

**Proposed clay excavation, Lots 10, 11 and Part Lot
36 Great Northern Highway, Upper Swan**

Metro Brick (A Division of Bristile Ltd)

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 604
December, 1991**

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 20 December, 1991.

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Summary and recommendations

Metro Brick (A Division of Bristle Ltd) currently excavate clay for brick making purposes in a quarry located on Part Lot 36 Coondaree Parade, Upper Swan, just east of Great Northern Highway and about 14 km north of Midland. The environmental impact of the project was previously assessed by the Environmental Protection Authority in 1988 prior to the Minister for the Environment setting conditions on the project.

An Application for Renewal of Excavation Licence by Metro Brick Pty Ltd was referred to the Environmental Protection Authority by the Shire of Swan in August, 1990. 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 briefly 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 responses 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, Metro 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:

- **Metro Brick has also given a commitment to the containment of turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat;**
- **For the first three annual excavations on Lot 10, Metro Brick would contain all their drainage water to within their site and immediate surrounds by bunding the perimeter with overburden to a height of 0.8m; and**
- **Metro Brick propose that future stages of excavation could be accommodated by diverting drainage waters to the north, by**

blocking off the existing culvert and enlarging and deepening the drainage line on the east side of the highway.

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 Metro Brick to:

- **monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;**
- **remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;**
- **detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere;**
- **divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

The Environmental Protection Authority concludes that, from investigations undertaken and advice given, the proposal by Metro Brick is most unlikely to impact on the groundwater of the tortoise habitat, provided that the following stringent controls and management procedures are adopted:

- **preparation of a staged excavation plan as part of an Environmental Management Programme (see Recommendation 4), with the first excavation to commence at the furthestmost point away from the tortoise habitat;**
- **preparation of an approved groundwater protection plan, as part of the Environmental Management Programme (see Recommendation 4), with the objective of delineating and monitoring perched groundwater levels and pit seepages, and designing suitable management practices to remedy any potentially unacceptable impacts; and**

- **establishment of a no-quarrying buffer of 100 metres around the reserve, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur (see Recommendation 3).**

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 their response to issues raised in submissions, Metro Brick has indicated that it is agreeable to assisting with machinery time for potential earthworks. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, and would be subject to further liaison and negotiation.

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.

It is unlikely that the proponent would want to excavate clay into the superficial aquifer because the plastic clay to be mined sits on top of the water table. In addition, wet plastic clay is difficult to excavate and would need dewatering, which is expensive and time consuming. If dewatering was necessary, it could be accomplished by pumping to another part of the pit, therefore minimising any drawdown effects.

The Water Authority of Western Australia has indicated that a groundwater licence would be required by the proponent prior to drawing groundwater.

The Environmental Protection Authority has recommended that Metro 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 4).

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 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 5).**

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

Metro Brick have outlined a number of management strategies which are currently used to minimise noise and dust impacts. These procedures have been used by the company successfully over the years, including at the nearby Part Lot 36, and there have not been any complaints registered against the company at this location to their knowledge. The company has stated that it would restrict its operating hours to 6.30am to 5.30pm, Monday to Friday. Metro Brick propose sequential rehabilitation and screening with vegetation to reduce visual impacts.

The community at Upper Swan townsite is less likely to be affected by Metro Brick's excavations, as the townsite is about 900m away from the boundaries of the property and 1.5km from the initial excavation site.

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 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.

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.

Metro Brick are prepared to rehabilitate their pits to a lake form that is compatible with the Shire of Swan requirements, to ensure these effects are minimised. Public access is restricted by fences in good condition and a lockable gate for security, and steep, dangerous areas would be fenced-off within the excavation. Metro Brick has advised that it is prepared to consider the provision of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by the Council, if this was considered of value in keeping children away from the site.

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 5).

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 Metro Brick to quarry clay on Lots 10, 11 and Part Lot 36, 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;
- 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 10 years from the time of commencement. Subsequent applications will be reviewed in the light of the proponent's environmental performance at the site.

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 Main Roads Department, the Swan River Trust and the Shire of Swan, Metro Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment. This plan should enable the proponent to:

- monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;**
- remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;**
- detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere; and**
- divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

Recommendation 3

The Environmental Protection Authority recommends that there be no quarrying within 100 metres of the boundaries of the Wild Life Sanctuary at Ellen Brook Nature Reserve and any additions thereto, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur to the tortoise habitat.

Recommendation 4

The Environmental Protection Authority recommends that, prior to the start of quarrying activities, Metro Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment. 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:

- a staged quarrying strategy;**
- drainage management;**
- groundwater 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; and**
- periodic reporting of monitoring results and consequential changes to environmental management.**

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

Recommendation 5

The Environmental Protection Authority recommends that Metro Brick, 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, should contribute to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, within 2 years of approval of this proposal and to the satisfaction of the Environmental Protection Authority.

1. Introduction and background

Metro Brick (A Division of Bristile Ltd), hereafter referred to as Metro Brick, propose to excavate clay on Lots 10, 11 and Part 36 Coondaree Parade, Upper Swan, just east of Great Northern Highway and about 14 km north of Midland (Figure 1).

An Application for Approval to Commence Development on Lot 10 and Part Lot 36 by International Brick and Tile Pty Ltd was referred to the Environmental Protection Authority by the Shire of Swan in October, 1989. 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 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. Metro Brick has recently provided further information on their proposal, in response to issues raised by the Authority as a result of the CER process (Appendix 2).

Metro Brick currently excavate clay for brick making purposes in a quarry located on Part Lot 36 Coondaree Parade. This project was previously assessed by the Environmental Protection Authority in 1988 prior to the Minister for the Environment setting environmental conditions on the proponent (International Brick and Tile Pty Ltd), which required the submission to the Authority of a report on environmental impacts of the company's operations after 12 months operation. This report was assessed by the Authority in consultation with other government authorities, and apart from the failure of a suitable establishment of screening vegetation (due to poor drainage), it showed that the project could operate without any unacceptable impacts on the environment.

In November 1991, Metro Brick wrote to the Authority to clarify that, due to their role as the major and managing partner in International Brick and Tile Pty Ltd, Metro Brick (A Division of Bristile Ltd) are the proponent for the proposal covering Part Lot 36 and Lots 10 and 11 (Appendix 3). Due to the shortage of suitable clay on Part Lot 36 and shortage of space at their Malaga factory, Metro Brick now propose to change the originally intended use of Part Lot 36 to long term stockpiling of clay extracted from Lots 10 and 11. These changes have been documented in the company's recent Application for an Excavation Licence, which was referred to the Authority in November, 1991, together with a late change to proposed drainage modifications in December, 1991 (Appendix 4).

2. The Western Swamp Tortoise

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 known only from Ellen Brook Nature Reserve and the Twin Swamps Nature Reserve, 4 km 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 has 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 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;
 - (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;
- 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 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

Lots 10, 11 and Part 36 are located to the east of the Great Northern Highway, north of the upper Swan townsite (Figure 1). An unconstructed road reserve, Coondaree Parade, forms part of the southern boundary of Lot 10. The existing access road is north of the road reserve.

The excavation would be for clay needed at the Malaga brickworks. Metro Brick estimate that 30,000 m³ would be required annually, although this volume would vary with demand. Work on Lot 10 and eventually Lot 11 would take place over several decades by a series of annual excavations over the summer periods. The internal access road would be constructed in the first year and a stockpile of clay on Part Lot 36 established (Figure 2). There is no vegetation to clear, and the area would be stripped of topsoil and overburden using scrapers and dumped in separate stockpiles adjacent to the excavation area. The surface area of each annual excavation is approximately 1 hectare, with 3 to 4 metres depth of overburden overlying 3 to 4 metres thickness of clay.

The rehabilitation objectives of the proponent are for the excavation pit to be rehabilitated as an artificial lake, and the stockpile area would be screened and the highway views framed by landscaping. Reshaping of the pit and drainage control would be completed before each winter. The procedure would involve recontouring the pit walls to acceptable grades, replacing and spreading overburden, respreading the topsoil, and reseeding with grasses.

A permanent stockpile of clay is proposed to be established to the south of the existing lake on Part Lot 36, to allow continuing supply of material to the Malaga brickworks, where capacity is limited to 1000 tonnes. The stockpile, which would be 5 metres high and cover approximately 50 x 100 metres, would be screened by landscaping. The tree planting around the stockpile area and along the highway would be initiated in the next planting season (1992), and be regularly monitored and supplemented as required.

Truck movements would occur throughout the year for approximately 4 days every six weeks. The truck movements would be between 2 to 5 hours each day during this period, depending on demand at the plant. Trucks would access the site from the Great Northern Highway along an existing formed access road next to Coondaree Parade and travel to Malaga via Great Northern Highway, West Swan Road, Gngangara Road, Beechboro Road and Beach Road.

4. Existing environment

Lots 10, 11 and Part Lot 36 are mostly cleared and the flat land on the western side is developed as pasture. A small creek flows south of the existing excavation on Part Lot 36 and there is a drainage reserve through Lot 10, and along the western boundary of Part Lot 36 to provide drainage of the area to Coondaree Swamp.

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.

In the long term, the proposed excavation could cover most of Lots 10 and 11, and extend to the western boundaries alongside the Great Northern Highway, which would then be within 50m of the eastern boundary of the fenced-off habitat of the short necked tortoise. However Metro Brick propose to commence operations in the south easterly section of Lot 10, which is the furthestmost point possible from the habitat area (about 600 m away) and have given a commitment not to mine within 100 metres of the reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur.

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 area 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.

However the highway drain (Figure 3) located in the south-east of the reserve, which carries runoff waters from Great Northern Highway and farmland to the south, west and east into the reserve, does represent a significant risk to the health of the tortoise and an interference to its 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 excavation, 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.

As a consequence of further interaction between Metro Brick, the Zoology Department of the University of Western Australia, the Department of Conservation and Land Management, the Shire of Swan, the Main Roads Department and the Environmental Protection Authority, the

company now proposes that surface drainage water from their clay excavation could be prevented from entering the tortoise habitat area by the construction of a suitable drainage diversion system (refer to Appendices 2 and 4). Metro Brick has also given a commitment to the containment of turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat.

For the first three annual excavations on Lot 10, Metro Brick would contain all their drainage water to within their site and immediate surrounds by bunding the perimeter with overburden to a height of 0.8m. This would prevent outside surface water from flowing into the disturbed area, and allow it to follow natural drainage patterns. The existing excavation site on Part Lot 36 would be rehabilitated to pasture before next winter, and bunded to prevent runoff waters entering the catchment of the tortoise habitat.

Metro Brick acknowledge that future stages of excavation may need diversion of drainage waters to the north, to prevent them from entering the tortoise habitat area. The company favours the option of blocking off water which currently enters the culvert leading under Great Northern Highway and discharges into the nature reserve (Figure 4). The drainage line along the east side of the highway could be enlarged and deepened to encourage flow in a northerly direction and into the next culvert. Here the water flows west under the highway, through Ellen Brook Nature Reserve but outside the fenced-off habitat area, and discharges into Ellen Brook. This modification to the drainage would require further engineering appraisal and possibly negotiation with other land owners prior to implementation.

The Environmental Protection Authority believes that the clay excavation proponents should carry out appropriate modifications to the drainage systems with which their proposals interact, to ensure that the habitat of the short necked tortoise is protected. The Authority considers that Metro Brick's drainage modifications are reasonable, and 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 proposed extensions, the Authority believes this work should be carried out within two years of approval of the proposal (see Recommendations 2 and 4).

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 swamp habitat are principally dependant on rainfall. Groundwater levels in the area of the proposed clay pits fluctuate at a similar depth of between 8 and 9 metres below the surface. The proponent concludes that the main groundwater aquifer is not a source of water, 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 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. Should there be a link between the perched water table and water levels in the swamp or other tortoise habitat, then a clay excavation could potentially lead to a reduction in the wet area available to the

tortoise. Such an effect is likely to occur and would be of major concern when clay excavations are in close proximity to the boundaries to the habitat area.

The proponent has 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 commences about 3 to 4 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, monitoring of two bores in the perched groundwater over a 12 month period recorded 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.

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. Land to the east, which was probably originally part of the tortoise habitat prior to clearing and subsequent agricultural land use, incorporates Lots 10 and 11. The proponent acknowledges the possibility of some sub-surface hydraulic link between this land and the swamp, although concluding that the potential 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 have submitted that the proponent's conclusions 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. This conclusion conflicts with that received from the Geological Survey of WA, which agreed with the proponent in that interception of the perched groundwater by the quarrying should have no effect. The Environmental Protection Authority considers that the proposals by Metro 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 (see below).

Of concern to the Authority are the impacts that the clay excavations might have on tortoise habitat areas within the fenced-off reserve but outside the swamp area, particularly as these impacts were not been addressed in detail by the proponent in the CER. In their response to submissions, Metro Brick acknowledge that there is insufficient evidence to say that there is negligible risk to the tortoise swamp habitat from the clay excavation, especially when in close proximity to the to the nature reserve. The company considers that 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 habitat area and any sub-surface water which may be present. In recognition of this risk, the company is committed to verifying that no adverse effects are experienced, by appropriate staging and monitoring of their excavations on Lots 10 and 11.

The Department of Conservation and Land Management have submitted that a no-quarrying buffer of 100 metres be established to guard against any error in the proponent's management practices or predictions. Metro Brick are committed to not quarrying within 100 metres of the reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur. Furthermore, the company propose to commence operations on Lot 10 as far as possible from the reserve, which would be initially at least 600 metres from the south-eastern corner of the reserve.

The Environmental Protection Authority concludes that, from investigations undertaken and advice given, the proposals by Metro Brick and other clay excavation proponents are most unlikely to impact on the groundwater of the tortoise habitat, provided that the following stringent controls and management procedures are adopted for each proposal:

- Preparation of an approved Staged Excavation Plan as part of an Environmental Management Programme, prior to excavation and in consultation with the Department of Conservation and Land Management (see Recommendation 4). The Plan should be implemented to the satisfaction of the Environmental Protection Authority, with the first excavation to commence at the furthestmost point away from the tortoise habitat;
- preparation of 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 perched groundwater levels and pit seepages, combined with suitable management practices to remedy any potentially unacceptable impacts;
- establishment of a no-quarrying buffer of 100 metres around the reserve, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur (see Recommendation 3).

6.4 Rehabilitation

Metro brick are 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 rehabilitation objectives of Metro Brick are consistent with the Authority's objective of re-establishing wetlands on the coastal plain. The proponent should liaise with the Department of Conservation and Land Management, to ensure that native species are catered for in the rehabilitation of the lakes and that suitable wildlife refuges (in the form of islands), are provided. The proponent should incorporate these plans into an approved rehabilitation plan as part of the Environmental Management Programme, to be prepared 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, Metro 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 tortoise inhabits 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 have indicated that, under the current proposals for rehabilitation to a series of lakes, the excavated sites 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) reserve 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, Metro Brick has indicated that it is agreeable to assisting with machinery time for potential earthworks. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, and would be subject to further liaison and negotiation.

The Environmental Protection Authority notes the intention of Metro 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;
- 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 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. Metro 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 Metro 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 5).

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 supplies if affected.

The main superficial groundwater aquifer is situated about 8 to 9 metres below the surface, and generally below the level of the plastic clay which the proponent wishes to excavate. In the CER, the proponent 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. The proponent considers that in the event that dewatering was required, this could be accomplished by pumping groundwater to another section of the pit or a nearby pit, where recharge could occur, thus concluding that the overall effect on the groundwater resource would be negligible.

In Metro Brick's response to submissions, the company indicated that excavations had been conducted to a depth of 9 metres on Part Lot 36 (since 1988) without intersecting groundwater. As further exploratory drilling is conducted over Lot 10, it would be possible for the company to establish the depth of the permanent water table. Metro Brick recognise and accept the philosophy of water resource protection and conservation, and have indicated that, in the unlikely event that the excavation did reach the water table or proceed slightly below it, the area would be backfilled with overburden to maintain at least one metre of cover. Water for dust suppression purposes would be obtained from a property owned by the company in Middle Swan, which was previously used for viticultural purposes. Rainfall and runoff water collected within the excavation could also be used for this purpose.

The Environmental Protection Authority considers that Metro 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 Lots 10 and 11. 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.

In response to submissions, Metro Brick has stated that it would restrict its operating times to 6.30am to 5.30pm, Monday to Friday. The truck movements at the Metro site are expected to be less intensive in comparison to the other excavation sites, and would be between 2 to 5 hours each day for approximately 4 days every six weeks, depending on demand at the plant.

The clay excavation proponents recognise that noise control and minimisation is a prerequisite to community acceptance and would incorporate 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;
- 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.

In the case of Metro Brick's proposed excavation on Lots 10 and 11, the noise impacts are reduced by their distance from most residences. The nearest residence is located on the proposed Midland Brick excavation site on Lot 22, about 350 m from the boundary to Lot 10 and about 1 km from the initial excavation site. The more densely populated Upper Swan townsite is located about 900m west of the western boundary of Lot 10.

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. Easterly and 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 a dust is unlikely to be a problem, due to various factors including:

- 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;

- 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.

In their response to submissions, Metro 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, and to preclude adverse effects to through traffic on Great Northern Highway. In the company's experience on Part Lot 36, there is not a dust problem with temporary overburden stockpiles and longer term clay stockpiles on the excavation site. To the company's knowledge, there have been no nuisance effects reported, and there have been no complaints to Metro brick in respect to noise or dust emissions. The most likely source of dust emissions is from working areas and the access track when traversed by trucks, which is simply controlled by watering. The company have stated that a watering truck would be present for all campaigns from their site, and for any trucking campaigns which occurred during the drier months of the year.

The flat terrain, coupled with the extensive clearing of vegetation in the past, means that the proposed clay excavations would be visible to local residents and traffic passing along Great Northern Highway. The proponents point out that the flat terrain is advantageous to some extent, in that the pit faces would be generally excluded from view because they would be below ground level. However the proponents recognise the potential of the excavations to impair visual quality to 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 quarries, in addition to the final rehabilitation plan. Principal techniques that could be used to minimise adverse visual effects include:

- strategic placement of temporary overburden stockpiles to screen the site from major viewsheds of concern;
- ensuring that stockpiles are smoothly contoured instead of a number of different sized heaps;
- planting vegetation screens at the site boundaries in areas where visual impact is required to be softened.

Metro Brick propose tree planting around the stockpile area and along the highway in the next planting season (1992), which would be regularly monitored and supplemented as required.

The Environmental Protection Authority considers that noise, dust and visual impacts from Metro Brick's proposed clay operation on Lots 10, 11 and Part Lot 36 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 management of mosquito breeding

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 Metro 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. The proponent suggests that the lake could be stocked with fish, to predate on the mosquito larvae, as is the case at the Ballajura Lakes Estate.

The company has stated that public access is presently restricted by boundary fences in good condition and a lockable gate off Great Northern Highway. A warning fence (eg fluorescent ribbon) would be placed around the sides of steep parts of the excavation. The company considers that their site would probably be of less risk to the children of the Upper Swan townsite than the other clay pits , due to the separation of distance and the highway. Metro Brick is prepared to consider the provision of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by the Council, if this was considered of value in keeping children away from the site.

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 2 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 area.

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.

8. 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 Metro Brick to quarry clay on Lots 10, 11 and Part Lot 36, 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;
- 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 10 years from the time of commencement. Subsequent applications will be reviewed in the light of the proponent's environmental performance at the site.

