan Valley?

Discussions will be held with the landowners, the Shire of Swan and adjoining property owners during the excavation programmes to explore the opportunities of reducing some setback requirements near property boundaries (to maximise the recovery of this scarce resource).

In relation to a regional rehabilitation strategy, an approach was made to DPUD in 1990 to advise of the extent of quarrying that was proposed in the area. This approach was made when it was found that DPUD was initiating a Structure Plan for the North-East Corridor, north of Midland. Discussions were held with Mr Tim Aurett who advised that the Structure Planning exercise is preliminary only, and that the area would remain available for clay excavation because of the scarcity of this resource. In the long term it should be assumed that the area may be more intensively developed. However, this is not likely to

occur for at least 25 years. The recently released Discussion Paper on planning options for the North-East Corridor shows the future usage of the Upper Swan locality as Rural, Conservation and Open Space.

Rehabilitation of the area with a mix of lakes and recontoured land would be consistent with future urban development intermingled with open space for passive recreation. The company is prepared to liaise further with Planning Authorities, as required during the lifetime of the excavations, to ensure compatibility with long-term plans for the area. However, as the site is privately owned, Midland Brick's main objective in rehabilitation planning is to fulfil the requirements of the existing owners.

Q30. What is meant by amenity lakes?-P56.

An amenity lake in this context refers to a clay pit which has been recontoured to form a basin that collects and holds water. Its primary purpose is to provide a landscape with aesthetic value. Open water areas are generally regarded as visually attractive and can form the basis of 'added-value' for future development or as a focal point for public open space.

Aboriginal Sites

Q31. The proponents should keep in mind the requirements of the Aboriginal Heritage Act. -P20. Do the proponents intend consulting with traditional landowners as well as current ones? Will a survey for sites of significant archaeological and ethnographic interest be carried out?

In response to a letter addressed to the company's environmental consultant from the Swan Valley Fringedwellers, an approach was made to both the Robert Bropho group and the Corrie Bodney group for the purposes of facilitating further consultations. A direct approach was made at the suggestion of the WA Museum, because at the time, Robert Bropho in particular, had indicated a reluctance to consult with any of the practising ethnographic/archaeological consultants in Perth.

A follow-up consultation attempt will be made once environmental approval is granted, with the objective of establishing the need for a detailed ethnographic/archaeological survey to satisfy the requirements of the Aboriginal Heritage Act.

Other Rare Species Impacts

Q32. CALM notes the existence of declared endangered flora *Hydrocotyle lemniodes* (Aquatic pennywart). No mention of this species occurs in the text. Does rehabilitation lend itself to propagation of this species?-P21.

Q33. CALM does not mention the shield shrimp. What is the distribution of this species? Does rehabilitation of the clay pits lend itself to the propagation of this species?-P22.

No further investigations have been conducted in relation to the matters raised here. On page 59 of the CER, the option of rehabilitation of clay quarries for tortoise habitat was briefly considered, along with the alternative option of expanding the existing nature reserve into areas that are not proposed for clay excavation. It is noted that CALM is presently pursuing the second option.

