Special Residential Development, Lyndon locations 222 and 223, Exmouth

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Shire of Exmouth and Greenough Holdings Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 829
August 1996

THE PURPOSE OF THIS REPORT

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

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

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

APPEALS

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

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

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 20 September, 1996.

Environmental Impact Assessment Process Timelines

Date	Timeline commences from receipt of full details of proposal from proponent for public review	Time (weeks)
6/11/95	Proponent document released for public comment	
16/12/95	Public comment period closed	6
12/1/96	Issues raised during public comment period summarised by EPA and forwarded to the Proponent	3
23/1/96	Proponent response to the issues raised received	2
6/8/96	EPA reported to the Minister for the Environment	32

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Summary and recommendations

The Environmental Protection Authority (EPA) has assessed, under Part IV of the *Environmental Protection Act* 1986, the proposal by the Shire of Exmouth and Greenough Holdings Pty Ltd to develop for special residential purposes Lyndon locations 222 and 223, approximately 10 kilometres south of Exmouth.

This report and recommendations provides advice to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures to which the proposal should be subject.

The EPA considers that the environmental factors relevant to the proposal are:

- impacts on karst systems, in particular groundwater quality and associated subterranean fauna;
- impacts on other flora, fauna and ecosystems and possible extensions to Cape Range National Park;
- impacts on the marine environment; and
- coastal management.

The EPA has concluded that the proposal by the Shire of Exmouth and Greenough Holdings can be managed within the objectives established by the EPA.

The EPA recommends that the Minister for the Environment:

- notes the environmental factors relevant to the proposal as set out in Section 5.1;
- notes that the EPA has concluded that the proposal by the Shire of Exmouth and Greenough Holdings to develop Lyndon locations 222 and 223 for special residential purposes can be managed to meet the objectives established by the EPA, subject to the implementation of the commitments made by the proponents;
- notes that the EPA intends to develop a policy on development within the Exmouth - Cape Range area to assist in the management of the area and the assessment of development proposals;
- notes that the EPA supports the concept of an eastern extension to the National Park to provide a representative system of areas set aside for conservation; and
- adopts the conditions set out in Section 6 of this report if the Minister determines that the proposal may be implemented.

1. The report

This report and recommendations provides the Environmental Protection Authority's advice and recommendations to the Minister for the Environment on the environmental factors applicable to the proposal to develop for special residential purposes Lyndon locations 222 and 223, approximately 10 kilometres south of Exmouth.

This report considers the environmental impact of the development proposal as described in the Consultative Environmental Review (CER) and summarised in Section 2. Section 3 explains the method of assessment and identifies and reviews the factors raised throughout the assessment, including those identified through public and government agency submissions. Those factors that are deemed by the EPA to be relevant to the environmental assessment of the proposal are identified in Section 3 and then evaluated in Section 4. The evaluation of each relevant environmental factor states the objectives of the assessment for that factor and sets out the relevant policy and technical information. Comments from key agencies and the public are summarised and the proponent response is presented. The sub-section on each relevant environmental factor is concluded with the EPA's evaluation in terms of achieving the stated objectives.

Advice to the Minister on the environmental factors relevant to the proposal, and any other matters, is provided in Section 5, while Section 6 sets out the proposed Environmental Conditions to which the proposal should be subject if the Minister determines that the proposal may proceed. The reference and bibliography list is contained in Section 7.

2. The proposal

The Shire of Exmouth and Greenough Holdings Pty Ltd propose to subdivide for special residential purposes 158 hectares of land at Lyndon locations 222 and 223. The subject land is on the eastern shoreline of the Cape Range peninsula immediately inland of the coastal dunes and approximately 10 kilometres south of Exmouth (refer Figure 1).

It is proposed to subdivide the land into 177 special residential lots, ranging in area from approximately 0.4 to 3.4 hectares. Refer to Figure 2 for a map showing the design of the subdivision and Table 1 which highlights aspects of the development.

The proposed disposal of domestic effluent from the development will be via septic tanks which incorporate special provisions to minimise the potential for pollution of groundwater (refer section 4.1 and Appendix 4, Commitment 8). It is proposed that each septic tank will utilise dual leach drains of extended length to ensure maximum dispersal of domestic effluent. It is intended that the use of the dual leach leach drains will be alternated on a six monthly basis in order to maximise nutrient uptake.

The proposal stipulates that reticulated water will be supplied from the Water Corporation wellfield. This is subject to environmental clearance of the expansion of the wellfield, which is currently subject to formal assessment by the EPA. Should this source not be granted approval and an alternate source is sought such as individual bores on each lot, the EPA would consider this to be a change of proposal which would require referral and further assessment.

It is proposed that the subdivision design will incorporate Water Sensitive Urban Design principles and that drainage will recharge groundwater.

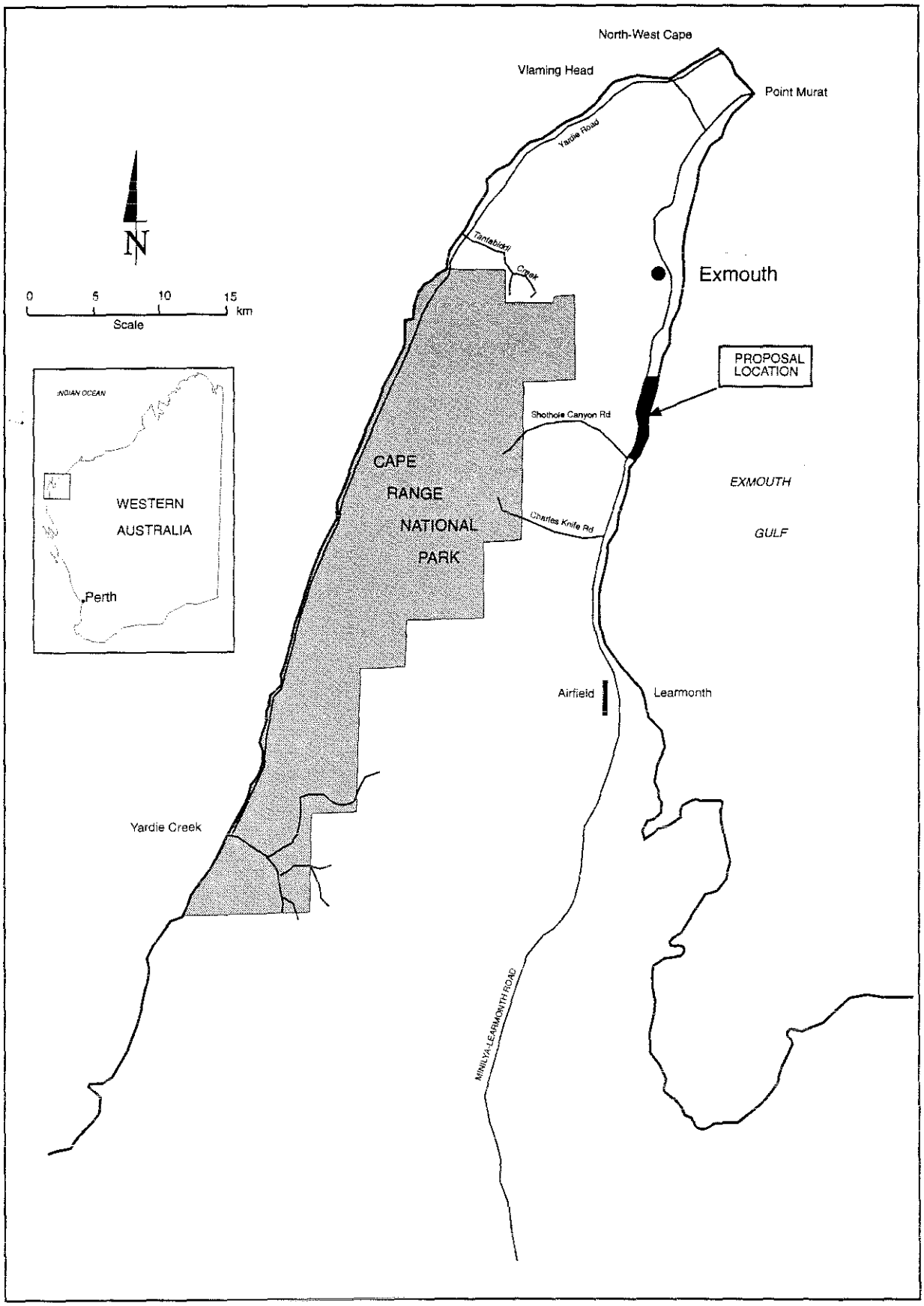

Figure 1. Locality map

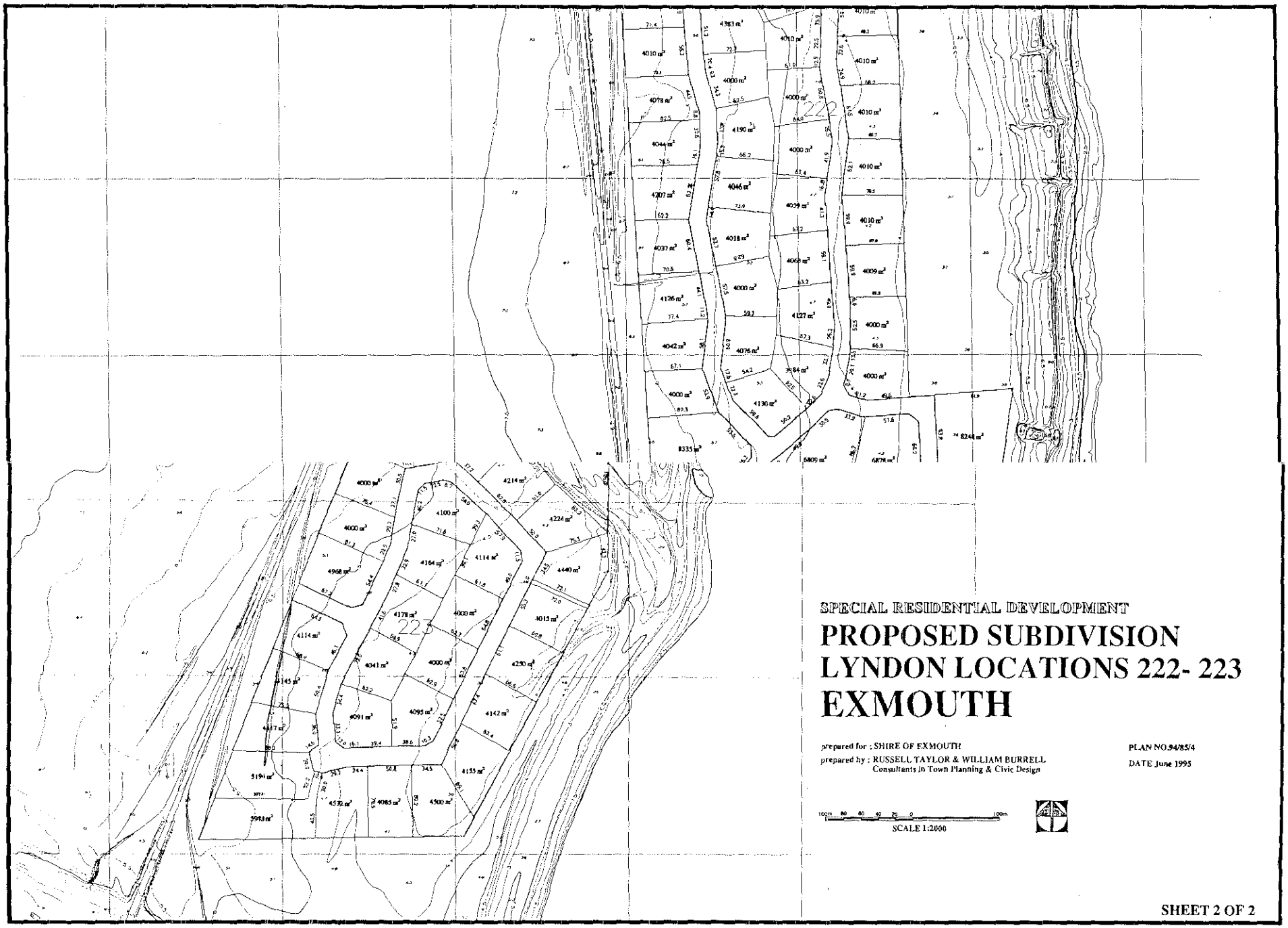

Figure 2. Design of Subdivision.

Figure 2. Design of Subdivision (cont'd).

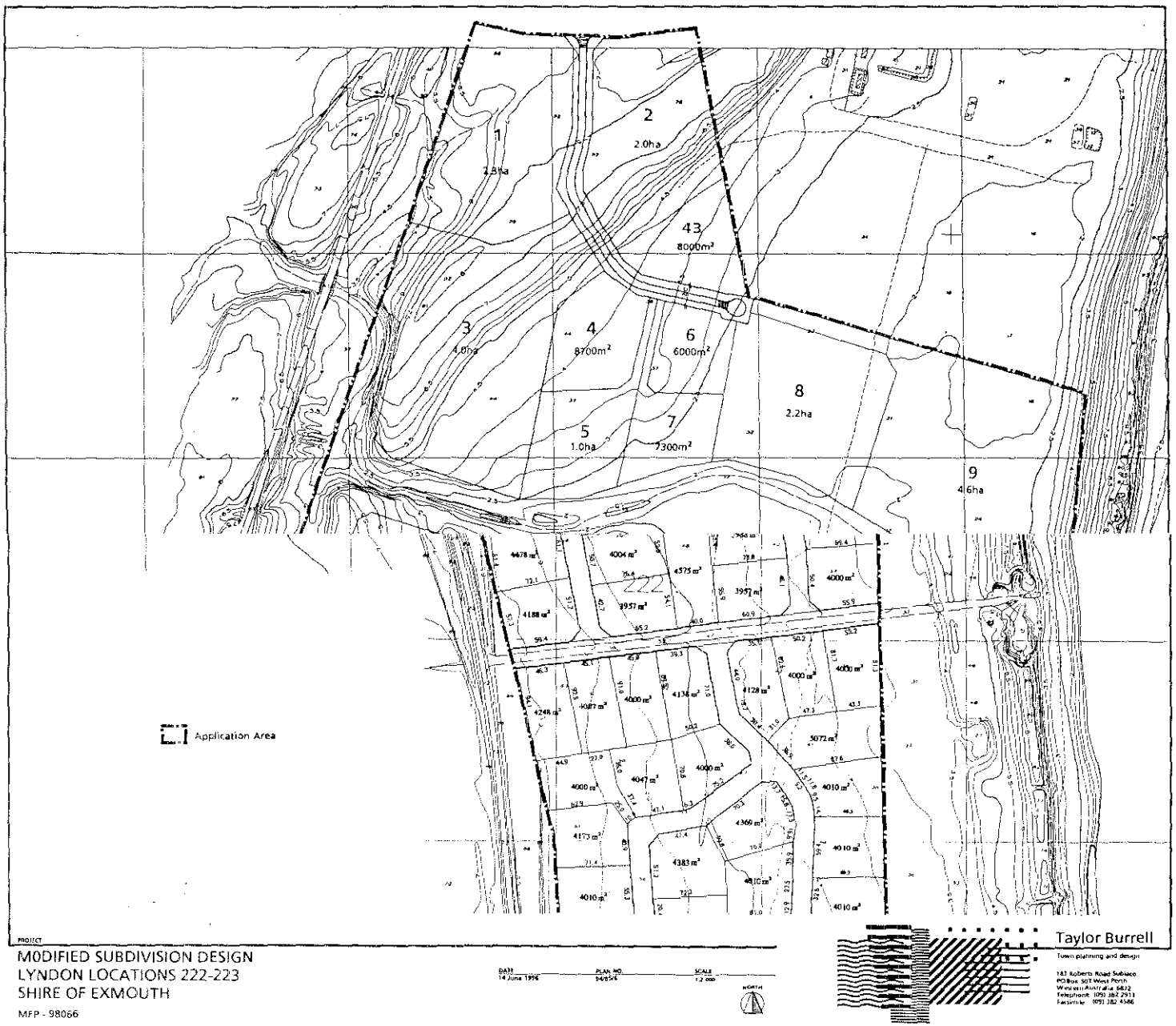

Table 1. Description of proposal

Area of subdivision	258 hectares.
No of lots	177.
Size of lots	0.4 to 3.4 hectares.
Water supply	Proposed to be taken from the Water Corporation wellfield.
Access provisions	Public access to beach via Pebble Beach Road maintained.
Effluent disposal	Septic tanks and dual leach drains.
Drainage	Incorporating Water Sensitive Urban Design Principles.
Solid waste disposal	Using existing Shire facilities.

3. Identification of factors

3.1 Method of assessment

The purpose of an assessment under Part IV of the *Environmental Protection Act* 1986 is for the Environmental Protection Authority to report to the Minister for the Environment on the environmental factors relevant to a proposal, and on the procedures and conditions to which the proposal should be subject if the Minister determines that the proposal may proceed. The EPA may also make such recommendations to the Minister as it sees fit.

Where a proposal is to be assessed by the EPA, the proponent is usually required to prepare an environmental review document which is made available for public and agency comment. To assist the proponent in the preparation of the document the Department of Environmental Protection, on behalf of the EPA, issues the proponent with guidelines which list the factors which should be examined.

In the assessment of the proposal the EPA considers the information contained in the document, public and agency submissions and the proponent's response to those submissions (refer Appendix 2). This consideration results in a list of factors and the EPA determines which of these are relevant to the proposal and require assessment (refer Table 2).

Each of the environmental factors relevant to the proposal is then assessed against policies and the EPA's objective in relation to that factor to determine if the proposal, incorporating the proponents' commitments (refer Appendix 4), can be managed within the objectives established by the EPA. This assessment is summarised in Table 3. The EPA then provides advice to the Minister on the conditions and procedures to be applied if the proposal is to be implemented.

The Department of Environmental Protection provides services to the EPA according to the *Environmental Protection Act* 1986, gazetted Administrative Procedures, 1993, and internal procedures agreed by the EPA (refer Appendix 1 for a flow chart illustrating the procedures). It is through these procedures that the EPA directs the preparation of guidelines, factors, environmental objectives and reporting to the Minister.

3.2 Public and agency submissions

Comments on the CER were sought from the public, interest groups and local and State government agencies. During the public review period 13 submissions were received, 7 of which were from State government agencies and 6 were public submissions. A summary of these submissions was forwarded to the proponents for response (Appendix 2).

The principal topics of concern raised in the submissions were:

Biophysical Impacts

- potential impacts on karst systems and associated subterranean fauna via the groundwater;
- other fauna, flora and ecosystems;
- marine environment;
- coastal management;
- extensions to Cape Range National Park;
- flood risk / storm surge;
- weed management;
- water supply;
- fire;

Pollution Potential

- management of contaminants from development;
- noise from limestone carrying trucks;
- alternatives options for wastewater disposal;

Social Surroundings

- Aboriginal heritage;
- boat launching facilities;

Other

- solid waste disposal; and
- planning context.

The Environmental Protection Authority has considered the submissions received and the proponent's response in its evaluation of the proposal.

3.3 Review of factors

3.3.1 Identification of factors

Fifteen factors were raised during the environmental impact assessment process including those factors identified in the guidelines for the CER, subsequent consultations and the submissions described above. These factors are discussed below and those that are relevant to the proposal and require further evaluation by the EPA are identified. Table 2 summarises this process.

3.3.2 Identification of environmental factors relevant to proposal

Biophysical Impacts

Impacts on karst systems in particular groundwater quality and associated subterranean fauna

The karst systems of the Cape Range peninsula support a diverse range of subterranean fauna, some species of which are listed under Schedule 1 of the Wildlife Conservation Act, 1950. The subterranean fauna on the Cape Range peninsula is recognised as a relict fauna of international significance, being highly endemic containing whole classes, orders, genera and species not

otherwise represented in the southern hemisphere (Australian Nature Conservation Agency, 1996a).

The proponents have assumed the fauna are present in the area, rather than undertake investigation to determine their presence.

Submissions indicated concern that subterranean fauna could be adversely impacted by the proposal, particularly through the pollution of groundwater.

This factor is relevant to the proposal and requires further evaluation by the EPA (refer Section 4.1).

