Mandurah Quay, Peel Inlet, Mandurah

Forx Pty Ltd

Report and recommendations of the
Environmental Protection Authority

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1. Proposal

The proposal consists of a boat haven with mooring facilities for up to 175 boats, a public boat landing, a launching ramp, refuelling and sullage pump-out facilities, a village centre, and tourist and residential accommodation. It is located on 36 ha of privately owned land situated adjacent to the Sticks Channel, Peel Inlet, in the town of Mandurah (see Figure 1). The land is zoned Tourist under the Mandurah Town Planning Scheme 1A, Amendment No 45.

2. Background

Several similar development concepts have been proposed, the first originating in 1984 with the Halls Head Development Plan. These proposals have been the subject of discussion with officers of the Authority, the Peel Inlet Management Authority, the Department of Planning and Urban Development, and the City of Mandurah.

The Authority has previously provided advice on the rezoning in 1986, specifically requesting 50 m wide foreshore reserves. Although Parry Corporation by virtue of the rezoning gained a considerable increase in the value of the land, provision was made for 30 m wide foreshore reserves, because as a condition of rezoning, two important wetlands, the Chimney Spit wetland and the major part of the Sticks wetlands were ceded to the Crown as reserves for Conservation. The reserves are as yet unvested.

In 1988 a subdivision proposal was referred to the Authority by the Department of Planning and Urban Development, with development in concept form including a residential area, and a small boat haven. The Authority assessed the proposal at an informal level, and provided advice on the width and vesting of the proposed foreshore reserve, management of the foreshore, stormwater drainage, the extent of public open space, and dust associated with construction.

Following changes to the original proposal, including proposed private housing adjacent to the waterfront, a proposed reduction in lot numbers from 1000 to 600, proposed major boat storage and commercial ferry and house boat berthing facilities, limited public access to the foreshore reserve, and a proposed large car park in the foreshore reserve area, the level of assessment for the new Mandurah Quay proposal was set as a Consultative Environmental Review (CER). The CER had a public review of four weeks closing 21 September 1990. During this period six government agency and public submissions were received, covering the following major environmental issues:

- wetland conservation and management, including mosquitoes;
- design, extent and management of the foreshore reserves;
- ground and estuarine water quality and nutrient management;
- design and management of the proposed boat haven and the inlet channel; and
- impact of the Estuary on the development.

3. The receiving environment

Regionally, the land lies within the Peel-Harvey Estuarine system, situated on the Swan Coastal Plain. Locally, the project site overlies Spearwood sands, elevated to between 1.5 and 2 m above Australian Height Datum, with the Chimney Spit tidal wetland to the east of the site, and the Sticks wetlands to the west of the proposed development. To the south, the site adjoins the Sticks Channel, a tidal channel through which the Peel Inlet flushes, via the Mandurah Channel, to the ocean. The hinterland meets the estuary at a steep cliff shore of up to 2 m in height, which lies behind a narrow beach.

The vegetation on site consists of Marri/Tuart with a cleared understorey. The ground cover consists of introduced pasture grasses. The eastern sector of the Sticks wetland upon which the development will encroach is mainly a series of recurved spits with predominantly samphire and salt-water paperbark vegetation. The Chimney Spit and adjacent lagoon is colonised mainly by samphires.

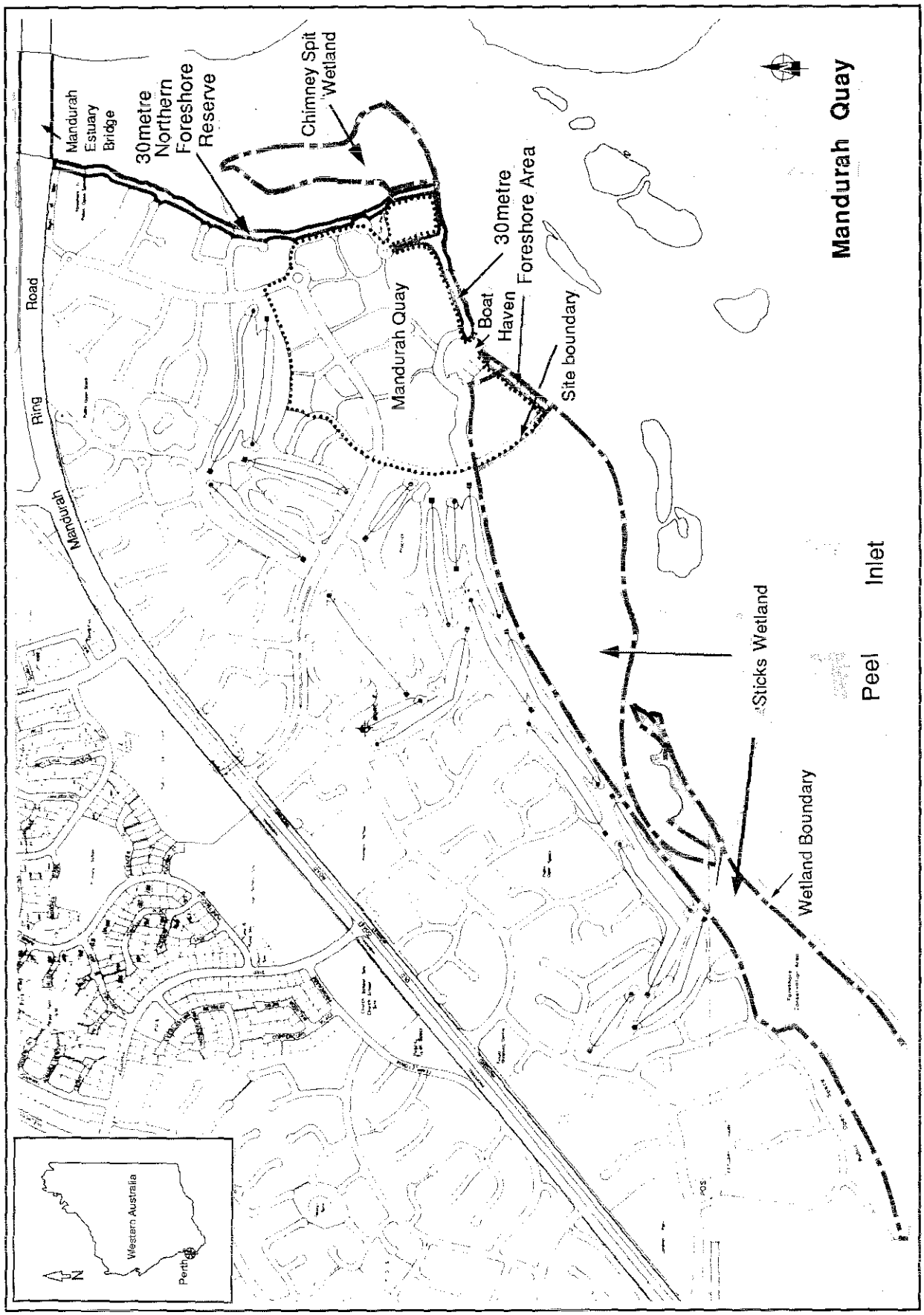

Figure 1: Site of proposed development

The Estuary shows signs of severe eutrophication. The cause of eutrophication is an inflow of nutrients (mainly phosphorus and nitrogen) from the coastal catchment into the Estuary. The nutrient input is currently far in excess of the Estuary's ability to assimilate, and therefore there are large accumulations of algae. This causes a loss of recreation and environmental quality through fouling of the Estuary waters and foreshore, and the development of odours as the algae decomposes.

The Government has taken specific action to improve the condition of the Estuary. Ministerial Conditions were set in January 1989 under Section 45 of the Environmental Protection Act for the Peel-Inlet Harvey Estuary Management Strategy (Stage 2). These conditions imposed constraints on developments in the catchment with the objective of reducing the flow of nutrients into the Estuary to about half their present level. The Strategy includes a commitment to a moratorium on further clearing and drainage in the catchment until the Minister for the Environment is satisfied that these activities would be environmentally acceptable.

The interpretation of this condition has been that a proposal which involves some additional clearing and/or drainage may proceed provided that the proposal incorporates sufficient ameliorative measures to ensure that the overall impact is consistent with the objective of reducing nutrient flows to the Estuary by 50%.