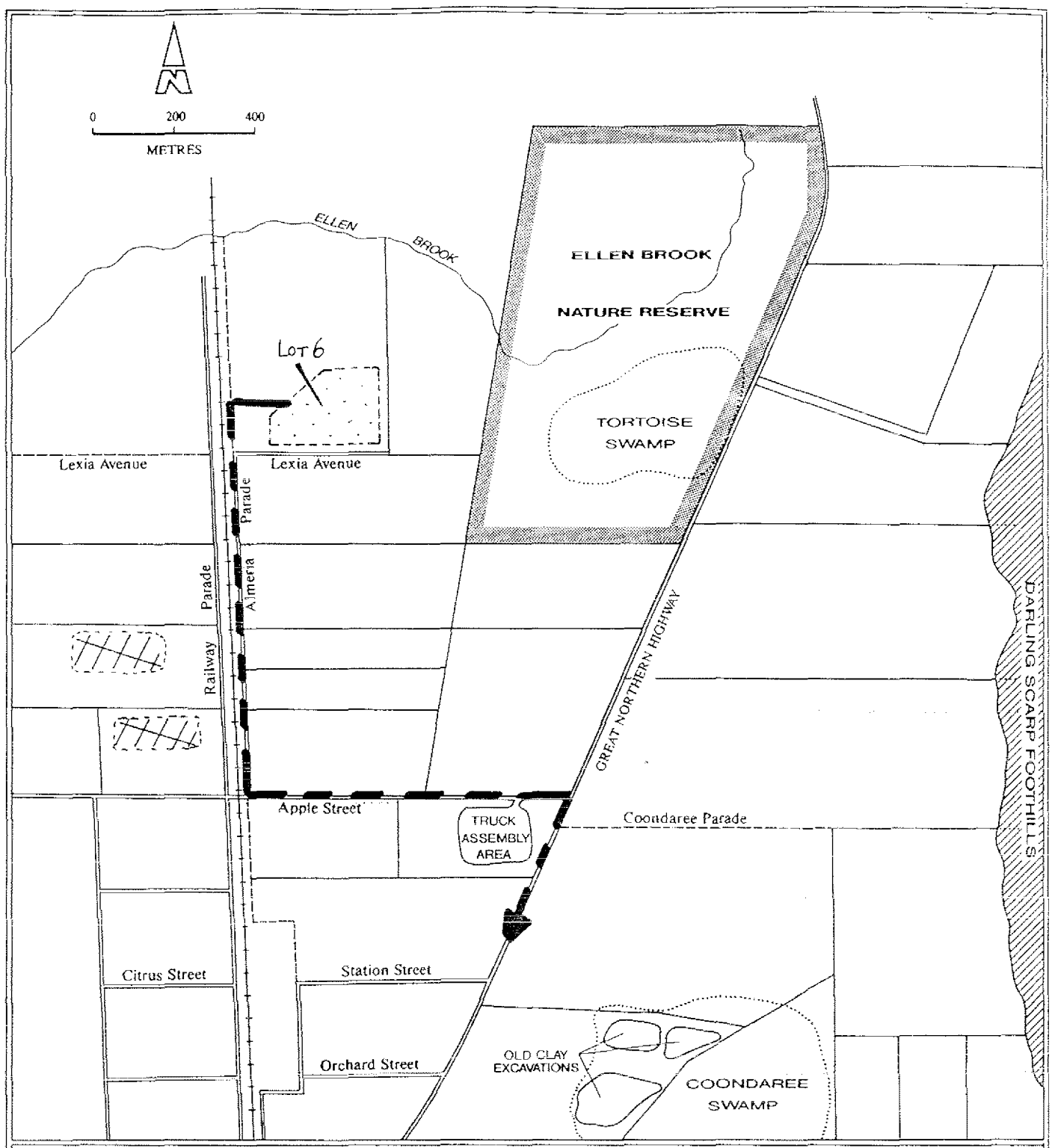
Environmental Monitoring and Management Programme (EMMP)

Q34. Management practices (P43&56) should be prepared for each proposal and either made as commitments or incorporated into an EPA - approved EMMP.

Midland Brick commits to preparation of an EMMP to the satisfaction of EPA prior to commencement of operations at the site.

The Raw Materials Manager (currently Mr Joe Glucina) is the company's representative who is responsible for:

- preparation of the EMMP;
- compliance with conditions and commitments of the proposals;
- contact for the public and government departments;
- monitoring and management of environmental impacts;
- management of complaints from the public.



LEGEND

Constructed roads

Road reserve (not constructed)