Other fauna, flora and ecosystems

The proponents commissioned a survey of terrestrial flora and fauna as part of the preparation of the CER. Submissions questioned the adequacy of the survey and considered the document did not adequately address the potential for impacts resulting from pets being brought into the area.

This factor is relevant to the proposal and requires further evaluation by the EPA (refer Section 4.2).

Marine environment

The proposed method of effluent disposal has raised concerns that the septic discharges to groundwater may lead to impacts on the marine environment.

This factor is relevant to the proposal and requires further evaluation by the EPA (refer Section 4.3).

Coastal Management

The proximity of the development to the coast and coastal dunes could result in impacts on the coastal environment. The proponents have committed to the preparation of a foreshore management plan to protect the coastal dunes and beaches.

This factor is relevant to the proposal and requires further evaluation by the EPA (refer Section 4.4).

Extensions to Cape Range National Park

The proposal is in the vicinity of an area highlighted for possible future extensions to the Cape Range National Park. The possibility of an eastward extension of the National Park through to the eastern shoreline of the Cape was identified in the Conservation Reserves for Western Australia, as recommended by the EPA (EPA, 1975).

This factor is relevant to the proposal. It is related to the factor 'other flora, fauna and ecosystems' and both factors are further evaluated together by the EPA (refer section 4.2).

Flood risk / storm surge

Proposed residences on the site could be subject to flooding through two mechanisms, ie flooding as a result of high rainfall and heavy creek flow from Cape Range, or from oceanic storm surge in the event of a cyclone.

Commitments 5 and 6 state that, prior to subdivision approval, the proponents will prepare a storm surge study to the requirements of the Ministry for Planning and a flood risk study to the requirements of the Ministry for Planning and the Water and Rivers Commission. Commitment 7 states that the subdivision will be modified in accordance with the results of the studies to meet the requirements of the Ministry for Planning. The requirements of the Ministry for Planning are outlined in the Country Coastal Planning Policy (WAPC Policy No. DC 6.1) and the Gascoyne Coast Regional Strategy (Ministry for Planning, 1996).

This factor can be adequately addressed through the subdivision approval as part of the planning process and does not require further evaluation by the EPA.

Weed management

Weed management was a factor raised through the issue of guidelines for the CER. The proponents have committed to the preparation of a weed management plan prior to construction (refer appendix 4, commitment 12).

This factor is addressed through the proponent commitment and can be adequately addressed through the auditing of compliance if the proponents' commitments are incorporated as Ministerial conditions. This factor does not require further evaluation by the EPA.

Water supply

It is proposed that water will be taken from the existing town supply or from the proposed Water Corporation wellfield expansion, which is currently being assessed by the EPA. The proposal does not include the establishment of private bores. If bores are proposed the EPA would likely consider the change to the proposal to be substantial and require further assessment. The proponent commitment (refer Appendix 4, Commitment 9) states that groundwater abstraction by private bores within proposed development will be controlled the Water and Rivers Commission licensing controls. Any application for private bores should be referred to the EPA.

This factor does not require further evaluation by the EPA in this report.

Fire

The issue of increase in fire risk was discussed within the CER and the proponents committed to enforcing the provisions of the Bush Fires Act with regard to the maintenance of firebreaks on privately owned land (refer Appendix 4, commitment 11).

This factor is addressed through the proponent commitment and other legislation and does not require further evaluation by the EPA.

Pollution Potential

Management of nutrients and contaminants from development

The proposed development could result in leaching of nutrients and contaminants through to groundwater, impacting on subterranean fauna, and the marine environment. A number of submissions questioned the suitability of the site for septic systems.

This factor is relevant to the proposal and requires further evaluation by the EPA (refer Sections 4.1 and 4.3).

Noise from nearby airport

The proposed development is in the vicinity of the Exmouth airfield. The EPA guidelines raised noise impacts from the airfield as a factor which needed to be addressed within the CER. The CER indicates that the low level of usage of the airfield by light aircraft is unlikely to result in levels of noise which could impact on future residents. In addition, most flights take-off or approach from a westerly direction, avoiding flying over the site which is to the east of the airfield.

This factor does not require further evaluation by the EPA.

Noise from limestone carrying trucks

A public submission stated that the road to Exmouth will be heavily trafficked if the limestone project is approved.

This factor will be addressed through the formal assessment of the limestone quarry and does not require further evaluation by the EPA in this report.

Social Surrounds

Aboriginal Heritage

A public submission considered that Aboriginal rock shelters may be present in caves in the area, and that the document did not adequately address this issue. A separate document based on consultations with Aboriginal Elders and an archaeological survey was commissioned by the proponent. Permission was subsequently obtained from the Minister for Aboriginal Affairs to use the land following a Notice under Section 18 of the Aboriginal Heritage Act.

This factor does not require further evaluation by the EPA.

Boat launching facilities

With the predicted high level of boat ownership and usage in the area, the provision of boat launching facilities would be important in reducing the impacts on the coastal area.

This factor should be addressed through the planning system and the preparation of a foreshore management plan and does not require further evaluation by the EPA.

Other

Solid waste disposal

A public submission was concerned that the CER did not address disposal of garbage generated within the development. Given the capacity of existing waste disposal facilities and the lack of recycling facilities, the public submission considered that solid waste disposal should have been addressed within the CER. In 1994 the Shire established disposal facilities which have been designed with an estimated life of 20 years allowing for a 2 to 4% growth rate in the Shire. As the proposed development is designed to cater for part of that population increase the existing disposal facilities have the capacity to accommodate the proposed development.

This factor does not require further evaluation by the EPA.

Planning context

A number of submissions expressed concerns regarding the planning implications of the proposal, in particular that it is not consistent with strategy documents for the region.

The Gascoyne Coast Regional Strategy (Ministry for Planning, 1996) is the basis of strategic planning policy for the region. Figure 3 shows the extent of the region and the regional strategy. The strategy included the following recommendations:

- *consider the development implications and constraints imposed by the karst landscape of the Cape Range peninsula (foundation instability, difficulty for excavation and poor nutrient retention ability) during the development planning process;*
- *recognise and protect the environmental sensitivity of coastal and littoral land systems from inappropriate uses;*
- *recognise the regional and international significance of the subterranean fauna and ensure their protection through appropriate management strategies; and*
- *have regard to the potential impacts on subterranean fauna species and research assessments of regional significance and the impact of mitigation on a development along the Cape Range peninsula.*

The subject land falls within the Exmouth policy area of the strategy which promotes tourism and residential development for the area. These uses are only recommended subject to detailed environmental / planning assessment. In addition, planning and management guidelines suggest that development in Exmouth should utilise existing or proposed infrastructure and services.

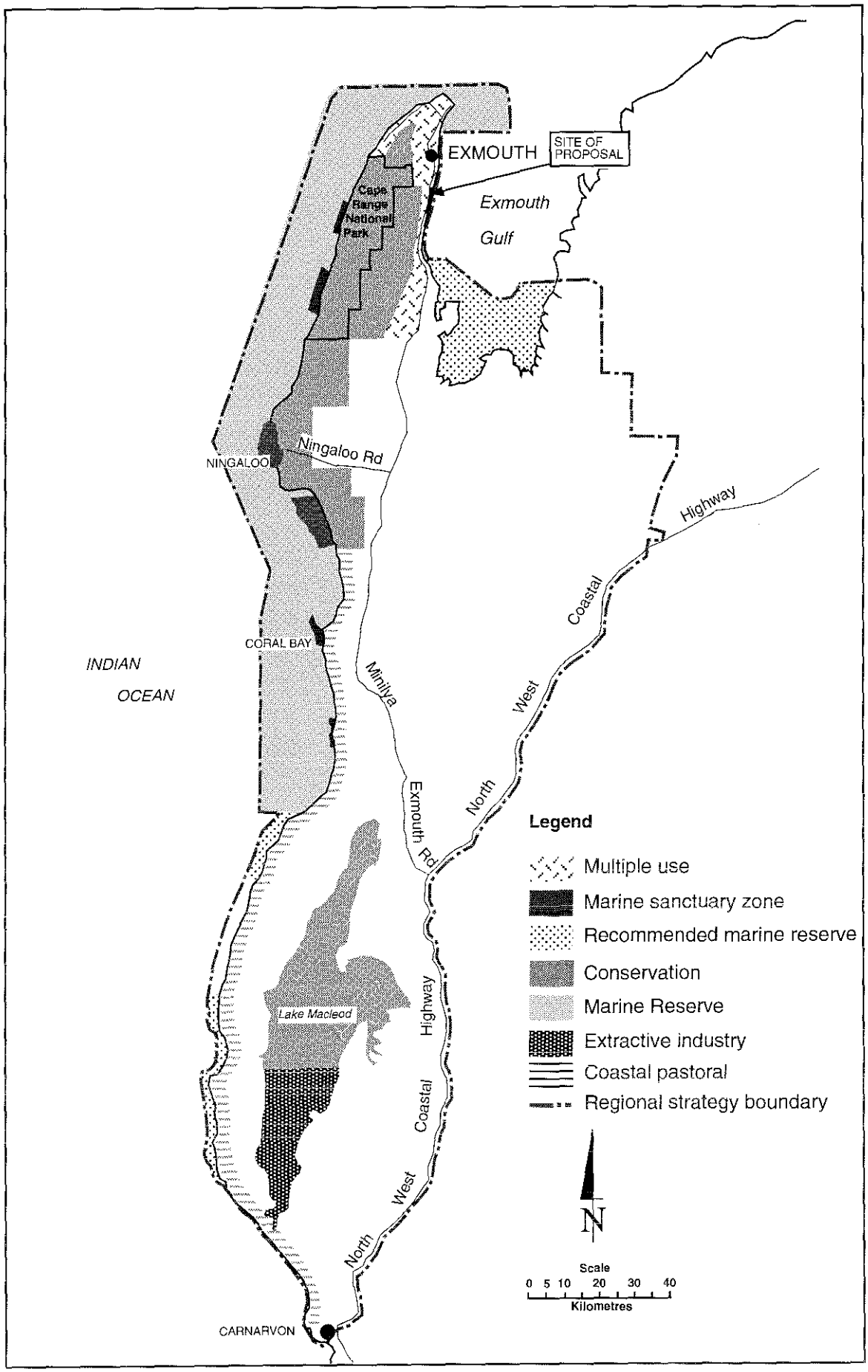

Figure 3. Gascoyne Coast Regional Strategy (Source: Ministry for Planning, 1996).

The Exmouth Coastal Strategy (DPUD, 1992) recognised a number of sites in this area of the coast that provide opportunities for development, and considered that any proposal should comply with sound coastal planning and environmental principles. It was recommended that all development be located away from all drainage lines and other areas that are prone to flooding.

The nature of this proposal is not inconsistent with the land use allocation provisions of the Gascoyne Coast Regional Strategy and the Exmouth Coastal Strategy. As noted above, the proposal is in the vicinity of an area highlighted for possible extensions to the Cape Range National Park and this factor is further evaluated by the EPA in Section 4.2. The factor of complying with sound coastal environmental planning principles, and, the environmental sensitivity of coastal and littoral land systems is considered in Section 4.4.

The significance of subterranean fauna and potential impacts of development are further evaluated in Section 4.1.

The factor of avoiding drainage lines and flood risk will be addressed in the planning process through subdivision approval.

This factor does not require further evaluation by the EPA.

3.3.3 Summary

The EPA has evaluated the above factors and considers that a number of them are factors which are relevant to the environmental assessment of the proposal and require further evaluation by the EPA (refer Table 2 for summary of process). The environmental factors relevant to the proposal are:

- impacts on karst systems, in particular groundwater quality and associated subterranean fauna;
- impacts on other flora, fauna and ecosystems and possible extensions to Cape Range National Park;
- impacts on the marine environment; and
- coastal management.

4. Evaluation of environmental factors relevant to proposal

4.1 Impacts on karst systems, in particular groundwater quality and associated subterranean fauna

Environmental Protection Authority Objective

To ensure that the recognised values of karst systems are adequately represented within the conservation estate.

To ensure that where karst systems are outside of the conservation estate, land use activity is managed to maintain, as far as practicable, the recognised values.

To ensure goundwater quality is maintained.

FACTOR		PUBLIC AND AGENCY COMMENTS	ENVIRONMENTAL FACTORS
Biophysical			
Impacts on subterranean fauna	Potential contamination of groundwater by herbicides, pesticides, heavy metals and nutrients from septic tanks and fertilisers and could impact on subterranean fauna.	Suitability of site for septic tanks questioned. Connection to sewer should be required. Pollution of groundwater from use of fertiliser, herbicides and pesticides could impact on subterranean fauna.	EPA EVALUATION REQUIRED Refer Section 4.1
Other flora, fauna and ecosystems	Loss of vegetation and habitat for fauna.	No systematic survey of flora or fauna undertaken. CER does not address the potential for impacts resulting from pets being brought into the area. By-laws needed to address management of domestic animals and other environmental issues.	EPA EVALUATION REQUIRED Refer Section 4.2
Marine Environment	Impacts on marine area adjacent to the development.	Marine algal growth may be encouraged locally by domestic effluent. Effluent from septic discharges have caused recognisable changes elsewhere on the Cape.	EPA EVALUATION REQUIRED Refer Section 4.3
Coastal Management	Development close to dunal areas, management required.	Development too close to dunes, which could lead to erosion from uncontrolled beach access. Foreshore management plan should be prepared.	EPA EVALUATION REQUIRED Refer Section 4.4
Extensions to Cape Range National Park	Proposal is in vicinity of area proposed for future extensions to the park.	Ecosystem type of site different to that within National Park and could warrant inclusion in park as eastern extension to the Gulf. The development would reduce the possibility of proposed extensions to the National Park.	EPA EVALUATION REQUIRED Refer Section 4.2
Flood risk / storm surge	Some areas are flood prone and present a flood risk in the event of a cyclone.	Potential for land to be inundated, particularly around creeks and close to dunes.	NO FURTHER EVALUATION REQUIRED BY EPA Addressed through commitment and through subdivision approval as part of planning process.
Weed management	Weeds may be favoured by site disturbance as part of development.	A weed management plan should be prepared.	NO FURTHER EVALUATION REQUIRED BY EPA Addressed through commitment and compliance auditing.
Water supply	Water will be taken from town supply, either existing or from wellfield expansion currently being assessed by EPA.	Water supply and private bores should be addressed in consultation with the Water Corporation.	NO FURTHER EVALUATION REQUIRED BY EPA Proposal does not include establishment of private bores. Wellfield expansion is being assessed by EPA as a separate proposal. If bores proposed, further assessment by EPA required.
Fire	Increase in fire risk.	Fire management initiatives required to the satisfaction of the Bush Fires Board.	NO FURTHER EVALUATION REQUIRED BY EPA Addressed through commitment and enforcement of Bushfires Act.

Table 2. Identification of environmental factors that are relevant to the proposal and require EPA evaluation

FACTOR	PROPOSAL CHARACTERISTICS	PUBLIC AND AGENCY COMMENTS	ENVIRONMENTAL FACTORS
Pollution			
Management of nutrients & contaminants from development	Septic tank leachate may pollute groundwater and marine environment.	Concerns of suitability of site and soils for septic tanks. Alternative options for wastewater disposal should be considered as the site is not suitable for septic tanks and leach drains. Connection to reticulated sewerage system or a small local treatment plant should occur. Fertilisers, herbicides and pesticides will result in pollution of groundwater and impacts on subterranean fauna.	EPA EVALUATION REQUIRED Refer Sections 4.1 and 4.3
Noise from nearby airport	Future residents may be exposed to noise from airport		NO FURTHER EVALUATION REQUIRED BY EPA Noise levels not expected to impact on future residents.
Noise from limestone carrying trucks	Limestone transporting trucks may result in noise impacts on future residents.	The road to Exmouth will be heavily trafficked if the limestone project is approved.	NO FURTHER EVALUATION REQUIRED BY EPA IN THIS REPORT Addressed through the formal assessment of the limestone quarry.
Social Surrounds			
Aboriginal Heritage	Aboriginal rock shelters may be present in caves in vicinity of development.	The document is not thorough in its treatment of Aboriginal heritage issues.	NO FURTHER EVALUATION REQUIRED BY EPA This factor was considered through processes under the Aboriginal Heritage Act.
Boat launching facilities	No provision made for boat launching facilities.	Boat launching facilities are important in the minimisation of coastal impacts.	NO FURTHER EVALUATION REQUIRED BY EPA Addressed through commitment to include in foreshore management plan to be dealt with through subdivision approval.
Other			
Solid waste disposal	The capacity of existing waste disposal facilities is not addressed.	Extra garbage will be generated by the development. The Shire should initiate a recycling programme to reduce the need for landfill.	NO FURTHER EVALUATION REQUIRED BY EPA Existing facilities have adequate capacity.
Planning context	Special Residential subdivision 10 km south of Exmouth.	Any development on the Cape should be considered on a strategic basis and be consistent with strategic documents such as the Gascoyne Coast Regional Strategy.	NO FURTHER EVALUATION REQUIRED BY EPA Proposal not inconsistent with land use allocation provisions. Environmental considerations addressed through other factors.

Table 2. Identification of environmental factors that are relevant to the proposal and require EPA evaluation (cont'd)

Technical information

The Gascoyne Coast Region Strategy (Ministry for Planning, 1996) describes the landform of Cape Range peninsula as deeply dissected limestone ranges and outwash plains with extensive cave formations. The landscape is referred to as karst, the main characteristics of which include extensive underground drainage and cave systems formed by the percolation of water through limestone sinkholes and the subsequent dissolution of minerals. The coastal plain, on which the subject land is located, is underlain by limestone honeycombed by caves formed at the interface between air and water (Marsh, 1996).

The Cape Range karst environment supports a great diversity of both terrestrial and aquatic animals that are especially adapted for subterranean life (within the caves) and are largely endemic to the area. The subterranean fauna of north-western Australia are recognised as amongst the most diverse in the world and contain relict fauna of the highest conservation status (Morton, Short and Barker, 1995).

The proponents have assumed subterranean fauna are present below the site, rather than seeking to demonstrate their presence.

The CER document provides discussion on the soils of the study area and specifically their nutrient-fixing properties in relation to the suitability of the site for septic tanks. Within the document it was considered that the phosphate retention index (PRI) of the soils confirms that most of the phosphates in domestic effluent water will be readily fixed within the soils of the study area and the leaching rate of phosphates would be low. The limestone and lime sands which underlie the soils would be expected to fix remaining phosphates (Martinick and Assoc, 1995).

With regard to nitrogen emanating from wastewater, the CER predicts that greater than 80% of nitrogen applied to soils from effluent water will be lost within 10m of lateral movement from the point of discharge (Martinick and Assoc, 1995). It is considered that the design of the septic tank leach drains could assist in reducing the amount of nitrogen that leaches to groundwater. The proposed septic tank systems utilise dual leach drains which will be alternated to provide maximum retention of phosphates by avoiding saturation of the soils in the vicinity of the leach drains. It will be the responsibility of the landowner to alternate the leach drains, although method by which the Shire will ensure that leach drains are alternated and working efficiently will be agreed upon by the Shire and the Department of Environmental Protection following subdivision but prior to any development application being approved. The Shire has stated that it will remind residents to alternate leach drains through rates notices and advertisements in the local paper.

There is some uncertainty in regards the sensitivity of subterranean fauna to increases in the levels of nutrients or other contaminants in the groundwater. Given that the CER did not present baseline information on the existing levels of nitrogen and phosphorus in the groundwater below the site, it could be difficult to determine in the future if the development results in increased levels of nutrients in groundwater.

The CER concluded that the proposed septic tank systems will have a very marginal impact on the phosphate concentrations of the underlying groundwater. It was predicted that an average household in the proposed development would result in approximately 5 kg of phosphorus being annually released from the septic tank to the underlying groundwater. For an average annual nitrogen load of 22 kg per household and a discharge length of 40 m about 550 g of nitrogen will be discharged annually per linear metre of leach drain, a considerable portion of which will be lost to the atmosphere within the initial 48 hours. It was predicted that the average nitrogen concentration in the surrounding cubic metre of groundwater could be 550 mg/L.

