Prawn Farm at Heron Point, Exmouth Gulf

Cape Seafarms Pty Ltd

Report and recommendations of the
Environmental Protection Authority

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Summary

This report is to provide Environmental Protection Authority (EPA) advice, to the Minister for the Environment, on the proposal by Cape Seafarms Pty Ltd to develop a prawn farm at Heron Point approximately 35 kilometres south of Exmouth in Exmouth Gulf.

It is the EPA's opinion that the following are the environmental factors relevant to the proposal:

(a) mangroves;

(b) dunes;

(c) groundwater quality;

(d) marine water quality;

(e) solid waste disposal; and

(e) disease

and the EPA's environmental objectives for these factors can be met subject to the conditions and procedures being enforceable should the project be implemented.

The conditions and procedures, in the EPA's opinion, to which the proposal should be subject if implemented are in summary:

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

(b) the proponent should be required to implement an Environmental Management Plan (EMP) which incorporates the principles of the draft Environmental Code of Practice for Australian Prawn Farmers and the details of the Water Quality Management and Monitoring Plan, and groundwater, mangrove and rehabilitation monitoring; and

(c) the proponent should be required to implement an environmental management system.

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and Environmental Protection Authority's objectives set for each factor (Section 3).

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures (Section 4), including the proponent's environmental management commitments, the proposal can be managed to meet the EPA's objectives.

Recommendation 3

That the Minister for the Environment imposes conditions and procedures set out in Section 4 of this report. The implementation of the Minister's conditions and procedures are to be audited by the Department of Environmental Protection.

Contents

Tables

Appendices

1. Introduction

This report is to provide Environmental Protection Authority (EPA) advice, to the Minister for the Environment, on the environmental factors relevant to the proposal to develop a prawn farm at Heron Point approximately 35 kilometres south of Exmouth in Exmouth Gulf.

The proposal by Cape Seafarms Pty Ltd to develop the prawn farm was referred to the EPA in February 1997. A level of assessment of Consultative Environmental Review (CER) was set on the proposal. The CER report (Bowman Bishaw Gorham, 1997) hereafter called the CER, was available for public review between 21 March 1997 and 7 April 1997.

Further details on the proposal are given in Section 2 of the report. Section 3 discusses environmental factors relevant to the proposal.

Conditions and procedures to which the proposal should be subject if the Minister determines that it may be implemented are set out in Section 4. Section 5 presents the EPA's recommendations to the Minister.

Appendix 1 provides maps relevant to the proposal. A list of organisations that made submissions is included in Appendix 2 and published information is listed in Appendix 3.

2. The Proposal

The proposal for a staged development of a 120 hectare prawn farm is detailed in the CER. A location map showing the proposed project area is shown in Figure 1 in Appendix 1. The area has been identified in the Gascoyne Coast Regional Strategy (MfP, 1996) and the Gascoyne Aquaculture Development Plan (FDWA & GDC, 1996) as suitable for aquaculture. A summary of the key proposal characteristics are outlined in Table 1 and the layout plan is shown in Figure 2.

Table 1 Summary of the proposal and material from fact sheet (Bowman Bishaw Gorham, 1997)

Proposal aspect	Description
Total grow-out pond area (Stage 1 - Stage 4)	120 ha (20 ponds - 120 ponds)
Species farmed: • Tiger Prawns (Primary) • Western Rock Oysters (Secondary) • Brine shrimp (Feed source)	 *Penaeus monodon*, 1000 tonnes/yr *Saccostrea commercialis*, 4 million/yr *Artemia*, as required
Seawater intake	Buried pipeline to a holding pond and reservoir (Stg1, 45 ML/d - Stg4, 224 ML/d)
Pelletised feed requirements	1900 tonnes/yr
Water discharge system	Two purification ponds: • settling basin to remove suspended solids, • biological filter with oysters
Discharge channel	From settling ponds to upper tidal limit of Wapet Creek
Wastewater discharge rate	224 ML/day

Proposal aspect (cont'd)	Description (cont'd)
Wastewater quality (Stage 1) • Nutrient concentrations in Wapet Creek • Total suspended solids • Chlorophyll-a	 Within 10% of ambient levels outside immediate vicinity of discharge Within 10% of ambient levels outside immediate vicinity of discharge No significant change in DO or light attenuation in Wapet Creek
Buildings	Hatchery, processing works, workshop, power generation (12 x 250 KVA)
Freshwater	Desalination plant (4000 L/d), brine discharge to wastewater treatment system
On-site fuel storage	100 000 L diesel in bunded storage above storm surge line
Chemical storage	Chemical storage will comply with relevant regulatory authorities
Access road	Upgrade of the access road is to the requirements of Main Roads WA and the pastoral lease holder
Area of disturbance (approx.)	250 ha
Monitoring	Wastewater, Wapet Creek (water and physical), groundwater, mangroves, disease, and revegetation

3. Environmental Factors

3.1 Relevant Environmental Factors

In the EPA's opinion, based on the submissions and material listed in Appendices 2 and 3, the following are the factors relevant to the proposal:

(a) mangroves;

(b) dunes;

(c) groundwater quality;

(d) marine water quality;

(e) solid waste disposal; and

(f) disease.

These relevant factors are discussed in the following Sections 3.2 to 3.7 of this report.

3.2 Mangroves

Aspects of mangroves

Mangroves are a relevant environmental factor because they provide shelter for other parts of the food web, provide habitat for other primary producers, assist in coastal protection, nutrient recycling and sediment stabilisation (Dierberg and Kiattisimkul, 1996; EPA "Draft Policy on the Protection of Arid Zone Mangroves, Pilbara", 1996).

The extent of mangrove distribution along Wapet Creek can be seen in Figure 3, Appendix 1. There are no mangroves to be directly affected by this proposal. However, mangroves line the tidal extent of Wapet Creek where the wastewater discharge is proposed to be directed. Mangroves could be impacted by the discharge of wastewater through changes to either hydrology or water quality of the creek.

The mangroves of Wapet Creek are described as a thin seaward (tidally inundated) zone of *Avicennia marina* woodland backed by low *A. marina* shrubland and is one of four mangals (small mangrove forests) identified in Exmouth Gulf (Johnstone, 1990).

Although the area is not pristine, the mangroves of Wapet Creek appear to be in good condition with the exception of bordering mangroves in front of cleared land associated with Learmonth Airport (Walker, D.- Bowman Bishaw Gorham, *pers. comm.*).

Assessment

The area considered for assessment of this relevant environmental factor is Wapet Creek and the surrounding mangrove habitat.

The EPA's regional objective for mangroves is to "maintain the abundance, diversity, geographic distribution and productivity of mangrove ecosystems". The local objective for Wapet Creek is to "avoid the loss of mangroves and their dependent habitats".

