Remediation of the former liquid waste disposal facility, Southern River Road, Gosnells

City of Gosnells

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

This report is to provide the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment, about the proposal to manage the environmental impact of a former liquid waste disposal site in Southern River Road, Gosnells. The report is based on the environmental factors relevant to the proposal.

The proponent, City of Gosnells, proposes to manage soil contamination on-site, by constructing a clay "capping" layer over the former lagoon area and "cut-off" walls around the lagoons. To manage groundwater contamination, it is proposed by the City of Gosnells that a two-phase monitoring programme will be implemented, and under certain circumstances, an alternative source of water will be provided to residents that rely on groundwater for drinking purposes.

Relevant environmental factors

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) soil contamination - as a result of activities on site;

(b) groundwater quality - delineation of plume of groundwater contamination; and

(c) groundwater quality - possibility of contamination of private bores.

Conclusion

The EPA has considered the proposal by the City of Gosnells to manage the environmental impact of a former liquid waste disposal site in Southern River Road, Gosnells. A consequence of the past land use of the site is the existence of soil contamination in the lagoon area and to a radius of 150 m, and groundwater contamination beneath the site with a plume extending to an unknown radius.

It is proposed that the issue of soil contamination be managed by the construction of a lined capping layer over the contaminated lagoon area, into which all contaminated soil from the site will be placed. The proponent has committed to the formulation of EMP's to manage contamination both on- and off-site. The EMP for the management of contamination off-site will address the ongoing monitoring of the viability of the clay cap and cut off walls and provide a contingency plan in case the strategy is deemed to have failed. The EMP for the management of contamination off-site will address the delineation of the plume of groundwater contamination through monitoring and sampling.

The proposal to rehabilitate the former liquid waste disposal site in Southern River Road, Gosnells, can be managed to meet the EPA's objectives, given the additional requirement to supply residents with drinking water, if necessary, at short notice in accordance with the conditions, the exclusion of groundwater bores within a defined radius of the site, and the implementation of the proposed commitments by the proponent.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that this proposal is about managing a liquid waste disposal site so as to reduce the impact of the waste disposal elements on the environment.
2. That the Minister considers the report on the relevant environmental factors of soil contamination, and groundwater quality, both on and off site.
3. That the EPA has concluded that the proposal will improve the environment by reducing the impact of a former liquid waste disposal site, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 5.
4. That the Minister for the Environment imposes the conditions and procedures consistent with Section 5 and set out in formal detail in Appendix 4 of this report.

Commitments

The EPA notes that the proponent has given commitments, which are required to be complied with under the recommended conditions, to address the relevant factors.

Conditions and procedures

The EPA recommends that the following conditions, which are set out in detail in Section 5, be imposed if the proposal by the City of Gosnells to remediate the former liquid waste disposal site in Southern River Road, Gosnells is approved for implementation:

(a) land above the existing contaminated groundwater plume should be identified on a publicly available map as being unsuitable for beneficial use;

(b) an EMP should be prepared to address the management of groundwater quality as it pertains to private bores. The EMP should meet the requirements of the EPA on advice of the DEP and WRC and include the following:

- the identification and sampling of all private bores that are used for drinking purposes, initially within a 1 500 metre radius of the site, as soon as possible but no later than 3 months from the finalisation of the Environmental Conditions. Sampling should be repeated at least every 6 months until accurate delineation of the groundwater contamination plume is completed. If a bore is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996), an interim source of water must be provided within 24 hours and an alternative source of water provided within seven days;
- monitoring of the area of land that may be affected by contaminated groundwater in the future and the provision of an alternative source of water as stated above, if a bore is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996);
- after the delineation of the plume of contaminated groundwater, all residents within that area who are dependent on groundwater for drinking purposes should be provided with an interim source of drinking water within 24 hours and an alternative water supply within 7 days; and
- the monitoring of all bores used for irrigation purposes, initially within a 1 500 m radius of the site, then within the defined area of the groundwater contamination plume, to determine levels of contaminants. It contaminants exceed levels as stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996) for irrigation water, an alternative source of water should be provided within 7 days.

(c) appropriate measures should be put in place by the City of Gosnells and the City of Armadale in collaboration with the WRC so that no additional groundwater bores are permitted, either within a two kilometre radius of the site, or within the area accurately delineated as being affected by groundwater contamination, as defined by further studies required by condition (a) above;

(d) the proponent's commitments should be made enforceable; and

(e) the proponent should be required to put an environmental management system in place.

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1. Introduction

This report is to provide the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to the proposal by the City of Gosnells to manage the environmental impact of a former liquid waste disposal site in Southern River Road, Gosnells.

The proposal to remediate the former liquid waste disposal facility was referred to the EPA in January 1995, and the level of assessment was set at Consultative Environmental Review (CER).

The CER report entitled "Former Liquid Waste Disposal Facility at Southern River", referred to here after as the CER, was made available for public review between 3 June and 25 June 1996. Submissions were received from members of the public, government agencies and other organisations.

In compiling this report, the EPA has considered the information provided in the CER, issues raised by the public, specialist advice from government agencies, the proponent's response to issues raised, the EPA's own research and, in some cases, research provided by other expert agencies.

Description of the proposal is provided in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal and other EPA advice is outlined in Section 4. Section 5 sets out the conditions and procedures which should be applied if the proposal is implemented. Section 6 presents the EPA's conclusion and Section 7 the EPA's recommendations.

Appendix 1 provides a list of people and organisations that made submissions. A list of references is contained in Appendix 2 and the proponent's commitments are provided in Appendix 3.

The DEP's summary of submissions and the proponent's response to those submissions has been published separately and is available in conjunction with this report.

2. The proposal

The proposal is to manage the environmental impact of a former liquid waste disposal site, in Southern River Road, Gosnells. The site includes 13 unlined lagoons constructed from sand. Discharges to the lagoons included primarily septage and brewery wastes, however unknown quantities of other wastes were also discharged.

The regional location of the site is shown in Figure 1 and the map of local constraints is presented in Figure 2. The site covers an area of 7.5 hectares (ha), and the lagoons cover an area of approximately 2.4 ha within the site (Figure 3).

Due to the potential for groundwater contamination, the area within a two kilometre radius of the site is relevant to this proposal. The proponent, City of Gosnells, is the relevant local authority for most of the affected area, although the two kilometre radius from the site also includes an area of the City of Armadale. The nearest residential area is a special kennel zone approximately 300 metres to the south east (Figure 2).

Operations at the site began in the mid 1950s and concluded at its closure in 1981. Soil contamination has been present at this site for approximately 40 years and leaching from the site over this time has caused a plume of contaminated groundwater to migrate from the site.

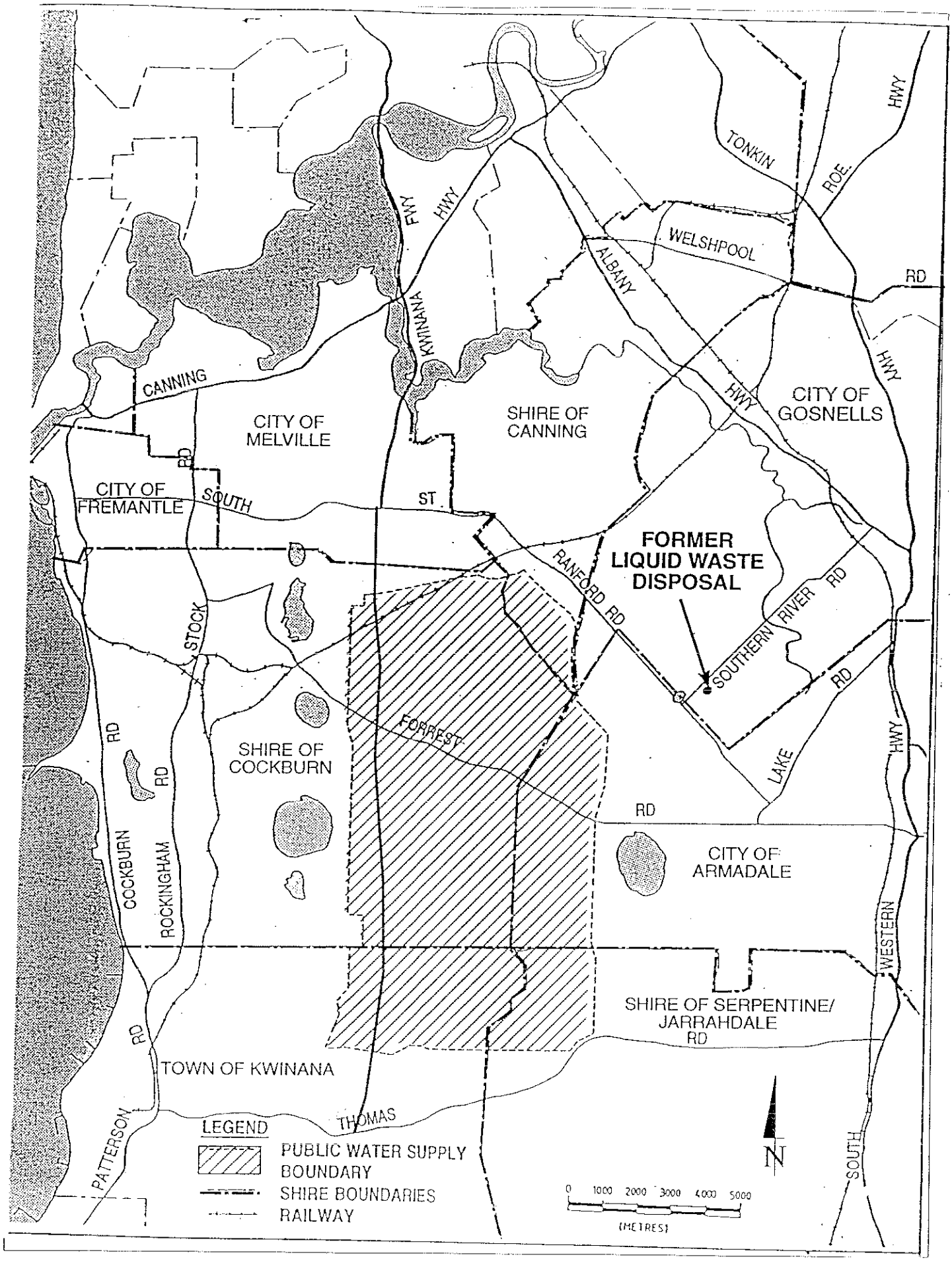

Figure 1. Location plan (Source: City of Gosnells CER 1996).

