Proposed refuse disposal site, Lot 2170, Millar Road, Baldivis

City of Rockingham

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
of Perth, Western Australia
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Summary and recommendations

The City of Rockingham is seeking approval to build and operate a landfill to take waste from the City and, for a fee, waste from other councils. Hazardous and other forms of intractable wastes would not be accepted at the proposed landfill. The City of Rockingham has been considering developing a new site since 1986 and its existing site at Ennis Avenue is now full.

The way the landfill is designed and operated can significantly affect the environmental impacts. The Public Environmental Review for this proposal has 78 environmental commitments which describe how the City of Rockingham intends to manage likely environmental impacts of the proposal. A copy of the environmental commitments is in Appendix 1 of this report.

Regionalisation

The need for another landfill site in the south-west zone of the Perth metropolitan area was a major issue raised in public submissions about this proposal. The Health Department of WA is developing a policy regarding waste disposal in Perth and in 1988 issued a discussion paper to find out community response to a proposed policy. The Discussion Paper suggested that there should be fewer landfill sites in Perth, and that the remaining operating sites should be bigger. This would mean fewer sites which could potentially cause pollution in Perth and this was supported by the Environmental Protection Authority.

The Environmental Protection Authority, noting that the Health Department has to approve all refuse disposal sites in the State, considers **the need for an additional refuse site in the South-West metropolitan region at this time should be determined by the Health Department.** The need should be determined on the basis of the space available at other sites in the region and the likelihood that the policy proposed in 1988 will be implemented. With the current priority on alternative waste disposal options, Lot 2170 Millar Road may not be needed for many years.

As indicated in this report this proposal is environmentally acceptable. **The Authority suggests that this site could be earmarked for future development when existing sites are full.**

Protecting groundwater

The landfill is proposed to be built as a series of small cells lined either with clay or with high density polyethylene (HDPE - which is a plastic material). The liner would be designed to collect leachate generated and prevent groundwater contamination. Evaporation and recirculation of the collected leachate through the refuse is proposed, and this should ensure no off-site disposal of leachate is required. Evaporation ponds also are proposed to be lined.

Cells would be built on top of and next to one another until the height allowed is reached. As soon as practical after the maximum height is reached a "cap" designed to reduce the amount of water entering the rubbish and to allow shallow-rooted plants to grow would be built on top of the rubbish. By reducing the amount of water entering the rubbish, the amount of leachate is reduced and therefore the potential for groundwater contamination also is reduced.

The Environmental Protection Authority has made recommendations in regard to two technical matters, namely the separation between the base of the landfill and the highest known groundwater level and the frequency of monitoring of groundwater to check that the lining is working (See Recommendation 2). The Environmental Protection Authority has also made a recommendation which identifies responsibilities should groundwater pollution, unacceptable to the Authority, occur (See Recommendation 2). The Authority is satisfied that the environmental commitments adequately address other technical issues relating to groundwater.

Landfill gas

Landfill gas, which is produced by organic material in the rubbish rotting, contributes to the Greenhouse Effect. Burning (ie flaring) landfill gas reduces the Greenhouse impacts and gives heat which could be used. The City of Rockingham has proposed to monitor landfill gas

production every six months and envisages that the gas would be flared. Whilst the City's commitments provide an indication of what is proposed, the Environmental Protection Authority considers a more detailed plan should be prepared (See Recommendation 3).

Potential off-site impacts

The potential for off-site impacts to affect nearby conservation areas was a major issue raised in public submissions.

The proposed site design and method of operation should significantly reduce the level of odours, windblown litter, gulls and other vermin, dust and smoke often associated with landfill operations.

Only trucks would be allowed to dump at the tip face. A transfer station would be built at the site to accept rubbish delivered by people in cars and trailers.

The rubbish is proposed to be placed in a series of small "cells", which would be regularly compacted and covered with a layer of soil every three or four hours, or as necessary. This method of operation keeps the area of exposed refuse at any time down to about 100 square metres to minimise odour generation, pest problems, fire risks and the amount of litter which blows away. A small busy area of exposed refuse reduces feeding opportunities for pests. Portable litter fences would be erected downwind of the exposed refuse. Litter along site access routes would be regularly removed.

Dust would be controlled by sealing roads with bitumen and using water tankers, and by mulching and planting sites which could generate dust. No fires would be allowed, so smoke would not be a problem. Fire-fighting equipment would be located on-site so that fires in the area could be quickly put out.

The Environmental Protection Authority considers that off-site impacts likely from this proposal would result in minor but acceptable levels of impact on adjacent conservation areas.

Increased traffic flows would be during the day when most wallabies, kangaroos, possums and bandicoots living in nearby bushland are resting. Those animals which wander onto the road should be easily seen and avoided.

Information forwarded to the Authority in relation to the Black-gloved Wallaby suggests that conservation of this species could best be managed by creating a fenced reserve in System 6 area M 104. This option would not be adversely affected by the landfill proposal.

Conservation value of Lot 2170

The Environmental Protection Authority considers that there are enough conservation areas nearby to represent the conservation values of Lot 2170 in this region.

Buffer zone

During the first 10 years of operation no existing house would be nearer than one kilometre from the tipping area.

The nearest existing house is 250 m from the eastern boundary of Lot 2170. This would be too close if tipping began near the eastern boundary. When the City of Rockingham reviews its Town Planning Scheme the proximity of the nearest residences and the type of developments which could be allowed within 500 m of the site during the operation of the site should be further considered. The Authority considers that the indicative land use proposals shown in the Public Environmental Review would be acceptable in a buffer zone.

Post-closure management

When tipping stops at a site, the production of leachate and landfill gas does not stop. After a site closes leachate, landfill gas and the condition of the covering material must be monitored and managed until the waste has fully degraded (ie rotted).

The City of Rockingham recognised the need for post-closure management in the Public Environmental Review. The Environmental Protection Authority has made recommendations which would ensure responsibility for the site and post-closure management remain with the proponent (See Recommendations 4 and 5).

Recommendation 1

The Environmental Protection Authority concludes that the proposal by the City of Rockingham to construct and operate a solid (domestic) waste landfill site at Lot 2170 Millar Road, Baldivis is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **measures to protect groundwater from contamination by leachates and monitoring to ensure groundwater protection measures are working;**
- **management of methane emissions caused by waste degradation in the landfill to reduce Greenhouse gas impacts; and**
- **long term responsibility for the site.**

The Environmental Protection Authority concludes that the environmental factors mentioned above have been addressed adequately by either 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 Environmental Protection Authority's recommendations in this Assessment Report; and**
- **the proponent's commitments given in the Public Environmental Review (Appendix 1).**

Recommendation 2

The Environmental Protection Authority recommends that to protect groundwater:

- **there should be an adequate separation between the base of the landfill and the highest known groundwater level to the satisfaction of the Environmental Protection Authority on advice of Geological Survey of Western Australia and Water Authority of Western Australia;**
- **the frequency of monitoring of groundwater should be to the satisfaction of the Environmental Protection Authority on advice of the Chemistry Centre and Water Authority of Western Australia;**
- **should monitoring indicate groundwater quality is being unacceptably affected, as determined by the Environmental Protection Authority, the proponent should prepare and implement a strategy to further control leachates and clean-up groundwater contamination to the satisfaction of the Environmental Protection Authority on advice of the Water Authority of Western Australia.**

Recommendation 3

The Environmental Protection Authority recommends that prior to the commencement of tipping the proponent prepare and then subsequently implement a methane gas management plan to the satisfaction of the Environmental Protection Authority

Recommendation 4

The Environmental Protection Authority recommends that the proponent be responsible for construction, operation, decommissioning and post-closure management of the site until the waste has fully degraded, to the satisfaction of the Environmental Protection Authority.

Recommendation 5

The Environmental Protection Authority recommends that prior to closure of the site the proponent prepare and then implement a decommissioning and post-closure management plan to the satisfaction of the Environmental Protection Authority.

1. Introduction and background

The City of Rockingham has been looking for an alternative site to the existing Ennis Avenue refuse disposal site since late 1986. In October 1988 the then Shire of Rockingham referred to the Authority a proposal to establish a refuse site at Lot 291 Kerosine Lane, Baldivis, which is next to and south of Lot 2170. The Authority decided that the potential environmental impacts of the proposal did not warrant assessment under the Environmental Protection Act however the Authority provided advice to the Health Department in response to the refuse site management plan in March 1989. In August 1989 the Minister for the Environment, in response to the concerns of local residents and parliamentary representatives directed the Authority to assess the proposal under Part IV of the Environmental Protection Act. A Public Environmental Review level of assessment was set.

In January 1990 the City of Rockingham withdrew the Kerosene Lane proposal and referred this proposal to landfill at Lot 2170 Millar Road to the Authority. As the environmental issues for the Millar Road site were similar to the Kerosene Lane proposal a Public Environmental Review level of assessment was set.

In November 1988 the Health Department of WA released a "Discussion paper for a Metropolitan Waste Strategy" which, with the exception of the proposed strategy on recycling, was endorsed by the Authority. The Health Department have not yet issued policy statements following the discussion paper, however it has endorsed the concept of regionalisation of refuse sites in correspondence to both the City of Rockingham and the Authority.

2. Description of proposal

The proposal is to construct and operate a landfill to accept waste collected by the City of Rockingham and other Councils who, for a fee decided by the City of Rockingham, want to use the landfill for their waste (ie a regional site based on host/guest agreements). Hazardous and other forms of intractable waste would not be accepted at this site.

The landfill is proposed to be built in parts of Lot 2170 Millar Road Baldivis which have been quarried for limestone and sand. The City of Rockingham has negotiated with the quarry operator so that the hole left after quarrying has the right depth and shape for the landfill operation.

The landfill would be lined either with clay or with HDPE (a plastic material). The liner would be designed to ensure groundwater contamination does not occur and to collect any leachate generated. Evaporation and recirculation of the collected leachate through the refuse is proposed, and this should ensure that no off-site disposal of leachate is required. Evaporation ponds are also proposed to be lined.

Groundwater monitoring is proposed to check that the lining is working.

Only trucks would be allowed to dump at the tip face. A transfer station would be constructed at the site to accept rubbish delivered by surrounding residents in cars and trailers.

The rubbish is proposed to be placed in a series of small "cells", which would be regularly compacted and covered with a layer of soil every three or four hours, or as necessary. This method of operation keeps the area of exposed refuse small to minimise odour generation, pest problems and the amount of litter which blows away. A small busy area of exposed refuse reduces feeding opportunities for pests.

Cells are proposed to be built on top of and next to one another until the maximum height is reached. As soon as practical after this height is reached a "cap" designed to reduce the amount of water entering the rubbish and to allow shallow rooted plants to grow would be built on top of the rubbish. By reducing the amount of water entering the rubbish the amount of leachate is reduced which would therefore lessen the potential for groundwater contamination.

A 3 m high hill (ie a bund) is proposed to be built around parts of the site. The bund and a strip around the whole site would be planted with trees and shrubs so that the site does not look unsightly from the road or surrounding properties.

Dust is proposed to be controlled by sealing roads, using water tankers, using mulch and planting. No burning would be allowed, so smoke would not be a problem. Litter along site access routes would be regularly removed. Fire control equipment is to be located on-site.

Landfill gas, produced by degrading (rotting) organic material in the rubbish is proposed to be monitored. Landfill gas contributes to the greenhouse effect. Burning (ie flaring) landfill gas reduces the greenhouse impacts and gives heat which could be used.

The City of Rockingham has proposed to set up a complaints register which would be able to be inspected by the Environmental Protection Authority and Health Department of WA.

The City of Rockingham has acknowledged that certain responsibilities continue after the site is closed. For example leachate and landfill gas will continue to be produced until the rubbish has finished degrading and these need to be monitored and managed.

3. Existing environment

The existing environment is described in detail in the Public Environmental Review. Aspects of the existing environment particularly relevant to environmental assessment of the proposal include:

- The site is located in Tamala Limestone. Tamala Limestone is usually porous and fissured and does not absorb leachate pollutants travelling through it, so leachate from landfill could pollute groundwater if it is not collected.
- Groundwater levels get higher towards the east indicating that groundwater flows towards the west. The highest groundwater level, which is used to determine the height of the base of the landfill, is estimated to be 5m AHD (Above Height Datum or above sea level) on the eastern side and 3.5m AHD on the western side of Lot 2170. This landfill proposal is situated on the western third of Lot 2170.
- Western Mining Corporation is currently undertaking a clean-up operation of groundwater pollution caused by leakage of ammonium sulphate from its pond located next-to and west of Lot 2170 Millar Road, Baldivis (EPA, 1991). Concentrations of ammonium sulphate in the groundwater affected by the leakage are significantly greater than occur in landfill leachate. Groundwater to the east is of good quality.
- Approximately 30% of Lot 2170 has been affected by quarrying operations and the remainder of the site is proposed to be quarried.
- The Conservation through Reserves for Western Australia recommendations of the Environmental Protection Authority for System 6 recommended that the conservation values of two areas near the proposed site be protected. These areas are known as M 103 (Lakes Cooloongup and Walyungup) and M 104 (Reserves C31102 and C33581, Leda). Area M 104 is separated by an existing railway line and a regional road reserve from Lot 2170.
- The land around the proposed site is zoned Rural and the nearest residence is 250m from the eastern boundary of Lot 2170. Landfill operations are proposed in the western part of the site. The City of Rockingham structure plan for the area proposes that land to the east of the proposed site become a regional cemetery.

4. Public submissions

The Environmental Protection Authority required that a Public Environmental Review be prepared for the proposal. The availability of the Public Environmental Review for comment over an eight week period was advertised in 'The West Australian' and local newspapers and the document was circulated to relevant government agencies.