The objectives are consistent with the EPA's strategy for protection of arid zone mangroves as outlined in the draft policy document (EPA draft, 1996). The objective of the draft policy document is to outline the EPA's position on arid zone mangroves with a focus on protection in the context of ecologically sustainable development. This proposal is consistent with the requirements of protection for mangroves in Area B, "Areas of high mangrove protection" (EPA draft, 1996).

The discharge of wastewater to Wapet Creek will only occur during ebb tides. This is unlikely to increase the level of Wapet Creek above the natural tidal fluctuations within the creek. However an Adaptive Mangrove Monitoring and Management Program will be implemented prior to construction of the project to ensure no adverse effects are detected. The creek is already scoured down to bedrock through natural processes and hence the potential effects of erosion from discharge to the creek are unlikely to be significant.

Arid zone mangroves have shown to have an annual uptake of nitrogen and phosphorous of 250 kg/ha and 20 kg/ha respectively (EPA draft, 1996). This would equate to an annual uptake in Wapet Creek of approximately 3125 kg of nitrogen and 250 kg of phosphorous. Based on the average flow rate at maximum production, the nitrogen concentration in Wapet Creek that can be taken up by the mangroves is approximately 40 micrograms per litre of nitrogen and 3 micrograms per litre of phosphorous. Both values are within the indicative concentrations for estuaries and embayments identified in Bulletin 711 (EPA "Western Australian Water Quality Guidelines for Fresh and Marine Waters", 1993).

Clough et al. (1983) have shown that mangroves can be used as final treatment areas for sewage discharge, and at least one shrimp farm in Belize, Central America pass nutrient rich water through mangrove areas as a filter prior to discharge to the Caribbean (White, 1997). Dierberg and Kiattisimkul (1996) recommend the integration of shrimp farming areas within mangrove zones to help process nutrients and solids. This suggests that some mangrove systems can withstand exposure to high nutrient concentrations.

The EPA considers that if the proposal is implemented the extent and health of the mangrove system in Wapet Creek should be monitored and a contingency plan established identifying remedial actions if unacceptable impacts are determined. This view has been recognised by the proponent, and is to be included in an Adaptive Mangrove Management and Monitoring

Program. It should be noted that some dead mangroves have been recorded adjacent to the Learmonth airport. This is presumably caused by the airport construction and run-off effects.

The EPA notes that the details of the proposed Adaptive Mangrove Management and Monitoring Program are yet to be finalised. However, the objectives of the monitoring program, as outlined in the proponent's response to public submissions, and the contingency plan of directing discharge away from Wapet Creek and/or recycling of effluent if unacceptable impacts are detected is in accord with EPA objectives.

A Works Approval will be required from the DEP prior to construction of each successive stage of the project and the contaminant concentration in discharge waters from the facility will be regulated through a DEP licence as set out under the provisions of Part V of the *Environmental Protection Act 1986*.

Having particular regard to:

(a) The discharge only occurring during ebb tides and hence any changes in creek hydrology will be within natural fluctuations;

(b) Wapet Creek is already scoured down to bedrock through natural processes;

(c) the marine water quality of Section 3.5;

(d) Results of previous studies which have demonstrated that some mangrove systems have the capacity to absorb high levels of nutrients (Nedwell, 1974; Boto and Wellington, 1983; 1984);

(e) The commitment to monitoring mangroves in Wapet Creek and the development of contingencies such as possible direct discharge into the ocean rather than Wapet Creek should the EPA objectives for mangroves not be met; and

(f) The project will be a staged development hence any changes will be gradual and the monitoring of mangrove systems may detect early indications of change if unexpected effects arise,

it is the EPA's opinion that its local and regional objectives for mangroves are unlikely to be compromised by the proposal.

3.3 Dunes

Aspects of dunes

Development of this prawn farm has the potential to impact on dunes and foreshore areas through the construction of pipeline trenches and subsequent effects of erosion from wind and water. The seawater intake pipe location is shown in Figure 2.

The dune systems are important for protection against storm surge and wind damage, and to reduce the visual impact of the facility from the Gulf or the foreshore. The beach/dune system is indicated in Figure 1 (adapted from DPUD, 1992).

No declared rare or priority listed flora were found in the project area and all species are described as common in the Exmouth areas and in most coastal regions of the north west of Western Australia.

Assessment

The area considered for assessment of this relevant environmental factor is the dune system that borders the eastern side of the lease boundary.

The EPA's objective is to "maintain the integrity, function and environmental values of the dune system."

A list of the vegetation species in the project area is listed in Appendix D of the CER. The proponent also provided a commitment to rehabilitate disturbed areas and monitor the success of the rehabilitation until the vegetation approaches its pre-construction state. The CER describes the management of the potential effects of wind erosion on the disturbed dune areas.

Having particular regard to:

(a) the small area of dune system that will be directly affected (10 metre wide trench);

(b) the function of the dune system as a visual screen, and to maintain a physical barrier against storm surge and wind damage will be retained;

(c) the fact that the dune vegetation is well represented elsewhere in the region; and

(d) the proponent's commitments in regard to rehabilitation,

it is the EPA's opinion that the impact on the dune system from the project is unlikely to compromise the objectives for dune management in the area.

3.4 Groundwater quality

Aspects of groundwater quality

Groundwater beneath the site could be affected by leakage from the ponds. The main concerns are for salinity and nutrients.

There is unlikely to be stygofauna in the groundwater beneath the site as most stygofauna occupy brackish to saline water (Humphreys, 1994). There are no other groundwater dependent ecosystems which would be affected by the project.

The aquifer at Cape Range is heavily influenced by seawater intrusion for about 5 kilometres inland from the coast (Martin, 1990). When measured, the groundwater was approximately 3 metres beneath the project site. The groundwater beneath the site was found to be saline to hypersaline and flows towards the coast where it discharges to the Gulf.

The proposal has the potential to impact on groundwater through leakage from the prawn farm ponds. There are no existing human users of the saline groundwater at or near the site.

Assessment

The area considered for assessment of this relevant environmental factor is the groundwater immediately beneath the lease site which extends to the coast.

The EPA's objective is "to maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance, are protected consistent with the draft Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711)".

Compaction and permeability studies were conducted on soils at the project site, the results are presented in the CER. Based on these permeability rates the CER states that the maximum

leakage of ponds at full production is 2.3 ML/day over 120 hectares. The EPA notes that this proposal may potentially cause some local mounding of the saline aquifer beneath the site. The leaching of the pond water into the aquifer is unlikely to significantly alter the salinity of the groundwater beneath the site which is already saline to hypersaline. Contingency plans for use of an inert binding agent or lining of ponds if required have been prepared.