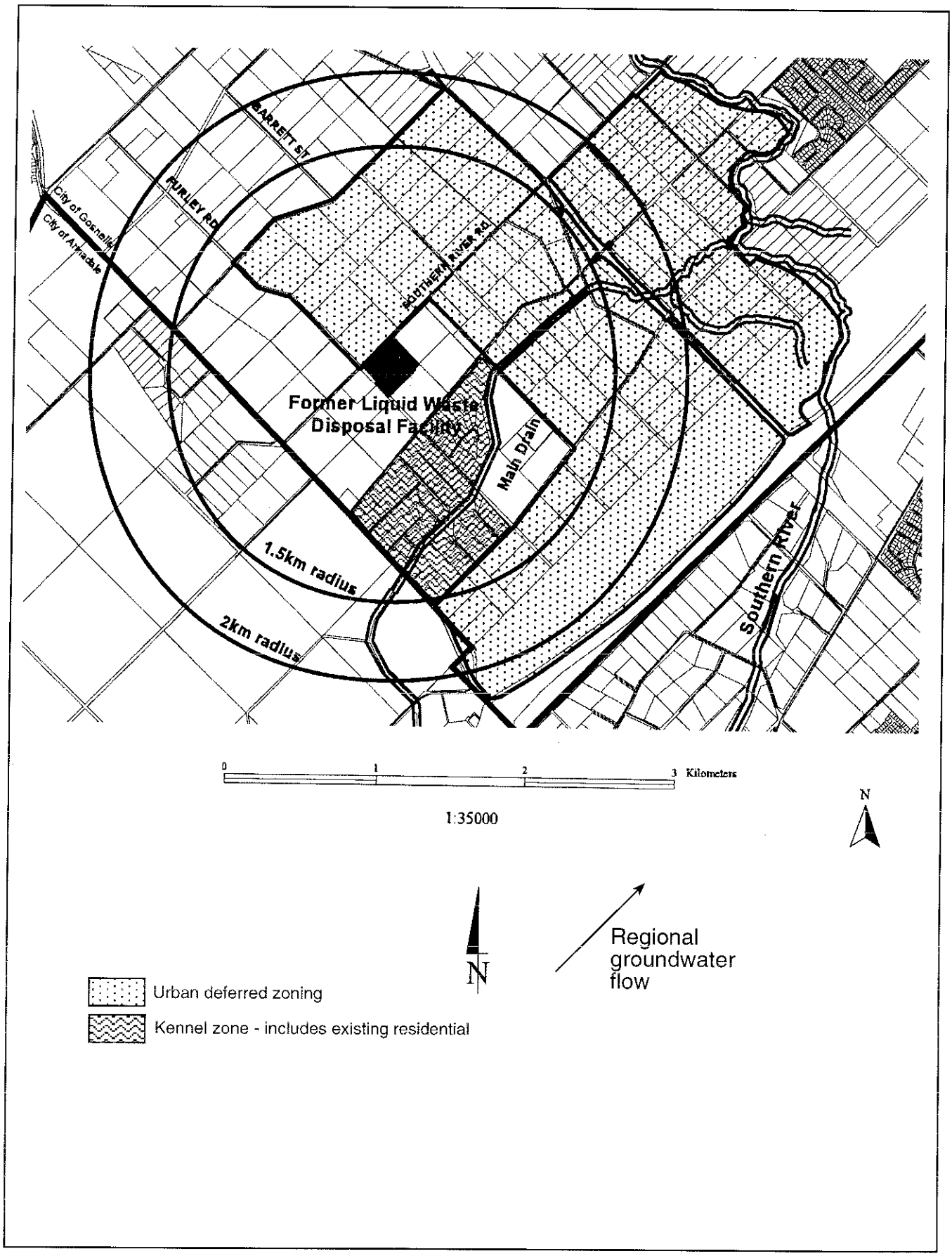

Figure 2. Environmental constraints in the vicinity of the former liquid waste disposal facility.

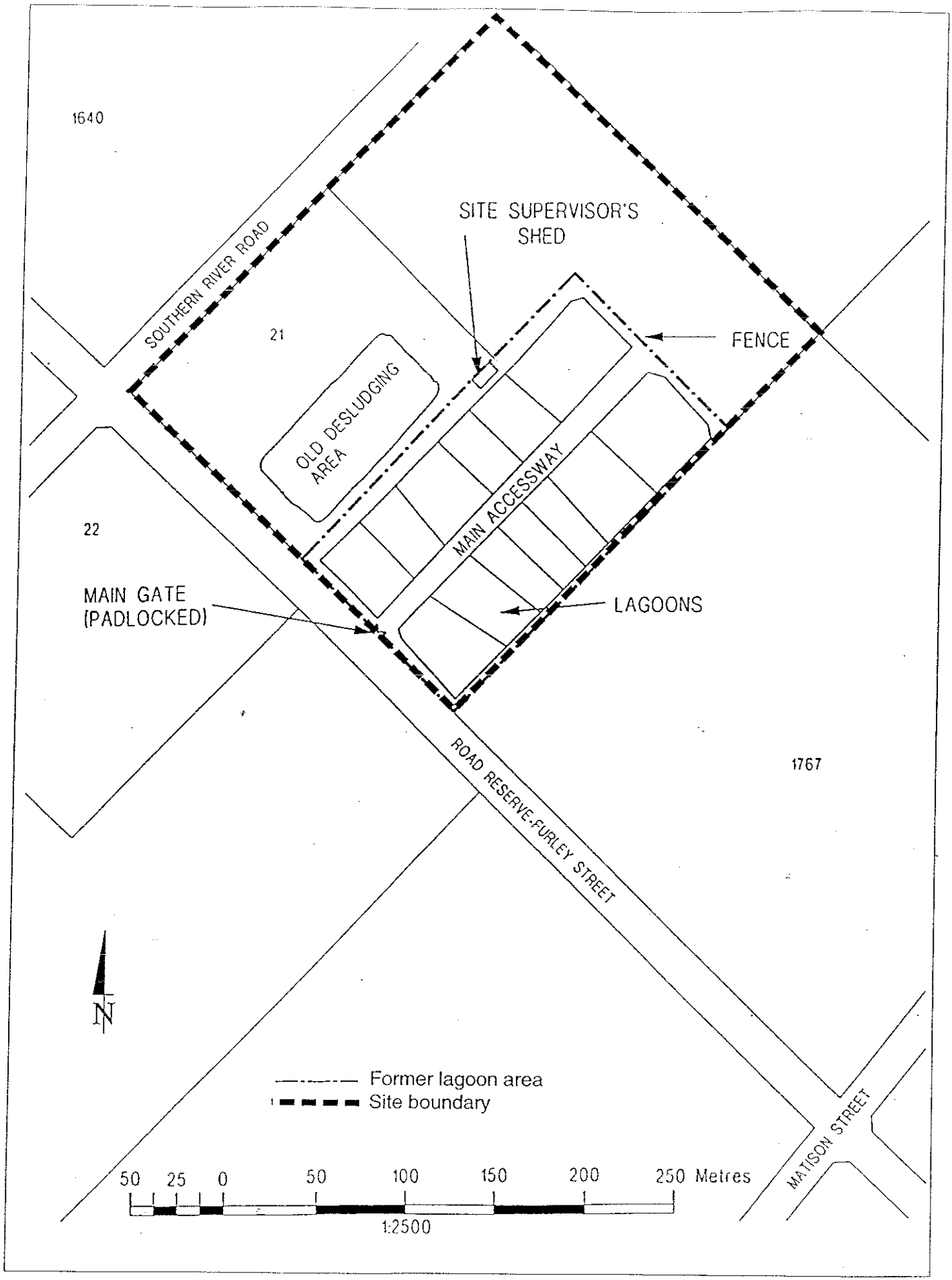

Figure 3. Current site layout (Source: City of Gosnells CER, 1996).

Groundwater beneath the lagoon area and up to 1 300 metres to the south east shows elevated levels of nutrients and metals. The nature and extent of the plume of contaminated groundwater is unknown.

The site is underlain predominantly by sand. The regional groundwater flow is to the north east at approximately 20 metres per year, but this has been locally altered by the mounding of groundwater beneath the liquid waste site. Groundwater flow at the site may be 40 to 110 metres per year, however conclusive tests have not been carried out to determine this.