The proponents were requested by the EPA to provide additional information on the nutrient levels in the sewered and unsewered areas in and around Exmouth. The proponents commissioned the work which reported levels of nutrients and numbers of subterranean fauna found in the areas sampled (Martinick and Assoc, 1996). Although nitrogen levels were found

to be slightly higher in non-sewered areas of Exmouth than in areas which are sewered, it was not possible to draw any statistically valid conclusions from the report.

Within the CER there was a lack of information on the depth to groundwater and the transmissivity of soils.

Policy information

Four of the aquatic and two of the terrestrial species of subterranean fauna found in the Cape Range area are listed under Schedule 1 of the Wildlife and Conservation Act 1950.

The National Strategy for the Conservation of Australia's Biological Diversity is concerned with the maintenance of biodiversity (Commonwealth Department of the Environment, Sport and Territories, 1996). Western Australia is a signatory to the strategy.

The Cape Range karst and subterranean groundwater system is the only subterranean wetland currently listed in the Australian Nature Conservation Agency (ANCA) register of wetlands of national significance (ANCA, 1996b).

As discussed above, in recognition of the need for guidelines for management of karst systems, the EPA has requested the Department of Environmental Protection coordinate the preparation of a policy for developments in karst landscapes. The policy would assist the EPA in the assessment of development proposals in these regions, and provide environmental guidance for proponents of development proposals in these regions. The report may also provide guidance on suitable areas to be added to the conservation estate. In the absence of this specific policy, the proposal has been judged on its merits within existing policy framework.

Comments from key agencies / interest groups

Submissions indicated concern that subterranean fauna could be adversely affected by the proposal through the pollution of groundwater (refer summary of submissions, Appendix 2). It was considered that the use of septic tanks could result in leaching of nutrients to the groundwater and the marine environment.

The majority of submissions, including those from government agencies, questioned the suitability of the site for septic tanks for a number of reasons, including:

- the sensitivity of subterranean fauna to concentrations of nitrogen, phosphates and other pollutants is unknown;
- insufficient data to support the calculated phosphate retention index for soils of the site;
- the shallow depth to groundwater (suggested to be 2 m) would increase the risk of pollution of groundwater;
- the area is flood prone and could result in septic systems being under water;
- the lack of information on underlying geology of the North West Cape and the questioning of the CER's assumptions about dispersal and leaching of nutrients;
- the lack of evidence to support the proposed nutrient management strategies ie dual leach drains; and
- difficulties with the proposed management of leach drains.

Connection to reticulated sewer was considered by some submitters, including the Ministry for Planning, to be a method of wastewater disposal preferable to septic tanks. Connection to sewer would ensure groundwater and the marine environment are not polluted by nutrients from wastewater.

Submissions also raised the issue of pollution of groundwater through the use of fertilisers, herbicides and pesticides, and considered that the encouragement of residents to minimise the use of these would not be adequate.

Response from the proponents

The proponents' response to submissions is contained in Appendix 2. A summary is provided below.

The proponents' response states that the proposed septic tank system will not result in environmentally adverse impacts. This is due in part to the design of the septic tanks and dual leach drains (refer Appendix 4, Commitment 8) and the capacity of the soils to retain and assimilate nutrients. In addition, the cavernous nature of the karst formation below the soils would result in rapid drainage to the Exmouth Gulf, thus minimising the likelihood of large stagnant zones within the groundwater and associated impacts on subterranean fauna.

The proponents considered that the low density of the development makes connection to reticulated sewerage unviable.

The proponents have committed to the preparation of an environmental pamphlet which aims to stimulate greater environmental awareness and improved environmental management by future landowners of the proposed development (refer Appendix 4, Commitment 3). The pamphlets will discuss the environmental importance and sensitivity of Cape Range peninsula and suggest ways in which impacts on the environment can be reduced.

Commitment 14 states that within 12 months of subdivision approval the Shire will ensure planning mechanisms are in place to prohibit intensive agricultural activities on the site which require high fertiliser and / or high water usage. These mechanisms will be reviewed following the development of any policy regarding protection of stygofauna in the region.

In addition, the Shire of Exmouth has advised that it will seek representation on any committee or group which is formed to develop policies for the protection of subterranean fauna in the region.

Environmental Protection Authority Evaluation

The matters considered by the EPA include:

- the need to maintain biological diversity;
- the subterranean fauna of the Cape Range peninsula are considered to be amongst the most diverse in the world and have a high degree of endemism;
- the conservation value of the subterranean fauna, some of which are listed under Schedule 1 of the Wildlife and Conservation Act 1950;
- the uncertainty regarding the presence of the subterranean fauna below the site;
- the nature of the soils and geology of the site and the capacity to retain nutrients;
- the proposed management of the septic tanks and leach drains;
- the uncertainty regarding impacts on subterranean fauna should the septic tanks and leach drains not function as predicted;
- the proponents' commitments in regards management of septic tanks and leach drains and further agreement with the Department of Environmental Protection on the method to ensure leach drains are alternated and working efficiently;
- the proponents' commitments in regards the environmental education of the future residents and restrictions on land uses which require high fertiliser and / or water usage; and
- the level of representation of karst landforms and subterranean fauna in the region.

Taking these matters into account, the EPA concludes:

- appropriate management and operation of the septic tank systems are fundamental to avoid nutrients entering the groundwater and impacting on karst values and the subterranean fauna;

- given the nature of the soils on the site and the commitments by the proponents regarding the design, placement and operation of leach drains and the future agreement between the Shire and the Department of Environmental Protection on the method by which the Shire will ensure that leach drains are alternated and working efficiently, the EPA believes impacts can be managed so karst values are not compromised and ground water quality is maintained and subterranean fauna are not significantly affected; and
- the potential impact on the karst values from the development is modest in comparison to the extent of the existing karst landforms within Cape Range peninsula and within the Cape Range National Park and proposed extensions.

In addition, the EPA supports the Shire of Exmouth's commitment to be involved in committees established for the protection of subterranean fauna in the region.

4.2 Impacts on other flora, fauna and ecosystems and possible extensions to Cape Range National Park

Environmental Protection Authority Objective

To ensure that, where possible, impacts upon flora, fauna or ecosystems which are recognised as having significant conservation value are avoided, and, that a representative system of areas be set aside for conservation of flora and fauna.

Policy information

The EPA considers that there should be a representative system of areas set aside for conservation of flora and fauna that could otherwise be lost as a consequence of development.

The EPA's strategy on conservation relies largely on the Conservation Through Reserves study undertaken by the Conservation Through Reserves Committee, which has been endorsed by Government. This study divided the State into 12 regions or Systems and culminated in recommendations for the reservation of land for conservation and recreation purposes.

In 1975 the EPA published a series of recommendations for conservation reserves for System 9 - the Central West Coast, which includes the Exmouth area (EPA, 1975). It was recommended that the Cape Range National Park boundaries be extended (refer Figure 4) to include a portion of the coastal plain to the east of Cape Range and Exmouth Gulf coast in the National Park and proposed an extension up the west coast to the north of the existing reserve. These proposed extensions were rejected by Cabinet in 1981 on the basis of concerns by the local community and objection from the Department of Minerals and Energy on account of limestone resources in the area.

Increased recognition of the conservation significance of the subterranean fauna under the coastal plain has again raised the possibility of the extension of the National Park in this area. The Cape Range National Park Management Plan (CALM, 1987) prescribed the extension of the National Park to incorporate scenic areas and complete catchments of most watercourses and a physiographic unit in the Park which is highly fossiliferous and of considerable scientific importance. The extension prescribed by CALM in the Management Plan is shown in Figure 5.

Technical information

The vegetation type of the site is broadly represented on the coastal plain to the north and south of the site. The flora or terrestrial fauna is not recognised as having high conservation value.

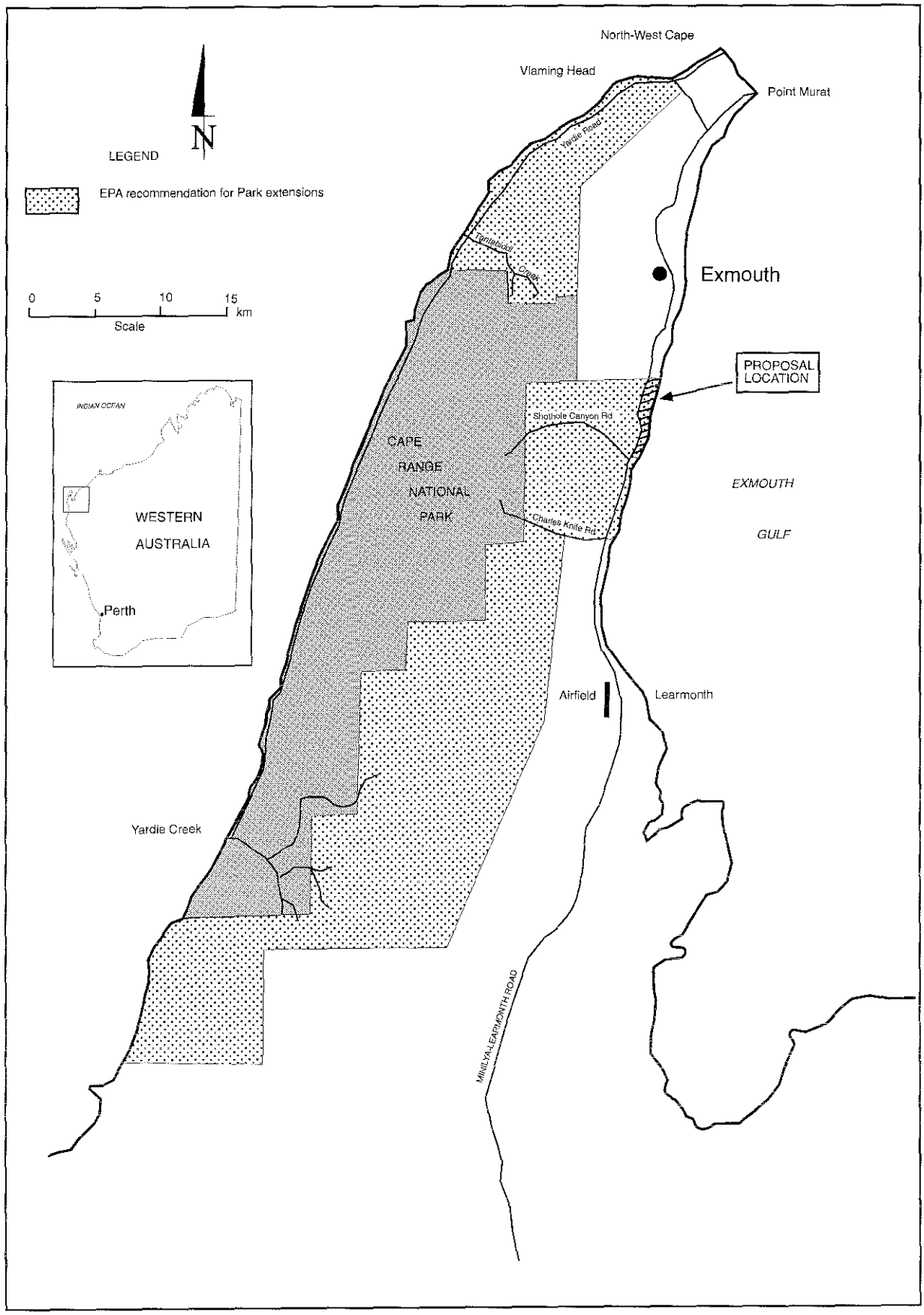

Figure 4. EPA recommendations for extensions to Cape Range National Park (1975).

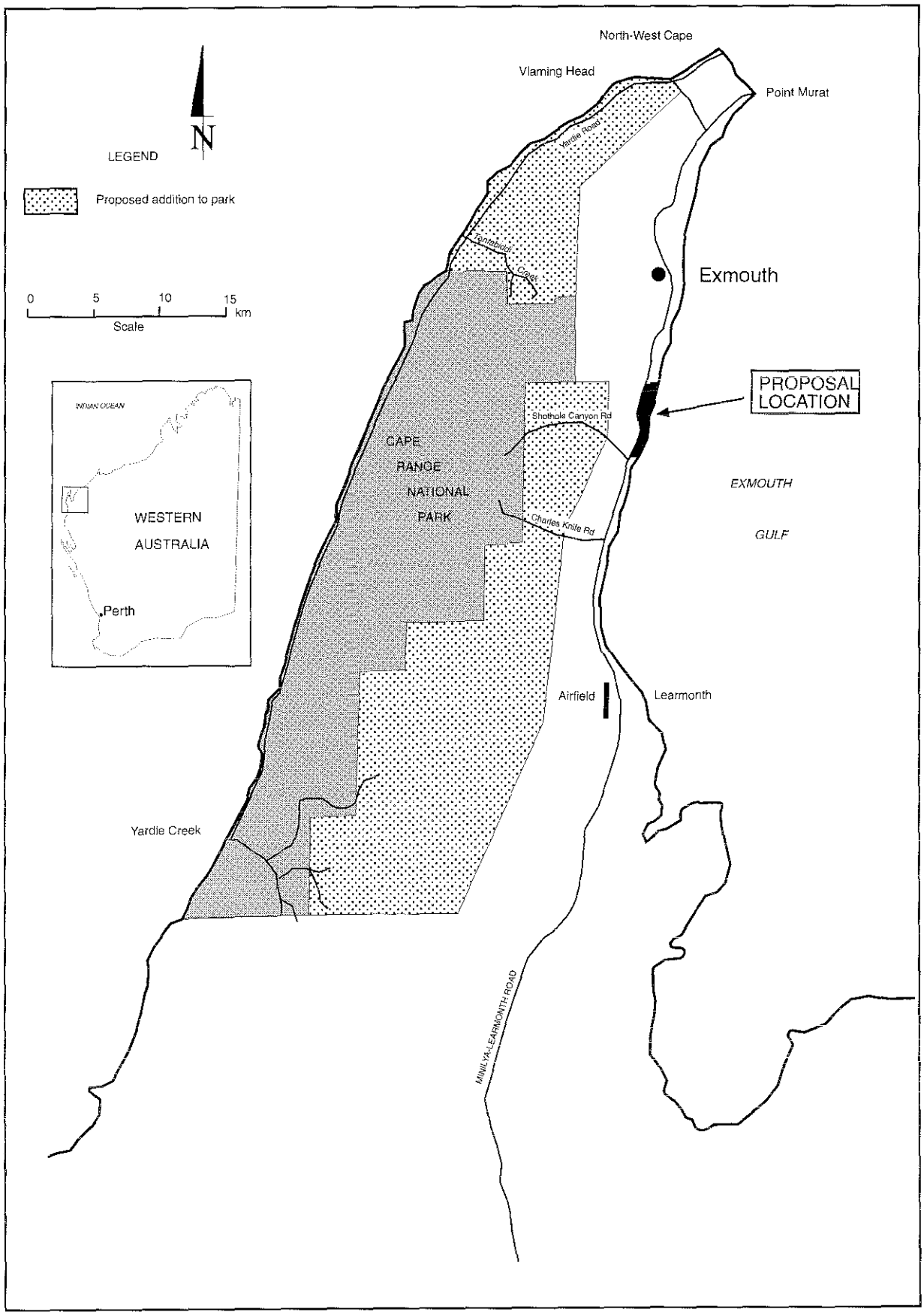

Figure 5. CALM prescription for extensions to Cape Range National Park (1987).

Comments from key agencies / interest groups

The full summary of submissions is provided in Appendix 2. Some points are highlighted below.

Submissions including those by the Department of Conservation and Land Management considered that there was no systematic survey of flora or fauna undertaken, and that it is possible that rare flora or fauna may be present on the site. It was also considered that the document did not consider the impacts of bringing pets into the area.

The Department of Conservation and Land Management made several submissions on the proposal but did not state that the flora or fauna was of high conservation value. It was, however, considered that the ecosystem type was different to that within the Cape Range National Park and there was merit in extending the park to include the contrasting ecosystems.

Another submission considered that the development of the land would reduce the possibility of proposed eastern extensions to the Cape Range National Park.

Response from the proponents

Responses to public and government agency submissions appear in Appendix 2.

The proponents responded to the statements that the flora and fauna surveys were inadequate by referring to the appendices of the CER which contained information on the vegetation survey and the body of the CER for the methodology employed.

The proponents considered that it is unlikely that the eastern extension to the coast, as proposed by the EPA in 1975, would occur. It was stated that the extension to the park will most likely terminate at the base of Cape Range. If the extension proposed by the Department of Conservation and Land Management in the management plan (CALM, 1987) was implemented, the new park boundary would lie approximately 4 km to the west of the proposed subdivision.

Environmental Protection Authority evaluation

The matters considered by the EPA include:

- the need for a representative system of areas set aside for conservation of flora and fauna; and
- the flora or fauna of the site are not considered by CALM to be of high conservation value, and are represented elsewhere on the Cape Range peninsula, although not within the National Park;
- the transfer of land ownership from the Crown to the proponents was reasonably progressed, which in essence reduced the likelihood of including any of the land within the proposed extensions to the National Park.
- although there has been a number of recommended extensions to the Cape Range National park, there has been no definitive proposal for an eastern extension;
- the availability of land outside this proposal which could be included in any eastern extension to the National Park.

Taking these matters into account, the EPA concludes:

- that whilst the flora, fauna and ecosystems are represented on the site, they are also represented in similar areas to the south of the site which are not subject to development pressure; and
- the proposed subdivision can meet the objective of avoiding impacts on flora, fauna or ecosystems which have significant conservation value because they can be protected in areas outside the proposed subdivision.

The EPA supports the concept of extending the National Park to provide a representative system of areas set aside for conservation, but considers that the site of the proposed subdivision need not be included in any extension.

4.3 Impacts on the marine environment

Environmental Protection Authority Objective

Protect the marine environment from elevated nutrient levels and other contaminants which exceed sustainable limits.

Policy information

As part of the System 9 recommendations, the EPA noted that the coastal region from Exmouth Gulf to Mary Anne Islands may provide a supply of nutrients to the adjacent marine ecosystem as well as being a nursery area for fisheries (EPA, 1975, Recommendation 9.8). This area includes that adjacent to the proposed subdivision.

The Report of the Marine Parks and Reserves Selection Working Group (CALM, 1994) recommended that the nearshore waters on the eastern and south western sides of Exmouth Gulf be considered for reservation for the protection of mangal habitat, prawn and fish nursery areas, turtle and dugong feeding areas, and coastal marine fauna and flora generally. In addition, it was suggested that the reservation of a small section of the coastline near Exmouth would adequately represent the western shore habitats.

These recommendations are within the Exmouth Gulf, but are not within the immediate vicinity of the proposal. They do, however emphasise the importance of the Exmouth Gulf for nature conservation and for sustaining local fisheries (CALM, 1994). The marine area adjacent to the proposal is not the subject of any recommendations, although it is reported to support diverse and abundant invertebrate fauna along sandy flats with rocky outcrops (CALM, 1994).

Comments from key agencies / interest groups

A number of submissions raised the issue of protection of the marine environment, particularly from impacts associated with disposal of domestic wastewater (refer Summary of Submissions, Appendix 2). It was considered that potential nutrient enrichment of Exmouth Gulf could result from the use of septic tanks, as has occurred elsewhere adjacent to the Cape. A submission by the Department of Conservation and Land Management questioned the statement, from the CER, that there is "very little likelihood of marine algal growth being encouraged locally by domestic effluent".

The CER described the soils on the site and provided data on the likely fate of nutrients from the site. Submissions from the Museum, the Water Corporation and members of the public raised concerns in relation to the types of soils, their suitability for use of septic tanks and the likelihood of pollution of groundwater and the marine environment (refer also Section 4.1).

Response from the proponents

The proponents' response to submissions is contained in Appendix 2. A number of points are discussed below.

As discussed in sections 4.1 and 4.2, the proponents consider that the design and proposed management of the septic tanks and leach drains will not result in significant environmental impacts. It was predicted that biological processes will assimilate much of the nitrogen and a proportion of the phosphorus will be retained by the soils, as indicated by the phosphate retention index. This prediction was supported by correspondence from the Coastal Information and Engineering Services which advised that none or very little of the nutrients is

likely to leach into the sea. In addition, tidal information was provided which showed that local tidal currents within the Exmouth Gulf result in considerable tidal exchange. This would reduce the likelihood of nutrient enrichment in the Gulf.