The CER states that approximately 87% of nitrogen and 91% of phosphorus are in the sediments of prawn farm ponds rather than in diluted form. The fine silty nature of the clay lining the ponds is expected to reduce the movement of nutrients in suspended sediments into the groundwater. The proponent has committed to monitoring groundwater quality beneath the site and has also prepared a contingency plan which includes lining ponds, if unacceptable groundwater impacts are detected.

With particular regard to:

(a) the permeability of the prawn pond wall and floor material;

(b) the current quality of the groundwater being saline to hypersaline;

(c) the fact that nutrients are bound into sediments in the prawn farm ponds, rather than in diluted water soluble form;

(d) the movement of groundwater towards the coast;

(e) no users of the groundwater in the vicinity of the project;

(f) the groundwater monitoring program to be implemented by the proponent; and

(g) the adoption of contingency plans to line ponds if necessary,

it is the EPA's opinion that the proposed prawn farm is unlikely to compromise the EPA's objective to maintain the existing quality and quantity of groundwater.

3.5 Marine water quality

Aspects of marine water quality

Marine water quality is a relevant environmental factor due to the relatively pristine environment of Exmouth Gulf and the reliance of the marine ecosystem on the continued high quality of marine waters.

The proposal could affect marine water quality by discharge of wastewater into Wapet Creek.

Preliminary background water quality analysis for Wapet Creek are shown in Table 4.1 in the CER. The values for phosphate, nitrate and chlorophyll-a are within the indicative concentration values for estuaries and embayments as stated in the Western Australian Water Quality Guidelines for Fresh and Marine Waters (EPA, 1993).

In the report by the Marine Parks and Reserves Selection Working Group entitled "A Representative Marine Reserve System for Western Australia" (MPRSWG, 1994), it states waters of the Gulf are generally turbid with a tidal range of approximately 3 m.

The near shore waters on the eastern and south-western sides of Exmouth Gulf have been recommended as a Marine Reserve system in the MPRSWG (1994) report. Wapet Creek discharges near the north western tip of the recommended Marine Reserve, see Figure 4. The Department of Conservation and Land Management (CALM), who are responsible for the management of Marine Reserves, are not opposed to this proposal.

Assessment

The area considered for assessment of this relevant environmental factor are the tidal waters and sediment of Wapet Creek and the near shore marine waters at the mouth of Wapet Creek.

The EPA's objective is "to maintain water quality and sediment quality to EPA (1993) standards and to protect environmental values of recreation, aesthetics, aquatic life for human consumption and maintenance of ecosystems in agreed areas".

During Stage 1 the proponent has committed to maintaining the nutrient concentration and total suspended solids outside the immediate vicinity of Wapet Creek within 10% of ambient levels. The level of Chlorophyll-a concentrations will not cause significant light attenuation or changes in dissolved oxygen concentration such that the bioproductivity in Wapet Creek will not be significantly affected. Stage 1 will be used as an intensive data gathering exercise to further determine the efficiency of the water treatment systems. The water quality criteria for Stage 1 are shown in Table 2.

Table 2 Water quality criteria and proponent commitments for Stage 1.

Parameter (all values in ug/L)	Ambient levels	WA water quality guidelines	Proponent commitments
PO_4-P	<20	5 - 15	Within 10% ambient
NO_3-N	<15	10 - 100	Within 10% ambient
Suspended solids	23	10% change in seasonal mean concentration	Within 10% ambient
Chlorophyll-a	0.88	-	No significant change in DO or bioproductivity

As the majority of nutrients from prawn farms are bound to sediments, the removal of solids through the settling ponds and nutrients through the biological filtration system will significantly reduce the nutrient concentrations in the discharge water. The nutrient levels can be further managed through appropriate feeding and hygiene procedures, ie not over feeding and removal of sediments during pond 'fallow' periods.

In assessing the proposal the EPA recognises the lack of research that has been undertaken in the response of tidal creeks in the Exmouth Gulf region to nutrient input. The periodic flush of nutrients into the Gulf following storm events would suggest the area is adapted to large but infrequent doses of nutrients. As mentioned in Section 3.2, arid zone mangroves have shown to have an annual uptake of nitrogen and phosphorous of 250 kg/ha and 20 kg/ha respectively (EPA draft, 1996). Other research has shown that some mangrove systems are tolerant of far higher nutrient concentrations (Boto and Wellington, 1983; 1984; Clough et al., 1983; Dierberg and Kiattisimkul, 1996; Nedwell, 1974).

The monitoring of background water quality, pollutant concentration in discharge water, and effect on mangrove systems as proposed by the proponent will allow a more accurate determination of the acceptable discharge levels to the receiving environment prior to the implementation of each successive stage. A Water Quality Management and Monitoring Plan (WQMMP) will be prepared by the proponent (Commitment 4). A schematic representation of the main monitoring parameters is presented in Figure 14 of the CER. A Works Approval will be required from the DEP prior to construction of each successive stage of the project and the contaminant concentration in discharge waters from the facility will be regulated through a DEP licence as set out under the provisions of Part V of the *Environmental Protection Act 1986*.

Having particular regard to:

(a) the commitments made by the proponent in relation to water quality for Stage 1 and the intensive data gathering that will occur prior to further development of stages;

(b) the staged development of the proposal;

(c) the monitoring requirements of each stage and the regulatory controls that can be applied through Part V of the *Environmental Protection Act 1986*; and

(d) the preliminary information regarding the ability of the receiving environment to accommodate additional nutrient inputs,

it is the EPA's opinion that the proposed prawn farm can be managed so that the water quality standards (EPA, 1993) and environmental quality objectives can be met and hence the EPA's objective is unlikely to be compromised.

3.6 Solid Waste Disposal

Aspects of solids disposal

The disposal of pond solids is a relevant environmental factor due to the large quantity of solids that will require disposal during full production and the potential for impacts on marine and groundwater quality.

The stockpiling of pond solids could potentially contaminate groundwater and surface water after rainfall events and during high winds.

Assessment

The area considered for assessment is the solids disposal area and the environment in the immediate vicinity.

The EPA's objective is to "ensure that wastes are contained and isolated from groundwater and surface surrounds and treatment or collection does not result in long term impacts on the natural environment."