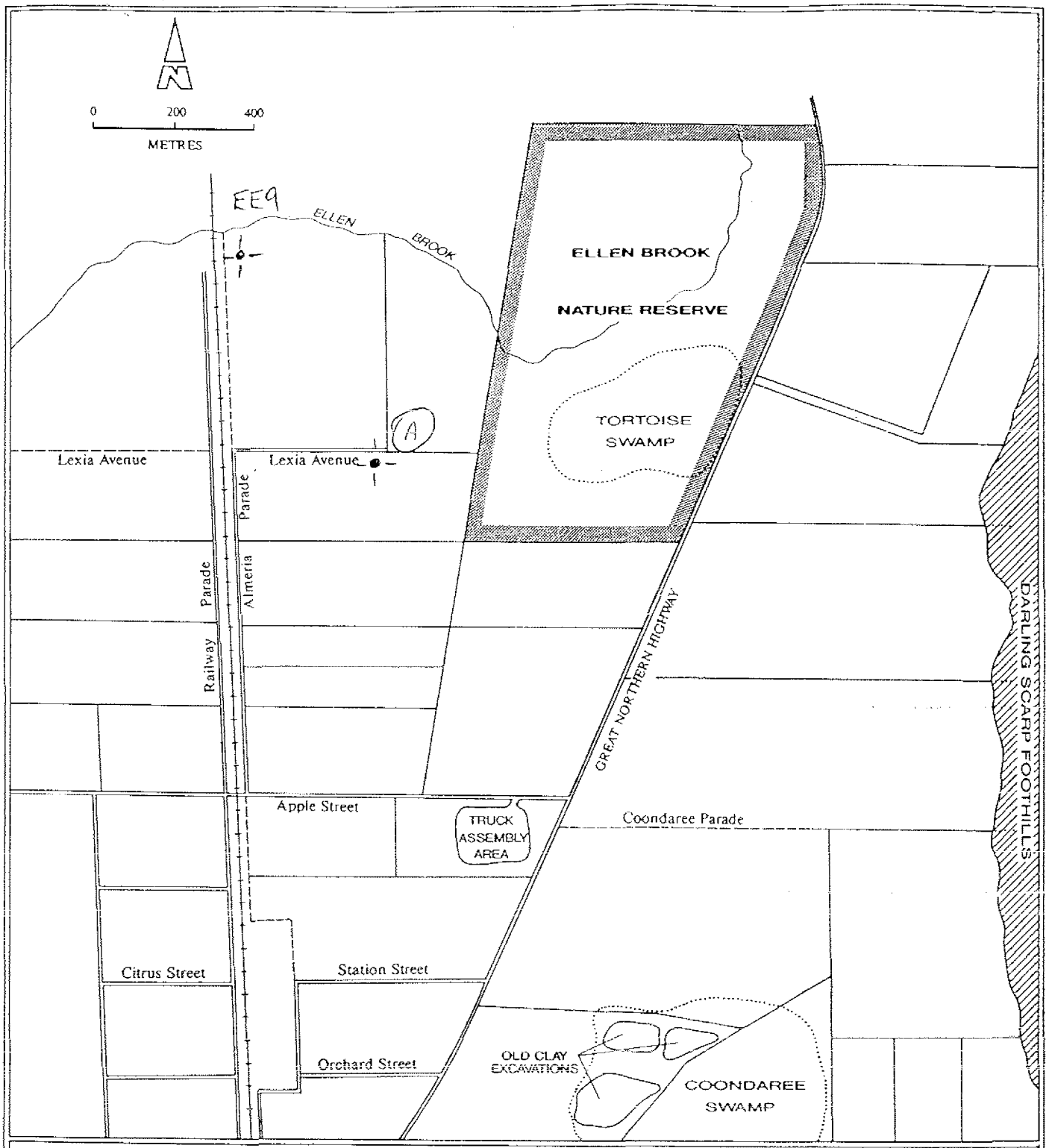
Standard gauge railway

Access Route

Previously Quarried Areas

PROPOSED ACCESS