The proponent considered that comparison to the nutrient enrichment at Coral Bay is not founded due to the different type of development proposed and the method of sewage disposal. Coral Bay is a very dense development close to the coast that does not have adequate facilities to manage the septage waste which has lead to nutrient problems in the adjacent waters. The proposed subdivision is low density housing spread along 4.2 km of coastline with the majority of lots more than 100 m inland of the coastal dune, and will utilise septic tanks with extended dual leach drains.

Environmental Protection Authority Evaluation

The matters considered by the EPA include:

- the marine environment adjacent to the development is not recognised in any strategy documents as having significant conservation value, although the Exmouth Gulf is an important nursery area for some marine species, as well as a feeding area for turtles and dugongs;
- the Gulf is well flushed, the soils on the site have good phosphate retention capacity and the nitrogen is likely to be bio-assimilated;
- the proposed management of wastewater disposal systems, and the low density of the proposed development; and
- the proponents' commitments in regards environmental education of the future residents and restrictions on land uses which require high fertiliser and / or water usage.

Taking these matters into account, the EPA concludes:

- it is unlikely the development will result in elevated nutrient levels or levels of other contaminants in the marine environment which exceed sustainable limits.

4.4 Coastal management

Environmental Protection Authority Objective

The EPA's objective is to maintain the integrity, function and environmental values of the coastal environment.

Policy information

The Western Australian Planning Commission Policy No.DC6.1 provides a guide for setbacks for developments and subdivisions proposed along the coast. The policy states that setbacks of 100m from the permanent vegetation line are to be used as a guideline for setbacks along sandy beaches with variations according to the site's topography, geomorphology , climatic and oceanographic conditions. Under the policy a foreshore plan should be prepared and implemented by the proponents.

Comments from key agencies / interest groups

Amongst the submissions there was some opposition to development along this area of the Cape Range peninsula. It was felt that the development was too close to the dune system and could lead to uncontrolled access to the beach through the dunes, resulting in loss of vegetation and erosion problems. It was considered that these problems could be avoided through location of the development to the west of Murat Road or through consolidation of the existing townsite.

Impact on visual amenity of the area and recreational use of the beach was also raised in submissions including a submission by the Department of Conservation and Land Management.

A submission from the Ministry for Planning considered that further work was required to justify the proposed foreshore setbacks and placement of the reserve. Concerns were raised regarding placement of lots abutting the coast and problems associated with beach access. The need for a foreshore plan to meet the requirements of the Country Coastal Planning Policy was highlighted.

Response from the proponents

The proponents considered that the majority of issues pertaining to coastal management would be dealt with at the subdivision stage through conditions on subdivision. The proponents have committed to the preparation of a foreshore management plan to protect the coastal dunes and beaches which lie between the proposed development and the ocean. The foreshore management plan will be to the requirements of the Ministry for Planning.

The line of permanent vegetation approximately coincides with the seaward toe of the fore dune system. The setback distances from the beach were set to take the Country Coastal Planning Policy requirements into account. An additional 1 m of elevation above high water mark was allowed to take into account the line of permanent vegetation. In many cases the distance to the high water mark greatly exceeds 100 m.

The proponents considered that the development will not have major impacts on views of Exmouth Gulf because of the low density of housing which is proposed. Given that the present access to the beach via Pebble Beach Road will not be changed, the proponents considered that the development will not affect the recreational use of the beach.

Environmental Protection Authority Evaluation

The matters considered by the EPA include:

- the proponents' commitments to prepare and implement a foreshore management plan to the requirements of the Ministry for Planning; and
- the Ministry for Planning has expertise in coastal management and will require a foreshore management plan prior to development proceeding.

Taking these matters into account, the EPA concludes:

- coastal management can be adequately addressed in the design of the subdivision through the planning approvals process, as committed to by the proponents; and
- the proponents' commitments adequately address the EPA objective of maintaining the integrity, function and environmental values of the coastal environment.

5. Advice to the Minister for the Environment

The EPA has assessed the proposal by Greenough Holdings and the Shire of Exmouth to subdivide for special residential purposes Lyndon Locations 222 and 223 as described in the CER. In undertaking its assessment the EPA has reviewed the CER, submissions from the public and government agencies, the proponents' response to those submissions and any additional information which has been forwarded (as detailed in Section 4). The EPA's conclusions and recommendations, as required under Section 44(1) of the *Environmental Protection Act* 1986, are set out below.

ENVIRONMENTAL FACTOR	OBJECTIVE	PROPONENTS' COMMITMENTS	EPA CONCLUSIONS
Impacts on karst systems, in particular groundwater quality and associated subterranean fauna	To ensure that the recognised values of karst systems are adequately represented within the conservation estate. To ensure that where karst systems are outside of the conservation estate, land use activity is managed to maintain, as far as practicable, the recognised values.	Commitments regarding management of septic tanks and leach drains, education of future residents, and development of planning mechanisms to control land uses.	Appropriate management and operation of the septic tank systems are fundamental to avoid nutrients entering the groundwater and impacting on karst values and the subterranean fauna; Given the nature of the soils on the site and the commitments by the proponents regarding the design, placement and operation of leach drains and the future agreement between the Shire and the Department of Environmental Protection on the method by which the Shire will ensure that leach drains are alternated and working efficiently, the EPA believes impacts can be managed so karst values are not compromised and ground water quality is maintained and subterranean fauna are not significantly affected; and The potential impact on the karst values from the development is modest in comparison to the extent of the existing karst landforms within Cape Range peninsula and within the Cape Range National Park and proposed extensions.
Other flora, fauna and ecosystems	To ensure that, where possible, impacts upon flora, fauna or ecosystems which are recognised as having significant conservation value are avoided, and, that a representative system of areas be set aside for conservation of flora and fauna.	Provision of environmental pamphlets addressing minimisation of vegetation clearance, responsible pet ownership, management of septic tanks and leach drains and guidelines on stock ownership and management.	That whilst the flora, fauna and ecosystems are represented on the site, they are also represented in similar areas to the south of the site which are not subject to development pressure; and The proposed subdivision can meet the objective of avoiding impacts on flora, fauna or ecosystems which have significant conservation value because they can be protected in areas outside the proposed subdivision.
Impacts on the marine environment	Protect marine environment from elevated nutrient levels and other contaminants which exceed sustainable limits.	No commitments specifically on the marine environment. Commitments discussed in row 1 are relevant.	Unlikely that the development will result in elevated nutrient levels of levels of other contaminants in the marine environment which exceed sustainable limits.
Coastal Management	Maintain integrity, function and environmental values of the coastal environment.	Preparation of foreshore management plan to the requirements of the Ministry for Planning.	Coastal management can be adequately addressed in the design of the subdivision through the planning approvals process, as committed to by the proponents; and The proponents' commitments adequately address the EPA objective of maintaining the integrity, function and environmental values of the coastal environment.

Table 3. Summary of assessment of environmental factors relevant to the proposal

5.1 Environmental factors relevant to the proposal

The EPA identified the environmental factors relevant to the proposal as:

- impacts on karst systems, in particular groundwater quality and associated subterranean fauna;
- impacts on other flora, fauna and ecosystems and possible extensions to Cape Range National Park;
- impacts on the marine environment; and
- coastal management.

The overall conclusion of the EPA is that the proposal by the Shire of Exmouth and Greenough Holdings can be managed within the objectives established by the EPA.

5.2 Recommendations

The EPA recommends that the Minister for the Environment:

- notes the environmental factors relevant to the proposal as set out in Section 5.1;
- notes that the EPA has concluded that the proposal by the Shire of Exmouth and Greenough Holdings to develop for special residential purposes Lyndon locations 222 and 223 can be managed to meet the objectives established by the EPA, subject to the implementation of the commitments made by the proponents;
- notes that the EPA intends to develop a policy on development within the Exmouth - Cape Range area to assist in the management of the area and the assessment of development proposals;
- notes that the EPA supports the concept of an eastern extension to the National Park to provide a representative system of areas set aside for conservation.
- adopts the conditions set out in Section 6 of this report if the Minister determines that the proposal may be implemented.

5.3 Conditions and procedures to be applied if the proposal is to be implemented

The EPA submits that if the proposal is to be implemented the following conditions should apply:

- the general conditions and processes normally applied to the approval of those proposals which the Minister determines may be implemented under Part IV of the *Environmental Protection Act.*
- the proponents be required to fulfil the commitments as detailed in Appendix 4.

The EPA has set out the above conditions in detail in section 6 below.

6. Recommended environmental conditions

The Environmental Protection Authority considers that it could be necessary or desirable to make minor and non-substantial changes to the designs and specifications of the proposal that were examined as part of the EPA's assessment. Accordingly, the EPA considers that subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to significantly change the environmental factors.

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

Based on its assessment of this proposal and the recommendations in this report, the EPA considers that the following Recommended Environmental Conditions are appropriate.

1 Proponent Commitments

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

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to public submissions; provided that the commitments and environmental management measures are not inconsistent with the conditions or procedures contained in this statement. These commitments are included in Appendix 4 of this report).

2 Implementation

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

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

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

3 Proponent

These conditions legally apply to the nominated proponent.

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

4 Time Limit on Approval

The environmental approval for the proposal is limited.

4-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

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

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

5 Performance Review

5-1 Following development of the site the proponent shall carry out an annual audit of environmental performance. The proponent shall provide the audit report to the Department of Environmental Protection each year for the first five years of the operation.

5-2 Each five years following the commencement of construction, the proponent shall prepare a major review of the following:

1 environmental protection, including but not limited to consideration of the environmental objectives;

2 the audit of performance against the environmental objectives; and

3 the annual audits required by condition 5-1,

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Ministry for Planning, the Department of Transport and the Water and Rivers Commission.

These environmental objectives shall include but not be limited to those identified by the Environmental Protection Authority in the assessment report (Environmental Protection Authority Bulletin 829).

The environmental objectives may be changed by the Environmental Protection Authority following the review.

6 Compliance Auditing

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

6-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponents.

Procedure

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

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

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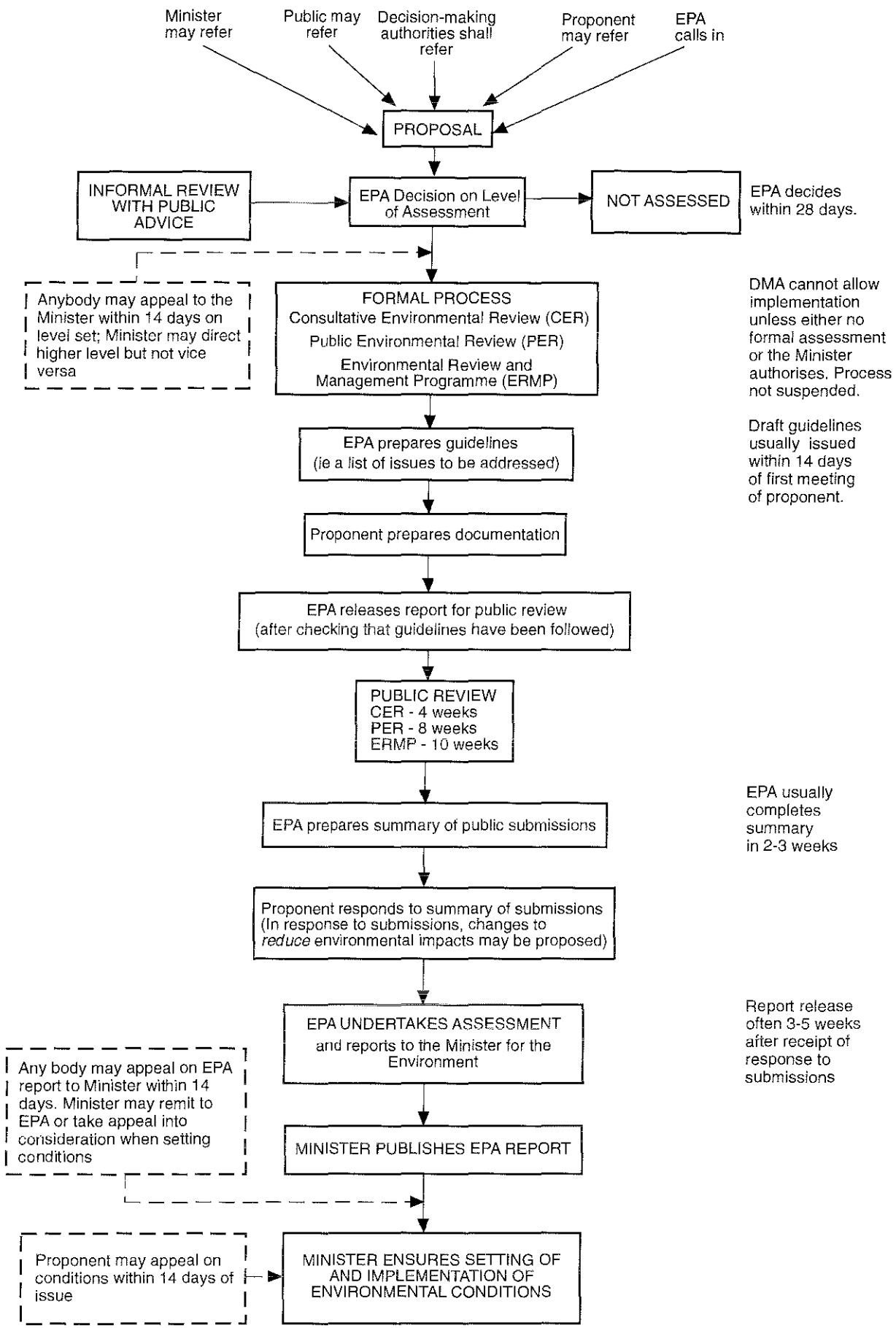
Appendix 1

Environmental Impact Assessment flow chart

EIA PROCESS FLOW CHART



Appendix 2

Summary of submissions, government agency submissions and proponent's response

SUMMARY OF SUBMISSIONS

BIOPHYSICAL

Potential impacts on subterranean fauna via the groundwater

All points raised in the Museum submission should be addressed.

Rigorous analysis of suitability of the site for septic tank usage is required because of the consequences of potential impacts of leachates upon the cave fauna and the vulnerability of the nearby marine environment.

The sensitivity of cave fauna to concentrations of nitrogen, phosphates, and other pollutants which would emanate from the development, is currently unknown. Given this uncertainty, the precautionary principle should be adopted.

Proposed fate of nutrients are based on assertion. There is no justification for the dilution figures for phosphates and poor justification for the rapid dispersal of nitrogen (refer Museum submission).

The 'rapid infiltration rates' of water seem contradictory to the presence of the 'underlying calcrete', as quoted in the CER. No data is provided on water infiltration rates into calcrete which lies either superficially or at depth.

Citing WAWA borefield chemical data is irrelevant to the area. Actual nitrogen levels in the groundwater on the coastal plain are on average 3.5 times greater than those from WAWA borefield data, and locally an order of magnitude higher. Phosphate levels similarly are twice as high on the coastal plain and also locally vary by an order of magnitude (refer Museum submission).

The proponent should establish protocols for any caverns that may be exposed during construction works (refer Museum submission).

More research should be undertaken on the presence of caves and herpetofauna fauna of the area prior to allowing development to proceed.

Other fauna, flora and ecosystems

The development of this land has the potential to cause significant pollution and impacts on the marine environment. This issue has barely been addressed within the CER.

If the proposal utilises septic tanks, there should be comprehensive monitoring of the groundwater to detect any changes in nutrient levels and chemical and bacteriological contamination well before it impacts on the marine environment.

It appears there was no systematic survey of flora or fauna undertaken. It is, therefore, that rare flora or fauna may be present on site. The presence of these species can only be determined through systematic survey.

The document does not adequately address the potential for impacts resulting from pets being brought into area. It is questionable whether improving public awareness of the potential for environmental impacts will have any significant mitigating effect. If the proposal is given approval then specific by-laws should be established to address management of domestic animals and other environmental issues.

Due to the potential for impacts on groundwater and the marine environment, septic tanks are inappropriate for area.

It is possible that marine algal growth will be encouraged locally by domestic effluent. The document states that it is unlikely that this would occur, but at the same time does not provide sufficient data to determine if adequate flushing exists at a local level. It should be noted that effluent from septic discharges have caused recognisable changes elsewhere on the Cape with similar or greater macro level tidal flows. Refer also to Department of Environmental Protection Technical Series 80 - Survey of Water Quality, groundwater, sediments and benthic habitats at Coral Bay, Ningaloo Reef, Western Australia.

Extensions to the Cape Range National Park

The development of the land would reduce the possibility of proposed extensions to the Cape Range National Park, as proposed in the Cape Range National Park Management Plan. The aim of the extension is to provide another representative ecosystem and habitat type within the local conservation estate, and it has been suggested that a corridor extending to the shoreline of the Exmouth Gulf would be appropriate.

Marine Park

The marine area adjacent to the development has particular conservation value and has been recommended to become a marine reserve in the draft report on 'A Representative Marine Reserve System for Western Australia". This highlights the importance of protecting the area from impacts that may arise from the development.

Coastal Management

The need to locate development so close to the dune system is questioned. This area of the coast is well utilised for recreational purposes, as well as providing views of the Exmouth Gulf from Murat Road. The developments should be sited away from the fragile dune system, and west of Murat Road.

There is no road along the eastern edge of the subdivision, and so a large number of the lots back onto the coastal reserve. This could lead to uncontrolled access to the beach areas through the dunes, leading to loss of vegetation and erosion problems.

Property boundaries should be kept off the back dunal areas so as not to create vegetation degradation and the need for dune rehabilitation. Some of the lots would require further setbacks from the dunal areas.

The Western Australian Planning Commission's Country Coastal Planning Policy determines that set backs of 100 metres from the permanent vegetation line are to be used as a guideline for setbacks along sandy beaches, with variations according to the site's topography, geomorphology, climatic and oceanographic conditions. The position of the permanent vegetation line is not marked on the plan. Further work to justify the foreshore setbacks would be appropriate.

Under the Western Australian Planning Commission's Country Coastal Planning Policy a foreshore plan should be prepared and implemented by the proponents. Such a plan should be provided prior to the release of lots for sale.

The presence of halophytic vegetation in Landscape Unit D represents a major limitation to development because:

- the watering of surfaces may increase surface and near surface salinities and induce potential soil erosion;
- it will be difficult to establish vegetation other than halophytic species and therefore any vegetation planted in the vicinity of leach drains in this landscape unit will need to be carefully selected to suit these conditions; and
- destruction of any existing vegetation in this area could lead to soil erosion. This raises the question as to whether the site is suitable for development.

The CER document states that "coastal studies indicate that the moderate tidal range and currents will ensure mixing of in-shore waters and that the very small outflow of nitrogen will not result in an accumulation of nitrogen in the in-shore waters adjacent to the study area. No reference or indication of which studies are being referred to is given. More information would be necessary to justify these statements.

Flood risk / storm surge

This area of the coast is prone to cyclones and flooding. In these events there is potential for the subject land to be inundated in some areas, particularly around the creeks and close to the dunes. Although the document states that proposed developments are "well back" from areas of potential flooding, no figures are provided to substantiate the claim (refer CALM submission).

Some areas are flood prone. It is acknowledged that larger lot sizes are allocated around the creeks which are most susceptible to flooding, but it is considered that the use of building or development envelopes would ensure that potential loss of property in these areas is minimised.

The validity of calculations on storm surge probabilities is questioned. The calculations consider 4 months of cyclone season, but in fact there is 6 months, from November to April. The likelihood of storm surge is greater than the document suggests.

Weed management

The proponent has assumed that Buffel Grass is not a weed because it has now become naturalised. Conventional thinking in most conservation land management and environmental protection agencies throughout Australia, would categorise this species as a major environmental weed (refer CALM submission).

Weeds such as buffel grass will be favoured by site disturbance and could impact outside the proposed development area. A weed management plan should be prepared.

Water Supply

The document states that the Water Authority will not permit the use of private bores within the proposed development. The Water Authority has advised that this statement is not correct and that the issue needs to be addressed in consultation with the Water Authority (refer Water Authority submission).