The CER states that approximately 20 - 40 cubic metres of pond sludge will be removed from each pond at the end of harvesting. The solids will be left to dry in the ponds for approximately 3 weeks. When solidified the sediment is moved to the stockpile area and dried for a further 12 to 18 months to allow for breakdown of bacteria. The sediments are then re-used for levelling of pond floors and repairing pond walls if required. The stockpile area, shown in Figure 2, is protected from storm surge and erosion by bunding and topography. All run-off from the stockpile area will be directed to the settling ponds and biological filtration system. Stockpiled sediment will be stabilised if necessary to minimise dust generation. The visual impact of the stockpile from the gulf will be reduced by the 6 - 10 metre sand dunes that run between the beach and the project site. The visual impact from the Exmouth-Minilya Road is not expected to be significant as the road is at least 1.3 km from the site.

A Works Approval and licence will be required from the DEP prior to construction. The disposal of pond solids can be regulated through these conditions as set out in the provisions of Part V of the *Environmental Protection Act 1986.*

Having particular regard to:

(a) stockpile area being protected from storm surge and erosion by bunding and stabilisation;

(b) all overflow drainage from the stockpiled area will be directed through the water treatment system;

(c) visual screening from dunes; and

(d) regulatory processes available under Part V of the *Environmental Protection Act 1986*

it is the EPA's opinion that its objective of protection of groundwater and surface surrounds and the prevention of long term impacts are unlikely to be compromised by the proposal.

3.7 Disease

Aspects of disease

Disease is a relevant environmental factor due to its potential to impact on wild stocks of prawns and pearl oysters.

Severe bacterial and viral infections in prawns are known to be directly related to water quality (Dierberg and Kiattisimkul, 1996). The wild stocks of prawns in Western Australia have been largely unaffected by large scale viral or bacterial disease outbreak. Prawn farming in Australia has remained relatively free of viral disease (Amalfi, 1997). However the outbreak of disease in Thai prawn farms shows that the potential for outbreak of endemic viral or bacterial disease in poorly managed farms is significant.

The CER states that the potential for outbreak of exotic disease is remote due to the treatment and quarantine of prawn feed and the use of endemic prawn and oyster species for stock only.

The potential impact of disease on the wild prawn and oyster stocks were raised as a concern in public submissions.

Prawn disease occurs naturally in the wild. However the low prawn density in the wild means that transmission through the population is restricted or very slow. In artificially densely populated prawn farms, the stocking density can amplify disease within the ponds.

Assessment

The area considered for assessment of this relevant environmental factor are the waters of Wapet Creek and the near shore marine waters at the mouth of Wapet Creek.

The EPA's objective is "to ensure the risk of disease amplification and distribution in the natural environment is kept as low as possible and meets acceptable standards so existing and potential uses, including ecosystem maintenance, are protected."

The EPA in assessing the potential risk of disease outbreak recognises the expertise, resources and control available to FDWA and Agriculture Western Australia (AgWA) in detecting, minimising and controlling the risk of disease outbreak. The proponent has committed to developing a disease contingency plan to the requirements of the EPA in consultation with FDWA and AgWA, and advice from the DEP. There are also statutory requirements imposed by these agencies which define the regulations for notification and/or quarantine on either the presence or suspicion of gazetted notifiable diseases. As part of the FDWA aquaculture licence conditions, the proponent is required to prepare a disease contingency plan and comply with disease testing and hygiene protocols. In assessing the risk of disease, the EPA recognises the link between water quality, pond management and disease outbreak. The EPA further recognises that the highest risk of disease outbreak is from amplification of local endemic viral or bacterial pathogens.

The EPA also notes the quarantine procedures required by the Australian Quarantine Inspection Service (AQIS) for the importation of prawn feed and the current review of these regulations.

Having particular regard to:

(a) the proponent's commitment to develop a disease contingency plan to the requirements of the EPA in consultation with FDWA and AgWA, and advice from the DEP;

(b) the requirement that all prawn stock will be sourced locally from the region;

(c) prawn feed will be subject to AQIS regulations regarding quarantine;

(d) any disease outbreak is likely to be from virus or bacteria endemic to the region; and

(e) the physical set-up of the hatchery and the monitoring program of the ponds and hatchery,

it is the EPA's opinion that the operation of this prawn farm is unlikely to compromise the EPA's objective in ensuring the risk of disease amplification and distribution meets acceptable standards.

4. Conditions and Procedures

In the EPA's opinion, the proposal should be subject to the following conditions and procedures if implemented.

4.1 Proponent's Commitments

The proponent's commitments made in the CER and Addendum (Bowman Bishaw Gorham, 1997) and summarised in Table 3, should be made enforceable conditions.

4.2 Environmental Management Plan

(i) The proponent should be required to implement an Environmental Management Plan (EMP) which incorporates the requirements of the "Environmental Code of Practice for Australian Prawn Farmers" shown in Appendix E of the CER and the details of the Water Quality Monitoring and Management Plan, groundwater, mangrove and rehabilitation monitoring referred to in the proponent's commitments.

(ii) the proponent should be required to report on progress and performance of the EMP annually to the EPA for at least the first 5 years. To be reviewed after 5 years.

4.3 Environmental Management System

The proponent should be required to prepare and implement an EMP and environmental management procedures in order to implement the proposal and manage the relevant environmental factors to ensure the EPA's objectives (Section 3) are met. The plan should adopt quality assurance principles (such as those adopted in the Australian Standards ISO 9000) series and environmental management principles (such as those adopted in the voluntary Australian Standards ISO 14000 (Int):1995 series), with appropriate monitoring and auditing to ensure compliance with this condition.

4.4 Procedure

The proponent will be required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

5. Recommendations

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and Environmental Protection Authority's objectives set for each factor (Section 3).

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures (Section 4), including the proponent's environmental management commitments, the proposal can be managed to meet the EPA's objectives.

Recommendation 3

That the Minister for the Environment imposes conditions and procedures set out in Section 4 of this report. The implementation of the Minister's conditions and procedures are to be audited by the Department of Environmental Protection.

Table 3. Summary of Environmental Protection Authority recommendations

Relevant Factor	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Mangroves	Regional Objective: Maintain the abundance, diversity, geographic distribution and productivity of mangrove ecosystems. Local Objective: Avoid the loss of mangroves and their dependent habitats.	Discharge will be via a discharge channel to the upper tidal reaches of Wapet Creek. Average discharge at maximum production will be 9.3 ML/hr potentially impacting on creek hydrology and water quality.	(1) No mangroves will be cleared for the construction of the discharge channel. This will be confirmed to the requirements of the Department of Environmental Protection (DEP) by photographic monitoring before and after construction. (3) The Proponent will prepare a Mangrove Management and Monitoring Plan to monitor and manage the physical characteristics of Wapet Creek and the extent and health of the mangroves in the creek, in order to confirm that the quality and quantity of water discharged from the prawn farm is having no adverse effects on the creek or its mangroves. The Plan will be prepared and implemented under the supervision and co-ordination of the Australian Institute of Marine Science (AIMS) as part of an Australia-wide research project, in association with CSIRO, the Fisheries Research and Development Corporation (FRDC), Australian prawn farms and the Aquaculture Co-operative Research Centre (CRC). The Plan will include contingency actions, including the option of direct ocean discharge, to be implemented should the EPA objectives for mangroves not be met. The Plan will be prepared and implemented to the requirements of the DEP.	Given the nature of the proponent's commitments, the staged development of the proposal, the development of contingency plans if unacceptable impacts are detected, and the monitoring of mangrove systems to detect any changes, the EPA believes impacts can be managed so that both regional and local objectives can be achieved.