Prior to and during the submission period the City of Rockingham organised public meetings for Rockingham and for Kwinana residents to discuss the proposal and held a public information day at the Rockingham City Council office during the submission period.

A local community group, known as the Residents' Action Group for the Environment (RAGE) distributed about 47 different form letters which people could sign to indicate their agreement with the content of the letter. RAGE delivered 1,981 signed form letters to the Authority at the end of the public submission period.

The Authority received 17 submissions from members of the public and community groups, and six submissions from State and local government agencies.

A detailed summary of the points raised in the submissions and form letters is presented in Appendix 2. The following key topics were covered in the submissions and form letters:

- The need to consider alternative waste management options and alternative sites.
- The relationship of the proposal to strategies detailed in the Health Department's Discussion Paper for a Metropolitan Waste Strategy, particularly those strategies in respect to regionalisation.
- The adequacy of measures to protect groundwater from contamination.
- The potential for groundwater contamination and the effects contaminated groundwater could have on water resources, wetlands and conservation areas.
- Planning issues such as the distance between existing and proposed developments and the proposed site.
- The impact of the proposal on the image of Kwinana.
- Potential off-site impacts such as vermin, odour, smoke, litter, noise and dust and the relationship of these impacts to the method of operation of the site.
- The potential impact of the proposal on nearby conservation areas, populations of uncommon wallabies and the conservation value of the site itself.
- The need for a transfer station and a caretakers residence.
- Landfill gas management.
- Use, monitoring and management of the site after dumping stops.

The City of Rockingham's response to all the issues raised appears in Appendix 3. The response to submissions appears in two parts due to a misunderstanding by the City that only items of particular interest to the Authority needed to be addressed.

5. Environmental assessment

The Public Environmental Review for this proposal has seventy-eight environmental commitments which describe how the City of Rockingham intends to manage each environmental impact likely from the proposal. A copy of the environmental commitments is in Appendix 1 of this report.

The design and operation of a landfill site can significantly affect the level of environmental impacts.

The Authority considers that the environmental commitments detailed in the Public Environmental Review should ensure minimal environmental impacts from the proposed operation, and has therefore made only four recommendations. The Authority would like to commend the City of Rockingham and its consultants for producing a comprehensive list of commitments.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by the City of Rockingham to construct and operate a solid (domestic) waste landfill site at Lot 2170 Millar Road, Baldivis is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **measures to protect groundwater from contamination by leachates and monitoring to ensure groundwater protection measures are working;**
- **management of methane emissions caused by waste degradation in the landfill to reduce Greenhouse gas impacts; and**
- **long term responsibility for the site.**

The Environmental Protection Authority concludes that the environmental factors mentioned above have been addressed adequately by either 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 Environmental Protection Authority's recommendations in this Assessment Report; and**
- **the proponent's commitments given in the Public Environmental Review (Appendix 1).**

5.1 Regionalisation of landfill sites

Under the Health Act, the Commissioner for Health has to approve all refuse disposal sites in the State.

In November 1988 the Health Department of WA released a "Discussion Paper for a Metropolitan Waste Strategy" which detailed the Department's proposed policy on a wide range of waste management issues.With the exception of the proposed strategy on recycling, the strategy was endorsed and supported by the Environmental Protection Authority.

The Health Department has not yet issued policy statements following the Discussion Paper. However it has endorsed the concept of regionalisation of waste disposal sites in correspondence to both the City of Rockingham and the Authority.

The Environmental Protection Authority is keen to minimise the number of sites which have the potential to cause pollution in the metropolitan area. Each refuse site has the potential to pollute groundwater and generate landfill gas emissions which contribute to the Greenhouse Effect. Whilst there are other reasons which support having fewer, larger landfill sites servicing the metropolitan area it is on the basis of reducing the number of potentially polluting sites that the Environmental Protection Authority supports the concept of regionalisation described in the Health Department's Discussion Paper.

Guidelines issued to the proponent by the Authority for the Public Environmental Review requested that the proponent outline the need for the proposal, but did not specifically request that sites outside of the City of Rockingham be examined.

During preparation of the Public Environmental Review officers of the Authority communicated to officers of the City of Rockingham that the Environmental Protection Authority supported the Health Department's proposed regionalisation strategy because the Authority considers that the number of landfill sites in the metropolitan area should be minimised.

The Authority understands that other sites in the region have adequate space to accept waste from the City of Rockingham and that these sites could be better managed to reduce pollution if they were better utilised.

In view of the above the Environmental Protection Authority considers that **the need for an additional refuse site in the South-West Zone of the metropolitan region at this time should to be determined by the Health Department.**

As indicated in this report this proposal itself is environmentally acceptable. However with the current emphasis on alternative waste disposal options, Lot 2170 Millar Road may not be needed for many years. In the context of the South West Zone the Authority considers that **this site could be earmarked for future development when existing sites are full if implementation of this proposal is postponed.**

5.2 Groundwater protection

5.2.1 Potential for and impacts of groundwater pollution

The City of Rockingham has made the following commitments in the Public Environmental Review to limit the potential for groundwater pollution:

- Only municipal and inert industrial waste will be accepted.
- The landfill will be constructed as a series of sealed cells. Each cell will be connected to a leachate drainage system which will flow into a lined evaporation pond.
- Surface runoff from active tipping areas will be directed to the leachate drainage system.
- Materials used for cell construction will be tested to ensure they meet engineering criteria.
- Each cell will be covered with a material of low permeability to reduce the amount of rainwater flowing through the refuse. (Rainwater flowing through refuse becomes leachate).
- The refuse will be separated from the water table.

Provided there is adequate separation between the base of the refuse and the water table the Environmental Protection Authority considers that the measures proposed to prevent groundwater pollution are adequate.

Information from the monitoring of groundwater contamination which occurred as a result of ammonium sulphate leakage from the pond located next to and west of Lot 2170 has provided the Environmental Protection Authority with an understanding of groundwater movement and the likely direction of flow of any pollution which may come from the landfill. As noted in Section 3, Western Mining Corporation is currently undertaking a clean-up operation of this pollution. The Authority considers it is unlikely that any private bores or significant water resources would be adversely affected by pollution from landfill leachate if some unexpected leakage occurred through the landfill liner.

Correspondence received from Western Mining Corporation by the Authority notes that, based on the information provided in Figure D1 of the Public Environmental Review, the landfill operation should not adversely affect their clean-up operation. Figure D1 indicates there would be negligible loss of leachate to the environment for at least 15 to 20 years. The City of Rockingham has made a commitment to address remedial measures in conjunction with Western Mining Corporation and in consultation with the Environmental Protection Authority and Water Authority of Western Australia if unexpected leakage of leachate occurs.

Concentrations of ammonium in the groundwater affected by the leakage are significantly greater than occur in landfill leachate. The Environmental Protection Authority considers that dilution of pollutants from unexpected leachate leakage would ensure that impacts on nearby wetlands would be negligible.

5.2.2 Groundwater monitoring

Groundwater monitoring is necessary to make sure that the liner is working. The City of Rockingham has made several commitments in regard to groundwater monitoring including:

- installation of monitoring bores to the satisfaction of the Environmental Protection Authority and Water Authority of Western Australia;
- regular monitoring of a range of parameters at monitoring bores and private bores; and
- annual reporting of monitoring programmes to the Environmental Protection Authority and Health Department of WA.

The Environmental Protection Authority considers that, depending on the definition of 'regular' the proposed monitoring and reporting programme as described in the Public Environmental Review is adequate.

Recommendation 2

The Environmental Protection Authority recommends that to protect groundwater:

- **there should be an adequate separation between the base of the landfill and the highest known groundwater level to the satisfaction of the Environmental Protection Authority on advice of Geological Survey of Western Australia and Water Authority of Western Australia;**
- **the frequency of monitoring of groundwater should be to the satisfaction of the Environmental Protection Authority on advice of the Chemistry Centre and Water Authority of Western Australia;**
- **should monitoring indicate groundwater quality is being unacceptably affected, as determined by the Environmental Protection Authority, the proponent should prepare and implement a strategy to control leachates and clean-up groundwater contamination to the satisfaction of the Environmental Protection Authority on advice of the Water Authority of Western Australia.**

5.3 Landfill gas and the Greenhouse Effect

Landfill gas is about 50% methane (CH_4) and 50% carbon dioxide (CO_2) and is generated as a result of anaerobic (ie without oxygen) degradation processes within the landfill. It has been estimated that about 300m^3 methane is produced per tonne of refuse landfilled (Western Australian Greenhouse Co-ordination Council, undated), however the production rate depends on several factors including the moisture status of the waste. The Public Environmental Review indicates that more than 52 400 tonnes of waste are currently generated in the City of Rockingham each year. Therefore it is expected that about 15 million m^3 of methane could be generated from each year's dumping over the period of time it takes for the waste to degrade. This volume would increase as more refuse is dumped.

The long term relative contribution to global warming for each methane molecule is six times that of a carbon dioxide molecule. Burning one methane molecule produces one carbon dioxide molecule. Therefore, burning the methane produced in tips or preventing its generation through composting or recycling organic waste, is considered to be worthwhile.

A detailed study for the New Zealand Climate Change Programme (Australian and New Zealand Environment Council, 1990) looked at a range of waste management options from a Greenhouse perspective. It found that increased recycling coupled with capture of methane from landfill was the most effective option in reducing Greenhouse emissions. The study estimated that emissions could be reduced by 50% using this approach.

The 'Greenhouse Gas Audit for Western Australia', which has been endorsed by the State Government, concluded that by phasing out CFC and halon usage and reducing the production of methane from landfills the State government's goal of a 20% reduction in Greenhouse gas emissions could be met.

The City of Rockingham has made commitments that landfill gas production would be monitored at six monthly intervals and notes that it envisages that, initially, landfill gas would be disposed of by flaring. Whilst the City's commitments provide an indication of what is proposed, the Environmental Protection Authority considers a more detailed plan should be prepared.

Recommendation 3

The Environmental Protection Authority recommends that prior to the commencement of tipping the proponent prepare and then subsequently implement a methane gas management plan to the satisfaction of the Environmental Protection Authority

5.4 Operational practices and environmental impacts

The rubbish is proposed to be placed in a series of small "cells", which would be regularly compacted and covered with a layer of soil every three or four hours, or as the need requires. This method of operation keeps the area of exposed refuse small and it is expected that only about 100 square metres of rubbish would be exposed at any one time.

5.4.1 Gulls and other vermin

Rubbish covered with a layer of soil should be inaccessible to gulls and other vermin. The small active area of exposed rubbish should not provide many feeding opportunities for pests. The City of Rockingham has made a commitment to crush and bury any items of refuse which may provide refuge for pests. If these measures do not provide adequate control the City of Rockingham has made a commitment to implement supplementary control measures.

The City of Rockingham has also made a commitment to monitor gull populations from the outset of landfilling operations.

The Authority considers that the proposed operational practices would minimise any increase in gulls and other vermin around the site.

5.4.2 Odour

Regular covering of the refuse should minimise odour generation at the site. The City of Rockingham has made a commitment that particularly odorous refuse will only be accepted at the landfill by prior arrangement and that such material will be covered immediately.

5.4.3 Litter

The City of Rockingham has made a commitment to remove litter along site access routes. The proposed site security fencing, frequency of covering refuse, small area of exposed refuse, use of portable litter control screens near exposed refuse and proposed routine collection of litter from the security fencing and litter control screens should ensure windblown litter does not become an eyesore.

5.4.4 Fire

The City of Rockingham has made a commitment that no burning of refuse will take place. The City of Rockingham has also made a commitment that adequate fire fighting machinery will be located on-site and that during working hours adequate staff to respond to a fire will be on-site. The small area of exposed refuse and frequent covering would minimise the fire risk.

5.4.5 Visual aspects

A 3m high hill (ie bund) is proposed to be built around the parts of the site. The bund and a strip around the whole site would be planted with trees and shrubs so that the site does not look ugly from the road or surrounding properties.

5.4.6 Noise and dust

The City of Rockingham has made a commitment to ensure mufflers are maintained on machinery and to limit the hours of operation from 7am to 7pm. The Authority expects the proposed operation would comply with the noise regulations.

Several commitments have been made by the City of Rockingham to ensure dust levels are minimised including:

- areas disturbed during construction and stockpiles of sand or overburden will be stabilised with plants or by other means;
- unsealed trafficked areas will be watered;
- the active tipping area will be dampened as necessary; and
- wheel cleaning facilities will be installed for trucks using the site.

The Authority is satisfied that proposed dust control measures are adequate.

5.5 Impact of proposal on conservation values on and off site

As outlined in Section 5.4 above, most of the potential off-site impacts are proposed to be managed so that the actual impacts are minor.

The Authority considers the impacts on System 6 area M 104 are minor and acceptable.

Some public submissions suggested that the conservation value of Lot 2170 was sufficient to warrant rejection of the proposed landfill. The Conservation Reserves for Western Australia recommendations of the Environmental Protection Authority for System 6 recommended that the conservation values of two areas near the proposed site be protected. These areas are known as M 103 (Lakes Cooloongup and Walyungup) and M 104 (Reserves C31102 and C33581, Leda). Area M 104 is separated by an existing railway line and a regional road reserve from Lot 2170. The Authority considers that there are adequate conservation areas to represent the conservation values of Lot 2170 in this region.

The City of Rockingham has responded to the concerns regarding illegal dumping raised in the public submissions by undertaking to liaise with Westrail regarding the control of vehicular access across the railway line, which currently provides direct access to System 6 area M 104.