Another condition states that for the present decisions on developments which may release phosphorus and /or nitrogen to the Estuary should be conservative.

4. Environmental issues

4.1. Wetland conservation and management

The Sticks wetland system is composed of three separate sectors, each with its own system of water characteristics and vegetation. It is proposed to use the soil excavated from the boat haven to fill the privately owned portion (approximately 2 ha) of the Sticks wetland in the northern sector, originally described in an earlier report by consultants Le Provost Semeniuk and Chalmer as degraded. This would be a balanced cut to fill operation, designed to avoid the cartage of fill from the site. The so called degraded area is now considered likely to be an example of the natural succession of vegetation, illustrating the change from a salt-water tolerant group of vegetation to an extremely salt-water tolerant group. The whole of the Sticks wetland is now considered to be of very high conservation value, as the system demonstrates a history of landform change, groundwater evolution, and corresponding vegetation changes.

Filling portion of the wetland will result in a direct loss of habitat, through a reduction in wetland surface area, and may cause changes in both groundwater and estuarine recharge of the wetland, and subsequent changes to flora and fauna. Accordingly, the Environmental Protection Authority considers that filling part of the Sticks wetland system is environmentally unacceptable and that the values and functions of the system should be maintained for the land in both public and private ownership.

The Department of Conservation and Land Management, and the Peel Inlet Management Authority have requested an amendment to the proposal in the form of a public accessway between the housing lots and the Sticks wetland, for maintenance purposes. This may result in increased access into the wetland by people and domestic animals. Management of impacts arising as a result of the development are to be addressed in a wetlands management strategy, to be prepared by the vesting authority with the assistance of the developer.

The System 6 C50 area adjacent to the Chimney Spit may be affected by improved road access to the adjacent foreshore area, which could result in an increased number of people using the area. Management of impacts arising as a result of the development will also be addressed in a Management Plan to be prepared by the vesting authority with the assistance of the developer.

Both the Chimney Spit and the Sticks wetland have been identified as major breeding areas for mosquitoes. At present, the City of Mandurah manages the Chimney Spit through applications of

larvicide and digging tidal channels through the area. They have also applied larvicide in the Sticks wetland. However the use of larvicide is not a satisfactory solution as the mosquitoes will probably develop a resistance in the long term. The location of the development will lead to an increased probability of individuals contracting Ross River virus. The further management of mosquitoes is important, and is to be addressed in the Wetlands Management Plan to be developed for each area.

4.2. Ground and estuarine water quality and nutrient management

It is proposed to excavate the boat haven to below ground water table using scrapers. Using this equipment means that dewatering to a depth of -3 m AHD for a period of up to 100 days may be required. A preliminary report from Rockwater Consultants indicated that there would be no significant effect on existing vegetation on the site. It is unlikely that the Chimney Spit wetland would be affected by the dewatering as it is subject to tidal influences. The effects of dewatering on the Sticks wetland are not clearly understood. Detailed hydro-geological studies have not been undertaken, and assessment of impacts has been on the basis of hydrological parameters from elsewhere in the Mandurah Delta. The consultant believes that remedial measures should be undertaken if dewatering affects the wetland.

In assessing this proposal the Authority was aware of the Minister for the Environment's conditions set as a consequence of the Peel-Harvey Estuary Management Strategy (Stage 2). In this regard the Authority has concluded that it is possible for this proposal to meet the Ministerial Conditions, as there has been a reduction in lot numbers, and the development will be deep sewered. In addition all stormwater will be contained on site in a large artificial lake, designed to strip nutrients. The public open space which contains a large stand of salt-water paperbarks will also assist in this function. A nutrient and irrigation management plan is being prepared which will ensure that the control of nutrients is addressed on an ongoing basis. The foreshore management plan of the Environmental Management Programme will also incorporate the nutrient and irrigation management plan's objectives.

4.3. Boat haven design and management

Issues in the public submissions were water quality, potential pollutants, algal control, and public access. The proponents consider that the boat haven will mostly flush fairly rapidly, as it adjoins a tidal deep water channel connected to the Mandurah Channel. There will be no boat work areas so pollutants of this nature will not be a problem. Public access around boat haven has been considerably improved through negotiations with the proponent. Monitoring and control of water quality, algal wrack, and pollutants such as fuel and oil spills and maintenance of the inlet channel are to be addressed in a boat haven monitoring and management section of the Environmental Management Programme.

4.4. Design, extent and management of foreshore reserves

Following negotiations with the Department of Conservation and Land Management, the Department of Planning and Urban Development, the Peel Inlet Management Authority, and the City of Mandurah, the proponent has modified the proposal to incorporate additional public accessways and roads to the foreshore, and two additional public car parks adjacent to the foreshore reserve. Part of the foreshore reserve between the hotel site and the Residential area has been used for an access road to the foreshore.

The submission by Peel Inlet Management Authority sought 50 m wide foreshore reserves. However, the 30 m width of the foreshore reserve and 20 m adjacent to the hotel has been accepted by the Environmental Protection Authority, as these widths had been previously determined by the Minister for Planning.

The question of foreshore erosion control and maintenance, preservation of foreshore vegetation, fire management and algal wrack management to prevent odour will be addressed in the foreshore management section of the Environmental Management Programme.

5. Conclusion

The Authority has identified a number of environmental constraints on the proposal, and also issues requiring further investigation, all of which are to be addressed in the preparation and implementation of an Environmental Management Programme, incorporating nutrient irrigation and management, boat haven monitoring and management, foreshore management, and management of the Chimney Spit and the Sticks wetlands.

Based on its assessment of the proposal and additional information provided by the proponents in response to the public submissions, the Authority recommends as follows:

Recommendation 1

The Environmental Protection Authority has concluded that the proposal to construct a boat haven, a village centre, and tourist and residential accommodation as modified during the process of interaction between the proponent, the Environmental Protection Authority, the public and the government agencies that were consulted, is environmentally acceptable, with the exception of the proposed filling of the Sticks wetland.

In reaching this conclusion, the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as wetland conservation and management, ground and estuarine water quality including nutrient management, boat haven design and management, and foreshore design and management.

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed subject to the proponent's commitments in the CER, as modified in response to the environmental issues raised during the public review period and the Environmental Protection Authority's recommendations.

Recommendation 2

The Environmental Protection Authority recommends that the proposal to fill part of the Sticks wetland is environmentally unacceptable, and that the integrity of the natural cliff face, the spits and cheniers, the nutrient balance, and the groundwater and estuarine recharge system of the wetland must be retained in its existing condition. All construction work should be carried out such that:

1 **wetland vegetation and function is not affected; and**

2 **no animals, firearms, burning or disposal of rubbish or solid or liquid waste be permitted in the wetland during construction.**

Recommendation 3

The Environmental Protection Authority recommends that any dewatering on site shall not affect the vegetation in the foreshore reserves, the trees in designated public open space, or the vegetation and function of the Sticks wetland.

Therefore the duration and quantity of dewatering should be managed to achieve this objective. If adverse effects become apparent, the proponent shall stop de-watering and undertake remedial measures to the satisfaction of the Environmental Protection Authority.

Recommendation 4

The Environmental Protection Authority recommends that prior to commencement of construction, a nutrient irrigation and management plan be prepared as part of the Environmental Management Programme. This Programme should accommodate the objectives of the Ministerial Conditions arising from the Peel Inlet-Harvey Estuary Management Strategy (Stage 2), commitments made by the proponent, and Recommendation 8 of this report.

The management area for the project should include sections of the adjacent Inlet, that in the opinion of the Department of Marine and Harbours and the Peel Inlet Management Authority may be affected by the existence of the project.

The nutrient irrigation and management plan should establish reporting and review mechanisms, and should be prepared prior to the commencement of construction in consultation with the City of Mandurah and the Peel Inlet Management Authority and to the satisfaction of the Environmental Protection Authority.

Should the Environmental Protection Authority determine that nutrients from the development are having any adverse effects on the environment, the Environmental Protection Authority further recommends that the proponent be required to put in place ameliorative measures to the satisfaction of the Environmental Protection Authority.