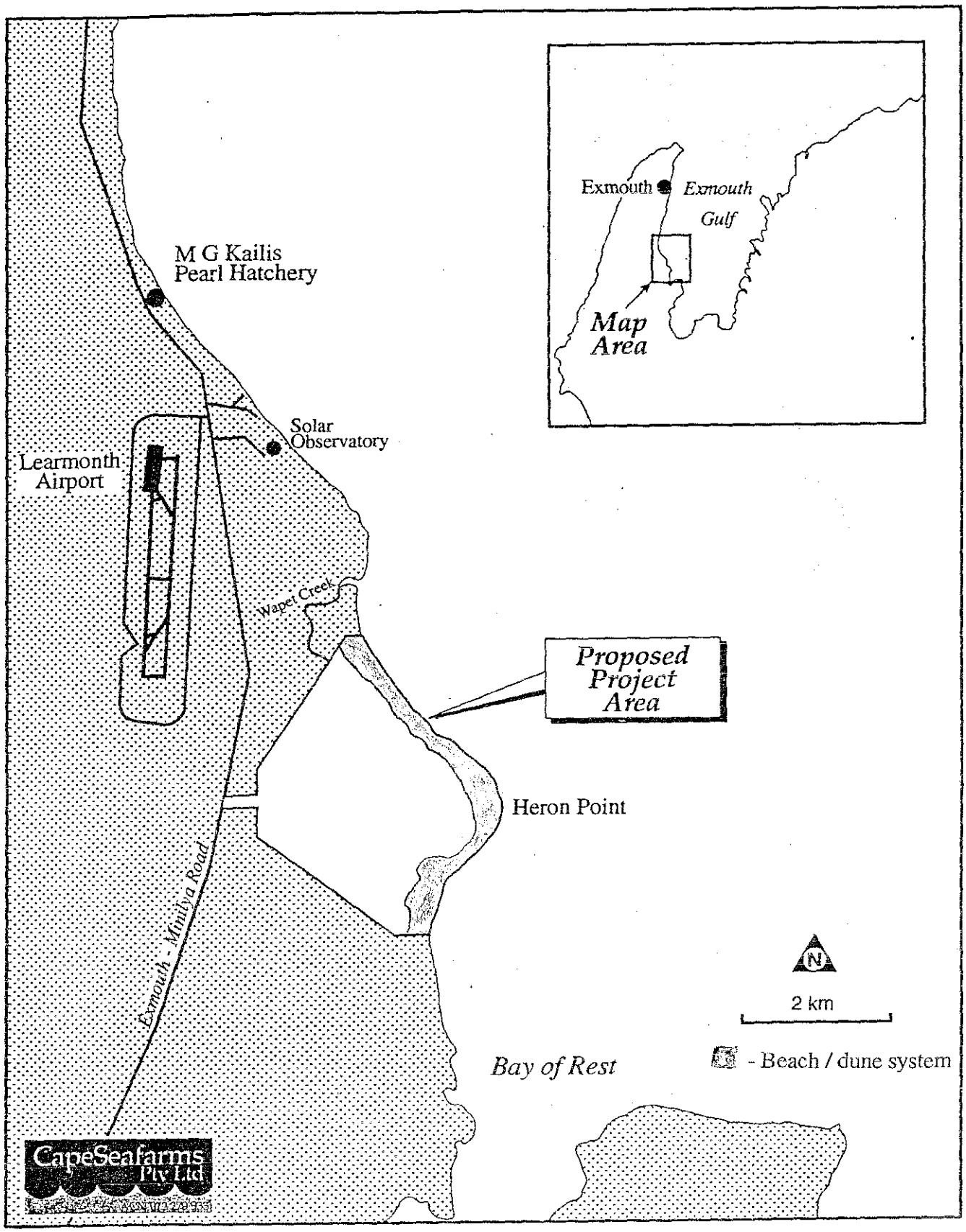
Relevant Factors	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Dunes	Maintain the integrity, function and environmental values of the dune system.	A 10 m wide trench will be dug through the dunes for placement of intake pipes.	(2) The Proponent will prepare a Rehabilitation Plan prior to construction in order to ensure that disturbed areas which are no longer required following construction or at any later stage of the project are protected from erosion and carry a vegetative cover similar to their pre-construction state. The Rehabilitation Plan will include details of rehabilitation methods, species, monitoring of regrowth and success criteria. The Plan will be prepared and implemented to the requirement of the DEP.	Given the commitments by the proponent, the small area of the dune system to be directly impacted and the fact that the vegetation removed is well represented elsewhere in the region, the EPA believes the integrity, function and environmental values of the dune system will not be significantly impacted.

Relevant Factors	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Groundwater quality	Maintain the quality of groundwater so that existing and potential uses, including ecosystem maintenance, are protected consistent with the draft Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711).	Maximum permeability rate through the ponds is 2.3 ML/day.	(4) The Proponent will prepare and implement a Water Quality Management and Monitoring Plan (WQMMP) to monitor and manage the quality of water in the ground beneath the project and in the receiving waters of Wapet Creek and Exmouth Gulf, in order to ensure that water quality-sensitive ecosystems in the Groundwater, Wapet Creek and Exmouth Gulf are protected. The WQMMP will be developed in consultation with AIMS, Aquaculture-CRC and CSIRO and will be integrated with the AIMS/CRC research project E.1: Pond Productivity and Effluent Management being conducted by the CSIRO Division of Fisheries. The WQMMP will be prepared and implemented prior to commissioning to the requirement of the DEP. The water quality criteria for Exmouth Gulf to be achieved during Stage 1 will be those stated on Page 51 of the CER. At the end of Stage 1 and in the light of results from both the Mangrove Management and Monitoring Plan and the completed three-year AIMS/CRC study, these initial criteria will be reviewed and revised as necessary to achieve the objectives of EPA Bulletin 711: Western Australian Water Quality Guidelines for Fresh and Marine Waters.	Given the permeability of the pond wall and floor material, the quality of the groundwater being saline to hypersaline, the movement of groundwater towards the coast, lack of any human users of the groundwater and the monitoring and contingency plans committed to by the proponent, the EPA believes that the groundwater will be maintained consistent with the EPA's objectives.

