PROPOSED REFUSE DISPOSAL FACILITY AT MINDARIE

CITY OF PERTH
CITY OF STIRLING
SHIRE OF WANNEROO

Report and Recommendations by the Environmental Protection Authority

Department of Conservation and Environment
Perth, Western Australia

Bulletin 230 November 1985

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REPORT AND RECOMMENDATIONS BY THE

ENVIRONMENTAL PROTECTION AUTHORITY

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SUMMARY AND RECOMMENDATIONS

The Environmental Protection Authority (the Authority or the EPA) has concluded an assessment of the proposed refuse disposal facility on 22 hectares of Lot 17, Mindarie. The proposed life-time of the facility is approximately 20 years. This report is presented to provide an environmental input to the decision-making process.

ISSUES TAKEN INTO CONSIDERATION

The Environmental Review and Management Programme (ERMP) prepared by Kinhill Stearns (on behalf of City of Perth, City of Stirling and the Shire of Wanneroo (the proponents)) was on public exhibition for sixteen weeks. The Authority has received a number of submissions on this project. The matter raised by these submissions included both the site-specific environmental issues and the broader issues of resource management and strategic planning. These broader issues include the need to investigate alternative waste disposal methods and the rationalisation of Perth's long-term waste management. The overall responsibility for metropolitan waste management lies within the domain of various Government agencies, and so the Authority has confined its assessment to the environmental implications of this project. Notification of the broader issues has been forwarded to the Cabinet Committee on Metropolitan Waste, which is currently reviewing an overall waste management strategy for Metropolitan Perth.

SITE SELECTION AND LANDUSE PLANNING

The ERMP identified five specific sites and three general areas within Perth's northern region. The document then developed site selection criteria and through a process of elimination, identified two potentially suitable sites. Of the two sites, lot 17 Mindarie is the proponents' preferred site because it is closer to the centroid of the three councils.

The Authority has reviewed the site selection process. The Authority believes that given:

- the linear nature of residential development along Perth's northern coast; and
- the predicted population within the catchment of the North-west corridor,

there is a need for a northern regional refuse disposal facility to be located either within or in the proximity of the catchment of the North-west Corridor. This is so even for the disposal of residue from future high technology or compost disposal methods. Of the alternative sites presented in the ERMP, Lot 17 Mindarie is considered the most appropriate site for the refuse disposal facility over the proposed life-time of the project. The main advantages of the site are its current isolation, location on Quindalup Sand (for leachate attenuation), its potential 1 km wide buffer zone, and its position toward the coastal margin of the Gnangara mound of groundwater.

The Lot 17 Mindarie site is 432 hectares in area of which the southern 220 hectares is designated in the North-west Corridor Structure Plan (MRPA 1977) as 'Parks and Recreation'. The 22 ha disposal site is located in an enclosed depression within this southern area. The System Six Red Book supports the concept of the southern area being incorporated within the Neerabup National Park to form an east-west wedge of open space in the long-term future.

The proponents propose to develop the waste disposal facility during the interim period ie up to 20 years. The Authority has been advised by the Town Planning Department that it is unlikely that the 'Parks and Recreation' component of Lot 17 Mindarie would be reserved, for this purpose, during the interim period of the waste disposal proposal.

The EPA System Six Red Book indicated that a refuse waste disposal facility was proposed for Lot 17. The Red Book suggests that the final rehabilitation of the proposal should conform to the 'Park and Recreation' nature of the surrounding area.

LEACHATE MANAGEMENT AND GROUNDWATER CONTAMINATION

The proponents prefer the 'dilute and disperse' method of leachate control. The ERMP states that there will be adequate time to observe and understand the behaviour of the plume, and to develop management strategies as appropriate to prevent any pollution of the marine environment. The document supports this statement by a hydrogeological analysis, using a number of assumptions and parameters.

The Authority has re-analysed this strategy, using alternate methods of analysis and different parameter values. The Authority's analysis gave different predictions for components of the water balance, but was still in support of the overall strategy.

While the Authority's analysis gave different predictions, the available evidence still suggests that reasonable reduction of pollutants will occur, through dilution, and that the rate of transport seaward of the plume will allow sufficient time for both monitoring, and for management strategies to be developed.

SOCIAL IMPACTS

The operation of a regional refuse disposal facility has the potential to generate socially undesirable environmental impacts. These include dust and odour emissions, noise, increase in vermin and rodents, fire risk, the spread of Salmonella by seagulls and other scavengers, increase in traffic and the visual impact if the site is left unscreened.

It is the Authority's opinion that the degree of local social impact can be adequately reduced by appropriate site management. The Authority has recommended that the proponent should prepare a detailed Environmental Management and Monitoring Programme (EMMP) which would, among other objectives, aim to develop the site in a manner so as to reduce the social impacts (see Chapter 5.3 for details).

ENVIRONMENTAL MANAGEMENT AND MONITORING

The Authority believes that the environmental management of a regional waste disposal facility cannot be reviewed in isolation. A Cabinet Committee on Metropolitan Waste is currently reviewing an overall Waste Management Strategy for Metropolitan Perth. The Authority has recommended, in Chapter 6 of this Assessment Report that once such Metropolitan Waste Management Strategy is developed, then the development and management of the Mindarie site should conform with this strategy.

As mentioned earlier, the Authority has recommended that the proponents prepare an Environmental Management and Monitoring Programme. This would provide the details on how the 22 hectare waste disposal site would be managed during the life-time of the proposal. This comprehensive report would also discuss how the site would be rehabilitated so as to prevent long-term leachate generation and be integrated with the regional open space proposed for the area.

The Authority believes that the EMMP should be updated every five years, taking into account the results of ongoing monitoring and management.

CONCLUSION

The Authority concludes that the proposed facility is acceptable on environmental grounds, subject to compliance by the proponents with commitments they have given, and to the adoption and implementation of the Authority's recommendations.

RECOMMENDATION 1

The EPA recommends that the excavated ground level of the refuse disposal site should be, at a minimum, 5 m above the groundwater table.

RECOMMENDATION 2

The EPA recommends that an appropriate number of monitoring bores be established, as soon as possible, around the proposed 22 hectare refuse disposal site in order to obtain background groundwater quality data. Furthermore, the bores should fully penetrate the aquifer in order to determine its true depth.

RECOMMENDATION 3

The EPA recommends that once an overall Waste Management Strategy is developed for Metropolitan Perth, then the development and management of the Mindarie site should conform with this strategy.

RECOMMENDATION 4

The EPA recommends that a condition of approval should be the preparation of an Environmental Management and Monitoring Programme (EMMP) to the EPA's satisfaction.

The EMMP should include:

- *matters identified in Chapter 5 of this Assessment Report as needing consideration in the EMMP;*
- *quarrying and refuse disposal management for the 22 hectare site, over the proposed life of the facility. (Sequential disposal should be undertaken in a manner so as to be moving away from the future nothern residential sector in the later years). Refuse disposal methodology should emphasise the safeguards undertaken to reduce social impacts like odours, noise, fires, rodents and Salmonella from the disposal site;*
- *overburden and stockpile management including dust control and minimisation of visual impact;*

- *rehabilitation of the 22 hectare site and other areas disturbed by quarrying of refuse disposal. This should include details of final landform, revegetation, proposals for the final landuse and its compatibility with the surroundings;*

- *a Landuse Management Plan for Lot 17 which should be compatible with any structure plan for the surrounding area;*

- *rationalisation of the traffic movements and methods by which traffic impact would be minimised;*

- *details of the monitoring of environmental parameters especially groundwater contamination;*

- *details of management of groundwater impacts including prevention of marine pollution. The EMMP should take into account the baseline monitoring information provided by the bores around the site (see Recommendation 2);*

- *details of longer-term (post refuse disposal) leachate prevention and management.*

RECOMMENDATION 5

The EPA recommends that the proponents should update the EMMP every five years, taking into account the results of ongoing monitoring and management, and re-submit it, for review, to the relevant Government agencies.

1. INTRODUCTION

The proponents, comprising the Cities of Perth and Stirling and the Shire of Wanneroo, propose to develop a 22 hectare refuse disposal facility on portions of Lot 17 Mindarie, a 432 hectare property situated approximately 3 km north of Burns Beach and 30 km north of the Perth City centre (see Figure 1).

The proposal consists of the sanitary landfall disposal of approximately 3.6 million tonnes of organic domestic refuse over the proposed life-time of the facility. The proposed facility would specifically exclude liquid or toxic wastes and sludges. Inert inorganic waste may or may not be disposed at the site depending on the availability of alternative disposal sites suitable for this type of waste elsewhere. The description of the proposal and the existing environment is discussed in Chapter 2.

The expected life-time of the proposed Mindarie refuse facility is approximately 20 years. The proponents may seek subsequent disposal approvals at Lot 17 Mindarie, at the end of this period. However, this should be the subject of a separate environmental review process.

An Environmental Review and Management Programme (ERMP) was prepared by the proponents under guidelines issued by the EPA (see Appendix A) and subsequently released for an eight-week public review period which ended on 27 April 1984. At the request of the Shire of Wanneroo, this review period was extended to close on 26 June 1984. The EPA has assessed the environmental aspects of the project from information provided in the ERMP, public and Government agencies' comments on the ERMP, the proponents' response to those comments and the Authority's own investigations.

The Authority has received a number of public submissions on this project. The matters raised by these submissions are analysed in Appendix B and are listed in Chapter 3. Some of these concern the broader issues of resource management and strategic planning. While there is an environmental component to these issues, overall responsibility for them lies within the demain of other Government agencies. Accordingly, the Authority, while recognising the importance of these issues, has confined its assessment to the environmental implications of this project.

These resource management and strategic planning issues, which aim to rationalise long-term waste disposal in Metropolitan Perth, have been forwarded to the Cabinet Committee on Metropolitan Waste, which is currently reviewing an overall waste management strategy for Metropolitan Perth. The Authority has suggested to the Cabinet Committee that these issues (listed in Chapter 3) be taken in any consideration of Perth's overall Waste Management Strategy (See Chapter 4).

The major environmental issues identified for the Mindarie project are as follows:

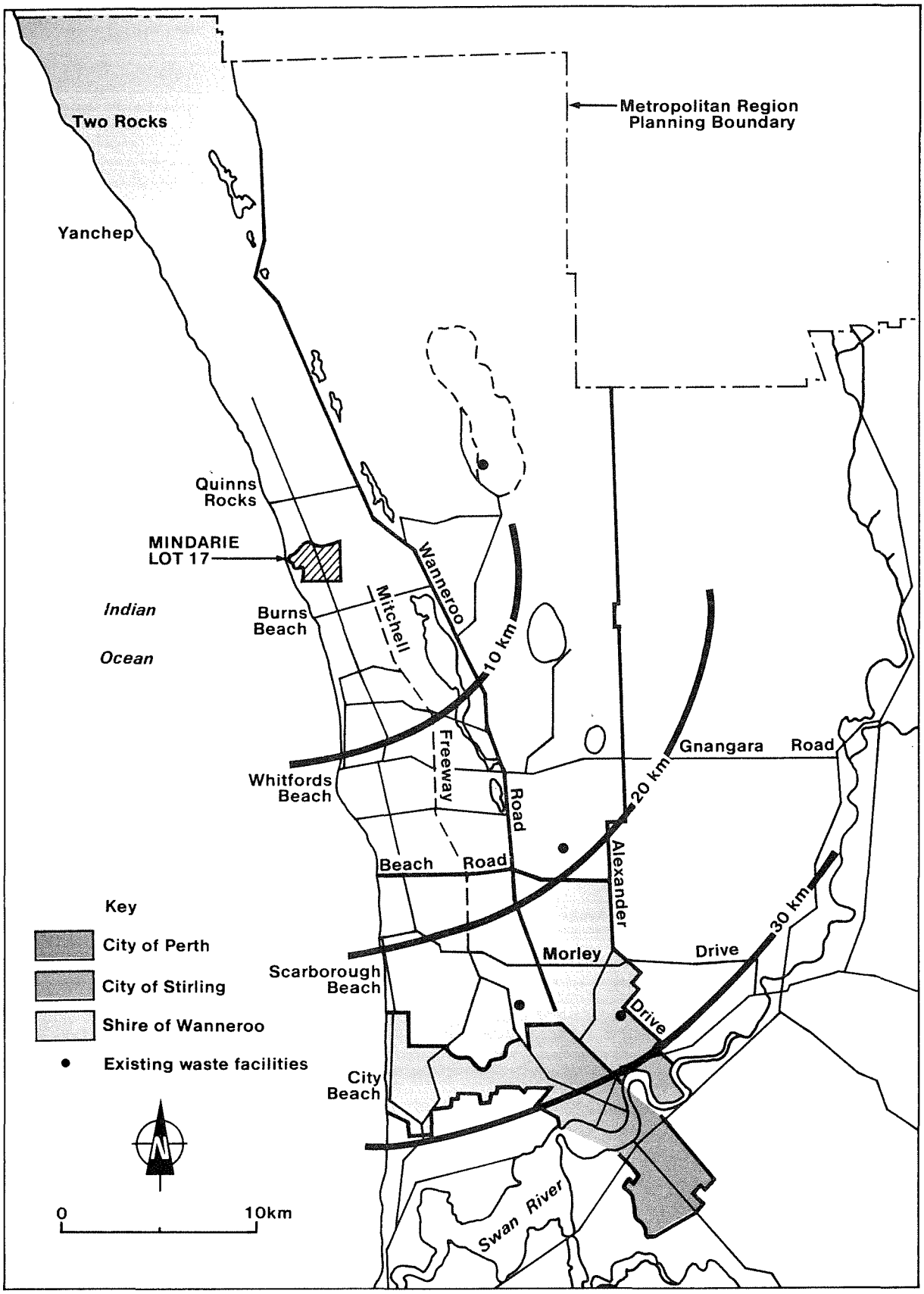


Figure 1 Location Plan. (Source : ERMP)

- site selection and land-use planning;
- leachate management and groundwater contamination;
- site management; and
- amenity and social impact

These issues are reviewed and discussed in Chapters 5 and 6 of this Assessment Report.

2. DESCRIPTION OF THE PROPOSAL AND EXISTING ENVIRONMENT

2.1 THE PROPOSAL

The existing refuse management system of the Cities of Stirling and Perth and the Shire of Wanneroo is as shown in Table 1.

EXISTING REFUSE MANAGEMENT SYSTEM

LOCAL GOVERNMENT AREA	PRETREATMENT	RESOURCE RECOVERY	ORGANIC DISPOSAL	INORGANIC REFUSE DISPOSAL ie BUILDING RUBBLE, etc	YEARS OF OPERATION LEFT
CITY OF STIRLING	Baling Plant at Balcatta Rd	Some resource recovery of metal, glass, etc	Sand pit at Alexander Yirrigan	Johnson Rd Maylands	Long period
CITY OF PERTH	(Baling Plant at Balcatta Rd)	Some recovery 60% glass recovered at source	. Brockway Road tip . Yirrigan . transfer station Bayswater	Johnson Rd Maylands Brockway Rd Nedlands	5 years (1990)
SHIRE OF WANNEROO	No pretreatment	Little recovery	Badgerup Rd Wanneroo	Badgerup Rd Wanneroo	2 years (1987)

Source . ERMP
. Health Commission

The capacity of the landfill disposal areas within the proponents' local Government catchment is limited. The proponents have argued that there is a need for a regional landfill site, capable of accommodating the northern regional domestic refuse, to the end of this century.

The proposal outlined in the ERMP calls for the progressive disposal of an average of 900 m^3 per day of organic domestic refuse on 22 hectares of the Lot 17 Mindarie site. Mindarie site location is shown in Figure 1. The method of disposal chosen is sanitary landfill. The proposed facility would not be accepting liquid and chemical refuse ie toxic wastes or sludges. Only representatives from the participating councils and persons represented by the three councils would be able to use the facility. Organic refuse would be taken from the existing Balcatta baling plant or from future transfer stations in the region.

The Lot 17 Mindarie site is 432 hectares in area of which the southern 220 hectares is designated as 'Parks and Recreation' future regional open space under the North-west Corridor Structure Plan (MRPA 1977). The proposal presented in the ERMP is for 22 hectares of an enclosed depression within this latter area to be used for land disposal of organic refuse over the next 20 years.

The landfill operation would be contained within a stable sand dune rim at the eastern edge of Lot 17.