5.5.1 Effects on fauna

Fauna populations are unlikely to be significantly affected by vermin or disease that vermin may carry.

Rainbow Bee-eaters (referred to as Jubilee Birds in some public submissions) which migrate from Australia's north and New Guinea to breed in south-Western Australia would not be significantly affected by the proposal. New breeding sites may be established in the 3m landscaping bund which is to be built.

Whilst there would be a large increase in traffic flows, this would be during the day when most wallabies, kangaroos, possums and bandicoots are resting. Those animals which do wander onto the road during the day should be easily seen and avoided.

Information forwarded to the Authority in relation to the Black-gloved Wallaby suggested that conservation of this species could be managed by creating a fenced reserve. This option would not be adversely affected by the landfill proposal.

5.6 Buffer zone

The Environmental Protection Authority considers that, as an environmental protection objective, a minimum buffer zone of 500m should be established around landfill sites in rural areas. The area around Lot 2170 Millar Road is currently zoned 'Rural' and 'Public Purposes'.

Based on the staging plan to the year 2003 (See Figure 7 of the Public Environmental Review) and the map showing existing nearby residences (Figure 8 of the Public Environmental Review) no existing residence would be in the recommended buffer zone for at least the next 10 years. The impacts of the landfill operation would rarely be noticeable during this period at the nearest existing residences.

The nearest existing house is 250m from the eastern boundary of Lot 2170 which may be too close if tipping commences near the eastern boundary.

The Authority would discourage any land-use which could lead to complaints from people within 500 m of the active tipping area.

The Public Environmental Review indicates that the City of Rockingham is mindful of the need to maintain a buffer zone. The indicative land use proposals for the region (See Figure 9 of the Public Environmental Review) indicate that light industrial development and a regional cemetery are proposed adjacent to the site. No residential development is proposed within 500m of the site. The Authority considers that the indicative land use proposals shown in the Public Environmental Review would be acceptable in a buffer zone.

The City of Rockingham should give further consideration to the proximity of the nearest residences and what types of development could be allowed within 500m of the site when it next reviews its Town Planning Scheme.

5.7 Decommissioning and post-closure management

Management of the refuse site is necessary until the waste has fully degraded, which can be many decades after closure of the site for tipping. When the waste is fully degraded methane is no longer generated and pollutant concentrations in leachates reach levels which are not likely to have adverse impacts on the environment.

The City of Rockingham has recognised the need for management following closure.

The Authority considers that responsibility for post-closure management should remain with an agency or group of agencies which are accountable to the community, have a guarantied life and which can generate sufficient funds to manage the site until the waste is fully degraded. The proponent should have the ability to generate funds for post closure management during the site's operation. Therefore the Authority believes that the proponent should take responsibility for post-closure management.

Recommendation 4

The Environmental Protection Authority recommends that the proponent be responsible for construction, operation, decommissioning and post-closure management of the site until such time as the waste has fully degraded, to the satisfaction of the Environmental Protection Authority.

The strategy for decommissioning and post-closure management of the refuse site needs to be determined prior to site closure so that closure can take place in an orderly manner and so that the likely costs of post-closure management can be identified. The proponent may then incorporate such costs into the charges levied for waste disposal. Whilst early consideration of a decommissioning and post-closure management plan is desirable, the plan may need to be amended to reflect standards current at the time of closure.

A draft post-closure management plan should be forwarded to the Authority for comments when it is prepared and the final plan should be forwarded to the Authority for approval when it has been determined that the remaining tipping space is likely to be filled within two years.

Future use of the site must be compatible with the required post-closure management.

Recommendation 5

The Environmental Protection Authority recommends that prior to closure of the site the proponent prepare and then implement a decommissioning and post-closure management plan to the satisfaction of the Environmental Protection Authority.

5.8 Project detail and approval period

The Authority's experience is that it is common for details of a proposal to alter through the detailed design and construction phase. In many cases alterations are not environmentally significant or have a positive effect on the environmental performance of the project. The Authority believes that such non-substantial changes, and especially those which improve environmental performance and protection, should be provided for.

In the area of waste management, acceptable waste disposal practices have changed dramatically, particularly during the last 5 years. During the last 5 years the State Government has questioned whether using landfill is the most appropriate approach to waste management and has set a goal of reducing the amount of refuse going into landfills by 50% over the next decade. Five years ago the need to control landfill gas was not anticipated.

As an example of potential change, the Authority understands that in the United States, some landfills are adopting management practices which encourage rapid degradation of organic materials in the waste, rather than limiting the production of leachate and entombing the waste. Such an approach may, in future, prove preferable.

In view of the rapidly changing community expectations and standards the Authority believes 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.

6. Conclusion

The Public Environmental Review for this proposal has 78 environmental commitments which describe how the City of Rockingham intends to manage likely environmental impacts of the proposal (See Appendix 1 of this report) The Authority considers that the environmental commitments would ensure minimal environmental impacts from the proposed operation.

The Environmental Protection Authority concludes that the proposal by the City of Rockingham to construct and operate a solid (domestic) waste landfill site at Lot 2170 Millar Road, Baldivis is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- measures to protect groundwater from contamination by leachates and monitoring to ensure groundwater protection measures are working;
- management of methane emissions caused by waste degradation in the landfill to reduce Greenhouse gas impacts; and
- long term responsibility for the site.

The Environmental Protection Authority concludes that the environmental factors mentioned above have been addressed adequately by either 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 Environmental Protection Authority's recommendations in this Assessment Report; and
- the proponent's commitments given in the Public Environmental Review (Appendix 1).

7. Reference

Environmental Protection Authority, 1991 *Tailing pond rehabilitation project and effluent management system upgrade, Baldivis*. Bulletin 489.

Appendix 1

Proponents environmental commitments

9 COMMITMENTS

The Proponent, the City of Rockingham, provides the following commitments concerning the construction, operation and management of the proposed landfill within Loc. 2170 Millar Road, Baldivis.

9.1 General Commitments

1) The Proponent will adhere to the proposal as described in the Public Environmental Review (PER) and as assessed by the Environmental Protection Authority (EPA), and will fulfil the commitments made therein and summarized below.

2) The Proponent will develop, operate and manage the proposed landfill to the satisfaction of all relevant Government agencies including the following:

- EPA;
- Health Department;
- Water Authority; and
- Department of Conservation and Land Management.

3) The Proponent is committed to the maintenance and enhancement of waste recycling programmes within its municipal district and will ensure that ongoing practices at the landfill will facilitate the current programmes being implemented and the introduction of additional programmes such as composting.

4) As the proposed landfill is intended as a secure facility for the disposal of municipal and inert industrial waste only, the Proponent will ensure that hazardous or other forms of intractable wastes will be excluded from the site.

9.2 Design Features

5) The Proponent will progressively develop the landfill as a series of sealed cells, each cell sized to accommodate approximately one year's refuse, in accordance with the staging plan included in the PER (Figure 10).

6) As part of the initial site development, the Proponent will establish an on-site transfer station to obviate the need for direct public access to the tipping face.

7) If detailed planning for the landfill indicates the need to defer construction of the on-site transfer station, the Proponent will submit a supplementary report to the EPA and Health Department explaining consequential changes to the landfill operation, including specific operational and management practices to be implemented at the tipping face and arrangements for subsequent construction of the on-site transfer station. This report would be submitted to the EPA and Health Department prior to commencement of site development, and development would not commence until the EPA and Health Department were satisfied that the modified proposals included in the report were acceptable.

8) The Proponent will maintain a vegetated buffer zone around the perimeter of the landfill site, being a minimum of 40 m in width on the Millar Road boundary and a minimum of 20 m in width on all other boundaries. The buffer zone will be comprehensively landscaped and will contain a perimeter fence, a firebreak track, and a 3 m high earth bund, these features being progressively established during ongoing development of the site.

9) The Proponent will implement site security measures to control vandalism, theft and illegal dumping, including the progressive construction of a 2 m high wire mesh fence with lockable gates around landfill facilities, a trench/bund "vehicle trap" in areas of the site associated with the landfilling operation but not initially enclosed by the 2 m fence, and closure to traffic of the access track along the western boundary of Loc. 2170.

9.3 Development and Operational Features

Site Preparation

10) The Proponent will ensure that, prior to the commencement of construction of the landfill cells, the final excavated quarry surface is graded to allow gravity drainage across each of the landfill cells, while maintaining of minimum 2 m vertical separation between the final excavated surface and the water table.

Cell Sealing

11) During development of landfill cells, the Proponent will ensure that a one metre thick compacted clay liner will be constructed over the excavated surface, giving a minimum 3 m separation above the water table. A 300 mm underdrainage blanket will be installed on the upper surface of the clay liner as part of the process of constructing the liner (refer to Commitment 17).

12) The Proponent will ensure that clay sources used in construction of the landfill cells will meet the following specifications, under both laboratory and field conditions as appropriate:

- in situ permeability of 1 x 10^{-7} cm/sec or less when clay is placed and compacted; and
- gypsum content of less than 1%.

13) The Proponent will ensure that both the excavation of clay for the landfill cell liner, and the construction of the clay liner, will be supervised by suitably qualified geologists or engineers to ensure that only materials that have been tested and found suitable are utilized.

14) The Proponent will ensure that, during development of the landfill cells, the liner will be constructed and compacted in thin layers (no more than 150 mm loose thickness) and density and moisture content will be controlled by continuous compaction testing.

15) The Proponent will ensure that, prior to deposition of refuse within a landfill cell, a starter embankment of 2 m height will be constructed around the perimeter of the liner to prevent leachate and stormwater from leaving the active cell. Construction techniques and controls for the starter embankment will be similar to those applying to the clay liner.

16) The Proponent will ensure that, on construction of the clay liner (and underdrainage blanket) and starter embankment, a 300 mm sand or soil cover, compacted and wetted, will be placed to provide protection against cracking of the clay material resulting from desiccation. Water application, to control variations in moisture content within any area of clay liner or starter embankment constructed substantially in advance of landfilling will continue as necessary.

17) In the event that a suitable clay source for construction of the basal liner of a landfill cell or cells and the starter embankment, is not accessible, the Proponent will utilize a barrier membrane to seal the landfill cell or cells. In this event, the Proponent will submit a supplementary report to the EPA and Health Department specifying the liner system to be used and explaining the leachate collection system to be installed. This report would be submitted to the EPA and Health Department prior to commencement of construction of the cell or cells in which the alternative lining system was to be installed, and construction of the cell or cells would not commence until the EPA and Health Department were satisfied that the systems proposed were acceptable.

Leachate Collection

18) The Proponent will ensure that a leachate collection system comprising a 300 mm deep permeable (permeability rating of 1×10^{-1} cm/sec or less) underdrainage blanket (placed immediately above the basal clay liner) and a series of drains consisting of high strength drain coil pipe encased in aggregate filled, filter fabric lined trenches will be installed in conjunction with construction of the clay liner. The liner will be graded to ensure flow of leachate to the drains.

19) The Proponent will ensure that leachate collection drains will gravity feed to a pond (lined with PVC covered with a 200 mm protective layer of sand) located on the perimeter of the currently active cell, and constructed at the same time as the clay liner. The design storage volume of the pond will be for a one in 100 year storm event of 24 hours' duration and a one in 10 year event of one hour's duration.

20) The Proponent will ensure that leachate collected will be disposed of by recycling through the refuse by pumping through an irrigation system onto the active landfill cell (only if wind conditions will not cause excessive dispersion of the leachate), and evaporation from the collection pond.

21) The Proponent will ensure that, on decommissioning of a completed landfill cell, the pond serving that cell will be drained and backfilled, and the leachate drains will be connected with the drains in the adjacent newly opened cell allowing continued collection of leachate from finished cells.

22) The Proponent will ensure that, at the earliest opportunity as determined by the progress of the extractive industry operation, a permanent leachate disposal/evaporation pond will be constructed to service all landfill cells. The permanent pond will be of similar construction to the temporary pond (i.e. PVC sealed and covered with a protective layer of sand). On construction of this pond, leachate collection drains from all completed landfill cells will be connected to the pond. Leachate collection drains from all cells developed subsequent to construction of the permanent pond will be connected to the pond from the outset. The permanent leachate disposal/evaporation pond will be sized on the basis of a water balance including incident rainfall during a 90 percentile wet year combined with anticipated rates of leachate generation and evaporation.

23) As part of normal site operational practices, the Proponent will ensure that sediments will be removed from the permanent evaporation pond as required for disposal within the active landfill cell. The Proponent recognizes that the removal of sediments from the pond, and their disposal, will be a continuing requirement following closure of the site. Following closure of the site, disposal of the sediments will occur in a manner satisfactory to the EPA and Health Department.

Peripheral Embankment Construction

24) The Proponent will ensure that, as the initial refuse storage capacity within an active landfill cell (provided by the clay starter embankments) is progressively utilized, lifter embankments and (where relevant) the bund parallel to the quarry wall, will be progressively constructed. The lifter embankments and side bund will be constructed by the placement of thin layers of earthfill, suitably moisture conditioned and compacted. As each lifter embankment is completed, drainage paths will be constructed, and the outer face vegetated to prevent erosion.

25) During progressive development of the operational landfill cell, the Proponent will ensure that a PVC liner will be incorporated into lifter embankment to limit rainfall infiltration into the landfill during the period in which the outer face is exposed prior to construction of the adjacent cell. The PVC liner will be near horizontal but graded to the outside of the cell to allow drainage of infiltrating water away from the emplaced refuse.

Placement and Compaction of Refuse

26) During operation of the site, the Proponent will ensure that refuse will be progressively placed and compacted into thin layers of approximately 500 mm compacted thickness. A dedicated refuse compacting machine will be used to achieve average compacted refuse densities of approximately 850 kg/m^3.