Relevant Factors	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Marine water quality	To maintain water quality to EPA (1993) standards and to protect environmental values of recreation, aesthetics, aquatic life for human consumption and maintenance of ecosystems in agreed areas.	The discharge water could potentially impact on the mangroves and near-shore marine habitats and species.	(4) The Proponent will prepare and implement a Water Quality Management and Monitoring Plan (WQMMP) to monitor and manage the quality of water in the ground beneath the project and in the receiving waters of Wapet Creek and Exmouth Gulf, in order to ensure that water quality-sensitive ecosystems in the Groundwater, Wapet Creek and Exmouth Gulf are protected. The WQMMP will be developed in consultation with AIMS, Aquaculture-CRC and CSIRO and will be integrated with the AIMS/CRC research project E.1: Pond Productivity and Effluent Management being conducted by the CSIRO Division of Fisheries. The WQMMP will be prepared and implemented prior to commissioning to the requirement of the DEP. The water quality criteria for Exmouth Gulf to be achieved during Stage 1 will be those stated on Page 51 of the CER. At the end of Stage 1 and in the light of results from both the Mangrove Management and Monitoring Plan and the completed three-year AIMS/CRC study, these initial criteria will be reviewed and revised as necessary to achieve the objectives of EPA Bulletin 711: Western Australian Water Quality Guidelines for Fresh and Marine Waters.	Given the commitments by the proponent, the design of the proposal, the staged development of the porposal, the monitoring work to be undertaken by the propnent, and the regulatory controls available under Part V of the *Environmental Protection Act, 1986*, the EPA believes the environmental values identified for Wapet Creek and the nearshore area will be maintained.

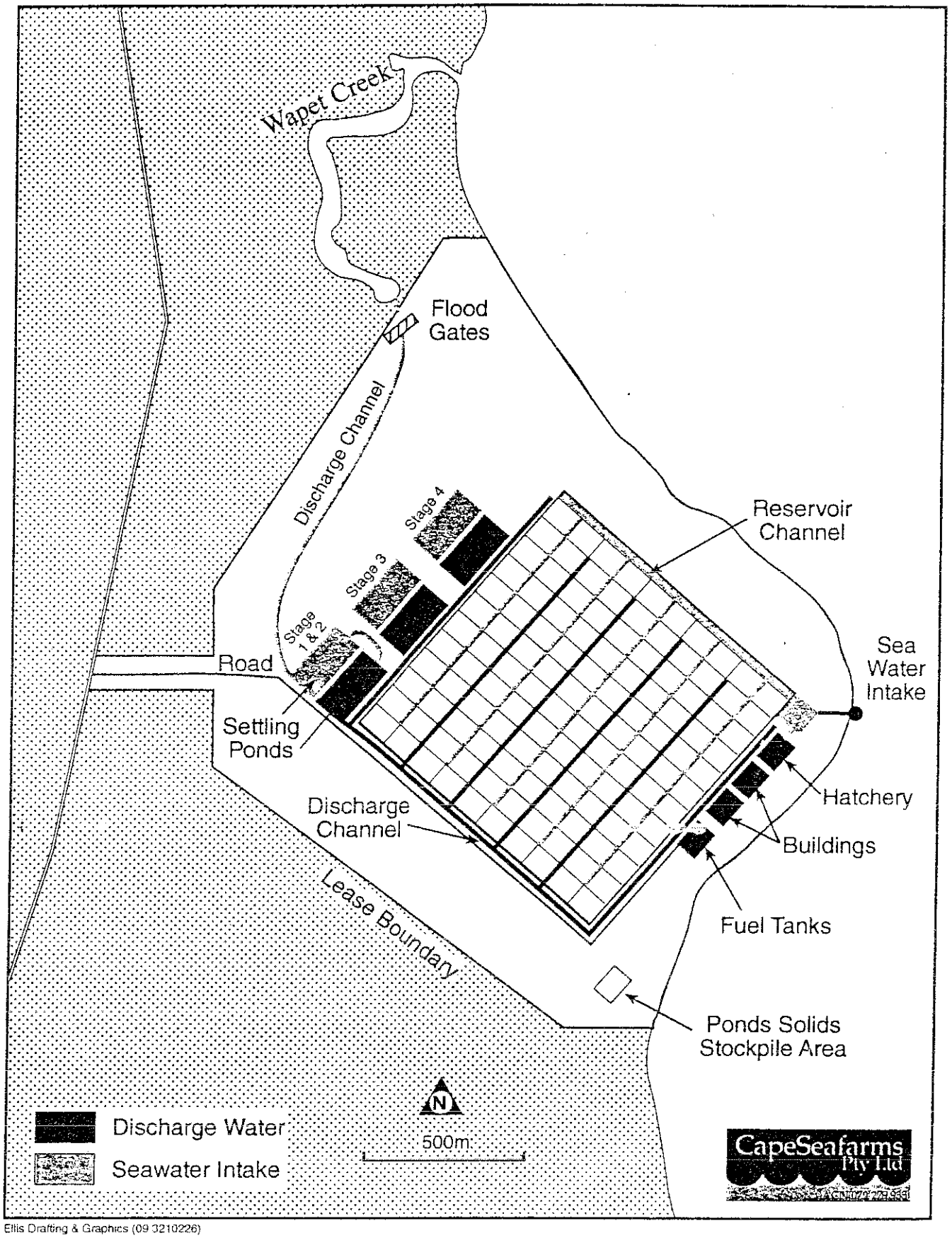
Relevant Factors	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Solid waste disposal	Ensure that wastes are contained and isolated from groundwater and surface surrounds and treatment or collection does not result in long term impacts on the natural environment.	Stockpile area and immediate surrounds	(8) The Proponent will include protection against storm surge, cyclones, flooding and erosion in all phases of the project from planning to operation, in order to prevent storm-caused release of sediment, fuels or chemicals to the environment. 8.1 All pond walls, drainage structures and other earthen surfaces within the farm will be designed, constructed and stabilised to minimise erosion and runoff generation in accordance with the draft Environmental Code of Practice for Australian Prawn Farmers. 8.2 All buildings will be built to Force 1 cyclone specifications to withstand cyclone damage. 8.3 The diesel fuel storage facility will be sited on high ground so as to minimise its exposure to storm surge. The facility will be constructed to Department of Minerals and Energy (DME) requirements to withstand cyclonic winds and flooding. 8.4 All disturbed earthen surfaces associated with the project will be drained to the settling ponds via the site drainage system to minimise sediment exports. 8.5 Workshop drainage that is susceptible to hydrocarbon contamination (oil, grease, solvents) will be routed through oil interceptors. Compliance with each element of this Commitment will be demonstrated to the DEP before commissioning of the project.	Given the commitments by the proponent and the regulatory processes available through Part V of the *Environmental Protection Acvt 1986,* the EPA believes that the area surrounding the site will be maintained consistent with the EPA's objectives.