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 Main Roads Department, the Swan River Trust and the Shire of Swan, Metro Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment. This plan should enable the proponent to:

- monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;
- remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;
- detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere;
- divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

Recommendation 3

The Environmental Protection Authority recommends that there be no quarrying within 100 metres of the boundaries of the Wild Life Sanctuary at Ellen Brook Nature Reserve and any additions thereto, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur to the tortoise habitat.

Recommendation 4

The Environmental Protection Authority recommends that, prior to the start of quarrying activities, Metro Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment. 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:

- a staged quarrying strategy;**
- drainage management;**
- groundwater 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; and**
- periodic reporting of monitoring results and consequential changes to environmental management.**

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

Recommendation 5

The Environmental Protection Authority recommends that Metro Brick, 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, should contribute to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, within 2 years of approval of this proposal and to the satisfaction of the Environmental Protection Authority.

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.

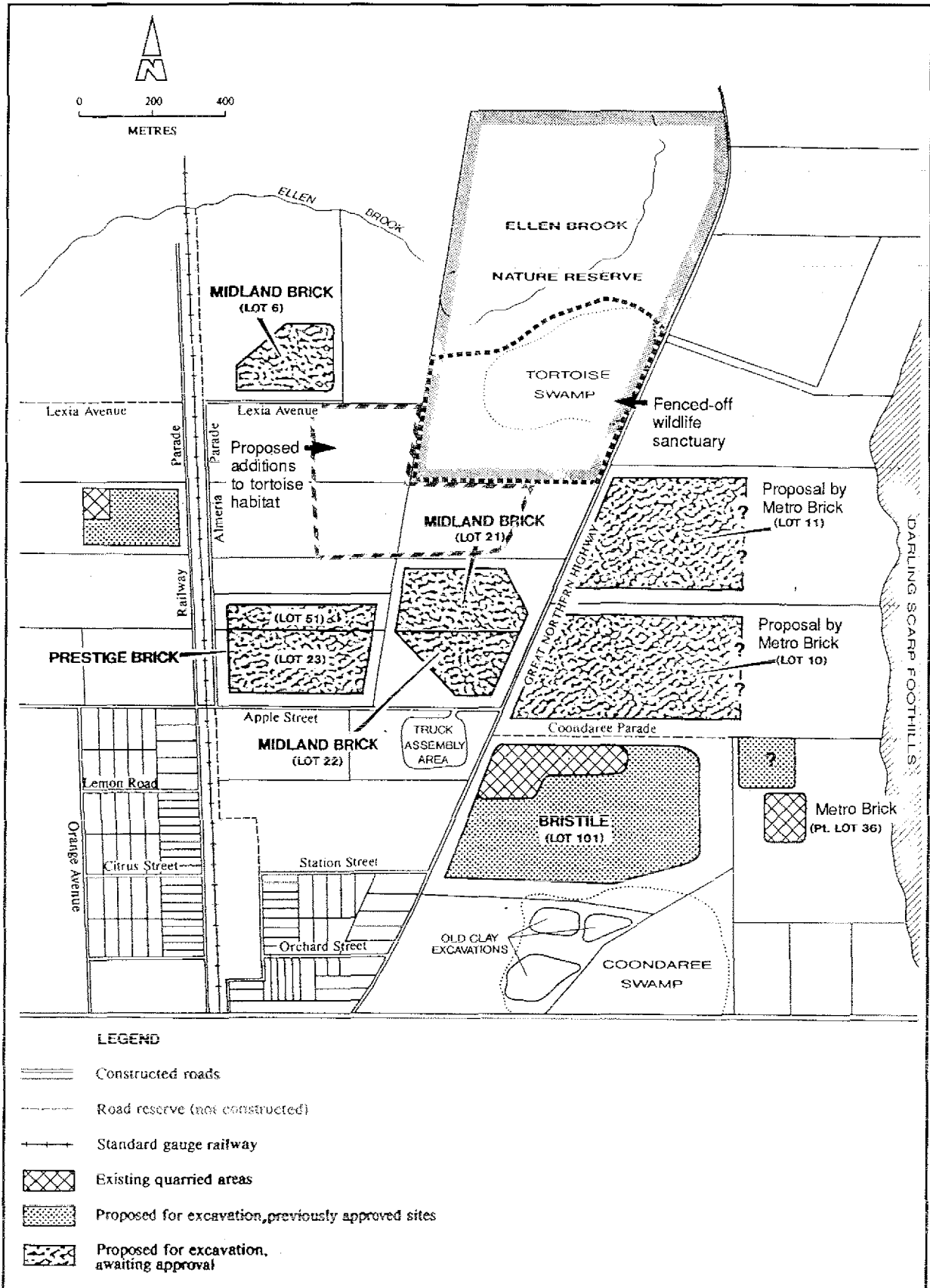


Figure 1. Location of proposal in relation to short necked tortoise habitat at Ellen Brook Nature Reserve and other current and proposed clay excavations.

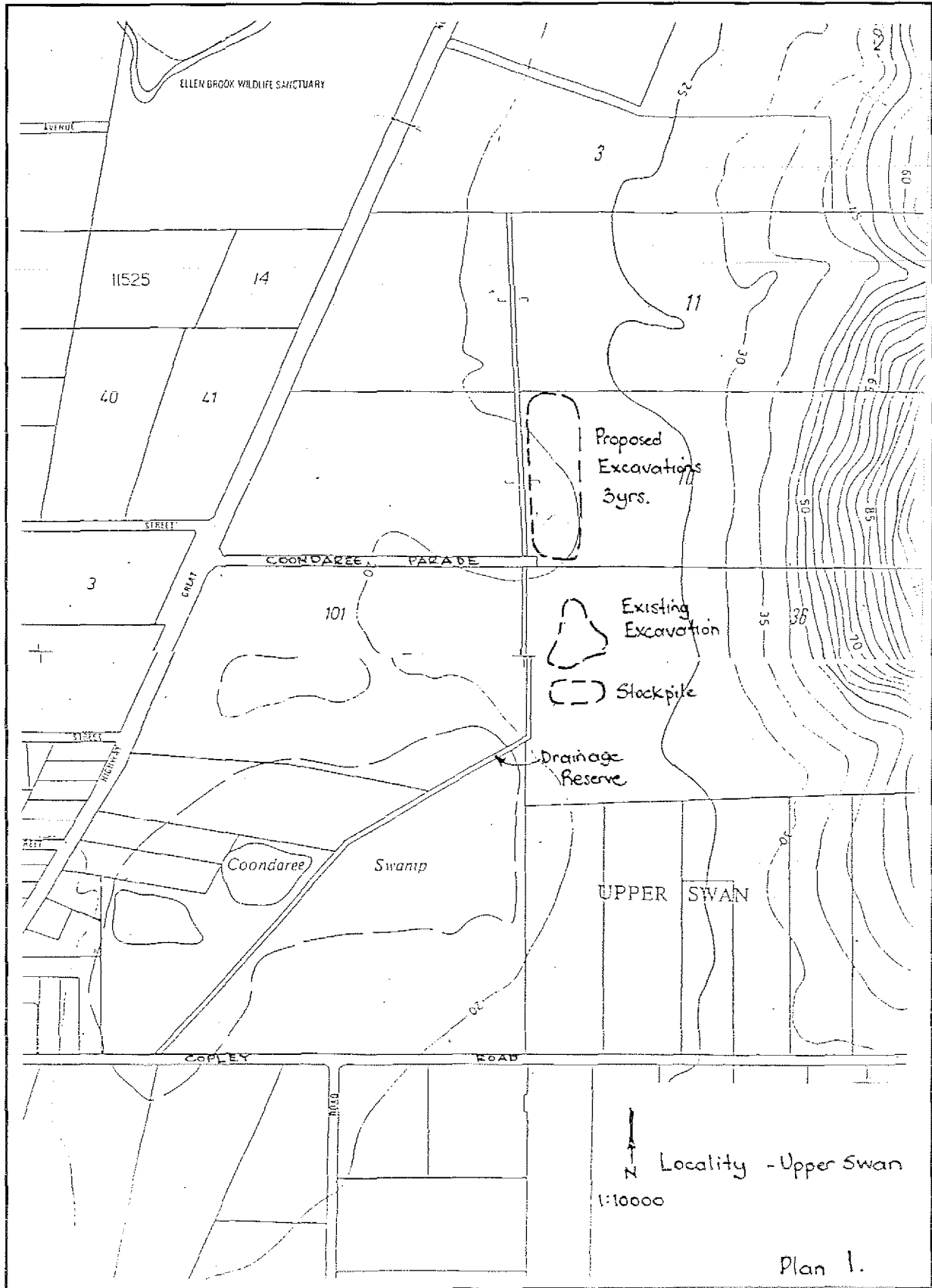


Figure 2. Proposed excavations by Metro Brick on Lot 10 for first 3 years

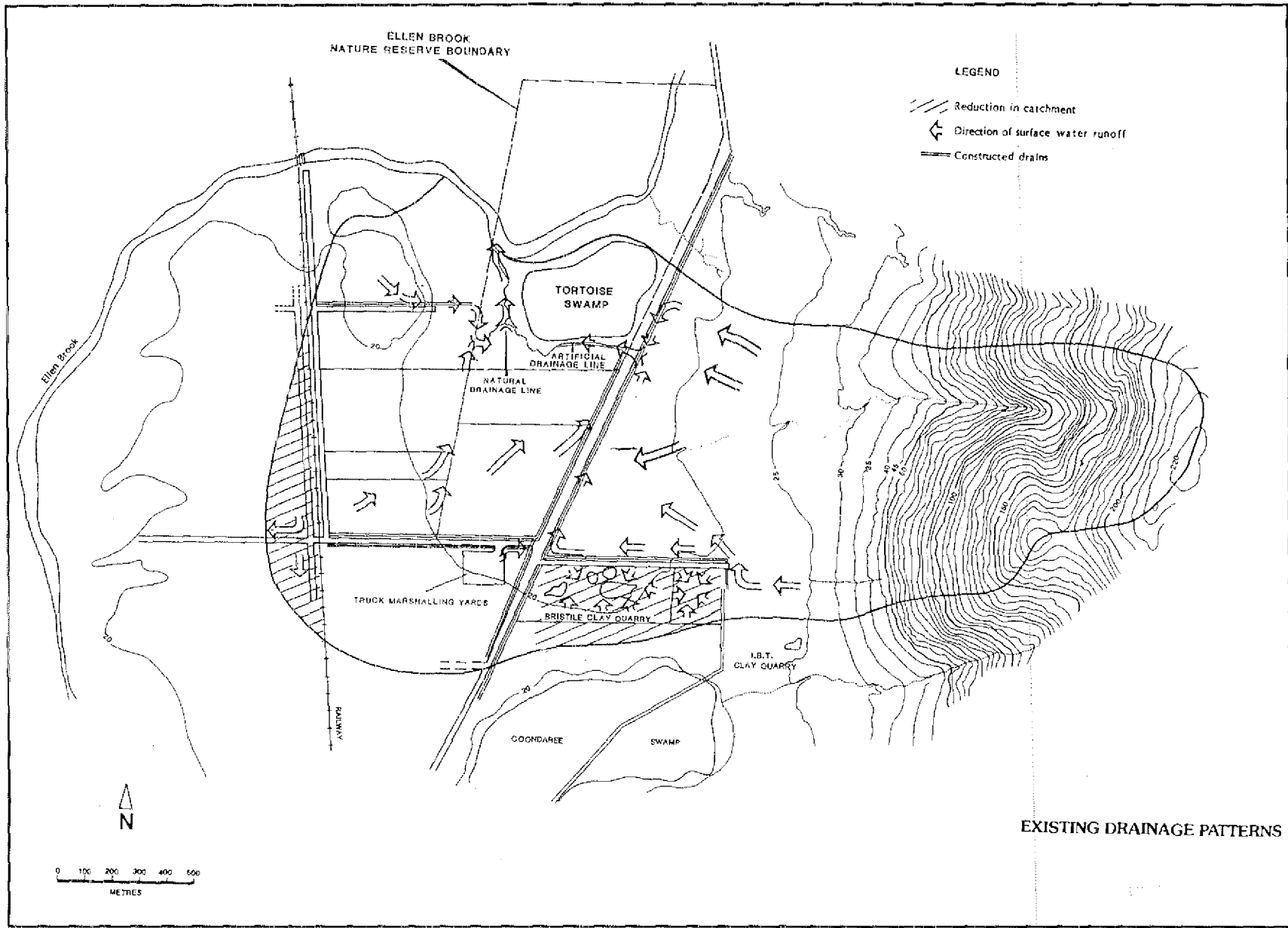


Figure 3. Existing drainage patterns into Ellen Brook Nature Reserve

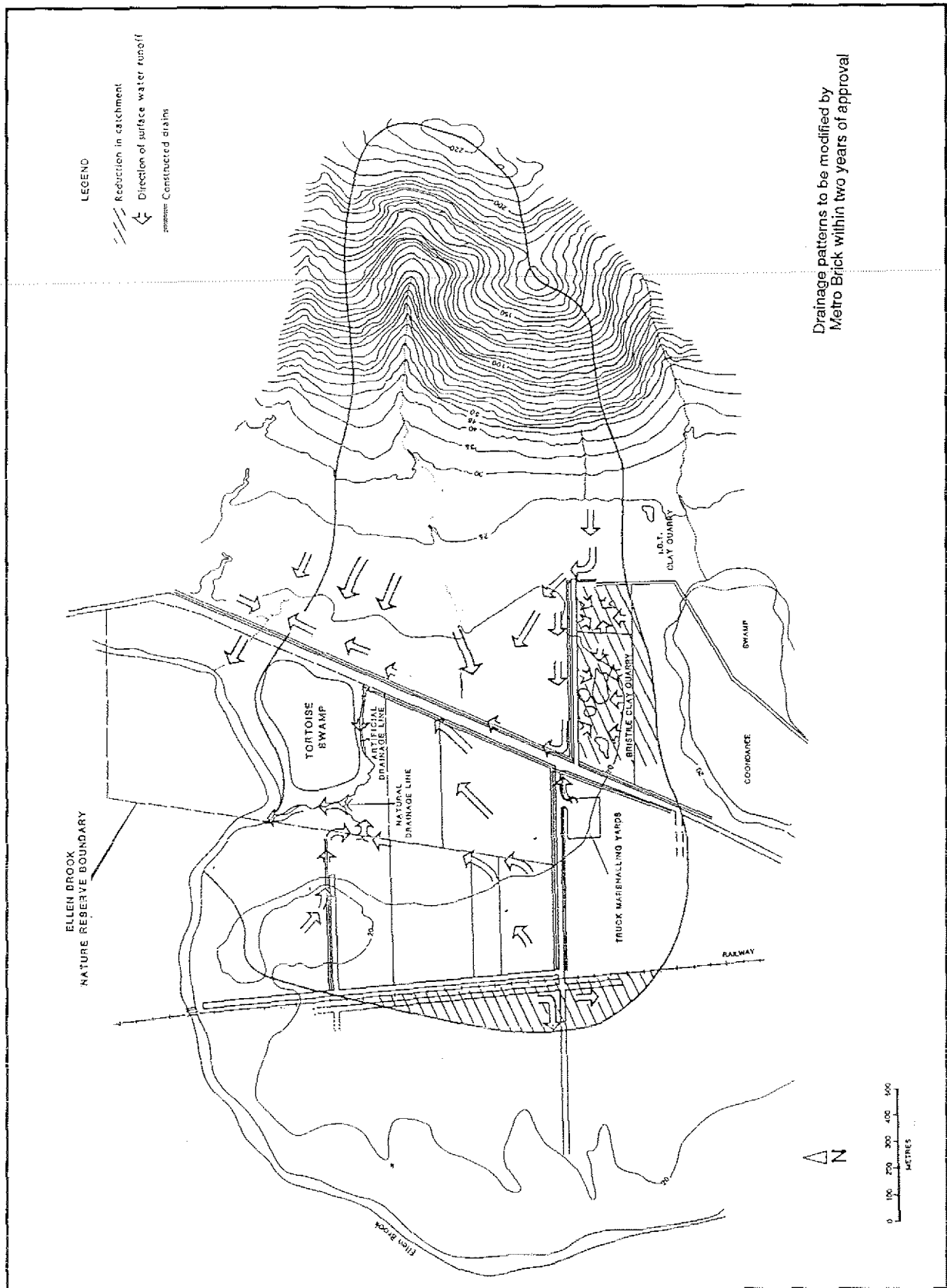


Figure 4. Proposed changes to Ellen Brook Nature Reserve drainage patterns on east side of Great Northern Highway, to be modified by Metro Brick within 2 years of approval

Appendix 1

**Environmental management commitments
by Metro 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 4 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 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;
 - 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 as 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) Contain turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat.
- (viii) Not quarry within a hundred metres of the nature reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur.

- (ix) Prepare an Environmental Monitoring and Management Programme to the satisfaction of the Environmental Protection Authority prior to commencement of operations at the site.
 - (x) Verify that no adverse effects experienced on the Short Necked Tortoise habitat are experienced, by appropriate staging and monitoring of excavations on lots 10 and 11.
-

Appendix 2

Proponent's response to issues raised in public submissions

METRO BRICK PTY LTD
LOTS 10/11 GREAT NORTHERN HIGHWAY

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 the proposed clay excavation at Upper Swan. The company is confident that the principal issues have been satisfactorily addressed to enable on-going assessment of this proposal.

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 information has been interpreted from aerial photography (scale 1:20,000; date = 4.1.91).

- (i) 100 metres - no houses.
- (ii) 500 metres - 2 houses.
- (iii) 1000 metres - 78 houses.

Note that this is a worst-case scenario especially for the initial years of excavation because the estimates are derived by measuring from the boundaries of the site, whereas there is a substantial buffer zone available within the site. For example, most of the houses occur to the south-west and, given that excavation will commence approximately 600 metres inside the south-west corner of the site, the number of houses within 1000 metres would then be reduced to less than 20.

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

This clay quarry proposal essentially represents a continuation of the excavation activity which has occurred on the adjoining Pt. Lot 36 for the last four years. It is proposed to commence excavation on Lot 10, only a short distance from the north-western corner of Pt. Lot 36. To the company's knowledge, no nuisance effects have been reported and there have definitely been no complaints to Metro Brick in respect of noise and dust emissions. (This also applies to Bristle Ltd., a company closely associated with Metro Brick, which has operated a clay quarry on adjoining land for the last 15 years or so).

It is the intention of Metro Brick to operate the clay quarry within noise and dust limits which can be tolerated by the local community with minimal inconvenience, and to preclude adverse effects to through-traffic on Great Northern Highway. With at least 20 years supply of clay available on Lots 10 and 11, it is obviously in the company's best interests to operate in a manner which is unobtrusive to neighbouring residents.

In the company's experience, there is not a dust problem from the temporary overburden stockpiles and longer term clay stockpile which is maintained on Pt. Lot 36. The main source of dust emissions is from the work areas and access track when traversed by trucks, which is simply controlled by watering. A watering truck will be present for all campaigns from this site and for the trucking campaigns which occur during the drier months of the year.

The potential for dust nuisance is also mitigated by the substantial buffer zone that is available between the quarry site and the nearest cluster of residences.

For the same reason, noise emissions are not an issue at this site.

(ii) Truck Movements

Truck movements at this site are less intensive in comparison to pits operated by other companies in the vicinity, but occur throughout the year. This is because the storage capacity at the Malaga plant is limited to 1,000 tonnes, under the terms of its original operating licence. Therefore, truck movements are anticipated to be between 2-5/hour for approximately 4 days every 6 weeks. The number of campaigns during the year is ultimately linked to economic/market factors.