Recommendation 5

The Environmental Protection Authority recommends that the Chimney Spit and the Sticks Wetland Conservation areas be vested in the Department of Conservation and Land Management or the Peel Inlet Management Authority, to the satisfaction of the Minister for the Environment.

As part of the Environmental Management Programme a wetland management strategy shall be prepared and implemented by the vesting authority or authorities in conjunction with the adjoining land owners. The management strategies are to include control of access, control of feral animals and of mosquitoes, and any other management issue which may arise as a consequence of development.

Recommendation 6

The Environmental Protection Authority recommends that as part of the Environmental Management Programme a foreshore management plan be prepared to meet the following objectives:

1 All indigenous vegetation must be retained on the foreshore reserves;

2 Nutrient management of the foreshores must be consistent with the nutrient and irrigation management programme. The fertiliser application rate for the foreshore shall not exceed a maximum of 15 kg/ha/a of Phosphorus,and 60 kg/ha/a of Nitrogen, and a maximum turf irrigation rate of 5000 kL/ha/a;

3 No construction activities shall be carried out inside the foreshore reserves; and

4 No animals, firearms, burning or disposal of rubbish or solid or liquid waste be permitted on the foreshore during construction.

Recommendation 7

The Environmental Protection Authority recommends that a boat haven monitoring and management plan be prepared as part of the Environmental Management Programme prior to the commencement of operations of the boat haven, to accommodate commitments made by proponent, recommendation 8 of this report,

and in consultation with the City of Mandurah, the Department of Marine and Harbours and the Peel Inlet Management Authority, and to the satisfaction of the Environmental Protection Authority.

Recommendation 8

The Environmental Protection Authority recommends that an Environmental Management Programme be prepared to meet the previous objectives for:

1 wetland conservation and management;

2 estuarine and ground water quality monitoring and nutrient and irrigation management;

3 foreshore management; and

4 boat haven monitoring and management.

The Environmental Management Programme is to be prepared in consultation with the City of Mandurah, the Peel Inlet Management Authority, the Department of Marine and Harbours, the Department of Conservation and Land Management, and to the satisfaction of the Environmental Protection Authority.

Recommendation 9

The Environmental Protection Authority recommends that prior to the commencement of sale of any property a Management Agreement must be signed between the proponent and the ultimate managing authority or authorities on the funding of all the required sections of the Environmental Management Programme after the initial five year period of management by the proponent.

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

The Environmental Protection Authority notes that during the detailed implementation of proposals, it is often necessary or desirable to make minor and non-substantial changes to the designs and specifications which have been examined as part of the Environmental Protection Authority's assessment. The Environmental Protection Authority believes subsequent statutory approvals for this proposal could make provision for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

Appendix 1

Summary of issues

Summary of issues

The following is a summary of the issues and questions raised by submissions to the Authority on the CER for the Marina at Mandurah Quay.

Evaluation of alternatives

The threat that if the marina is not approved the whole site would be utilised for residential use to gain a viable return for the land should be disregarded. The whole project is already designed and intended for high density residential housing estate, with the exception of the relatively small area allocated for the marina-hotel, and the drainage sump. Its potential impact should be seen as such.

Because the land is not viable for a rural holding should not automatically qualify it for residential or tourist zoning. This land has never been suitable for rural use.

Need for the development

If there is such an urgent need for boat harbours in Mandurah, the large marina next to the old traffic bridge is an ideal venue.

No development option

The proponent states that if development is not allowed, uncontrolled access to conservation areas by four wheel drive vehicles will occur leading to further degradation. Ownership of low lying land so close to wetlands described authoritatively as relatively unique in West Australia, implies some degree of responsibility by the owner, both for his own land holdings and the adjacent wetlands.

If four wheel drive vehicles are allowed uncontrolled access through the site, why should failure to proceed with the project mean that public access to the foreshores would be lost?

Zoning

The site was rezoned from Rural to Tourist Zone in 1987. At this time the proposal involved an inland boat haven of 1.4 ha, surmounted by a 20 m wide area for commercial facilities adjacent to the boat haven. The current development plan includes a boat haven of 1.8 ha abutted by attached housing lots. It also includes an artificial lake surrounded by future residential development. The boat haven was not required previously to comply with Department of Planning and Urban Department Canal Guidelines, as it did not involve residential development adjacent to the waterway. It may now be desirable to require the development to comply with the proposed new policy, which requires projects involving artificial waterways and canal estates to be rezoned "Canal Zone".

In addition further details are required about the proposed artificial lake and adjacent residential development to enable the "Canal Zone" issue to be addressed.

The provision for public ownership of the foreshore around the boat haven may avoid the classification of the development as a canal development.

Proposed subdivision

The relationship of the proposed subdivision plan to the staging of the development should be addressed in the CER.

It is premature to approve subdivision of the land fronting the canal and western foreshore, since there is no acceptable structural form and viable management organisation.

The environmental documents introduce new proposals for shoreline development and ownership, including some de-facto private canal frontages to what was previously a wholly public waterfront.

Description of the environment

Greater detail should have been given of the local biota, including species lists.

The review should have critically assessed the conclusions of previous studies associated with this development in the context of the current proposal, and the possible need for further studies to determine environmental viability, with such studies being carried out if necessary.

Wetlands

Each of the three sectors of the wetland is unique in terms of its vegetation and ecological history, and therefore one part cannot and should not be sacrificed for the other. It should be preserved totally, because at present the system preserves a history of landform change, groundwater evolution, and corresponding vegetation association changes. This information is of great importance in the management of this estuarine coastline, because it will provide a model of coastal response to changes in relative sea level due to either Greenhouse effect or to the effects of the Dawesville Cut. This information base has not yet been fully studied.

The wetlands appear to support a rich invertebrate community, and given the significance of the area and the encroachment of fill into it, a study of the community may be warranted. Le Provost, Semeniuk and Chalmer in the 1985 assessment of the area stated that, due to the diverse range of habitats in the area, there are "no peripheral wetlands in the Peel-Harvey system that are comparable". This significance is not fully acknowledged in the review.

Semeniuk & Semeniuk (1990) in their paper on the coastal landforms and peripheral wetlands of the Peel-Harvey system show this area to be unique and significant in the whole estuary.

In 1985 a compromise was proposed that a small section of the north-east sector be developed as a boat haven, in exchange for relinquishing the rest of the wetland complex to the Crown because of its significance. The current plan far exceeds that proposal as a much larger part of the eastern sector is now proposed for development. As a result of additional study of the wetland, together with additional information on estuarine wetlands in the south-west, the Sticks wetland is now seen to be of even greater significance. Therefore the whole wetland must be preserved, and not compromised in any way by development.

Development of the far NE edge of the eastern sector will result in the termination of recharge of estuarine water to this sector of the wetland, possibly causing changes to its maintenance characteristics. The recharge of this sector is from fresh water seepage from the hinterland at its natural boundary. This is approximately the 1.5 contour which runs east-west and is south of the boat haven.

Mosquitoes

Two out of four adjacent breeding sites of mosquitoes are situated east and west of the site on wetlands protected under System 6. The exposure of high density urban development to mosquitoes will inevitably lead to an outcry from residents to spray or fill those wetlands. This and other problems have been left to the appropriate authorities by the proponent.

The implications for mosquitoes breeding in the adjacent wetlands has been given little consideration, despite being identified as being one of the most significant impacts, and an issue of great concern to residents. The issue is dismissed as being the responsibility of the vesting Authority. This position may not be consistent with Government strategy, and consultation is recommended with the Health Department and the Mosquito Control Advisory Committee.

Despite some control mechanisms, severe mosquito problems are likely to occur in this area with an associated disease risk from Ross River virus.

Algae

A build up of algae with its attendant odours will present problems to residents surrounding the marina. The proponent's solutions of manual removal and yearly monitoring is not feasible in the case of micro-algae, and there is no example of such undertakings being kept.

The accumulation of macroalgae and microalgal blooms should be addressed in greater detail. This is likely to have great impact on the habitability within the development, and is acknowledged within the review to be of greatest concern to Mandurah residents.

Specific areas of concern are the channel in front of the planned boat-haven which shows a heavy build-up of algae and silt, with associated anoxic bottom conditions; weed accumulation between the Chimney Spit and the foreshore, and along the foreshore generally; and algal blooms within the boat haven, and on the human environment in general.