Part of the area around this site is zoned Urban Deferred under the current Metropolitan Region Scheme (MRS) and this zoning may be lifted to allow residential development in the near future. The purpose of Urban Deferred zoning is to identify areas of land that may be appropriate for residential purposes in the future. The lifting of the Urban Deferred zoning is at the discretion of the Western Australian Planning Commission and does not require a formal amendment to the MRS.

The EPA advised the City of Gosnells in 1994 that increased urbanisation of the Southern River area should not proceed until the extent of soil and groundwater contamination in the vicinity of the former liquid waste disposal facility has been determined.

The site is currently zoned rural in the MRS and there are no plans to rezone the site to urban.

Existing residents in the area (shown in Figure 2) surrounding the former liquid waste disposal site are not connected to scheme water and some rely on groundwater for their drinking water. Reticulated water is not proposed to be connected in the near future.

No clean-up of the site is proposed at this time. Rather, the proponent intends to manage soil contamination on-site by constructing a clay "capping" layer over the former lagoon area and "cut-off" walls around the lagoons. The aim of this strategy is to reduce further leaching of contaminants to an acceptable level, but not to completely eliminate the leaching process.

The proponent also proposes to define the extent of the groundwater contamination and to monitor the capped area in case of leakage.

The proponent, the City of Gosnells, has committed to the preparation of Environmental Management Plans (EMP) to manage the contamination on-site (soil contamination) and off-site (groundwater contamination and use and management of groundwater).

The EMP addressing soil contamination will outline the ongoing management and monitoring of the contaminated site and its effect on the surrounding public and environment. The EMP will outline the construction of the clay cap and walls, the clean-up strategy for the adjacent contaminated areas, provide a definition of the criteria by which the remediation strategy is deemed to have succeeded or failed and details of a contingency plan in case of failure.

No clean-up of contaminated groundwater is proposed. The proponent has agreed to the formulation of an EMP to aid in the management of groundwater contamination and its effects on surrounding residents. The proponent has committed to the formulation of a comprehensive investigation and monitoring plan which will delineate the extent of the groundwater contamination plume to within approximately 500m. The EMP will also identify areas that are at risk of being over contaminated groundwater in the future as a result of further migration of the contaminated plume.

In order to manage the delineation of the plume of groundwater contamination, the City of Gosnells propose to implement a staged monitoring program. The program will monitor the following:

- the extent of groundwater contamination as defined by concentration of metals that exceed drinking water guidelines;
- the continued migration of the groundwater plume of contamination; and
- drainage and surface water from the site that flows into the Forrestdale Main Drain and the Southern River.

Eight groundwater monitoring bores would be constructed and monitored six monthly for one year (stage 1) with the aim of identifying the boundary of the plume of contaminated groundwater. Based on the first year's monitoring, six additional bores would be constructed and monitored. Further bores may then be installed where necessary, to aid in the refinement of the border of the plume (stage 2).

On request of landowners, the City of Gosnells will undertake testing of water from private bores, where the bores are used for drinking purposes, within a 1 500 metre radius from the site. If the bores are found to be contaminated and where it can be shown that the contamination is a result of activities at the site, the City of Gosnells would provide an alternative source of drinking water within two months.

Table 1. Summary of Proposal

Aspects	Description
Lagoon area	2.4 ha
Soil contamination	
area effected	lagoon area and up to 150 metres to the south east
contaminants	heavy metals, hydrocarbons and sulphates
proposed management	The lagoon area and excavated contaminated soil will be clay capped with cut off walls constructed extending to the winter water table level. An EMP will be prepared that will outline the ongoing management of soil contamination, failure criteria and a contingency plan.
Groundwater contamination	
area effected	under the lagoon area and up to 1 300 metres to the south east
contaminants	metals and nutrients
proposed management	A staged groundwater investigation to delineate the extent of the plume of groundwater contamination as detailed in the proposed EMP including: • the installation of eight monitoring bores monitored six monthly for one year • a further six bores will be added based on above results with continued monitoring • additional bores would be added based on additional results • testing of private bores within 1 500 metres on request of land owners • modelling to determine areas at risk of being subjected to contaminated groundwater as a result of further migration in the future
	Surface water investigation • monitoring of effects of drainage and surface water from the site on the Forrestdale Main Drain and the Southern River
	Water supply • provision of alternative drinking water supply within two months if bore is contaminated by the site

3 Environmental factors

3.1 Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in this report:

(a) soil contamination - as a result of activities on site;

(b) groundwater quality - delineation of plume of groundwater contamination; and

(c) groundwater quality - possibility of contamination of private bores.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponents' response and commitments and the effectiveness of the proposed management. On this basis, the EPA considers that the impact on wetlands, gaseous emission and other issues raised in the submissions, including the provision of alternative processes to recover costs incurred by residents, do not require further evaluation by the EPA. The identification process is summarised in Table 2.

The environmental factors and their assessment is discussed in Sections 3.2 to 3.5 of this report.

3.2 Soil contamination - as a result of activities on site

Description

Soil contamination is present both on- and off-site as a result of previous activities that occurred on the site. The majority of the soil contamination is confined to the lagoon area, however hydrocarbon contamination also exists to a distance of approximately 50 to 150 metres east of the lagoons (Figure 4). Soil contamination is relatively shallow and does not extend more than 1 metre below the winter water table (approximately 1 to 2 metres below the ground surface) at concentrations which exceed guidelines, with the exception of sulphate.

The proposal to manage this environmental factor is to contain the soil contamination on-site to an acceptable level by building a clay cap over the contaminated lagoon pits with cut-off walls extending into the summer water table. In addition, any remaining contaminated soil will be excavated from around the lagoons and from affected areas on adjacent land, and contained under the clay cap. Soil remaining after the identification of contaminated material and its subsequent transfer for capping on-site, would be required to meet standards compatible with the intended land use.

Table 2: Identification of Environmental Factors Requiring EPA Evaluation

Preliminary Factor	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Factors
Biophysical			
Wetlands - contamination from affected groundwater	The site is about 1 km from Balannup Lake and there are other wetlands nearby which are a known habitat for the rare and endangered Freckled Duck.	The contaminated groundwater may have an adverse effect on the nearby wetlands.	Balannup Lake and the other wetlands are upgradient of the site and hence it is unlikely that contamination will move towards the lakes. Water quality monitoring of Balannup Lake is currently being undertaken by the proponent and is proposed to be continued. No increase in nutrient levels of the lake has been detected. *Factor does not require EPA evaluation.*
Pollution Management			
Gaseous emissions	Large quantities of biological material were discharged to the site when in operation. As a result of the decomposition of the biological matter, a large amount of landfill gas has been produced.	The CER does not adequately address the issue of air pollution and there is no monitoring program proposed for air quality (CCWA). The management strategy outlined in the CER is hazardous and this should not be implemented until the nature of the substances comprising the landfill gas is determined.	Land fill gas will be extracted and managed in accordance with section 6.3.4 of the CER. The proponent also commits to monitor any vented gases to determine the quantity and content of methane and other constituents. *Factor does not require EPA evaluation.*
Soil contamination	The liquid waste disposal site in Southern River Road was in operation between 1955 and 1981. Wastes comprised mainly night soil (septage) and brewery wastes, but also included an unknown quantity of other wastes. Consequently, soil contamination exists within the lagoon area and extends to some of the surrounding soil. A clay cap with cut-off walls extending 1 m into the summer water table will be constructed to contain the contaminated soil within the lagoon ponds on-site. Contaminated soil from around the site will be excavated and contained under the clay cap. Buried metallic objects identified through site investigations will be excavated.	The extent of the clay cap proposed in the CER is inadequate and the shallow cut-off trench is likely to be of limited effectiveness in preventing the migration of contaminants off-site (WRC). The contaminated soil at the site should be removed to at least the water table and disposed to landfill to ensure there is no off-site transport of contaminants to the groundwater (WRC) The capping of the contaminated site would be a contradiction of the ANZECC (1992) and the Department of Environmental Protection guidelines for the assessment and management of contaminated sites (1997) as 'cap and contain' measures are the least preferred options for the clean-up of contaminated sites.	*Considered to be a relevant factor.*

Groundwater quality - contamination of private bores	Results of groundwater testing revealed the existence of contaminated groundwater below the lagoon area. The investigations also suggested the presence of a plume of groundwater contamination, possibly extending to a distance of 1500 m from the lagoons.	As there is an established link between groundwater abstraction and off site migration of contaminants, no groundwater abstraction should occur within a 1 500 metre radius of the site (SRT). With the limited data available, it is inconclusive whether the regional groundwater is contaminated. Future monitoring must be performed to accurately define the extent of groundwater contamination (MfP). The WRC should be consulted when designing the surface and groundwater sampling program (SRT). The two month waiting period for an alternative drinking water source as proposed by the proponent is unacceptable. PVC's were detected in one of the bores, however no determination of PVC concentration in groundwater was made. This should be accurately determined. All houses within 1 500 metres of the site should receive immediate connection to a reticulated water supply. Residents should be notified of the health risks associated with the site and be informed that the groundwater is not suitable for consumption. Signage should be used in open drains warning the public of potential contamination	*Considered to be a relevant factor.*
Other			
Cost to nearby residents		The City of Gosnells should purchase contaminated land, reimburse landowners for hydrogeological investigations and compensate landowners for any losses caused by contamination. All costs associated with groundwater contamination should be incurred by the City of Gosnells.	This matter should be addressed through the proposed contaminated sites legislation. *Factor does not require EPA evaluation.*
Management		The management program and monitoring should be ongoing and the results should be readily available (CCWA). Continued community involvement and consultation should also be encouraged.	The proponent will provide, on request, residents and rate payers with copies of results and supporting notes from all investigations. The results will also be available for public viewing in the City of Gosnells Administration building and the Gosnells Library. The proponent has committed to the undertaking of ongoing community consultation. *Factor does not require EPA evaluation.*