(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 for the drier months of the year are presented in Tables 1, 2 and 3.

North-easterly winds are noted as the main winds of concern with respect to potential dust impacts on the nearest residential area within the Upper Swan townsite. 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.

Table 1

Analysis of North-Easterly Winds During Potential Excavation Season

North-Easterlies		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Morning winds (0900 hrs)	% Occurrence	13	13	14	15	15	19	17	30
	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 (1500 hrs)	% Occurrence	4	2	3	4	4	5	5	10
	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 (0900 hrs)	% Occurrence	20	21	26	28	38	29	20	12
	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 (1500 hrs)	% Occurrence	10	10	9	12	18	18	15	12
	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

- 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. However, the residential density due west of the site is extremely low.

As a result of the above analysis, Metro Brick undertakes to excavate and stockpile its annual clay requirement as soon as access to the site is possible, following the winter rainfall period. This is when winds are most favourable and when soil moisture contents are relatively high, therefore minimising the potential for dust generation. The more frequent trucking campaigns will be strictly managed by access track watering during the higher risk periods of January to March.

(iv) Conclusion

Whilst north-easterly winds are recognised as the most unfavourable in terms of potential dust effects on the Upper Swan townsite, it is emphasized that these winds do not occur frequently. They occur for 13-19% of the time in the mornings (November to April) and for 2-5% of the time in the afternoons.

In addition, trucking campaigns which are the main source of potential dust nuisance, occur for only about 10% of the time.

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.

Whilst the company has used scrapers at Pt. Lot 36, it was found that the overburden was too hard to preclude the use of dozers in conjunction with the scrapers, for supplementary ripping or power assistance.

Given that noise is not an issue at this site, the use of dozers is not constrained by the potential for off-site disturbance.

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 are shown on Figure 1. The on-site access is an all-weather limestone road to enable collection and transfer of clay to Malaga during winter. The objective in selection of the road alignment was to avoid the use of the Coondaree Parade road reserve so that public access could be controlled. The road does not pass residential areas.

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?

Metro Brick will restrict operating times to the hours of 6.30am to 5.30pm, Monday to Friday.

The life of the pit is dictated by demand for bricks and therefore to reduce the lifetime it would be necessary to create larger stockpiles. This could result in an aesthetics problem so the intention is to stockpile only 9-12 months supply of clay at the site at any particular time.

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 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 pit during its operational life.

Ultimately, if a lake is formed during the rehabilitation programme, attention will be devoted to contouring of the sides to minimise mosquito breeding risk. The lake could also be stocked with fish, as is the case at Ballajura Lakes Estate, to predate on mosquito larvae.

Public access is presently restricted by boundary fences which are in good condition and by a lockable gate at the entrance to the limestone access road. The area will be signposted with "danger - open pit" signs. Fluorescent ribbon or a supplementary warning fence would be placed around the open pit in areas where the sides were left relatively steep, particularly in future years as excavations are conducted nearer to Great Northern Highway. (However, given that children are the main concern, it is considered that children residing in the Upper Swan townsite would tend to remain or be restrained by parents to the other side of the highway, due to the greater risk of injury in crossing Great Northern Highway).

Metro Brick is prepared to consider provision of assistance with the cost of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by Council if this was considered of value in keeping children away from the site.

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, it is accepted that there is insufficient evidence to remove all uncertainty especially 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 prior to excavating near to the reserve.

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 it is accepted that there may still be a risk, albeit slight, of hydrological effects between future, potential excavation sites and the nearest habitat

area. Metro is committed to verifying that no adverse effects are experienced, by appropriate staging and monitoring of excavations on Lots 10 and 11. This is why the initial excavation is proposed near to previous excavations on Pt. Lot 36, i.e. as far as possible from the nature reserve and in an area where monitoring has shown no adverse hydrological effects from clay quarrying.

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?

Metro Brick is agreeable to assisting with machinery time for potential earthworks that may be required for recontouring or drainage works. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, subject to further liaison and negotiation.

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?

Question not relevant to Metro Brick.

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 area 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.

Metro Brick's land is not being considered by CALM for future tortoise habitat. The site has no remnant native vegetation and the surface soils have been substantially disturbed as a result of past agricultural practises.

Surface Water Impacts on Tortoise Habitat

Q12. Since the tortoise is well known to habitat 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.

Refer to answer for Question 13 below.

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 are 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 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 etc.

In the event that drainage from Lot 10, where clay excavation is initially proposed, is required to be diverted away from the nature reserve, then Metro Brick has two options:

- (i) capture all runoff from disturbed areas and divert it to the south, into the catchment which drains to the Swan River, or
- (ii) block the culvert which leads under Great Northern Highway (and discharges into the nature reserve), then to enhance the drain along the eastern side of Great Northern Highway to encourage flow in a northerly direction, as mentioned above. This would not involve any disruption to traffic throughflow on Great Northern Highway as it would not be necessary to re-construct the culvert.

Metro Brick is prepared to contribute to the necessary drainage line enhancement. At present there is additional runoff that is diverted onto Lot 10 from Pt. Lot 36 ('clean' runoff from the

Darling Scarp which is diverted away from the clay workings), therefore increasing flow volumes in the Great Northern Highway drain. Once the Pt. Lot 36 operation has ceased, this excess drainage can be returned to its natural flow pattern, some of which flows to the south.

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.

Four monitor bores were installed at Pt. Lot 36 in May 1988, at the locations shown on Figure 5. In addition to measuring water table levels, observations were conducted within the clay pit to determine whether or not groundwater inflow occurred.

Monitoring was conducted at about monthly intervals during the period June 1988 to May 1989, inclusive. Water levels recorded in each of the bores are listed in Table 4.

Table 4
Monitor Bores Results - Pt. Lot 36

Date	Water Levels (metres, AHD)			
	Bore 1	Bore 2	Bore 3	Bore 4
22 June 1988	11.19	17.05	12.11	14.90
1 July	11.26	17.43	12.19	16.53
1 August	11.37	17.59	12.30	16.25
22 August	11.41	17.84	12.40	16.95
19 September	11.57	18.01	12.63	18.24
17 October	11.66	18.38	12.76	18.41
21 November	11.69	17.78	12.81	18.30
19 December	11.65	17.52	12.75	17.36
18 January 1989	11.57	17.39	12.70	16.05
22 February	11.47	17.22	12.60	13.30
20 March	11.37	17.06	12.48	12.56
4 May	11.23	16.78	12.24	11.76
Total Variation	0.5m	1.5m	0.7m	6.65m
Ground Level	20.46	23.48	24.95	20.82

(i) Perched Groundwater

Bore numbers two and four exhibit large fluctuations in water levels at shallow depth, which is typical of the perched groundwater lenses that are known to occur in the area. Bore two, located in the north-eastern sector, recorded a water level variation of 1.6 metres and at its maximum level, water was 5.1 metres below surface. Bore four, located in the south-western sector, recorded a much larger water level variation (6.6 metres) and at the maximum level, was only 2.4 metres below surface.

The latter bore is located in an area of the site which is regularly flooded due to poor drainage. The extremely large fluctuations in water level suggests that either the bore is situated in a zone of "delayed" recharge to the underlying true aquifer, or some leakage was occurring down the side of the casing from the surface. Whilst the casing was sealed with both bentonite and cement plugs, this bore was inundated for long periods following rainfall and the possibility of leakage occurring has not been discounted.

However, it is reasonable to assume that both of these bores indicate the development of perched groundwater during winter. The important result with respect to potential environmental effects is that no shallow seepage occurred within the clay pit. Thus, despite the fact that perched groundwater was recorded between 2.4 and 5.1 metres below surface and the clay pit was just over 7 metres deep, no seepage was recorded. Bore two is approximately 230 metres from the excavation, whilst bore four is only about 140 metres distant. Obviously, these perched groundwater lenses are discontinuous and highly localised.

(ii) Deep Groundwater

Bore numbers one and three monitored the main Guildford Formation aquifer. The results indicate a relatively small variation in water levels of 0.5 and 0.7 metres (Table 4). Maximum water table heights were recorded in November and were 12.81 metres (AHD) on the eastern side of the quarry and 11.69 metres (AHD) on the western side.

The clay pit did not exceed about nine metres in depth and, by interpolation of topographic contours and recorded water levels, the base of the pit was always above the water table.

(iii) Conclusion

The perched groundwater occurs above the plastic clay layer to be mined, but is not necessarily perched on the clay layer. That is, the full thickness of overburden sediments is not necessarily a 'continuous' aquifer. There is considered to be a high degree of variability in the hydraulic conductivity of the shallow sediments as they are known to vary from almost 'pure' sand to strong sandy clays and gravelly clays. In addition, the experience of the clay extraction industry in the Swan Valley is that there is a high degree of lateral variability in the characteristics of both the overburden and the clay. The clay itself is not continuous therefore it is highly unlikely that perched groundwater occurs other than in small 'pockets'.

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.

Metro Brick will commit to not quarry clay within 100 metres of the nature reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur. Furthermore, Metro Brick proposes to commence operations on Lot 10 as far as

possible from the reserve, which will initially be at least 600 metres from the south-eastern corner of the nature reserve. For the first 10-15 years of operation, excavation activity will be restricted to Lot 10 (the southern half of the company's landholding).

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.

At present, the company has insufficient detailed information on stratigraphic levels and in particular, the degree of continuity of the sub-surface clay layer, to compile a meaningful cross-section between the nature reserve and existing operations on Pt. Lot 36 (and the proposed excavation on Lot 10).

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.

Excavations have been conducted to a depth of 9 metres on Pt. Lot 36 without intersecting groundwater. Exploratory drilling will be conducted on Lot 10 to define the clay resource prior to commencing excavation. At the same time, it will be possible to establish the depth to the permanent water table to plan the excavation. Whilst it is not considered essential to only excavate clay that is above the water table the company recognises and accepts the philosophy of water resource protection and conservation. Therefore, in the unlikely event that the excavation did reach the water table or proceed slightly below it, the area would be backfilled with overburden to maintain at least 1 metre of cover.

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?

Data from the groundwater investigations conducted at Metro Brick's excavations on Pt. Lot 36 were submitted to EPA in June 1989, in the name of International Brick and Tile Holdings who was the operator at the time. These data are summarised under question 15 above. Additional data will be collected during the exploratory drilling phase mentioned previously.

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?

Water for dust suppression will be obtained from a property owned by the company in Middle Swan, which has a dam that has previously supplied water for viticultural purposes. In addition, 'dams' could be formed within the excavation to collect runoff and rainfall to provide water for this purpose. (This may impede progressive restoration somewhat, but only to a limited degree).

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?

Only the excavation machinery (dozer and hydraulic excavator) will be refuelled on-site; the trucks will be refuelled elsewhere. On-site refuelling will be conducted via provision of a temporary above-ground tank, which will only be present during each excavation campaign. This is considered to pose negligible risk of a serious diesel spill.

The tank will be placed in an enclosure of bunded soil. If a substantial spillage occurs, the contaminated sediments will be excavated and removed from the site to an approved disposal location. The Red Hill tip site or the Shire of Chittering's Muchea tip site would be the most secure landfill sites in the vicinity.

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 from the main aquifer 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?

The proposed use of the site after excavation is complete is either rural-residential (low density) or agricultural (grazing etc).

Rehabilitation will be conducted to the satisfaction of the Shire of Swan under the terms of an excavation licence. It is expected that DPUD will also be consulted during the requisite planning approval stage.

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?

Most of the settling occurs in the first two years with respect to suitability for general agricultural use. It may take many years (5-10) before the site could be used for building upon, although it is believed to offer suitable foundations in the long term. However, the material exhibits excellent compaction characteristics.

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.

Question not relevant to Metro Brick.

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.

In the company's experience, the temporary overburden stockpiles, as well as the clay stockpile, are not subject to wind erosion and 'dusting'. Therefore, hydro-mulching for grass cover is not intended.

The company intends to plant native trees along Great Northern Highway and on Pt. Lot 36, near to the clay stockpile, for screening purposes. Planting would commence in the autumn after approval is granted.

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.

Metro Brick is prepared to commit to progressive restoration of the pits (presumably an annual restoration effort is being suggested as satisfactory to EPA).

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?

It is agreed that some setback requirements could be eliminated, for example along the east-west property boundaries between Lots 10 and 11 and between Lot 10 and the lots on the southern side. In the latter case, there is a gazetted road reserve (Coondaree Parade) between the lots, which could also be mined for clay as it is not required for access purposes in the foreseeable future. Efficient utilisation of this scarce clay resource is considered essential by Metro Brick and a relaxation of setback requirements from property boundaries would be endorsed.

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 'foothills' region 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 residential development in the area will intensify.

Rehabilitation of the area with a mix of lakes and recontoured land would be consistent with future residential 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 excavation, to ensure compatibility with long-term plans for the area.

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 pennywort). 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.

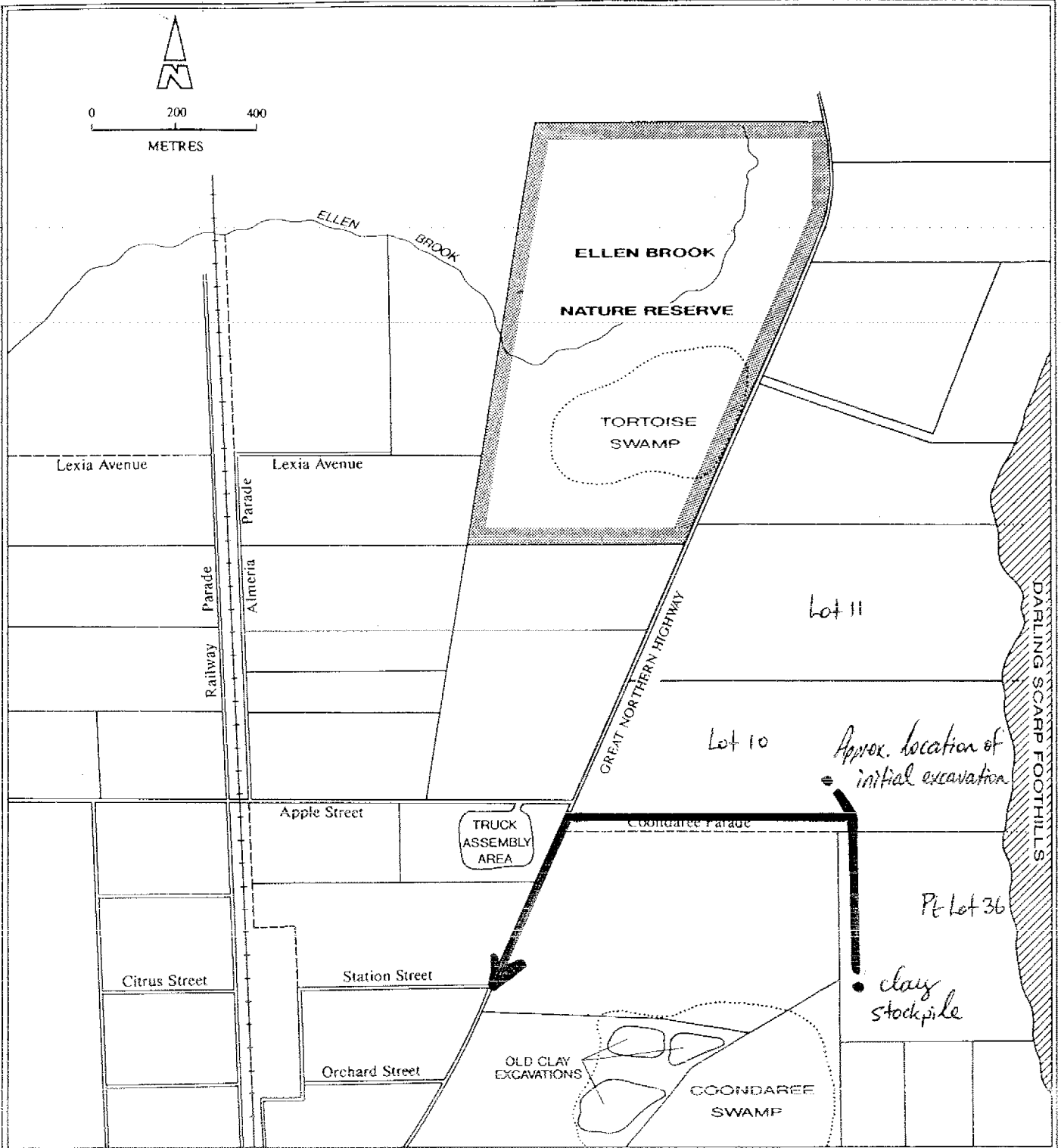
No further investigations have been conducted in relation to the matters raised here. On page 59 of the CER, the option of rehabilitation of clay quarries for tortoise habitat was briefly considered, along with the alternative option of expanding the existing nature reserve into areas that are not proposed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

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

The fundamental approach in the EMMP would be to focus on the initial years of excavation on the site and the manner in which groundwater aspects would be monitored to verify the acceptability of the operation. It is considered premature to prepare the EMMP at this stage until Ministerial approval is granted, without which there seems little point in conducting further preparatory work.

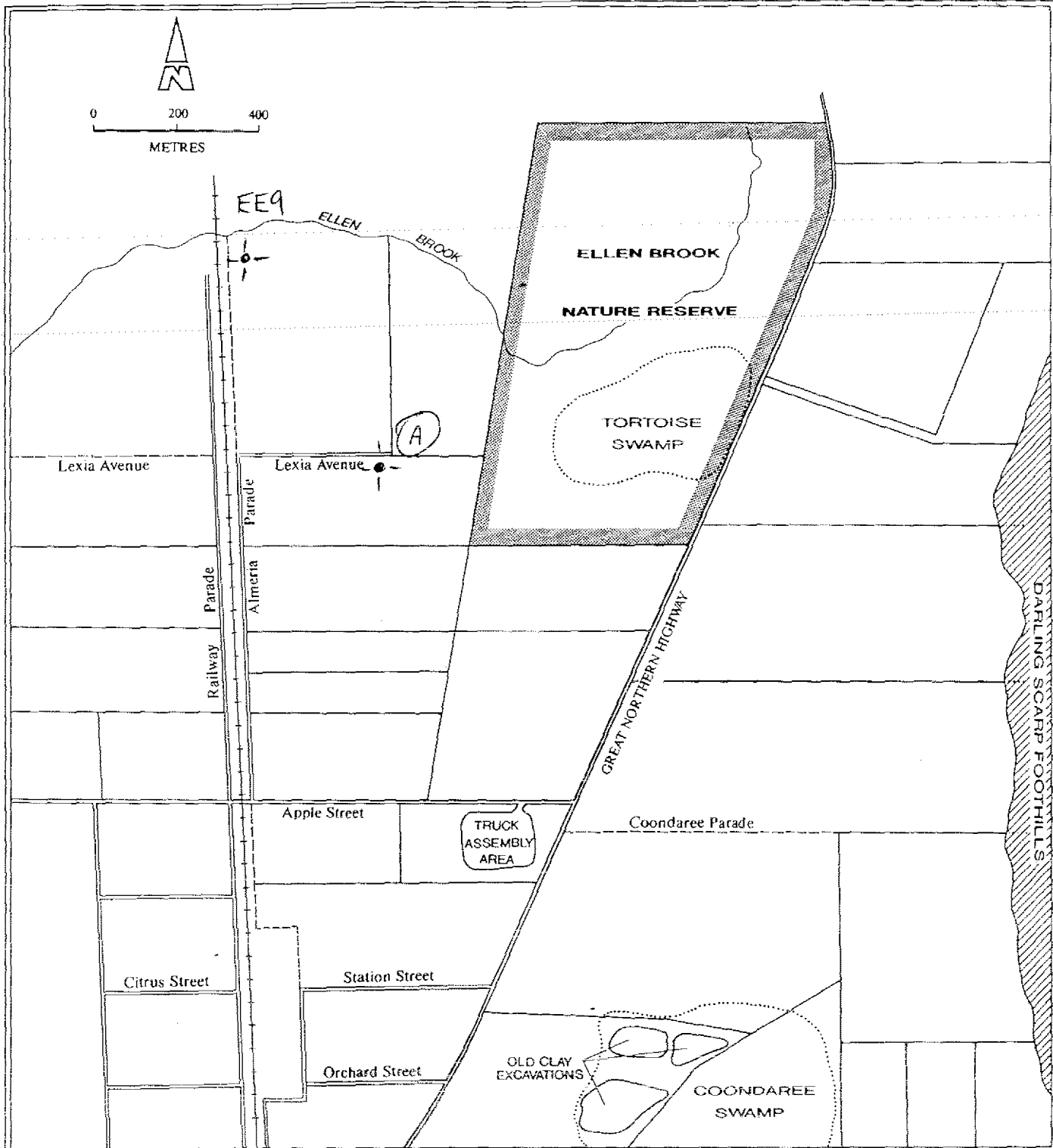


LEGEND

- ==== Constructed roads
- Road reserve (not constructed)
- + + + Standard gauge railway

METRO BRICK
ACCESS

Figure ①.