Some 2.1 million m^3 of limestone and sand would be excavated over the life-time of the facility. Of this, 1.35 million m^3 would be re-used for cover material. The excess would either be sold or disposed off-site.

Within the 22 hectare waste disposal site, the existing rim ground level varies between RL22 to RL38. The proposal requires that this area be excavated to RL8, some 5-8 m above the groundwater table. The proposed excavation operational sequence would be in two strips as shown in Figure 2.

After examining two options by which the final height of the enclosed rim could be increased ie rapid development of rim or delayed gradual development, the ERMP prefers the latter option as this would have a minimum impact on the existing rim and vegetation. Figure 3 presents a diagrammatic explanation of the two options.

The placement of refuse in the disposal area would be as shown in Figure 4 and in accordance with the following guidelines as put forward in the ERMP (p 52):

- "compaction of loose refuse to conserve capacity and to make the refuse less permeable in order to reduce quantities of leachate;
- careful stacking of bales by forklift;
- covering of the refuse to control aspects such as odour and vermin and to deter gulls and other wildlife from feeding on the refuse;
- construction of the horizontal cover layers and vertical sand columns of soil to allow for escape of gases upwards and to assist in the free drainage of water through the disposal area;
- the depth of deposited refuse to be limited to about 6 m annually, to assist in reducing the volume of leachate while landfilling was being conducted; and
- the height of compacted refuse benches to be limited to 20 m above the adjoining level."

Refuse would arrive at the site either as 'loose' refuse from the transfer stations or as bales from the baling plant. The ERMP (p 52) states that the:

> "loose refuse would be deposited close to, and either above or, below the operating face of the disposal area and then 'pushed' to the operating face and completed in situ with mechanical compactors, in layers not exceeding about 0.5 m deep (loose)."

Bales, on the other hand, would be forklifted and stacked in 3 bale (approximately 2.4 m) height as shown in Figure 4.

All refuse would be placed in cells (200 m x 100 m) having sand columns or walls 2 m thick. The refuse would be covered daily with a 0.1 m layer. After a refuse depth of 2.4 m, an additional 0.3 m covering sand layer would be deposited. To assist drainage, refuse and covering placement would be sloped. This disposal method is designed to allow for the upward movement of decomposition gases and downward movement of drainage. An artist's view of what the site may look like after 15 years of operation is shown in Figure 5.

Associated facilities include a weigh-bridge, a wash-down area for trucks, a servicing area, water supply service, staff facilities and possibly a refuse transfer station.

The site is proposed to be progressively rehabilitated. The final landform is as shown in Figure 6.

The ERMP (p 54) states that site runoff and leachate would be controlled by the following methods:

. "the containment of stormwater to the working area and avoidance of concentrated flows over working batters; and

. the design of the work to include the stormwater to a predefined disposal sump."

The ERMP, while admitting that the generation of odours cannot entirely be eliminated from a refuse disposal site, states that with regular covering and other site management, all attempts would be made to substantially reduce the rate of odour release.

While no final landuse details are given for the rehabilitated refuse disposal site, the ERMP implies that this landuse would be compatible with the future 'open space' category of the site.

No information is provided in the ERMP on the facility's hours of operation or the number of people to be employed on site.

2.2 THE PROPOSED SITE

The proposed 22 hectare site is located in Lot 17 Mindarie on land currently owned by the proponents. As shown in Figure 1, the site is some 30 km north of the Perth Central business district, some 10 km from the Wanneroo townsite, 3 km from Burns Beach to the south-west and 4 km from Quinns Rocks to the north-west.

Lot 17 is bound by a strip of 'rural' land and then a narrow Crown reserve along ocean foreshore to the west and joins Neerabup Park on the east. While the areas to the north and south of the site are currently zoned rural, they have been identified in the North-west Corridor Plan (MRPA 1977) as being urban (deferred). The ERMP states that residential development is likely in the proximity of Lot 17 within the next 15 years.

During the site selection procedure, the proponent evaluated five specific sites and three general areas within the northern region

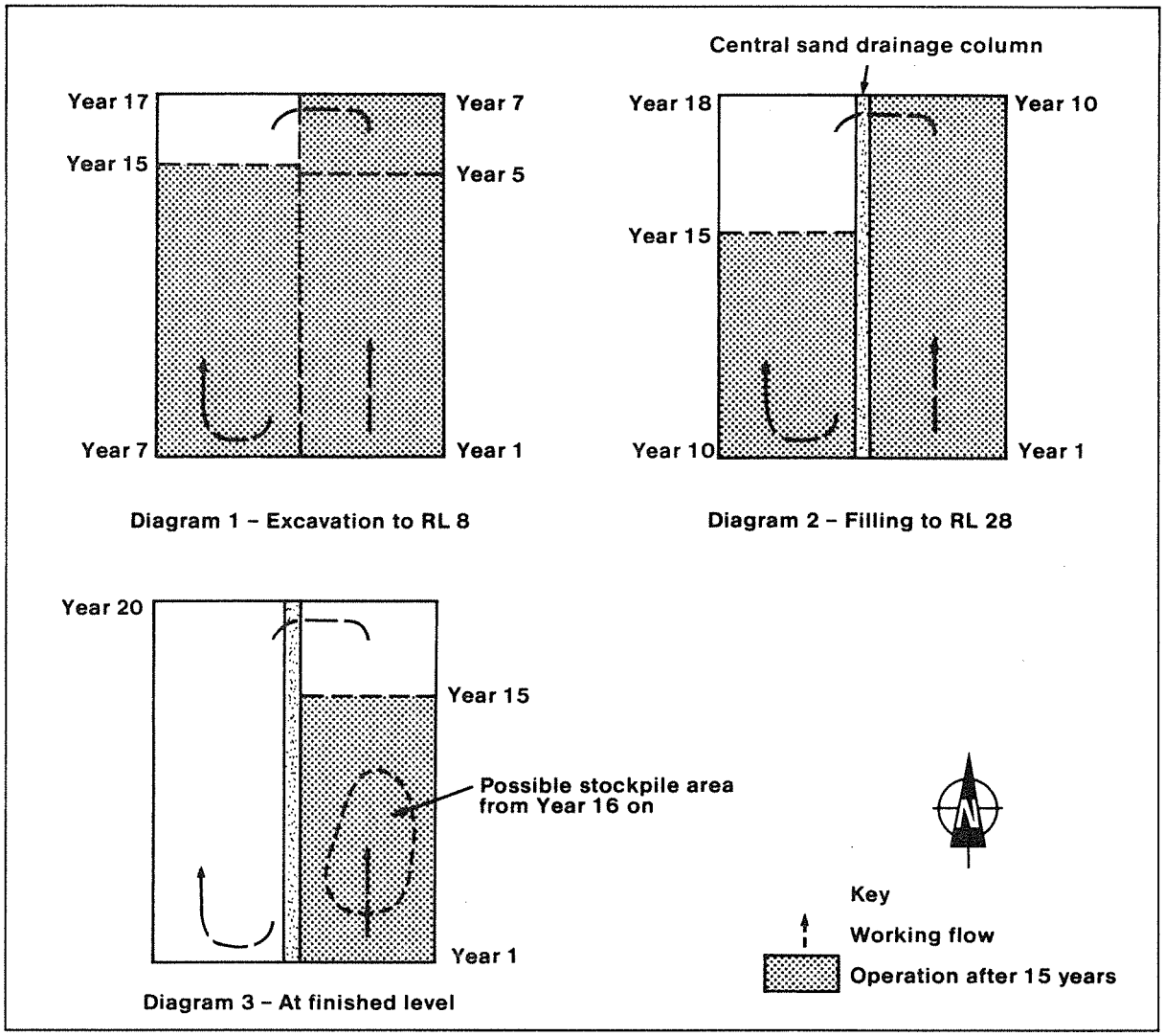


Figure 2 Operation Sequences. (Source : ERMP)

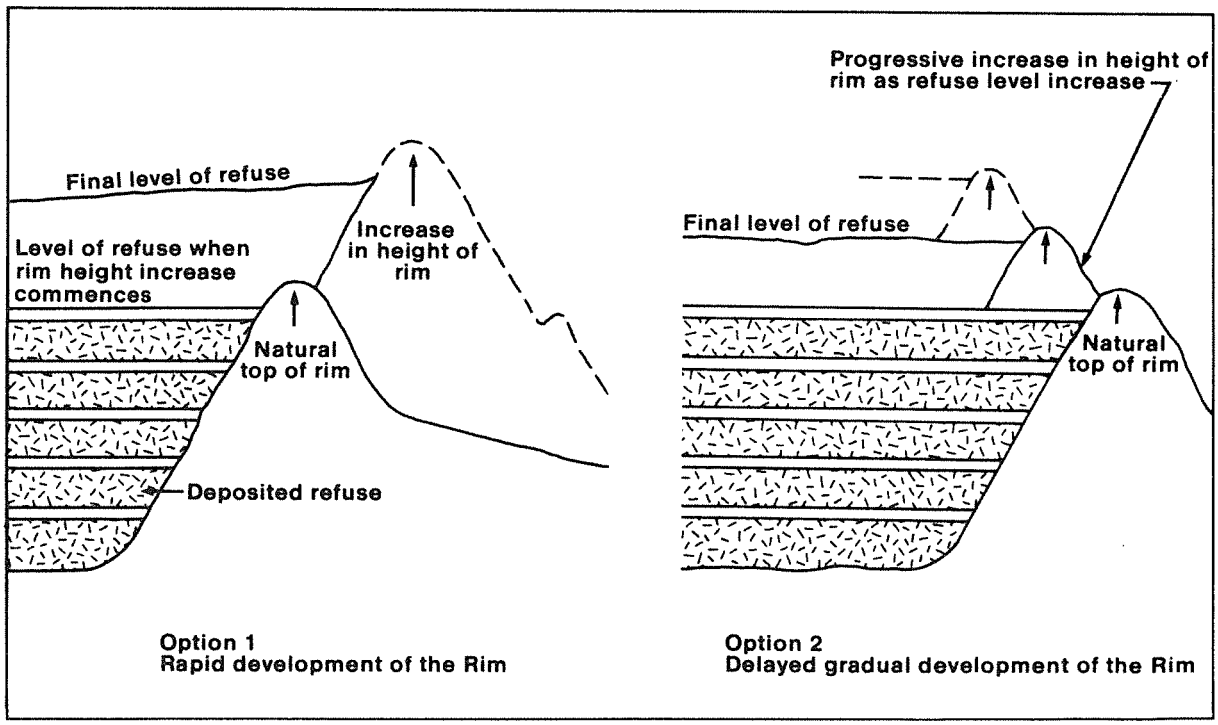


Figure 3 Rim construction options (Source : ERMP)

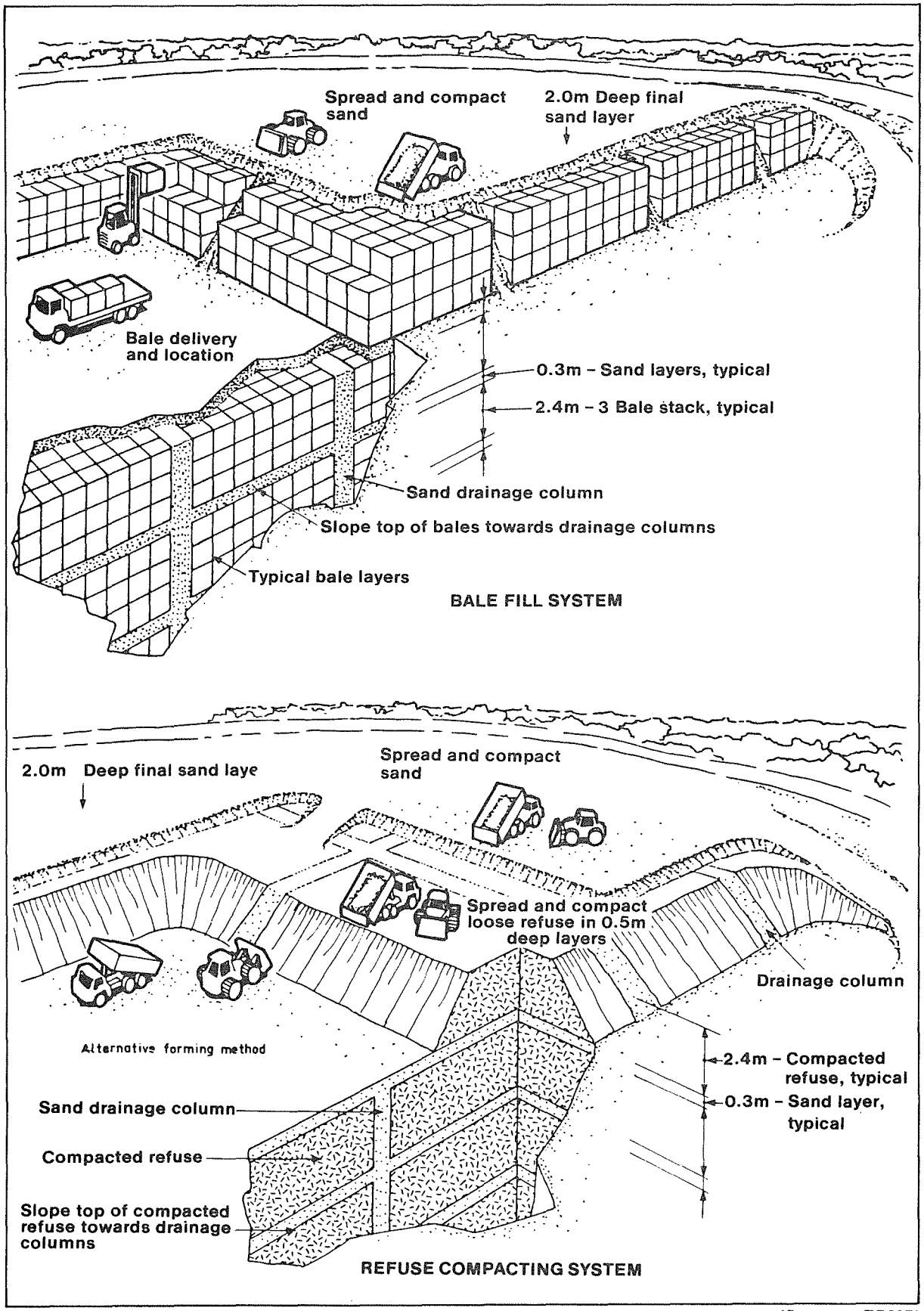


Figure 4 Refuse placement systems (Source : ERMP)

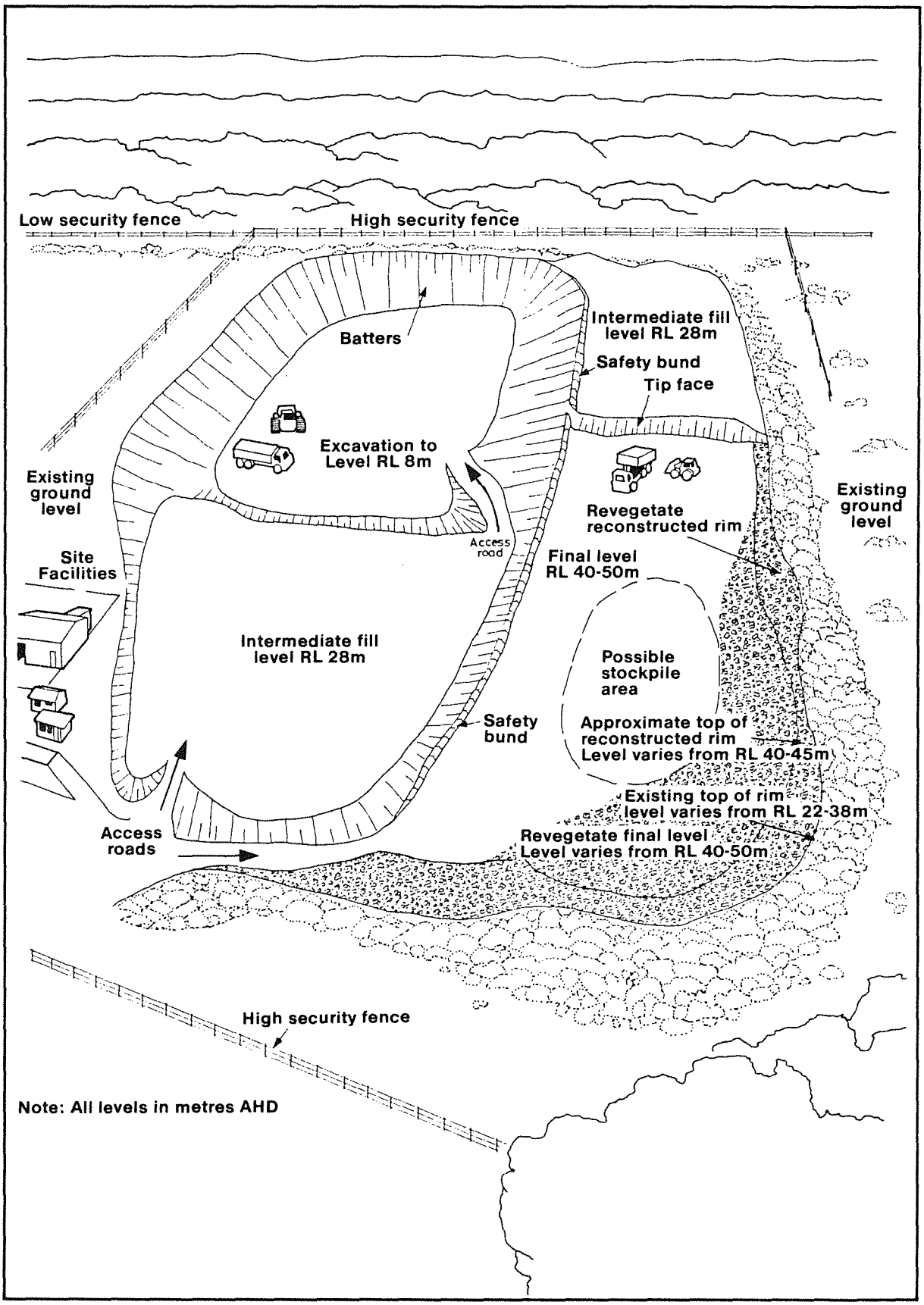


Figure 5 Site operations after 15 years (Artist impression)