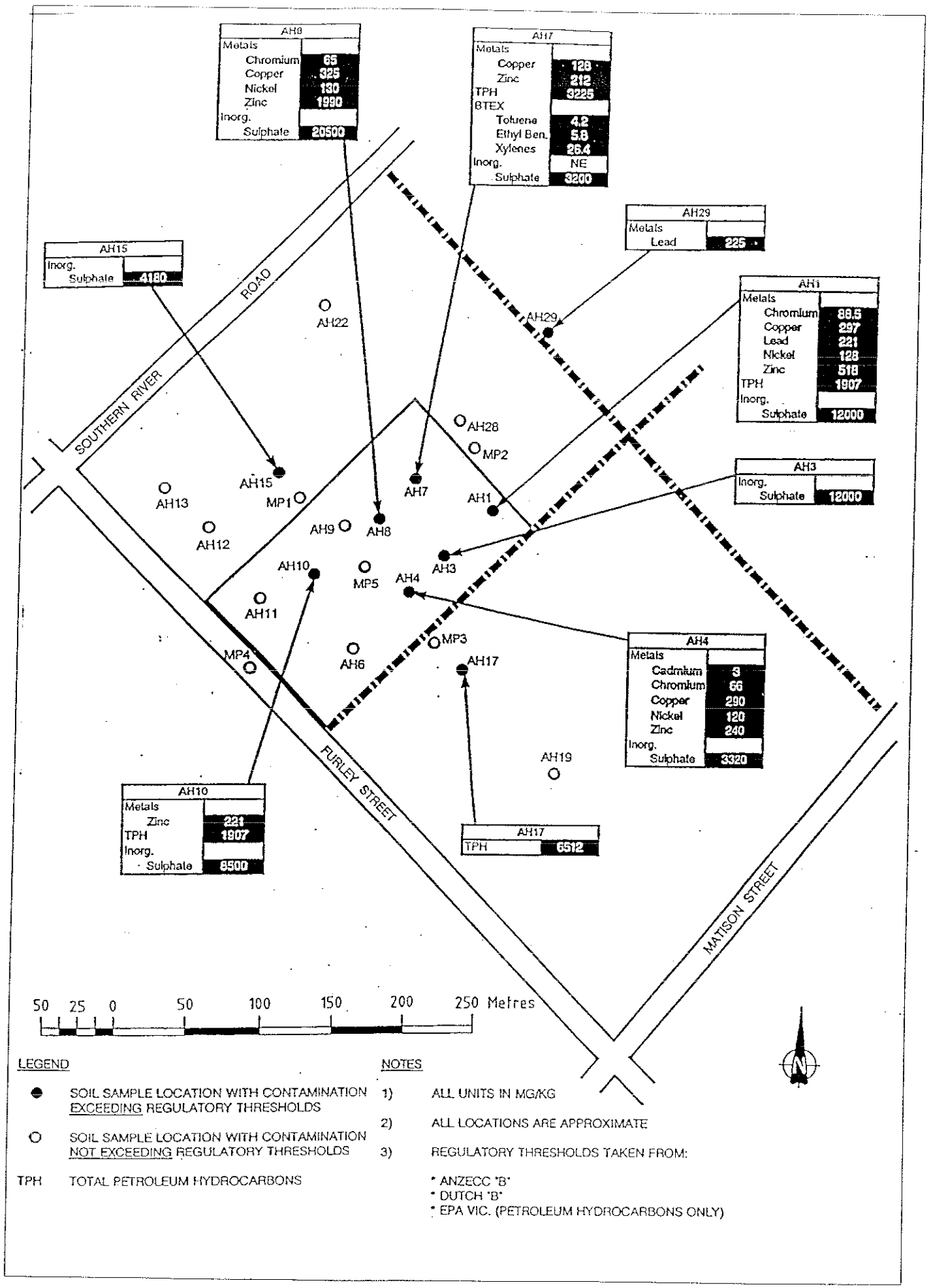

Figure 4. Location of soil contamination (Source: City of Gosnells CER, 1996).

Land fill gas will also be extracted and monitored for quantity and content of methane and other constituents, and buried metallic objects that were discovered during initial surveys will be excavated and disposed of appropriately.

Some submitters stated that capping of the contaminated site would be a contradiction of the ANZECC and DEP (1997) public position paper on contaminated site clean-up, both of which state that the "cap and contain" measures are the least preferred options.

The aim of the proposal to cap and contain the contaminated soil on-site is to isolate the contaminated soil and reduce the leaching of contaminants to an acceptable level, not to completely eliminate the leaching process (City of Gosnells, 1996). The capping layer will prevent unauthorised entry to the lagoons and potential exposure to windblown contaminants. Monitoring bores will also be installed both within and at the edge the capping area to determine the effectiveness of the capping layer. In the event that there is excessive leakage through the cap and cut-off trench, it is proposed that the capping layer be repaired and second lining installed.

Assessment

The area considered for assessment of this environmental factor is the former liquid waste disposal site on Southern River Road, Gosnells (Figure 2) and the contaminated soil immediately surrounding the site to a distance of 150 metres (Figure 4).

The EPA has two environmental objectives in regard to this factor. They are:

- to ensure the rehabilitation of the site to an acceptable standard that is compatible with the intended land use, and consistent with appropriate criteria; and
- to ensure that contaminated material is treated on-site or disposed of off-site at an appropriate land fill facility. Where this is not feasible, to ensure that contaminated material is managed on-site to prevent further groundwater contamination or risk to public health.

Investigation criteria should be derived in accordance with the procedures outlined in the ANZECC Guidelines (ANZECC, 1992).

Some members of the public considered in their submissions that the capping of the site may not inhibit the horizontal movement of landfill gas. It was also considered that the proponent should carry out an air monitoring programme to detect levels of methane and other possible toxic air contaminants. In response to these issues, the proponent has made a commitment to monitor any gases collected and vented from beneath the proposed capping until the contents of the gases and consequent risks are defined. The EPA considers this is an appropriate approach to manage the issue of landfill gas.

In other submissions, the Swan River Trust and Water and Rivers Commission considered that the extent of clay capping proposed was inadequate and that the proposed shallow cut-off walls were likely to be of limited effectiveness in preventing the migration of contaminants. The EPA acknowledges this view, and notes that it is not the aim of the "cap and contain" option to prevent the migration of contaminants. The clay capping layer is proposed to reduce rainfall infiltration on the site by up to 90%, thus reducing the on-going leaching of contaminants through the soil to the groundwater table.

The proposal to use a clay cap and cut off walls to contain the contaminated soil on-site allows the cleanup of the soil outside the capped area to standards outlined in the ANZECC & NHMRC Guidelines for the Assessment and Management of Contaminated Sites (1992). The proposal is considered by the DEP to be technically feasible, yet this is not the preferred option of the DEP for the clean-up of a contaminated site (DEP, 1997). However, when the proposal

is combined with an environmental management program (EMP) designed to deal with the ongoing management of the contamination on site, the proposal is considered adequate to address what is currently an unsatisfactory situation. The proponent has agreed to formulate an EMP containing a detailed contingency plan in case of inadequate performance of the clay cap and walls, and to provide a definition of the criteria by which the "cap and contain" proposal is deemed to have failed, thus triggering the contingency plan. This EMP and the criteria and contingency plan will be to the satisfaction and requirements of the EPA on advice of the DEP and WRC.

Having particular regard to:

(a) the presence of soil contamination both on and off-site as a result of activities on the site;

(b) concerns from other government agencies regarding the migration of contaminants;

(c) the technical feasibility of the proposal to use a clay cap and cut off walls;

(d) the preparation and implementation of an Environmental Management Plan (EMP) that will outline the management of soil contamination including detail of:

  (i) the ongoing management required;

  (ii) a definition of the criteria by which the "cap and contain" proposal is deemed to have failed, thus triggering the contingency plan; and

  (iii) a contingency plan in case of failure; and

(e) the proponent's expectation that the proposal will only reduce, rather than prevent the leaching of contaminants,

it is the EPA's opinion that the proposal to contain the soil contamination on-site, together with the preparation and implementation of a monitoring program to be detailed in an EMP, will meet the EPA's objectives for this factor.

3.3 Groundwater quality - delineation of plume of groundwater contamination

Description

A series of investigations have been undertaken since the site's closure in 1981 by three different consultants to the City of Gosnells. The exact extent of the contaminated plume remains unknown, however it has been determined that groundwater beneath the site has been contaminated as a result of activities carried out on the site. Contamination on-site has leached into the groundwater and, due to groundwater movement, a plume of contaminated water extends from the site. The contamination is predominantly metals and nutrients.

The plume of contamination will be influenced by groundwater flow and there is also an established link between groundwater abstraction and off site migration of contaminants. It is possible that the flow of groundwater may transport the contaminated groundwater to the area currently zoned Urban Deferred under the MRS.

Due to the migration of contaminants off site, contaminated groundwater may already be affecting private bores in the vicinity of the site, or may do so in the future. This is discussed in greater detail in section 3.4 below.

Groundwater, surface water and drainage water was sampled at various locations around the site (Figure 5). Arsenic was found in bore GW9, approximately 1 300 metres from the site, at a level that exceeds NHMRC (1994) drinking water guidelines.