LEGEND

- ==== Constructed roads
- Road reserve (not constructed)
- + + + Standard gauge railway

-|- Water Authority Bore

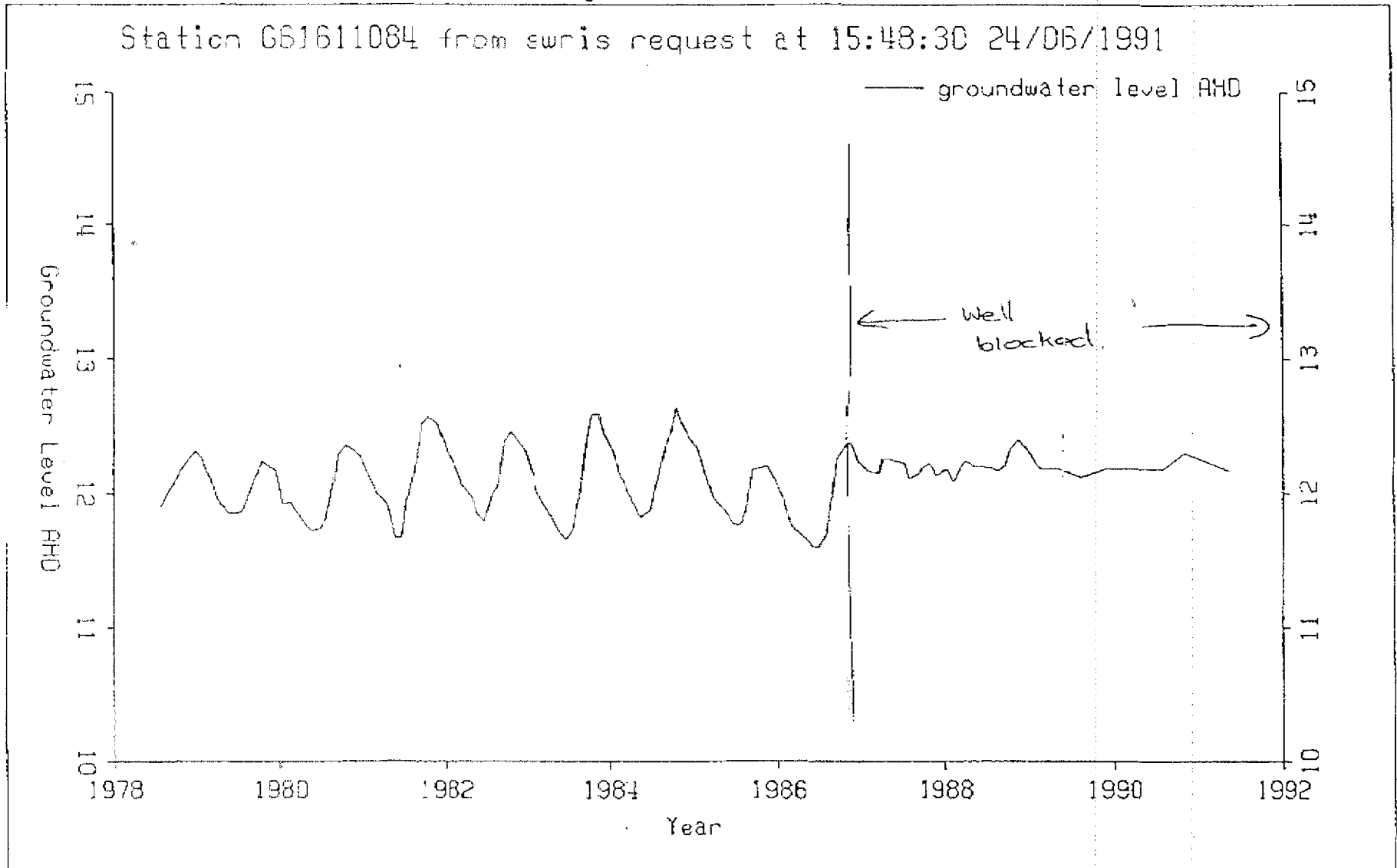
LOCATION OF LONG-TERM MONITOR BORES

FIGURE 2

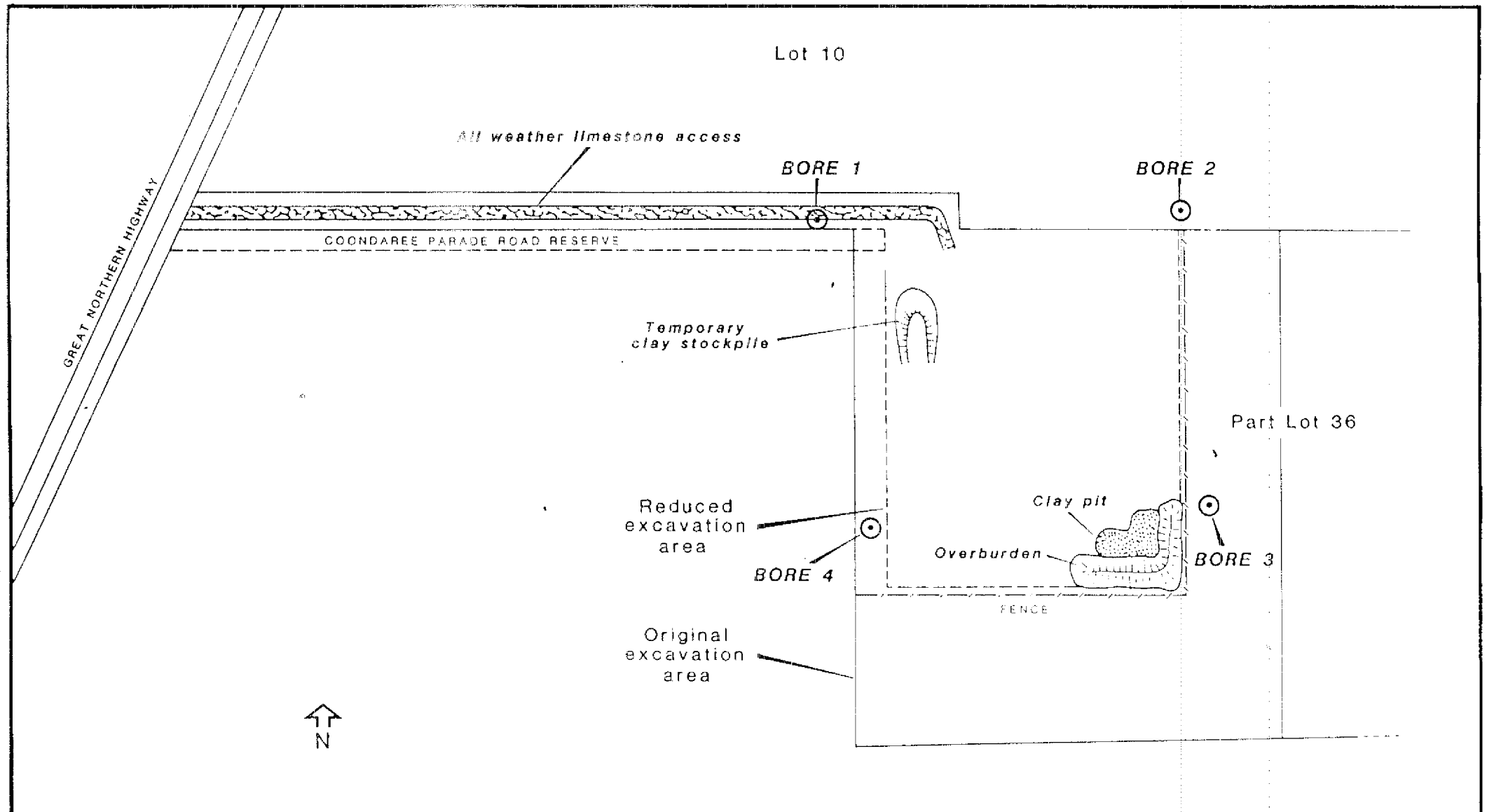
BORE (A)

FIGURE 3

Plotted on 6/24/91 at 16:13 from file b:gd13.dat



1000



LOCATION OF MONITOR BORES

FIGURE 5

FIGURE 4

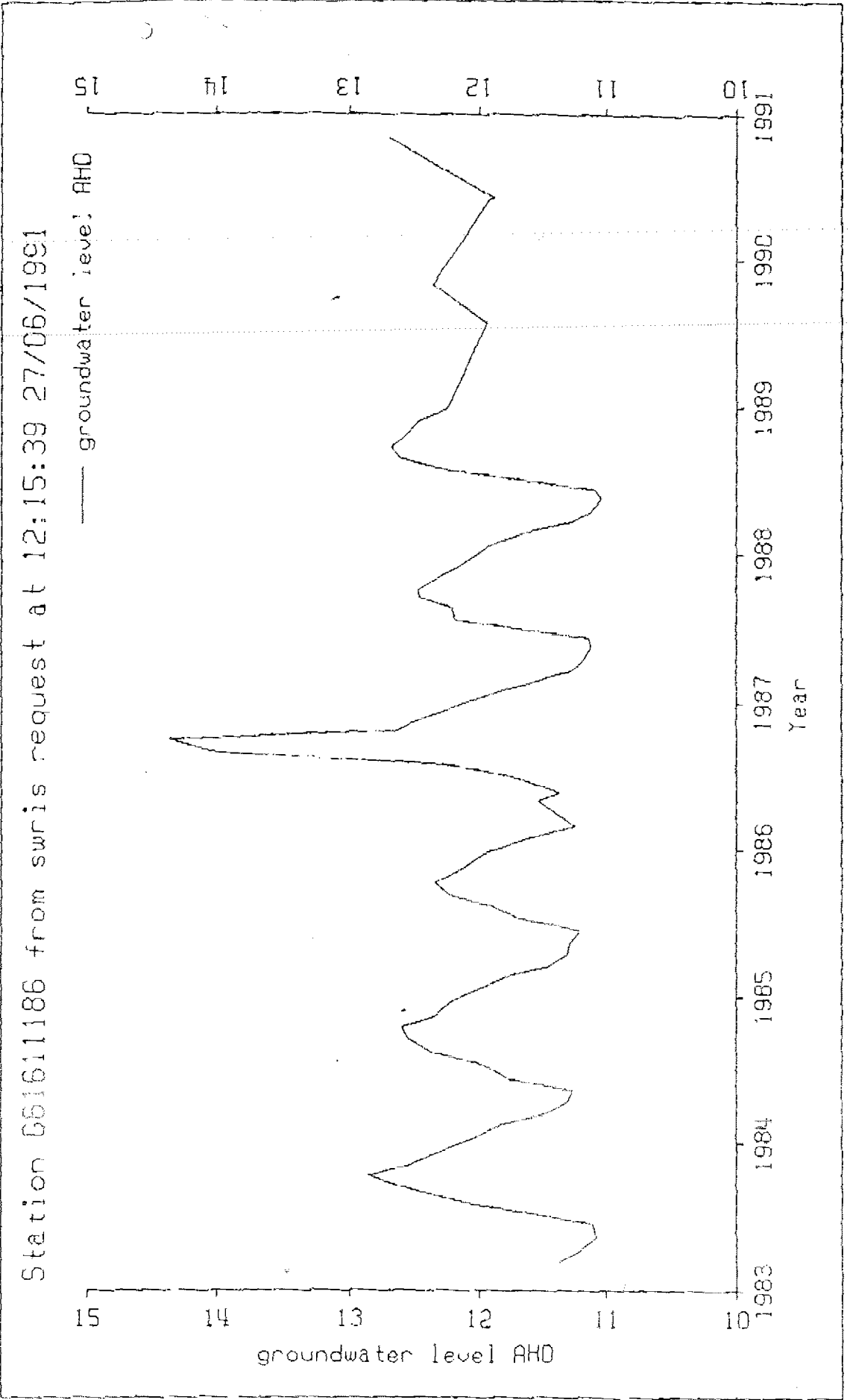
Well EE9

Total depth = 12 m

Slotted from 3.75 m to 12 m.

Plotted on 6/27/91 at 12:48 from file ee.pic

Station 061611186 from swris request at 12:15:39 27/06/1991

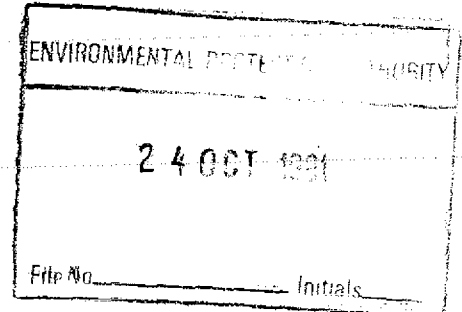


Appendix 3

Clarification of proposal and proponent, October, 1991

23 October, 1991

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH W A 6000



Attention: Mr S Sadler

Dear Sir,

Re: Clay Excavation Proposals - Lots 36, 10 and 11 Great Northern Highway Upper Swan

We wish to thank you and Dr Kennedy for agreeing to meet with us at short notice. Subsequent to that meeting of Tuesday 22 October 1991 this Company wishes to confirm the following points arising out of those discussions.

1. We apologise for the confusion surrounding the nomination of proponents. Please confirm that Metro Brick (A Division of Bristle Ltd) is the major, and managing partner in International Brick and Tile. It is appropriate therefore that all proposals/licences etc. relating to Lots 10, 11 and Pt. 36 Great Northern Highway, Upper Swan, should have Metro Brick as the "Proponent". Metro Brick assumes full responsibility for the proposed project. If it is seen as necessary to change documentation, please take the appropriate action. If further assistance is required, please do not hesitate to call the writer.
2. Economically viable clay has run out on Pt. Lot 36. We seek only permission to extract clay within Lots 10 and 11 and regret the application which refers to Pt. 36 and Pt. 10. This was a previous management initiative which was unknown to us prior to the meeting. Further, that application is no longer appropriate.
3. We shall prepare a summary of our intentions for continued use of Pt. 36 for permanent stockpiling only. This will include definite rehabilitation and beautification work to be completed by July '92. Also included will be a staging plan for excavations spanning 10 years on Lots 10 and 11. This summary will be available by late next week.

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contd.

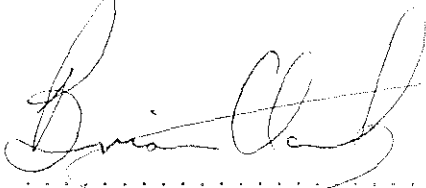


4

4. Contact has been made this day with The Main Roads Department to enable discussions re: drainage works, to commence.
5. The Company has above ground supplies of this material until sometime in January. Any new extraction will be of about 5 weeks duration.

We are now rather more optimistic that our proposal will receive a positive response prior to our material supply being exhausted in January.

Yours faithfully,



B.W. CLARK
Technical Manager.

Appendix 4

Drainage modifications to proposal, December, 1991



A Division of Bristle Ltd. A.C.N. 008 668 540
245 South Western Hwy, Armadale, Western Australia.
Locked Bag No. 1, Armadale, W.A. 6112.
Telephone: (09) 399 0399, Telefax: (09) 399 6033
Sales: (09) 399 0333

3 December, 1991

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH W A 6000

Attention: Mr S Sadlier

ENVIRONMENTAL PROTECTION AUTHORITY	
- 3 DEC 1991	
File No. _____	Initials _____

Dear Sir,

Re: Clay Excavation Proposals - Lots 36, 10 & 11 Great Northern Highway, Upper Swan.

Following discussions on December 2, 1991 with your Mr Sadlier it is now evident that a change to our proposal is necessary.

The intention to divert drainage water southwards from our first three extraction campaigns may be at odds with current wetlands legislation in respect to Coondaree Swamp.

Metro Brick (a division of Bristle Ltd.) hereby gives total commitment to the containment of turbid water within its excavations and their immediate surroundings thus ensuring it does not flow on to the tortoise habitat.

This will be effectively achieved by close bunding of each excavation cell with overburden. The overburden will be placed by scrapers approximately 800mm high and two scraper widths wide around the entire edge of the excavation. Topsoil will be placed over the bund. In so doing run-off water from the Scarp will be directed around the excavations and follow natural drainage patterns.

In addition, the existing excavation on Lot 36 will be completely backfilled to a level condition and seeded thus ensuring run-off from this area flows south and away from the tortoise habitat. Run-off from Lot 36 will be effectively returned to its original path, south-west to Coondaree Swamp.

During the first winter and prior to initial growth, it is not anticipated that the rehabilitated area of Lot 36 will contribute to turbidity entering Coondaree Swamp. No clay will be exposed to run-off only the land and durable overburden and topsoil of the region.

52371

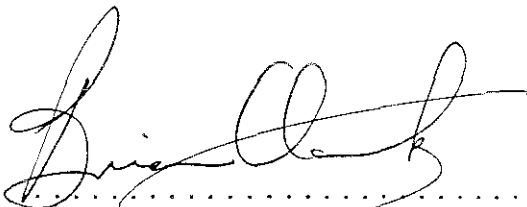


Bunding of excavations would be a temporary measure until arrangements can be made to divert all drainage away from the tortoise habitat.

The height of these bund walls and their distance from Great Northern Highway will ensure that visual impact from this proposal is negligible.

We await your most urgent consideration of our proposals.

Yours faithfully,

A handwritten signature in cursive script, appearing to read 'B W Clark', written over a horizontal dotted line.

B W CLARK
Technical Manager.

**Proposed clay excavation, Lots 10, 11 and Part Lot
36 Great Northern Highway, Upper Swan**

Metro Brick (A Division of Bristile Ltd)

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 604
December, 1991**

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 20 December, 1991.

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Assessment Number 322

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1. Environmental management commitments by Metro Brick (A Division of Bristile Ltd)
2. Proponent's response to issues raised in public submissions
3. Clarification of proposal and proponent, October, 1991
4. Drainage modifications to proposal, December, 1991

Summary and recommendations

Metro Brick (A Division of Bristle Ltd) currently excavate clay for brick making purposes in a quarry located on Part Lot 36 Coondaree Parade, Upper Swan, just east of Great Northern Highway and about 14 km north of Midland. The environmental impact of the project was previously assessed by the Environmental Protection Authority in 1988 prior to the Minister for the Environment setting conditions on the project.