27) During operation of the site, the Proponent will ensure that compacted refuse will be covered with 200 mm of clean material, to provide an effective cover of at least 100 mm, at 3 - 4 hourly intervals.

Cell Completion

28) The Proponent will ensure that, upon completion of refuse deposition, landfill cells will be covered with a layer of granular material, bedding sand (below and above the barrier membrane), a composite barrier membrane of low permeability, further granular material, and a final layer of soil suitable for vegetation establishment.

29) The Proponent will ensure that, as part of ongoing operational practice, the final landfill surface will be constructed to a predetermined crossfall to enhance surface runoff while safeguarding against erosion, and to ensure that final contours of the site will not constrain future use for light industry.

30) The Proponent will ensure that, on completion of each landfill cell, shallow rooted native vegetation (in accordance with advice from the Department of Conservation and Land Management) will be established and maintained.

Surface Water Runoff

31) During the active operation of a landfill cell, all surface water runoff from within the active cell will be treated as leachate and the Proponent will ensure that it will be collected and disposed of through the leachate drainage system.

32) The Proponent will ensure that a site drainage system which will direct runoff water from the outer slopes of active landfill cell embankments, and from the surface of completed landfill cells, away from active tipping areas will be progressively installed as the site is developed. As water from this system will not have contacted refuse, it will be uncontaminated and will be disposed of by ground infiltration.

Landfill Gas Collection

33) The Proponent will ensure that, although the rate of gas production will be minimized by restricting the amount of water entering the landfill cells, landfill gas monitoring bores will be installed immediately upon closure and capping of each cell.

Road Construction and Maintenance

34) The Proponent will ensure that the main site access from Millar Road is constructed as a one-way system, with separate entry and exit points to reduce cross traffic movements, and that marked turning and passing lanes will be provided to assist traffic movement on Millar Road.

35) A separate access to the WA Limestone quarry will be constructed by the Proponent in conjunction with initial development of the landfill facility.

36) The Proponent will ensure that, from the outset of the landfill operation, all roads to be used by the public for access to the site, and at the transfer station, will be sealed.

37) The Proponent will ensure that surface runoff from internal roads within the landfill site will not contact refuse and will be directed to on-site infiltration basins.

38) The Proponent will ensure that a water tanker will be permanently on-site and available for dust suppression on all unsealed trafficked areas during dry periods or as required.

Wheel Cleaning Facilities

39) As part of the initial site development, the Proponent will ensure that a wheel cleaning grid is installed on the egress from the landfill cell area to dislodge debris and sediment from vehicle wheels. Debris collected in the grid sump will be regularly removed and disposed of within the active landfill cell.

Water Supply

40) The Proponent will comply with all requirements of the Water Authority regarding the siting, construction and licencing of on-site production bores.

9.4 Management of Environmental Impacts

Water Resources

Commitments regarding Cell Sealing and Leachate Collection also pertain.

41) The Proponent will ensure that a site drainage system that will divert clean surface runoff away from areas receiving refuse, for disposal by ground infiltration, will be progressively installed in conjunction with establishment of landfill cells.

42) The Proponent will provide Western Mining Corporation Limited (WMC) with information on total organic carbon and ammonia-nitrogen levels in groundwater samples from monitor bores along the western boundary of Loc. 2170 as soon as practicable following receipt of analytical results. If the levels of these parameters are of concern to WMC, the Proponent will address remedial measures in conjunction with WMC and in consultation with the EPA and Water Authority as appropriate.

Odours

Commitments regarding Cell Sealing, Leachate Collection, and Water Resources also pertain.

43) The Proponent will ensure that particularly odorous refuse will only be accepted at the landfill by prior arrangement and that any such material received will be covered immediately.

Litter

Commitments regarding Placement and Compaction of Refuse also pertain.

44) The Proponent will initiate and maintain a programme to educate the public of obligations under the Litter Act as an adjunct to establishment of the landfill facility.

45) In the event that littering along access routes to the landfill site becomes a problem, the Proponent will pursue prosecution of offenders under the provisions of the Litter Act as rigorously as possible.

46) The Proponent will ensure that any landfill related litter along the site access routes is regularly removed.

47) The Proponent will ensure that, as part of normal operational practices, portable litter control screens will be placed in the vicinity of the active tipping face to intercept any material blown from the tipping face.

48) The Proponent will ensure that, as part of normal operational practices, any litter blown from the tipping face and intercepted by the portable screens, the site security fence or perimeter vegetation will be routinely collected and returned to the tipping face.

Noise

Commitments regarding Design Features (perimeter buffers and earth bunds) also pertain.

49) The Proponent will ensure that all vehicles and machines operating at the landfill site and which are under its control will be fitted with effective exhaust system silencers.

50) The Proponent will limit the daily hours of operation of the landfill to between 0700 and 1900 hours.

Dust

Commitments regarding Design Features (perimeter buffers and earth bund), Road Construction and Maintenance, and Wheel Cleaning Facilities also pertain.

51) The Proponent will, during initial site development and as part of normal operational practices, ensure the stabilization by vegetation or other means of disturbed areas not immediately needed for landfill operations.

52) As part of normal operational practices, the Proponent will ensure that any unsealed trafficked areas are watered as necessary to lay dust.

53) As part of normal operational practices, the Proponent will ensure that:

- the active tipping area will be dampened (either by leachate irrigation or water application) as necessary to lay dust; and
- overburden, cover material stockpiles will be stabilized with temporary cover vegetation, mulching, watering or other technique to suppress dust generation.

54) The Proponent will ensure that if a clay lined landfill cell has to be constructed substantially ahead of use and a protective cover layer has been placed to protect the liner from desiccation, the cover material will be stabilized with a temporary cover crop, watering or some other technique.

Pest Species

Commitments regarding Placement and Compaction of Refuse also pertain.

55) The Proponent will ensure that, as part of normal operational practices, any large appliances, crates etc. placed in the active tipping area will be specifically crushed before covering with refuse and cover material, and that any tyres dumped will be spread out and carefully covered.

56) The Proponent will implement supplementary control measures directed towards specific pest species on an as-required basis in consultation with, and to the satisfaction of the EPA, Water Authority, Department of Conservation and Land Management or other relevant regulatory authority.

Landfill Gas

Commitments regarding Landfill Gas Collection also pertain.

57) The Proponent will liaise with the relevant authorities regarding the beneficial use of landfill gas but envisages that, initially, gas will be disposed of by flaring. When monitoring results indicate that action to manage landfill gas emissions is warranted, the Proponent will determine what this action should be through consultation with the EPA and other relevant authorities.

58) The Proponent will co-operate with Government agencies wishing to undertake investigations into the stimulation of methane generation at landfills.

Fire

Commitments regarding Placement and Compaction of Refuse, Landfill Gas Collection, and Landfill Gas also pertain.

59) The Proponent will ensure that, from the outset of the landfill operation, site operational and management practices will not include utilization of fire except for the controlled flaring of landfill gas.

60) The Proponent will ensure that, from the outset of the landfill operation, adequate manpower and machinery resources to combat any fires which may occur within the landfill site will be maintained on-site during operating hours.

Social Impacts

Effectively all commitments given pertain directly or indirectly to the amelioration of social impacts.

9.5 Environmental Monitoring

Water Resources

61) The Proponent will progressively construct a series of dedicated groundwater monitoring bores to specifications acceptable to the EPA and Water Authority. It is anticipated that monitor bores will need to be installed at about 50 m intervals along sections of the site boundary down hydraulic gradient from areas used for landfilling.

62) On commissioning of each monitor bore, groundwater will be sampled and analysed for a range of potential contaminants to provide background information on groundwater quality. Parameters determined will include pH, salinity (as TDS), redox potential, major ions, nutrients, total organic carbon, and heavy metals.

63) The Proponent will implement a programme of regular sampling from the monitor bores. This programme will be determined by the site hydrogeological conditions although initially, sampling on a three monthly basis is envisaged. Water samples collected will be analysed for a select range of parameters. These will include pH, salinity (as TDS), iron, total organic carbon, five day biochemical oxygen demand, ammonia-nitrogen, and total alkalinity.

64) The Proponent will sample privately owned bores on selected properties in the vicinity of Loc. 2170, initially on an annual basis, and analyze samples for a select range of parameters. These will include pH, salinity (as TDS), and ammonia-nitrogen.

65) Groundwater samples will be collected and analysed in accordance with recognized standard procedures, and to the satisfaction of the EPA and Water Authority.

66) Should groundwater analyses indicate contamination by landfill leachate, the Proponent will immediately undertake further sampling and analysis for a more extensive range of parameters in consultation with, and to the satisfaction of, the EPA and Water Authority.

67) Any compliant about a deterioration in groundwater quality attributable to the landfill operation will be immediately investigated by the Proponent in consultation with, and to the satisfaction of, the EPA and Water Authority.

68) As soon as leachate is detected in the temporary collection ponds, and thereafter in conjunction with the groundwater monitoring programme, samples will be collected and analysed for comparison with anticipated leachate chemistry. Continuing sampling and analysis will be co-ordinated with the groundwater monitoring programme, and analytical results will be included in the periodic performance reports.

Other Environmental Monitoring

69) From the outset of the landfill operation, the Proponent will maintain a complaints register in which details of any complaints from local residents, within the Rockingham and Kwinana municipalities, about the landfill operation will be recorded.

70) From the outset of the landfill operation, access routes to the landfill site will be regularly inspected by City of Rockingham officers to determine whether landfill related littering is occurring along those routes.

71) The Proponent will monitor the activity of Silver Gulls at the landfill site, from the outset of landfilling operations, in consultation with, and to the satisfaction of, the Department of Conservation and Land Management.

72) The Proponent will measure landfill gas flow rates at six monthly intervals following the completion and capping of individual landfill cells. Results will be forwarded directly to the EPA and will also be incorporated into the periodic performance reports.

9.6 Performance Reporting

73) The Proponent will submit annual performance reports to the EPA and Health Department within three months following each anniversary of the commencement of the landfilling operation. These reports will address such matters as:

- the stage that has been reached in the various operational and management programmes being implemented;
- results from monitoring programmes instituted, including the complaints register, and the response to any complaints received;
- modifications to the various programmes that have been implemented in response to monitoring results;
- any unforeseen or extraordinary event associated with the landfill that adversely affected off-site environmental quality (and the Proponent's response to that event) occurring during the preceding twelve months.

The final report submitted during a reporting period will provide a detailed review of performance over the entire period and of any modifications to operational and management programmes intended.

74) The Proponent will respond, through an interactive process with the EPA and Health Department, to any issues those agencies may raise following receipt of the performance reports.

75) At the same time the periodic performance reports are submitted to the EPA and Health Department, the Proponent will make the reports available to relevant community organizations within both the Rockingham and Kwinana municipal districts.

76) Any unforeseen or extraordinary events associated with the landfill that adversely affect off-site environmental quality, and the Proponent's response to any such event, will be reported immediately (by the Proponent) to the EPA and Health Department.

9.7 Contingency Planning

77) The Proponent will respond to any unforeseen contingency associated with the landfill and which is producing a demonstrable and unacceptable off-site impact in consultation with the EPA and Health Department, and to the satisfaction of the Minister for the Environment as appropriate.

9.8 Management Following Closure

78) The Proponent recognizes that certain management responsibilities will continue following closure of the landfill site and will ensure that such responsibilities will be discharged in consultation with the relevant regulatory authorities (presently the EPA and Health Department).

Appendix 2

Summary of public submissions

PROPOSED REFUSE DISPOSAL FACILITY, LOT 2170 MILLAR ROAD, BALDIVIS

SUMMARY OF PUBLIC SUBMISSIONS

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1 Need for the proposal

1.1 Need for the proposal - Alternative waste management options

1.1.1 Tips are antiquated technology/pre-historic/out-of-date, should use state-of-the art high-technology methods as used in many European countries/ recycling & composting.

1.1.2 Landfill is the "canine solution" to waste management and should end.

1.1.3 Other disposal options dismissed too easily (See Page 12 of PER).

1.1.4 Only lip service given to National Waste Minimisation Strategy.

1.1.5 Government should legislate for "clean production" so refuse sites not needed.

1.1.6 Waste minimisation, composting & recycling should be used/investigated. These options could reduce waste stream by 90% so there would be no need for tip.

1.1.7 Composting is a viable alternative if heavy metal problems can be resolved; There is a ready market for the product as compost can reduce water usage etc.

1.1.8 Recycling industries should be established in IP14.

1.1.9 No need for tip and associated risk of groundwater pollution if recycling implemented.

1.1.10 Landfills are an environmental hazard; Should use more friendly methods such as recycling/composting.

1.1.11 Economics of tip and alternatives not adequately costed.

1.1.12 Permitting tips such as this discourages waste minimisation and recycling programmes

1.1.13 Rockingham should be given targets for waste reduction.

1.1.14 Issue of an inner city transfer station has not been discussed; would be reduce traffic flows along Miller Rd.

1 1.15 A new landfill site is urgently needed in Rockingham.

1.2 Need for the proposal in a regional context

1.2.1 No demonstrated need for an additional refuse disposal site in the South West Metropolitan Region; there is sufficient existing refuse space.

1.2.2 Proponent does not consider areas or options outside of the City of Rockingham boundaries.

1.2.3 Rockingham should be made to dump at Cockburn.

1.2.4 Rockingham, Kwinana & Cockburn should form a Regional Council, close Ennis Rd, establish a joint transfer station at Kwinana & dump at Henderson.