Some management measures are proposed, but need to be discussed in greater detail particularly the method of removal and the provision of disposal sites. Regular inspections may be necessary.

Buffer zones

The development is adjacent to System 6 wetlands and also adjacent to the waterways, the channel and the Creery Islands and Creery wetlands, all of which are in System 6 areas. Therefore it is essential that part of the areas be retained as a buffer zone between the housing and conservation areas.

Given the location and density of the development there are concerns about the lack of a buffer between it and the conservation areas. This automatically compromises the environmental integrity of the wetlands.

The invasion of wetland conservation areas by exotic plants or feral animals has not been addressed in the management plan. Types of proposed walling and fencing should be specified for this reason.

Filling of part of site

Encroachment of fill into the wetland to the south-west has the potential to interfere with the natural surface drainage of the conservation area, which has implications for the biota. The further introduction of exotic plants into the conservation areas as a result of this intrusion has not been addressed.

Drainage

Close packed housing on low lying areas will generate heavy outfalls of run-off close to the estuary. EPA Technical Bulletin 33 on North Lake problems is specific on this point. In the long term the marina and the artificial lake could well finish up with a higher eutrophication level than that of the adjacent estuary.

Conservation significance

It would prove impossible with a 30 m foreshore to high density urban development and a 0.5 annual erosion figure to protect important water and bird habitat as required under the Jamba Agreement.

The Marri-Tuart woodland is not the only conservation value in this area. The paperbark (*Melaleuca cuticularis*) ringed lagoon adjacent to the Spit is noted for its range of raptors.

The Peel-Harvey wetlands are now party to the Ramsar Agreement which places them in a world wide category, and have also been recently placed on the Register of the National Estate. This could help in providing State and Federal assistance in protection of bird habitats.

Regional values

The Mandurah Tidal Delta has been considered the most important of the three areas in need of protection for the Peel-Harvey Regional Park, and the Sticks channel and wetlands are a major part of that delta. Existing foreshore reserves with conservational values averaging 250 m, shown from Dorothy Avenue in Novara to the western boundary of Mandurah Quay, should be continued through the study area to the New Estuary Traffic Bridge and the Parry Samphire area, to form the basis of a regional park of world wide importance in terms of wetlands and bird habitats. This would be in tune with the Government's stated concerns to protect wetlands and to reduce nutrients to the estuary.

The present proposal of a marina and high density housing central to areas of such high conservation value is environmentally unsound, and our comments on the Regional Park should be considered as an alternative to the present proposal.

Groundwater

The document does not include the required data on groundwater to make proper assessment, both as a potential resource, and also the effect the actual construction of the above project would have on it.

Waste matter

Sewage outflow or air-conditioner bleed-off must not be allowed to enter the estuary. Emergency back-ups must be provided to cater for system breakdowns.

Artificial lake

Use of a landscaped lake as a sump has serious implications. Eutrophication of the lake is likely to occur, with resultant algal and midge problems. An efficient nutrient sink requires substantial emergent vegetation which may act as mosquito habitat. It may be necessary to remove nutrient-rich sediments from the bottom of the lake periodically.

The use of porous materials to percolate drainage through some surfaces could be investigated, with the aim of minimising pressure to contain run-off.

Overflow drainage details for the lake are required. The overflow outfall from the lake must have litter, oil and silt traps. The quality of potential discharge from the lake must be strictly controlled to prevent the discharge of nutrient enriched water during storm events.

Nutrient budget and management plan

Although the use of low-maintenance vegetation, slow release fertiliser and resident education are planned to minimise nutrient loss, a full nutrient budget and fertiliser management plan should be prepared by the developer. This must demonstrate that the development will not increase the flow of nutrients to the estuary.

Foreshore

The width (30 m or less) of the foreshore is inadequate, because of intensive use by both tourist and residents. Public access to the recreational foreshore is important as this reserve will eventually serve the needs of an intensively populated western foreshore, where there is limited opportunity for such access. An adequate area of recreational reserve and associated infrastructure is also essential in order to manage the pressure on the adjacent conservation areas.

A condition of TPS1A Amendment 45 was that foreshore reserves were to be surveyed from the top of the bank along the edge of the foreshore. The boundary of Lot 10 should be set back 30 m from the top of the bank on its southern side and clearly indicated as such on any revised subdivision plan.

The following modifications to the plan are recommended:

1 Adequate parking must be provided for users of the foreshore adjacent to Lot 6, within the development area.

2 The road between Lots 1 and 2 be relocated to bound the development adjacent to the conservation reserve, through to boundary of the foreshore reserve,and passing through to the accessway around the boat haven.

3 The road between Lots 11 and 12 be relocated to bound the development adjacent to the eastern foreshore.

4 The road bounding Lot 6 to be modified to pass fully through to the foreshore, and to form a continuous road along this section.

On the western lots facing the water, land within 30 m of the High Water Mark is to be elevated up to 2 m, which significantly changes the foreshore slope and stability. Until an acceptable means of stabilising this slope is established, the boundary of developable land should not be established by subdivision.

The small area of reserve to the west of Lot 10 is not usable or accessible except through Lot 10. This could be included in Lot 10 in exchange for the addition of 10 m of extra foreshore reserve around the boundary of Lot 10.

The current 20 m reserve around this lot was conceded in the context of the overall development of the Sticks superlot, with undertakings to provide for appropriate control of public access. The fragmentation of the development represents a new situation where a 20 m width is no longer acceptable.

If the proposed hotel or similar facility is not developed on Lot 10 further foreshore is required to be ceded to give a 50 m reserve to provide an adequate buffer.

Foreshore management

There is no assessment of predicted foreshore use and the resulting intensity of people pressure on the conservation areas. Foreshore management decisions cannot and should not be made without this information. The current subdivision plan is not acceptable with regard to the management of existing foreshore reserve.

The provision of a dual use path, vehicle exclusion, fencing of the development to prevent access during construction, and control of erosion are relevant, but have not been explored in adequate detail.

Detailed erosion and macroalgal accumulation control strategies should be part of a foreshore management plan.

Fire control must be addressed in greater detail. Any fire breaks or emergency access tracks should be within the development area. To minimise fire risk, gas barbecues should be installed on the foreshore.

Public access for the wetland conservation areas from the foreshore reserve should be discouraged. This could be by a 10 m buffer zone between the two reserves, delineated by low barriers and signs identifying the conservation area. Buffer zones should be provided within the development area. The channel constructed between the Chimney Spit is not adequate to isolate the area due to its small cross section and rapid siltation. A fence needs to be constructed as per the Bridgewater Management Plan.

Space for a dual use path along the boundary of the wetland area to the west of the development must be provided within the development area.

A dual-use path raises doubt as to the responsibility for maintenance of the retaining wall, which must be resolved before the concept can be accepted.

A management strategy for minimising impacts on the wetland conservation areas adjoining the development should be developed in consultation with the Department of Conservation and Land Management.

The current draft of the Foreshore Management Plan for this development could not be considered adequate in its scope or detail. Given the sensitivity and regional significance of the area, it should be a detailed working document before development proceeds.

Public access

Provision for public access around the boat haven and to the foreshore is considered inadequate. A minimum of 4 or 5 m wide access around the boat haven is required.

Provision must be made for continuous public access and recreation around the development. The accessway around the boat haven should be a 10 m wide reserve.

The dual use path and barbecue/picnic facilities along the foreshore should be illustrated on the development plan as well as the management plan. Where private lots abut the foreshore, the dual use path may be more appropriately located adjacent to the lot boundaries to clearly define the boundary between private and public land.

The current development plan limits car parking to the proposed hotel site. The plan should be modified to provide road frontage to the foreshore reserve. A public carpark should also be identified in the widened foreshore reserve to the north of the hotel site.

The adequacy of parking is of concern as the Australian Standard nearing completion requires 0.3 parking spaces per wet pen, and 40 car/trailer spaces per launching ramp lane.

Adequate parking must be provided for users of the foreshore adjacent to Lot 6, within the development area.

Lot frontage is proposed adjacent to the Sticks conservation area with retaining walls and a fire break along the boundary. A road may be desirable along this boundary to maximise access for emergency vehicles, provide separation between private lots and the conservation reserve, and to retain the possibility of controlled public access to the foreshore area south of the development site.