An Application for Renewal of Excavation Licence by Metro Brick Pty Ltd was referred to the Environmental Protection Authority by the Shire of Swan in August, 1990. 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 briefly 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 responses 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, Metro 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:

- **Metro Brick has also given a commitment to the containment of turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat;**
- **For the first three annual excavations on Lot 10, Metro Brick would contain all their drainage water to within their site and immediate surrounds by bunding the perimeter with overburden to a height of 0.8m; and**
- **Metro Brick propose that future stages of excavation could be accommodated by diverting drainage waters to the north, by**

blocking off the existing culvert and enlarging and deepening the drainage line on the east side of the highway.

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 Metro Brick to:

- **monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;**
- **remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;**
- **detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere;**
- **divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

The Environmental Protection Authority concludes that, from investigations undertaken and advice given, the proposal by Metro Brick is most unlikely to impact on the groundwater of the tortoise habitat, provided that the following stringent controls and management procedures are adopted:

- **preparation of a staged excavation plan as part of an Environmental Management Programme (see Recommendation 4), with the first excavation to commence at the furthestmost point away from the tortoise habitat;**
- **preparation of an approved groundwater protection plan, as part of the Environmental Management Programme (see Recommendation 4), with the objective of delineating and monitoring perched groundwater levels and pit seepages, and designing suitable management practices to remedy any potentially unacceptable impacts; and**

- **establishment of a no-quarrying buffer of 100 metres around the reserve, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur (see Recommendation 3).**

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 their response to issues raised in submissions, Metro Brick has indicated that it is agreeable to assisting with machinery time for potential earthworks. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, and would be subject to further liaison and negotiation.

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.

It is unlikely that the proponent would want to excavate clay into the superficial aquifer because the plastic clay to be mined sits on top of the water table. In addition, wet plastic clay is difficult to excavate and would need dewatering, which is expensive and time consuming. If dewatering was necessary, it could be accomplished by pumping to another part of the pit, therefore minimising any drawdown effects.

The Water Authority of Western Australia has indicated that a groundwater licence would be required by the proponent prior to drawing groundwater.

The Environmental Protection Authority has recommended that Metro 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 4).

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 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 5).**

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

Metro Brick have outlined a number of management strategies which are currently used to minimise noise and dust impacts. These procedures have been used by the company successfully over the years, including at the nearby Part Lot 36, and there have not been any complaints registered against the company at this location to their knowledge. The company has stated that it would restrict its operating hours to 6.30am to 5.30pm, Monday to Friday. Metro Brick propose sequential rehabilitation and screening with vegetation to reduce visual impacts.

The community at Upper Swan townsite is less likely to be affected by Metro Brick's excavations, as the townsite is about 900m away from the boundaries of the property and 1.5km from the initial excavation site.

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 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.

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.

Metro Brick are prepared to rehabilitate their pits to a lake form that is compatible with the Shire of Swan requirements, to ensure these effects are minimised. Public access is restricted by fences in good condition and a lockable gate for security, and steep, dangerous areas would be fenced-off within the excavation. Metro Brick has advised that it is prepared to consider the provision of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by the Council, if this was considered of value in keeping children away from the site.

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 5).

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 Metro Brick to quarry clay on Lots 10, 11 and Part Lot 36, 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;
- 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 10 years from the time of commencement. Subsequent applications will be reviewed in the light of the proponent's environmental performance at the site.

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 Main Roads Department, the Swan River Trust and the Shire of Swan, Metro Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment. This plan should enable the proponent to:

- monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;**
- remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;**
- detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere; and**
- divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

Recommendation 3

The Environmental Protection Authority recommends that there be no quarrying within 100 metres of the boundaries of the Wild Life Sanctuary at Ellen Brook Nature Reserve and any additions thereto, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur to the tortoise habitat.

Recommendation 4

The Environmental Protection Authority recommends that, prior to the start of quarrying activities, Metro Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment. 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:

- a staged quarrying strategy;**
- drainage management;**
- groundwater 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; and**
- periodic reporting of monitoring results and consequential changes to environmental management.**

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

Recommendation 5

The Environmental Protection Authority recommends that Metro Brick, 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, should contribute to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, within 2 years of approval of this proposal and to the satisfaction of the Environmental Protection Authority.

1. Introduction and background

Metro Brick (A Division of Bristile Ltd), hereafter referred to as Metro Brick, propose to excavate clay on Lots 10, 11 and Part 36 Coondaree Parade, Upper Swan, just east of Great Northern Highway and about 14 km north of Midland (Figure 1).

An Application for Approval to Commence Development on Lot 10 and Part Lot 36 by International Brick and Tile Pty Ltd was referred to the Environmental Protection Authority by the Shire of Swan in October, 1989. 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 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. Metro Brick has recently provided further information on their proposal, in response to issues raised by the Authority as a result of the CER process (Appendix 2).

Metro Brick currently excavate clay for brick making purposes in a quarry located on Part Lot 36 Coondaree Parade. This project was previously assessed by the Environmental Protection Authority in 1988 prior to the Minister for the Environment setting environmental conditions on the proponent (International Brick and Tile Pty Ltd), which required the submission to the Authority of a report on environmental impacts of the company's operations after 12 months operation. This report was assessed by the Authority in consultation with other government authorities, and apart from the failure of a suitable establishment of screening vegetation (due to poor drainage), it showed that the project could operate without any unacceptable impacts on the environment.

In November 1991, Metro Brick wrote to the Authority to clarify that, due to their role as the major and managing partner in International Brick and Tile Pty Ltd, Metro Brick (A Division of Bristile Ltd) are the proponent for the proposal covering Part Lot 36 and Lots 10 and 11 (Appendix 3). Due to the shortage of suitable clay on Part Lot 36 and shortage of space at their Malaga factory, Metro Brick now propose to change the originally intended use of Part Lot 36 to long term stockpiling of clay extracted from Lots 10 and 11. These changes have been documented in the company's recent Application for an Excavation Licence, which was referred to the Authority in November, 1991, together with a late change to proposed drainage modifications in December, 1991 (Appendix 4).

2. The Western Swamp Tortoise

The Western Swamp Tortoise (*Pseudemys 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 known only from Ellen Brook Nature Reserve and the Twin Swamps Nature Reserve, 4 km 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. *Pseudemys 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 has 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 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;
 - (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;
- 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 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

Lots 10, 11 and Part 36 are located to the east of the Great Northern Highway, north of the upper Swan townsite (Figure 1). An unconstructed road reserve, Coondaree Parade, forms part of the southern boundary of Lot 10. The existing access road is north of the road reserve.

The excavation would be for clay needed at the Malaga brickworks. Metro Brick estimate that 30,000 m³ would be required annually, although this volume would vary with demand. Work on Lot 10 and eventually Lot 11 would take place over several decades by a series of annual excavations over the summer periods. The internal access road would be constructed in the first year and a stockpile of clay on Part Lot 36 established (Figure 2). There is no vegetation to clear, and the area would be stripped of topsoil and overburden using scrapers and dumped in separate stockpiles adjacent to the excavation area. The surface area of each annual excavation is approximately 1 hectare, with 3 to 4 metres depth of overburden overlying 3 to 4 metres thickness of clay.

The rehabilitation objectives of the proponent are for the excavation pit to be rehabilitated as an artificial lake, and the stockpile area would be screened and the highway views framed by landscaping. Reshaping of the pit and drainage control would be completed before each winter. The procedure would involve recontouring the pit walls to acceptable grades, replacing and spreading overburden, respreading the topsoil, and reseeding with grasses.

A permanent stockpile of clay is proposed to be established to the south of the existing lake on Part Lot 36, to allow continuing supply of material to the Malaga brickworks, where capacity is limited to 1000 tonnes. The stockpile, which would be 5 metres high and cover approximately 50 x 100 metres, would be screened by landscaping. The tree planting around the stockpile area and along the highway would be initiated in the next planting season (1992), and be regularly monitored and supplemented as required.

Truck movements would occur throughout the year for approximately 4 days every six weeks. The truck movements would be between 2 to 5 hours each day during this period, depending on demand at the plant. Trucks would access the site from the Great Northern Highway along an existing formed access road next to Coondaree Parade and travel to Malaga via Great Northern Highway, West Swan Road, Gngangara Road, Beechboro Road and Beach Road.

4. Existing environment

Lots 10, 11 and Part Lot 36 are mostly cleared and the flat land on the western side is developed as pasture. A small creek flows south of the existing excavation on Part Lot 36 and there is a drainage reserve through Lot 10, and along the western boundary of Part Lot 36 to provide drainage of the area to Coondaree Swamp.

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.

In the long term, the proposed excavation could cover most of Lots 10 and 11, and extend to the western boundaries alongside the Great Northern Highway, which would then be within 50m of the eastern boundary of the fenced-off habitat of the short necked tortoise. However Metro Brick propose to commence operations in the south easterly section of Lot 10, which is the furthestmost point possible from the habitat area (about 600 m away) and have given a commitment not to mine within 100 metres of the reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur.

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 area 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.

However the highway drain (Figure 3) located in the south-east of the reserve, which carries runoff waters from Great Northern Highway and farmland to the south, west and east into the reserve, does represent a significant risk to the health of the tortoise and an interference to its 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 excavation, 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.

As a consequence of further interaction between Metro Brick, the Zoology Department of the University of Western Australia, the Department of Conservation and Land Management, the Shire of Swan, the Main Roads Department and the Environmental Protection Authority, the

company now proposes that surface drainage water from their clay excavation could be prevented from entering the tortoise habitat area by the construction of a suitable drainage diversion system (refer to Appendices 2 and 4). Metro Brick has also given a commitment to the containment of turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat.

For the first three annual excavations on Lot 10, Metro Brick would contain all their drainage water to within their site and immediate surrounds by bunding the perimeter with overburden to a height of 0.8m. This would prevent outside surface water from flowing into the disturbed area, and allow it to follow natural drainage patterns. The existing excavation site on Part Lot 36 would be rehabilitated to pasture before next winter, and bunded to prevent runoff waters entering the catchment of the tortoise habitat.

Metro Brick acknowledge that future stages of excavation may need diversion of drainage waters to the north, to prevent them from entering the tortoise habitat area. The company favours the option of blocking off water which currently enters the culvert leading under Great Northern Highway and discharges into the nature reserve (Figure 4). The drainage line along the east side of the highway could be enlarged and deepened to encourage flow in a northerly direction and into the next culvert. Here the water flows west under the highway, through Ellen Brook Nature Reserve but outside the fenced-off habitat area, and discharges into Ellen Brook. This modification to the drainage would require further engineering appraisal and possibly negotiation with other land owners prior to implementation.

The Environmental Protection Authority believes that the clay excavation proponents should carry out appropriate modifications to the drainage systems with which their proposals interact, to ensure that the habitat of the short necked tortoise is protected. The Authority considers that Metro Brick's drainage modifications are reasonable, and 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 proposed extensions, the Authority believes this work should be carried out within two years of approval of the proposal (see Recommendations 2 and 4).

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 swamp habitat are principally dependant on rainfall. Groundwater levels in the area of the proposed clay pits fluctuate at a similar depth of between 8 and 9 metres below the surface. The proponent concludes that the main groundwater aquifer is not a source of water, 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 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. Should there be a link between the perched water table and water levels in the swamp or other tortoise habitat, then a clay excavation could potentially lead to a reduction in the wet area available to the

tortoise. Such an effect is likely to occur and would be of major concern when clay excavations are in close proximity to the boundaries to the habitat area.

The proponent has 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 commences about 3 to 4 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, monitoring of two bores in the perched groundwater over a 12 month period recorded 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.

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. Land to the east, which was probably originally part of the tortoise habitat prior to clearing and subsequent agricultural land use, incorporates Lots 10 and 11. The proponent acknowledges the possibility of some sub-surface hydraulic link between this land and the swamp, although concluding that the potential 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 have submitted that the proponent's conclusions 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. This conclusion conflicts with that received from the Geological Survey of WA, which agreed with the proponent in that interception of the perched groundwater by the quarrying should have no effect. The Environmental Protection Authority considers that the proposals by Metro 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 (see below).

Of concern to the Authority are the impacts that the clay excavations might have on tortoise habitat areas within the fenced-off reserve but outside the swamp area, particularly as these impacts were not been addressed in detail by the proponent in the CER. In their response to submissions, Metro Brick acknowledge that there is insufficient evidence to say that there is negligible risk to the tortoise swamp habitat from the clay excavation, especially when in close proximity to the to the nature reserve. The company considers that 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 habitat area and any sub-surface water which may be present. In recognition of this risk, the company is committed to verifying that no adverse effects are experienced, by appropriate staging and monitoring of their excavations on Lots 10 and 11.

The Department of Conservation and Land Management have submitted that a no-quarrying buffer of 100 metres be established to guard against any error in the proponent's management practices or predictions. Metro Brick are committed to not quarrying within 100 metres of the reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur. Furthermore, the company propose to commence operations on Lot 10 as far as possible from the reserve, which would be initially at least 600 metres from the south-eastern corner of the reserve.

The Environmental Protection Authority concludes that, from investigations undertaken and advice given, the proposals by Metro Brick and other clay excavation proponents are most unlikely to impact on the groundwater of the tortoise habitat, provided that the following stringent controls and management procedures are adopted for each proposal:

- Preparation of an approved Staged Excavation Plan as part of an Environmental Management Programme, prior to excavation and in consultation with the Department of Conservation and Land Management (see Recommendation 4). The Plan should be implemented to the satisfaction of the Environmental Protection Authority, with the first excavation to commence at the furthestmost point away from the tortoise habitat;
- preparation of 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 perched groundwater levels and pit seepages, combined with suitable management practices to remedy any potentially unacceptable impacts;
- establishment of a no-quarrying buffer of 100 metres around the reserve, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur (see Recommendation 3).

6.4 Rehabilitation

Metro brick are 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 rehabilitation objectives of Metro Brick are consistent with the Authority's objective of re-establishing wetlands on the coastal plain. The proponent should liaise with the Department of Conservation and Land Management, to ensure that native species are catered for in the rehabilitation of the lakes and that suitable wildlife refuges (in the form of islands), are provided. The proponent should incorporate these plans into an approved rehabilitation plan as part of the Environmental Management Programme, to be prepared 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, Metro 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 tortoise inhabits 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 have indicated that, under the current proposals for rehabilitation to a series of lakes, the excavated sites 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) reserve 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, Metro Brick has indicated that it is agreeable to assisting with machinery time for potential earthworks. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, and would be subject to further liaison and negotiation.

The Environmental Protection Authority notes the intention of Metro 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;
- 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 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. Metro 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 Metro 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 5).

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 supplies if affected.

The main superficial groundwater aquifer is situated about 8 to 9 metres below the surface, and generally below the level of the plastic clay which the proponent wishes to excavate. In the CER, the proponent 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. The proponent considers that in the event that dewatering was required, this could be accomplished by pumping groundwater to another section of the pit or a nearby pit, where recharge could occur, thus concluding that the overall effect on the groundwater resource would be negligible.

In Metro Brick's response to submissions, the company indicated that excavations had been conducted to a depth of 9 metres on Part Lot 36 (since 1988) without intersecting groundwater. As further exploratory drilling is conducted over Lot 10, it would be possible for the company to establish the depth of the permanent water table. Metro Brick recognise and accept the philosophy of water resource protection and conservation, and have indicated that, in the unlikely event that the excavation did reach the water table or proceed slightly below it, the area would be backfilled with overburden to maintain at least one metre of cover. Water for dust suppression purposes would be obtained from a property owned by the company in Middle Swan, which was previously used for viticultural purposes. Rainfall and runoff water collected within the excavation could also be used for this purpose.

The Environmental Protection Authority considers that Metro 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 Lots 10 and 11. 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.

In response to submissions, Metro Brick has stated that it would restrict its operating times to 6.30am to 5.30pm, Monday to Friday. The truck movements at the Metro site are expected to be less intensive in comparison to the other excavation sites, and would be between 2 to 5 hours each day for approximately 4 days every six weeks, depending on demand at the plant.

The clay excavation proponents recognise that noise control and minimisation is a prerequisite to community acceptance and would incorporate 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;
- 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.

In the case of Metro Brick's proposed excavation on Lots 10 and 11, the noise impacts are reduced by their distance from most residences. The nearest residence is located on the proposed Midland Brick excavation site on Lot 22, about 350 m from the boundary to Lot 10 and about 1 km from the initial excavation site. The more densely populated Upper Swan townsite is located about 900m west of the western boundary of Lot 10.

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. Easterly and 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 a dust is unlikely to be a problem, due to various factors including:

- 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;

- 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.

In their response to submissions, Metro 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, and to preclude adverse effects to through traffic on Great Northern Highway. In the company's experience on Part Lot 36, there is not a dust problem with temporary overburden stockpiles and longer term clay stockpiles on the excavation site. To the company's knowledge, there have been no nuisance effects reported, and there have been no complaints to Metro brick in respect to noise or dust emissions. The most likely source of dust emissions is from working areas and the access track when traversed by trucks, which is simply controlled by watering. The company have stated that a watering truck would be present for all campaigns from their site, and for any trucking campaigns which occurred during the drier months of the year.

The flat terrain, coupled with the extensive clearing of vegetation in the past, means that the proposed clay excavations would be visible to local residents and traffic passing along Great Northern Highway. The proponents point out that the flat terrain is advantageous to some extent, in that the pit faces would be generally excluded from view because they would be below ground level. However the proponents recognise the potential of the excavations to impair visual quality to 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 quarries, in addition to the final rehabilitation plan. Principal techniques that could be used to minimise adverse visual effects include:

- strategic placement of temporary overburden stockpiles to screen the site from major viewsheds of concern;
- ensuring that stockpiles are smoothly contoured instead of a number of different sized heaps;
- planting vegetation screens at the site boundaries in areas where visual impact is required to be softened.

Metro Brick propose tree planting around the stockpile area and along the highway in the next planting season (1992), which would be regularly monitored and supplemented as required.

The Environmental Protection Authority considers that noise, dust and visual impacts from Metro Brick's proposed clay operation on Lots 10, 11 and Part Lot 36 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 management of mosquito breeding

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 Metro 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. The proponent suggests that the lake could be stocked with fish, to predate on the mosquito larvae, as is the case at the Ballajura Lakes Estate.

The company has stated that public access is presently restricted by boundary fences in good condition and a lockable gate off Great Northern Highway. A warning fence (eg fluorescent ribbon) would be placed around the sides of steep parts of the excavation. The company considers that their site would probably be of less risk to the children of the Upper Swan townsite than the other clay pits, due to the separation of distance and the highway. Metro Brick is prepared to consider the provision of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by the Council, if this was considered of value in keeping children away from the site.

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 2 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 area.

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.

8. 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 Metro Brick to quarry clay on Lots 10, 11 and Part Lot 36, 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;
- 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 10 years from the time of commencement. Subsequent applications will be reviewed in the light of the proponent's environmental performance at the site.

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 Main Roads Department, the Swan River Trust and the Shire of Swan, Metro Brick should prepare a drainage management plan as part of an Environmental Management Programme to the satisfaction of the Minister for the Environment. This plan should enable the proponent to:

- monitor drainage to detect, report on, and manage any drainage impacts on the habitat of the short necked tortoise at Ellen Brook Nature Reserve;
- remedy any unacceptable drainage impacts on the tortoise habitat by this proposal;
- detain all drainage waters on site in the first 3 years of operation, so that they do not enter the tortoise habitat at Ellen Brook Nature Reserve nor create an unacceptable impact elsewhere;
- divert all drainage waters from the eastern side the Great Northern Highway from entering the tortoise habitat area 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.