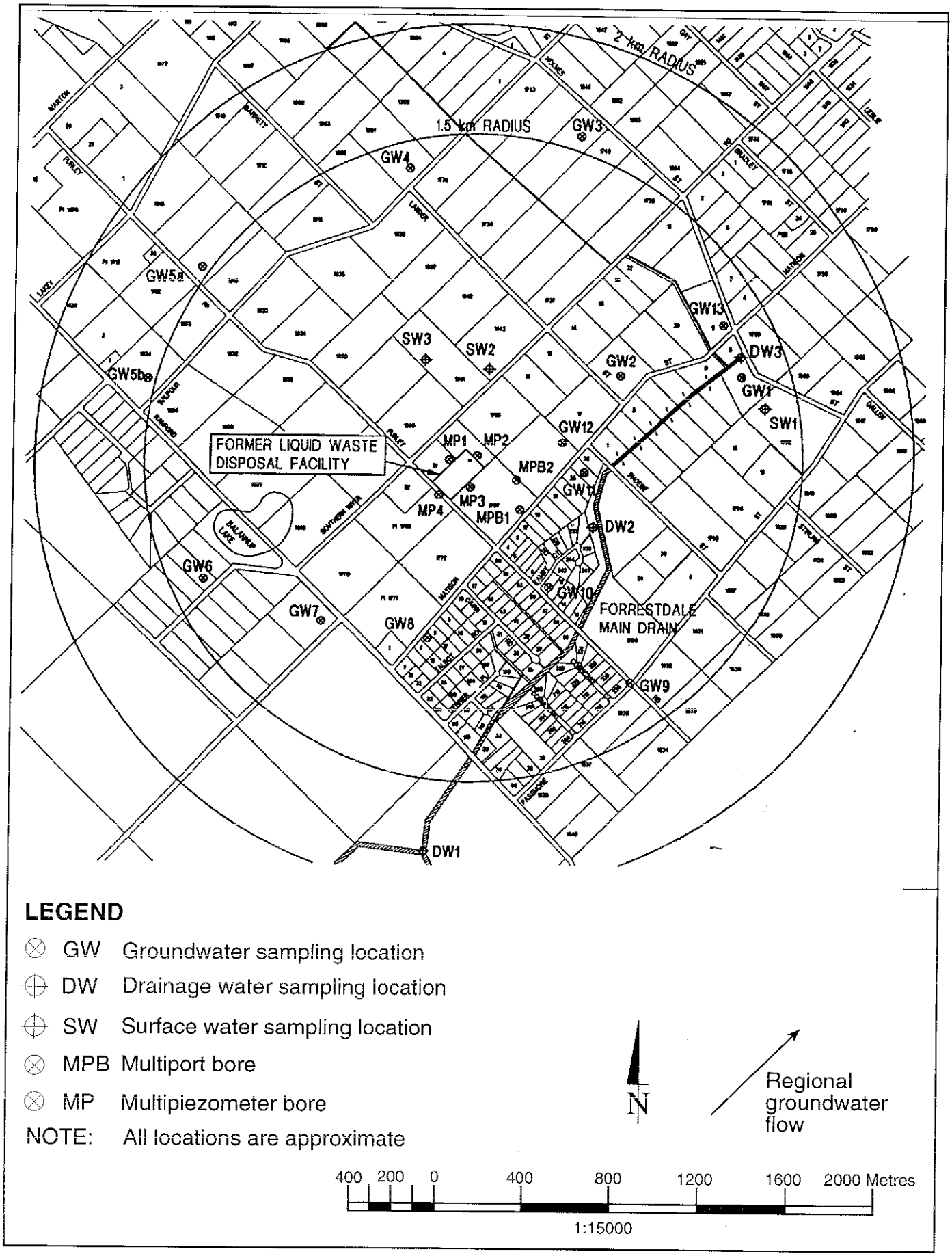

Figure 5. Groundwater, surface water and drainage water sample locations (City of Gosnells CER, 1996).

Testing of private bores in 1994 found lead levels at concentrations which exceeded drinking water guidelines. These bores were approximately 300 to 700 metres to the east and south of the site and were used for irrigation purposes. Resampling of these bores in 1995 did not detect lead at concentrations which exceeded drinking water guidelines.

Separate studies carried out at the site have determined different extents of migration of contaminants. Submissions stated that the actual extent of migration of contaminants cannot be determined and accordingly, a final decision on treatment possibilities cannot be made until the full extent of migration is determined.

A number of submitters consider that inconsistent testing methods were employed and a grid system of testing should have been used. It was requested that monitoring be continued and the results be made publicly available.

It is proposed, by the proponent, that a detailed, staged monitoring program be prepared to aid in the determination of the extent of the groundwater plume (as outlined in section 3.1). Stage 1 involves the construction of eight multiport bores around the site, allowing samples to be taken from three depths at each location, and monitored six monthly for a year. Six more triplex monitoring bores will then be installed (stage 2) and based on the first year's monitoring and monitoring of the stage 2 bores, additional bores would be constructed if, and where, necessary. The proponent anticipates that this programme would define the extent of the plume of groundwater contamination in one to two years.

Assessment

The area considered for assessment of this environmental factor extends to a 1 500 metre radius around the site, as shown in Figure 2.

The EPA has three environmental objectives in regard to this factor. They are to:

- demonstrate that, through thorough investigations, modelling and monitoring, existing leachate from the contaminants on the site, transported by groundwater, does not have an adverse impact on people or the environment;
- to ensure that in the long term, water quality of the groundwater will meet appropriate groundwater quality standards, including those in the NHMRC/ARMCANZ Australian Drinking Water Guidelines (1996) where groundwater is used to supply drinking water; and
- demonstrate that, through thorough investigations, modelling and monitoring, leachate from the contaminants on the site will not be a source of groundwater contamination.

The results of groundwater sampling to date have not delineated the full extent of the groundwater contamination plume. The DEP has given advice that the limited sampling proposed in the CER would not be sufficient to accurately delineate the existing groundwater plume. The proponent has since made a commitment to prepare an EMP to effectively delineate the groundwater plume to within 500m. Their investigation will identify areas that are at risk of being subject to contaminated groundwater in the future.

Having particular regard to:

(a) the contamination on-site that has leached into the groundwater causing a plume of contaminated water to extend from the site;

(b) the results of groundwater sampling, that to date has not delineated the full extent of the groundwater contamination plume; and

(c) the preparation and implementation by the proponent of an EMP that outlines the management of groundwater quality as it pertains to delineation of the contaminated groundwater plume, including detail of:

(i) the investigation, modelling and monitoring that will be implemented to clearly delineate the nature and extent of groundwater contamination;

(ii) identification of the existing plume;

(iii) modelling of the predicted future nature and extent of the plume;

(iv) the timeline for sampling and justification for varying monitoring;

with the EMP being to the requirements of the EPA on advice of the DEP and WRC,

it is the EPA's opinion that the proposal to prepare and implement an EMP to delineate the contaminated groundwater plume, as it currently exists and as it may be in the foreseeable future, will meet the objectives for this factor, provided that land above the existing contaminated groundwater plume be identified on a publicly available map as being unsuitable for beneficial use.

3.4 Groundwater quality - possibility of contamination of private bores

Description

Residents in this area are not connected to scheme water and some rely on groundwater as their sole source of drinking water. The potential exists that contaminated groundwater from the site could contaminate residents' drinking water.

The proposal by the City of Gosnells is that on request of landowners, the proponent will undertake testing of water from private bores, where the bores are used for drinking purposes, within a 1 500 metre radius from the site (City of Gosnells, 1996). If the bores are found to be contaminated and where it can be shown that the contamination is a result of activities at the site, the City of Gosnells will provide an alternative drinking water source within two months. Groundwater quality would be required to meet the NHMRC/ARMCANZ Australian Drinking Water Guidelines (1996).

It was stated in submissions that the two month waiting period proposed by the proponent is unacceptable and that an immediate safe drinking water source should be installed if groundwater is found to be contaminated.

Assessment

The area considered for assessment of this environmental factor extends to a 1 500 metre radius around the site, as shown in Figure 2.

The EPA's environmental objectives in regard to this factor are to:

- demonstrate that, through thorough investigations, modelling and monitoring, existing leachate from the contaminants on the site, transported by groundwater, does not have an adverse impact on people or the environment; and
- to ensure that in the long term, water quality of the groundwater will meet appropriate groundwater quality standards, including those in the NHMRC/ARMCANZ Australian Drinking Water Guidelines (1996) where groundwater is used to supply drinking water.

As an interim measure and to ensure that the EPA's objectives are met, all private bores within 1 500 metres of the site should be tested for contaminants, and an alternative drinking water source should be provided if a bore is found to be contaminated. If contamination is discovered beyond 1 500 metres and private drinking water bores are affected, similar action should be taken.

The proponent should prepare and EMP to discuss the management of groundwater quality as it pertains to private bores and include a more acceptable time limit for the provision of an alternate source of drinking water if a bore is found to be contaminated. This EMP should outline the following:

(i) the location of private bores;

(ii) the sampling regime that will be implemented:-

- all private bores initially within a 1 500 metre radius of the site that are used for drinking purposes should be sampled as soon as possible but no later than within 3 months from the finalisation of the Environmental Conditions;
- all bores in the area of land that may be affected by contaminated groundwater in the future should also be sampled; and
- after the delineation of the plume of contaminated groundwater, all bores used for irrigation purposes should be sampled to determine levels of contaminants;

(iii) the frequency of sampling:-

- sampling should be repeated at least every 6 months until accurate delineation of the groundwater contamination plume is completed (as required in Section 3.3);

(iv) provision of an alternative source of water:

- if a bore used for drinking water is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996), an interim source of water must be provided within 24 hours and an alternative source of water provided within seven days;
- after the delineation of the plume of contaminated groundwater, all residents relying on groundwater for drinking purposes within this area should be supplied with an interim source of drinking water within 24 hours and an alternative source of water provided within seven days; and
- if a bore used for irrigation purposes is found to contain contaminants that exceed levels as stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996) for irrigation water, an alternative source of water should be provided within 7 days.