Under the proposed Town and Country Halls Head Bicycle Plan pedestrian accessways or public open space links will be required to link the proposed development to adjacent future subdivisions.

Public open space

The development plan should be modified to identify the location of the required 10% Public Open Space contribution for the development site, which excludes waterways and commercial areas.

Boat haven

A commitment should be given that during construction discharge from stilling ponds following dewatering will conform to accepted turbidity standards.

The opening of the boat haven is into what is effectively a back water. Weed and silt will accumulate in the adjacent channel and at the entrance, requiring adequate long and short term management of not only the entrance, but also the approaches in the adjacent channel.

The potential scale of the accumulation of debris including algal wrack in the boat haven and its management is not acknowledged. Nor is the reduction in water quality due to algal blooms addressed in sufficient detail. A commitment to maintain quality is given, but means little without details of the mechanisms and infrastructure required.

The suitability of the sullage and fuel jetty site is of concern.

Working areas must be designed to prevent entry of run-off to the boat haven.

The use of a sullage pump-out facility within the berthing area and its connection to a deep sewerage system is endorsed.

The sullage pump-out facility should be sited to avoid the spillage of effluent. The design and layout must be submitted to PIMA for approval.

The fuelling station should be sited so that any spills are contained within the haven for as long as possible. Fuel lines must be protectively encased and pumps regularly inspected.

The managers should be required to keep an oil-spill boom and associated equipment on-site near the bowser so as to contain spills quickly.

The status of and responsibility for the moorings and pens is unclear, and possibly the State will be expected to take operational responsibility in the future. Until this is clarified in a formal deed or agreement, the boundaries of this space should not be established by subdivision.

Moored boats in danger of sinking should be refloated and removed by the haven manager.

Fishing

The taking of mussels within the haven should be banned and signs to this effect erected, as they are likely to accumulate significant levels of contaminants and toxic blue-green algae.

Fish cleaning by recreational fishermen needs to be controlled, and special areas provided for this purpose.

Monitoring programmes

Modifications to the monitoring programmes are recommended as follows:

1. Water quality

a Monitoring of water quality should take place monthly for the first 13 months (instead of 12) then quarterly for four years. Sampling times over these four years should be staggered by one month each year, in order that sampling occurs at least once in each month.

b The suggested parameters should be sampled at the surface and at 0.1 m from the bottom. Dissolved oxygen, salinity and temperature should be sampled at 0.1 m intervals from 0.1 m above the bottom to the surface. Monitoring should also include phaeophytin levels and total surface hydrocarbons.

c Monitoring should occur weekly for the duration of intense Nodularia and other phytoplankton blooms.

d Bacteriological monitoring adjacent to the sullage pump-out facility should be included in the monitoring programme. The commitment to maintain water quality with the haven should be accompanied by a suitable standard for human immersion from the Health Department.

2. Sediments

Sediment sampling should be carried out in April/May and in October of each year. It should also include iron levels, sediment wet to dry ratios and organic loss-on-ignition. Traps should be placed to monitor sediment accumulation at each site, and their location determined on consultation with PIMA.

3. Biota

Mussels growing in the haven should be sampled for metal, bacterial and toxic algae accumulation.

4. Structures

The structural quality of the boat haven should be monitored on an annual basis, and a commitment made by the proponents to correct any problems during their management period.

5. Shoreline stability

A commitment should be given to rectify any erosion.

6. Artificial lake

The quality of the emergency outfall must be controlled. A water quality monitoring programme should be carried out before the onset of the winter rains each year.

7. Results

All monitoring results should be forwarded to PIMA as they are obtained. These results should be reviewed annually, not just reported as proposed. Any unusual conditions within the boat haven or adjacent waters should be reported to PIMA. A commitment should be given by the owner to take ameliorative action if instructed to do so by PIMA or the Environmental Protection Authority.

Commitments

Subdividing the area into 13 lots prior to construction of the boat haven and associated facilities may be undesirable, as it may result in a number of different landowners being involved in the project. This could prejudice project agreements and management proposals.

Detailed agreements should be made to ensure adequate management of the boat haven and other areas both in the short term and after the initial five year period.

A Quay management programme and a foreshore management plan will be incorporated in a project agreement between the proponent, the State and the Local Authority. Finalisation of these agreements and all undertakings should be required prior to approval of the CER.

Under the proposed agreement responsibility will revert to the Local Authority and or relevant Government Agencies after a five year period. It is important that the agreement between the Local Authority and the Department of Marine and Harbours provided for suitable financing for ongoing maintenance by way of special or differential rating, or contributions from general rating revenue, or other agreed arrangement.

In the CER there are references to references to a number of ongoing management tasks for which there may not be an ongoing managing body with sufficient funds to perform the necessary duties and tasks.

Appendix 2

Proponent's responses to submissions

SUMMARY OF RESPONSES TO ISSUES RAISED BY SUBMISSIONS ON THE CONSULTATIVE ENVIRONMENTAL REVIEW FOR MANDURAH QUAY

EVALUATION OF ALTERNATIVES

The discussion of alternative potential uses for the land was presented in the CER in response to the Environmental Protection Authority guidelines. The relevant section of the CER presents a number of alternative development scenarios, including residential use, as is currently being undertaken on adjacent land. The discussion of alternatives should not be considered as a threat, rather it is presented as an appraisal of the various alternate uses for the land, as required under the guidelines.

The impacts of the project have been assessed on the scale of development proposed. The density of development proposed in the CER is in fact considerably lower than that allowed for under the existing approved zoning.

The Mandurah Quay site is part of the original rural holdings which comprised the Halls Head Estate and the site has a long history of use as pastoral land. This is clearly seen by the fact that the understorey has been cleared and pasture plants introduced over the site. The viability of the land for pastoral purposes has been reduced by a relatively recent reduction in the available land area and increasing land values as a result of regional growth, not because the land is not otherwise suitable for this purpose.

NEED FOR THE DEVELOPMENT

The existing marina next to the old traffic bridge is a comparatively small marina which has limited further development potential. The Mandurah Quay marina is seen as complementary to existing developments, not as a competitor. The draft Peel Inlet Management Programme Review has identified boating as a "major recreational activity on the estuary and (that) planning should designate areas for a range of boating areas" (Waterways Commission, 1990). As one of the relatively few sites on the inlet with access to deep water, the Mandurah Quay site has always been identified as a focal point for boating activity.

NO DEVELOPMENT OPTION

The land is presently accessible by 4WD vehicle from the Old Coast Road through adjacent public and privately owned land. One of the benefits of the project is that the development will physically define access routes to the foreshore and wetlands, while the implementation of the Foreshore Management Plan will provide for the

management of that access. The construction of road and pedestrian access to the foreshore and provision of formal car parking areas will allow the managed use of the foreshore by members of the general public to whom it is presently inaccessible.

ZONING

The proposed housing will be separated from the marina by a public access way having a minimum width of 5 m. This separation of the marina from private lands is considered by the Department of Planning and Urban Development to differentiate the proposed boat haven from a canal development.

Subdivisional design for the development adjacent to the artificial lake has not yet been undertaken and will therefore be reviewed by the relevant authorities on the basis of detailed plans to be presented at a later stage.

PROPOSED SUBDIVISION

The relationship of the proposed subdivision plan to the staging of the development is shown in Figure 2 of the CER. In summary, Stage 1 of the development will involve construction of the marina and development on Lots 1 - 5. Stage 2 will involve development on Lots 6 - 9, Stage 3 the development of Lot 11 and Stage 4 the development of Lot 12. The timing of development of Lot 10, the hotel site, and Lot 13, the proposed aged persons complex, has yet to be determined.

It is the proponent's understanding that final approval of the proposed subdivision would be conditional upon the establishment of a legally binding agreement between the proponent, the State and the City of Mandurah, which would address the ongoing management of the marina and foreshores. The proponent is currently awaiting advice regarding the determination of the various authorities in which the reserves will be vested and to which the overall management of the marina will be assigned.

The proposed development retains the concept of public access to the waterfront. In addition, since the CER was released further access points, parking areas and walkways have been included in a revised design, which is shown as Figure 1 of this response to submissions.