Recommendation 3

The Environmental Protection Authority recommends that there be no quarrying within 100 metres of the boundaries of the Wild Life Sanctuary at Ellen Brook Nature Reserve and any additions thereto, until further investigations are able to conclusively demonstrate to the satisfaction of the Environmental Protection Authority that no adverse effect could occur to the tortoise habitat.

Recommendation 4

The Environmental Protection Authority recommends that, prior to the start of quarrying activities, Metro Brick should prepare an Environmental Management Programme to the satisfaction of the Minister for the Environment. 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:

- a staged quarrying strategy;**
- drainage management;**
- groundwater 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; and**
- periodic reporting of monitoring results and consequential changes to environmental management.**

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

Recommendation 5

The Environmental Protection Authority recommends that Metro Brick, 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, should contribute to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan Locality, within 2 years of approval of this proposal and to the satisfaction of the Environmental Protection Authority.

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.

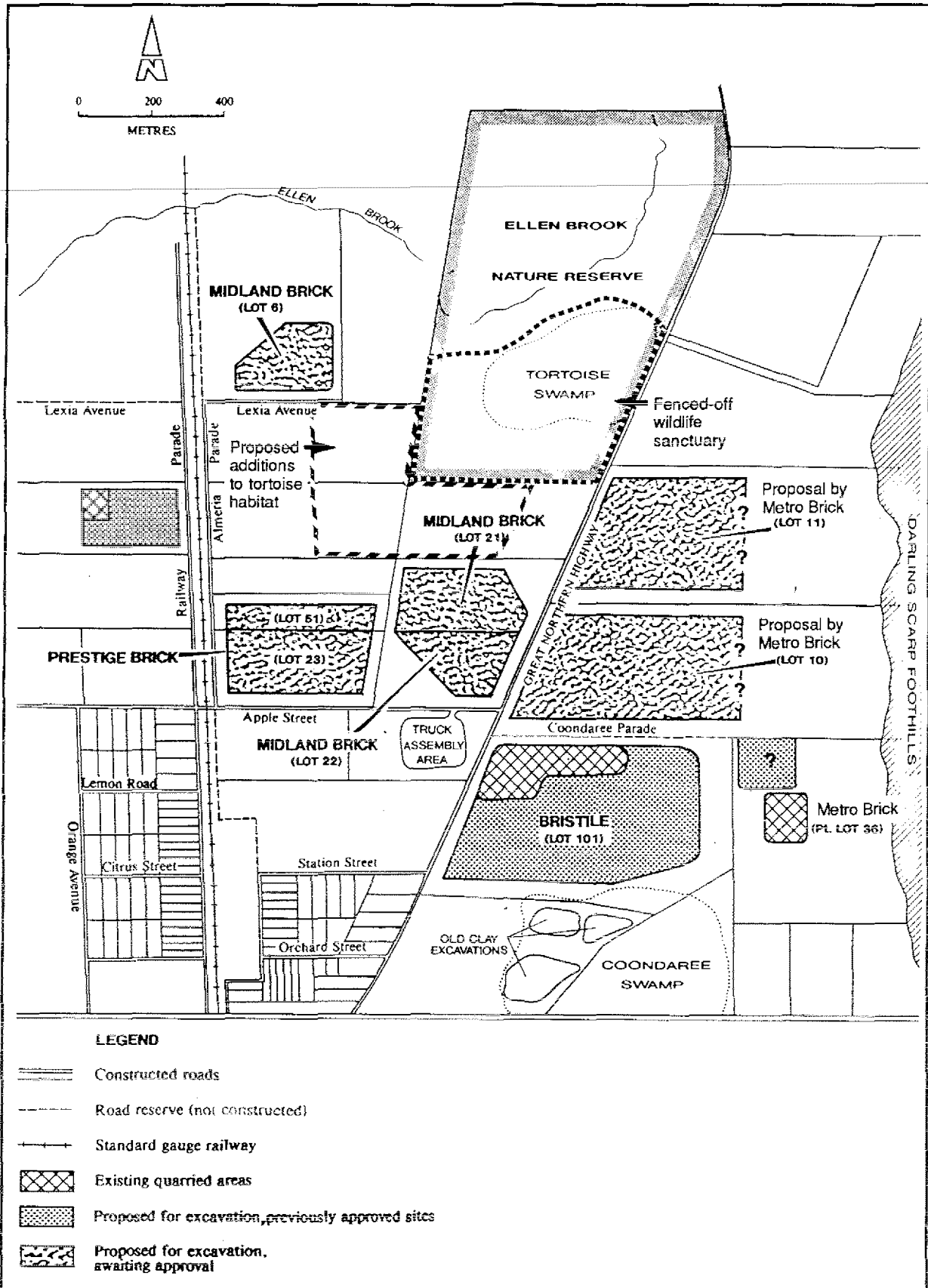


Figure 1. Location of proposal in relation to short necked tortoise habitat at Ellen Brook Nature Reserve and other current and proposed clay excavations.

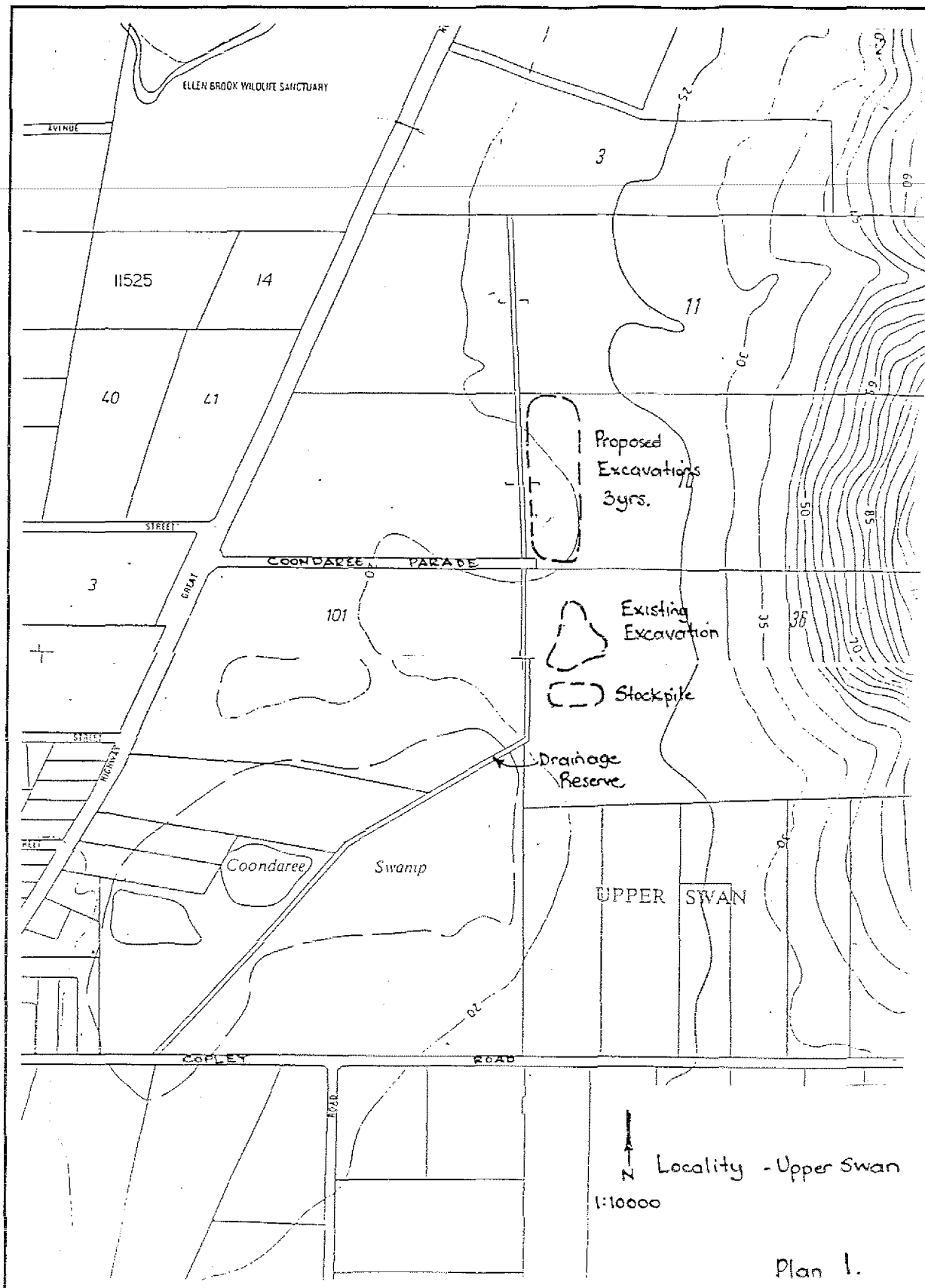
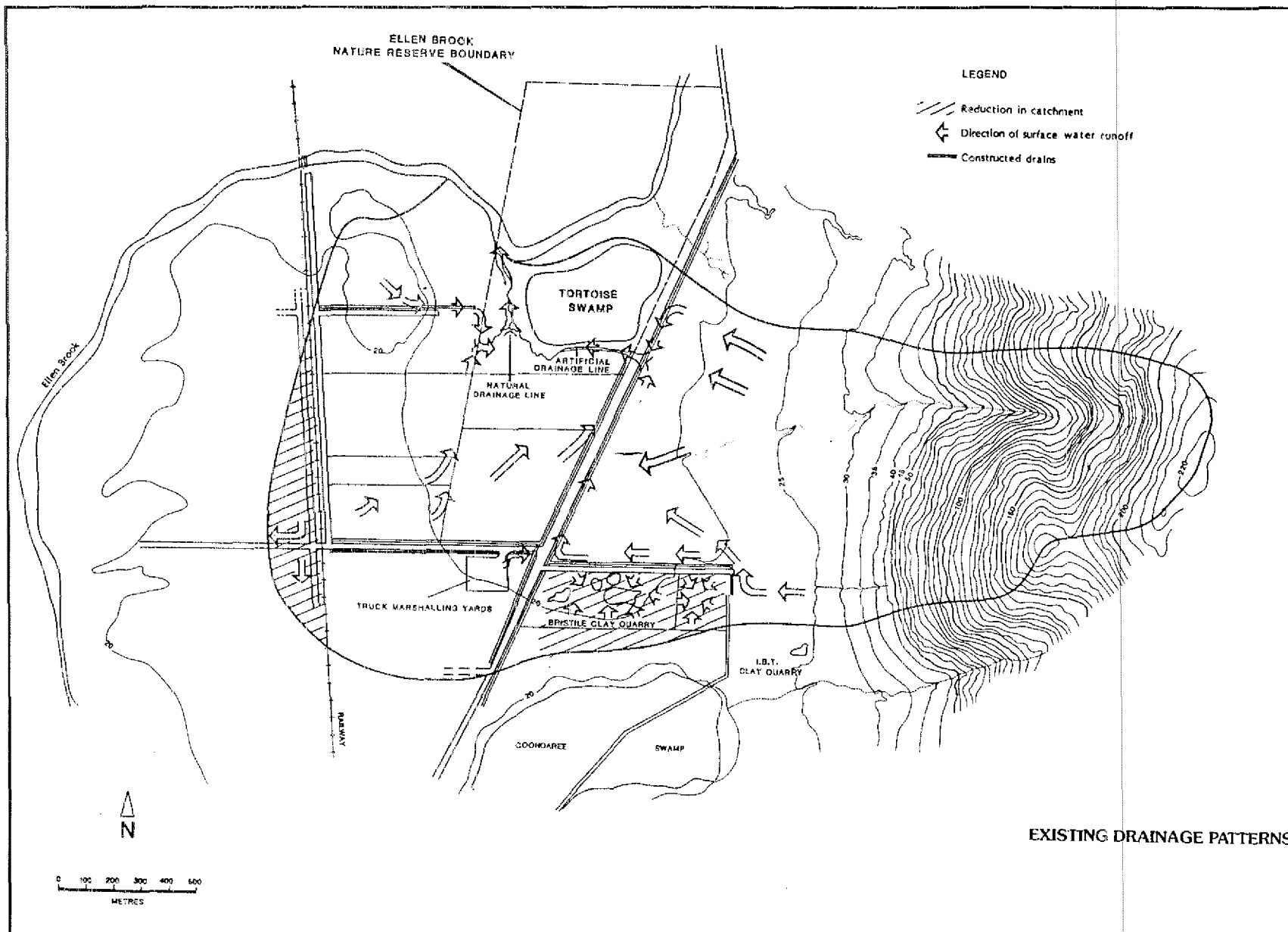


Figure 2. Proposed excavations by Metro Brick on Lot 10 for first 3 years

Figure 3. Existing drainage patterns into Ellen Brook Nature Reserve



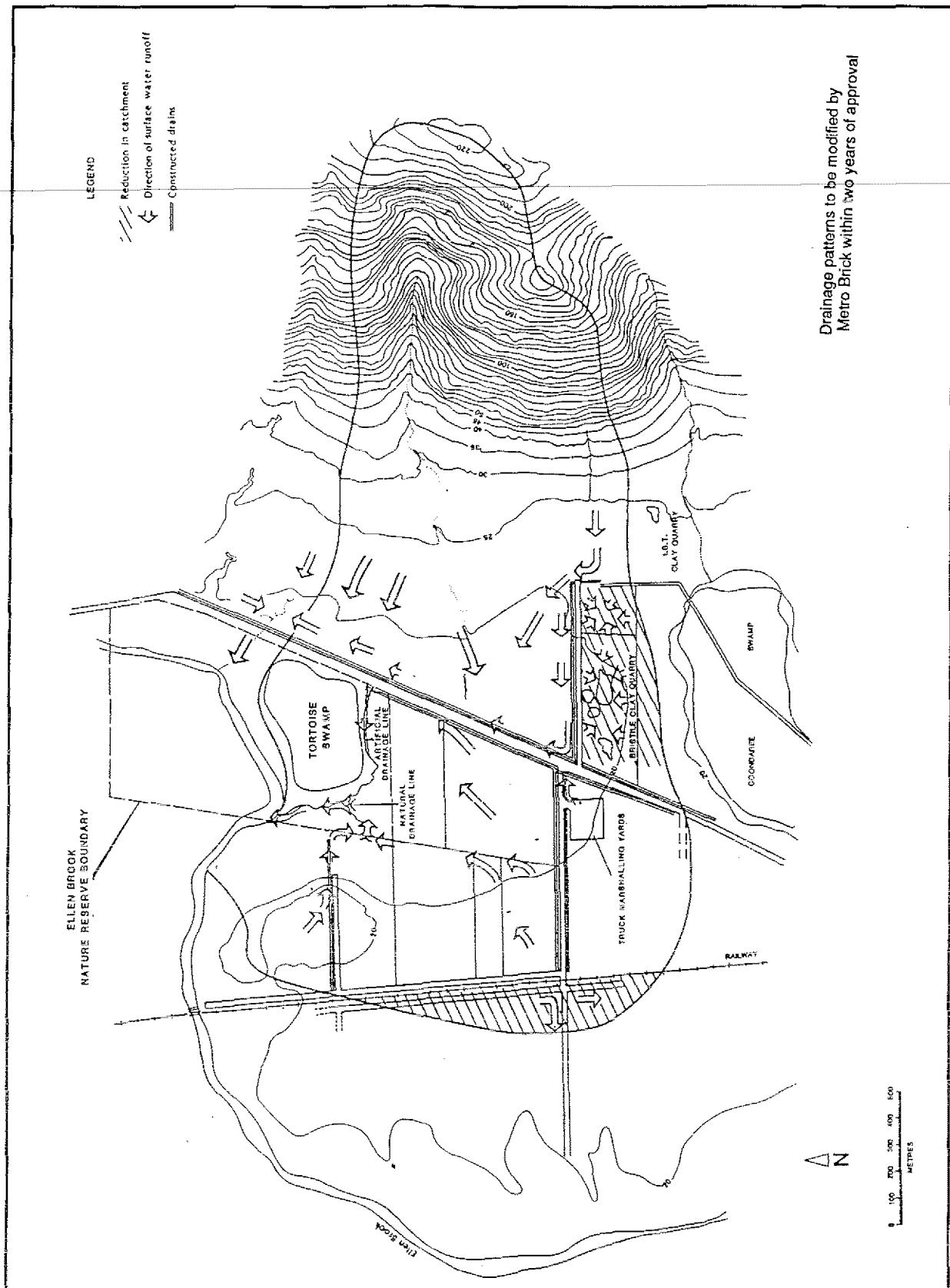


Figure 4. Proposed changes to Ellen Brook Nature Reserve drainage patterns on east side of Great Northern Highway, to be modified by Metro Brick within 2 years of approval

Appendix 1

**Environmental management commitments
by Metro 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 4 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 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;
 - 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 as 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) Contain turbid water within its excavations and immediate surroundings thus ensuring it does not flow on to the tortoise habitat.
- (viii) Not quarry within a hundred metres of the nature reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur.

- (ix) Prepare an Environmental Monitoring and Management Programme to the satisfaction of the Environmental Protection Authority prior to commencement of operations at the site.
- (x) Verify that no adverse effects experienced on the Short Necked Tortoise habitat are experienced, by appropriate staging and monitoring of excavations on lots 10 and 11.

Appendix 2

Proponent's response to issues raised in public submissions

METRO BRICK PTY LTD
LOTS 10/11 GREAT NORTHERN HIGHWAY

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 the proposed clay excavation at Upper Swan. The company is confident that the principal issues have been satisfactorily addressed to enable on-going assessment of this proposal.

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 information has been interpreted from aerial photography (scale 1:20,000; date = 4.1.91).

- (i) 100 metres - no houses.
- (ii) 500 metres - 2 houses.
- (iii) 1000 metres - 78 houses.

Note that this is a worst-case scenario especially for the initial years of excavation because the estimates are derived by measuring from the boundaries of the site, whereas there is a substantial buffer zone available within the site. For example, most of the houses occur to the south-west and, given that excavation will commence approximately 600 metres inside the south-west corner of the site, the number of houses within 1000 metres would then be reduced to less than 20.

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

This clay quarry proposal essentially represents a continuation of the excavation activity which has occurred on the adjoining Pt. Lot 36 for the last four years. It is proposed to commence excavation on Lot 10, only a short distance from the north-western corner of Pt. Lot 36. To the company's knowledge, no nuisance effects have been reported and there have definitely been no complaints to Metro Brick in respect of noise and dust emissions. (This also applies to Bristle Ltd., a company closely associated with Metro Brick, which has operated a clay quarry on adjoining land for the last 15 years or so).

It is the intention of Metro Brick to operate the clay quarry within noise and dust limits which can be tolerated by the local community with minimal inconvenience, and to preclude adverse effects to through-traffic on Great Northern Highway. With at least 20 years supply of clay available on Lots 10 and 11, it is obviously in the company's best interests to operate in a manner which is unobtrusive to neighbouring residents.

In the company's experience, there is not a dust problem from the temporary overburden stockpiles and longer term clay stockpile which is maintained on Pt. Lot 36. The main source of dust emissions is from the work areas and access track when traversed by trucks, which is simply controlled by watering. A watering truck will be present for all campaigns from this site and for the trucking campaigns which occur during the drier months of the year.