1.2.5 As above but could perhaps use Thomas Rd site as interim site until transfer station established.

1.2.6 Mandurah, Rockingham & Kwinana could form a Regional Council.

1.2.7 Rockingham should use Henderson landfill and a transfer & recycling station should be located at Ennis Road.

1.2.8 Kwinana has offered use of its tip as an interim measure; this tip is not necessary.

2 Relationship of proposal to regionalisation policies

2.1.1 Proposal not consistent with Metropolitan Waste Strategy.

2.1.2 Regionalisation should be upheld/implemented by the Health Department of WA/EPA/State Government/relevant Minister.

2.1.3 Regionalisation should be immediate.

2.1.4 Concerned tip is City of Rockingham proposal, not a Regional Council proposal - "who are they going to be regional with?

2.1.5 Host-guest relationship proposed has several limitations; should be managed by a Regional Council.

2.1.6 Concerned Rockingham will not be able to meet commitment because of the cost and will ask for a relaxation of environmental controls. Millar Rd is a costly option. A public enquiry is needed to address this issue.

2.1.7 "Lone Ranger" approach by Rockingham not appropriate or viable.

2.1.8 A State Waste Management Authority is needed; local councils not appropriate because of economies of scale.

2.1.9 Proposal pre-empts regionalisation by taking into account Kwinana's waste volumes.

2.1.10 Does not take into account Sinclair Knight waste management report/discussion paper.

2.1.11 Existing sites should be capitalised before next site considered.

3 Alternative sites

3.1 Consider site is appropriate, being rural, separated from housing by ground contours, a railway reserve and vegetation.

3.2 Full and adequate feasibility of alternative sites not done.

3.3 Alternative sites report rejects sites because of soil type, but this site is to be lined and soil type is almost irrelevant.

3.4 Suggestions include; Alcoa Red Mud Lakes (which are already lined and do not leak); SECWA Flare Ash Dump; Quarry site on Postans Road; Reserve 21815 Moylan Rd Kwinana; Quarry sites in Kwinana Industrial Strip; sites along Mandurah Road; and East Rockingham with other industries.

4 Adequacy of report

4.1 In sufficient detail to make a full counter-submission.

4.2 Environmental issues recognised but not addressed.

4.3 Does not adequately deal with alternative sites & methods, liaison with other Councils, town planning issues, types of waste, climatic factors and noise; therefore PER should be considered legally null and void.

4.4 PER assessment based on assumption that whole of site will be quarried. This is not necessarily so.

4.5 Disagree with statement that environmental issues can be addressed by sound design and operation.

4.6 Present state of knowledge inadequate to predict long term impacts; concerned unexpected impacts may occur.

4.7 Public enquiry needed to investigate alternative sites & options.

4.8 Public enquiry needed to determine what sort of waste management system people want.

4.9 Public enquiry needed to explain why regionalisation not be implemented/pursued.

5 Consultation

5.1 Happy with level of publicity given to proposal; surprised by adverse reaction to proposal by Leda residents; we are in favour of the proposal.

5.2 Wish to thank EPA for keeping us informed after our interest in Kerosene Lane.

5.3 PER omits to note objections from the Town of Kwinana.

5.4 Emotionally expressed arguments should be investigated for factual basis.

6 Groundwater contamination and related issues

6.1 General comments

6.1.1 Refuse site leachate ammonia concentrations probably several orders of magnitude less than from the WMC tailings dam so downstream impacts negligible in this respect.

6.1.2 Statement that "most potential leachate contaminants will probably not penetrate very far into aquifer" subjective and should be substantiated with scientific tests.

6.1.3 Rockingham tip does not have same measures as Cockburn to prevent groundwater pollution so leachate will pollute wetlands and private bores.

6.1.4 Health impacts of contaminated groundwater should be considered (See also 6.3.3).

6.2 Groundwater levels

6.2.1 Eleven years of monitoring at WMC ponds insufficient to predict highest known groundwater table; with a 1 in 100 year rainfall, the water table could rise and significant contamination could occur.

6.2.2 Records indicate maximum groundwater levels are up to 5 m AHD, not 2.5 m as stated in the report.

6.2.3 Quarrying will go to depths of 2 m AHD so there will be almost no barrier between the rubbish and the groundwater.

6.3 Impact on water resources, wetlands and conservation areas.

6.3.1 Site is located on Stakehill mound which is a future water source for Rockingham/Baldivis.

6.3.2 Groundwater should be protected at all costs, especially as there are users of this resource nearby; the tip should not be built.

6.3.3 Concerned groundwater flow may not be strongly westward & that plume could be wide and affect nearby bores, affecting drinking water resources, food production (fruit, vegetables, and livestock) and nurseries.

6.3.4 Groundwater flow is the NW & SW and will therefore affect downstream wetlands & System 6 areas M103 &M104.

6.3.5 Leaching from the tip would pollute/adversely affect wetlands and their associated flora and fauna; Is difficult to clean-up plume.

6.4 Effects on WMC plume and remediation programme

6.4.1 No practical solutions provided for potential effects of elevated TOC and ammonium-nitrogen levels on WMC's reverse osmosis plant. PER should identify the problem and its extent. Assurance that problems would be resolved insufficient (Pg 55, 6.2.1).

6.4.2 Elevated ammonia-nitrogen levels could effect proposed groundwater recharge schemes to protect Lake Cooloongup.

6.5 Monitoring and management

6.5.1 EPA Bulletin 489 in respect of clean-up of WMC pollution illustrates difficulty in cleaning up contaminated groundwater. Concerned tip will make problem worse; no further contamination should be permitted.

6.5.2 Extensive groundwater monitoring should detect groundwater contamination.

6.5.3 No plan for action if contamination detected. (Pg 81, S 67)

7 Planning issues

7.1 General comments

7.1.1 Tip site is inconsistent with surroundings (ie the rural atmosphere).

7.1.2 Location of tip contradicts good town planning.

7.1.3 Should be a full & proper enquiry into land use/development in Rockingham area.

7.1.4 Tip is inappropriate use of land - alienates 95 ha for at least 50 years.

7.1.5 Waste management needs active planning and should be an important consideration in town planning schemes.

7.1.6 Traffic levels from tip unacceptable because of danger to pedestrians and small children.

7.2 Adequacy of and management of buffer zone

7.2.1 All private residences immediately adjoining Lot 2170 should be purchased by the City of Rockingham.

7.2.2 Concerned rubbish tip will affect viability of existing operations and proposals on adjoining and nearby land, namely;

1. Mango Orchard, Marron Farm (Silver Gulls would predate marron ponds , this is not now a problem), proposed Retail Plant Nursery & Devonshire Teas etc. Have been working towards proposals over many years;
2. Stock grazing property would be affected if water supplies from bores about 1 km away became polluted.

7.2.3 Tip should be rejected because it is too close to existing residences (Lot 655 Eighty Rd was rejected on this basis).

7.2.4 Tip is too close to protect residents from off site effects such as flies, smells, smoke from spontaneous combustion, methane gas, offensive surface water ponding, dust, noise from trucks & earth-moving equipment and wind-blown litter. These impacts will make life intolerable for neighbours.

7.2.5 Closest residence will be 250 m/ 450-500 m from tip, not 1 km as noted in report.

7.2.6 Extent of buffer zone requirement not defined; Should be done in relation to climate & topography.

7.2.7 Buffer zones should be a minimum of 100 m.

7.2.8 Victorian EPA buffer zone of 200 m in urban areas insufficient in WA.

7.2.9 Buffer zone is needed that would alienate a large area of potential urban land; including the proposed "Leda Boulevard" development (700 m away).

7.2.10 Tip site too close to Leda/ Parmelia/ areas with children.

7.2.11 Residents in the "Forest Glades" estate can see the site.

7.2.12 City of Rockingham has a conflict of interest in the review of the zonings in this area.

7.2.13 System 6 area should not be used a a buffer zone.

7.2.14 Proximity of proposal to residences will mean design, operational and monitoring expenses will be higher and a burden on the community.

7.3 Social impacts

7.3.1 Does not adequately address social issues, especially with respect to residents of Leda

7.3.2 Concerned Millar Rd part of a secret agenda to turn Kwinana into a dumping ground.

7.3.3 Proposal will erode image/compound negative image of Kwinana.

7.3.4 Tip affects Kwinana's image & will deter good Leda type developments.

7.3.5 Tip site will de-value land around it.

7.3.6 Compensation as a social impact management measure should be considered; written guarantee should be given that if lifestyle of surrounding residents altered/affected by pollution compensation would be payable.

7.3.7 Social Impact Unit should establish impact management measures to alleviate predicted social impacts.

7.3.8 Length of time impacts present would be significantly less if the site was a regional site.

8 Conservation value of site and proximity of System 6 area

8.1 Conservation value of site

8.1.1 Consider that flora & fauna lists for Leda apply equally to Millar Road.

8.1.2 Fauna list on Pg B6 Vol 2 of PER is not comprehensive/incomplete.(One submission provided specific information with respect to Lot 2170 Millar Rd).

8.1.3 The endangered Southern Brown Bandicoot occurs in the area.

8.1.4 Black Glove Wallaby occurs in Leda (Approx 15-20 animals) and although not listed as rare should be treated as such. (Will be adversely affected as per 8.2.1 & 8.2.2)

8.1.5 Leda used as release area for injured fauna & this will be adversely impacted by off-site impacts from the tip.

8.1.6 Quarrying should be stopped and the remaining 70% of the site preserved.

8.1.7 Quarry operation should not extend further than it has already.

8.1.8 Tip will irreversibly destroy 95 ha of virgin bushland; Could be avoided by dumping at Cockburn.

8.2 Impacts of proposal on conservation areas and preventative measures recommended

8.2.1 Site is on boundary of System 6 area and proposal will adversely affect it. (Eg. Increased traffic levels will affect fauna movement, increased vermin levels).

8.2.2 Tip will increase vermin levels (dogs, cats & seagulls) to detriment of local fauna and flora/gulls in their hundreds or thousands will adversely affect (or make extinct) flora & fauna (such as other birds) on adjacent conservation areas.

8.2.3 Noise from machinery operations & noise generators to control gulls will disturb fauna.

8.2.4 Development of the tip will scare away migratory Rainbow Bee-eaters (called Jubilee Bird in the letters) from here.

8.2.5 The implementation of the tip will destroy some wallaby/Black Glove Wallaby/possum habitat within and outside the tip area.

8.2.6 There is no buffer between tip & System 6 for control of predators.

8.2.7 Predator proof fence should be erected on System 6 Lot 2170 boundary

8.2.8 An alternative route to the site should be considered to reduce traffic impacts on fauna from System 6 area.

8.2.9 Plant diseases may be introduced to reserves from contaminated soil from gardens falling off trailers etc on their way to the tip.

8.2.10 Proximity of such bushland to tip may encourage illegal dumping in this reserve; access easy via Westrail service tracks.

9 Site design and construction

9.1 Lining the site and containment/treatment of leachates

9.1.1 Experience with lined ponds in Kwinana (and the USA) shows many of them leak despite the best technology; how is this proposal different.

9.1.2 Clay lining unsatisfactory by itself because clay is variable in physical & chemical properties, has low permeability but still allows leachate through, has limited shear strength compared with HDPE and must be installed to high standards or problems occur such as cracking if it becomes dry.

9.1.3 Testing standard for clay permeability not specified. Should be to AS 1289F7.1; large scale double ring infiltrometer tests should be used.

9.1.4 Compaction standard not specified. Australian Standard E1.1 or E2.1 should be specified.

9.1.5 Van Delft & Hansen (1990, pg 7) note that use of clay questionable because of uniformity & moisture related problems & note soil liners typically collect only 85% of the leachate.

9.1.6 An independent consultant should test the permeability (and joints if HDPE is used) of the lining.

9.1.7 PER notes chemical content of leachate uncertain; how then can you predict effects of chemicals on effectiveness of the clay liner.

9.1.8 Concerned about variable bearing capacity note in Geological Survey maps for the area; some settlement may occur.

9.1.9 PER does not address long term viability of liner with respect to slumping, soil creep etc.

9.1.10 Liner should be clay and HDPE.

9.1.11 The proponent has not identified a suitable source of clay for lining the site; this is poor planning.

9.1.12 Drainage system capacity & size not related to rainfall events.

9.1.13 Recycling leachate can result in site becoming stable sooner; should be further investigated.

9.1.14 Best technology is being used.

9.1.15 Leachate control measures should be adequate if properly installed.

9.1.16 Disposal method for leachate is acceptable

9.1.17 Under-drainage should be removed from site (rather than evaporated in ponds) to minimise odour problems.

9.2 Transfer station and caretakers residence

9.2.1 Consider it essential proposal implemented as described, particularly with respect to the transfer station and frequency of cover. Concerned frequency of cover may be dependent of transfer station because without transfer station tip face would be always busy.

9.2.2 Alternative management measures not described if the transfer station does not go ahead.

9.2.3 Alternatives not detailed to prevent vandalism & illegal dumping if City decides not to have a caretaker on-site.

9.2.4 Commitment to have a caretaker does not have a time-frame, so could be avoided for many years.

9.3 Bunding, vehicle wash-down and site security

9.3.1 Bund height of 3 m inadequate; 4.5 m needed because of undulating terrain.

9.3.2 Bund height of 3 m adequate but a formal landscaping plan should be submitted for assessment.

9.3.3 Dust lift from bund should be addressed.

9.3.4 Vehicle wash-down facilities to prevent sludge from site being deposited on roadways is not proposed but should be.

9.3.5 Perimeter fencing inadequate to deter school children from entering area and injuring themselves (or dying). Young children must be protected from themselves.