Fire

Fire hazard should be given some consideration. Fire management initiatives would be required to the satisfaction of the Bush Fires Board.

POLLUTION

All points raised in the Water Authority submission should be addressed.

Management of contaminants from septic tanks

The document provides insufficient data to support PRI claims. The document suggests that the soils are moderate to strongly phosphate fixing, but the data does not justify this suggestion.

The area is unsuitable for septic systems because;

- the depth to groundwater is too shallow - shallower than suggested in the CER (predicted about 2 metres below ground level);
- the soil allows water to drain through very quickly, so effluent from leach drains would go straight into the natural water table then into the gulf; and
- the area is flood prone and could result in septics systems being underwater.

The groundwater is closer to the surface than the document suggests. Shallow depth to groundwater means it would be very easy to pollute the water through leach drains, fertilisers, herbicides and pesticides. It would be impossible to impose restraints on the use of any of these normal household chemicals on such a development. The encouragement of residents to minimise use of fertilisers, pesticides and herbicides would not be sufficient to minimise pollution.

Although little is known about the underlying geology of the North West Cape, it is known that there is a high degree of connectivity between marine system and groundwater. Tidal movements have been detected several kilometres inland. On this basis alone, the CER's assumptions about dispersal and leaching of nutrients must be questioned.

The proposal of dual leach drains has merit, and could be effective. The switching of the leach drains would be the responsibility of the residents and even though the Shire would remind residents to switch, no obligation is suggested. As it will probably take a number of years for nutrient build-up, it is important that the Shire take on long term responsibility for reminding residents to switch the drains. The management of the dual leach drains would be difficult to police.

There is a lack of technical evidence to support the proposed nutrient management strategies, such as dual leach drains.

The CER does not adequately address the management of nutrients and other pollutants such as hydrocarbons and pesticides that will inevitably be in any stormwater run-off. The proposal should include design criteria which will ensure minimal hard surfaces and drainage into retention areas to minimise the impacts of run-off.

Alternative options for wastewater disposal should be considered as the site is not suitable for septic tanks and leach drains. Connection to Exmouth town's reticulated sewerage system or a small local treatment plant should occur. If the subdivision proceeds without this provision, a requirement of the subdivision should be that infrastructure be provided for later connection to such a system.

The planting of deep rooted shrubs or trees on top of, or immediately adjacent to, leach drains is not supported. It is commonly known that roots will grow into, and block, leach drains and septic tanks. If vegetation is to be planted in the vicinity it should be shallow rooted such that the roots will not affect the operation of the leach drains and septic tanks.

Noise from limestone carrying trucks

The road to Exmouth will be heavily trafficked if the limestone project is approved. The CER makes no mention of this and the potential impacts on future residents.

Alternatives

Alternative options for wastewater disposal should be considered. The method of disposal should be in accordance with the sensitivity of the environment.

SOCIAL SURROUNDS

Planning Context

How can development such as this be considered within the Cape Range peninsula and Exmouth Gulf without adequate studies having been commenced or completed as how to best use the land and resources?

The development should await outcomes of Town Planning Scheme No 3. Any development on the Cape should be considered on a strategic basis and should be consistent with strategic documents such as the Town Planning Scheme and Structure Plans.

The proponent should explain why they are not developing north of the town around the existing subdivision or immediately south of the town. The development of the land would consolidate the existing town site and would make more sense than developing 10 km to the south.

The CER does not indicate what services will be provided for the new residential area. The distance to the town makes the provision of services particularly important. The provision of reticulated sewerage is recommended.

The development is inappropriately sited as it impacts on popular public recreation space and the view of the Exmouth Gulf.

No development should be considered until the results from the Marine Pollution Inquiry are obtained.

Aboriginal Heritage

The document is not thorough in its treatment of Aboriginal heritage issues. It is possible that aboriginal rockshelters exist in limestone caves in the area.

Boat launching facilities

No provision is made for boat launching facilities. In an area where boat ownership and usage is high, the provision for boat launching facilities would be an important step in coastal management and the minimisation of coastal impacts.

OTHER

Garbage

The CER does not address the capacity of existing garbage disposal facilities to cope with extra garbage generated by development. If the development proceeds it would be essential that the Shire initiate a recycling programme to reduce the need for landfill.

Western Australian museum

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17

Biogeography, Ecology and Biospeleology
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6/11/95

Attention: Ms Karen Sanders
Environmental Protection Authority
Westralia Square
141 St George's Terrace
Perth
WA 6000

Dear Ms Sanders,

Exmouth: Lyndon Locations 222 and 223—comments

I address some comments to this proposal which need to be addressed.

This report inadequately deals with potential contamination of the groundwater on several fronts.

1. The proposed chemical fate of N and P are based on assertion.

2. No data are presented on groundwater movement — the piezometric surface needs to be established in the project area and measurement made of groundwater movement.

3. Groundwater chemistry is inappropriately based on WAWA borefield data.

4. Groundwater monitoring should be established

5. A protocol needs to be established for dealing with any caverns opened up during site and subsequent development.

My best wishes

Dr W.F. Humphreys
Senior Curator

091150

Exmouth: Lyndon Locations 222 and 223—comments

The report claims that "groundwater ... discharges largely as sub-sea springs" (p. iii). Such springs (known to karstologists as vruljas) frequently occur at depth and can be expected to occur at depth owing to cavern formation during glacial minimum sea levels. Hence, although the rate of groundwater flow may average in the order of hundreds of meters per year (presumably in reference to the WAWA borefield), it is most probably channelled through areas of lower resistance such as in open conduits widely reported for this area. Furthermore, it will probably not discharge from close to the piezometric surface but at depth. In consequence, as is characteristic of karst areas, stagnant zone in the water will not flush contaminants to sea and the residence time may be very long.

No evidence, e.g. from piezometric surveys, is presented to show the water level or evidence presented of water movement through this coastal system. p. 17. This poorly justified movement of the groundwater to the sea is then used to justify that the nitrogen "will be rapidly dispersed because of the high rate of groundwater movement to the sea" (p.v). No evidence of groundwater flow of any sort is provided to justify the dilution figures for phosphates p 15.

The "rapid infiltration rates" of water (p. v) seems contradictory to the presence of the "underlying calcrete" (p. v). Appendix 2 provides no data on water infiltration rates into calcrete which lies either superficially or at depth.

p. 14. Citing WAWA borefield chemical data is irrelevant to the area. Actual nitrogen level in the groundwater on the coastal plain are on average 3.5 fold greater than those from WAWA borefield data, and locally an order of magnitude higher. Phosphate levels similarly are twice as high on the coastal plain and also locally vary by an order of magnitude.

I find the arguments presented as to the fate of N and P unconvincing (they are not referenced), and in some places seemingly obfuscating (e.g. what is the relevance of the statement of inputs of N into streams p. 17).

What is the relevance of the PRI in terms of throughput in the long term — does the local soil become saturate and thus does the PRI change with time?

16-17. Citing figures relating to nitrogen loss within 10 m of lateral movement through the soil is not relevant as most of the soil is <2 m deep and the groundwater is everywhere within 5 m of the soil surface and as close as 2 m.

Groundwater monitoring

The adjacent Mowbowra Creek catchment contains 2 of 11 known sites for the Cave Eel, *Ophisternon candidum*, and 4 of 18 sites for the Blind Gudgeon — both are protected species.

The project lies to the coast of two other projects likely to need groundwater monitoring (WAWA borefield and the land release). How is any impact of each going top be assessed if they do not all have their own up and downstream monitoring?

It would seem appropriate that the proponents establish a monitoring scheme for water quality and a base line stygofauna survey. This should detail the monitoring proposed [e.g. how frequently, what will be monitored and why, what criteria (thresholds) will be used to determine the outcome, who will audit the results, what action will be taken, etc.]

Caverns

Coastal caves are known to contain the only known examples of terrestrial obligate cave fauna. No protocol is established for dealing with the presence of caverns during the site development (a cave containing rare fauna was once opened up by a bulldozer on the coastal plain near Exmouth). A protocol needs to be established as to what action will be taken if caverns are opened up during site development or building operations. The significance of the find needs to be determined by an experienced speleologist and then, if necessary, action taken to minimise further impact or else to salvage irreplaceable information within an established time frame to allow mining to proceed. The caverns should also be surveyed for specialised cave fauna by a suitably experienced biospeleologist. The protocol needs to address: how large a hole should be reported, to whom will the find be reported, how much time will be allowed for a site survey, to whom will the report be made, how much time will be allowed for a salvage operation, etc.

P.O. Box 100
Leederville,W.A. 6007

FACSIMILE MESSAGE

From: **The Pollution Control Section**
Water Quality Protection Branch
Water Authority of W.A.

Fax: (09) 420 3176 (278 0301 as of 18/12/95)

To: Ms Karen Sanders

Of: Department of Environmental Protection

Fax No:

Copies To: Mr K Griffin, Water Resources Officer - Mid West

Subject: Consultative Environmental Review
Proposed Special Residential Development, Exmouth:
Lyndon Locations 222 & 223

Our File: **Your File:**

The proposal is for the development of a special residential area at Lyndon Locations 222 and 223, approximately 10km to the south of the town of Exmouth on the Cape Range Peninsula. The subdivision consists of 158 hectares of gently undulating to flat terrain immediately inland of the coastal dunes along the western shoreline of the Gulf of Exmouth.

The proponent, the Shire of Exmouth, is developing the land in a joint venture with Greenough Holdings Pty Ltd with the intent to provide additional housing to meet the housing needs for employees of the proposed limestone mining project.

The Water Authority has reviewed the CER proposal and has the following comments to offer in relation to:

- Disposal of Sewage using septic tank/double leach drain system
- water supply

Disposal of Sewage using septic tank/double leach drain system

- It is unclear how the proponent proposes to minimise the infiltration rate of stormwater at site 4 (fig 2), near septic tank, which is one of the lower lying soil inspection sites (p14, s 5.3.1.1).

Are there drainage management strategies to divert stormwater infiltration at these vulnerable sites (ie sites potentially susceptible to soakage near septic tank area?)

- Proponent indicates that *"the PRIs of the soils of the Study Area confirm that most of the phosphates in effluent water will be readily fixed within the soils of the Study Area. Phosphates are expected to be further fixed by the calcium ions of the limestone and lime sands which underlie the soils of the Study Area."* (p14, s5.3.2.1). There is insufficient data provided to support this claim.

On what data does the proponent base this argument/theory ? (p14, s 5.3.2.1).

- The efficiency of phosphate retention in soil through soil adsorption depends on a number of variables including soil matrix (ie composition of soil), particle size and retention time of permeate in soil (or infiltration rate).

The proponent states that "the water infiltration rates of the soils of the Sandy Area" are such *"that water will infiltrate rapidly into all of the horizons of these soils"* (p14, s5.3.1.2 b).

Has the proponent determined the optimum infiltration rate of septic tank leachate through the soil in order to obtain maximum removal of phosphates ?

- The proponent states that *"domestic effluent contains phosphorus, almost exclusively as phosphates, and nitrogen, mainly as nitrates and nitrites"* (p14, s5.3.2). The proponent has failed to recognise that nitrogen is predominantly present as ammonium-nitrogen under septic conditions which is predominantly anaerobic. The ammonium-nitrogen however may be converted to nitrate and nitrite. Groundwater monitoring in the vicinity of septic tanks/leach drain residential sites has shown that ammonium-nitrogen is also a contaminant?

- para 2 on p15 s5.3.2.1 a) is poorly written particularly the sentence *"Importantly, the leaching rate of the phosphorus .....distance from the source"* is unclear.

- The proponent has failed to recognise the management of pesticides and herbicides that invariably exist in domestic developments. The presence of organic chemicals in septic tanks is well known, and yet the proponent has not even identified the issue.

- The proponent has failed to address the issue of potential threat of groundwater supplies from bacterial contamination ie E coli present in septic wastes

- The proponent has not provided any alternate options of wastewater treatment or disposal. Can domestic wastewater be managed through disposal to a sewerage system?

In general the document does not adequately identify and quantify the impact of nutrients on groundwater, and although it provides practical solutions to the management of nutrients in leachate particularly in relation to its removal from the leachate, there is no technical evidence supporting its treatment strategies

Water Supply

Section 6 "Consultation with Government Departments and Community Organisations" (p26) does not list the Water Authority as an organisation that was consulted, yet the CER states that "the Water Authority will not permit the use of private bores within the proposed development" (p13, s5.3).

This statement is not correct and the issue needs to be addressed in consultation with the Water Authority.

Sent By: Raymond P Claudius
Senior Scientific Officer
Pollution Control

Phone: (09) 420 2133

Pages sent:

Date: 15 December 1995

Time: 9.05 am

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Please note: The present Water Authority of W.A. will cease to exist from Dec. 31 1995. The Authority will be replaced by 3 new agencies providing water related services. Most of the functions now conducted by the Authority's Water Resources directorate, the Waterways Commission & the Mines Dept's Geological Survey will be then undertaken by a newly established **Water Resources Commission**. During the period July -Dec. 1995 most of the structures & operational arrangements will be put into place to allow the new **Commission** to be fully functional by Jan. 1 1996.

(12)

Ministry for Planning
WESTERN AUSTRALIA

Our ref: 98066
Contact Officer: Barbara Pedersen

Department of Environmental Protection
Westralia Square
141 St George's Terrace
PERTH WA 6000

Attention: Ms Karen Sanders

Dear Ms Sanders,

RE: CONSULTATIVE ENVIRONMENTAL REVIEW:
PROPOSED SPECIAL RESIDENTIAL DEVELOPMENT, EXMOUTH:
LYNDON LOCATIONS 222 AND 223.

The special residential development proposed for this site is difficult to assess because the subdivision plan which was provided does not provide the level of detail required for assessment. A number of details of the proposal are therefore unclear.

Given the above, concerns of this Branch relate to facets of the proposal which are summarised below. The greatest problems relate to the foreshore reserve and the use of septic tanks. Other concerns relate to the impact of residential development on the existing flora, the placement of some lots in relation to flood prone areas or back dunes, and the types of controls which will be placed on the residential development at the subdivision stage.

1. Foreshore reserve: The precise placement of the reserve is not clear, although the Executive Summary at the beginning of the report states that "All of the precincts have a minimum setback distance of 100m from the high water mark". The Western Australian Planning Commission Policy No. DC 6.1 (the Country Coastal Planning Policy) determines that set backs of one hundred metres from the permanent vegetation line are to be used as a guideline for setbacks along sandy beaches, with variations according to the site's topography, geomorphology, climatic and oceanographic conditions. The position of the permanent vegetation line is not marked on the plan. Further work to justify the foreshore setbacks would be appropriate.

No foreshore management plan is presented for the coastal foreshore. Under the Country Coastal Planning Policy No. DC 6.1, Section 4.1.1, a foreshore plan should be prepared and implemented by the proponents. Such a plan should be provided prior to the release of lots for sale.

Public access is to be provided via Pebble Beach Road and along the creek lines. No

093455

ALBERT FACEY HOUSE
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associated car parking facilities are depicted. The lack of a road along the western edge of the subdivision introduces additional access problems where lots abut the coastal reserve. This issue has not been adequately addressed. Additionally, access to the foreshore or to creek lines is provided at a number of points through apparent Right of Ways (ROW's) between lots. These provide additional access to the coastal foreshore and may result in localised dune erosion with subsequent management problems.

2. The use of septic tanks: The use of duel leach drains and the planting of vegetation in association with the drain fields is supported.

However, description of the Phosphate Retention Indexes (PRI's) of the soils is misleading in stating that the soils are strongly fixing. Appendix 2 provides a table showing the results of soil testing indicates that of the 19 sites described, 8 samples were not analysed for their PRI, 5 returned moderate fixing levels, and the remaining 6 were at the lower end of the strongly fixing range. It is curious that the results of nine sampling sites are presented, but those from the other 11 sites are omitted.

From the results which are presented, it appears that soils in Landscape Unit A vary in PRI from moderately to relatively strongly fixing, whilst single samples from Landscape units B, C and D returned relatively strongly fixing PRI's. Unit F's single result showed moderate PRI. Samples 15 and 18 are in areas where the Landscape Units are not defined. Two sites are depicted as being sample site 15.

Depth to ground water is provided for a single site. Depth to groundwater is crucial information in determining the suitability of this area for the use of septic tanks.

Therefore, given the paucity of data on the conditions over the entire area proposed for residential development, statements regarding the suitability of this area for septic tank usage are questioned. Further and more rigorous analysis is required because of the vulnerability of the nearby marine environment and the consequences of potential impacts of leachates upon the cave fauna and the local vegetation communities.

Given these concerns and comments in the both the Exmouth Coastal Strategy (1992) and the Gascoyne Coast Regional Strategy (1994) regarding the constraints imposed by the karst landscape of the Cape Range Peninsula and the need for developments to take advantage of existing infrastructure, connection to either the town's reticulated sewerage system or a small local treatment plant is preferred. As a last resort, if the subdivision proceeds without such a provision, a requirement of the subdivision should be that infrastructure be provided for later connection to such a system.

3. Bush fire protection: Although the vegetation is of low fuel status, fire hazard should be given some consideration. The placement of lots abutting both the coastal reserve and crown reserve 32946 will require fire management initiatives in the form of fire breaks either through the lots or the reserves. Details of these fire evaluation and mitigation strategies can be prepared to the satisfaction of the Bush Fires Board and the Shire at the subdivision stage.

4. Degradation of the existing flora: The proposed lots range in size from 4000m^2 to over 3ha with no determination of how many dwellings are permitted per lot, and no

constraints on how much of each lot may be cleared and developed. This may result in extensive degradation of the flora if extensive residential development occurs in the form of access roads, sheds, boat and car parking areas, informal tracks and refuse disposal areas. Such degradation is likely to result in soil erosion and blowing sand.

The presence of halophytic vegetation in Landscape Unit D represents a major limitation to development because:

A. the watering of surfaces may increase surface and near surface salinities and induce potential soil erosion;

B. it will be difficult to establish vegetation other than halophytic species, and therefore any vegetation planted in the vicinity of leach drains in this landscape unit will need to be carefully selected to suit these conditions, and

C. destruction of any existing vegetation in this area could lead to soil erosion.

Disturbances relating to housing development are likely to favour weed invasion over the existing flora. A weed management plan may assist, particularly given the presence of Buffel Grass (which some would classify as a major environmental weed).

5. Placement of lots in relation to flood prone areas and back dunes: Substantial portions of one lot in Precinct A, Landscape Unit D, are depicted as being flood prone, and three other lots in this area have significant areas similarly affected. The use of building or development envelopes would ensure that potential loss of property in these areas is minimised. Access to these lots or to the foreshore may be restricted during flash flood events in the cyclone season.

Three lots in Precinct A, Landscape Unit C appear to include some of the back dunal areas. Uncontrolled access through these dunes may create vegetation degradation and lead to the need for dune rehabilitation. It is preferable that property boundaries be kept off these back dunes.

6. Water supply: Arrangements for the provision of water supplies to the subdivision are noted. These arrangements conform with the service requirements for special residential zones under the Western Australian Planning Commission's Policy No. DC 2.5.

The use of water sensitive design in road construction is laudable. Replanting of local flora along swales adjacent to roads will also aid fire management by maintaining low fuel zones.

A number of special provisions may be appropriately required at the subdivision stage. These requirements include: the determination of building envelopes on each lot, which specify suitable sites on each lot so as to avoid degradation of sensitive flora (such as halophytic communities), flood prone areas, areas of high visibility, areas prone to excessive noise (from either the nearby light aircraft facility or from Murat Road itself, which is expected to carry greater truck traffic as a consequence of limestone mining

operations), and to prevent excessive sprawling use of the lots with subsequent degradation of vegetation and soil erosion. Development envelopes should include the siting of leach drains. Restrictions on the number of dwellings should be provided.

Please contact this office if you have any queries or require further information regarding this matter.

Yours faithfully,

DAVID NUNN
MANAGER
ENVIRONMENTAL PLANNING BRANCH

5TH JANUARY, 1996

C:/vhc/plamsys/pederseb/document/EXMOUTH

Proponent Response to Submissions

The paragraph numbers below correspond to the headings or paragraph numbers in the written submissions.