DESCRIPTION OF ENVIRONMENT

The description of the environment presented in the CER is based on studies of the development upon which zoning approval was given by the relevant authorities for a tourist zone and marina development on this site. These studies concluded that the environmental effects of such a development were acceptable. The proposal

which is currently before the EPA provides for a reduction in development density to 60% of that on which planning consent was previously granted and therefore some reduction in the effects on the environment of the present development, as compared to that previously approved, could be expected. Consequently the need for additional studies is difficult to accept.

WETLANDS

The approved location of the Mandurah Quay tourist zone was determined by the relevant authorities based on achieving a balance between conservation and development requirements. The recognition by the original developer, the Parry Corporation, of the value of the wetlands resulted in that company giving up access to the majority of its Peel inlet shoreline.

The area of the wetlands upon which development has been approved was assessed on behalf of LeProvost Semeniuk & Chalmer, Environmental Consultants by Dr V. Semeniuk who has subsequently published a number of papers on the sedimentology, geomorphology and wetlands of the Peel - Harvey System. In the 1985 Assessment of Residential Development and Marina Construction in the Styx (Sticks) Area, Peel Inlet (LSC, 1985) Dr Semeniuk concluded that "... The Styx (Sticks) wetlands are regionally significant because they are relatively unique in Western Australia, contain a wide diversity of floral assemblages, and provide a very good example of coastal shore-forming and wetlands forming processes. As such they have high conservation, education and research value." Dr Semeniuk therefore suggested that the proposed development boundaries be modified by reducing the marina in size and orientating it normal to the shoreline; and moving the location of a natural spit seaward into the wetland. This development configuration was subsequently assessed as being "... unlikely to affect adjacent wetlands because the artificial coastline configuration will mimic the natural hydrogeological situation. The revised smaller marina as now proposed will be located primarily over a small degraded portion of wetland and, as such, will not significantly reduce the ecological significance of the Styx (Sticks) wetlands complex." The development area to which this latter conclusion refers is outlined in Section 4.3 and Figure 12 of the LSC (1985) report. The boundary of this area is shown in Figure 2 of this response. Comparison of this boundary with that of the current proposal indicates that the current plan in fact proposes a major reduction in development area to that originally proposed by LSC in 1985.

Subsequent published information on the wetlands (i.e. Semeniuk and Semeniuk, 1990) merely summarises the description presented in the 1985 report and provides no new or additional information on their ecological significance. Their paper identifies the Sticks wetlands as being "Unique areas ... (which) ... provide classic examples of vegetation and landform interrelationships that are useful for research and education." The Semeniuks' paper also reiterates the need to preserve various tracts of shore for purposes of conservation, research and education.

These conclusions are no different to those of the 1985 report. To our knowledge no other information is available to support the contention that the whole wetland must now be preserved and not compromised in any way by development.

Given that the proposed development will affect only a small part of the shoreline located at the erosional eastern end of the Sticks wetland in an area which has previously been described as degraded by "tracks, weeds and surface disturbance", it is concluded that the development would not seriously impede future studies of coastal change in relation to either Greenhouse effects or the Dawesville cut, both of which are also human-induced changes.

Because of the small area involved, less than 3% of the total area of the Sticks wetlands, and the fact that it is located within a wetland unit which is repeated a number of times within the Sticks wetlands, the proposed development is unlikely to seriously impair the conservation value of the wetlands.

With respect to the effect of the development on freshwater recharge to the wetlands, Dr Semeniuk in 1985 concluded that there was little hydrologic connection between the wetland and the hinterland. Subsequent hydrogeological investigation by Rockwater Pty Ltd (Appendix 1) basically confirms this assessment, but indicates that hinterland recharge could be expected to occur during winter as a result of seasonal rises in the water table. Accepting that some recharge does occur from the hinterland, the proposed development is unlikely to stop this from occurring in the future because the western edge of the development is aligned parallel to the direction of groundwater flow. Consequently, hinterland groundwater flow to the wetland in the area not directly affected by the development can be expected to remain unaltered.

MOSQUITOES

The presence of mosquito breeding areas in the vicinity of the development has been acknowledged by the proponent. The responsibility for mosquito control in these areas is however that of the State Government and the City of Mandurah, and it is likely that the mosquito control measures finally adopted will depend on which authority finally accepts responsibility for the reserves. The proponent has no authority to undertake mosquito control measures on land not covered by his title, but would wish to be a party to discussion on the future management of the adjacent wetlands, at the appropriate time. The proponent is however prepared to produce a public educational package for distribution to future potential residents of the development which will inform them that the area, like most of Mandurah, is mosquito prone and that precautions would need to be taken to minimise the risk of contracting Ross River Virus.

It is relevant to point out that residential development has been approved and is taking place on land immediately to the north of the wetlands within a few hundred metres of this site, and hence that the level of mosquito control adopted in this area

is unlikely to be significantly affected by the approval of the Mandurah Quay development. *Aedes vigilax*, one of the species of mosquito known to breed in the vicinity of this development disperses widely (up to 20 km regularly) in search of blood meals and the Chimneys Spit breeding area was implicated in the mosquito problem existing at Halls Head in 1988 (Wright, 1988). As a consequence of Wright's investigation, control measures, including isolation channels and larvicide applications, were recommended for the Chimneys Spit and Sticks wetlands.

ALGAE

The accumulation of micro-algae has not posed a problem in existing developments in the Mandurah Channel. Although micro-algal blooms have been found to enter the canals from the Mandurah Channel, they have been found to remain at similar concentrations to that within the Channel (LSC, 1987). Due to the small area of the proposed marina and its predicted rapid flushing a similar situation is expected to prevail at Mandurah Quay.

It is anticipated that there will be occasional periods when a dense bloom will be present in the boat haven and adjacent channel. These blooms will be flushed from the area on subsequent changes of tide or prevailing wind direction but could persist for several days during periods of calm weather.

Shoreline accumulations of macro or micro-algae will be cleared manually or with the use of a small machine ("Bobcat"). Collected material will be carted from the site by truck to a disposal area approved by the City of Mandurah. The regular monitoring of weed accumulation and the initiation of clearing procedures will be the responsibility of the proponent under the terms of the proposed management agreement.

BUFFER ZONES

The wetland conservation areas will be buffered from the development by the foreshore reserves to the south and east, and by walling and a public access way to the west of the development.

The location and extent of public access provided to the conservation areas will be determined on the basis of advice received from relevant authorities, i.e. PIMA, CALM and City of Mandurah.

It is considered unlikely that the development would result in the introduction of additional species of feral animals to the wetlands. Domestic animals (cats and dogs), however, pose a recognised problem in the management of conservation areas which can be addressed only through the education of pet owners. The proposed upgrading of the channel through the base of the Chimneys Spit will however assist by providing at least a partial physical barrier to domestic animals.

In a similar way the wetlands will be partly buffered from the introduction of exotic plant species by the foreshore reserves and proposed channel on the eastern side of the development and the public access way to the west. In this instance the presence of adjacent development may be of benefit in discouraging some of the illegal dumping which presently takes place.

FILLING OF PART OF SITE

Filling of the south-western part of the development site will not markedly affect the drainage of the Sticks wetland which is drained primarily by groundwater flow rather than surface run-off (LSC, 1985). Consequently the biota of the wetlands are expected to remain unaltered.

Since the fill used in the development will be derived from other parts of the site, the potential for the introduction of further exotic plant species to the site during filling operations does not occur.

DRAINAGE

Drainage of the development to the artificial lake has been designed specifically for the purpose of managing stormwater runoff, including nutrient trapping, to minimise the input of nutrients to Peel Inlet. Water quality within the lake will be managed in accordance with an approved management and monitoring plan developed to the satisfaction of relevant authorities to ensure its suitability for stormwater containment and as a passive recreational feature. It is accepted that this could include the need for forced aeration of the waterbody and the periodic removal of nutrient-enriched sediments.

CONSERVATION SIGNIFICANCE

The proposed foreshore reserve, which was approved during the rezoning, will be protected by foreshore stabilisation works to prevent any further erosion. The recreational foreshore will provide a buffer between the development and the conservation area to the east, while a combination of vertical walling and a public access way will provide a buffer to the wetland area to the west. The use of foreshore reserves as buffers to conservation areas has been successfully adopted in the Metropolitan Area at Alfred Cove and Herdsman Lake, both of which have high density residential development in close proximity to significant wetlands.