(Source : ERMP)

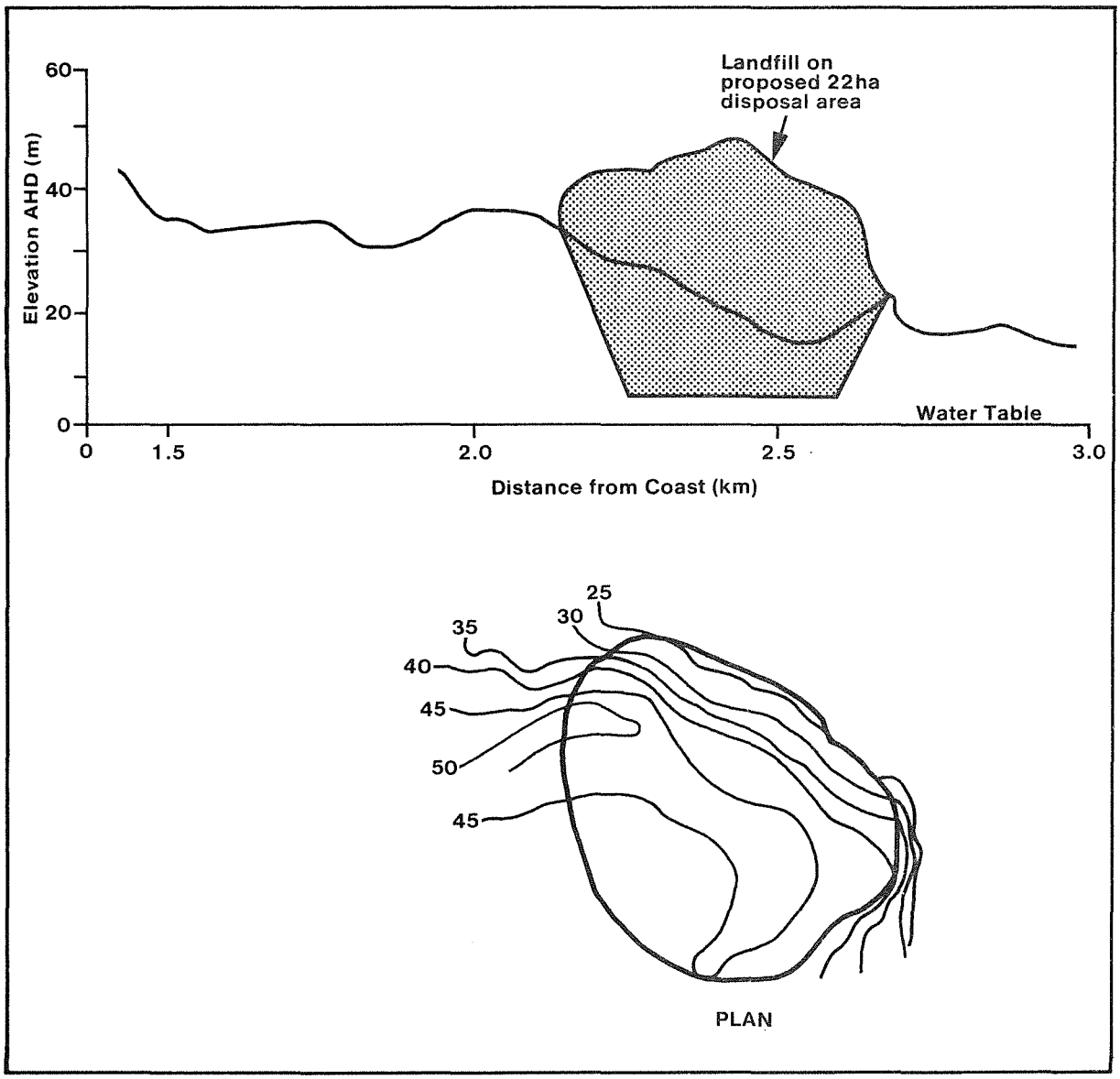


Figure 6 Final Landform (Source : ERMP)

(see Figure 7). An appropriate site selection criteria was identified in the ERMP, and by comparing a set of site selection factors against the identified sites, a process of elimination of unsuitable sites was undertaken (see Table 2). Table 2 identified two potentially suitable sites, one at Lot 17 Mindarie and in Area B. The ERMP states that while both sites are similar Mindarie is preferred because it is closer to the centroid of the three councils.

TABLE 2 QUALITATIVE APPRAISAL OF POSSIBLE REFUSE DISPOSAL SITES

Site selection factor	Yirrigan	Badgerup Road	Flynn Drive	Mindarie	Pinjar Road	Area A	Area B	Area C
Ownership	●	○	⊙	○	○	⊙	●	●
Environmental								
. Biological significance of the site	○	○	⊙	⊙	⊙	○	○	●
. Groundwater pollution	○	■	■	○	⊙	○	○	⊙
. Air emission impacts	●	⊙	⊙	⊙	○	○	⊙	○
Engineering								
. Topography	○	○	⊙	○	●	⊙	○	○
. Road access	○	○	○	⊙	○	⊙	⊙	●
. Size	○	○	⊙	○	●	⊙	○	⊙
Social								
. Town planning	●	⊙	⊙	○	○	○	○	●
. Region scheme	⊙	○	⊙	○	○	○	○	⊙
. Surrounding residents	●	⊙	⊙	⊙	○	○	⊙	○
Location								
. Economics	○	○	○	⊙	⊙	■	●	■

Level of constraint

○ Little or no constraint
⊙ Moderate constraint
● Major constraint
■ Over-riding constraint

SOURCE ERMP

The ERMP (p 37) gives the following reasons why Lot 17 was chosen as the preferred site.

. "Groundwater flows from the site would be to the ocean to the west, and it is considered unlikely that there would be future private users of the groundwater along this route.

. The site has capacity to accommodate long-term disposal capacity.

. The site is sufficiently large to accommodate the initial disposal operation requiring 22 hectares while still maintaining adequate buffers to residential and similar uses.

. By the time that the northwards extension of urbanization reached the site, the landscaping screening and sand stabilization should be well established.

. As an interim land use, sanitary landfill at the site would be compatible with the strategy to develop a major east-west park/recreation link between the coast and the Neerabup National Park.

. The site is owned by the participating councils."

The matter of site selection is further discussed in Chapter 5.1 of this Assessment Report.

2.3 THE EXISTING ENVIRONMENT

2.3.1 The Bio-Physical Environment

The preferred site is located near the western edge of the Swan Coastal Plain. The surface geology of this area of the plain consists mainly of deposits of calcareous sands and derivatives. Adjacent to the coastline are the Safety Bay Sands of the Quindalup Dune System. Within a short distance from the coast, the dune system changes from Safety Bay Sands to the older Tamala (Coastal) Limestone of the Spearwood Dune System. Further inland from the coast lies the Bassendean Sand System (see Figure 7). Table 3 shows the general relationship and characteristics of the geology, landform and soils of the north-west coastal region.

TABLE 3 GEOLOGY, LANDFORM, LANDSCAPE AND SOIL (SOURCE ERMP)

Geology	Landform unit	Landscape	Soil
Safety Bay Sands	Quindalup Dunes	Generally steep dunes	Calcareous profile throughout, generally white but occasional incorporation of yellow sands from underlying Spearwood Dunes. Organic accumulation to depths between almost zero (the youngest and the unstable dunes) to over 30 cm (for the older dunes)
Tamala (Coastal Limestone	Spearwood Dunes Cottesloe	Rolling dune	Large proportion of rock shallow brown sands
	Karrakatta	Undulating	Deep yellow sands over limestone

As mentioned earlier, Lot 17 borders on the east to the Neerabup National Park. The Park vegetation consists primarly of low woodlands and open woodlands of sheoak, banksia, Christmas tree and prickly bark. There is also limited occurrence of marri, paperbark and patches of jarrah and tuart. System Six Red Book states that 'the area (of Neerabup National Park) constitutes open-space of regional significance because of its high conservation and recreation value and its proximity to Perth's residential areas' (EPA 1983 P164).

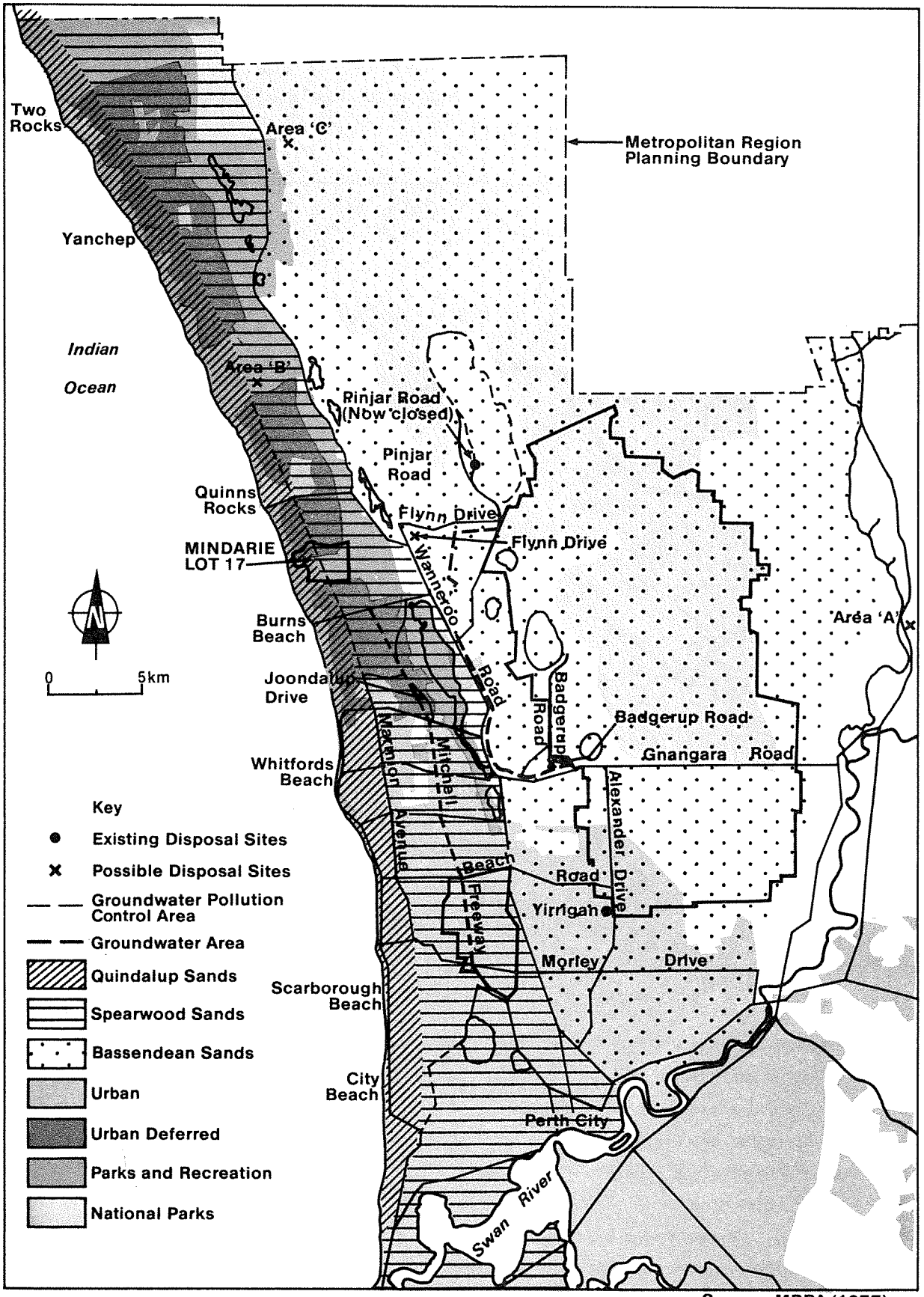


Figure 7 Alternative sites, generalised geology, land use and zoning.

Source: MRPA (1977)
NEWMAN (1981)
ERMP

The landform and soils of Lot 17 are shown in Figure 8. lies within the interface of the Quindalup and Spearwood Systems. The existing vegetation of the site is shown i Sections of Lot 17 were cleared in the past for grazing, areas have been highlighted in Figure 9.