1.0 WA Museum, Dr W Humphreys

Dr Humphreys provided an earlier submission which is reproduced in Appendix 6 of the CER. These questions were addressed in the final draft of the CER and also on page 26 of the CER. The second submission by Dr Humphreys (below) deals with the same issues relating to cave fauna.

1.1 The report claims that "groundwater ... discharges largely as sub-sea springs" (piii). Such springs (known to karstologists as vruljas) frequently occur at depth and can be expected to occur at depth owing to cavern formation during glacial minimum sea levels. Hence, although the rate of groundwater flow may average in the order of hundreds of metres per year (presumably in reference to the WAWA borefield), it is most probably channelled through areas of lower resistance such as in open conduits widely reported for this area. Furthermore, it will probably not discharge from close to the piezometric surface but a depth. In consequence, as is characteristic of karst areas, stagnant zone in the water will not flush contaminants to sea and the residence time may be very long.

Reply: As stated on page 14 of the CER, the groundwater gradients of the Cape Range are steep, resulting in groundwater to flow rapidly from the Ranges to beneath the coastal plain into the sea. According to information provided by Geological Services of Western Australia, this flow rate is thought to be of the order of hundreds of metres per annum.

The soils of the region are loamy sands and they have a high transmissivity. This and the high groundwater gradient are responsible for the high rate of flow of all of the groundwater and the likely absence of large stagnant zones within the surface horizon of the groundwater. In addition, small tunnels in the karst formations are likely to result in localised groundwater drainage to the sea at an even faster rate.

The concerns expressed in the submission are for the animals which live in cavern systems and not for soils where cave animals do not dwell. Any water from leach drains which enters cavern systems will be rapidly removed to the sea (as stated in the submission above). If water from leach drains moves at a slower rate through the soil it is unlikely to cause harm to cave species because cave animals do not live in the soil.

1.2 No evidence, e.g. from piezometric surveys, is presented to show the water level or evidence presented of water movement through this coastal system. (p.17). This poorly justified movement of the groundwater to the sea is then used to justify that the nitrogen "will be rapidly dispersed because of the high rate of groundwater movement to the sea" (p.v). No evidence of groundwater flow of any sort is provided to justify the dilution figures for phosphates p 15.

Reply: Extensive regional studies by Geological Surveys of Western Australia and the Water Authority of Western Australia were reviewed and experts were consulted on the basis of their local groundwater knowledge. The CER quoted the review by Allen (1993), reproduced figures (See Figure 4) from the review. Mr Martin, an expert with local knowledge within the Hydrology Section of the Department of the Department of Minerals and Energy, was also consulted (see page 14).

In view of the comprehensive regional groundwater data, and the uniformity of terrain and soil types within the study area and the adjoining areas, the conclusions of the regional studies were considered to also apply to the Study Area. Site specific hydrological studies were thus not considered to be essential.

1.3 The "rapid infiltration rates" of water (p.v) seems contradictory to the presence of the "underlying calcrete" (p.v). Appendix 2 provides no data on water infiltration rates into calcrete which lies either superficially or at depth.

CRN 94285/MG

Reply: The statement in the CER refers to the ability of the *soil* to accept effluent water. Paragraph 4 of page V provides information which confirms that the soils in which leach drains are to be installed meet the requirements of the Department of Health with respect to water infiltration rates.

1.4 p 14. Citing the WAWA borefield chemical data is irrelevant to the area. Actual nitrogen level in the groundwater on the coastal plain are on average 3.5 fold greater than those from the WAWA borefield data, and locally an order of magnitude higher. Phosphate levels similarly are twice as high on the coastal plain and also locally vary by an order of magnitude.

Reply: Regional data derived from a very large data base of the Water Authority and collected for a substantial number of bores in the locality which supply the Exmouth Townsite, was used as the source of information. These bores are located on the coastal plain inland from the coast and lie between the Study Area, the Exmouth Townsite and the Cape Ranges. We are not aware of the data to which Dr Humphreys is referring.

The information in the submission strengthens the argument relevant to groundwater impacts which is given in s. 5.3.2.1. According to the submission the nitrogen concentrations on the edge of the coastal plain could be as high as 7.5mg/L. Consequently the presence of nitrogen and phosphorus (according to the submission) could be an existing state of the environment suggesting that fauna which may occupy habitats beneath the coastal plain may well be adapted to high concentrations of nitrogen.

1.5 I find the arguments presented as to the fate of N and P unconvincing (they are not referenced), and in some places seemingly obfuscating (e.g. what is the relevance of the statement of inputs of N into streams p 17).2

Reply: The information provided on pages 16 and 17 of the CER are referenced to published data. The flow of water beneath the Study Area is known from regional studies by the Hydrology Section of the Department of Minerals and Energy and the amount of N or P likely to flow from leach drains is based upon published studies (Gerritse et al, 1995). The reference to discharge to streams gives an indication of how much nitrogen naturally occurs in soils due to the processes of nitrogen fixed by plant species, especially pastures, and how much is leached into streams from agricultural properties.

1.6 What is the relevance of the PRI in terms of throughput in the longterm - does the local soil become saturate and thus does the PRI change with time?

Reply: See page 15, paragraph 2 of the CER. The phosphate sorption sites of soils immediately adjacent to the leach drain become progressively saturated with phosphates from leachate. This phosphate saturation fans outward from the source at an ever decreasing rate with increasing distance from the source (leach drain) due to the increasing volume of soil which becomes available for phosphates with distance from the source. Phosphates which are fixed in soils become part of the soil phosphorus cycle and some of these phosphates will with time become available to plant uptake. The removal of phosphates by plants will allow more phosphate to be fixed. See 2.5 below for a more detailed description. The PRI is an index of the ability of a soil to fix phosphates. It is dependant on a number of criteria and it can vary with time, but not sufficiently to invalidate the conclusions given in the CER.

1.7 Citing figures relating to nitrogen loss within 10m of lateral movement through the soil is not relevant as most of the soil is <2m deep and the groundwater is everywhere within 5m of the soil surface and as close as 2m.

Reply: See p.16. Leachate, which remains after evaporation and plant uptake, seeps vertically to the groundwater and then moves laterally in the direction of groundwater flow. This groundwater may then be sampled at a distance from the leach drain. For this reason Gerritse *et al* monitored nitrogen levels at a 10m distance (horizontal) from the source.

1.8 The adjacent Mowbowra Creek catchment contains 2 of 11 known sites for the Cave Eel, Ophisternon candidum, and 4 of 18 sites for the Blind Gudgeon - both are protected species.

Reply: Mowbowra Creek is located approximately 3.5km to the north of the proposed development. The CER acknowledges that protected fauna may be found at depth beneath the Study Area, especially the creekbeds. The CER presents data from which it is concluded that the impacts of the development will be minimal on these habitats.

It is interesting to note that during the environmental appraisal of the Study Area Mowbowra Pool was visited and found to have a major algal bloom. This suggests that this waterbody has a high nutrient loading, and if it supports the rare cave fauna, that this fauna can tolerate high nutrient concentrations.

1.9, 1.10 The project lies to the coast of two other projects likely to need groundwater monitoring (WAWA borefield and the land release). How is any impact of each going to be assessed if they do not all have their own up and downstream monitoring?

It would seem appropriate that the proponents establish a monitoring scheme for water quality and a base line stygofauna survey. This should detail the monitoring proposed (e.g. how frequently, what will be monitored and why, what criteria (thresholds) will be used to determine the outcome, who will audit the results and what action will be taken etc).

Reply: A monitoring project would not be appropriate for a very low density residential development as outlined in the CER for the following reasons:

- the impacts of nutrients on groundwater are likely to be minimal due to the very low density of the development and design and management provisions,

- submission 1.4 above indicates that the nutrient levels could already be quite high and consequently cave species are likely to be tolerant to these natural N and P concentrations in groundwater. These levels are unlikely to be significantly affected by the proposed development.

1.11 Coastal caves are known to contain the only known examples of terrestrial obligate cave fauna. No protocol is established for dealing with the presence of caverns during the site development (a cave containing rare fauna was once opened up by a bulldozer on the coastal plain near Exmouth). A protocol needs to be established as to what action will be taken if caverns are opened up during site development of building operations, The significance of the find needs to be determined by an experienced speleologist and then, if necessary, action taken to minimise further impact or else to salvage irreplaceable information within an established time frame to allow mining to proceed. The caverns should also be surveyed for specialised cave fauna by a suitably experienced biospeleologist. The protocol needs to address: how large a hole should be reported, to whom will the find be reported, how much time be allowed for a site survey, to whom will the report be made, how much time will be allowed for a salvage operation, etc.

Reply: There do not appear to be any solid limestone outcroppings within the Study Area which could contain limestone caverns. Descriptions of the soil profiles are given in Appendix 2. At all sites which were investigated the soil was either deep or else a colluvium of rounded stones and gravel was uncovered which sometimes was in the form of a calcrete of cemented stones and gravel. Construction for housing will not require extensive earthworks as described in the submission. Contrary to the submission there will be no mining. Excavations will be required for leach drains and septic tanks and the recommendation for these is that they be as shallow as possible, and within soils and not within limestone. Consequently, the risk of exposing caverns appears to be highly unlikely.

2.0 Water Resources Commission (previously WAWA), Mr R.P.Claudius

2.1 It is unclear how the proponent proposes to minimise the infiltration rate of the storm water at site (Fig 2), near septic tank, which is one of the lower lying soil inspections sites (p14, s 5.3.1.1).

Are there drainage management strategies to divert stormwater infiltration at these vulnerable sites (ie sites potentially susceptible to soakage near septic tank area?)

Reply: Stormwater is unlikely to be a problem for the following reasons:

- It is not entirely clear whether the submission refers to stormwater created by roof run-off or stream discharge. In the case of the latter the CER deals extensively with stream discharges and recommends that houses (and their leach drains) be built above possible flood levels (Section 5.1.3.2, p.9). Inspection of the terrain of the Study Area shows that this will be readily achieved. Consequently floodwater is unlikely to interfere with the function of leach drains.

- Measurements of the ability of soils to infiltrate water (CER, Appendix 2) indicate that the soils of the Study Area have good infiltration characteristics.

- Localised stormwater can occur where artificial surfaces, such as roofs and bitumen surfaces, direct water away from areas which in the absence of the development would infiltrate water. The ratio of roof and bitumen areas to land which can accept stormwater is very low due to the large lot sizes which are planned. This problem will also be addressed in the design of road drainage.

- The rainfall in the region is low and high rainfall events are not common (p.5). Consequently, the occurrence of stormwater will be confined to very short periods which will occur infrequently.

- Leach drains and stormwater loads often become a problem in areas of high rainfall (say greater than 600mm per annum) and where there is a high groundwater table and where soils are unable to readily infiltrate water.

- Stormwater will be easily dealt with by diverting roof run-off to garden areas.

- Shire by-laws with respect to drainage will be observed.

2.2 Proponent indicates that "the PRI's of the soils of the Study Area confirm that most of the phosphates in effluent water will be readily fixed within the soils of the Study Area. Phosphates are expected to be further fixed by the calcium ions of the limestone and lime sands which underlie the soils of the Study Area" (p14, s 5.3.2.1). There is insufficient data provided to support this claim.

On what data does the proponent base this argument/theory? (p14, s 5.3.2.1)

Reply: Laboratory analysis of the soil samples from the Study Area showed that the PRI values varied from moderate to strongly phosphate absorbing (Appendix 2). An explanation of PRI together with a suitable reference is given in s 2.0, p.3.

The Study Area is located on the Cape Range Peninsula which is a massive limestone structure with groundwater which is characterised by high calcium concentrations (p.14). Positively charged calcium cations (in soil and in water) will react with negatively charged phosphate anions (in effluent) to form insoluble calcium phosphate compounds.

2.3 The efficiency of phosphate retention in soil through soil absorption depends on a number of variables including soil matrix (ie composition of soil), particle size and retention time of permeate in soil (or infiltration rate).

The proponent state that "the water infiltration rates of the soils of the Sandy Area" are such "that water will infiltrate rapidly into all of the horizons of these soils" (p14, s 5.3.1.2b).

Has the proponent determined the optimum infiltration rate of septic tank leachate through the soil in order to obtain maximum removal of phosphates?

Reply: The ability of a soil to fix phosphates is dependant on the absorption and adsorption characteristics of a soil. This phosphate sorption characteristic of a soil is dependant on the availability of positively charged particles in the soil to form insoluble and strongly bonded compounds with the negatively charged phosphates ions of the leachate. The main source of positively charged sites in the soil are cations, especially of aluminium, iron and calcium, clay minerals and organic matter. Phosphate sorption on fixation in soils is complex and it is affected by pH and temperature.

Phosphates in water will move in the direction of mass flow, but the rate of flow is independent of the rate of mass water flow. Instead, the rate of phosphate movement is dependant on the rate at which phosphate sorption sites in the path of the moving phosphates become saturated with phosphates. Consequently, in most soils the rate at which phosphates move from a point such as a septic tank is typically measured in centimetres per year. The exception being very bleached white sands which often have very few or no sorption sites. Such soils are relatively scarce but they do occur on parts of the Swan Coastal Plain

The water infiltration measurements given in the CER demonstrate that the soils of the Study Area have infiltration characteristics which comply with the guidelines of the Department of Health for establishing septic systems. This will ensure that infiltration is not a problem.

2.4 The proponent states that "domestic effluent contains phosphorous, almost exclusively as phosphates, and nitrogen, mainly as nitrates and nitrites" (p14, s 5.3.2). The proponent has failed to recognise that nitrogen is predominantly present as ammonium-nitrogen under septic conditions which is predominantly anaerobic. The ammonium-nitrogen however may be converted to nitrate and nitrite. Groundwater monitoring in the vicinity of septic tanks/leach drain residential sites has also shown that ammonium-nitrogen is also a contaminant?

Reply: Ammonium nitrogen was not considered because the impacts are largely due to the effects of effluent at a distance from the leach drain. Ammonium nitrogen is present in significant concentrations within the actual septic system, but this is not where the possible impacts of effluent occur. Ammonium nitrogen is not usually present in significant concentrations some distance from septic tanks. In soils substantial losses of nitrogen to the atmosphere are common and this is well recognised in the agricultural industry where losses of nitrogen from nitrogenous fertilisers due to gaseous escape during denitrification is a major problem. Similar processes occur in the soil near to a septic tank system (and it is important to distinguish between the soil environment and that within the septic tank) and consequently substantial losses of nitrogen which has entered the soil from the leach drains of a septic tank are common. Some ammonium-nitrogen is likely to be in the soil, but this is likely to be relatively minor in comparison to the presence of nitrite and especially nitrate nitrogen. Authoritative studies referred to in the CER (Gerritse et al, 1995) did not measure ammonium nitrogen in soils presumably because of the volatility of ammonium nitrogen which would ensure it was present only in very small concentrations. Instead, they measured nitrate nitrogen.

2.5 Paragraph 2 on page 15 s 5.3.2.1a is poorly written particularly in the sentence "Importantly, the leaching rate of the phosphorous ..... distance from the source" is unclear.

Reply: The sentence reads in full: "Importantly, the leaching rate of the phosphorus plume below a septic tank system will decrease with time and distance from the source due to the increasing area of the leaching front and the increasing volume of soil which this plume will traverse with increasing distance from the source."

The above concept is outlined in more detail below:

- Phosphates from a point source, will move within a soil in the direction of groundwater flow but at a rate at which phosphate sorption sites within the soil become saturated. It will not move at the rate of groundwater flow.

- Phosphates discharged from a leach drain system will move vertically in the direction of drainage until they reach the groundwater table. With time this will result in the column of soil below the leach drain becoming saturated with phosphates (eg. all of the phosphate sorption sites will have taken up phosphates). For sandy soils in Perth this condition is likely to occur within 1-2 years (Dr Brian Whelan, pers comm) depending on the type of soil (sand) and the depth to the water table.

- Once the column of soil between the leach drain and the water table has become saturated with phosphates, all additional phosphate additions to the top of the soil column from the leach drain will result in an equal amount of phosphate entering the water table from the bottom of this soil column.

- Phosphates entering the groundwater will move laterally in the direction of mass water flow, but again at a rate at which phosphate sorption sites become saturated.

- Unlike the vertical movement of phosphates from the leach drain to the water table, where the movement was confined to the column of vertically draining water, the phosphates entering the groundwater will move laterally, but they will have the opportunity to fan out rather than moving in a single column. This fanning out will be mainly along the horizontal but some vertical (downwards) movement will also occur. The result of this is that an ever increasing volume of soil and sorption sites become available to the laterally moving phosphates. This will result in the rate of lateral movement decreasing rapidly with distance from the source. Studies in Perth on yellow sandy soils have shown that the lateral movement is of the order of a few centimetres per year.

2.6 The proponent has failed to recognise the management of pesticides and herbicides that invariably exist in domestic developments. The presence of organic chemicals in septic tanks is well known, and yet the proponent has not even identified the issue.

Reply: Section 5.3.2.3 discusses the impacts of pesticides and herbicides which could be used in the gardens and recommends the inclusion of this subject in an environmental pamphlet (Commitment 2, point ii). The management of these substances lies in educating the public as to the consequences of such use and how to plan gardens in a way which minimises the need for these chemicals.

It should however be remembered that these chemicals meet the necessary Australian health standards and that their applications are is accepted by the relevant authorities.

Organic chemicals will only be found in septic systems if they are put there by the users of the systems. This has probably occurred where ignorance of the consequences of pouring unwanted solvents or other chemicals into drains has prevailed. It is important that householders accept the view that only wastewater from normal washing procedures (showers, dish and clothes washing) and toilets be allowed to flow into the septic systems. This is one of the subjects to be included in the environmental pamphlet (Commitment 2, point v) which will be distributed to prospective home builders and be made available via the Shire of Exmouth Shire and the local Library.

This potential problem applies to all housing areas and needs to be addressed by the community in general. The large block sizes will ensure that this potential problem will be relatively small.

2.7 The proponent has failed to address the issue of potential threat of groundwater supplies from bacterial contamination ie E coil present in septic tanks.

Reply: The submission implies that there could be a threat to human health (groundwater supplies) from effluent disposal. As stated in the CER, the general direction of groundwater flow is towards the ocean and unless drinking water is abstracted in the direct path of groundwater flow, no risks to human health are likely. The CER also stated (p.24) that advice had been received from WAWA that no bores would be permitted in the proposed development.

The general conclusions provided by a study "Microbial aspects of septic tank effluent disposal" (EPA Bull 130) are that definitive scientific evidence regarding the safety or otherwise of septic systems is difficult to establish due to the unique combination of a large number of soil variables at a given location. The presence of clay

particles within soils and cations such as calcium ions facilitates the filtering of bacteria (Bull 130). The PRI data indicate the substantial presence of cations. Consequently the soils are likely to have properties which will filter bacteria from effluent water. However, commonsense should prevail in the placement of bores adjacent to effluent disposal. Similarly, water from bores must meet health standards set by the Shire of Exmouth before domestic consumption is permitted. However, it is emphasised that the Water Authority advised that bores will not be permitted within the Study Area.

2.8 The proponent has not yet provided any alternate options of wastewater treatment or disposal. Can domestic wastewater be managed through disposal to a sewage system?

Reply: Other options for the disposal of effluent include the use of Aerated Treatment Units (ATUs) where an aerobic system operates in the collection tank and chlorinated effluent is applied to the soil surface rather than via leach drains below the ground surface. ATUs have the disadvantage that phosphates are applied to the surface of the soil and could be removed by surface run off with stormwater. ATUs also require the use of pumps for aeration and distribution of effluent water and the regular application of chlorine to remove bacteria from effluent water. Such pumps fail from time to time and require replacement or maintenance. During these periods the ATU's have the potential to not operate efficiently. These systems provide no advantage with respect to phosphates since in common with septic tank systems they rely entirely on the soils to fix phosphates. With respect to nitrogen they result in approximately a similar nett removal of nitrogen to that which is removed naturally from septic tanks by denitrification. However, they remove the nitrogen slightly more rapidly (by a number of days).

Reticulated sewerage is not an option for the Study Area because of the large lot sizes and the consequent low housing density would require an extensive collection network. The development of reticulated sewerage is not an economically viable alternative and can not be justified on environmental grounds.