Having particular regard to:

(a) residents in this area not being connected to scheme water and the reliance of some on groundwater as their sole source of drinking water; and

(b) statements in submissions indicating that the two month waiting period proposed by the proponent is unacceptable and requesting that an immediate safe drinking water source should be installed if groundwater is found to be contaminated,

it is the EPA's opinion that the proposal will meet the objectives for this factor, provided that the proposal includes the preparation and implementation of an EMP that will meet the requirements of the EPA on advice of the DEP and WRC.

4. Other advice

The following issue is also relevant to assessment of the proposal.

4.1 Urban deferred

Part of the area around this site is zoned Urban Deferred under the MRS (Figure 2) and this zoning may be lifted in the near future to allow residential development. It is expected that residential development would not proceed prior to scheme water being made available, and that subdivision applications would be referred to the EPA for setting of level of assessment.

The potential exists that when residential development is allowed in the area currently zoned Urban Deferred, residents may use the groundwater and this water may be contaminated as a result of activities at the former liquid waste disposal site.

To ensure that leachate from the contaminants on the site, transported by groundwater, does not have an adverse impact on people or the environment, measures should be put in place to ensure that residents located over contaminated groundwater do not have access to that water.

Accordingly, as stated in Procedure 3 of the draft Environmental Conditions, appropriate measures should be put in place to prevent the use of groundwater bores, either within a two kilometre radius of the site or within the area accurately delineated as being affected by groundwater contamination, as defined by further studies discussed in Section 3.3.

5. Conditions and procedures

5.1 Conditions

In the EPA's opinion, this proposal should be subject to the following conditions:

(a) land above the existing contaminated groundwater plume should be identified on a publicly available map as being unsuitable for beneficial use;

(b) an EMP should be prepared to address the management of groundwater quality as it pertains to private bores. The EMP should meet the requirements of the EPA on advice of the DEP and WRC and include the following:

- the identification and sampling of all private bores that are used for drinking purposes, initially within a 1 500 metre radius of the site, as soon as possible but no later than 3 months from the finalisation of the Environmental Conditions. Sampling should be repeated at least every 6 months until accurate delineation of the groundwater contamination plume is completed. If a bore is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996), an interim source of water must be provided within 24 hours and an alternative source of water provided within seven days;
- monitoring of the area of land that may be affected by contaminated groundwater in the future and the provision of an alternative source of water as stated above, if a bore is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996);
- after the delineation of the plume of contaminated groundwater, all residents within that area who are dependent on groundwater for drinking purposes should be provided with an interim source of drinking water within 24 hours and an alternative water supply within 7 days; and

Table 3: Summary of assessment of relevant environmental factors

Environmental Factor	Relevant Area	EPA Objective	Assessment	EPA advice
Soil contamination	The area considered for the assessment of this factor is the former liquid waste disposal site on Southern River Road, Gosnells (Figure 2) and the contaminated soil immediately surrounding the site to a distance of 150 metres (Figure 4).	Ensure the rehabilitation of the site to an acceptable standard that is compatible with the intended land use, consistent with appropriate criteria. Contaminated material should be treated on-site or disposed of off-site at an appropriate land fill facility. Where this is not feasible, contaminated material should be managed on-site to prevent further groundwater contamination or risk to public health.	The proposal to use a clay cap and cut off walls is considered by the DEP to be a way of achieving health and environmental criteria, yet this is not the preferred option of the DEP for the clean-up of a contaminated site (DEP, 1997). However, when the proposal is combined with an environmental management program (EMP) designed to deal with the ongoing management of the contamination on site, the proposal is considered adequate to address what is currently an unsatisfactory situation. The proponent has agreed to formulate an EMP which will describe the management of soil contamination and include detail of the ongoing management required. It will also contain a contingency plan in case of failure of the clay cap and walls, and will provide a definition of the criteria by which the "cap and contain" proposal is deemed to have failed, thus triggering the contingency plan. This EMP will be to the satisfaction and requirements of the EPA on advice of the DEP and WRC.	Having particular regard to: (a) the presence of soil contamination both on and off-site as a result of activities on the site; (b) concerns from other government agencies regarding the migration of contaminants; (c) the likelihood that the proposal to use a clay cap and cut off walls will achieve acceptable health and environmental criteria; (d) the preparation and implementation of an Environmental Management Plan (EMP) that discusses the management of soil contamination including detail of: (i) the ongoing management required; (ii) a definition of the criteria by which the "cap and contain" proposal is deemed to have failed health and environmental standards, thus triggering the contingency plan; and (iii) a contingency plan in case of failure; and (e) the proponent's expectation that the proposal will only reduce, rather than prevent the leaching of contaminants, it is the EPA's opinion that the proposal to contain the soil contamination on-site will meet the objectives for this factor.

Groundwater quality - delineation of plume of groundwater contamination	The area considered for assessment of this factor extends to a 1 500 metre radius around the site	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.	The results of previous groundwater sampling have not delineated the groundwater contamination plume. The limited sampling proposed in the CER would not be sufficient to accurately delineate the groundwater plume. The proponent has since committed to the preparation of an EMP that outlines the management of contaminated groundwater as it pertains to the delineation of the plume of contaminated groundwater. The monitoring programme will be implemented in stages and will monitor: • extent of groundwater contamination as defined by concentration of metals; • migration of the plume of contamination; • the composition of the drainage and surface water from the site.	Having particular regard to: (a) the contamination on-site that has leached into the groundwater causing a plume of contaminated water to extend from the site; (b) the results of groundwater sampling, that to date has not delineated the full extent of the groundwater contamination plume; and (c) the preparation and implementation of an EMP that outlines the management of groundwater quality as it pertains to delineation of the contaminated groundwater plume to an accuracy of approximately 500m, including detail of: (i) the investigation, modelling and monitoring that will be implemented to clearly delineate the nature and extent of groundwater contamination; (ii) identification of the existing plume; (iii) modelling of the predicted future nature and extent of the plume; (iv) the timeline for sampling and justification for varying monitoring; with the EMP being to the requirements of the EPA on advice of the DEP and WRC, it is the EPA's opinion that the proposal to prepare and implement an EMP to delineate the contaminated groundwater plume, as it currently exists and as it may be in the foreseeable future, will meet the objectives for this factor, provided that: (a) the land above the existing plume should be identified on a publicly available map as being unsuitable for beneficial use.

Groundwater quality - possibility of contamination of private bores	The area considered for assessment of this factor extends to a 1 500 metre radius around the site	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.	The City of Gosnells will undertake testing of water from private bores, where the bores are used for drinking purposes, within a 1 500 metre radius from the site. If the bores are found to be contaminated and where it can be shown that the contamination is a result of activities at the site, the City of Gosnells will provide an alternative drinking water source within two months The EPA is recommending that if an alternative water source is required, it should be provided by the proponent in accordance with the proposed conditions.. The Water Corporation has indicated that reticulated water will not be available in this area immediately. The EPA's recommendations have the objective of ensuring that no contaminated water is used for drinking purposes. The EPA has recommended that a monitoring plan be prepared to clearly identify the area that is affected by contamination. Residents above contaminated water will be notified. Results of monitoring will be publicly available.	Having particular regard to: (a) residents in this area not being connected to scheme water and the reliance of some on groundwater as their sole source of drinking water; and (b) statements in submissions indicating that the two month waiting period proposed by the proponent is unacceptable and requesting that an immediate safe drinking water source should be installed if groundwater is found to be contaminated, it is the EPA's opinion that the proposal will meet the objectives for this factor, provided that the proposal includes the preparation and implementation of an EMP should meet the requirements of the EPA on advice of the DEP and WRC and discuss the management of groundwater quality as it pertains to private bores, including detail of: (i) the location of private bores; (ii) the sampling regime that will be implemented:- (a) all private bores initially within a 1 500 metre radius of the site that are used for drinking purposes should be sampled as soon as possible but no later than within 3 months from the finalisation of the Environmental Conditions; (b) all bores in the area of land that may be affected by contaminated groundwater in the future should also be sampled; and (c) after the delineation of the plume of contaminated groundwater, all bores used for irrigation purposes should be sampled to determine levels of contaminants; (iii) the frequency of sampling:- (a) sampling should be repeated at least every 6 months until accurate delineation of the groundwater contamination plume is completed (as required in Section 3.3); (iv) provision of an alternative source of water: (a) if a bore used for drinking water is found to contain contamination levels higher than the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996), an interim source of water must be provided within 24 hours and an alternative source of water provided within seven days; (b) after the delineation of the plume of contaminated groundwater, all residents relying on groundwater for drinking purposes within this area should be supplied with an interim source of drinking water within 24 hours and an alternative source of water provided within seven days; and (c) if a bore used for irrigation purposes is found to contain contaminants that exceed levels as stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996) for irrigation water, an alternative source of water should be provided within 7 days.

- the monitoring of all bores used for irrigation purposes, initially within a 1 500 m radius of the site, then within the defined area of the groundwater contamination plume, to determine levels of contaminants. It contaminants exceed levels as stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996) for irrigation water, an alternative source of water should be provided within 7 days.