FIGURE 1



LEGEND

Constructed roads

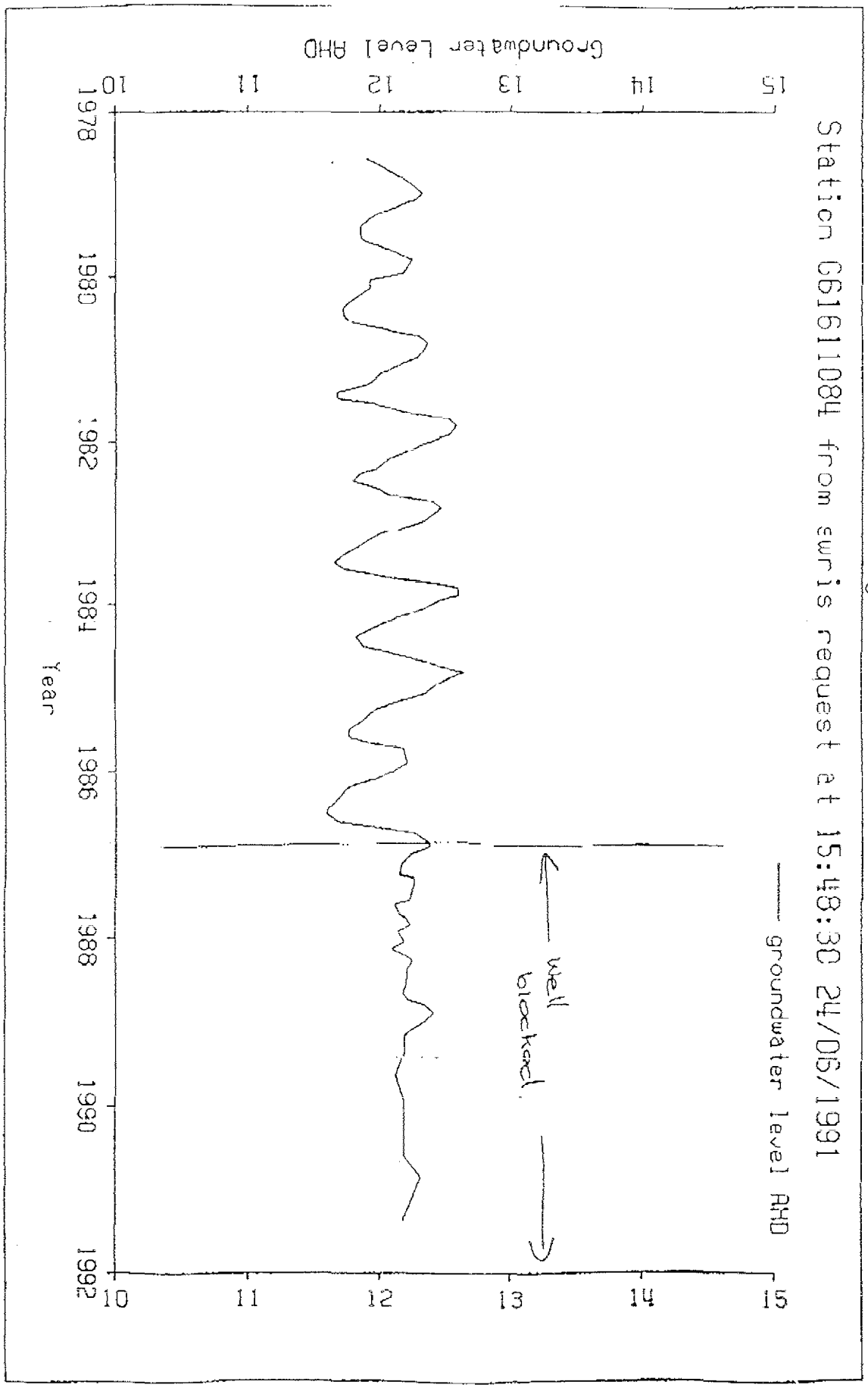
Road reserve (not constructed)