Relevant Factors	Environmental Objective	Proposal Characteristics	Proponents Commitments	EPA Opinion
Disease	To ensure the risk of disease amplification and distribution in the natural environment meets acceptable standards so existing and potential uses, including ecosystem maintenance, are protected.	Hatchery and pond operation and feed importation.	(7) The Proponent will prepare and implement a Disease Contingency Plan that will minimise the risk of disease being imported into or escaping from the prawn farm, in order to prevent the transmission of diseases to wild populations. 7.1 The Proponent will maintain strict compliance with Australian quarantine regulations and licences in the importation of all feeds and other materials for the prawn farm. 7.2 The Proponent will maintain hygiene standards which meet or improve upon industry Best Practice as set out in the draft Environmental Code of Practice for Australian Prawn Farmers and applicable licences, and will continue to implement industry Best Practice as it evolves. The Disease Contingency Plan will meet the standards of the national Disease Contingency Plan (developed by CSIRO Division of Animal Health), will be prepared in consultation with the Department of Agriculture Western Australia and the Fish Health Section of Fisheries Department of WA, and will incorporate all reporting and other requirements of the Stock Diseases Regulations Act. The Disease Contingency Plan will be prepared to the requirement of the DEP prior to commissioning and will be implemented throughout the life of the project.	Given the commitments by the proponent, the regulatory powers of FDWA and AgWA in prevention, detection and management of disease outbreak, and the AQIS regulations for importation of prawn feed, the EPA believes the impacts of disease can be managed so existing and potential uses in the area can be maintained.



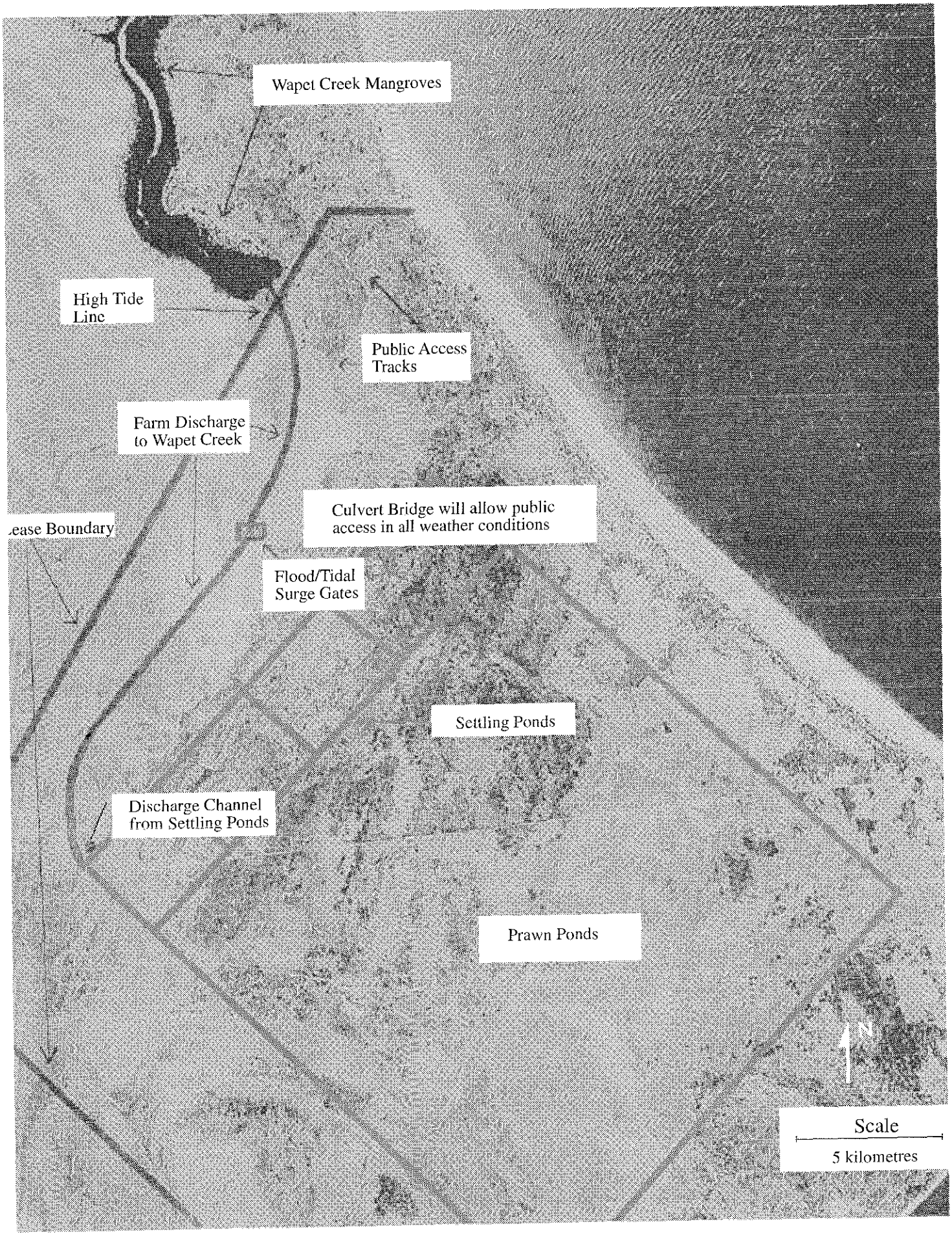
Ellis Drafting & Graphics (09 3210226)

Figure 1. Location map.



Ellis Drafting & Graphics (09 3210226)

Figure 2. Layout plan.



igure 3. Extent of Wapet Creek mangroves.