(c) The proponent's commitments should be made enforceable. Some commitments may be inconsistent with the above recommended conditions, however where there are any inconsistencies, the conditions and procedures will prevail to the extent of the inconsistency; and

(d) In order to manage the relevant environmental factors, to meet the EPA's environmental objectives, and to fulfil the requirements of the conditions and procedures in this statement, the proponent shall prepare environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority.

5.2 Procedures

In the EPA's opinion, this proposal should be subject to the following procedure:

(a) Appropriate measures should be put in place by the City of Gosnells and the City of Armadale in collaboration with the WRC so that additional groundwater bores are not permitted, either within a two kilometre radius of the site, or within the area accurately delineated as being affected by groundwater contamination, as defined by further studies required by proponent commitment 25.

6. Conclusion

The EPA has considered the proposal by the City of Gosnells to manage the environmental impact of a former liquid waste disposal site in Southern River Road, Gosnells. A consequence of the past land use of the site is the existence of soil contamination in the lagoon area and to a radius of 150 m, and groundwater contamination beneath the site with a plume extending to an unknown radius.

It is proposed that the issue of soil contamination be managed by the construction of a lined capping layer over the contaminated lagoon area, into which all contaminated soil from the site will be placed. The proponent has committed to the formulation of EMP's to manage contamination both on- and off-site. The EMP for the management of contamination off-site will address the ongoing monitoring of the viability of the clay cap and cut off walls and provide a contingency plan in case the strategy is deemed to have failed. The EMP for the management of contamination off-site will address the delineation of the plume of groundwater contamination through monitoring and sampling.

The proposal to rehabilitate the former liquid disposal site in Southern River Road, Gosnells, can be managed to meet the EPA's objectives, given the additional requirement to supply residents with drinking water, if necessary, at short notice in accordance with the conditions, the exclusion of groundwater bores within a defined radius of the site, and the implementation of the proposed commitments by the proponent.

7. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations:

1. That the Minister notes that this proposal is about managing a liquid waste disposal site so as to reduce the impact of the waste disposal elements on the environment.
2. That the Minister considers the report on the relevant environmental factors of soil contamination, and groundwater quality, both on and off site.
3. That the EPA has concluded that the proposal will improve the environment by reducing the impact of a former liquid waste disposal site, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 5.
4. That the Minister for the Environment imposes the conditions and procedures consistent with Section 5 and set out in formal detail in Appendix 4 of this report.

Appendix 1

List of submitters

State and local government agencies:

- Swan River Trust
- City of Perth
- Ministry for Planning
- Water and Rivers Commission

Organisations:

- Conservation Council of Western Australia Inc

Members of the Public:

- C & D Bailey
- Ms M Banks
- Ms C Cathie
- M & M Curran
- A & L Fedrici
- Ms M Germon
- M & D Gribble
- W & G Lawrence
- D E, C M, P D & V M Matthews
- S & E Morrison
- Mr J Prince
- P & J Rogers
- Mr D Walker
- J A & J E Baldwin
- Ms C Bevan
- M, C, G & M Crow & S McLean
- Mr B Dynon & Ms H Swan
- R & S Francis
- Mr P Goff
- Mr G Kemp
- A &T Lynch
- C & J McRae
- G & S Newman
- Ms J Renisch
- Mr S Ruscoe & Ms F Movalo
- R & D Wells

Appendix 2

References

References

ANZECC/NHMRC, (1992). *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.* Australian and New Zealand Environment and Conservation Council and National Health and Medical Research Council

City of Gosnells, (1996). *Former Liquid Waste Disposal Facility at Southern River, Consultative Environmental Review.*

DEP, (1997). *Contaminated sites; assessment and management of contaminated land and groundwater in Western Australia. A public position paper.* Department of Environmental Protection, Government of Western Australia. May 1997.

NHMRC, (1994). *Agricultural and Resource Management Council of Australia and New Zealand, Australian Drinking Water Guidelines - Draft.* National Health and Medical Research Council

NHMRC/ARMCANZ, (1996). *Australian Drinking Water Guidelines - National Water Quality Management Strategy.* National Health and Medical Research Council / Agriculture and Resource Management Council of Australia and New Zealand

Appendix 3

Draft environmental conditions and proponents commitments

REMEDIATION OF THE FORMER LIQUID WASTE DISPOSAL FACILITY, SOUTHERN RIVER ROAD, GOSNELLS (930)

CITY OF GOSNELLS

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to issues raised following public submissions, provided that the commitments are not inconsistent with the conditions or procedures contained in this statement. In the event of any inconsistency, the conditions and procedures shall prevail to the extent of the inconsistency.

The attached environmental management commitments form the basis for consideration by the Chief Executive Officer of the Department of Environmental Protection for auditing of this proposal in conjunction with the conditions and procedures contained in this statement.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 Groundwater Quality - delineation of plume of groundwater contamination

4-1 The proponent shall ensure that in the long term, water quality of the groundwater meets groundwater quality standards, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Water and Rivers Commission.

4-2 The proponent shall demonstrate through thorough investigations, modelling and monitoring, that leachate from the contaminants on the site will not be a source of groundwater contamination, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Water and Rivers Commission.

4-3 Within 3 months following the issuing of the final authority notice under Section 45(7) of the *Environmental Protection Act* 1986, the proponent shall prepare a Groundwater Management Plan (delineation of plume of groundwater contamination) (see proponent commitment no. 25), to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Water and Rivers Commission. This Plan shall include the following:

1 identification of the land above the contaminated groundwater and the provision of this information on a publicly available map;
2 provision of an interim source of drinking water within 24 hours and an alternative source of water within seven days of the delineation of the plume of groundwater contamination to all residents above the contaminated groundwater who are dependent on groundwater for drinking purposes;
3 monitoring of the groundwater in areas that may be affected by contaminated groundwater as a result of migration of contaminants off-site; and
4 provision of an interim source of water within 24 hours and an alternative source of water within seven days, if a bore is found to contain contamination levels higher than stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996).

4-4 The proponent shall implement the Groundwater Management Plan (delineation of plume of groundwater contamination) required by condition 4-3.

5 Groundwater Quality - possibility of contamination of private bores

5-1 The proponent shall demonstrate through thorough investigations, modelling and monitoring, that existing leachate from the contaminants on the site, transported by groundwater, does not have an adverse impact on people or the environment, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Water and Rivers Commission..

5-2 The proponent shall prepare a Groundwater Management Plan (contamination of private bores), to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Water and Rivers Commission. This Plan shall include the following:

1 the location of private bores;
2 sampling of all private bores that are used for drinking purposes, initially within a 1 500 metre radius of the site, as soon as possible, but no later than 3 months following the issuing of the final authority notice under Section 45(7);
3 repetition of sampling every 6 months until accurate delineation of the groundwater contamination plume is completed;

4 provision of an interim source of water within 24 hours and an alternative source of water within seven days, in the event that a bore within 1 500 metres of the site is found to contain contamination levels higher than stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996); and

5 the monitoring of all bores used for irrigation purposes, initially within a 1 500 m radius of the site, then within the defined area of the groundwater contamination plume, to determine levels of contaminants. If contaminants exceed levels as stated in the NHMRC /ARMCANZ Australian Drinking Water Guidelines (1996) for irrigation water, an alternative source of water should be provided within 7 days.

5-3 The proponent shall implement the Groundwater Management Plan (contamination of private bores) required by condition 5-2.

6 Environmental Management System

The proponent should exercise care and diligence in accordance with best practice environmental management principles.

6-1 In order to manage the relevant environmental factors, to meet the environmental objectives in Environmental Protection Authority Bulletin 8xx, and to fulfil the requirements of the conditions and procedures in this statement, prior to ground-disturbing activity, the proponent shall prepare environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority.

6-2 The proponent shall implement the environmental management system referred to in condition 6-1.

7 Commencement

The environmental approval for the substantial commencement of the proposal is limited.

7-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years.

8 Performance Review

The proponent should review the environmental performance of the proposal to ensure that the environmental management meets the environmental objectives and allows for continuous improvement.

8-1 Each six years following the commencement of construction, the proponent shall prepare and submit a performance review to evaluate the environmental performance, which shall include, but not be limited to:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 8XX;

2 proponent environmental management commitments made in the Public Environmental Review (etc), those made in response to issues raised following public submissions, and those published in Environmental Protection Authority Bulletin 8XX (as Appendix 3);

3 Environmental Management System environmental management targets;

4 Environmental Management Plans; and

5 environmental performance indicators,

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and where significant, recommend actions, to the Minister for the Environment following consideration of the performance review.

9 Compliance Auditing

To help determine environmental performance and compliance with the conditions, periodic reports on the implementation of the proposal are required.

9-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

2 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

3 The City of Gosnells and the City of Armadale, in collaboration with the Water and Rivers Commission and any other relevant agency, will put in place appropriate measures so that additional groundwater bores are not permitted, either within a two kilometre radius of the site, or within the area delineated as being affected by groundwater contamination, as defined by further studies required by condition 4-3.

Note

1 The Environmental Protection Authority reported on the proposal in Environmental Protection Authority Bulletin 8xx (December 1997).