Standard gauge railway

Water Authority Bores

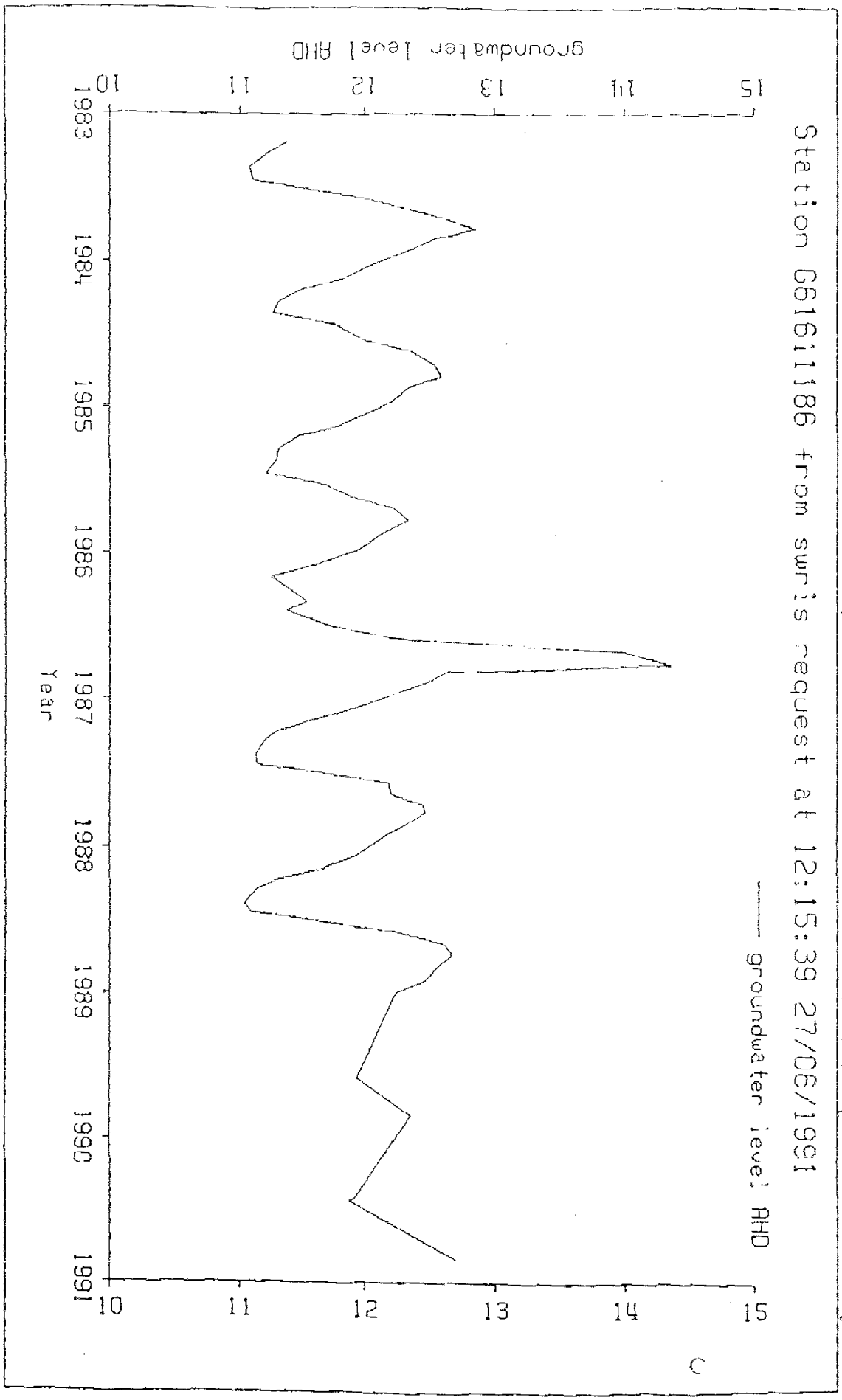
LOCATION OF LONG-TERM MONITOR BORES

FIGURE 2



BORE (A)