The potential for dust nuisance is also mitigated by the substantial buffer zone that is available between the quarry site and the nearest cluster of residences.

For the same reason, noise emissions are not an issue at this site.

(ii) Truck Movements

Truck movements at this site are less intensive in comparison to pits operated by other companies in the vicinity, but occur throughout the year. This is because the storage capacity at the Malaga plant is limited to 1,000 tonnes, under the terms of its original operating licence. Therefore, truck movements are anticipated to be between 2-5/hour for approximately 4 days every 6 weeks. The number of campaigns during the year is ultimately linked to economic/market factors.

(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 for the drier months of the year are presented in Tables 1, 2 and 3.

North-easterly winds are noted as the main winds of concern with respect to potential dust impacts on the nearest residential area within the Upper Swan townsite. 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.

Table 1

Analysis of North-Easterly Winds During Potential Excavation Season

North-Easterlies		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Morning winds (0900 hrs)	% Occurrence	13	13	14	15	15	19	17	30
	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 (1500 hrs)	% Occurrence	4	2	3	4	4	5	5	10
	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 (0900 hrs)	% Occurrence	20	21	26	28	38	29	20	12
	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 (1500 hrs)	% Occurrence	10	10	9	12	18	18	15	12
	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

- 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. However, the residential density due west of the site is extremely low.

As a result of the above analysis, Metro Brick undertakes to excavate and stockpile its annual clay requirement as soon as access to the site is possible, following the winter rainfall period. This is when winds are most favourable and when soil moisture contents are relatively high, therefore minimising the potential for dust generation. The more frequent trucking campaigns will be strictly managed by access track watering during the higher risk periods of January to March.

(iv) Conclusion

Whilst north-easterly winds are recognised as the most unfavourable in terms of potential dust effects on the Upper Swan townsite, it is emphasized that these winds do not occur frequently. They occur for 13-19% of the time in the mornings (November to April) and for 2-5% of the time in the afternoons.

In addition, trucking campaigns which are the main source of potential dust nuisance, occur for only about 10% of the time.

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.

Whilst the company has used scrapers at Pt. Lot 36, it was found that the overburden was too hard to preclude the use of dozers in conjunction with the scrapers, for supplementary ripping or power assistance.

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?

The life of the pit is dictated by demand for bricks and therefore to reduce the lifetime it would be necessary to create larger stockpiles. This could result in an aesthetics problem so the intention is to stockpile only 9-12 months supply of clay at the site at any particular time.

Metro Brick will restrict operating times to the hours of 6.30am to 5.30pm, Monday to Friday.

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?

The access point and transport route are shown on Figure 1. The on-site access is an all-weather limestone road to enable collection and transfer of clay to Malaga during winter. The objective in selection of the road alignment was to avoid the use of the Coondaree Parade road reserve so that public access could be controlled. The road does not pass residential areas.

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?

Given that noise is not an issue at this site, the use of dozers is not constrained by the potential for off-site disturbance.

Discussions have been held with a health surveyor from the Shire of Swan in relation to the mosquito issue. There is 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 pit during its operational life.

Ultimately, if a lake is formed during the rehabilitation programme, attention will be devoted to contouring of the sides to minimise mosquito breeding risk. The lake could also be stocked with fish, as is the case at Ballajura Lakes Estate, to predate on mosquito larvae.

Public access is presently restricted by boundary fences which are in good condition and by a lockable gate at the entrance to the limestone access road. The area will be signposted with "danger - open pit" signs. Fluorescent ribbon or a supplementary warning fence would be placed around the open pit in areas where the sides were left relatively steep, particularly in future years as excavations are conducted nearer to Great Northern Highway. (However, given that children are the main concern, it is considered that children residing in the Upper Swan townsite would tend to remain or be restrained by parents to the other side of the highway, due to the greater risk of injury in crossing Great Northern Highway).

Metro Brick is prepared to consider provision of assistance with the cost of materials and/or machine time (on a one-third basis with Midland Brick and Prestige Brick) for recreational areas provided by Council if this was considered of value in keeping children away from the site.

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, it is accepted that there is insufficient evidence to remove all uncertainty especially 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 prior to excavating near to the reserve.

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 it is accepted that there may still be a risk, albeit slight, of hydrological effects between future, potential excavation sites and the nearest habitat

area. Metro is committed to verifying that no adverse effects are experienced, by appropriate staging and monitoring of excavations on Lots 10 and 11. This is why the initial excavation is proposed near to previous excavations on Pt. Lot 36, i.e. as far as possible from the nature reserve and in an area where monitoring has shown no adverse hydrological effects from clay quarrying.

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?

Metro Brick is agreeable to assisting with machinery time for potential earthworks that may be required for recontouring or drainage works. The timing of assistance would preferably need to fit in with the company's seasonal working arrangements, subject to further liaison and negotiation.

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?

Question not relevant to Metro Brick.

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 area 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.

Metro Brick's land is not being considered by CALM for future tortoise habitat. The site has no remnant native vegetation and the surface soils have been substantially disturbed as a result of past agricultural practises.

Surface Water Impacts on Tortoise Habitat

Q12. Since the tortoise is well known to habitat 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.

Refer to answer for Question 13 below.

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 are 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 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 etc.

In the event that drainage from Lot 10, where clay excavation is initially proposed, is required to be diverted away from the nature reserve, then Metro Brick has two options:

- (i) capture all runoff from disturbed areas and divert it to the south, into the catchment which drains to the Swan River, or
- (ii) block the culvert which leads under Great Northern Highway (and discharges into the nature reserve), then to enhance the drain along the eastern side of Great Northern Highway to encourage flow in a northerly direction, as mentioned above. This would not involve any disruption to traffic throughflow on Great Northern Highway as it would not be necessary to re-construct the culvert.

Metro Brick is prepared to contribute to the necessary drainage line enhancement. At present there is additional runoff that is diverted onto Lot 10 from Pt. Lot 36 ('clean' runoff from the

Darling Scarp which is diverted away from the clay workings), therefore increasing flow volumes in the Great Northern Highway drain. Once the Pt. Lot 36 operation has ceased, this excess drainage can be returned to its natural flow pattern, some of which flows to the south.

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.

Four monitor bores were installed at Pt. Lot 36 in May 1988, at the locations shown on Figure 5. In addition to measuring water table levels, observations were conducted within the clay pit to determine whether or not groundwater inflow occurred.

Monitoring was conducted at about monthly intervals during the period June 1988 to May 1989, inclusive. Water levels recorded in each of the bores are listed in Table 4.

Table 4
Monitor Bores Results - Pt. Lot 36

Date	Water Levels (metres, AHD)			
	Bore 1	Bore 2	Bore 3	Bore 4
22 June 1988	11.19	17.05	12.11	14.90
1 July	11.26	17.43	12.19	16.53
1 August	11.37	17.59	12.30	16.25
22 August	11.41	17.84	12.40	16.95
19 September	11.57	18.01	12.63	18.24
17 October	11.66	18.38	12.76	18.41
21 November	11.69	17.78	12.81	18.30
19 December	11.65	17.52	12.75	17.36
18 January 1989	11.57	17.39	12.70	16.05
22 February	11.47	17.22	12.60	13.30
20 March	11.37	17.06	12.48	12.56
4 May	11.23	16.78	12.24	11.76
Total Variation	0.5m	1.5m	0.7m	6.65m
Ground Level	20.46	23.48	24.95	20.82

(i) Perched Groundwater

Bore numbers two and four exhibit large fluctuations in water levels at shallow depth, which is typical of the perched groundwater lenses that are known to occur in the area. Bore two, located in the north-eastern sector, recorded a water level variation of 1.6 metres and at its maximum level, water was 5.1 metres below surface. Bore four, located in the south-western sector, recorded a much larger water level variation (6.6 metres) and at the maximum level, was only 2.4 metres below surface.

The latter bore is located in an area of the site which is regularly flooded due to poor drainage. The extremely large fluctuations in water level suggests that either the bore is situated in a zone of "delayed" recharge to the underlying true aquifer, or some leakage was occurring down the side of the casing from the surface. Whilst the casing was sealed with both bentonite and cement plugs, this bore was inundated for long periods following rainfall and the possibility of leakage occurring has not been discounted.

However, it is reasonable to assume that both of these bores indicate the development of perched groundwater during winter. The important result with respect to potential environmental effects is that no shallow seepage occurred within the clay pit. Thus, despite the fact that perched groundwater was recorded between 2.4 and 5.1 metres below surface and the clay pit was just over 7 metres deep, no seepage was recorded. Bore two is approximately 230 metres from the excavation, whilst bore four is only about 140 metres distant. Obviously, these perched groundwater lenses are discontinuous and highly localised.

(ii) Deep Groundwater

Bore numbers one and three monitored the main Guildford Formation aquifer. The results indicate a relatively small variation in water levels of 0.5 and 0.7 metres (Table 4). Maximum water table heights were recorded in November and were 12.81 metres (AHD) on the eastern side of the quarry and 11.69 metres (AHD) on the western side.

The clay pit did not exceed about nine metres in depth and, by interpolation of topographic contours and recorded water levels, the base of the pit was always above the water table.

(iii) Conclusion

The perched groundwater occurs above the plastic clay layer to be mined, but is not necessarily perched on the clay layer. That is, the full thickness of overburden sediments is not necessarily a 'continuous' aquifer. There is considered to be a high degree of variability in the hydraulic conductivity of the shallow sediments as they are known to vary from almost 'pure' sand to strong sandy clays and gravelly clays. In addition, the experience of the clay extraction industry in the Swan Valley is that there is a high degree of lateral variability in the characteristics of both the overburden and the clay. The clay itself is not continuous therefore it is highly unlikely that perched groundwater occurs other than in small 'pockets'.

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.

Metro Brick will commit to not quarry clay within 100 metres of the nature reserve boundary, until further investigations are able to conclusively demonstrate that no adverse effect could occur. Furthermore, Metro Brick proposes to commence operations on Lot 10 as far as

possible from the reserve, which will initially be at least 600 metres from the south-eastern corner of the nature reserve. For the first 10-15 years of operation, excavation activity will be restricted to Lot 10 (the southern half of the company's landholding).

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.

At present, the company has insufficient detailed information on stratigraphic levels and in particular, the degree of continuity of the sub-surface clay layer, to compile a meaningful cross-section between the nature reserve and existing operations on Pt. Lot 36 (and the proposed excavation on Lot 10).

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.

Excavations have been conducted to a depth of 9 metres on Pt. Lot 36 without intersecting groundwater. Exploratory drilling will be conducted on Lot 10 to define the clay resource prior to commencing excavation. At the same time, it will be possible to establish the depth to the permanent water table to plan the excavation. Whilst it is not considered essential to only excavate clay that is above the water table the company recognises and accepts the philosophy of water resource protection and conservation. Therefore, in the unlikely event that the excavation did reach the water table or proceed slightly below it, the area would be backfilled with overburden to maintain at least 1 metre of cover.

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?

Data from the groundwater investigations conducted at Metro Brick's excavations on Pt. Lot 36 were submitted to EPA in June 1989, in the name of International Brick and Tile Holdings who was the operator at the time. These data are summarised under question 15 above. Additional data will be collected during the exploratory drilling phase mentioned previously.

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?

Water for dust suppression will be obtained from a property owned by the company in Middle Swan, which has a dam that has previously supplied water for viticultural purposes. In addition, 'dams' could be formed within the excavation to collect runoff and rainfall to provide water for this purpose. (This may impede progressive restoration somewhat, but only to a limited degree).

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?

Only the excavation machinery (dozer and hydraulic excavator) will be refuelled on-site; the trucks will be refuelled elsewhere. On-site refuelling will be conducted via provision of a temporary above-ground tank, which will only be present during each excavation campaign. This is considered to pose negligible risk of a serious diesel spill.

The tank will be placed in an enclosure of bunded soil. If a substantial spillage occurs, the contaminated sediments will be excavated and removed from the site to an approved disposal location. The Red Hill tip site or the Shire of Chittering's Muchea tip site would be the most secure landfill sites in the vicinity.

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 from the main aquifer 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?

The proposed use of the site after excavation is complete is either rural-residential (low density) or agricultural (grazing etc).

Rehabilitation will be conducted to the satisfaction of the Shire of Swan under the terms of an excavation licence. It is expected that DPUD will also be consulted during the requisite planning approval stage.

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?

Most of the settling occurs in the first two years with respect to suitability for general agricultural use. It may take many years (5-10) before the site could be used for building upon, although it is believed to offer suitable foundations in the long term. However, the material exhibits excellent compaction characteristics.

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.

Question not relevant to Metro Brick.

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.

In the company's experience, the temporary overburden stockpiles, as well as the clay stockpile, are not subject to wind erosion and 'dusting'. Therefore, hydro-mulching for grass cover is not intended.

The company intends to plant native trees along Great Northern Highway and on Pt. Lot 36, near to the clay stockpile, for screening purposes. Planting would commence in the autumn after approval is granted.

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.

Metro Brick is prepared to commit to progressive restoration of the pits (presumably an annual restoration effort is being suggested as satisfactory to EPA).

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-P56. 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?

It is agreed that some setback requirements could be eliminated, for example along the east-west property boundaries between Lots 10 and 11 and between Lot 10 and the lots on the southern side. In the latter case, there is a gazetted road reserve (Coondaree Parade) between the lots, which could also be mined for clay as it is not required for access purposes in the foreseeable future. Efficient utilisation of this scarce clay resource is considered essential by Metro Brick and a relaxation of setback requirements from property boundaries would be endorsed.

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 'foothills' region north of Midland. Discussions were held with Mr Tim Aurrett 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 residential development in the area will intensify.

Rehabilitation of the area with a mix of lakes and recontoured land would be consistent with future residential 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 excavation, to ensure compatibility with long-term plans for the area.

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 pennywort). 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.

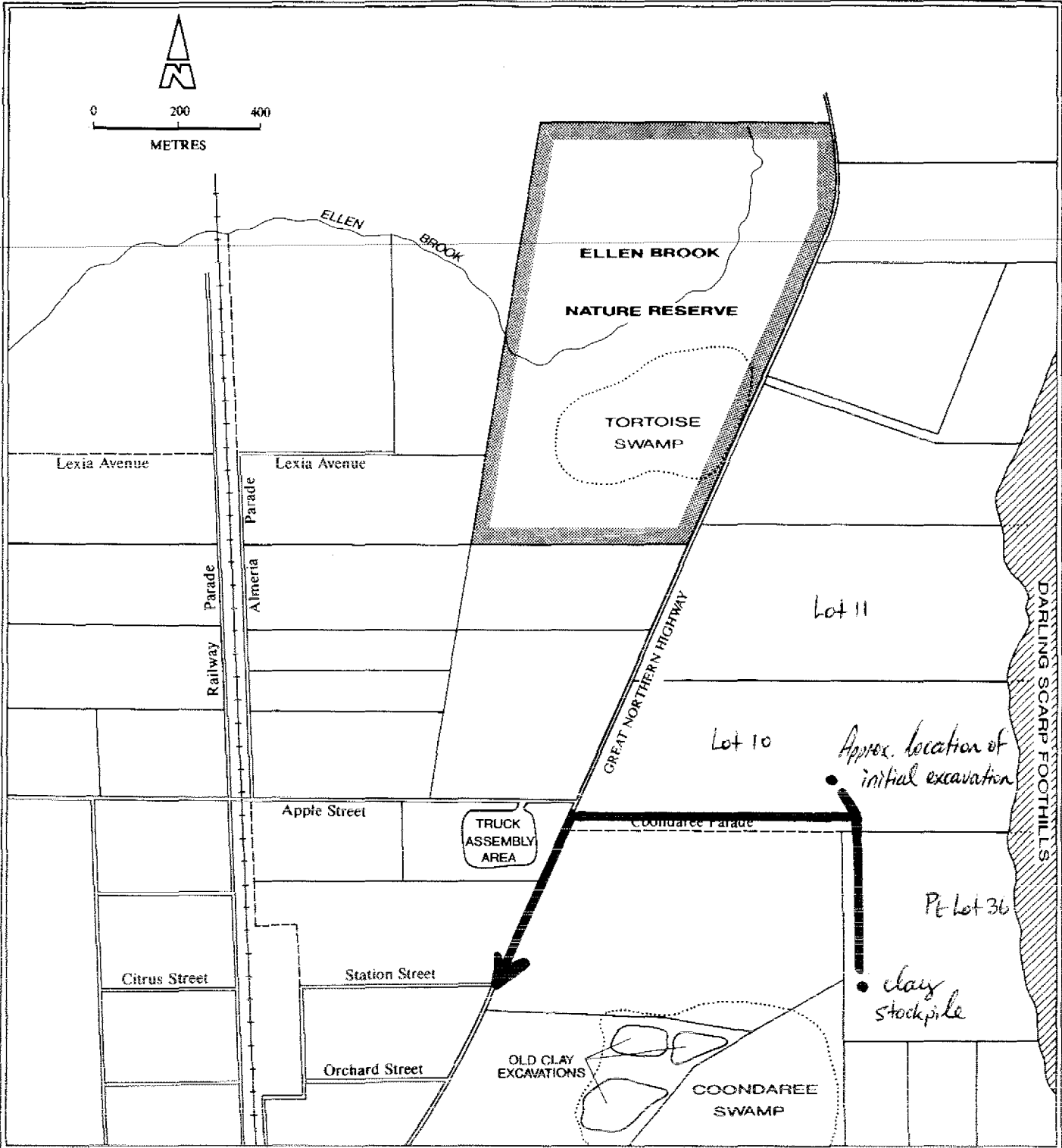
No further investigations have been conducted in relation to the matters raised here. On page 59 of the CER, the option of rehabilitation of clay quarries for tortoise habitat was briefly considered, along with the alternative option of expanding the existing nature reserve into areas that are not proposed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

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

The fundamental approach in the EMMP would be to focus on the initial years of excavation on the site and the manner in which groundwater aspects would be monitored to verify the acceptability of the operation. It is considered premature to prepare the EMMP at this stage until Ministerial approval is granted, without which there seems little point in conducting further preparatory work.