The benefits of retaining at least part of the paperbark vegetated area on the eastern side of the site is recognised by the proponent, and it is intended that part of this area will be included within part of the open space allocation for the development. It is proposed to integrate this area with the landscaped artificial lake described in the CER.

REGIONAL VALUES

As a result of measures to be taken to protect the Chimneys Spit wetland, the development will have minimal impact on the Mandurah Tidal Delta. The Sticks wetlands have been shown by Semeniuk and Semeniuk (1990) to have a different history of formation to the delta and are described as a spit - lagoon complex rather than as a tidal delta unit. Thus, while they occur adjacent to the delta, the Sticks wetlands are not a delta unit.

The present regional development plans provide for the protection of the foreshores and wetlands of recognised conservation significance in both the Chimneys Spit and Sticks wetlands areas. Further extension of this area in the manner suggested would largely involve the incorporation of cleared and disturbed terrestrial habitat of low conservation value.

GROUNDWATER

An examination of the impacts of the development on the water table during construction and on the groundwater resource is presented in a report by Rockwater Pty Ltd which is presented as Appendix 1 of this response to submissions.

This investigation has concluded that:

- There is fresh to brackish groundwater in boreholes beneath the higher ground, and probably a thin layer of water which could be used for domestic irrigation in the vicinity of the Mandurah Quay Project Area (MQPA).

- Dewatering for construction of sewers and the boat haven in the MQPA will lower groundwater levels within a distance of about 300 m, and possibly more than 500 m. The largest drawdown within the nearby foreshore conservation area will probably be to a water level in the range of -1.0 to -1.5 m AHD for a period of up to 100 days. This is unlikely to have any noticeable short-term or long-term effect on the wetland vegetation.

- Existing residential development is generally in excess of 400 m from the MQPA. Construction of the project is unlikely to have any deleterious long-term effects on the shallow aquifer underlying that development.

- Groundwater levels will recover to essentially their undisturbed condition in the winter following excavation. It may take two winters of average rainfall for the freshwater resource to recover its original condition after the dewatering.

- Dewatering will result in inland movement of the salt water interface along the estuary shoreline. In the immediate vicinity of the boathaven, there will be a permanent inland movement of the interface by about 100 m. Elsewhere the movement will be much less and recovery will take place during the following winter.

SEWERAGE

The sewage pumping station, which is located on the landward margin of the development, will be provided with emergency backup facilities in accordance with the requirements of the Water Authority of Western Australia.

ARTIFICIAL LAKE

The artificial lake, required to accommodate site drainage under draft EPA guidelines, will be designed and managed to the satisfaction of the appropriate authorities having due regard for the potential problems of nutrient enrichment and insect pest breeding.

Within the project area, maximum use of in-situ drainage will be made to reduce the amount of runoff, however, the lake will still be required to accommodate a 1 in 10 year storm event for a period of several days, as required by the EPA.

NUTRIENT BUDGET AND MANAGEMENT PLAN

A detailed nutrient budget and management plan will be prepared once the conditions of approval have been determined and detailed planning has proceeded to the stage where the area of landscaped garden and lawn area can be accurately determined. The selection of plant species and their ongoing maintenance will be undertaken having regard to the necessity to minimise nutrient export from the site. This will incorporate the selection of plant species with low nutrient requirements coupled with minimum use of slow release fertilisers.

It needs to be remembered that the proposed development is located adjacent to the Mandurah Channel which is a well flushed body of water. Most nutrient discharge to the channel is likely to be flushed to the sea rather than to the inlet.

FORESHORE

The foreshore width for the development was agreed by the relevant authorities having due regard to the requirements of this site and the major contributions made by the original developer to the preservation of the Sticks wetlands.

The boundaries of the Mandurah Quay site have been established by survey according to the conditions of the zoning approval.

Following receipt of submissions and further discussion with the City of Mandurah, Department of Planning and Urban Development and Peel Inlet Management Authority, the proponent has modified his proposed development plan (Fig. 1) to incorporate:

(i) upgraded public access to the foreshore, including increased parking adjacent to Lot 6;

(ii) increased road access to the foreshore; and

(iii) a public access way has been incorporated along the western boundary of the site to provide continuity of access around the site and to provide emergency vehicle access.

Public parking available for the users of the foreshore adjacent to Lot 6 will be provided in the area adjacent to the hotel site which will incorporate some 30 parking bays.

The margins of land which will be filled will be supported by stable slope or retaining wall to the satisfaction of the City of Mandurah.

The area of reserve to the west of Lot 10 has been amended to provide public access to the foreshore and to a public parking area to be provided by the proponent.

The development as proposed contains some 600 residential accommodation units, compared with the previously approved development which incorporated 1000 residential units. This reduction in intensity of development, combined with the proponent's commitment to the implementation of an overall management plan for the development and adjoining foreshore, indicates that the intensity of use of the foreshore will be less than that originally proposed, while retaining the same level of management.

FORESHORE MANAGEMENT

The Foreshore Management Plan, as presented in the CER, is a discussion draft which requires input from interested parties, finalisation of the development plan and vesting of the reserve in an appropriate management authority. It is anticipated that finalisation of the management plan will be a condition of approval of the CER, as has previously been the case with similar projects of this nature.

It is difficult to assess the level of future foreshore use adjacent to Mandurah Quay as this area has been defined as being a recreational area of regional significance,

and thus usage levels will be defined by future development and population trends over the wider region as well as by the extent of similar recreational facilities developed within the Peel-Harvey Estuary. Since much of the planning for the region is conceptual and subject to rapid change, any estimate of future regionally generated use of the Mandurah Quay foreshore would be meaningless. In terms of foreshore use generated by this project, the development plan presented in the CER represents a reduction in development to 60% of that previously approved and hence use of the foreshore generated from within the development will be similarly reduced. An amended plan of development showing changes to foreshore access and other management considerations has been discussed with relevant authorities and is presented as Figure 1 of this response.

The Foreshore Management Plan presented in the CER is a draft document which considers the broad concepts of foreshore management in order to elicit comment from concerned groups. To finalise the detailed foreshore management plan requires consideration of this input in conjunction with the effects of any modifications to the project development plan, as finally approved by the relevant authorities. This can not be completed, however, until the foreshore reserve is formally vested in an appropriate management authority which has the power to approve the final document.

Erosion and macro-algal management strategies are identified elements of the Marina and Foreshore Management Plans.

Fire control measures which are proposed include separation of the Chimneys Spit from the mainland by an upgraded isolation channel, to be constructed by the proponent, and the separation of the development from the Sticks wetland by vertical walling and a public access way located within the development site which will also serve as a firebreak and an access way for emergency vehicles. In addition, regular maintenance of the recreational foreshore reserve will ensure that a fire hazard and fuel source is not generated within this area. Where provided, barbeque facilities located within the foreshore reserve will be gas fuelled.

Public access to the two conservation areas from the foreshore reserve will be managed. In the case of Chimneys Spit, the proponent proposes to upgrade the present channel to restrict access, while at the Sticks wetland a physical barrier will be provided to prevent vehicle access but allow pedestrian access.

As indicated previously, a public access way will be provided between the Sticks wetland and the adjacent development. The retaining wall for the development will be within the boundaries of the adjacent lots and will be the responsibility of the respective landowner or landowners association, as appropriate. The public access way and respective secondary retaining wall will be handed over to the local authority upon completion.

Upon vesting of the conservation reserves in an appropriate management authority, the proponent will enter discussions on any additional steps required to minimise the impact of the development on these areas.

The present Foreshore Management Plan is a discussion draft awaiting comment from interested parties, finalisation of the development plan and vesting of the foreshore in an appropriate management authority. It is anticipated that finalisation of the plan will be a condition of the approval of the CER.

PUBLIC ACCESS

Public access around the boat haven has been increased to a minimum of 5 m following discussions with relevant authorities. It is considered that this width is adequate to provide unhindered public access.