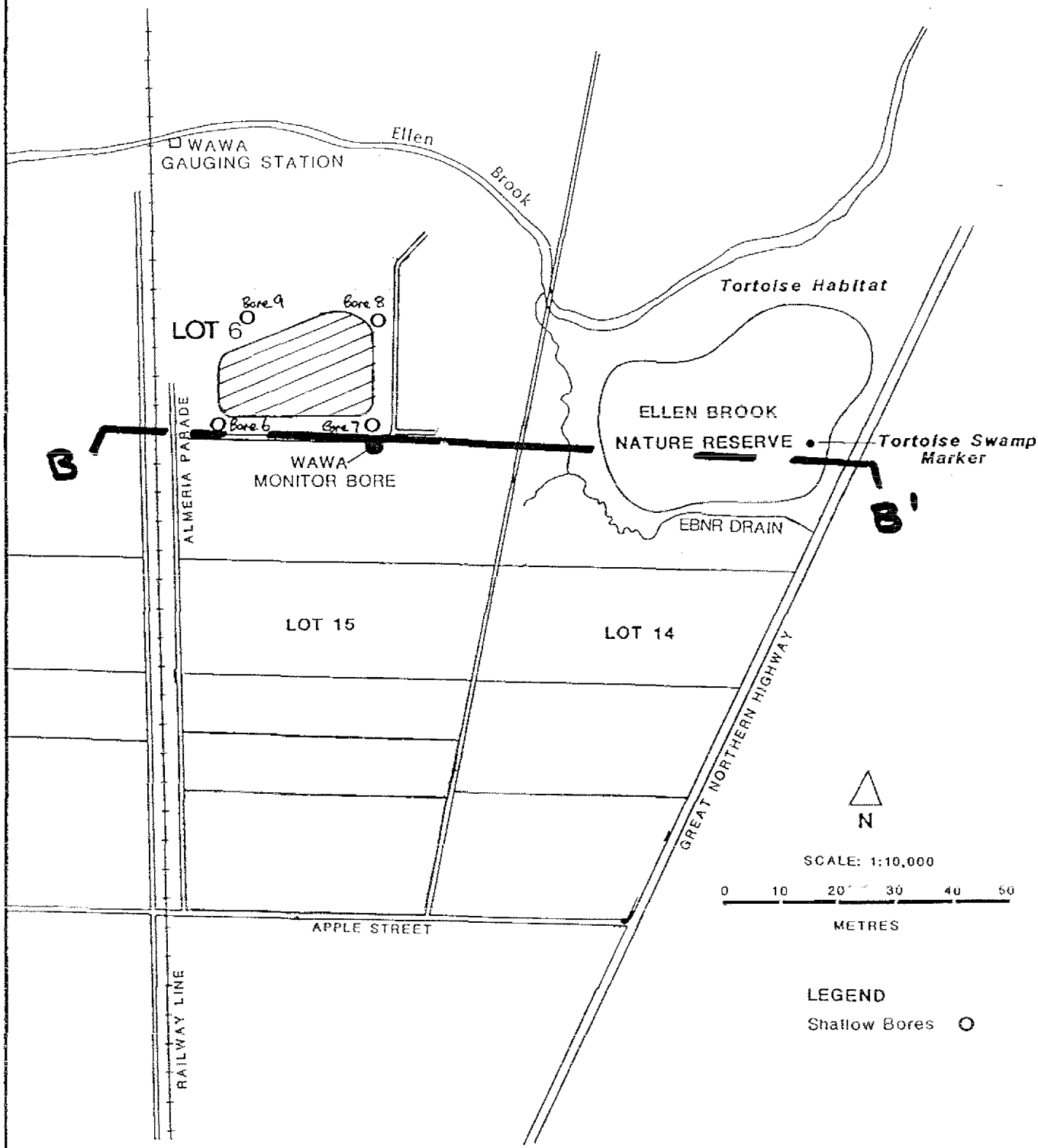
FIGURE 2



Well EE9

Total depth = 12m

Slotted from 3.75m to 12m.