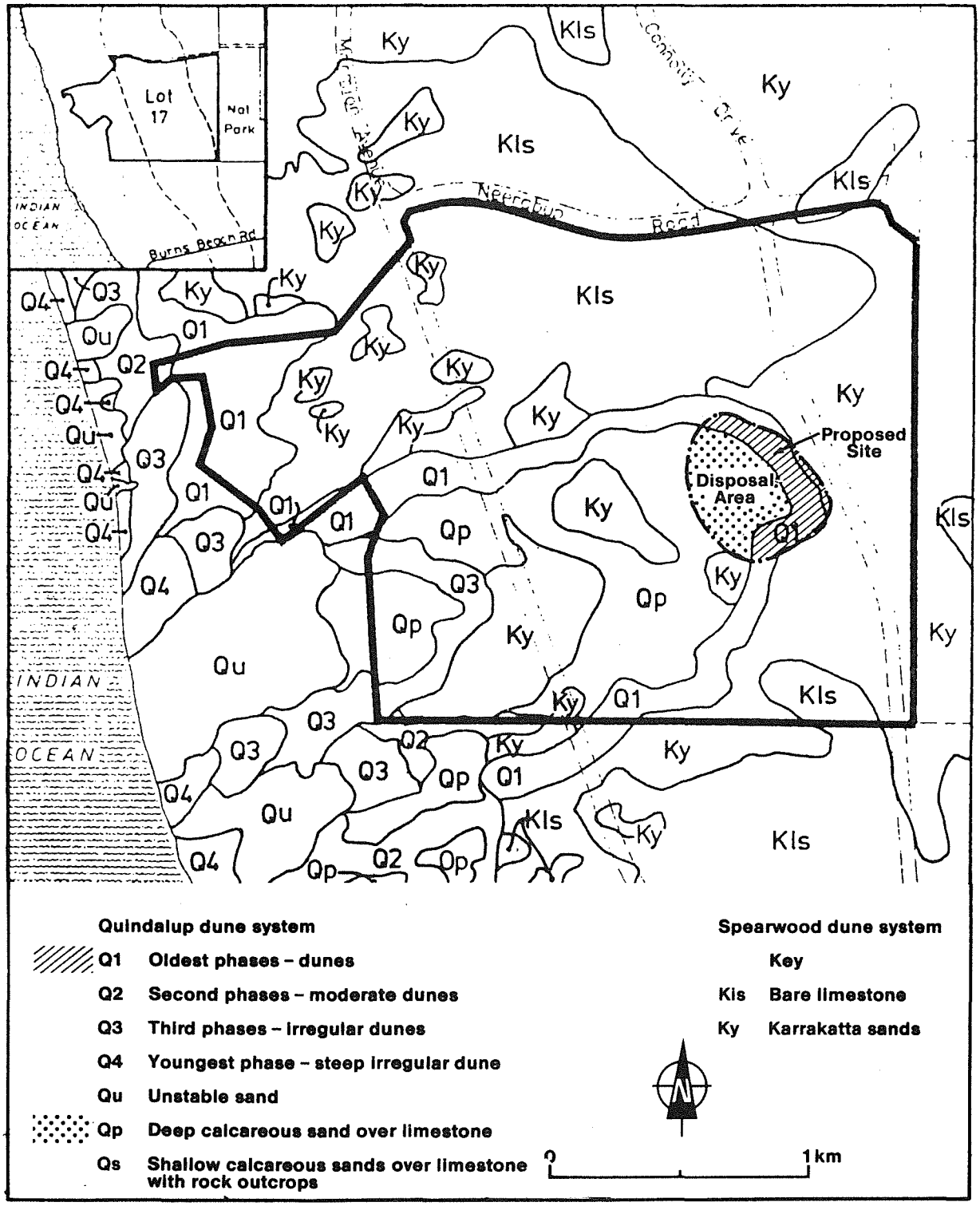
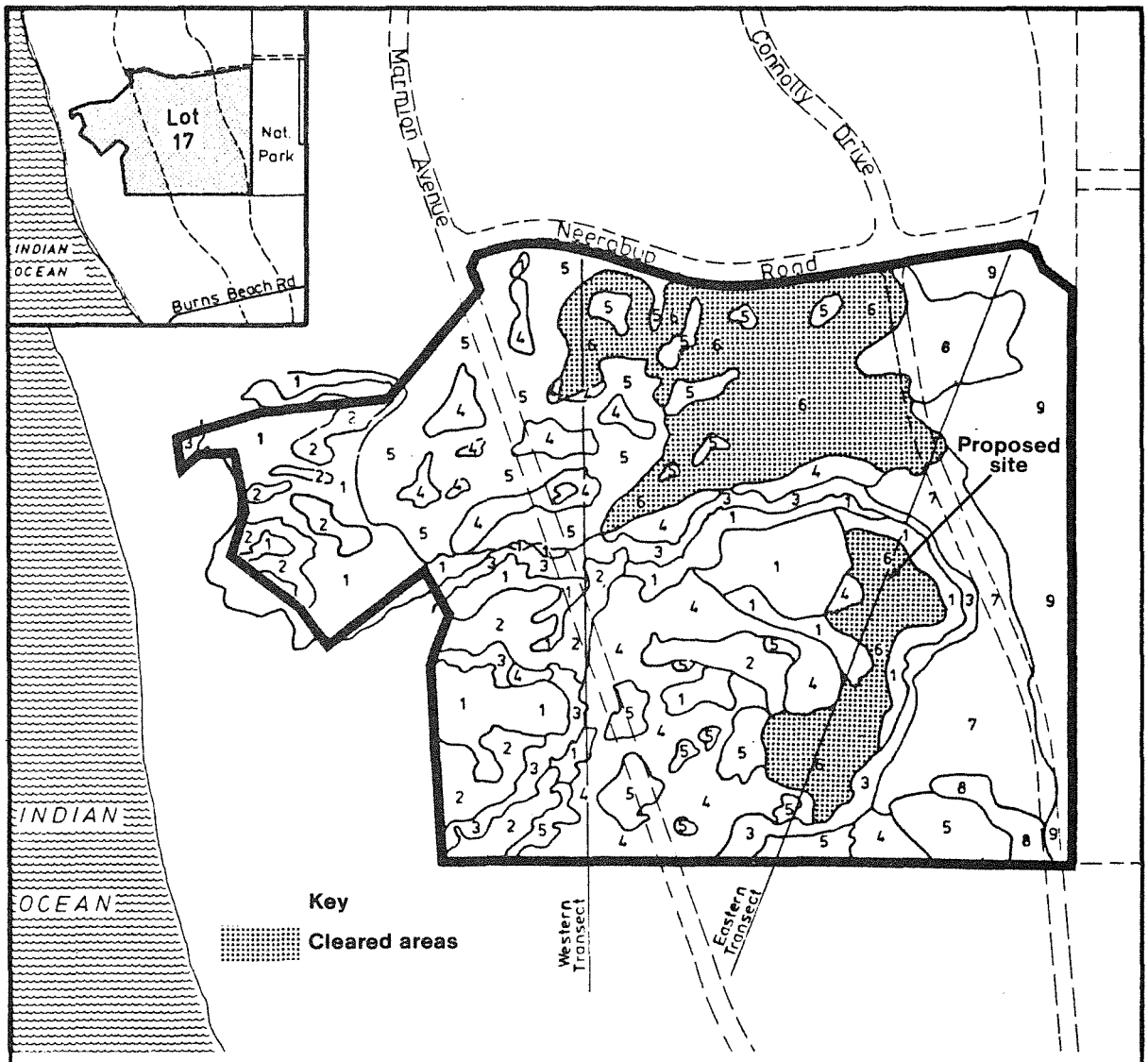


Figure 8 Landform and soils (Source : ERMP)



1 Low shrubland of Acacia. Predominantly Acacia rostellifera in gullies of the Quindalup dune system. Note some mallee species present and sections have been burnt recently.

2 Coastal complex - consisting of low shrubs and sedges. Emergent species include the daisy - Olearia axillaris.

3 Low shrubland on the unstable dune breakaways. In sections the plant community has been disturbed by localised blowouts.

4 Low open woodland of Banksia attenuata - B. menziesii.

5 Limestone heath dominated by Dryandra sessilis. This community is associated with the shallow limestone outcropping of the Cottesloe system.

6 Grassland with a few Acacias and occasional pocket of Tuart (Eucalyptus gomphocephala). This community appears to be disturbed and degraded as '4' above.

7 Woodland of Tuart (Eucalyptus gomphocephala).

8 Cleared open woodland of communities '4' and '9' - mostly introduced grass species with the occasional Coastal Blackbutt (Eucalyptus todtiana) and Banksia (Banksia attenuata and B. menziesii).

9 Woodland of Jarrah, Coastal Blackbutt (Eucalyptus marginatta - E. todtiana) with occasional Tuart. This community occurs on the deeper yellow sands of the Karrakatta dune system.

Figure 9 Vegetation Map units **(Source : ERMP)**

Figure 10 shows the water regime at Lot 17 Mindarie in diagrammatic form. While no extensive exploratory drilling has been undertaken, it is believed that the base of the Tamala Limestone lies about 35 m below AHD.

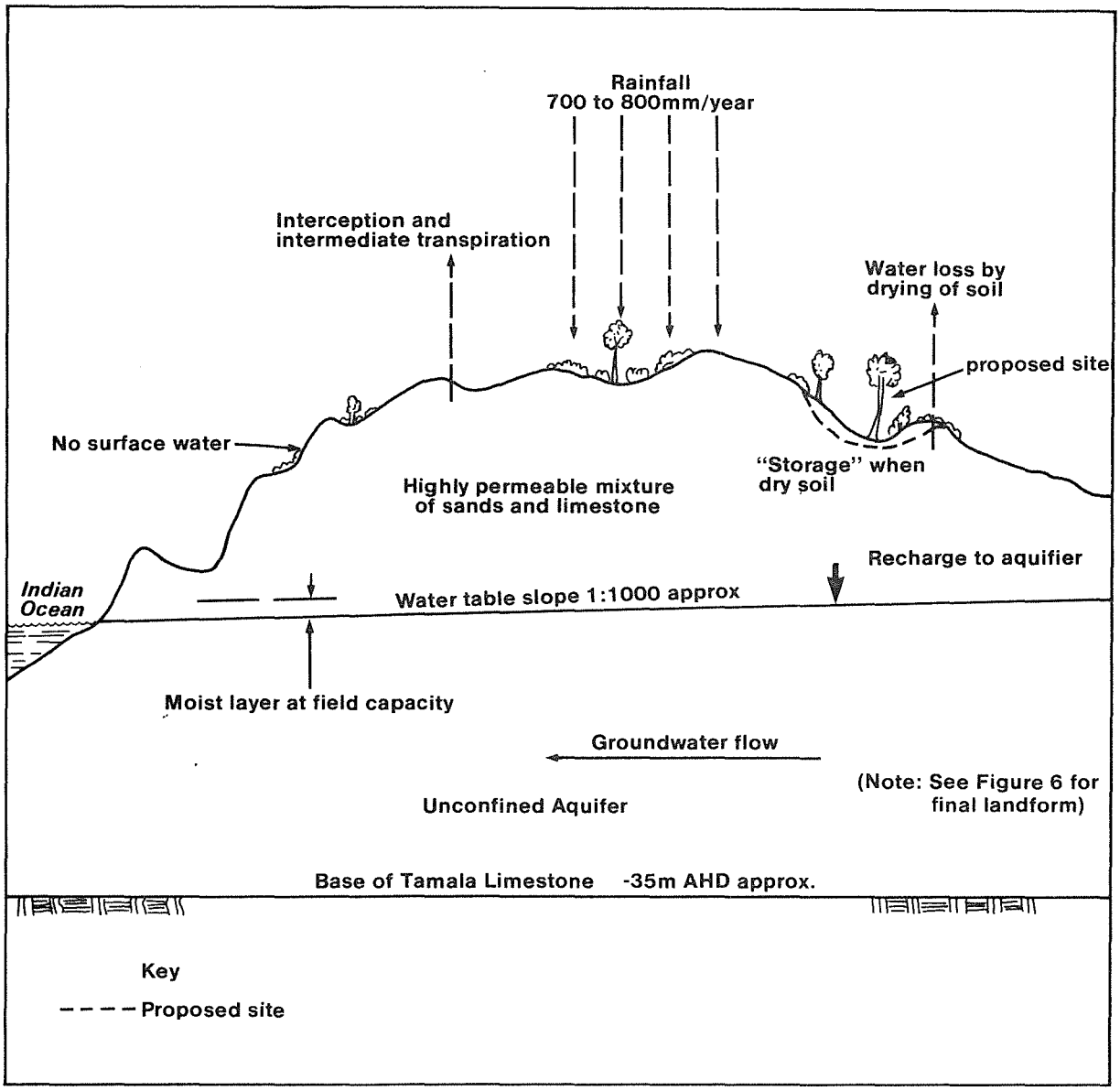


Figure 10 Water Regime (Source : ERMP)

Initial investigation work, undertaken by the proponent and mentioned in the ERMP (p A16), states that the limestone appears to be saturated to a few centimetres above sea level. In addition, regional hydraulic data (Allen 1981) suggests that the potentiometric surface (water-table) of the Tamala Limestone aquifer near the coast grades gently seaward (approximate slope 1:1000). The low gradient is indicative of a highly transmissive aquifer.

However, whilst no exploratory drilling has been undertaken to verify this, the ERMP states that the water table below Lot 17 lies between 1 and 3 m above AHD. Similarly, while no site measurements have been made, the ERMP estimates that the partially saturated zone exists above the water-table, and which may fluctuate in response to rainfall exchange, up to 3 m above this table. This level appears to be much higher than that put forward by other sources in the literature (Todd 1959).

The annual precipitation for the Lot 17 area is approximately 700 mm while the evapotranspiration would be approximately 1275 mm. Much of this rainfall would occur over the winter months. The ERMP cites Carbon (1976) to highlight the fact that only about 8-10 per cent of the total rainfall would eventually reach the aquifer for re-charge.

In regard to other meteorological factors, the ERMP states that the site is 'windy' and subject to strong sea breezes and other winds associated with the prevailing weather pattern. The prevailing winds are generally from the west in winter, while in summer there is an approximate six-day cycle of winds from the south-west shifting to the south and then the east.

The nominated 22 hectare waste disposal area is predominantly cleared of vegetation. This area's landform and soil consists of the Quindalup Dune System comprising of the oldest phase dunes and deep calcareous sands over limestone.

2.3.2 Landuse and Zoning

The existing zoning, as shown in the Metropolitan Region Scheme (MRPA 1982), for Lot 17 and adjacent areas to the north and south is 'rural'.

The North-west Corridor Structure Plan (MRPA 1977) is shown in Figure 7. This Plan shows the following features relevant to this proposal:

- 'Urban deferred' areas to the immediate south of, and in the northern half of, and extending northward from, Lot 17 Mindarie.

- An east-west wedge of 'parks and recreation' area linking the coast to the Neerabup National Park through the southern half of Lot 17 Mindarie. The purpose of this reserve as outlined in the structure plan (MRPA 1977 p 141) is to:

  - "provide active recreation space, such as a golf course;

  - protect an area of scenic interest;

  - protect an old blowout as a feature of scientific (geomorphological) interest; and

  - protect a cross-section of corridor vegetation."

The Plan states that the expected total population of the North-west region, when ultimately developed, would be approximately 330 000 (p 46).

Another relevant input to the planning of the study area is the EPA System six 'Red Book'. The EPA observed in the Red Book that the long, narrow shape of the Neerabup National Park makes its management difficult. However, the Red Book stated that:

> "this problem could be partially alleviated by the addition to the park of (the southern 220 hectares of Lot 17 Mindarie and immediately adjoining area to the south)... The addition of the two areas would also give the Park improved representation of the local ecosystems." (EPA 1983, p 164.)

The EPA was aware while compiling the Red Book that there may be a refuse disposal site on Lot 17 Mindarie, but thought that the relevant section of Lot 17 "may be suitable for inclusion in the Park if it is properly rehabilitated". (EPA 1983 p 164.)

3. REVIEW OF SUBMISSIONS

As mentioned earlier, the ERMP was released to the public and Government agencies for an eight-week public review period, which was to have ended on 27 April 1984. At the request of the Shire of Wanneroo, the review period was subsequently extended to close on 26 June 1984.

A total of 31 submissions was received: 15 from Government agencies and 16 public submissions, one of which was accompanied by a petition, against the proposal, containing over 450 signatures. All the submissions have been analysed and the main issues summarised in Table 4. A more detailed list of comments can be found in Appendix B, which also includes the list of people and Government departments making submissions.
The issues that received most frequent comment related to:

. Planning and Site Selection

- alternative disposal technology/techniques
- alternative sites for landfill, site selection process
- economics of proposal
- optimal use of excavated limestone
- System Six (conflict)
- landuse 'not compatible' with Neerabup National Park
- road access
- regional planning issues and implications
- need for more co-ordinated planning for waste management.

. Leachate Management and Groundwater Contamination

- leaching and groundwater contamination
- data, models, terms, formula and calculations questioned
- coastal (marine) impacts of leachate

. Site Management

- management issues and problems
- dune instability
- odour, smoke, litter, noise, flies, vermin and feral animals
- Salmonella
- excavation engineering and pit stability

. Amenity

- general quality of life
- property values
- odour, smoke, litter, noise, flies, vermin and feral animals
- Salmonella

. Other Specific Comments

- flora and fauna ('all residual vegetation important, even degraded')
- Aboriginal sites not investigated
- sanitary landfill 'antiquated'

TABLE 4.

SUMMARY OF ISSUES RAISED IN SUBMISSIONS

MAIN ISSUES	GOVERNMENT DEPARTMENT SUBMISSIONS															PUBLIC SUBMISSIONS																TOTAL
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20a	21	22	23	24	25	26	27	28	29	30	31	
Disposal technology/techniques										●					●			●	●	●		●	●			●	●	●			●		11
Coordinated waste planning										●					●			●	●				●			●		●		●		●	9
Economics										●								●	●	●		●	●			●		●					8
Site selection				●	●					●								●								●		●			●		7
Road access								●		●					●			●									●						5
System Six										●								●								●	●	●					5
Neerabup National Park						●												●					●									●	4
Regional planning										●					●			●									●						4
Limestone resource				●						●																							2
Leaching and groundwater				●	●	●			●	●	●			●		●	●	●	●	●	●	●	●		●	●	●	●	●		●	●	22
Coastal/marine impacts				●		●			●							●	●	●		●		●	●		●				●			●	12
Data, models, terms, formula, calculations				●	●													●	●								●				●		6
Odour, smoke, litter, noise, flies, vermin and feral animals										●							●					●	●		●	●		●	●			●	9
Salmonella																	●			●			●		●	●	●	●					7
Site management				●						●	●			●				●									●				●		7
Dune stability	●					●																				●		●					4
Pit excavation and stability				●																													1
Quality of life																	●						●										2
Property values																	●																1
Sanitary landfill "antiquated"																		●				●	●		●	●	●	●	●				8
Flora and fauna			●			●												●								●	●	●					6
Aboriginal sites												●																					1
ERMP investigation/documentation				●		●				●	●		●	●				●	●	●		●				●	●	●			●		14
EIA process/EPA function																		●								●		●	●				4
Oppose project (no reasons)																								●						●			2
No impact foreseen/no comment		●					●																										2

. Environmental Assessment

- EIA and EPA function should be expanded to include 'other' issues
- adequacy of ERMP documentation

Information and comments on site-specific environmental matters, provided in submissions, have been used to assist in the evaluation of the Mindarie refuse disposal facility proposal. Other issues, identified in the submissions, and listed below, have been forwarded to the Cabinet Committee on Metropolitan Waste which is currently reviewing an overall management strategy for Perth's waste disposal.