10 Site operation and off-site impacts

10.1 General comments

10.1.1 More detailed study of wind patterns & topography needed to evaluate odour, litter, dust & noise impacts.

10.1.2 Concerned about health effects from dumping of asbestos related materials and methane gasses which could contain carcinogenic substances. These would be carried to residences & schools.

10.2 Gulls and other vermin

10.2.1 Proposed pest control strategies inadequate; currently no pests (gulls & rats) present.

10.2.2 Frequency of covering insufficient to prevent seagulls becoming a problem.

10.2.3 Tip will increase gulls to detriment of local fauna and flora.

10.2.4 No plan/commitment to rectify any problems caused by increased presence of gulls (Eg they may contaminate supplies in rainwater tanks).

10.2.5 The commitments regarding silver gulls are satisfactory to alleviate concerns regarding impact of gull populations on the Shoalwater Bay islands.

10.2.6 Vermin will be a hazard to residents/will carry filth & disease into primary school which is currently under construction.

10.3 Odour

10.3.1 Combination of odours from existing industry & tip will make situation intolerable.

10.3.2 Continuous covering rather than 3-4 hourly may be necessary to limit odours.

10.3.3 Under-drainage should be removed from site (rather than evaporated in ponds) to minimise odour problems.

10.3.4 Odour & leachate from proposed composting operation is a concern; larger buffer zones may be required for odour control.

10.3.5 Definition of a significant odour problem should be with independent party or body, not the City of Rockingham (Pg 58, 7.3.2).

10.4 Fire & smoke

10.4.1 Gas migrating through dry vegetation could significantly increase fire risk.

10.4.2 Spontaneous combustion of refuse may ignite valuable bushland (containing Donkey Orchid & Black Gloved Wallaby) which is adjacent.

10.4.3 Flaring landfill gas risky because of fire hazard in the area.

10.4.4 Fires may be intentionally lit if security inadequate (eg. No caretaker).

10.4.5 Increased fire risk unacceptable because owners in Leda are required to maintain bushland around their houses.

10.4.6 Fire fighting and management plans not adequately described especially in regard to warning residents in case of fire and time taken for fire fighting units to respond. No second line barrier for fire.

10.4.7 Concerned local volunteer fire brigade/Rockingham fire brigade/Kwinana fire brigade would be unable to handle a tip/bush fire.

10.4.8 Concerned smoke and odour from burning tips will be a problem despite guarantees that fires would not be lit.

10.5 Noise and dust

10.5.1 Noise from machinery operations & noise generators to control gulls will disturb residents.

10.5.2 Noise likely to be a nuisance based on machinery & traffic noise at Cockburn tip.

10.5.3 Definition of a significant noise problem should be with independent party or body, not the City of Rockingham.

10.5.4 Combined dust impacts from quarry and tip likely to cause films of dust to settle.

10.5.5 Asthmatics in the area will suffer from increased dust levels.

10.5.6 Heavy traffic will bring noise, dust and fumes.

10.6 Litter

10.6.1 PER notes peripheral areas will be under constant review but does not specify how large an area will be monitored and how.

10.6.2 The proponent should draft & finalise, publicise and implement regulations & by-laws to prevent litter from vehicles

10.6.3 Current litter levels near Ennis Road/ other nearby sites unacceptable.

10.7 Types of waste accepted

10.7.1 Heavy metals and general inert industrial waste should be excluded.

10.7.2 Concerned about possible chemical reactions between leachate & undefined inert industrial waste.

11 Landfill gas

11.1 The proposal appears satisfactory from a landfill gas perspective.

11.2 Gas recovery not thought through.

11.3 Flaring landfill gas risky because of fire hazard in the area & gas migrating through dry vegetation could significantly increase fire risk (rpt).

11.4 Methane gas could cause fire or explosion; this is unsafe and fire-fighting units would not be able to cope.

11.5 Flaring of methane will add to the greenhouse effect on the ozone layer of the atmosphere and clearing trees that purify the air for tip is vandalism.

11.6 We should reduce greenhouse impacts of tips by recycling.

11.7 Concerned about greenhouse gasses from old tips, such as Ennis Road.

11.8 Studies into composition of gasses incomplete; how can we be assured of no adverse health effects.

12 Monitoring and management

12.1 Monitoring should be undertaken by independent consultants - not Council staff. Reports should be issued bi-monthly and be publicly available.

12.2 The groundwater monitoring limited because downstream pollution limits proponents ability to detect and take appropriate measures to prevent pollution.

12.3 Extensive groundwater monitoring should detect groundwater contamination.

12.4 Gate security to prevent shady deals should be improved (eg. use a video camera as at Mindarie).

12.5 Concerned that directing commercial operators to the tipping face will enable industrial waste to enter site unchecked. Site should not accept risks associated with industrial wastes.

12.6 No plan/commitment to rectify any problems caused by increased presence of gulls (eg. they may contaminate supplies in rainwater tanks) (rpt)

12.7 How will spread of fire, disease & filth-bearing animals be contained and policed.

13 Post closure management and end-use

13.1 Final contours not provided; should be consistent with surrounding landform & be provided in management plans for the site.

13.2 Site should be completely stable before any development takes place; PER notes it will take place "at the earliest opportunity".

13.3 Appropriate conditions will be necessary to ensure industrial development does not cause the landfill to have greater impact on the environment (eg. puncturing liner with bores) and that appropriate monitoring & management continue.

13.4 Reserve funds must be adequate to deal with long term management.

14 Miscellaneous comments

14.1 Proponent has a poor track record at Ennis Road, concerned this may not improve at new site.

14.2 Public health may be at risk

14.3 Rejection of proposal will not adversely affect viability of local industries.

14.4 Kwinana's aesthetics is under attack from proposals such as Rockingham tip, proposed tip at Reserve 21815 Moylan Rd, regional cemetery & regional sewerage plant.

Appendix 3

Proponents response to public submissions

55/03

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AGC Woodward-Clyde
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ph:ft:2381/1

c2286

3 September 1991

Acting Director
Evaluation Division
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention: Mr R Van Delft

Dear Sir

CITY OF ROCKINGHAM PROPOSED LANDFILL
COCKBURN SOUND LOCATION 2170 MILLAR ROAD BALDIVIS

Thank you for your 9 August letter enclosing the summary of public submissions relating to the above proposal.

As a result of the meeting between representatives of the Authority and the Proponent (as mentioned in your letter), the following issues were identified as requiring a response:

* Need for the proposal:
  - inner city transfer station;
  - need for additional regional facility;
  - management by Regional Council.

* Groundwater contamination:
  - maximum groundwater levels;
  - implications for Western Mining Corporation's operations.

* Planning issues:
  - buffer zones.

* Conservation values:
  - illegal dumping in nearby bushland.

* Site design and construction:
  - compaction standards;
  - independent testing.

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* Off site impacts:
  . off site movement of fire.

* Post closure management:
  . stability of site for end use:
  . ongoing responsibility.

On behalf of the City of Rockingham, we have responded to the issues (enclosed). The specific issues addressed are referenced according to the summary listing enclosed with your 9 August letter.

We trust that the information provided will be satisfactory, however, should you need any additional material, please do not hesitate to contact Mr Paul Holmes of this office.

Yours faithfully
AGC Woodward-Clyde Pty Ltd

Dr J S YEATES
Manager - Western Operating Unit

P HOLMES
Supervising Environmental Planner

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1 NEED FOR THE PROPOSAL

1.1 Alternative Waste Management Options

1.1.14 Issue of an inner city transfer station has not been discussed; would reduce traffic flows along Millar Road.

RESPONSE

An on-site transfer station rather than an inner city facility has been proposed to facilitate operation and management of the landfill site (i.e. by obviating the need for direct access to the active tipping face by casual users). Because of the pattern of urban development within the Rockingham municipal district and the juxtaposition of the Millar Road site (Loc. 2170) to existing and future urban areas, it would be logistically difficult to preclude public access to the landfill through establishment of an inner city transfer station. Further, even if such a restriction was imposed, traffic accessing the off-site transfer station would still produce impacts as are apparently perceived as undesirable along Millar Road, albeit somewhere else.

However, again, because of the development pattern within the Rockingham municipal district, and in view of the limited development fronting onto Millar Road (at present there is only one inhabited property on Millar Road and this will probably become light industrial land - refer to PER page 60) the potential for traffic impacts could actually increase if an inner city rather than an on-site transfer station was established.

Consolidating the waste disposal facility (i.e. the transfer station and landfill) as proposed, enhances the opportunity for operational efficiencies and management of potential environmental impacts. Establishing an inner city transfer station would diffuse operational and management resources and would, therefore, increase costs (if appropriately high operational and management standards are to be maintained).

Significant traffic impacts will not occur along Millar Road. Accordingly, there is no real benefit to be achieved from an inner city transfer station. Such a facility would, however, produce demonstrable disbenefits.

1.2 Need for the Proposal in a Regional Context

1.2.1 No demonstrated need for an additional refuse disposal site in the south west metropolitan region; there is sufficient existing refuse space.

2 RELATIONSHIP OF PROPOSAL TO REGIONALIZATION POLICIES

2.1.5 Host-guest relationship proposed has several limitations; should be managed by a regional council

RESPONSE (Joint response to 1.2.1 and 2.1.5)

At the time of preparing the PER, the regional context for municipal waste disposal operations within the south west sector of the Perth metropolitan area was effectively

established by the Health Department's 1988 "Discussion Paper for a Perth Metropolitan Waste Strategy"[1].

In respect of the future scenarios for solid waste disposal by the Local Government Authorities comprising the South West Zone Refuse Disposal Committee, the Health Department's discussion paper presents the following information.

Local Government Authority	Proposed Disposal Arrangements	Comments
Canning	Regional transfer station in Canning Vale/Melville area. Transport to regional landfill.	Current landfill site undesirable due to potential groundwater pollution. Should be converted to non-putrescible site. Regional transfer station should be shared by Canning and Melville. Regional landfill site could be Bells quarry, Henderson or Byford clay-pits.
Cockburn	New landfill in Henderson (9 mile quarry).	Development of regional landfill site at Henderson.
East Fremantle	Use of South Fremantle transfer station. Transport to Henderson.	-
Fremantle	Regional transfer station. South Fremantle landfill site Cockburn.	-
Kwinana	No change.	Rockingham and Kwinana to develop regional landfill.
Melville	Regional transfer station in Canning Vale/Melville area. Transport to regional landfill.	Current landfill site undesirable due to potential groundwater pollution. Should be converted to non-putrescible site. Regional transfer station should be shared by Canning and Melville. Regional landfill could be Bells quarry, Henderson or Byford clay-pits.
Rockingham	Regional disposal site. Composting.	Regional landfill at Kerosene Lane or Kwinana or Cockburn.

It is evident that the option of a regional landfill facility to service the municipalities of Kwinana and Rockingham was specifically canvassed in the Health Department's 1988 discussion paper and that a site on Kerosene Lane within the Rockingham municipal district was under consideration for this facility.

Correspondence from the Health Department to the City of Rockingham (dated 4 May 1989) confirmed the potential acceptability of the Kerosene Lane site (the Health Department letter referred specifically to approval in principle having already been given for the Kerosene Lane site), and of the Council's willingness for the site to be a regional facility (refer to PER page 14).

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1 *Discussion Paper for a Metropolitan Waste Strategy*. Health Inspection Services, Health Department of Western Australia, November 1988.

Although approvals for the Kerosene Lane site were not finalized (for reasons outlined at PER page 13), further correspondence from the City of Rockingham to the Health Department (dated 11 October 1990) and the Department's undated response to this letter (received by the Council 19 December 1990) confirm the Council's willingness for the Millar Road site (as an alternative to the Kerosene Lane site) to be a regional facility, and the Department's belief that a satisfactory case can be made for another regional landfill (i.e. in addition to the existing Henderson facility) being established in the Rockingham district. Refer to PER pages 6 and 7 for direct citation from the Health Department letter confirming the above.

It can therefore be seen that, historically, the Health Department has recognized the need for a second regional landfill to service the south-west sector of the Perth metropolitan area, and that the Kerosene Lane/Millar Road area within the City of Rockingham is an appropriate location for this site.

The recent report "Managing Perth's Solid Wastes - Recycling, Processing and Disposal Options for the next 20 years"[1] also recommends the Millar Road site as a regional landfill to service the Kwinana and Rockingham municipalities.

As indicated, the City of Rockingham accepts that the Millar Road landfill should function as a regional facility. The Council has indicated in writing to the Health Department its willingness to enter into Host/Guest Agreements (in accordance with the guidelines included in the Department's 1988 discussion paper) as a basis for formalizing the site's regional function.

However, the City of Rockingham also recognizes that formation of a Regional Refuse Disposal Council is a necessary element of regionalization of municipal waste disposal operations within the south-west sector of the metropolitan area. In this regard, the City of Rockingham is an active member of the South West Zone Refuse Disposal Committee which has already initiated the process of Regional Council formation. With formation of the Regional Council and the City of Rockingham's membership of that Council, a range of options concerning operation of the Millar Road site as a regional facility will become available.

In the absence of a formal Regional Refuse Disposal Council and regional waste disposal strategy for the south-west sector of the metropolitan area, and because of its own waste disposal requirements, it has been necessary for the City of Rockingham to assume a lead role in the development of a disposal facility that will satisfy its own needs and provide a basis for a rational regional strategy. The proposal for the Millar Road site achieves both objectives.

It is demonstrably consistent with the Health Department's position as presented in the 1988 discussion paper and subsequent correspondence. Additionally, in conjunction with the existing Henderson site within the City of Cockburn, the Millar Road site will provide an effective foundation for operation of the Regional Refuse Disposal Council when formed. The City of Rockingham's commitment to the concept of regionalization of municipal waste disposal operations is clear from its acceptance that the proposed Millar Road site will be a regional facility (as evidenced in the PER and correspondence from Council to the Health Department) and its active participation in the South West Zone Refuse Disposal Committee.