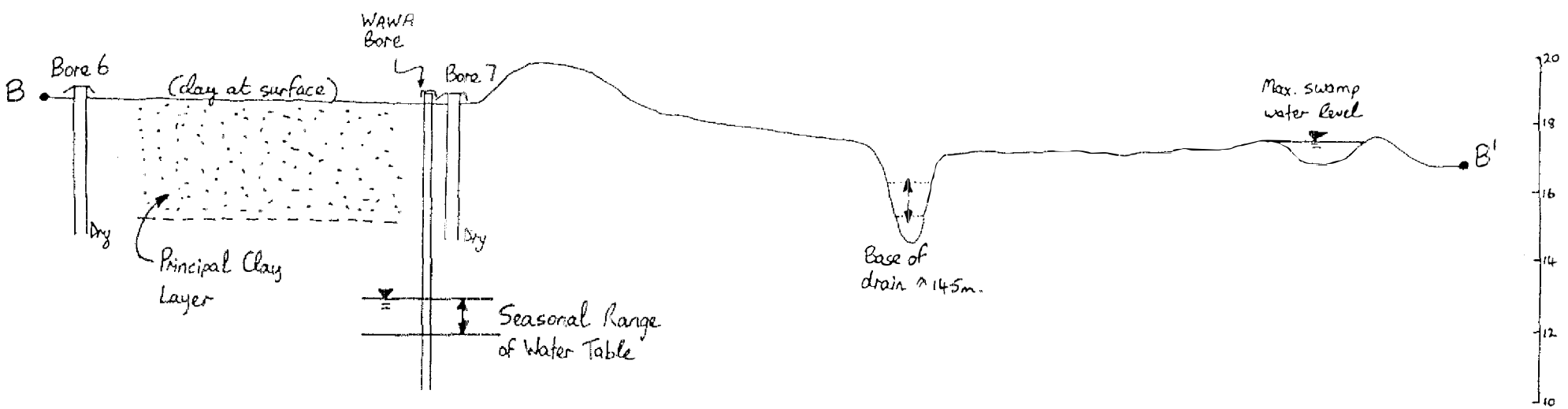


- Bores installed on 10/11/89.
- Monitored in November & December 1989 and checked again in March 1990.

LOCATION OF MONITOR BORES

FIGURE 5

LOT 6 ALMERIA PARADE



SCHEMATIC CROSS-SECTION SHOWING RELATIVE WATER LEVELS

FIGURE 6

Fig. 6

Appendix 3

Clarification of proposal and drainage modifications, January, 1992

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Midland Brick

Midland Brick Company Pty Ltd A.C.N. 008 674 244 A member of the Boral Group

6 January, 1991
JG/aem/L226

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention : Mr S Sadleier

Dear Sir

Re : Clay Excavation Lot 6 Lexia Street, Upper Swan

The following information is provided to clarify issues discussed at our site meeting on 18.12.91.

1. To minimise the impact on the local community, we intend to complete the proposed development within three digging seasons instead of the original five years schedule.

2. Midland proposes to operate this excavation and trucking activity between the hours of 6.00 a.m. to 5.30 p.m. Monday to Friday and 6.00 a.m. to 1.00 p.m. Saturdays with no additional activity outside these timeframes.

3. As the top of ground water aquifer fluctuates between 6.8 and 7.8 metres below the surface and excavation depth will not exceed 4.0 metres, no mining will occur below the water table.

4. The annual surface water yield for this catchment is estimated at 55,000 cubic metres and the bulk of this now enters the Ellen Brook Nature Reserve from constructed drains within the Lexia Street Road Reserve. Dams formed during the excavation process will have a maximum storage capacity of 150,000 cubic metres and a predicted annual loss of 35,000 cubic metres from evaporation and additional indeterminate quantities from seepage through the Dam linings. Therefore, it may take seven to ten years to fill the Dams from this catchment and no water will enter the Ellen Brook Nature Reserve from Lot 6 during this period. Should these Dams eventually fill and overflow into the existing road drains, this flow will be insignificant in comparison to existing runoff volumes entering the Ellen Brook Nature Reserve.

/2...

Bassett Road,
Middle Swan 6056
Western Australia

Administration:
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53044

Sales:
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Facsimile: (09) 250 1340

Midland Brick Company Pty Ltd commit that, during the mining activity, no silt laden runoff will enter the Ellen Brook Nature Reserve from Lot 6. This will be achieved by constructing an earth bund to contain all silt laden storm water within and deflect clean runoff away from areas disturbed by mining and road transport. Should the Department of Conservation and Management wish to divert or modify the existing drainage system from this catchment, Midland Brick will provide equipment and personnel at its cost to complete this task to an agreed and pre-arranged specification.

Yours faithfully
MIDLAND BRICK COMPANY PTY LTD

J GLUCINA
Raw Materials Manager

Appendix 4

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NOTE: These reports are available either in the libraries of the Environmental Protection Authority or the Department of Conservation and Land Management.