The Resource Management and Strategic Planning issues identified in the submissions included the following:

. The need for a comprehensive and co-ordinated approach to the management of metropolitan and regional waste.

. The land disposal strategy adopted would significantly delay the rationalisation of Perth's waste disposal problem. Perth needs alternative technology disposal methods ie an incinerator or composting plant allied with the encouragement of recycling. The Mindarie site could be used for the 'residue' waste.

. Perth city development planning should be 'core' oriented rather than following a 'dispersed' strategy. Premature extension of Marmion Avenue would continue this dispersed development philosophy and compound the existing environmental problems.

. Financial assistance should be given to local government authorities to set up at source separation schemes by providing funds to supply households with receptacles for separated rubbish; also for educational material setting out the advantages of separation at source and recycling.

. A deposit on beverage containers should be introduced (by Government through legislation).

. Government should assist authorities wishing to set up alternative plants for waste treatment and disposal.

. Legislation should be introduced which provides for subsidies or other financial incentives to manufacturers of containers who use between 30% to 50% or more recycled material.

. Any regional refuse disposal facility in the north should be available to all local Governments in the catchment.

. The regional facility should be operated and managed by a responsible body ie Waste Disposal Authority.

These matters are further discussed in Chapter 4.

4. RESOURCE MANAGEMENT AND STRATEGIC PLANNING

As mentioned in Chapter 3, a number of submissions especially one from the Metropolitan Region Planning Authority (see appendix C) raised the matter of co-ordinated planning and rationalisation of waste disposal for Perth's metropolitan area. These matters are relevant to the consideration of the Mindarie waste disposal facility, in that they have the potential to either change the character of waste being disposed at the proposed Mindarie facility (ie disposal of residue and inert inorganic waste) or affect the time-table of Perth's existing and proposed waste treatment and disposal facilities. For example, the Authority has been informed that the City of Perth (one of the proponents of the Mindarie proposal) has resolved to construct a composting plant to be commissioned in 1990. How this plant would be integrated in an overall refuse disposal framework and the effect it would have on the timetable of the Mindarie site has not been finalised.

Similarly, the development of the Mindarie facility has the potential to postpone the adoption of resource management and strategic planning initiatives in any waste management strategy for Perth's metropolitan area: ie the Mindarie proposal can 'lock' Perth's solid waste disposal into sanitary landfill and may postpone the consideration and implementation of other options.

The authority is aware that the Cabinet Committee on Metropolitan Waste is currently reviewing an overall waste management strategy for metropolitan Perth. The Authority believes that this strategy should take into consideration the Resource Management and Strategic Planning issues listed in Chapter 3 of this Assessment Report.

The Authority has already referred, through correspondence, these overall management issues to the Cabinet Committee on Waste Disposal.

The Authority believes that the environmental management of a regional waste disposal facility cannot be reviewed in isolation. The Authority has recommended, in Chapter 6 of this Assessment Report, that once an overall waste management strategy is developed for Metropolitan Perth, then the development and management of the Mindarie site should conform with this strategy.

5. ENVIRONMENTAL IMPACTS

5.1 SITE SELECTION AND PLANNING

5.1.1 Site Selection

The review process for any development site selection requires the following three steps:

- compilation of relevant site selection criteria which should be applied objectively to the alternative sites;
- identification of a number of possible alternative sites and;
- through an iterative process of elimination, the selection of the most acceptable site.

The ERMP discusses the proponent's site selection process, the salient points of which are summarised in Chapter 2.2 of this Assessment Report.

A number of submissions included expressions of concern about the proposed site. This concern included the objectivity of the site selection process, put forward by the proponent in the ERMP, given that the site was already owned by the local governments concerned.

The Authority has made its own review of the site selection process for a regional waste disposal facility for the northern area of Perth. The Authority believes that given:

- the linear nature of residental development along Perth's northern coast; and
- the predicted population within the catchment of the North-west corridor,

there is a need for a northern regional refuse disposal facility to be located either within or in the proximity of the catchment of the North-west Corridor. This is so even for the disposal of residue from future high technology or compost disposal methods. Within the breadth of this Corridor, ie between the coast and the Darling ranges, Newman (1981) has ranked sands and soils, capable of attenuation of leachate, especially metals, in the following order.

Quindalup > Spearwood > Bassendean (lowest attenuation).

The Bassendean Sands was seen as totally 'inappropriate as a soil for removal of wastes from underlying groundwater' (Newman 1981).

Newman (1979, 1981) points out that while the Quindalup Sands appear to have the best leachate removal characteristics, the Spearwood Sands areas are normally chosen for landfill sites because such areas are away from the sea foreshores and hence do not conflict with recreation opportunities of the Quindalup Sand.

As was emphasised in Chapter 2.3, Lot 17, Mindarie is located within the interface of Quindalup and Spearwood dunal areas, with the 22 hectare disposal site being within the Quindalup Sands system. This may indicate satisfactory qualities, for leachate removal, of the disposal site.

In addition, the proposed site is located in the first non-urban 'wedge' within the North-west Corridor Structure. This means that it is within transportable distance from the centroid of the local government areas concerned while still being on the Quindalup - Spearwood dunal interface. In addition, the proposed site would not be alienating future urban areas or be in the close proximity to residential development.

Lot 17 consists of 432 hectares. There is, at a minimum, 1 km radius of buffer zone, owned by the proponents, in the surrounds of the 22 hectare disposal area.

Finally, in any assessment of waste disposal sites, it is important to understand the interaction between waste disposal sites and the integrity and quality of the Gnangara Mound. It is imperative, in order to prevent contamination of groundwater resources, that such sites not be located in an existing or proposed public water supply, water reserve or catchment areas.

The Authority has sought advice, on this matter from the Water Authority of Western Australia (WAWA). In its reply (see appendix D) WAWA concurs that waste disposal sites should be located away from the central portion of the Gnangara Mound and in general, on the metropolitan coastal plain, be sited in a narrow strip of fairly high ground fronting the ocean. The Mindarie site complies with these basic requirements, and in WAWA's opinion, if properly engineered and managed would not have an impact on the local water supply.

The Authority believes that the sanitary landfill disposal site and the surrounding buffer zone can be managed so as to minimise the environmental impacts generated by refuse disposal landuse. The Authority has made recommendations on the required management programme (see Chapter 6) which would need to be prepared by the proponent.

The Authority concludes that the proposed 22 hectares of Lot 17, Mindarie would be an acceptable site for sanitary landfill refuse disposal as long as the management of the site and the surrounding buffer zone was undertaken in a proper and acceptable manner.

5.1.2 Metropolitan Region Plan, North-west Corridor Structure Plan (NWCSP) and System Six Study (Red Book)

Salient features of the above planning documents have been discussed in Chapter 2.3. The relevant factors to consider are:

- The existing zoning of the site and its surrounds is 'rural' under Metropolitan Region Plan. This zoning does not preclude the establishment of a refuse disposal facility at the site.

- The North-west Corridor Structure Plan document cites the Metropolitan Refuse Disposal Planning Committee's estimates that, by the year 2000, the average per capita total waste generated would be 4.66 kg per person. While this figure appears to be higher than that put forward for Perth in other sources (Ho, 1981, 1983), on its basis, a population of 330 000 people in the Corridor could ultimately generate 600 000 tonnes of total solid waste per annum.

. The North-west Corridor Structure Plan (MRPA 1977 p 162) makes the following statement on the subject of waste disposal:

"It is proposed that solid waste be disposed of through sanitary landfill initially -

. in the rural wedge adjacent to the southern part of the Corridor; and

. through the rehabilitation of quarries in the Corridor, with clean rubble, in advance of development.

Alternative methods of disposal must be adopted long before the Corridor is fully developed."

However, the document does not identify any specific sites for organic refuse disposal either within the Corridor or in its catchment. Any site within the rural 'wedge' adjacent to the southern part of the Corridor would appear to be close to the currently identified groundwater areas or groundwater pollution control areas. In addition such sites would mostly be located on the Bassendean Sands which may be inappropriate for leachate attenuation.

. While the structure plan is not statutory, it does provide a strategy for likely development in the Corridor. However, no time-table for development is presented in the structure plan. The ERMP predicts that residential development would occur, in the proximity of Lot 17 Mindarie, by the year 2000.

. The Lot 17 Mindarie site in 432 hectares in area of which the southern 220 hectares is designated in NWCSP as 'Parks and Recreation'. The other 212 hectares are zoned 'Urban deferred'. The Town Planning Department has advised the EPA that it is unlikely that the 'Parks and Recreation' component of Lot 17 Mindarie would be reserved, for this purpose, during the interim period of the waste disposal proposal (see appendix E).

. For the long term, the structure plan recommends an east-west wedge of 'Park and Recreation' area linking the coast to the Neerabup National Park. This would form a regional open space area in the future. The System Six Red Book supports this concept.

. The System Six Red Book indicated that a refuse waste disposal facility was proposed for Lot 17. The Red Book suggests that the final rehabilitation of the proposal should conform to the 'Park and Recreation' nature of the surrounding area.

After taking the above information into consideration, the Authority concludes that, from an environmental point of view, an interim or medium-term (ie up to 20 years) use of the 22 hectare site for a regional refuse disposal facility would not be inappropriate given that the 212 hectare northern 'urban deferred' area is owned by the proponents. This means that a one kilometre radius buffer zone, surrounding the proposed waste disposal site, is possible and can be implemented during the life-time of the refuse disposal facility.

5.2 LEACHATE MANAGEMENT AND GROUNDWATER CONTAMINATION

5.2.1 Introduction

As mentioned in Section 2.3, the proponents have not investigated, in detail, the hydrogeological characteristics of the Mindarie site. The hydrogeological analysis in the ERMP relies on results of some shallow foundation tests, and from the extrapolation of regional hydraulic and geological data gathered elsewhere. This analysis demonstrates, however, that a volume of chemically-enriched leachate will be derived at the site through the mixing of percolating rain-water and decomposing material.

Two strategies have been considered in the ERMP for the management of the leachate. The first involves the 'containment' of the leachate within the enclosed 22 hectare site by the laying down of an impermeable base or membrane, whilst the second option would allow the leachate to percolate downward into the underlying Tamala Limestone aquifer in order to be diluted and dispersed.

The proponents do not favour the containment option. The ERMP predicts that there would be difficulties in controlling the buildup of liquor in the site. In addition, this option would be more expensive. On the other hand, the percolation strategy is preferred, as much of the chemical contaminants would be expected to be stripped away by adsorption to the substrate material, and through attenuation by dilution and dispersion within the groundwater. In this context, the Mindarie site was selected, among other critera, because of its perceived low risk of contamination of usable groundwater resources.

As the proposed site is located on the extreme western flank of the Gnangara Mound where the groundwater is flowing seaward, and in an area devoid of potential industry or urban development, it was suggested by the proponents that some 'pollution' of the groundwater could be tolerated without causing either a significant environmental effect or reducing the quality of the usable groundwater available elsewhere.

The proponent recognises, however, that the diluted leachate plume would have to be monitored and, in time, possibly managed. In this regard, because a considerable period of time would elapse before the plume becomes evident, the ERMP states that there will be adequate time to observe and understand the behaviour of the plume, and to develop management strategies as appropriate to prevent any pollution of the marine environment. The Authority is aware that a number of strategies exist which includes the option of reclaiming the 'polluted' plume by pumping through a network of bores and land irrigating the collected liquid on other parts of Lot 17. A network of monitoring bores is suggested in the ERMP's management programme which could be utilized for reclamation, if this becomes necessary in the future.

The Authority has reviewed the information provided by the proponent, and by submissions on the ERMP, on the matter of leachate management and potential groundwater contamination of the Mindarie area. While the Authority concurs with the conclusion, reached by the proponent regarding the management of groundwater contamination, it observes that the methodology by which the ERMP reached its conclusion

contained a number of variations in the parameters to those used by the Authority in its assessment. These variations, concern the quantity of leachate likely to be generated, the depth of the groundwater table, the extent of contamination and the rate of outflow of leachate or leachate transportation.

5.2.2 Quantity of Leachate Generated

The ERMP gives a figure of 8-10 percent mean annual re-charge of rainfall for the site. The EPA believes a more relevant re-charge rate would be 25-45 percent (Sharma et al. 1983, Carbon 1982) given that the site would be cleared and excavated. This matter needs to be investigated and discussed in the EMMP (see Chapter 6 for discussion on EMMP).

5.2.3 Depth of Water-Table

The ERMP states that the water-table below the site would vary from between 1-3 m above AHD.

A number of submissions, to the Authority, dispute this claim. While no 'hard' information is provided, these submissions suggest that the groundwater table under Lot 17 would be higher than that mentioned in the ERMP. The height of the groundwater table becomes important due to the fact that the 22 hectare waste disposal site would be excavated. If the distance between the bottom of the excavated area (lowest level where refuse would be deposited) and the groundwater table is too narrow, then groundwater could permeate up into the refuse and increase the rate of leachate generation. In addition, adequate buffer between refuse and groundwater table acts as a physical and biological filter, reducing the concentration of leachate being received into the groundwater. This matter is further discussed in Section 5.2.4.

The ERMP states that the buffer between leachate source and groundwater should be approximately 5 m. The Authority's own assessment substantiates the proponents conclusion and agrees that this level of separation would be acceptable.

RECOMMENDATION 1

The EPA recommends that the excavated ground level of the refuse disposal site should be, at a minimum, 5 m above the groundwater table.

5.2.4 Quantity of Leachate Reaching Groundwater

The ERMP indicates the likely chemical composition of the leachate which would have a high Biological Oxygen Demand (BOD), and includes such contaminants as ammonia nitrogen, phosphorus, chloride and sulphate, as well as microbiological material. The degree of stripping of these in the course of percolation through the unsaturated zone is dependent on the exchange and adsorptive capacities of the soil matrix, and on other factors.

In an endeavour to understand the likely sequence of events, the ERMP has wrongly compared the Mindarie site with that at Hertha Road. The latter location has considerable peat and clay layers which, in particular, have ability to attenuate contaminants. The

limestone and sand at Mindarie would probably not have the same adsorptive capacity. However, the Quindalup sand, at the site makes this location more attractive than other sites available in the north-west region or presented in the ERMP.

The Geological Survey of Western Australia, in its submission to the Authority, has pointed out that for the Mindarie site the contamination of the groundwater will be higher than that mentioned in the ERMP, although without geological data it would not be possible to estimate this rate with confidence.

5.2.5 Rate of Outflow of Leachate

In endeavouring to model the plume's behaviour, the ERM has adopted a hydraulic conductivity for the aquifer of 100 $m^3/day/m^2$, which is a regionally-applied figure without local validity. Moreover, the equation used to determine the velocity of flow has no porosity function.

In this regard, in the ERMP, it is estimated that the leachate plume would travel seaward at between 30 and 40 m per year. However, by inserting a porosity coefficient of 0.3 into the equation, and using the same regional value for hydraulic conductivity, the velocity becomes 100 to 130 m per year. This would mean that a leachate plume would reach the sea some 2 km westward of the refuse site in about 15 to 20 years, rather than the 80 to 100 years as suggested in the ERMP.

Furthermore, the use of regionally-derived hydraulic parameters to model segments of the Tamala Limestone aquifer is dubious. Characteristically, the aquifer is known to be anisotropic* with hydraulic conductivities ranging from low values, where tight pinnacles of a limestone occur, to very high values (eg 200 $m^3/day/m^2$) in the more porous sections. In addition, in places, conduit flow may occur through caverns and fissures.