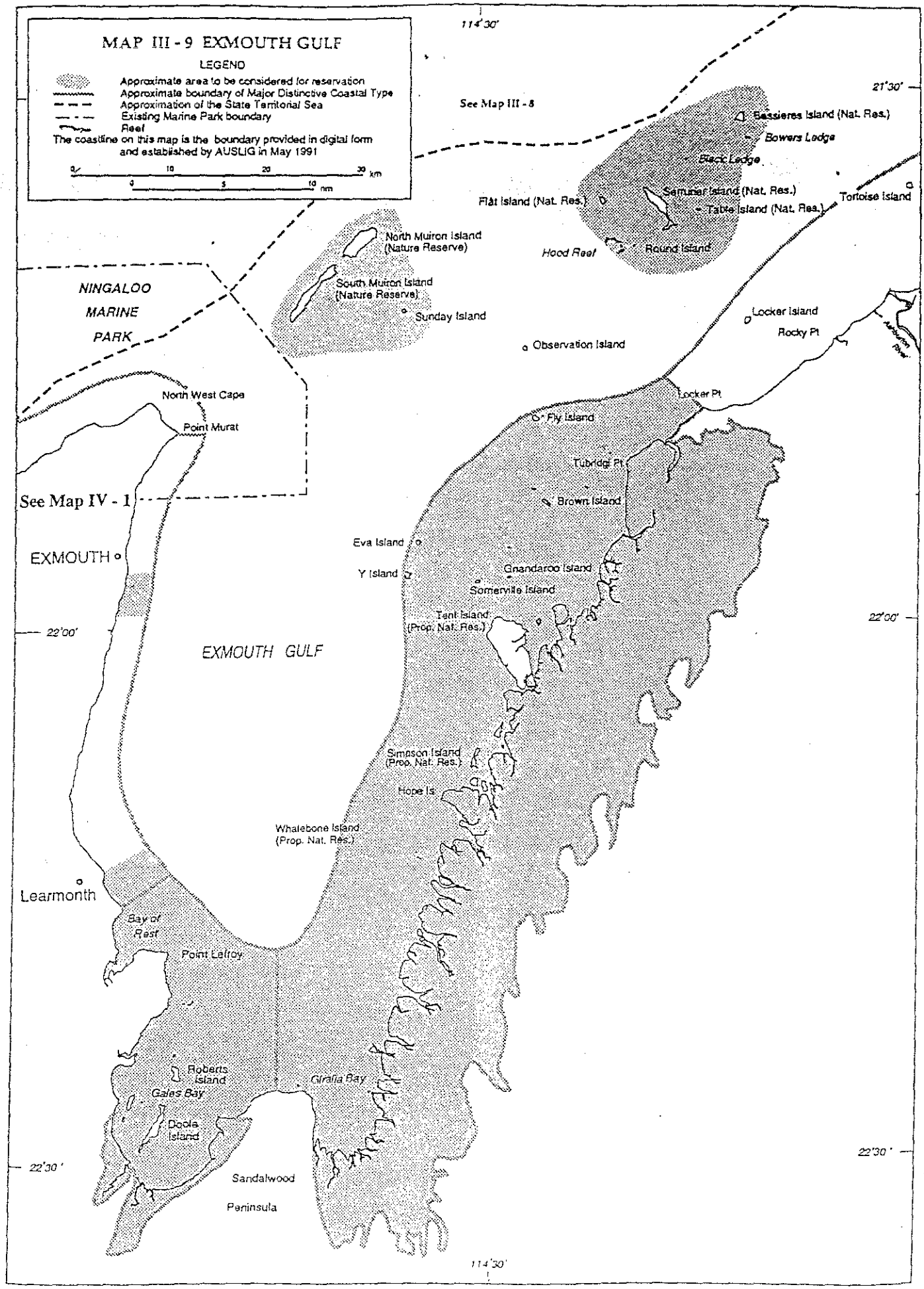


Figure 4. Recommended Marine Reserves for Exmouth Gulf.

Appendix 2

List of submitters

State and local government agencies

Fisheries Department of Western Australia

Fisheries Department of Western Australia, Inter-Departmental Committee for Aquaculture

Water and Rivers Commission

Organisations

Cape Conservation Group

Conservation Council

M.G.Kailis Exports Pty. Ltd.

Appendix 3

References

Amalfi, C. (1997) Viral disease threaten prawns. In *The West Australian*, March 14 1997, Perth, pp.44.

Boto, K.G and Wellington, J.T. (1983) Nitrogen and phosphorous nutritional status of a northern Australian mangrove forest. Marine Ecology Progress Series II, 63 - 69. In *Mangrove Ecosystems of Asia and the Pacific, status, exploitation and management.* (Field, C.D and Dartnall, A.J. Eds.). Australian Institute of Marine Science, Townsville.

Boto, K.G and Wellington, J.T. (1984) Soil characteristics and nutrient status in a northern Australian mangrove forest. *Estuaries* 7, 61 - 69. In *Mangrove Ecosystems of Asia and the Pacific, status, exploitation and management.* (Field, C.D and Dartnall, A.J. Eds.). Australian Institute of Marine Science, Townsville.

Bowman Bishaw Gorham (1997) *Consultative Environmental Review Exmouth Prawn Farm.* Bowman Bishaw Gorham, Perth.

Clough, B.F., Boto, K.G. and Attiwill, P.M. (1983) Mangroves and sewage - a re-evaluation. In *Tasks for vegetation science 8.* (Teas, H.J.Ed.). Dr W. Junk Publication, The Hague. pp. 151 - 161.

Department of Planning and Urban Development (1992) *Exmouth Coastal Strategy*, Department of Planning and Urban Development, Perth.

Dierberg, F.E. and Kiattisimkul, W. (1996) Issues, Impacts and Implications of Shrimp Aquaculture in Thailand. In *Environmental Management, Vol. 20, No. 5*, Springer-Verlag, New York, pp.649 - 666.

Environmental Protection Authority (1993) *Western Australian Water Quality Guidelines for Fresh and Marine Waters*, Bulletin 711. EPA. Perth.

Environmental Protection Authority (1996) *Protection of Arid Zone Mangroves: Draft Policy.* EPA. Perth.

Fisheries Department of Western Australia & Gascoyne Development Commission (1996) *Gascoyne Aquaculture Development Plan*, Fisheries Department of Western Australia, Perth.

Humphreys, W.F. (1994) *The Subterranean Fauna of the Cape Range Coastal Plain, Northwestern Australia*, Report to the Australian Heritage Commission and the Western Australian Heritage Commission, Western Australian Museum, pp. 202.

Johnstone, R.E. (1990) *Records of the Western Australian Museum, supplement no. 32: mangroves and mangrove birds of Western Australia.* Western Australian Museum. Perth.

Marine Parks and Reserves Selection Working Group (1994) *A Representative Marine Reserve System for Western Australia.* Department of Conservation and Land Management, Perth.

Martin, M.W. (1990) *Exmouth Town Water Supply Investigation Report and Recommendations for Future Work.* Hydrology Report No. 1990/36. West. Aust. Geol. Surv. Perth Unpubl.

Ministry for Planning (1996) *Gascoyne Coast Regional Strategy*, Western Australian Planning Commission, Perth.

White, B. (1997) *Bluewater Aquaculture*. Internet address http://www.bwaqua.com.