Proponent's Environmental Management Commitments

REMEDIATION OF THE FORMER LIQUID WASTE DISPOSAL SITE

SOUTHERN RIVER ROAD, GOSNELLS (930)

CITY OF GOSNELLS

Proponent's commitments
Southern River Liquid Waste Disposal Site (Asst No 930)

1. A monitoring plan, as outlined in Section 7.1 of the CER for the above assessment, will be prepared and submitted to the Department of Environmental Protection for approval. The plan will be submitted to the DEP within 3 months of the release of the ministerial conditions for this CER. Implementation will begin within 3 months of the plan's approval by the DEP. All bore construction and monitoring will be funded by the City of Gosnells.

2. A detailed Site Management Plan will be prepared and submitted to the DEP for approval within 3 months of the release of the ministerial conditions for this CER. Implementation of the Management Plan will commence within 6 months of the DEP's approval. The preparation of the Management Plan and the implementation of the plan will be funded by the City of Gosnells.

   The Site Management Plan will detail:
   (1) the construction of a clay cap and cut-off walls (Section 6.3.1.1)
   (2) facilities to be used for the extraction of landfill gas (Section 6.3.4)
   (3) procedures for the excavation of contaminated soil from around the Site and placement of this contaminated soil under the cap (Section 6.3.3)
   (4) procedures for the excavation of metallic objects buried beneath the Site (Section 6.3.4).

3. The City of Gosnells will provide an alternative drinking water source to all existing households within the defined distance from the Site who currently rely on groundwater for drinking purposes and where the groundwater shows lead, arsenic, or chromium contamination in excess of NHMRC drinking water guidelines as a result of activities at the Site.

   The defined distance cited above will extend 1,500 metres radially from the Site. The City of Gosnells will review the defined distance as the results of the planned monitoring programme become available. Any changes to the defined distance will be subject to the approval of the DEP. The term "defined distance" as defined in this commitment has also been used in following commitments.

4. The City of Gosnells will test the groundwater of any household within the defined distance at their request provided that the groundwater is currently relied on for drinking purposes. The test will comprise one representative sample taken with the test commencing within 1 week of the request. If the test shows arsenic, chromium, or lead contamination at concentrations which exceed NHMRC drinking water guidelines and where the contamination is a result of activities at the Site, the City of Gosnells will provide an alternative drinking water source as described in Commitment (3). The City of Gosnells will perform the test up to twice annually. The sampling frequency will be reviewed as results of the monitoring programme become available. Any modifications to the sampling frequency will be subject to the approval of the DEP.

5. Where contamination above drinking water guidelines has been detected, the City of Gosnells will negotiate with the landowner to place a memorial on the title which informs prospective purchasers of the potential risks (Section 6.3.1.2). If the property is outside the City of Gosnells, the City of Gosnells will advise the relevant local government authority and recommend that the authority undertake a similar action or that the City of Gosnells undertake the negotiation on their behalf. All settlements would be funded by the City of Gosnells.

The memorial cited above would be removed and the supply of alternative drinking water discontinued when the results of ongoing monitoring indicate that the groundwater is no longer contaminated with arsenic, chromium, or lead at levels which exceed NHMRC drinking water guidelines.

6. The City of Gosnells will supply funding for a rainwater tank and tankered water as an alternative water source. This Commitment will be implemented within 2 months of the groundwater being identified as contaminated. Over the longer term, the City of Gosnells undertake to request the Water Corporation to provide scheme water to households close to the Site as part of the urbanisation of the Southern River area.

7. All landowners and households within the defined distance from the Site will be informed of: the potential risks associated with the use of groundwater for drinking purposes; the findings of the groundwater monitoring; and the commitments put in place by the City of Gosnells (Section 6.3.1.3). All notifications will be by means letter drops with each letter addressed to the individual household and landowner.

8. Where ongoing monitoring indicates that groundwater contamination exceeds NHMRC drinking water guidelines as a result of activities at the Site, those properties in the affected area will be notified within 2 weeks. The City of Gosnells will then negotiate with the landowner to place a memorial on the title advising prospective buyers of the risks associated with the use of groundwater for drinking purposes. The memorial would be removed when groundwater monitoring results indicate that the contamination no longer exceeds NHMRC guidelines.

9. For landowners and households within the defined distance of the Site who are currently using the groundwater for the watering of animals, and where these animals are not covered by ANZECC (1992), the City of Gosnells will, at their request and for the specified animal, determine guidelines for acceptable levels of arsenic, chromium, and lead in groundwater (Section 6.3.2). The guidelines will be based on a risk assessment using available data. The guidelines will be made available within 4 weeks of the request.

10. If the monitoring programme indicates that groundwater contamination which is a result of activities at the Site exceeds the ANZECC (1992) guidelines or the guidelines determined by the risk assessments cited in Commitment (9), the City of Gosnells will advise the affected landowners and households of: the level of contamination detected and the potential risks. The land owners and households will be advised within 2 weeks of the contamination being detected. (Section 6.3.2).

11. Where it becomes necessary to recommend that the groundwater is no longer suitable for irrigation or stock watering purposes as a result of activities on the Site, the City of Gosnells will negotiate with the land owner to place a memorial on the title of the property, advising of the condition of the groundwater. (Section 6.3.2)

    The memorial cited above would be removed when results from the monitoring programme indicate that the groundwater is suitable for irrigation and livestock purposes. (Section 6.3.2).

12. Soil contamination around the Site will be identified using a 25 metre grid survey (Section 6.3.3). All soil in which the contamination exceeds:
    - ANZECC B (1992) guidelines , or
    - Victorian EPA hydrocarbon cleanup criteria for the Bayside site,

    will be excavated and placed under the cap. Where ANZECC guidelines are not available, Dutch "B" (1990) will be used. The area around the Site will be validated using a second grid survey at 25 metres intervals. Details of the process to remove contaminated soil from around the Site will be incorporated into the Site Management Plan.

13. All metallic objects buried on the Site which were identified during the magnetic survey (Groundwater Technology, 1994) will be excavated (Section 6.3.4).

14. The City of Gosnells undertake to request the WA Planning Commission for a condition of subdivision that all residential developments within the defined distance from the Site include a hydrogeological study. The objective of this study would be to determine the impact of any changes to the groundwater table on the migration of contaminants from the Site. The investigation would also be required to confirm the suitability of groundwater for reticulation purposes within the development. (Section 6.4.1).

15. If the hydrogeological investigation identifies any aspect of the development as adversely affecting the migration of contaminated groundwater and thereby resulting in a health or environmental risk, and if this conclusion is supported by the regulatory authorities, the City of Gosnells would apply to the WA Planning Commission for a condition of subdivision which addresses these risks (eg a condition of subdivision which prohibits the construction of bores or the use of sub-soil drainage). (Section 6.4.1).

16. Where the hydrogeological study cannot eliminate the risk to prospective purchasers to the satisfaction of the regulatory authorities, the City of Gosnells will undertake to request the WA Planning Commission to place a memorial on title as a condition of subdivision that notifies prospective purchasers or landowners of potential risks associated with the contaminated groundwater. (Section 6.4.1).

17. Where the hydrogeological study cannot eliminate the risk arising from the development to existing residents to the satisfaction of the regulatory authorities, the City of Gosnells will withhold planning approval for the subdivision. (Section 6.4.1).

18. Where a lot is to be developed within the defined distance from the Site, the City of Gosnells will subject the approval of the development licence to the approval of the DEP. If the property is outside the City of Gosnells, the City of Gosnells will advise the relevant local government authority and recommend that the authority undertake a similar action. (Section 6.4.2).

19. The City of Gosnells will advise the Water and Rivers Commission and the Swan River Trust of the current extent of groundwater contamination and the results of ongoing monitoring. (Section 6.4.2).

20. The City of Gosnells undertake to request that the Water and Rivers Commission link the granting of bore licences in the defined area to potential adverse effects on contaminated groundwater movement. The need to perform a hydrogeological investigation to quantify the potential effects would be determined on a case by case basis by the City of Gosnells and the Water and Rivers Commission (Section 6.4.2).

21. The City of Gosnells will not approve any building application for a house if that house relies on groundwater for drinking purposes and if the groundwater contains contamination in excess of NHMRC drinking water guidelines. (Section 6.4.2).

22. The City of Gosnells will monitor any gases collected and vented from beneath the proposed capping until the contents of the gases and consequent risks are defined to the satisfaction of the DEP.

23. The City of Gosnells will undertake ongoing community consultation similar to that undertaken during the CER to present results from the proposed monitoring programme. Letter drops and meetings with members of the community affected would be undertaken at least annually.

24. An Environmental Management Plan (EMP) will be prepared to describe the management of soil contamination and include detail of ongoing management required, a draft definition of the criteria by which the proposal to cap and contain could be deemed to have succeeded or failed, and a contingency plan in case of failure. This EMP will meet the requirements of the EPA on advice of the Department of Environmental Protection (DEP) and Water and Rivers Commission (WRC). The EMP will be submitted to the DEP within 3 months of the release of the ministerial conditions for this CER. Implementation will begin within 3 months of the plan's approval by the EPA.

25. An EMP will be prepared to accurately delineate the contaminated groundwater plume to an accuracy of approximately 500 m as it currently exists and as it may be in the foreseeable future. The comprehensive investigation, modelling and monitoring plan will delineate the nature and extent of the contaminated groundwater plume to an accuracy of approximately 500 m, and model and identify areas that are at risk of being subject to contaminated groundwater in the future. The plan will detail the timing of sampling and basis for varying monitoring. This EMP will meet the requirements of the EPA on advice of the DEP and WRC. The EMP will be submitted to the DEP within 3 months of the release of the ministerial conditions for this CER. Implementation will begin within 3 months of the plan's approval by the EPA. All bore construction and monitoring will be funded by the City of Gosnells."