A reasonable hypothesis, therefore, for the Mindarie location would be that the groundwater flow rate is high, and probably substantially higher than the estimates presented in the ERMP.

5.2.6 Conclusion on Leachate Management

The Authority has reviewed the matter of leachate management from the proposed refuse disposal facility at Lot 17 Mindarie. The Authority has predicted a higher rate of recharge and a faster flow of ground water. These differences in prediction do not affect the acceptability of the overall water management strategy.

It is the Authority's view that the available evidence still suggests that reasonable attentuation of entrained contaminants will occur, probably through dilution, and that the rate of transport seaward of the plume will still allow sufficient time for both monitoring, and for management strategies to be developed. One such strategy of reclamation of an affected plume has been discussed in this Assessment Report (see 5.2.1).

The Authority believes that any future groundwater management strategy for Lot 17 Mindarie would require that base data be collected at the earliest period possible.

*irregular grain size and distribution which results in uneven flow.

RECOMMENDATION 2

The EPA recommends that an appropriate number of monitoring bores be established, as soon as possible, about the proposed 22 h refuse disposal site in order to obtain background ground quality data. Furthermore, the bores should fully penetrate the aquifer in order to determine its true depth.

All the bores should be levelled relative to AHD, so that some measure can be made of the local hydraulic gradient.

An issue, raised by some submissions, concerns the pollution of the marine environment by leachate contaminated plume in the proximity of the disposal site. The experience along the foreshore, south of the site, shows that this matter may not be of major concern (Johannes 1980) although Johannes and Hearne (1983) suggested that nitrogen loading in groundwater may increase under urban areas and could become significant in the long-term future. The Authority is aware that management options exist which would prevent this problem from occurring from the Mindarie site. (See 5.2.1). The Authority recommends, in chapter 6 of this Assessment Report that these management options be investigated and discussed in the EMMP.

One other issue concerns the long-term management of potentially polluted groundwater ie of the management of groundwater leachate after the end of the refuse disposal period. The Authority is aware that leachate generation can be prevented by 'sealing' the rehabilitated disposal area with impermeable membrane or soil covering. In addition, as discussed in chapter 5.2.1 any 'polluted' groundwater plume can be extracted, treated and irrigated on other parts of Lot 17. The Authority believes that this matter also needs to be investigated and discussed in the EMMP.

In summary, the Authority believes that the siting of a regional refuse disposal facility at Lot 17 Mindarie would generate leachate which would contaminate the groundwater below the site. However, key factors, such as quantity of leachate generated, depth of attenuation matrix etc, can be controlled by an appropriate refuse disposal strategy. The Authority believes that such management strategies can be developed before the construction of the proposed facility and further improved during the operation phase of the facility.

In this regard, the Authority has recommended that the proponent prepare an Environmental Management and Monitoring Programme (EMMP) which would present the management of the groundwater impact and the long-term monitoring of the groundwater contamination (see Chapter 6).

5.3 SOCIAL IMPACTS

5.3.1 Local Social Impacts

The operation of a regional refuse disposal facility has the potential to generate local social impacts. This includes dust and odour emissions, noise, increase in vermin and rodents, fire risk, and the spread of salmonella by seagulls and other scavengers.

The ERMP, while admitting the inevitability of some social impact, states that the degree of impact is dependent on site management. Proper site management including daily covering with sand, on-site facilities for fire suppression, more frequent and deeper covering of material of high odour potential, and adequate compaction of covering would reduce or eliminate the potential social impacts.

The Authority concurs with this management approach and has recommended in Chapter 6 that the proponent should prepare a detailed quarrying and refuse disposal management plan which should emphasise the safeguards taken, to reduce the social impacts.

5.3.2 Regional Social Impacts - Traffic

A regional social impact would be the increase in heavy truck movement in the local road network system and the subsequent additional noise experienced by the residents along the roads being used. The estimated number of truck movements per day delivering refuse to the Mindarie site is shown in Table 5. The designated road (and its alternative) for the truck movements are shown in Figure 11.

TABLE 5

ESTIMATED NUMBER OF TRUCKS PER DAY DELIVERING REFUSE TO THE MINDARIE DISPOSAL SITE

Year	Cities of Perth & Stirling		Shire of Wanneroo			
	Annual refuse quantity	No of trucks per day	Annual refuse quantity t	No of trucks per day	Combined total number of trucks per day	Combined truck movements per day
1985			80 500	44	44	88
1989			85 700	39	39	78
1994	113 400	22	96 300	44	66	132
1999	116 200	23	120 400	45	68	136
2004	119 100	24	147 200	45	69	138

source ERMP

While no background level of existing and expected traffic movement is presented in the ERMP, it is expected that the approximately 90-140 truck movements per day (including truck movement for quarrying operation) would not cause a major impact on the road network system chosen, given the quality and isolation of the roads, especially Joondalup Drive. Wanneroo Road is a major North-south artery and

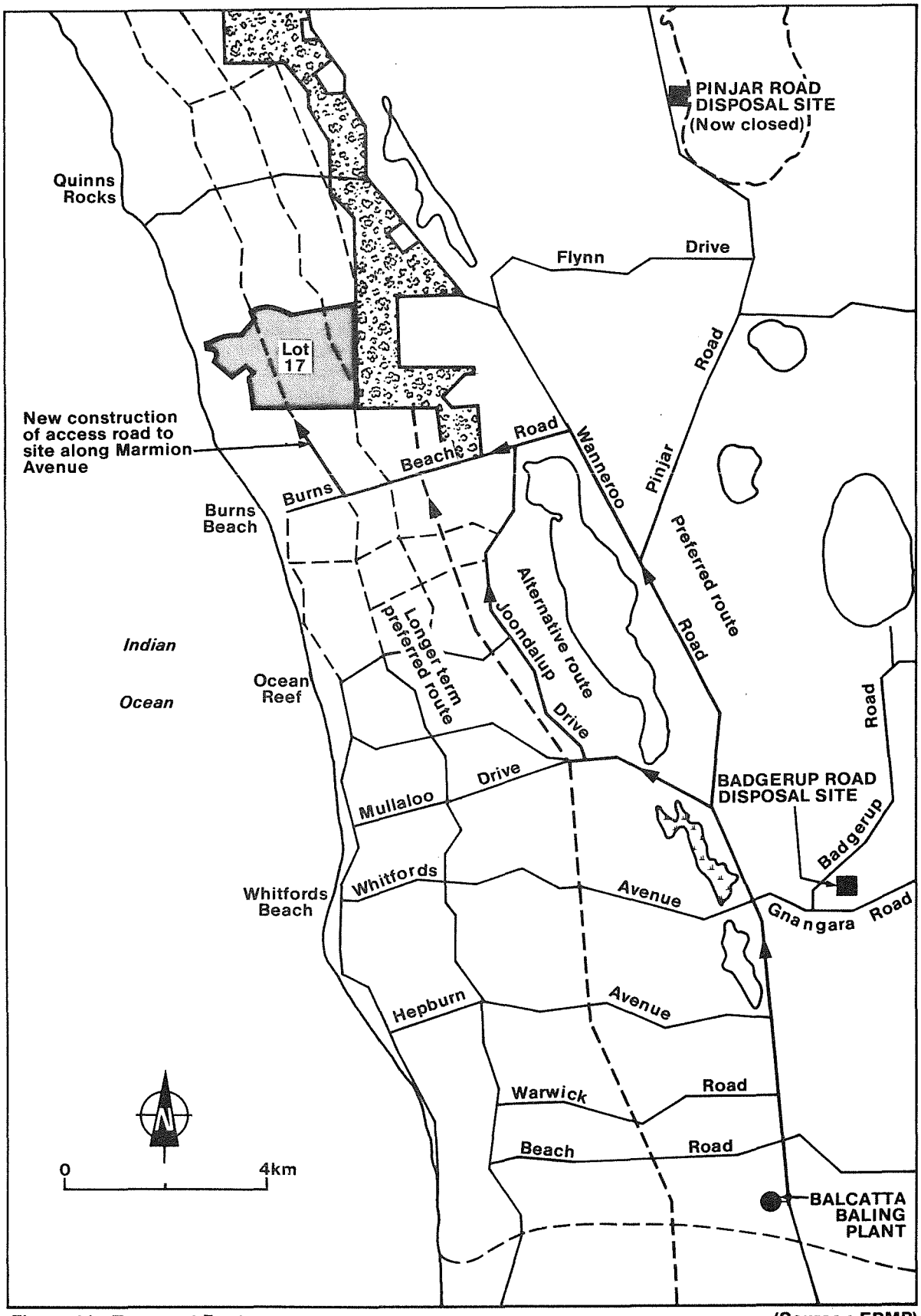


Figure 11 Transport Routes (Source : ERMP)

currently carries heavy traffic. The proponent states that traffic impact would be minimal given that, in the near future, Mitchell Freeway is expected to be completed and would be used for refuse transport.

The Authority believes that while the traffic impact may be minimal, the proponent needs to identify this impact and identify methods by which this impact can be managed.

5.3.3 Visual Impact

The waste disposal operation is planned to proceed behind a steep edged rim. This rim would be gradually increased so that it would form a visual screen at all stages during the life-time of the proposal. The proponent has stated that the proposed operation site would not be visible from any point off-site Lot 17 Mindarie or from Connolly Drive or Marmion Avenue public roads. The Authority believes that appropriate tree screenings need to be planted as visual buffers along these roads.

5.3.4 Aboriginal sites

The Authority notes that the proponent has not carried out an Aboriginal site survey of the disposal area. This matter needs to be addressed and the Department of Aboriginal Sites of the Western Australian Museum consulted to ensure that no likely sites are disturbed.

6. ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental assessment process in Western Australia places a high priority on the management of environmental impacts and the monitoring of both the management programme and the impacts to ensure that appropriate steps are taken to ameliorate and minimise impacts.

6.1 ENVIRONMENTAL MANAGEMENT CONTEXT

As discussed in Chapter 4 of this Assessment Report, the environmental management of a regional waste disposal facility cannot be reviewed in isolation. It needs to be placed in the context of the State's and regional waste disposal management and strategic planning.

RECOMMENDATION 3

The EPA recommends that once an overall waste management strategy is developed for Metropolitan Perth, then the development and management of the Mindarie site should conform with this strategy.

6.2 ENVIRONMENTAL MANAGEMENT OUTLINED IN THE ERMP

The ERMP states, in section 8, that the potential impacts of the refuse disposal facility at the Mindarie site would be minimised in the following ways:

- fencing of site to protect vegetation and to facilitate rehabilitation;
- stabilisation of stockpiled area of greater than 1 hectare;
- establishment of a 150 metre (minimum) buffer zone;
- reconstructed rim to have gentle slopes; and
- the final contours of the rehabilitated area to be selected by taking into consideration 'sight' lines from possible future residential development and from proposed major roadworks adjoining the proposed operation.

The ERMP puts forward a management strategy, in section 8, which would reduce the quantity of leachate produced by the following methods:

- reducing the amount of water applied to the surface of the disposal area for dust suppression or irrigation purposes evaporation and evapotranspiration would remove a large proportion of such water;
- depositing refuse in as dry a condition as practicable;
- compacting the refuse to reduce permeability;
- depositing refuse in cells of limited area, but as deeply as practicable;
- final grading of the surface and choice of surface soils and vegetation to encourage surface run-off rather than infiltration; and
- providing a final land-use that would require minimal water reticulation of plants.

The following regular monitoring is proposed, in the ERMP (section 8) for the site:

- recording of quantities of refuse 'as delivered' and 'in place';
- monitoring of groundwater quality; and
- monitoring of Salmonella in wildlife, especially in seagulls (including regular counts of seagull numbers), and also in reptiles.

The ERMP also states that intermittent special purpose monitoring could include odour surveys around the site (see ERMP, section 8).

6.3 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAMME

At the time that the ERMP was released, no decision had been made by the proponent regarding the details of the disposal operation, ie the site excavation, the method of refuse displacement, the design alignment of access and interval roads and site management. Details of a management and monitoring programme were not provided although the proponent has made a commitment to undertake management and monitoring of the site. Other matters needing consideration have been indicated in Section 5 of this Assessment Report.

These matters, which are relevant to the assessment of the environmental impacts of the proposal, need to be addressed in a consolidated report, an Environmental Management and Monitoring Programme, and submitted to the EPA prior to the beginning of construction of the regional refuse disposal facility.

RECOMMENDATION 4

The EPA recommends that a condition of approval should be the preparation of an Environmental Management and Monitoring Programme (EMMP) to the EPA's satisfaction.

The EMMP should address:

- *matters identified in Chapter 5 of this Assessment Report as needing consideration in the EMMP;*
- *quarrying and refuse disposal management for the 22 hectare site, over the proposed life of the facility. (Sequential disposal should be undertaken in a manner so as to be moving away from the future northern residential sector in the later years). Refuse disposal methodology should emphasise the safeguards undertaken to reduce social impacts like odours, noise, fires, rodents and Salmonella from the disposal site;*
- *overburden and stockpile management including dust control and minimisation of visual impact;*
- *rehabilitation of the 22 hectare site and other areas disturbed by quarrying of refuse disposal. This should include details of final landform, revegetation, proposals for the final landuse and its compatibility with the surroundings;*

- *a Landuse Management Plan for Lot 17 which should be compatible with any structure plan for the surrounding area;*

- *rationalisation of the traffic movements and methods by which traffic impact would be minimised;*

- *details of the monitoring of environmental parameters especially groundwater contamination;*

- *details of management of groundwater impacts including prevention of marine pollution. The EMMP should take into account the base-line monitoring information provided by the bores around the site (see recommendation 2); and*

- *details of longer-term (post refuse disposal) leachate prevention and management.*

The Authority is satisfied that management strategy safeguards exist in relation to sanitary landfill refuse disposal and once implemented would make the proposed facility environmentally acceptable.

The Authority believes that the management and monitoring of the proposed facility should be an ongoing process requiring regular review. This would ensure that the approved management objectives were being achieved. It would also mean that the available resources for monitoring were being used in the most effective manner giving due regard to likely effects and their consequences. This can be done only if an initial ten-year Management and Monitoring Programme is prepared and updated and reviewed on a five-year basis.

RECOMMENDATION 5

The EPA recommends that the proponent should update the EMMP every five years, taking into account the results of ongoing monitoring and management, and resubmit it, for review, to the relevant Government agencies.

7. CONCLUSION

This Assessment Report is submitted to provide an environmental input to decision making on the proposed 22 hectare regional domestic organic refuse disposal facility on Lot 17 Mindarie. In preparing this report, the Authority has considered a range of documentation, and has been assisted by contributions from the public and from other Government agencies.

The Authority concludes that the proposed facility is acceptable on environmental grounds, subject to compliance by the proponents with commitments they have given and subject to the adoption and implementation of the Authority's recommendations.

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APPENDICES

APPENDIX A

PROPOSED REFUSE DISPOSAL FACILITY AT MINDARIE
CITY OF PERTH, CITY OF STIRLING AND SHIRE OF WANNEROO

EPA GUIDELINES FOR THE ENVIRONMENTAL REVIEW AND MANAGEMENT PROGRAMME

The following guidelines for the proposal were issued by the Department of Conservation and Environment.

OBJECTIVES OF AN ERMP

An (Environmental Review and Management Programme) ERMP is a detailed document which should satisfy the following broad objectives:

- Provide a description of the proposed development, alternatives, the physical, biological and human environment and the likely effects of the proposed action on the environment.

- Provide details of safeguards and environmental management to minimize or ameliorate environmental impacts.

- Provide an outline of monitoring programmes which should aim to resolve uncertainties, verify predictions, assess effects on the environment and be the basis for later revision of operational or management practices.

- Provide details of the requirements of local, State and other legislation and any relevant environmental standards.

- To be written in a manner which is readily understood by members of the public who have an interest in the proposal.

The following are preliminary guidelines for an ERMP for the disposal of municipal waste from Perth, Wanneroo and Stirling municipalities at Mindarie Superlot 17. These guidelines are not considered to be exhaustive, but do provide an indication of major matters that should be considered in an ERMP. These guidelines are recommendations by the Department to assist the proponent in the preparation of an ERMP. The guidelines do not bind the EPA in its decisions on the proposal.