2.9 In general the document does not adequately identify and quantify the impact of nutrients on groundwater, and although it provides practical solutions to the management of nutrients in leachate particularly in relation to its removal from the leachate, there is no technical evidence supporting its treatment strategies.

Reply: The study evaluated the impacts on the basis of extensive field observations, laboratory analysis of soil samples and a review of an extensive regional data base on groundwater. The design and management options will minimise potential impacts. Consequently it is concluded that there is no need for additional site-specific studies to further quantify the possible impacts.

2.10 Section 6 "Consultation with the Government Departments and Community Organisations" (p26) does not list the Water Authority as an organisation that was consulted, yet the CER states that "the Water Authority will not permit the use of private bores within the proposed development" (p13, s 5.3).

This statement is not correct and the issue needs to be addressed in consultation with the Water Authority.

Reply: The introduction to s.6.0 on page 26 explains that certain organisations were provided with a draft of the CER and written submissions were requested. The WAWA was not included in this category. However, the WAWA was subsequently provided with a copy of the CER for comment. During the planning stage of the CER extensive liaison prevailed with representatives of the WAWA to obtain and discuss the essential information, including the provision of services such as reticulated water to the proposed subdivision.

The following were consulted by the consultants and/or the proponent:

- Mr Peter Goodall, WAWA Leederville.
- Ms Kathy Ryan and Mr Brian Wylkes, WAWA Exmouth.
- Mr Paul Harry and Mr Phil Gail, WAWA Geraldton.

The consultations with the Water Authority resulted in W G Martinick and Associates, at the request of the Water Authority of Western Australia, providing an input to the CER for the WAWA Borefields. This included a biological appraisal, archaeological survey and cultural site survey for the pipeline corridor from the Water Authority of Western Australia's borefield to the Study Area.

Department of Conservation and Land Management - 4 submissions

3.0 Department of Conservation and Land Management, Mr D.Myers, District Manager CALM, Karratha

The submissions by CALM following a review of an earlier draft were included in Appendix 6 of the CER and were dealt with in the body of the CER. Replies to the individual paragraphs of this submission are given below.

3.1 In my view, it is unfortunate that this proposal is being considered before Town Planning Scheme No 3 is in place as it may conflict with the Scheme's basic philosophy and intent. Indeed, it is difficult to see any merit in providing basic services to land that is significantly removed from existing reticulation systems.

Reply: Greenough Holdings, Shire of Exmouth and the Ministry of Planning have discussed this matter. Under TPS No.3 the Study Area is zoned "pastoral". This will be changed to reflect the proposed residential development.

3.2 I also question the need to place this type of development next to a shoreline that attracts many local people and tourists for recreational purposes. It would be more appropriate to have this subdivision and development west of Murat Road, well away from coastal dunes and not interfering with existing pristine and attractive views of Exmouth Gulf. Views at the Southern end of the proposed development will be specially affected because of the very flat terrain.

Reply: Land to the west of Murat Road is not owned by the Proponent. The proposed development will not have major impacts on views of Exmouth Gulf because of the low density of housing which is proposed. The present access to the beach is via Pebble Beach Road. This will not be changed by the proposal and the development will not affect the recreational use of the beach.

3.3 This document states that no rare or priority listed fauna were found in the study area yet I find no reference to any survey or study being carried out. The document seems to infer that all plants worthy of protection occur within Cape Range National Park but acknowledges that the Cape Range is a different land system to that of the study area.

Reply: See Appendices 3 and 4 of the CER for information on the vegetation survey and page 2 for methodology. Local species which are rare or priority listed were discussed and a discussion of the likelihood of the species occurring within the Study Area was assessed. During a detailed search of the Study Area no rare or priority listed flora were found.

The fauna which is likely to occur within the Study Area was assessed on the basis of a habitat assessment and opportunistic sightings during extensive traverses.

3.4 Once again, there is no reference to any survey or study been carried out in the study area.

Reply: Reply as for 3.3.

3.5 There is no reference in the document about specific studies being undertaken to determine the type and numbers of endemic animals that live within the Study area. The statement that the sub-division area ecosystem contrasts those contained in Cape Range National Park lends weight to the concept of having the National Park extended eastwards to include some of these contrasting ecosystems.

Reply: See methods on page 2 of the CER. The habitats of the Study Area were described and a discussion of fauna and rare fauna which are likely to occur in these habitats was included (page 20). It was concluded that on the basis of extant knowledge (reviews are quoted) and assessment of the habitats of the Study Area that a detailed fauna trapping programme was not appropriate. No rare animal species are likely to occur within the Study Area.

See reply to 3.10 below.

3.7 Once again, the source of comments made in the document about rare fauna is not identified.

Reply: A review of the literature pertaining to the Cape Range Peninsula fauna was given (s.5.4.1,p.19) and the rare fauna which occur within relevant regions of the Pilbara are discussed within this literature and is appropriately referenced (p.20).

3.8 The document does not demonstrate to me that a determined effort was made to ensure that there are no sites of cultural significance contained in the sub-division area. It would have been useful to have made known the identities of people making assessments about these matters.

Reply: A separate document, based on consultations with Aboriginal Elders and an archaeological survey, was prepared. Permission was subsequently obtained from the Minister for Aboriginal Affairs to use the land (s.5.5 and 5.6, p.22) following a Notice under Section 18 of the Aboriginal Heritage Act which was submitted to the Aboriginal Cultural Materials Committee.

3.9 The document acknowledges that there are concerns about the potential threat to cave fauna habitats via phosphorous and nitrogen discharge. Potential nutrient enrichment of Exmouth Gulf water also needs to be considered, given the close proximity of the proposed development to the shoreline.

It would appear that the decision not to provide sewage service to the proposed lots is being influenced by the excessive cost of providing that service. This should raise the question about the suitability of the development at this point in time.

Reply: Wastewater management has been extensively dealt with in reply to the Museum submission (Section 1.0 above). With regard to the marine environment, this has been discussed in Section 5.3.2.4, page 18 and also in response to 5.4.

The economics of whether or not to provide reticulated sewerage to a housing sub-division is based upon the density of housing. The proposed subdivision has a very low density of housing (s.1.1, p.1). Usually reticulated sewage services may be considered where the lot size is less than 2,000m^2. The minimum lot size proposed for the development is 4,000m^2 and the maximum lot size is 34,000m^2, with an average lot size of 8900m^2 for the 177 lots which are proposed. A higher housing density which would have made reticulated sewerage a more economic proposition would have been inappropriate for the locality.

3.10 The document states that all lots will be connected to scheme water reticulation from nearby borefields. Are these existing borefields, managed by the Water Authority or new ones yet to be developed? If they are new, have any studies been carried out to assess the likely impacts of the increased demand on groundwater?

In respect to development proposals of this nature on the shores of Exmouth Gulf, it should be remembered that there are a couple of conservation and reservation proposals, yet to be fully addressed, in the vicinity of this particular development.

There is a body of opinion that recommends that the eastern extension of Cape Range National Park should contain a corridor extending to the shoreline of Exmouth Gulf. This would provide another representative ecosystem and habitat type within the local conservation estate. The proposal is signalled in the Cape Range National Park management plan.

A recommendation to similarly reserve a portion of Exmouth Gulf in the vicinity of the proposed development is contained in the draft report on 'A Representative Marine Reserve System For Western Australia'.

Reply: The document states (s5.8, p.23) that the borefield is being developed by WAWA and this development is currently the subject of a separate CER.

The Study Area is adjoined to the west by an airfield used by light aircraft and a major highway both of which could be inappropriate to include into a National Park.

Although The Cape Range National Park Management Plan (CALM, 1987) alluded to an extensive eastern extension of the Park following an EPA recommendation in 1975 which was adopted by the State Cabinet in 1976, the Shire is reliably informed that the eastern extension will more than likely terminate at the base of the Cape Range. This means that the proposed sub-division will be unaffected by the extension.

The management plan for the Cape Range National Park (CALM, 1987) proposed extending the Park in an easterly direction to a line within approximately 4km west of Murat Road. If this proposal by CALM is implemented then the new Park boundary would lie approximately 4km to the west of the Study Area. Consequently proposed extensions by CALM of the National Park will not be impacted upon by the proposed development.

It would appear from the draft report on "A representative Marine System for Western Australia" that the marine area referred to is almost adjacent to and north of Mowbowra Creek which lies to the north of the proposed development. Thus the impacts on marine systems are likely to be minimal (see 5.4 below) and consequently any future marine reserves are very unlikely to be affected by the proposed development.

4.0 Department of Conservation and Land Management, Mr Stephen van Leeuwin, CALM Karratha

Much of the submission does not require a response as the details have been attended to in the final draft of the CER. The comments in regard to the treatment of Rare and Priority Listed flora are: "The treatment ..... is reasonable and the conclusions appear legitimate ...".

In regard to the treatment of weeds:

> "The treatment of weeds is questionable. The proponent appears to assume that Buffel Grass is not a weed because it has now become naturalised."

A vegetation survey conducted by CALM in the Karijini National Park (Stephen J van Leeuwin and Robert Bromilow, 1995) reports as follows:

> "Five introduced vascular plants species were located..... Most species recorded were regarded as naturalised. One species .... is a serious environmental weed ..." (s4.1.3, p28, CALM Report).

It follows that the remaining four weed species found by CALM are not serious environmental weeds. The reporting of weeds in the draft CER appears consistent with the document produced by CALM.

We are not questioning whether or not Buffel grass is a weed. We acknowledge that it is widespread in the North West and that will be difficult to eradicate. It should also be noted that "Buffel Grass - WA strain" is being promoted and sold throughout the North West and Northern Australian as a pasture grass.

5.0 Department of Conservation and Land Management, Mr C.Muller CALM Regional Manager, Karratha

5.1 A PRI of 20-70 is stated to indicate soils which are strongly phosphate fixing. Table 1 shows five of the eleven samples has a PRI<20, two were 22, and all were less than 30. On this basis it is incorrect to state that the soils are all strongly phosphate fixing, and raises the question whether the statement was designed to be deliberately misleading.

Reply: An editing error occurred in the draft document which was originally reviewed by CALM. This was corrected in the final draft of the CER (s5.3.1.2, p.14).

5.2 Spreading point loading data over the total area to provide a low average per hectare rate for comparison with broadacre fertiliser application is also misleading. A higher point source loading has a far greater potential to leach into waters.

Reply: This comparison was removed from the final CER.

5.3 The nutrient input from septic and from fertiliser application have been treated separately. The document acknowledges that residents will use fertiliser, and proposes an information sheet that will "encourage" the use of slow release fertiliser. The strategy proposed, of encouraging lawns and trees, is likely to encourage much greater inputs in order to maintain them. A "worst case" scenario of heavy fertiliser application combined with the maximum loading from septic should be considered to determine potential impacts. It is irrelevant to consider "average" loadings spread over the total area.

Reply: The "encouragement of lawns and trees" (see commitment ii, point 4) is for the purpose of encouraging the use of plants to take up water and nutrients in the vicinity of and above the leach drain. The CER outlined that the planting of such vegetation above and adjacent to the leach drains will be encouraged as a management option for the septic tank systems and not as a general recommendation. In deference to the submission, "lawns" are not referred to in the commitment. Average loadings are included for the sake of comparison with other nutrient inputs to the environment.

A worst case scenario of fertiliser application and heavy septic loading could possibly include a spill from a bag of fertiliser in a household where there is a large family. Such a single household within the low density development is unlikely to have any significant effect on an ecosystem which is very widely distributed beneath the entire coastal plain.

5.4 I question the statement that there is "very little likelihood of marine algal growth being encouraged locally by domestic effluent". Insufficient data is provided to determine if adequate flushing exists at a local level. Effluent from septic discharges have caused recognisable changes elsewhere on the Cape with similar macro level tidal flows. For example, to address the problem of nutrient discharge,sealed vault toilets have been installed in Cape Range National Park, and sewerage is being investigated for Coral Bay.

Reply: Tidal and marine information has been provided (s. 5.1.4, p.10) which shows that local tidal currents vary between 0.1 knot and 0.8 knot. This will result in considerable tidal exchange. The Coral Bay facilities cannot be compared with the proposed development. Coral Bay consists of high density camping ground located very close to the coast with a limited number of toilet facilities which have a very high usage rate. Proposed tourist developments at Coral Bay will also cater for tourists at a high density in a small area. By comparison, the proposed development is a very low density and removed considerably further from the sea.

The reference to recognisable effluent effects probably refers to public toilet facilities with a high usage rate located in coastal dunes or close to them. This cannot be compared with septic facilities provided for a single family, isolated from other facilities located well inland from the coastal dunes. It should also be noted that the Study Area is not inside a National Park.

It should be noted that the Study Area is adjacent to about 4.2km of coastline. It commences about 100m inland of the highwater mark, 1m or more above the high water mark and extends inland for about 1.7km. 117 lots are proposed on about 158 hectares. This demonstrates the low density of the proposed housing and its spread along the coastline, with the bulk of the lots being several 100m inland of the coastal dune.

5.5 The document states that the proposed developments are "well back" from potential flooding but does not provide any figures to substantiate this.

Reply: The draft document has been revised and additional data and discussion has been included to take account of this submission (s.5.1.3, p9).

5.6 The document recognises some potential problems, but does not provide commitments to address these. For example (my emphasis):

"Guidelines for pet management should be provided..."

"the environmental information sheet ..... will encourage the use of slow release fertilisers"

It is recommended that a tabular summary of commitments be provided.

Reply: This refers to the draft CER. In the final CER these issues have been addressed in the list of commitments in Section 7.2 in commitment ii. All commitments are provided in Section 7.2.

6.0 Department of Conservation and Land Management, Mr P.Kendrick, Karratha.

6.1 The report is confused in its treatment of weeds. Section 5.11.3 implies that while two species of Cenchrus are introduced, they are not weeds because they are "naturalised grasses which are widespread". These species, and the other three introduced species mentioned are weeds precisely because they have become naturalised.

Reply: See response to 4.0 above.

6.2 The report states that the study area is free of weeds, however, weed species are noted to occur in 6 of the 7 landscape units described. The statement that "they are not currently a problem" is odd; no context within which they may or may not be a problem is identified. All environmental weeds are a problem to some degree, and their presence is of concern. The disturbances associated with housing development of sub-division will almost certainly favour weed species at the expense of native species.

Reply: See response to 4.0 above. It is worth reiterating that the Study Area is located within a pastoral region and grasses introduced by or for the pastoral industry are present. This applies especially to Buffel grass. Buffel grass is present throughout the coastal plains of Exmouth Peninsula, as well as the entire North West and Kimberley.

6.3 It appears that no systematic fauna survey was undertaken during the study. None of the four species of threatened mammals noted as 'endemic to the Pilbara' are currently endemic, or have in the past been endemic to the Pilbara. The presence or otherwise of these large and relatively conspicuous species would be conclusively determined by field investigation.

Aquatic cave fauna is mentioned as being possibly present in the vicinity of the development (Section 5.12.3, para 3), but this is taken no further than to mention that it may occur up to 100 metres below the study area. The subterranean fauna is of considerable biological significance and deserves a thorough treatment. The report is deficient in this crucial aspect.

Reply: These comments were based in a review of a draft CER and they have been addressed in the CER. See reply to 3.5. All habitats were described and were found unlikely to contain rare animal species. There appears to be an objection to the term "endemic" and may have been interpreted in a more narrow sense. The large species referred to are:

- The Spectacled Hare Wallaby which has a population near the Pilgangoora Mining centre 100km inland of Port Hedland and on off-shore Islands.
- The Burrowing Bettong which has a distribution now restricted to off-shore islands but previously included the Pilbara.
- The Bilby, of which evidence has been found at Abydos-Woodstock in the Pilbara.

The authoritative book on Australian Mammals edited by R.Strahan shows former distributions of these species which included the Pilbara.

The CER concurs that it is possible that the aquatic cave fauna species could be found in caverns or in deep gravels below creekbeds of the Study Area. Extensive reviews of the aquatic cave fauna have been published and these are referred to in the CER (s.5.4.2, p.20). The first paragraph of Section 5.4.2.1, p.20 describes the significance of the species.

7.0 Conservation Council of WA

This submission is reproduced in Appendix 6 and replies are given in Section 6 of the CER. The final draft of the CER included concerns expressed in this submission.

8.0 Ministry for Planning, Western Australia

8.1 Foreshore reserve: The precise placement of the reserve is not clear, although the Executive Summary at the beginning of the report states that "All of the precincts have a minimum setback distance of 100m from the high water mark". The Western Australian Planning Commission Policy No. DC 6.1 (the Country Coastal Planning Policy) determines that set backs of one hundred metres from the permanent vegetation line are to be used as a guideline for setback along sandy beaches, with variations according to the site's topography, geomorphology, climatic and oceanographic conditions. The position of the permanent vegetation line is not marked on the plan. Further work to justify the foreshore setbacks would be appropriate.

No foreshore management plan is presented for the coastal foreshore. Under the Country Coastal Planning Policy No. DC 6.1, Section 4.1.1, a foreshore plan should be prepared and implemented by the proponents. Such a plan should be provided prior to the release of lots for sale.

Public access is to be provided via Pebble Beach Road and along the creek lines. No associated car parking facilities are depicted. The lack of a road along the western edge of the subdivision introduces additional access problems where lots abut the coastal reserve. This issue has not been adequately addressed. Additionally, access to the foreshore or to creek lines is provided at a number of points through apparent Right of Ways (ROW's) between lots. These provide additional access to the coastal foreshore and may result in localised dune erosion with subsequent management problems.

Reply: The line of permanent vegetation closest to the ocean is described in the CER on page 4 of Appendix 3 where Beach and dune vegetation is described. The second paragraph on page 4 states "The beach above the high water mark supports a very sparse community of .....". This is the line of permanent vegetation which approximately coincides with the seaward base or toe of the foredune system. The setback distances from the beach were carefully set to take this Country Coastal Planning Policy requirements into account. An additional 1m of height was allowed above the high water mark to take into account the "line of permanent vegetation". In many cases the distance to the high water mark greatly exceeds 100m.

The proposed Sub-division and Development of Locations 222 and 223 Document provided for the vesting of the coastal land in the Shire of Exmouth. A management plan for the land will be prepared and implemented by the Shire. Protection of the Dune system will be an important aspect of the Management Plan.

A fence, which will be erected, will direct traffic to creek areas and will discourage traffic across the dunes. The existing access to the beach will be available to future residents.

8.2 The use of septic tanks: The use of duel leach drains and the planting of vegetation in association with the drain fields is supported.

However, description of the Phosphate Retention Indexes (PRI's) of the soils is misleading in stating that the soils are strongly fixing. Appendix 2 provides a table showing the results of soil testing indicates that of the 20 sites described, 8 samples were not analysed for their PRI, five returned moderate fixing levels, and the remaining six were at the lower end of the strongly fixing range. It is curious that the results of nine sampling sites are presented but those from the other 11 sites are omitted.

From the results which are presented, it appears that soils in Landscape Unit A vary in PRI from moderately to relatively strongly fixing, whilst single samples from Landscape Units B, C and D returned relatively strongly fixing PRI's. Unit F's single result showed moderate PRI. Samples 15 and 18 are in areas where the Landscape Units are not defined. Two sites are depicted as being sample site 15.

Depth to groundwater is provided for single site. Depth to groundwater is crucial information in determining the suitability of this area for the use of septic tanks.

Therefore, given the paucity of data on the conditions over the entire area proposed for residential development, statements regarding the suitability of this area for septic tank usage are questioned.

Further and more rigorous analysis is required because of the vulnerability of the nearby marine environment and the consequences of potential impacts of leachate upon the cave fauna and the local vegetation communities.

Given these concerns and comments in the both the Exmouth Coastal Strategy (1992) and the Gascoyne Coast Regional Strategy (1994) regarding the constraints imposed by the karst landscape of the Cape Range Peninsula and the need for developments to take advantage of existing infrastructure, connection to either the town's reticulated sewerage system or a small local treatment plant is preferred. As a last resort, if the subdivision proceeds without such a provision, a requirement of the subdivision should be that infrastructure be provided for later connection to such a system.