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1 *Managing Perth's Solid Wastes - Recycling, Processing and Disposal Options for the Next 20 Years*. A study commissioned by the Department of State Development and Metropolitan Local Government Authorities, undertaken by Sinclair Knight and Partners Pty Ltd, July 1991 (Section 5.7, pages 25 and 26).

6 GROUNDWATER CONTAMINATION AND RELATED ISSUES

6.2 Groundwater Levels

6.2.2 Records indicate maximum groundwater levels are up to 5 m AHD, not 2.5 m as stated in the report.

RESPONSE

The guidelines for the PER provided by the EPA indicate the need to consider maximum groundwater levels. The context in which groundwater levels need to be addressed is outlined in the 1990 paper "Landfill Design" by Van Delft and Hansen[1] which states:

> "The (Environmental Protection) Authority and Health Department specify a minimum distance of 3 m from the base of the tip site to the highest known groundwater level. This distance is specified to ensure waste does not become inundated and to provide some assimilative capacity for leachates generated".

Information on groundwater levels beneath the western portion of Loc. 2170 that is affected by the landfilling proposal described in the PER, is based on historical and recent measurements in monitoring bores installed by Western Mining Corporation (WMC) within the western portion of the site, and recent measurements of static water levels within a costean in the central southern portion of the site. Based on these data, the *highest known* groundwater level beneath the western portion of the site is concluded to be 2.5 m AHD.

The detailed landfilling proposal is based on achieving the specified vertical separation from this datum (i.e. 2.5 m AHD). It can therefore be contended that the proposal does satisfy the requirement as specified in the "Landfill Design" paper.

As indicated, information on groundwater levels presented in the PER is based on actual measurements within the project site. However, advice from the Water Authority indicates that the comment that 5 m AHD (not 2.5 m AHD) is the appropriate maximum groundwater level is based on extrapolation from the hydrograph for Lake Cooloongup and the interpretation of aerial photography.

The contention that groundwater levels beneath the western portion of Loc. 2170 are up to 5 m AHD is premised on the maximum recorded water level in Lake Cooloongup of approximately 3.1 m AHD and the assumed extent of mounding of the water table in response to rising landform east of the lake. On this basis, there appears to be a presumption that Lake Cooloongup is a surface expression of the surficial water table. Salinity levels in the lake do not support this presumption and there is also other evidence to suggest that this is not the case.

A layer of marls of low permeability have developed over the base of Lake Cooloongup and restricts groundwater - lakewater interaction. Limnological studies of Lake Cooloongup indicate that replenishment (of the lake) results predominantly from direct precipitation, with some surface runoff and groundwater input, and that strong seasonal

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1 *Landfill Design*. A paper presented to the 7th State Conference; Local Government Engineers Association of Western Australia March 29, 1990 (updated August 1990) by Ron Van Delft, Environmental Protection Authority and Sven Hansen, Health Department of Western Australia (Section 3.1.2, pages 6 and 7).

variations occur due to the effects of winter rainfall and summer evaporation upon a virtually closed lake basin.[1 & 2]

However, even if a direct connection between Lake Cooloongup and the surficial aquifer is assumed, available data do not indicate mounding of the water table to the degree suspected by the Water Authority. Groundwater levels in the vicinity of Loc. 2170 have been monitored by WMC since the early 1980s. Water levels in monitoring bores along transects between the western portion of Loc. 2170 and Lake Cooloongup indicate a shallow groundwater gradient under peak water level conditions, with a differential between lake water level and the highest groundwater level recorded during the monitoring period beneath Loc. 2170 varying from 22 to 30 cm.

Static water levels within the western portion of Loc. 2170 have been measured on four occasions from October 1990 to August 1991. The actual measurements recorded are:

October 1990	2.08 m AHD
November 1990	2.09 m AHD
December 1990	2.05 m AHD
August 1991	2.18 m AHD

Historically, peak groundwater levels occur in the October/November period each year. On this basis, the differential between peak lake water level in 1990 (1.87 m AHD) and the November 1990 static groundwater level recorded at Loc. 2170, is 22 cm (consistent with the above range). There is no peak 1991 water level reading for Lake Cooloongup available at this time. However, assuming no change from 1990, the differential (i.e. 1.87 m AHD to 2.18 m AHD) is still consistent with the above range.

Therefore, even assuming a direct connection between Lake Cooloongup and the surficial aquifer, a maximum lake water level of 3.1 m AHD could be expected to correspond with a "possible peak" groundwater level beneath the western portion of Loc. 2170 of not more than 3.5 m AHD, compared with the maximum recorded level of 2.5 m AHD and the Water Authority's suspected maximum of up to 5 m AHD.

Measurement of static water levels in the two monitoring bores installed along the eastern boundary of Loc. 2170 as part of the PER investigations indicates that 5 m AHD is an appropriate maximum groundwater level within the eastern portion of the site. Indicative maximum groundwater level plans from the Water Authority also suggest that the 5 m AHD groundwater contour would underlie the eastern portion of Loc. 2170.

Furthermore, if there is a direct relationship between the surficial aquifer beneath the western portion of Loc. 2170 and water levels in Lake Cooloongup, it could be argued (on the basis of the Water Authority's hydrograph) that groundwater levels are trending downwards. Notwithstanding the short-term fluctuations apparent, the hydrograph for Lake Cooloongup shows an underlying decline in lake water levels, particularly since the mid-1960s.

A "possible peak" groundwater level of 3.5 m AHD (although considered unlikely) would still be well within the safety margin imposed by the requirement for a vertical separation of 3 m between the base of the landfill and the water table. As indicated in the "Landfill Design" paper, the objectives of the vertical separation requirement are:

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1 *Lake Cooloongup Limnology Study Baldivis, WA.* A report for Western Mining Corporation prepared by Dames and Moore, April 1983 (page 5).

2 *Addendum - Lake Cooloongup Limnology Study Baldivis, WA.* Dames and Moore, August 1983 (page 2).

- to prevent saturation of the emplaced refuse; and
- to provide for some attenuation of infiltrating leachate.

Using the 3 m vertical separation and the 2.5 m AHD maximum groundwater level from the PER, the base of the landfill would be at 5.5 m AHD, 2 m above the 3.5 m "possible peak". Saturation from the water table would not, therefore, occur. Attenuation of leachate would also continue within the clay liner, and the underlying unsaturated soil layer and aquifer as described in Appendix D of the PER.

The available data do not support the contention that a level of 5 m AHD should be adopted as the maximum groundwater level to be assumed for landfill design purposes. The 2.5 m AHD groundwater level used in the PER is still considered realistic. .

6.4 Effects on WMC Plume and Remediation Programme

RESPONSE

Representatives of the Proponent and WMC have met to further discuss the implications of landfill leachate for WMC's tailings disposal site rehabilitation programme. WMC has subsequently written directly to the EPA explaining its position on this matter.

In essence, WMC's position is that provided the timing of leachate loss from the landfill is as anticipated in the PER, there would be no adverse effects on the tailings disposal site rehabilitation programme.

There is no reason to anticipate markedly more rapid leachate generation than is envisaged in the PER. However, even when adopting a conservative approach on leachate generation, leachate is unlikely to be lost to the environment earlier than 10 years after closure of the initial landfill cell, and the maximum anticipated rate of leachate loss would not occur earlier than 10 years after closure of the last landfill cell (i.e. 23 years after closure of the initial cell).

Even based on these conservative figures, landfill leachates should not pose a problem for the WMC rehabilitation programme in view of the anticipated timing of the programme.

A conservative approach has also been adopted in estimating the concentration of leachate constituents in leachate affected groundwater. The concentrations tabulated in the PER (Table D2, page D13, PER Appendix D) are those anticipated at the western boundary of Loc. 2170 assuming a dilution factor of 1 in 10. A dilution factor of 1 in 25 could actually occur up to the site boundary, with far greater dilution occurring further down hydraulic gradient from the site.

Actual concentrations of potentially problematical leachate constituents at the WMC recovery bores (and the production bores for the freshwater injection scheme if required) would, therefore, be less than the levels tabulated.

PLANNING ISSUES

7.2 Adequacy of and Management of Buffer Zones

RESPONSE

The PER contains a specific commitment regarding the establishment and management of the on-site buffer zones (refer to Section 9.2 regarding design feature commitments, PER page 8). If the project is approved, this commitment (and all others given by the Proponent) will be legally enforceable under the conditions applied to the project through the Ministerial Statement pursuant to Section 45 of the Environmental Protection Act, 1986.

Within the wedge of land bounded by Millar, Mandurah and Baldivis Roads, and Kerosene Lane, there are seven individual residences. The closest of these is approximately 250 m east of the south-eastern boundary of the Millar Road site. The remainder of these residences are upwards of 400 m from the nearest boundary of the site (refer also to Section 5.1.2 of the PER, page 12, and Figure 8).

Land use structure plans prepared during the process of preparation of the City of Rockingham's new District Town Planning Scheme designates the above described wedge of land for the following uses (refer also to PER Figure 9):

- open space;
- light industry;
- regional cemetery.

Under the structure plans, residential development is proposed to be confined to the area south of Kerosene Lane, at least 500 m south of the Millar Road site. In addition to being Proponent for the Millar Road landfill, the City of Rockingham also has statutory responsibility for local land use planning. In this regard, although its forthcoming District Town Planning Scheme will continue to reflect the current Rural zoning of the locality, any rezoning proposals will only be considered in the context of the above-mentioned structure plan land use designations. As such, the physical separation between the proposed landfill and future uses with which it could conflict (i.e. essentially urban residential development) of at least 500 m will be reflected in documentation published as part of the statutory District Town Planning Scheme. The Proponent will, obviously, not initiate or endorse any amendment to its Town Planning Scheme that would result in conflict with its published structure plans.

With respect to the control of land uses and development under the existing Rural zoning, Council will continue to assess any application for approval to commence development (or use) under the following criteria:

- the requirements of the Zoning/Land-Use Table;
- any other relevant provisions of the Town Planning Scheme;
- the maintenance of orderly and properly planning for the locality;
- the views and comments of relevant Government Departments and Agencies;
- the individual merits of the proposal.

North of Millar Road (within the Town of Kwinana) structure planning for the Leda locality is continuing. A substantial buffer of open space, to accommodate System 6 Recommendations M104, will be established within the southern portion of Leda. Current structure plans for Leda indicate that this buffer will create a physical separation between future residential development and the closest extremity of the Millar Road site of at least 500 m. Because a System 6 area is involved, the EPA itself has a pivotal role in ensuring the continued integrity of this open space buffer.

8 CONSERVATION VALUE OF SITE AND PROXIMITY OF SYSTEM 6 AREA

8.2 Impacts of the Proposal on Conservation Areas and Preventative Measures

8.2.10 Proximity of such bushland to tip may encourage illegal dumping in this reserve; access via Westrail service tracks.

RESPONSE

Like any other comparatively isolated but accessible urban bushland, the System 6 area at Leda already suffers littering and illegal dumping. The proposal for the Millar Road site includes the following precautions against exacerbation of these impacts:

- surveillance by City of Rockingham personnel of access to the landfill site, including Millar Road, to identify whether littering (or illegal dumping) is occurring; and
- regular removal of any litter (or refuse) occurring along access roads to the landfill site (including Millar Road) and in the vicinity of the site.

In addition, the Proponent will liaise with Westrail concerning the control of vehicular access to the two informal level crossings over the Kwinana to Jarrahdale railway line in the vicinity of Loc. 2170. These crossings presently provide direct access to the System 6 area at Leda but are important access points for fire control operations.

The Proponent will also liaise with the Department of Land Administration concerning the control of vehicular access to Reserve 22429 (part of the Rockingham Lakes System 6 area). Again, however, the existing access track to the reserve from Millar Road is important in a fire control sense.

9 SITE DESIGN AND CONSTRUCTION

9.1 Lining the Site and Containment/Treatment of Leachates

9.1.4 Compaction standard not specified. Australian Standard E1.1 or E2.1 should be specified.

RESPONSE

Detailed specifications are being prepared for the proposed landfill, including those for construction of the clay liner and associated earthworks. These specifications include reference to soil compaction tests AS 1289 E1.1 and AS 1289 E2.1. The clay liner will be compacted to 98% standard maximum dry density in accordance with AS 1289 E1.1, although moisture content will be maintained above optimum to ensure an appropriate level of impermeability is achieved.

The objective of the specification being written for the construction of the clay liner is to ensure that permeabilities will not exceed 10^{-7} cm/second.

9.1.6 An independent consultant should test the permeability (and joints if HDPE is used) of the lining.

RESPONSE

Construction of the landfill cell lining system will be supervised by suitably qualified geologists or engineers independent of the Proponent. The permeability of the compacted clay liner will be monitored during construction by field testing, and laboratory testing by a NATA registered geotechnical laboratory.

In the event that a membrane lining system (rather than compacted clay) is to be used, the supplementary report to be submitted by the Proponent detailing the system proposed (refer to commitment 17, PER page 74) will obviously have to address quality control issues such as the supervision of liner installation.

10 SITE OPERATION AND OFF-SITE IMPACTS

10.4 Fire and Smoke

RESPONSE

With the exception of the controlled flaring of landfill gas, fire will not form part of site operational and management practices (refer to commitment 59, PER page 80). Gas flaring structures will be designed and operated to conform with all relevant safety requirements and will not, therefore, pose a fire hazard.