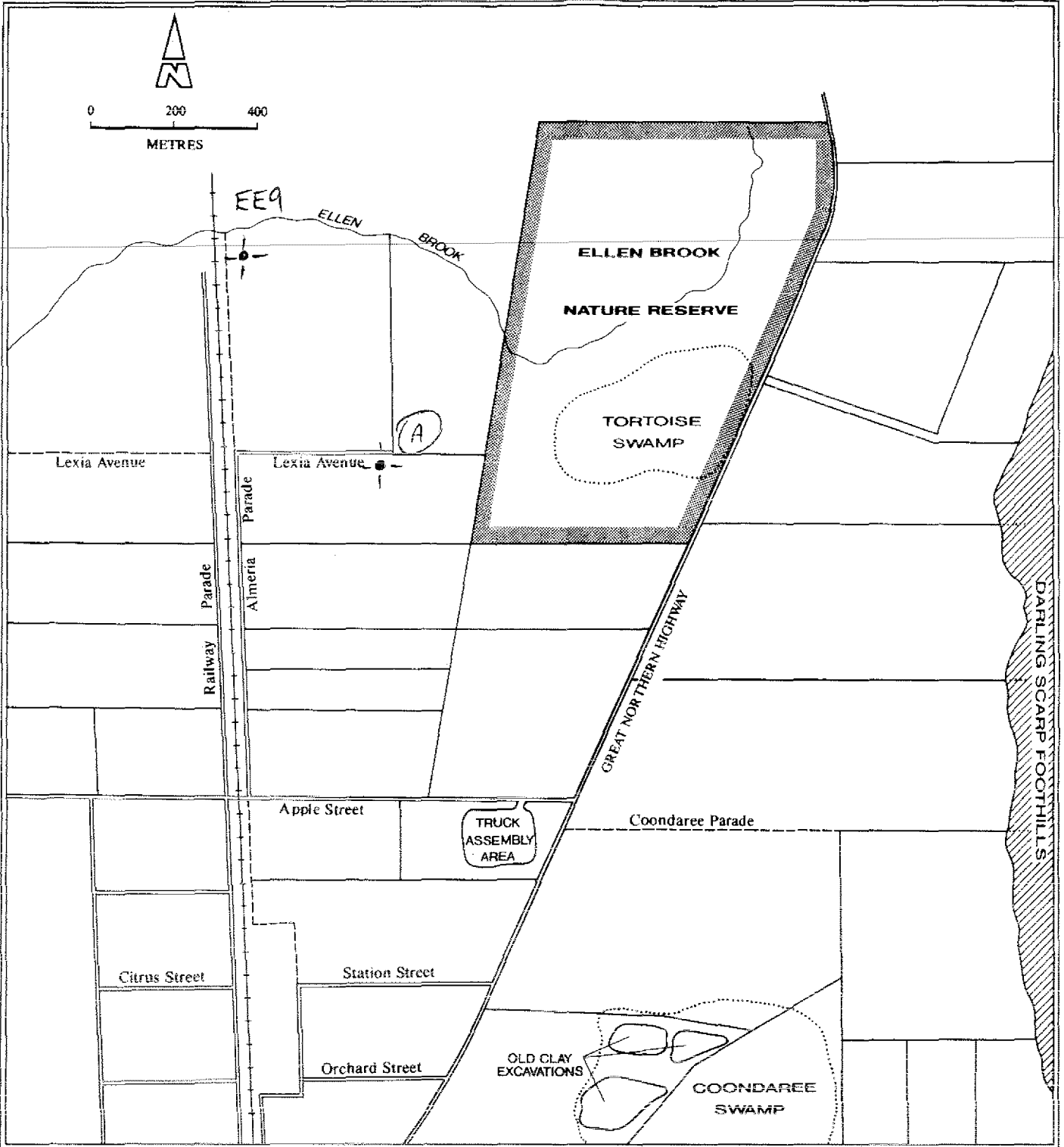


LEGEND




-  Constructed roads
-  Road reserve (not constructed)
-  Standard gauge railway

METRO BRICK
ACCESS

Figure ①.



LEGEND

-  Constructed roads
-  Road reserve (not constructed)
-  Standard gauge railway

 Water Authority Bores

LOCATION OF LONG-TERM MONITOR BORES

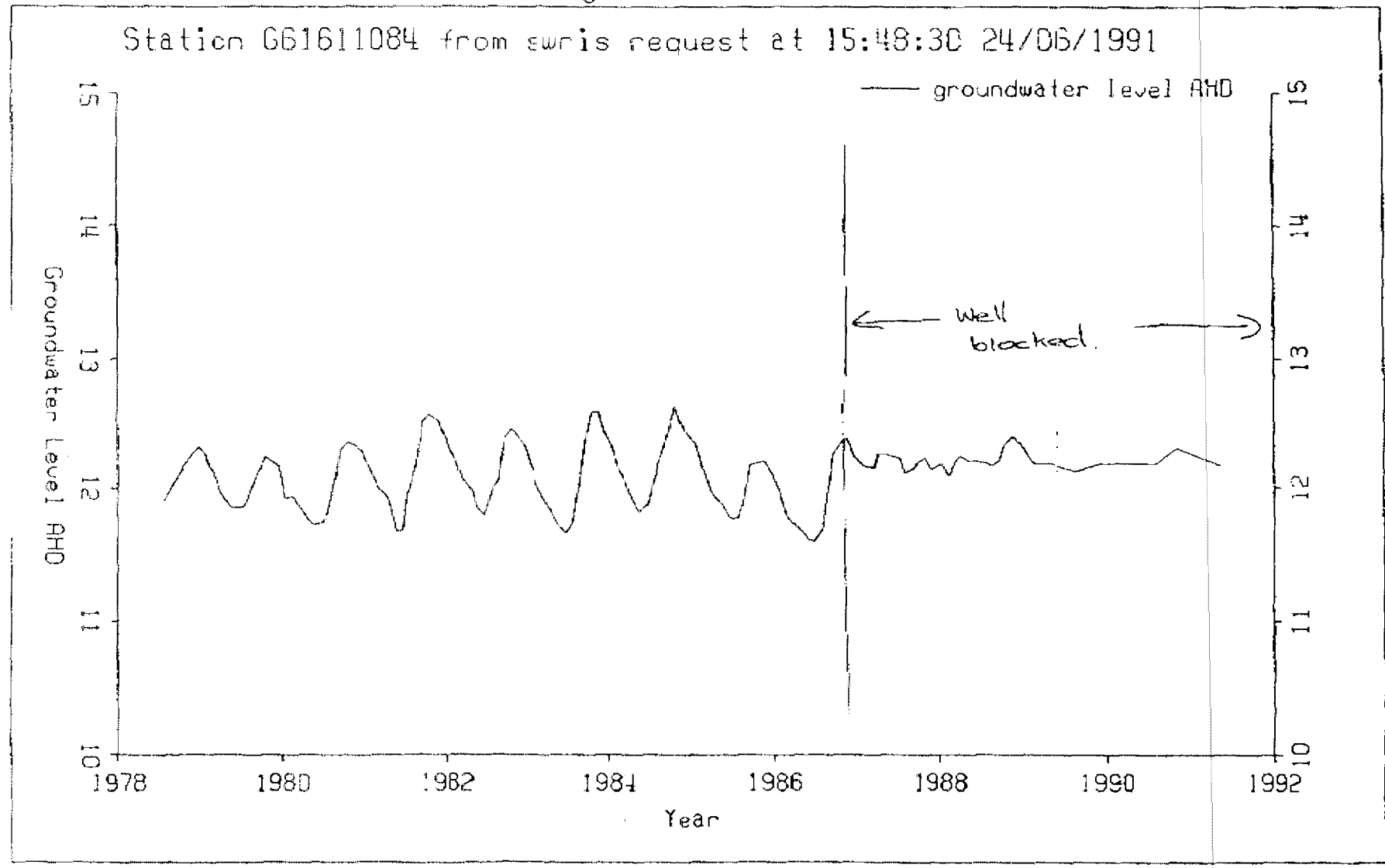
FIGURE 2

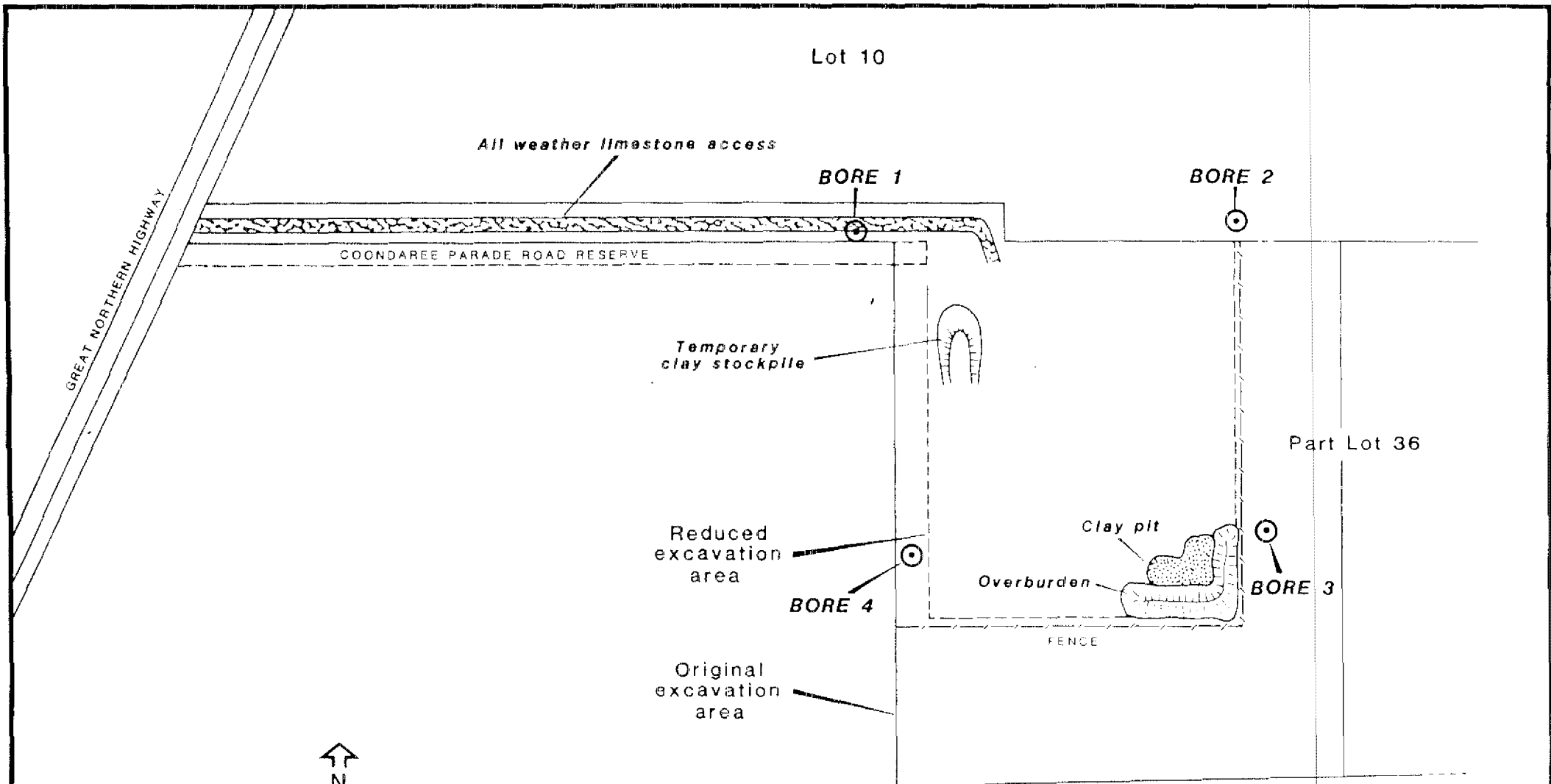
25 Jun 91 9:15 No.001 P.04
TEL NO.09-4203176
COMPUTER

BORE (A)

FIGURE 3

Plotted on 6/24/91 at 16:13 from file b:gd13.dat





LOCATION OF MONITOR BORES

FIGURE 5

Well EE9

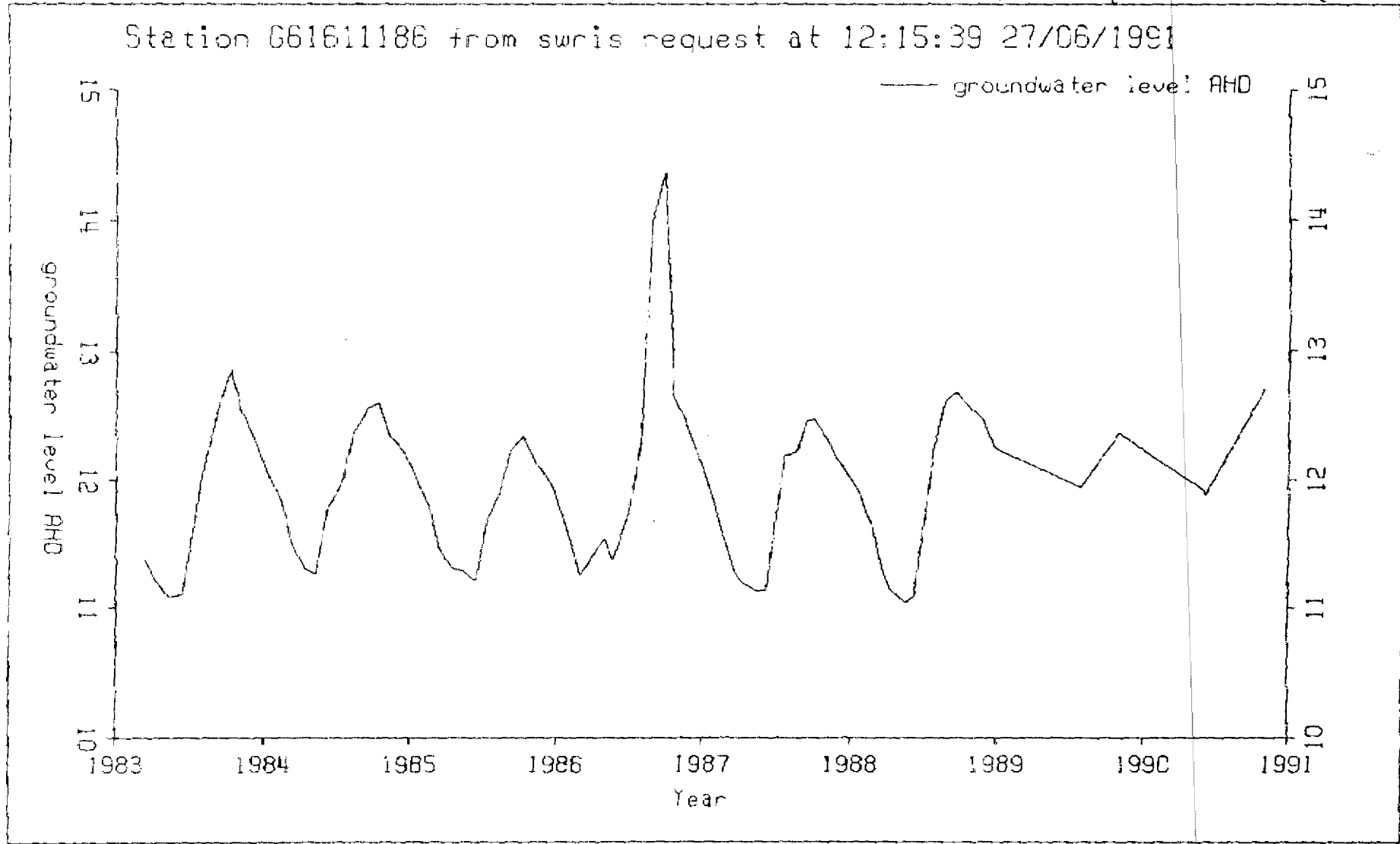
Total depth = 12 m

Slotted from 3.75 m to 12 m.

FIGURE 4

Plotted on 6/27/91 at 12:48 from file ee.pic

Station G61611186 from swris request at 12:15:39 27/06/1991



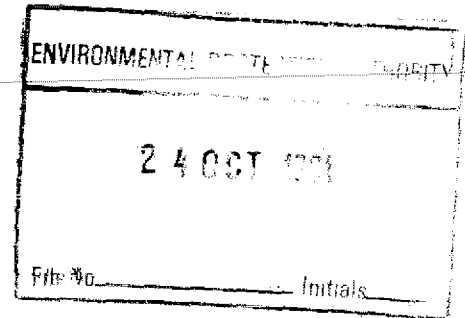
Appendix 3

Clarification of proposal and proponent, October, 1991

23 October, 1991

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH W A 6000

Attention: Mr S Sadlier



Dear Sir,

Re: Clay Excavation Proposals - Lots 36, 10 and 11 Great Northern Highway Upper Swan

We wish to thank you and Dr Kennedy for agreeing to meet with us at short notice. Subsequent to that meeting of Tuesday 22 October 1991 this Company wishes to confirm the following points arising out of those discussions.

1. We apologise for the confusion surrounding the nomination of proponents. Please confirm that Metro Brick (A Division of Bristle Ltd) is the major, and managing partner in International Brick and Tile. It is appropriate therefore that all proposals/licences etc. relating to Lots 10, 11 and Pt. 36 Great Northern Highway, Upper Swan, should have Metro Brick as the "Proponent". Metro Brick assumes full responsibility for the proposed project. If it is seen as necessary to change documentation, please take the appropriate action. If further assistance is required, please do not hesitate to call the writer.
2. Economically viable clay has run out on Pt. Lot 36. We seek only permission to extract clay within Lots 10 and 11 and regret the application which refers to Pt. 36 and Pt. 10. This was a previous management initiative which was unknown to us prior to the meeting. Further, that application is no longer appropriate.
3. We shall prepare a summary of our intentions for continued use of Pt. 36 for permanent stockpiling only. This will include definite rehabilitation and beautification work to be completed by July '92. Also included will be a staging plan for excavations spanning 10 years on Lots 10 and 11. This summary will be available by late next week.

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contd.

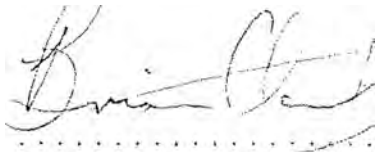
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4. Contact has been made this day with The Main Roads Department to enable discussions re: drainage works, to commence.
5. The Company has above ground supplies of this material until sometime in January. Any new extraction will be of about 5 weeks duration.

We are now rather more optimistic that our proposal will receive a positive response prior to our material supply being exhausted in January.

Yours faithfully,



.....
E.W. CLARK
Technical Manager.

Appendix 4

Drainage modifications to proposal, December, 1991

3 December, 1991

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH W A 6000

Attention: Mr S Sadlier

ENVIRONMENTAL PROTECTION AUTHORITY	
- 3 DEC 1991	
File No. _____	Initials _____

Dear Sir,

Re: Clay Excavation Proposals - Lots 36, 10 & 11 Great Northern Highway, Upper Swan.

Following discussions on December 2, 1991 with your Mr Sadlier it is now evident that a change to our proposal is necessary.

The intention to divert drainage water southwards from our first three extraction campaigns may be at odds with current wetlands legislation in respect to Coondaree Swamp.

Metro Brick (a division of Bristle Ltd.) hereby gives total commitment to the containment of turbid water within its excavations and their immediate surroundings thus ensuring it does not flow on to the tortoise habitat.

This will be effectively achieved by close bunding of each excavation cell with overburden. The overburden will be placed by scrapers approximately 800mm high and two scraper widths wide around the entire edge of the excavation. Topsoil will be placed over the bund. In so doing run-off water from the Scarp will be directed around the excavations and follow natural drainage patterns.

In addition, the existing excavation on Lot 36 will be completely backfilled to a level condition and seeded thus ensuring run-off from this area flows south and away from the tortoise habitat. Run-off from Lot 36 will be effectively returned to its original path, south-west to Coondaree Swamp.

During the first winter and prior to initial growth, it is not anticipated that the rehabilitated area of Lot 36 will contribute to turbidity entering Coondaree Swamp. No clay will be exposed to run-off only the land and durable overburden and topsoil of the region.

52371

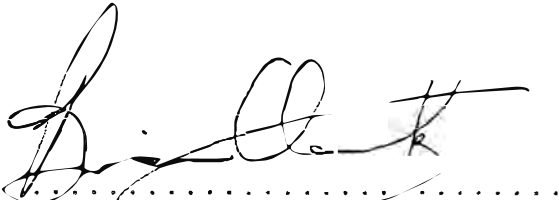


Bunding of excavations would be a temporary measure until arrangements can be made to divert all drainage away from the tortoise habitat.

The height of these bund walls and their distance from Great Northern Highway will ensure that visual impact from this proposal is negligible.

We await your most urgent consideration of our proposals.

Yours faithfully,

A handwritten signature in cursive script, appearing to read 'B W Clark', written over a horizontal dotted line.

B W CLARK
Technical Manager.