THE GUIDELINES

Outline

Summary
1. Introduction
2. Need for development
3. Evaluation of alternative disposal schemes
4. Selection of site
5. The proposal
6. Existing environment
7. Environmental impact
8. Environmental management and safeguards.

SUMMARY

Should contain a brief summary of the salient features of the proposal, alternatives, receiving environment, the extent of environmental impacts and environmental safeguards and management.

1. INTRODUCTION

This section should include an explanation of why an ERMP has been prepared, the objectives and history of the development, details of the proponent(s) and timing of the development. Also provide details of any relevant legislative requirements that apply to the proposal.

2. NEED FOR THE DEVELOPMENT

Outline the need for the project and include considerations of the following aspects:

- Projected volume of municipal wastes
- Capacities of existing sites
- Future capacities required
- Comparative costs of existing schemes and the proposal.

3. EVALUATION OF ALTERNATIVE DISPOSAL SCHEMES

Describe alternative schemes and methods for the disposal of municipal wastes. Document the rationale and criteria used in the evaluation of alternatives and show how each alternative was appraised and compared with respect to environmental engineering and economic advantages and disadvantages.

4. SELECTION OF SITE

This section should state the basic environmental (including planning), engineering and economic parameters used in the investigation and evaluation of alternative sites. Each site considered should be described at least to provide an appreciation of its salient features.

Factors which should be considered in the above analyses are:

- Any inter-relationship between alternative disposal schemes and method and siting of landfill site.
- Hydrogeology, proximity to groundwater users, wetlands and water catchments.
- Proximity to residential areas.
- Soil characteristics.
- Access.
- Town planning and land uses.

Discuss and document the reasons for rejection or acceptance of each site.

5. THE PROPOSAL

5.1 Overall concept and scheme

Describe the overall concept and scheme envisaged for the disposal of municipal waste. Highlight any intention for the development of further sites on Mindarie Superlot 17 or elsewhere.

5.2 Location and layout

Provide appropriate maps and drawings and description of the area, location and layout of the site, access and traffic routes. Include an indication of the distance to sensitive areas (including future and present residential ares) from the site.

5.3 Waste

Describe all the types and characteristics of wastes to be disposed of at the site and specify which wastes will be excluded from the site. Provide an indication (as precisely as possible) of the existing and future volumes (daily and annual) of wastes to be deposited. Also include estimates of the volume of wastes if deposited loose or in bale form.

5.4 Operation of disposal scheme

Describe the proposed scheme for disposal from collection to disposal at the site. Provide details of transport vehicles and transport movements on weekends and weekdays.

Provide a detailed description of tip operation and include the following considerations:

- Site operation (including daily covering, plant, etc.)
- Details of planned excavations
- Resource recovery operations
- Source availability and volumes of cover material
- Direction of workings
- Thickness of primary and final covers
- Number, depth of layers
- Life of sites
- Roads (include whether sealed or unsealed)
- Truck cleaning
- Emergency tipping areas
- Disposal of excluded waste
- Traffic movements
- Fire control (on the tip and surrounding land)
- Vermin control
- Litter control
- Contingency plans (in case of breakdowns or strikes, etc.)

5.5 Run-off and leachate

Provide details of site drainage, the expected quantity and quality of run-off, its location and the means of disposal.

Discuss in detail the leachate expected both during and following the disposal operation. Describe the proposed method of monitoring, capture, treatment or disposal of leachate.

5.6 Air emissions

Give details of proposals to control the generation or venting of odours, methane and dust at the site.

5.7 Future use of disposal site

Describe the future use of the site and remaining area of Mindarie Superlot 17. Provide a time schedule for the development of Mindarie Superlot 17. Give details of

rehabilitation and final profiles of the site (this may be treated in more detail in Section 8).

6. THE EXISTING ENVIRONMENT

This section should provide an adequate description of the total environment affected by any aspects of the proposal. This description should concentrate on the aspects of the environment which interact or are affected individually or collectively by the proposal.

6.1 Physical environment

6.1.1 Topography, geology and soils

Include details of land forms and mineral resources and existing landscapes, coastal geomorphology and processes.

6.1.2 Climate and meteorology

Include details of the following:

- Rainfall, winds, evaporation, temperature and floods
- Some indication of atmospheric stability.

6.1.3 Surface water

Include details of drainage patterns.

6.1.4 Groundwater

Define and describe the characteristics of local and regional groundwater systems. Include details of groundwater levels, quality, movement, salinity, current usage and commitments in the vicinity.

6.2 Biological environment

List botanical species and define plant communities. Include a vegetation map showing distribution of plant communities.

Faunal survey including baseline study of well-being using a survey of the occurrence of Salmonella serotypes as an indicator.

Include description of the status of the existing ecosystems.

6.3 Human environment

6.3.1 Land use and zoning

Include a description of existing and future land uses and zoning. Highlight any reports, etc. that have commented or recommended the future use of zoning of the area. Discuss and document the conservation and recreational uses of the area and highlight any reports that have comments or recommendations on these aspects of the area.

6.3.2 Population

Include details of the following:

- Existing population.

- Existing and future growth in population.

- Anticipated growth (provide if possible a schedule of this growth) of residential areas in the vicinity of the development.

7. ENVIRONMENTAL IMPACTS

Discuss (and quantify where possible) the various impacts and their significance on the local environment. This treatment should include discussions of impacts on the following:

- Groundwater quality and usage (should give an indication of the dispersion and movement of leachates in aquifer systems).

- Air quality.

- Flora and fauna.

- Conservation and recreational values of the area.

- Existing and future residential areas.

- Traffic patterns, routes and densities.

- Coastal systems.

- Landscape and aesthetics.

- Land use.

All cases where an assessment is made, it should be quite clear what criteria have been employed in the assessment. Where possible, effects should be quantified and uncertainties highlighted. Demonstrate compliance with relevant environmental standards.

8. ENVIRONMENTAL SAFEGUARDS AND MANAGEMENT

8.1 Safeguards

Summarize safeguards previously described under Section 5 for control of effluents, litter, air emission, noise, etc. Full details of safeguards not previously described (ie. pest and weed control, erosion control) should be included with a discussion of their effectiveness.

8.2 Future use of the site

Provide full details of the anticipated end use of the site and also provide a full discussion and commitments for future management and maintenance of the site.

8.3 Restoration and rehabilitation

- Provide details of the programmes for restoration and rehabilitation of the site and show how the objectives of the programmes fit in with the future use of the site.

- Give an indication of the final contours of the site.

- Include a discussion of costs involved for the methods of rehabilitation and restoration.

- Have an assessment of the anticipated effectiveness of these programmes.

8.4 Buffer zones

Provide a description of any intended buffer zones that will be maintained throughout the life of the development.

8.5 Landscaping and aesthetics

Include a discussion of how impacts on the landscape and aesthetics will be minimized or ameliorated.

8.6 Monitoring

8.6.1 Groundwater

Provide details of a programme for monitoring groundwater quality and include details of:

- Depth, location of monitoring bores
- Parameters monitored and frequency of sampling.

8.6.2 Surface water run-off (effluent)

Describe programme for monitoring any effluents generated by the development.

8.6.3 Fauna

Details of programme for monitoring well-being of fauna (seagulls, reptiles, etc.) using occurrence of Salmonella serotypes as an indicator.

8.6.4 Progress and effectiveness of rehabilitation

8.7 Persons responsible for environmental management

Indicate who will have the responsibility for environmental management and how this person(s) fits into the management structure and relates with environmental and regulatory agencies.

8.8 Management

- Provide a full description of the management structure and responsibilities during the operation of the landfill site.

- Describe in detail the costs and the management structure and responsibilities that will apply to the site (and Mindarie Superlot 17) when it has been rehabilitated to its end use.

APPENDIX B

SUBMISSIONS FROM THE PUBLIC AND GOVERNMENT DEPARTMENTS

A total of 31 submissions were received on the proposed Refuse Disposal Facility at Mindarie; 15 from Government agencies and 16 public submissions, one of which was accompanied by a petition containing over 450 signatures protesting the projects potential impact on groundwater. Following a request for further information and clarification on specific issues, supplementary submissions have been provided, to the EPA, by the Metropolitan Region Planning Authority (see Appendix C), the Water Authority of Western Australia (see Appendix D), and the Town Planning Department (see Appendix E). Permission has been given by these three Government agencies for the Authority to include their submissions as appendices in the EPA Assessment Report.

The main issues addressed in all submissions are indicated in Section 3 and Table 4 of the Assessment Report. This Appendix provides a more detailed analysis of the issues raised and comments made in the submissions received by the EPA.

The issues that received most frequent comment in the submissions related to the following categories:

B1 Planning and Site Selection
B2 Leachate Management and Groundwater Contamination
B3 Site Management
B4 Amenity
B5 Environmental Assessment Process
B6 Other Specific Comments

B1 PLANNING AND SITE SELECTION

B.1.1 Co-ordinated Waste Planning

Nine of the thirty one submissions made comments on the present inadequacies in waste management planning in Perth. One Government agency submission expressed concern at the apparent inefficiency in the present system for co-ordinating waste disposal on a regional basis. This submission suggested the need to review overall waste disposal requirements for the Perth Region and concluded that the document under review represented an 'ad hoc' approach to a serious problem. On this issue, the Metropolitan Region Planning Authority's submission, reproduced as Appendix C, stated "that if this site is environmentally suitable and development approval is eventually forthcoming, (then) this facility and the planned Perth City Council composting plant in Brockway Road, Shenton Park must form part of a strategic solution to waste management."

A number of public submissions also expressed the view that the present waste disposal system is not optimising the opportunities which would be available to a Perth wide co-ordinating body. The public submissions went even further in suggesting that various parties (the Department of Conservation and Environment, the Environmental Protection Authority, the Government, etc) should initiate a broad range of actions to reduce the quantity of

wastes generated, encourage/enforce return and reuse of containers, expand the "separation at source of collection" practice already followed in some local authority areas and promote investigations and adoption of alternative disposal techniques more appropriate than sanitary landfill.

B.1.2 Disposal Technology/Techniques

Comments on this subject ranged from reasoned discussion of "proven" alternatives to emotional criticism of sanitary landfill technology.

The ERMP discounts some disposal alternatives on the basis of their mixed success in overseas applications and others as less economically attractive than landfill. The latter argument is challenged in a number of public submissions which question the cost comparisons used in the document.

The information upon which the disposal alternatives are compared is described variously as "inadequate" and is perceived as locking the three authorities concerned into using landfill for the foreseeable future, thus precluding development of alternatives during that time.

Most State Government agencies responding to the ERMP agreed with or had no comment on this aspect of the proposal. However, a number also noted that further assurances are required on a range of management committments not contained in the ERMP. In particular, these Government Agencies asked that an Environmental Management and Monitoring Programme be undertaken by the proponent.

B.1.3 Site Selection

Several Government agencies agreed that "The site is the most suitable of the alternatives considered and has the overriding merit of isolation" and "the argument for such a facility seems soundly based and presented" with the rider that "provided the safeguards mentioned are installed (ie a Management and monitoring programme), there should be no foreseeable insurmountable problems".

One government agency submission questioned the location of a regional landfill facility within the North-West Corridor. This submission asserted that the ERMP basically ascribed a predetermined use to an area of land which has potential for other uses. The submission went on to discuss the use of Baderup Road disposal site and concluded that the assessment of alternative sites in the ERMP may be inadequate.

The MRPA in its submission of 27 November 1985 acknowledged that "given the need to protect groundwater resources, the general character/soil types of the area to the east of the Corridor and the type of soils considered suitable for this type of facility, the Authority (MRPA) acknowledges that in a physical and geographical sense, the chosen site has much to recommend it" (see Appendix C).

A number of public submissions were also critical of the "inadequate" attention given to consideration of alternative sites for landfill, describing analysis for selecting the Mindarie site as "biased by the fact the three metropolitan councils concerned have purchased the land for a very large sum of money."

B.1.4 Economics of Proposal

Seven submissions questioned the economics of the operation at Mindarie, particularly with the pre-processing (baling) and transport costs involved for the Cities of Perth and Stirling.

One of the public submissions expressed disappointment that a more comprehensive cost comparison of alternatives disposal disposal techniques, similar to that undertaken by the Western Refuse Disposal Zone, was not carried out for a project of this scale and duration of operation. This submission suggested that the cost of landfilling would be near the upper limit of the range shown in Figure 3.4 of the ERMP, and speculates that for the cities of Perth and Stirling, either composting or incineration might be a more economical solution to waste disposal.

B.1.5 Road Access

Three government departments noted the need to extend Marmion Avenue in advance of existing programmes and it was stated that the cost of road works would have to be borne by the proponent.

Several submissions addressed the traffic impact of the long haul routes, including the network of transfer stations. One public submission suggested that the early extension of Marmion Avenue would promote premature suburban development in the areas serviced by the road, contributing to further urban sprawl.

B.1.6 System Six

One Government agency noted the System 6 recommendation that Lot 17, Mindarie might be suitable for inclusion in an extension of the Neerabup National Park, and commented that this might still be appropriate if the refuse disposal site was properly rehabilitated.

Several public submissions also noted the System 6 recommendation for Lot 17 and stated that this should be implemented, or at least taken in account, when making any decisions regarding the area.

B.1.7 Neerabup National Park

One government department expressed concern regarding the visual impact on the Park.

Several public submissions discussed the loss of the area as an extension to the Park and one addressed the impact on the Park of

increased numbers of feral cats, dogs, and rodents, while another suggested that odours from the landfill site would reduce the enjoyment for Park users.

B.1.8 Regional Planning Issues and Implications

One Government agency asserted that a regional waste disposal facility of the type recommended in the ERMP could be seen as a use which might conflict with future urban uses proposed within the North-West Corridor. The area is presently zoned 'Rural' in the Metropolitan Region Scheme and is shown as future 'Parks and Recreation' in the structure plan recommended in the 1977 report 'Planning Structure for the North West Corridor'. This submission goes on to suggest that the ERMP basically ascribes a predetermined use to an area of land which has potential for other uses.

Another Government agency noted the future refuse disposal areas depicted in Figure 5.1 of the ERMP and suggested that further consideration will need to be given to these areas when required in the future, concluding that a detailed town planning scheme would be desirable.

Several public submissions suggested that use of the site for landfill will "constrain" future use for parks and recreation.

Another public submission, mentioned already under Road Access, addressed the implications of the site's development on urban sprawl to the detriment of consolidation of established near-city suburbs.

B.1.9 Limestone Resource

The existence at Lot 17 of a significant resource suitable for road base use and possibly also cement and agricultural applications was noted in two government agency submissions.

B2 LEACHATE MANAGEMENT AND GROUNDWATER CONTAMINATION

Twenty two submissions, seven from government agencies and fifteen public, commented on the issue of leaching from the deposited waste and the potential contamination of groundwater beneath and downstream of the site. A petition of over 450 signatures protested".. the unknown factor polluting the under-ground water table".

The government agency submissions generally either agreed with the contents of the ERMP or, if not the detail, the conclusion that leachate generated could be managed in order to maintain groundwater quality outside the site boundaries. The Water Authority submission (see appendix D) is extremely valuable and is therefore partially reproduced below:

"The Water Authority agrees that the relationship between waste disposal sites and the integreity and quality of the Gnangara Mound is most important. It is the Authority's view that waste

disposal sites must be located so as to minimise any potential adverse impacts on the State's water resources. In particular they must not be located in an existing or proposed public water supply areas, water reserve or catchment area.

Further groundwater areas for public water supply extends as far north as Moore River and as far as Mandurah.

Therefore any disposal sites on the coastal plain should be located downstream of existing or potential public water supply areas. The basic object is to ensure that:-

(i) the groundwater from beneath the site flows towards the ocean and not to lakes or streams, and

(ii) the groundwater is at a reasonable depth below the surface so that its interception by excavation of disposal pits does not occur.

For these reasons, it is preferred that waste disposal sites on the coastal plain be located in a narrow strip of fairly high ground fronting the ocean.

Although it may not be ideal, the Mindarie site complies with the basic requirements as far as protection of public water supplies are concerned. It is considered that a properly engineered waste site would not threaten the Quinns Rock water supply."

Public submissions expressed concern regarding the generation of leachate and pollution of the groundwater table, both in terms of contamination of a water resource and potential downstream impacts, particularly coastal.