Reply: The statement is that soils are moderately to strongly phosphate fixing (s.5.3.1.2, p.14). An error in the methods section (p.3) states that there were 12 inspection trenches dug. There were a total of 20 sites where data was collected (photographs, description of the superficial soils noted, and plants identified or plant samples taken) and at 9 of these sites trenches were dug where the soil profile was described, infiltration tests were conducted and soil samples were taken for laboratory analysis.

Soil colours and textures were very similar over the entire Study Area and PRI values did not vary considerably (Table in Appendix 2). Most importantly, the PRI values showed that none of the inspection sites and landscape units had soils with low values, confirming that they are all suitable for septic tank systems.

A backhoe was employed to dig trenches and these sites were located across the Study Area on representative sites of the various landscape units, within the constraint of using existing tracks or roads to avoid unnecessary damage to the vegetation. The operator was instructed to dig to approximately 2m in depth or until the calcrete (cemented colluvium) or limestone colluvium (loose rubble of rounded limestone rocks and gravel) was reached. The depth of each inspection trench is given in the Table in Appendix 2. In only one case was the water table reached and this was at the lowest site within the Study Area. It was not expedient to dig to the water table in every case due to the excessive depth. Similarly, from the regional knowledge of the RL of the groundwater and the RL of the terrain surface the depth to the groundwater can be readily estimated.

The suitability for any particular site for leach drain emplacement is that the water table is at a defined distance below the leach drain. The water table is at 2m depth or greater at all inspection sites and hence there are unlikely to be problems regarding leach drain functioning. (The RL of the groundwater is about 0.2m AHD).

The cave fauna and marine environment have been dealt with in replies to submissions from the Museum.

A small local sewage treatment plant would be inappropriate for the proposed development due to the extensive network of connecting pipes that would be required for the low density of housing which is proposed. Provision for later connection to reticulated sewage is inappropriate for the same reason. Importantly, the proposed septic tank system will not result in major environmentally adverse impacts.

8.3 Bush fire protection: Although the vegetation is of low fuel status, fire hazard should be given some consideration. The placement of lots abutting both the coastal reserve and crown reserve 32946 will require fire management initiatives in the form of fire breaks either through the lots or the reserves. Details of these fire evaluation and mitigation strategies can be prepared to the satisfaction of the Bush Fires Board and the Shire at the subdivision stage.

Reply: The Shire of Exmouth currently has a by-law relating to the establishment, maintenance and equipment of Bush Fire Brigades. The Shire currently enforces the provisions of the Bush Fires Act and will be responsible for necessary requirements to be undertaken at the proposed development site.

8.4 Degradation of the existing flora: The proposed lots range in size from 4000m² to over 3ha with no determination of how many dwellings are permitted per lot, and no constraints on how much of each lot may be cleared and developed. This may result in extensive degradation of the flora if extensive residential development occurs in the form of access roads, sheds, boat and car parking areas, informal tracks and refuse disposal areas. Such degradation is likely to result in soil erosion and blowing sand.

The presence of halophytic vegetation in Landscape Unit D represents a major limitation to development because:

A. the watering of surfaces may increase surface and near surface salinities and induce potential soil erosion;

B. it will be difficult to establish vegetation other than halophytic species, and therefore any vegetation planted in the vicinity of leach drains in this landscape unit will need to be carefully selected to suit these conditions; and

C. destruction of any existing vegetation in this area could lead to soil erosion.

Disturbances relating to housing development are likely to favour weed invasion over the existing flora. A weed management plan may assist, particularly given the presence of Buffel Grass (which some would classify as a major environmental weed).

Reply: It is accepted by the Proponent that the number of dwellings per lot will be negotiated with the Ministry for Planning.

It is likely that native vegetation will be cleared for the placement of facilities which future landholders require. However, it is important that unnecessary clearing or degradation does not take place and to this end the environmental pamphlet (Commitment 1) will emphasise the risks of allowing degradation of the existing vegetation or unnecessary clearing.

Where lots include flood-prone land (which has halophytic vegetation) constraints will be set in terms of building envelopes and the placement of leach drains and these areas will either not be built upon or will require the import of fill to create acceptable areas for house and leach drain construction. The placement of building envelopes will ensure houses are place in non-flood prone areas. Consequently halophytic vegetation and saline soils will not present a problem.

A weed control programme which does not include control of buffel grass is given below. Buffel grass is widespread throughout the region and its control should be approached on a regional basis. This is because eradication measures restricted to relatively small areas are likely to fail due to reinfestations from surrounding land.

i. Prevent the entry of weeds into the development area. All construction machinery should be brought on-site in a clean condition. Prior to transporting construction machinery to the site, these should be inspected and where necessary, cleansed of dirt and embedded thorns.

ii. Eradicate any existing weed infestation. Prior to the commencement of work, construction areas should be inspected for the presence of weed infestations and should be sprayed where appropriate.

iii. Prevent the outbreak of new weed infections by isolating existing infections. All disturbed ground must be inspected following rainfall. Any weed outbreaks in these areas must be controlled by spraying before sufficient time has elapsed to allow seeds to set.

iv. Post-construction weed control. It shall be the responsibility of the Shire of Exmouth to implement weed control measures after roads and other services have been completed.

8.5 Placement of lots in relation to flood prone areas and back dunes: Substantial portions of one lot in Precinct A, Landscape Unit D, are depicted as being flood prone, and three other lots in this area have significant areas similarly affected. The use of building or development envelopes would ensure that potential loss of property in these areas is minimised. Access to these lots or to the foreshore may be restricted during flash flood events in the cyclone season.

Three lots in Precinct A, Landscape Unit C appear to include some of the back dunal areas. Uncontrolled access through these dunes may create vegetation degradation and lead to the need for dune rehabilitation.

It is preferable that property boundaries be kept off these back dunes.

Reply: A total of 4 lots in Precinct A have a proportion of their total area which is described in the CER as being flood-prone land. Included in these lots are elevated areas which are not flood prone. The placement of building envelopes will ensure houses are place in non-flood prone areas or areas which are suitable for filling to acceptable levels. Furthermore, the envelopes will be placed such that access is also via non-flood prone areas. Very heavy rainfall is extremely rare in the region and any flooding is likely to be of a temporary nature and access to housing may be limited to short periods when flooding occurs.

Uncontrolled access across the dunes will not occur because a fence will be erected to deter pedestrian dune crossings (see Commitments).

8.6 Water supply: Arrangements for the provision of water supplies to the subdivision are noted. These arrangements conform with the service requirements for special residential zones under the Western Australian Planning Commission's Policy No. DC 2.5.

The use of water sensitive design in road construction is laudable. Replanting of local flora along swales adjacent to roads will also aid fire management by maintaining low fuel zones.

A number of special provisions may be appropriately required at the subdivision stage. These requirements include: the determination of building envelopes on each lot, which specify suitable sites on each lot so as to avoid degradation of sensitive flora (such as halophytic communities), flood prone areas, areas of high visibility, areas prone to excessive noise (from either the nearby light aircraft facility or from Murat Road itself, which is expected to carry greater truck traffic as a consequence of limestone mining operations), and to prevent excessive sprawling use of the lots with subsequent degradation of vegetation and soil erosion. Development envelopes should include the siting of leach drains. Restrictions on the number of dwellings should be provided.

Reply: See reply to 8.1 in regard to a foreshore Management Plan.

The proposed subdivision will not change the existing access to the beach. The environmental pamphlet will educate the public about the necessity of protecting coastal dunes and it is anticipated that pedestrians will follow this path to the nearest beach access (see Commitment 1).

9.0 SUMMARY OF SUBMISSIONS

The summary of submissions were provided by Ms Karen Sanders, Department of Environmental Protection on 12 January 1996. Most of the points in the summary have been addressed in the responses to submissions by Government agencies in the pages above. The summary paragraphs have been numbered according to the headings provided by Ms Sanders. Where the questions/comments have already been addressed, the appropriate reply number is given.

BIOPHYSICAL

Paragraphs 1 to 4: see replies to the Museum submission.

5. See reply 1.3

6. See reply 1.4

7. See reply 1.11

8. See replies 1.8 and 3.5

OTHER FAUNA, FLORA AND ECOSYSTEMS

1. See reply 5.4

2. See reply 1.11

3. See replies 3.3, 3.4, 3.5

4. Control of pets. The control of pets (dogs and cats) can be addressed by education and legislation. The Proponent is able to provide the means of education by providing environmental pamphlets (see commitments). Legislation cannot be provided by the Proponent. The issue of pets needs to be resolved at a regional level, with the Shire providing guidelines or conditions.

5. This issue has been extensively discussed in s.5.3.2, p.14 of the CER.

6. See reply 5.4

EXTENSIONS TO CAPE RANGE NATIONAL PARK

see reply 3.10

MARINE PARK

See reply 5.4

COASTAL MANAGEMENT

1. See reply 3.2

2. See reply 8.6

3. Dune areas will be protected by a fence (see Commitment 1)

4. See reply 8.1

5. See reply 8.1

6. See reply 8.4

7. The section referred to in the CER unfortunately did not give a cross-reference to an earlier section. See the CER s.5.1.4, p.10.

FLOOD RISK/STORM SURGE

1. See reply 5.5

2. See reply 8.5.

3. The probability of a high spring tide does not change if the period is 4 months or 6 months. This can be verified by noting that the months in the equation (para.2, p.11) (4 months) cancel out. Other probabilities do not change either, these include the chance of a 0.6m surge or the long-term probability of a cyclone.

WEED MANAGEMENT

See replies 4.0 and 6.2

WATER SUPPLY

See reply 2.10

FIRE

See reply 8.3

POLLUTION

1. See table in Appendix 2 of the CER.

2. See reply 8.2. This submission assumes the contents of leach drains will flow directly from leach drains into the gulf with little interaction between the content of leachate and the soils which lie between the leach drain and the coast. An extensive discussion is provided in section 5.3.2, p. 14 which explains the likely fate of N and P in effluent water.

Flooding - see reply 8.5

3. See reply 8.2

4. Tidal movements in groundwater which are detected several kilometres inland do not necessarily indicate that the ocean moves into the karst system or that there may be reverse flows in groundwater. This is borne out be the presence of fresh water beneath the coastal plain near to the ocean. When the level of the sea rises with each tide, groundwater levels rise in sympathy to match the difference in gradient between groundwater beneath the Ranges and sea level. The net movement of groundwater is from the higher gradients below the Ranges to the lower gradient at sea level.

5. Environmental responsibility will rest with a blend of education and legislation. Suggestions of "policing" the use of leach drains is not likely to be helpful. The message will be put to landholders that it is in their own interest to switch leach drains every 6 months and the reasons why drains should be switched will also be given.

6. The criticism does not specify how the technical data is lacking. The most authoritative references have been employed in the discussion (s.5.3.2, p.14).

7. See reply 2.1

8. See replies 3.9 and 8.3

9. The submission confuses the blocking of sewage pipes, which supply septic tanks or which connect the tank and the leach drain, and the blocking of leach drains. Older concrete or clay pipes used to conduct sewage have joints which are sealed with mortar which invariably crack with time. Roots then infiltrate through these cracks into the pipes and may cause a blockage of a domestic septic system. Leach drains are unlikely to become blocked by roots due to the open nature of the drain. The flow of effluent water in leach drains is seldom prevented by the presence of roots. Furthermore, two leach drains are recommended which will be alternated every six months. This will discourage prolific root growth. This will also inhibit the accumulation of slimes or bacterial growth which could limit effluent flow. A worst case scenario is that the roots may have to be removed from the leach drain. This is a simple procedure and similar to the removal of roots from sewage pipes.

NOISE FROM LIMESTONE CARRYING TRUCKS

The trucks carrying limestone from the proposed Whitecrest/Swan limestone mine will enter Murat Road to the north of Stoney Creek which lies to the north of the proposed development. Trucks will use Murat Road north of this entry point to convey limestone to facilities which are proposed to be located on the peninsula further north. Consequently there will be no trucking impact on the proposed development.

WASTEWATER ALTERNATIVES

11. See reply to 2.8.

PLANNING CONTEXT

1. Regional studies (Exmouth Coastal Strategy (DPUD, 1992) have been completed which recommend that future development should take place in the coastal region to the south of Exmouth subject to constraints which have been addressed in the CER (s.5.1.1, p.7).

2. See reply 3.1.

3. See reply 3.2.

4. The services which should be made available are not enumerated. The development is a rural development and future residents will purchase the land in the knowledge of this fact. Reticulated sewerage - See reply 3.9.

5. Public access to the sea will not be changed by the proposed development. The present access via Pebble Beach Road which will remain. There will be no impact on the view of Exmouth Gulf. Houses will be evident, but their low density will not obstruct the view of Exmouth Gulf.

6. Marine Pollution Inquiry. The results will not be known until the end of the 1996 Federal Parliamentary Budget sitting. It is not known whether this inquiry will produce recommendation which are of any relevance to the Study Area.

ABORIGINAL HERITAGE

See reply to 3.8. There are no rockshelters in or adjacent to the Study Area.

BOAT LAUNCHING FACILITIES

Boat launching facilities are provided as a public facility and not as a device to protect the environment. The Shire has provided nearby launching facilities at Bundegi Beach and at Town Beach. The new boat harbour will also provide launching facilities. The Shire is reluctant to provide another boat ramp considering the number of nearby existing facilities and the high cost of providing new facilities.

GARBAGE

The proposed development will cater for natural regional population increase and is unlikely to cause or create a population increase which will require an amendment of policy by the Shire of Exmouth. The existing disposal facilities established in 1994 have been designed with an estimated life of 20 years plus allowing for 2 to 4% growth rate in the Shire. These existing facilities will easily cope with the proposed development.

Appendix 3

List of submitters

Conservation Council of Western Australia Inc
Department of Conservation and Land Management
Ms L Falconer
Gascoyne Development Commission
Mr L Harris
Health Department of Western Australia
Dr C Hendersen
Ministry for Planning
Ningaloo Preservation Association
Ms DA Preest
Water Authority of Western Australia
Western Australian Museum
Western Australian Petroleum Pty Limited

Appendix 4

Proponent's Commitments

COMMITMENTS

PROPOSED SPECIAL RESIDENTIAL SUBDIVISION LYNDON LOCATIONS 222 AND 223.

The joint proponents, the Shire of Exmouth and Greenough Holdings, have made the following commitments and are legally responsible for compliance. These commitments will be implemented by Greenough Holdings, on behalf of the Shire. In the commitments below, "construction phase" refers to the installation of roads, reticulated water and electricity supply required by future landholders.

FORESHORE MANAGEMENT

1. Prior to the release of lots for sale, the proponent will prepare a foreshore management plan to protect the coastal dunes and beaches which lie between the proposed development and the ocean.

   The foreshore management plan will be to the requirements of the Ministry for Planning and will address, but not be limited to:

   1. Access to the beach;
   2. Provision of boat launching facilities; and
   3. Construction of a north-south fence to discourage access across the dunes.

2. Within 12 months of subdivision approval, implementation of the approved foreshore management plan will begin.

ENVIRONMENTAL AWARENESS PAMPHLET

3. Prior to the release of lots for sale, the proponent will prepare a pamphlet which aims to stimulate greater environmental awareness and improved environmental management by future landowners of the development.

   The pamphlet will be to the requirements of the Ministry for Planning and will address, but not be limited to, the following topics:

   1. A description of the environmental importance and sensitivity of Cape Range Peninsula in terms of the habitats of the Ranges and plains and the subterranean cave and aquatic fauna.
   2. Use of gardening techniques to minimise fertiliser, water use and use of insecticides and herbicides.
   3. Keeping vegetation clearance to a minimum and managing the remaining native vegetation in such a way as to minimise degradation of this vegetation.
   4. Prevention of the creation of bare surface areas that could be a source of dust. Any such areas that develop will be revegetated.
   5. Planting of shrubs and trees adjacent to leach drains to act as biological pumps of domestic effluent water.
   6. The importance of minimising the use of polluting substances which could enter groundwater via the leach drains or by surface drainage.
   7. Direction of stormwater from roofs and other hard surfaces to garden areas, rainwater tanks or wide and open drains to minimise sediment transport off the respective property.
   8. A discussion of responsible pet ownership.
   9. Guidelines on stock ownership and management; and
   10. The importance of controlled access to the beach.

4. Sufficient pamphlets will be printed for distribution to prospective buyers and to be displayed in the Offices and Public Library of the Shire of Exmouth.

STORM SURGE AND FLOOD RISK STUDIES

5. Prior to subdivision approval, the proponent will complete a storm surge study to the requirements of the Ministry for Planning.

6. Prior to subdivision approval, the proponent will complete a flood risk study to meet the requirements of the Ministry for Planning and the Waters and Rivers Commission.

7. Following completion of the storm surge and flood risk studies and prior to subdivision approval, the proponent will modify the subdivision in accordance with the results of the studies to meet the requirements of the Ministry for Planning.

EFFLUENT DISPOSAL

8. The proponent will minimise the impacts of domestic effluent disposal through appropriate design, placement and operation of leach drains, in accordance with the requirements of the Health Department.

   The requirements are as follows:

   1. Leach drains shall be constructed at the minimal depth required by Shire regulations. This measure is to permit maximum uptake of domestic effluent by shrubs and trees and will facilitate evaporation of effluent and the natural processes that encourage denitrification of nitrogen based nutrients.
   2. On lots immediately adjacent to public open space provided for creeks, leach drains shall be located in the vicinity of the lot boundary furthest removed from the creekline. This measure is to minimise the leaching of effluent into gravels below creeks which might provide habitats for subterranean invertebrate fauna.
   3. Where development envelopes have been set in accordance with the requirements of the Ministry for Planning, leach drains and septic tanks will be located within these envelopes. This commitment is to minimise the risk of floods interfering with the normal operation of leach drains.
   4. Dual leach drains, not being adjacent to one another, will be required to permit a cycling of aerobic and anaerobic conditions within the leach drains. This measure will allow the removal by natural processes of bacterial slimes which diminish the infiltrative ability of soil surfaces surrounding leach drains.
   5. Only one leach drain shall be used at a time, and the use of leach drains shall be alternated at 6 monthly intervals. The method by which the Shire will ensure that leach drains are alternated and working efficiently will be agreed upon by the Shire and DEP following subdivision but prior to any development application being approved.
   6. A length of up to 20 m for each leach drain (resulting in a total length of up to 2 x 20 m) shall be required to ensure maximum dispersal of domestic effluent.

PRIVATE BORES

9. Groundwater abstraction by private bores within the proposed development will be controlled through Water and Rivers Commission licensing controls.

STORMWATER

10. The proponent will ensure that the transport of surface sediments in storm water is minimised through direction of storm water to wide and open drains which will be

seeded with local plant species.

FIRE BREAKS

11. Following construction, the proponent will minimise the risk of fires within the development by enforcing the provisions of the Bush Fires Act with regard to the maintenance of firebreaks on privately owned land.

WEEDS

12. Prior to construction the proponent will minimise the potential for spreading weeds by the preparation of a weed management plan, to the satisfaction of the Shire of Exmouth. The weed management plan will be exclusive of Buffel Grass *(Cenchrus ciliaris)* and Birdwood Grass (*Cenchrus setiger*) which are widespread in the locality and which should be controlled on a regional basis.

    The requirements of the weed management plan are as follows:

    1 All construction machinery shall be brought on site in a clean condition;

    2 Areas set aside for the provision of roads and other services shall be inspected prior to the commencement of work and any weed infestations shall be treated by spraying or by other methods.

    3 During the construction phase all disturbed areas shall be inspected for weeds following rainfall. Any weed infestations shall be controlled by spraying or other methods; and

    4 On-going weed control shall be the responsibility of the Shire of Exmouth.

13. The approved weed management plan will be implemented during the construction phase of the project to the satisfaction of the Shire of Exmouth.

LAND USE

14. Within 12 months of subdivision approval, the Shire of Exmouth, as joint proponent will ensure planning mechanisms are in place to prohibit intensive agricultural activities on the site which require high fertiliser and / or high water usage.

15. These mechanisms will be reviewed following the development of any policy regarding protection of stygofauna in the region.

SUBTERANNEAN FAUNA

16. Prior to the commencement of site works the proponent will develop a protocol for the identification and investigation of voids for subterranean fauna discovered during site works to meet the requirements of the EPA on advice from DEP.