Operational and management practices, including gas flaring, will limit the risk of spontaneous combustion within emplaced refuse, and boundary firebreak requirements will be satisfied as a matter of course. Additionally, the Proponent is committed to maintaining adequate manpower and machinery resources on-site during operating hours to respond in the event of fire. The availability of machinery and equipment on-site will also facilitate a rapid response outside normal operating hours in the event of fire.

The risk of on-site fire cannot, therefore, be realistically regarded as significant, and the risk of any fire which did start on-site moving into the surrounding environment would be even lower. Manpower and machinery resources at the landfill would, in fact, enhance fire response capability, thereby lessening fire hazard within the general locale.

13 POST CLOSURE MANAGEMENT AND END USE

13.2 **Site should be completely stable before any development takes place; PER notes it will take place "at the earliest opportunity".**

RESPONSE

The objective of redeveloping the site for light industry "at the earliest opportunity" in no way implies that redevelopment would occur before the site is stable. At a number

of points throughout the PER there is specific acknowledgement that there will be a considerable lag between completion of landfilling and the availability of the site for redevelopment. Identification of an interim use of the site during this period (i.e. bushland open space) emphasizes recognition of this fact.

Commitments regarding environmental monitoring and site management following closure will ensure that decisions about site redevelopment will be taken in consultation with the EPA. The intent of the Proponent's commitment regarding management of the site following closure (commitment 78, PER page 83) is considered quite consistent with the decommissioning and post closure management recommendations made by the EPA in respect of the Narngulu waste disposal site (i.e. the EPA's most recent assessment of a regional municipal landfill project).

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E0599

13 September 1991

The Director
Evaluation Division
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

Attention: Mr R Van Delft

Dear Sir

CITY OF ROCKINGHAM PROPOSED LANDFILL
COCKBURN SOUND LOCATION 2170
MILLAR ROAD, BALDIVIS

The specific issues raised in public submissions on the Public Environmental Review (PER) for this project that were identified by the Authority as important and requiring a response from the Proponent have been responded to under separate cover.

The enclosed supplementary responses deal generically with other issues raised in submissions on the PER.

Yours faithfully
AGC WOODWARD-CLYDE

Dr J Yeates
Manager - Western Operating Unit

P Holmes
Supervising Environmental Planner

1 NEED FOR THE PROPOSAL

1.1 Need for the Proposal - Alternative Waste Management Options

Response

Establishment of a "rubbish tip" is not being proposed. The proposal entails establishment of a properly designed, engineered and managed landfill. Such landfills are an acceptable form of waste disposal facility, in operation locally, nationally and internationally.

Landfilling is regarded as an essential element of Perth's long-term waste disposal strategies, and the City of Rockingham's proposed landfill is specifically included in these strategies as a regional facility to service the Municipalities of Kwinana and Rockingham.[1]

As it entails a cellular approach to landfilling, the proposed facility is inherently flexible and will not preclude the introduction of alternative technology if and when it becomes feasible.

1.2 Need for the Proposal in a Regional Context

Addressed in previous detailed response.

2 RELATIONSHIP OF PROPOSAL TO REGIONALIZATION POLICIES

Response

As established in the previous detailed response, the proposal is consistent with the Health Department's 1988 "Discussion Paper for a Metropolitan Waste Strategy"[2] and the recommended strategy in the recent report "Managing Perth's Solid Wastes - Recycling, Processing and Disposal Options for the Next 20 Years".

3 ALTERNATIVE SITES

Response

The examination of alternative sites occurred through a series of investigations undertaken by the City of Rockingham (and its predecessor, the Shire of Rockingham) during 1986 and 1987. As

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1 *Managing Perth's Solid wastes - Recycling, Processing and Disposal Options for the Next 20 Years*, Sinclair Knight and Partners Pty Ltd, July 1991.

2 *Discussion Paper for a Metropolitan Waste Strategy*, Health Inspection Services, Health Department of Western Australia, November 1988.

stated in the PER (Section 3.1, pages 12 and 13), prevailing environmental conditions preclude landfilling within all geologic units occurring within the Rockingham Municipal District except the Tamala Limestone Formation.

The Health Department's 1988 discussion paper, and the subsequent near-approval of a landfill site on Kerosene Lane (immediately south of Loc. 2170) as a regional facility, confirm the Tamala Limestone Formation within the Rockingham Municipal District to be generally appropriate for a waste disposal facility.

4 ADEQUACY OF REPORT

Response

In permitting release of the PER for public review, the EPA indicated its belief that the document provided a satisfactory basis for scrutiny of the proposal. Further, in assessing the proposal, the EPA will presumably make judgements about how adequately issues arising from the proposal (including the relationship between landfilling and the extractive operation) have been addressed.

The level of environmental assessment was as determined appropriate by the EPA. In that the project was assessed at PER level, it can be concluded that "higher" levels of assessment (ie. Environmental Review and Management Programme or Public Enquiry Pursuant to Section 40(2)(c) of the Environmental Protection Act, 1986) were not warranted.

5 CONSULTATION

Response

Refer to Section 2.5 of PER (pages 7-10).

6 GROUNDWATER CONTAMINATION AND RELATED ISSUES

6.1 General Comments

Response

The proposal presents an objective assessment of leachate related groundwater impacts (Section 7.2 pages 54 and 55, and Appendix D), and incorporates thorough leachate containment, collection and disposal measures and groundwater monitoring programmes.

The concentrations at which leachate constituents will occur in groundwater some distance down hydraulic gradient of Loc. 2170 cannot realistically be regarded as posing an environmental or public health threat. As stated in Appendix D:

> "Elevated levels of salinity (as TDS), TOC and inorganic nitrogen (ammonia-nitrogen and/or nitrate-nitrogen) are the major concerns in the contamination of groundwater by a methanogenic-stage leachate. Although the estimated salinity and TOC levels of leachate-affected groundwater are increased, they are still comparable with present levels of these parameters within groundwaters in the immediate environs of Loc. 2170 (Table D2). For down-gradient groundwaters more distant from Loc. 2170, minimal increase in the concentration of these parameters is anticipated. The level of ammonia-nitrogen in the leachate-affected groundwater is estimated to be higher than the existing groundwater level within the immediate environs of Loc. 2170. However, as indicated above, groundwaters further down-gradient from Loc. 2170 are characterised by inorganic nitrogen levels arising from the leakage of liquor from WMC's tailings dam and/or the intensive use of nitrogenous fertilizers by market gardeners. On this basis, minimal impact on down-gradient groundwaters more distant from Loc. 2170 is anticipated."

6.2 Groundwater Levels

Addressed in previous detailed response.

6.3 Impact on Water Resources, Wetlands and Conservation Areas

Refer to 6.1 above.

6.4 Effects on WMC Plume and Remediation Programme

Addressed in previous detailed response.

6.5 Monitoring and Management

Response

Groundwater pollution impacts are not anticipated. Comprehensive groundwater monitoring as proposed will establish if unanticipated impacts are occurring and the Proponent has provided a commitment to respond to any such impacts "in consultation with the EPA and Health Department, and to the satisfaction of the Minister for the Environment as appropriate" (commitment number 77, PER, page 83).

7 PLANNING ISSUES

7.1 General Comments

As discussed at various points in the PER, Loc. 2170 is in an area designated for future light industrial development, and is bounded to the east by a future regional cemetery site. Only one inhabited property fronts onto Millar Road, and this within the future light industrial area. The City of Rockingham is also the local planning authority and the possible establishment of the landfill has been incorporated into planning strategies for the locality.

7.2 Adequacy of and Management of Buffer Zone

Addressed in previous detailed response.

7.3 Social Impacts

Response

Such impacts are specifically addressed in the PER (Section 7.10, page 67). Presumably, the EPA has received advice from the Social Impact Unit concerning the adequacy of measures proposed for addressing potential social impacts and will take this advice into account in assessing the proposal.

8 CONSERVATION VALUE OF SITE AND PROXIMITY OF SYSTEM 6 AREA

8.1 Conservation Value of Site

Response

As stated in the PER, the current quarrying operations, *not* the landfilling project, will lead to the destruction of the remaining bushland vegetation within Loc. 2170.

8.2 Impacts of Proposal on Conservation Areas and Preventative Measures Recommended

Response

The PER identifies all anticipated impacts associated with the proposed landfill. Increased traffic on Millar Road is an unavoidable consequence of the proposal although, in the context of the existing quarrying operation, other traffic using Millar Road and the railway line, and future land development within the Millar Road - Kerosene Lane area, a major impact (including on wildlife) is considered unlikely.

Other potential impacts on the adjacent conservation areas are addressed through the management undertakings given by the Proponent.

9 SITE DESIGN AND CONSTRUCTION

9.1 Lining the Site and Containment/Treatment of Leachates

A properly designed and constructed clay lining system is more secure than a membrane liner, being less prone to failure through penetration and settlement, and through degradation by the inevitable solvent fraction within the waste stream.

As indicated in the PER, construction of the clay lining system, including excavation of the clay, will be fully supervised by appropriately qualified personnel, and will be subjected to field and laboratory testing. The proposal also incorporates precautions against desiccation of the clay liner once constructed.

The geotechnical and geochemical qualities of the clay to be used are also specified and have to be satisfied irrespective of the source.

As indicated in Appendix D, leachate chemistry is sufficiently understood to predict with reasonable certainty what will happen to infiltrating leachate.

The PER does demonstrate that appropriate design standards will be used for the leachate collection system.

9.2 Transfer Station and Caretaker's Residence

Response

Since preparation of the PER, the Proponent has developed detailed costings for the proposed landfill and, as a result, has established that the transfer station will be constructed as part of initial site development. However, irrespective of this advancement since preparation of the PER, commitment number 7 (PER, page 73) explains how the Proponent would have responded if the on-site transfer station could not have been constructed as part of the initial site development.

Commitment number 1 (PER, page 72) binds the Proponent to development of the proposed facility in accordance with the proposal described in the PER. The proposal includes construction of a permanent residence on-site, thereby enabling "the Proponent to maintain a permanent presence at the site should such be necessary to supplement security measures" (PER, page 40). The Council residence *will* be constructed as part of the initial development.

9.3 Bunding, Vehicle Wash-Down and Site Security

Response

The three-metre bund, combined with landscaping, will adequately screen the facility. The bund will be progressively constructed and landscaped (commitment number 8, PER, page 73), and all areas that are disturbed but not immediately needed for landfilling will be stabilized to avoid dust generation (commitment number 49, PER page 79).

The proposed vehicle wheel cleaning facilities (commitment 39, PER, page 77), combined with the extent of internal sealed accessways, indicate the unlikelihood of sediment being tracked onto public roadways.

The isolation of the site from residential areas indicates that access by unescorted children is unlikely to be a problem. Supervision by site staff during operating hours (when the hazard would be greatest) would also minimize risk in this regard.

10 SITE OPERATION AND OFF SITE IMPACTS

10.1 General Comments

Response

Adequate buffers and site management practices (as the proposal incorporates) safeguard against adverse impacts from odour, litter, dust and noise, and other perceived undesirable impacts.

10.2 Gulls and Other Vermin

Response

Because of management programmes included in the proposal, problems associated with gulls/vermin are not anticipated.

The monitoring programme, which includes maintenance of a public complaints register, combined with the Proponent's commitment regarding contingency planning (commitment number 77, PER, page 83) provide an adequate mechanism for addressing genuine off-site problems that may arise from the facility.

10.3 Odour

Response

As for 10.2.

10.4 Fire and Smoke

Addressed in previous detailed response.

10.5 Noise and Dust

Response

As for 10.2.

10.6 Litter

Response

As for 10.2.

10.7 Types of Waste Accepted

Response

Refer to commitment number 4 (PER, page 72).

11 LANDFILL GAS

Response

Refer to commitment numbers 33 (PER, page 77), and 57 and 58 (PER, page 80).

By operating and managing the site as proposed, the opportunity to effectively manage landfill gases exists and, as indicated by the Proponent's commitments, will be pursued.

12 MONITORING AND MANAGMENT

Response

The monitoring programme proposed is thorough and realistic and, through the mechanisms of the public complaints register and periodic reporting provisions, ensures independent scrutiny of the Proponent's operational and management practices. The contingency planning commitment provided (commitment number 77, PER, page 83) adequately addresses how the Proponent will respond in the event of an unanticipated impact occurring.

13 POST-CLOSURE MANAGEMENT AND END USE

Addressed in previous detailed response.

14 MISCELLANEOUS COMMENT

14.1 Proponent's Track Record

Response

The Proponent has received no complaints about the Ennis Avenue site for the past three years, and is unaware of any complaints having been directed to the Health Department or other Authorities during this period. The Proponent's track record at Ennis Avenue cannot, therefore, be regarded as poor.

Nevertheless, if the Millar Road project is approved, the commitments given by the Proponent will be legally enforceable through conditions attached via the Ministerial Statement issued pursuant to Section 45(5) of the Environmental Protection Act, 1986. The Proponent will, therefore, have to comply with the undertakings given or other conditions imposed through the Ministerial Statement.

14.2 Public Health Risk

Response

In view of the design, operational and management features incorporated in the proposal, there is no valid reason to believe that the landfill would pose a public health risk. Presumably, if landfills did represent a public health risk, the Health Department would respond appropriately.

14.3 Effect of Rejection on Viability of Local Industries

This is not of relevance to the environmental impact assessment process. The facility will, however, be more convenient to the local communities and, therefore, may present opportunities for cost savings to local industries with inert waste materials requiring disposal.

14.4 Aesthetics of the Kwinana Locale

Response

The site will be effectively screened and therefore unlikely to produce a significant impact on local landscape amenity.