Of the submissions which attempted to assess the technical aspects of this issue (as opposed to simply expressing concern), the majority concluded that the ERMP approach is "simplistic" and in many ways inappropriate to the situation existing at Mindarie. Particular examples of this are the recharge and infiltration figures assumed in the report and use of Bestow's work at the Hertha Road site in proposing attenuation levels of leachates generated at Mindarie. The report is also said to ignore the "probability" of a "highly fissured limestone" substrate which may result in fissure flow rates of "greater than 2 kms/year."

Basically, many of the submissions on this issue agreed that if the project proceeds, then a baseline data of the existing watertable has to be undertaken initially and this information used to develop management strategies which would prevent or minimise leachate from the proposed refuse disposal site.

B.2.2 Coastal/Marine Impacts

Twelve submissions commented on potential marine impacts of the project, noting the proximity of the project to the coast and the generation of leachate from the site operation.

Several submissions questioned the horizontal transport velocities of the leachate put forward in the ERMP and suggested

that much shorter travel-times to the ocean, in the order of 15-20 years, would be more feasible. Others suggested that the report does nothing ".. to allay fears that these leachates may, in the long term, have deleterious effects upon the marine life". This sentiment appears to be supported by the nine public submissions expressing concern on this issue. One government department did comment that if the behaviour and content of the leachate was as indicated in the report, "..., then no harmful effects on inshore marine life would be expected,..."

B.2.3 Data, Models, Terms, Formula and Calculations

A range of comments were contained in six submissions. Of particular concern were the following:

- groundwater velocity equation should have incorporated a porosity factor and therefore the equation should read:

$$V = \frac{KS}{P}$$

- use of leachate concentration estimates generated at sites with different physical characteristics eg for N - NH_3.
- use of data from the United States where similar information on Western Australia exists eg Table A2.2 (of the ERMP).
- the use of the term "organic" instead of "solid" waste.
- "worst case" leachate calculations not really assuming "worst case" situations which are according to submission, "..well within the realms of possibility".
- "site specific data (2.2.1, A16) is not presented or discussed".

B3 SITE MANAGEMENT

B.3.1 Odour, Smoke, Litter, Noise, Flies, Vermin and Feral Animals

Nine submissions cited these types of problems as typical of landfill sites and many expressed concern that the proposed site would be no better managed at this location than others. There was some concern that the lifestyle sought by residents of this area might be further compromised by this development. However, some of these submission put forward the view that a "proper" and "sophisticated" site management programme with a "level of management hither to unheard of in the Perth region" may make the proposal environmentally acceptable.

One submission previously mentioned suggested that cats, dogs and rodents from the site might move into the Neerabup National Park and destroy wildlife.

B.3.2 Salmonella

The link between rubbish disposal sites, seagulls, fresh water and human infections by Salmonella bacteria was raised in seven public submissions.

The same submission from two groups questioned the "credence" of Salmonella studies indicating a healthy native fauna when all this will be changed by "disturbance" associated with sanitary landfill operations.

B.3.3 Site Management Issues and Problems

Seven submissions addressed site management issues and problems in addition to those specific to leachate generation and recovery.

One government department discussed suitable means of disposing of excavated material, suggesting that most sand will be "yellow" and therefore unsuitable for stabilisation of Quindalup dunes. This may reduce local use of sand by 750 000 m^3 to 490 000 m^3. The same submission questions the source of Quindalup sand for final covering of the refuse site. Another agency suggested that site management problems ".. will become increasingly exacerbated as population growth and development occurs around the site". In order to overcome conflict with urban development. The MRPA in its submission suggested that:

".. it would be necessary to prevent development of the surrounding area; including the balance of Lot 17 and possibly other land to the north and south. The extent would depend on the management technique adopted for the site."

The MRPA submission went on to state that "In the event that the site is considered acceptable from an environmental viewpoint, the Authority (MRPA) would expect to see a requirement for a sophisticated management and monitoring programme. The programme should be based on the acceptance of the site within the framework of an approved Structure Plan for the Mindarie/Clarkson locality that shows the disposal site in relation to the future urban infrastructure."

"The Authority (MRPA) would oppose any development without the Structure Plan referred to, as this document would be used as the basis for consideration of rezoning and development proposals at both a local and regional level" (see appendix C).

Several public submissions question "Procedures for dealing with the problem of toxic and other non-acceptable wastes which arrive on site," and how to prevent illicit dumping.

B.3.4 Dune Stability

Two government departments and two public submissions addressed this issue.

The potential for wind erosion was noted by these submissions. Stabilisation of the raised dune rim around the landfill site is

seen as important, as is the potential for erosion if later development occurs in the western part of the Lot 17 on the fragile Quindalup Dune System.

B.3.5 Pit Excavation and Stability

One government department suggested that instability in the limestone and sand to be excavated will necessitate lower batter angles or benching, effectively reducing the excavated pit volume for the stated surface area.

B4 AMENITY

B.4.1 General Quality of Life

Two public submissions specifically addressed the "way of life" enjoyed at Quinns Rocks and the penalities in travelling time incurred to live in the area. The landfill proposal is seen to compromise this lifestyle.

B.4.2 Property values

One of the above public submissions also claims that establishment of the landfill project would effect real estate values (adversely).

B.4.3 Odour, Smoke, Litter, Noise, Flies, Vermin and Feral Animals

These problems were raised in public submissions as site management issues which also have the potential to significantly affect the enjoyment of life by residents in surrounding areas, particularly Quinns Rocks and Burn's Beach. It has also been suggested in several submissions that these problems could adversely impact Neerabup National Park.

B5 ENVIRONMENTAL ASSESSMENT PROCESS

B.5.1 ERMP Investigation/Documentation

Fourteen submissions addressed this matter, four concluding that essentially the ERMP investigations and documentation were "adequate" and ten concluded that they did not adequately address the proposal or contained "major deficiencies".

The two areas most commonly seen to be deficient were the evaluation of alternative disposal options (ie choice of sanitary landfill over other techniques and the Mindarie site over other locations) and the analysis of potential leachate and groundwater problems.

One submission expressed concern at the number of important supporting statements not referenced.

Several submissions suggested that the report did not satisfactorily address future expansion beyond the 22 ha site, establishment of transfer stations and associated road haulage.

One submission noted that the proposal contained no statement on long term ownership and maintenance of the site.

The sentiments of a number of submissions are summed up as "Despite the lavishly produced report the conclusions are not of similar standard", "The ERMP Report as it stands is not a basis for allowing proposed development to proceed".

B.5.2 Environmental Impact Assessment/EPA Function

One organization offered many comments related to the general EIA process, the function of the EPA and waste management, in addition to those specific to the proposal in hand:

- in future ERMP's should be released for public submissions before irreversible decisions on proposals are made.
- the EPA should clearly state that the Mindarie refuse disposal facility is an inadequate solution to the problems facing the local authorities in disposing of refuse.
- the EPA should seek assistance from the State and Commonwealth governments to help put an end to the use of fragile and valuable land for rubbish disposal.
- a single multi-disciplinary Waste Disposal Authority should be established, strongly oriented towards separation and recycling.
- the EPA should take a high profile in advocating reduction of rubbish, source separation and recycling.
- the EPA should assist the Perth City Council in finding a suitable site for composting.
- the EPA should compile a directory of groups who will recycle/ reuse rubbish.
- should the proposal proceed, then a separate management and monitoring programme should be compiled and publicly released. The proponent should be required to report on the project every three years. This report should be made public.

Another group suggested that the issuing of guidelines by the EPA for preparation of the ERMP ".. infers complete approval of the site by the Environmental Protection Authority".

B6 OTHER SPECIFIC COMMENTS

B.6.1 Sanitary Landfill "Antiquated"

Eight of the sixteen public submissions suggested that sanitary landfill is "antiquated" (or similar words). Some submissions simply expressed opposition to sanitary landfill while others suggested the application of alternatives such as composting and incineration, preferably preceeded by recycling. Many recognised a potential cost penalty but suggested that such was justified.

B.6.2 Flora and Fauna

One government department submission noted the occurence of Eucalyptus drummondii as a geographical outlier. The other department to comment on this subject expressed concern at "the possible destruction of the valuable limestone heath vegetation which occurs in small pockets of Karrakatta limestone soils in the Spearwood Dune System."

B.6.3 Aboriginal Sites

One government department noted that ".. no systematic survey has been undertaken,..".

MINDARIE REFUSE DISPOSAL FACILITY SUBMISSIONS

The order of names presented in this Appendix bears no relation to the order of submissions in Table 4 of Chapter 3 of this Assessment Report.

Public Submissions

Cannon & Co (Barristers & Solicitors) on behalf of a groups of local fishermen.

D & A Collins
Conservation Council of WA (Inc)
Dr G E Ho
F Jacobi (attached a petition containing over 450 signatures)
E R Kidd
A & P Lorenz, M Wilson
Marmion Sorrento Duncraig Progress & Ratepayers Assoc Inc
I C Marr
WA National Parks & Reserves Assoc (Inc)
Dr P Newman
Quinns Rocks Civic Assoc (Inc)
I Southall
O J Spire
Michael Wainwright & Associates
M & B Williams

Government Departments

West Australian Department of Agriculture
Coastal Management of Co-ordinating Committee
Department of Fisheries & Wildlife
Geological Survey of Western Australia
Government Chemical Labortories
Western Australian Herbarium
Department of Lands and Surveys
Main Roads Department
Western Australian Marine Research Laboratories
(Department of Fisheries and Wildlife)
Metropolitan Region Planning Authority
Metropolitan Water Authority
Western Australian Museum
Public Health Department
Public Works Department
Town Planning Department

22 ST. GEORGE'S TERRACE, PERTH, 6000 W.A. TELEPHONE 425 7333

METROPOLITAN REGION PLANNING AUTHORITY

IN REPLY PLEASE QUOTE

AUTHORITY REF: 556-2-30-2 MRPA

YOUR REF: Mr.D. Brown

THE CHAIRMAN.
EVIRONMENTAL PROTECTION AUTHORITY.

MINDARIE REFUSE DISPOSAL SITE

I refer to your letter of November 13, regarding the ERMP for the proposed Mindarie refuse disposal site. I apologise for the delay in replying, but understand that discussions have occurred between yourself, Mr. Don Brown of the Town Planning Department and officers of the Department of Conservation and Environment.

I understand that Mr. Brown briefed officers prior to your Authority's meeting on November 21 and this letter is to confirm the following advice given at those meetings.

1. The Authority re-iterates the need for a comprehensive and co-ordinated approach to the management of regional waste disposal - something that is long overdue and of the utmost urgency.

   In the absence of a region-wide solution, the Mindarie proposal must be seen as an ad-hoc approach. Notwithstanding this, I believe that if this site is environmentally suitable and development approval is eventually forthcoming, this facility and the planned Perth City Council composting plant in Brockway Road, Shenton Park must form part of a strategic solution to waste management.

2. The Authority acknowledges the need for a site to serve the future population of the Northern Corridor and that the facility may also be needed to serve the inner suburbs.

   However, the extent and type of facility proposed must be questioned; given that technological changes (and consequently the philosophical approach to waste management) may obviate the need for the present system of sanitary landfill.

3. The Authority still maintains that the proposed facility has the potential to conflict with future urban development in the Corridor, and that the use would be more appropriate in the rural wedge.

   However, given the need to protect groundwater resources, the general character/soil types of the area to the east of the Corridor and the

type of soils considered suitable for this type of facility, the Authority acknowledges that in a physical and geographical sense, the chosen site has much to recommend it.

4. Present indications are that the ERMP is generally correct in predicting urban growth in the Mindarie/Clarkson localities. From this it is evident that, in all probability, a refuse disposal facility will conflict with urban development and continue to operate after urban development is completed.

   Given the experience with disposal sites at Brockway and Hertha Roads, the Authority could not support the operation of the Mindarie facility close to urban development.

5. In order to overcome the conflict referred to in 4 it would be necessary to prevent development of the surrounding area; including the balance of Lot 17 and possibly other land to the north and south. The extent would depend on the management technique adopted for the site. The Authority does not support the sterilisation of land in this manner.

6. The successful operation of a disposal facility in this area - without the conflict referred to - would require a level of management hitherto unheard of in the Perth region.

7. In the event that the site is considered acceptable from an environmental viewpoint, the Authority would expect to see a requirement for a sophisticated management and monitoring programme. The programme should be based on the acceptance of the site within the framework of an approved Structure Plan for the Mindarie/Clarkson locality that shows the disposal site in relation to the future urban infrastructure.

   The Authority would oppose any development without the Structure Plan referred to, as this document would be used as the basis for consideration of rezoning and development proposals at both a local and regional level.

8. The Authority accepts that a planned extraction of limestone within the context of the management and monitoring programme can overcome the earlier reservations related to sterilising this resource.

9. The Authority wishes to stress that these comments relate to the 22 ha. site only. Under no circumstances could the Authority support further development of the site as envisaged in the ERMP.

W. A. McKENZIE.
CHAIRMAN.

November 27, 1985.
DB:AO

Special permission has been received
from WAWA to include this submission,
as an appendix, in the EPA Assessment Report.

APPENDIX D

WATER AUTHORITY of Western Australia

629 NEWCASTLE STREET
LEEDERVILLE W.A.
Postal Address: P.O. Box 100 Leederville
Western Australia 6007
Telephone: (09) 420 2420 Telex: AA 95140

Your Ref
Our Ref A 17804
Enquiries MR B SANDERS
Tele Direct 420 2471

Mr B A Carbon
Chairman
Environmental Protection Authority
BP House
1 Mount Street
PERTH

Dear Sir

MINDARIE REFUSE DISPOSAL FACILITY

The Water Authority agrees that the relationship between waste disposal sites and the integrity and quality of the Gnangara Mound is most important. It is the Authority's view that waste disposal sites must be located so as to minimise any potential adverse impacts on the State's water resources. In particular they must not be located in an existing or proposed public water supply area, water reserve or catchment area.

Further groundwater areas for public water supply extends as far north as Moore River and as far south as Mandurah.

Therefore any disposal sites on the coastal plain should be located downstream of existing or potential public water supply areas. The basic object is to ensure that:-

(i) the groundwater from beneath the site flows towards the ocean and not to lakes or streams, and

(ii) the groundwater is at a reasonable depth below the surface so that its interception by excavation of disposal pits does not occur.

For these reasons, it is preferred that waste disposal sites on the coastal plain be located in a narrow strip of fairly high ground fronting the ocean.

Although it may not be ideal, the Mindarie site complies with the basic requirements as far as protection of public water supplies are concerned. It is considered that a properly engineered waste site would not threaten the Quinns Rock water supply.

Yours faithfully,

MANAGING DIRECTOR

November 20, 1985 BS:DCA

Special permission has been received from the Town Planning Department to include this submission, as an appendix, in the EPA Assessment Report

APPENDIX E

TOWN PLANNING DEPARTMENT OF WESTERN AUSTRALIA
22 ST. GEORGE'S TERRACE, PERTH 6000 W.A. TELEPHONE 425 7333

GOVERNMENT OF WESTERN AUSTRALIA

IN REPLY PLEASE QUOTE 556-2-30-2 TPD

AUTHORITY REF: Mr. D. Brown

YOUR REF: 125/73wp

DIRECTOR
DEPARTMENT OF CONSERVATION & ENVIRONMENT.

MINDARIE REFUSE DISPOSAL SITE

I refer to your letter of November 6 regarding the above.

The Metropolitan Region Planning Authority and Town Planning Board will require that a comprehensive Structure Plan be prepared prior to any amendment to the Metropolitan Region Scheme aimed at implementing the 'Planning Structure for the N.W. Corridor' prepared in 1977. The Structure Plan will have to contain a justification for any development proposal.

Much will depend on the Structure Plan; which should contain a re-assessment of the assumptions and conclusions made in the 1977 proposal and should amount to a fine-tuning of that plan.

It is unlikely that the site of the refuse facility - if it proceeds - would be reserved for Parks and Recreation until after development was completed and rehabilitation had occurred. Its suitability as a regional reserve would then be assessed.

It is possible that the Structure Plan will justify a substantial amendment to the Metropolitan Region Scheme to provide for a regional road network and urban infrastructure. Reservation of the balance of the land earmarked for Parks and Recreation will depend on the proponent's submission. If the land is reserved it will almost certainly preclude any future expansion of the disposal site.

L.W. GRAHAM.
A/TOWN PLANNING COMMISSIONER.

November 27, 1985.

DB:AO

DEPARTMENT OF CONSERVATION AND ENVIRONMENT
29 NOV 1985
File No. T116 125/73