Proposed facilities within the foreshore will be detailed in the revised management plan following receipt of comment from all relevant authorities. The dual use path is proposed to take a meandering route amongst the existing trees to provide the maximum recreational and aesthetic benefit from this facility. It is considered that the required retaining walls which will be constructed along property boundaries abutting the foreshore will provide the necessary physical and visual separation between public and private lands.

As shown in the revised development plan (Fig. 1), public parking will be provided adjacent to the foreshore in the tavern/commercial area carpark (180 bays) and adjacent to the hotel site (30 bays).

In addition to the above, some 40 car and trailer bays will be provided adjacent to the public boat ramp.

Public parking for users of the foreshore adjacent to Lot 6 will be provided in the proposed car park adjacent to the hotel site.

Proposed amendments to the development plan (Fig. 1) provide for a concrete surfaced access way between the development and the Sticks conservation area in addition to the retaining walls previously described in the CER. This will retain the option of providing public access to the foreshore south of the development as well as providing increased accessibility for emergency vehicles.

The development plan (Fig. 1) provides for both a commuter cycleway and an inter-linked recreational dual use path around the foreshore to link into the proposed regional cycle network.

PUBLIC OPEN SPACE

The 10% public open space requirement is recognised by the proponent and will be provided to the satisfaction of the planning authorities. As previously discussed, it is the proponent's intention to provide the balance of the required open space allocation in the paperbark woodland area located in the north-western part of the site.

BOAT HAVEN

During construction, the boat haven will be dewatered into stilling basins located within the development area before being allowed to flow into the inlet. The discharge from the stilling ponds will conform to accepted turbidity standards.

The extent of siltation and macro-algal accumulation in the entrance to the boat haven and in the adjacent channel is not predictable prior to construction. However, the proponent is aware of the potential for such events to occur and will address these issues in the management agreement, which will make provision for ongoing management of all aspects of marina operations. Prior to construction, a survey of the channel area will be undertaken to determine the impact that the channel dredging programme, undertaken by the Department of Marine and Harbours in 1987, has had on the stability and bathymetry of the Sticks Channel.

Previous experience with canal developments in the Mandurah Channel has shown that while phytoplankton blooms enter artificial water bodies as a result of normal exchange processes, they have not tended to accumulate within the canals, and have been flushed out once water quality in the channel has improved. Water quality within and outside the canals has consequently been found to be similar (LSC, 1987; 1988; 1989). With the expected rapid flushing of the comparatively small body of water within the Mandurah Quay marina, a similar situation would be expected to occur. Water quality within the marina will thus tend to emulate that of the source water.

There will be no boat work areas within the marina precinct and consequently no input of anti-fouling material, paint flakes, oil or debris from this source which could affect water quality.

The fuelling and sullage pump-out facilities will be sited and designed to the approval of the relevant authorities at the detailed design stage. The appropriate safety measures and maintenance procedures necessary to ensure their satisfactory operation will be specified in the Marina Management Plan.

Details of the operation of the marina, including the responsibility for pens and moorings, will be defined in the proposed agreement between the proponent and State and local authorities.

FISHING

Appropriately worded signage will be erected to warn of the dangers of consuming mussels from the inlet and the marina.

Fish cleaning within the marina precinct will not be permitted due to the proximity of commercial premises.

MONITORING PROGRAMMES

The monitoring programmes outlined in the CER will be finalised following receipt of comments from all relevant authorities and will be detailed in the Marina Management Plan and Foreshore Management Plan, as appropriate.

Interpreted monitoring results will be reported annually to the Peel Inlet Management Authority, City of Mandurah, Environmental Protection Authority and Department of Marine and Harbours.

COMMITMENTS

Appropriate conditions will be set in place to ensure that subdivision of the land into superlots does not prejudice the project agreement and management proposals. The developer is prepared to undertake construction of the marina prior to subdivision to ensure that the major public amenities, including the public boat ramp, are constructed as proposed.

It is expected that the requirement for finalisation of the Foreshore and Marina Management Plans and the project agreement will apply as conditions of approval of the proposal recommended by the EPA, which will have the opportunity to comment on the plans prior to their adoption. It is not possible to seek approval to these documents by the relevant authorities prior to determination of the CER, as such an approval could be seen as an approval of the project prior to final determination of the proposal and thus be contrary to Section 41 of the *Environmental Protection Act 1986.*

The proponent has indicated his willingness to enter negotiations with the relevant authorities to ensure that the costs of ongoing management and maintenance after the initial five year period are met by the various landowners within the development.

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Appendix 3

Summary of proponent's major commitments

8 COMMITMENTS

The proponent will undertake to abide by all commitments made in this CER. The project will be operated and maintained in accordance with guidelines established by the two management programmes detailed in Section 6 of this document. These commitments will be incorporated into the project agreement, which is to be established between the proponent, the State and the City of Mandurah.

Major commitments given within the management programmes are summarised in the following sections.

8.1 MANDURAH QUAY MANAGEMENT PROGRAMME

8.1.1 Construction Impacts

Hours of operation will be negotiated with the EPA and the City of Mandurah.

Trees on land surrounding the Stage 1 development site will be retained to act as a buffer between the development and residential areas.

It is proposed to excavate the harbour to depths ranging from -3.26 m below AHD at the entrance and within the fairway, to -2.26 m below AHD in small boat mooring areas.

It is proposed to excavate the boat haven using conventional land-based earthmoving equipment.

Water from dewatering operations will be imponded to allow settlement of suspended solids before being discharged to Peel Inlet.

Proposed deposition of spoil for fill at the southwestern corner of the site will take place to the satisfaction of the City of Mandurah and the EPA. Retaining walls are proposed to prevent incursion into the adjacent wetlands.

Any additional fill required will be obtained from existing sources within the Mandurah region.

All exposed soil surfaces will be stabilised immediately following clearing.

A soil wetting agent will be applied if required and extra water trucks will be brought on site if dust problems arise.

Topsoil removed will be stockpiled and used in revegetation of landscaped areas.

It is proposed to open the entrance to Sticks Channel at a time which is to the satisfaction of PIMA and the EPA.

Entrance channel walls are proposed to be constructed to a height matching existing land levels. Details of walling will be to the satisfaction of DMH and PIMA.

All wall structures will be designed in accordance with standard engineering practice.

The structural integrity of all civil works will be monitored on an annual basis for five years.

High visual amenity is proposed within the development with total architectural control, control of building materials and careful design of scale and form.

Any waste material generated during construction will be disposed of in accordance with Council regulations. Proper sanitation facilities will be provided for the construction workforce.

It is proposed to retain existing trees along the foreshore and as much indigenous vegetation as possible throughout the development area. Landscaping will utilise vegetation species native to the area.

8.1.2 Operation Impacts

Minimum development levels are proposed to be set at 2.15 m above AHD.

Power supply within the proposed development will be underground.

The proposed development will be deep sewered throughout in accordance with WAWA requirements.

A sullage pumpout facility is intended within the boat haven and will be connected directly to the deep-sewerage system to the satisfaction of the EPA.

Public boat landings, service berths, refuelling facilities and a boat launching ramp are proposed within the development. Vehicle and trailer parking will be provided.

Dual-use pathways will be provided along the foreshore and skirting the boat haven to provide unrestricted public access to the shoreline between Chimneys Spit and Sticks Wetland.

Public access to adjacent conservation areas will be discouraged.

Water quality within the proposed boat haven will be maintained such that it is suitable for boating and adjacent development and occasional human immersion, while not adversely affecting the estuarine fishery or Peel Inlet waters.

A comprehensive water quality monitoring programme is proposed, to be implemented to the satisfaction of the EPA and PIMA.

Boats with TBT-based antifouling paint will not be permitted to moor within the boat haven.

Measures such as artificial aeration or circulation of boat haven waters will be employed if required as a result of poor water quality.

The proponent is committed to remove litter, floating debris and weed accumulating in the boat haven, as required.

It is proposed to monitor the sediments in the boat haven as follows:

- sampling monthly in the first year and quarterly for the following four years for nutrients and other water quality parameters; and

- sampling when the boat haven is initially opened and subsequently in years three and five for heavy metals.

Monitoring will be to the satisfaction of the EPA and PIMA.

Navigable water depth at the entrance will be maintained by dredging as required, to the satisfaction of DMH.

Navigable aids proposed will be in accordance with DMH requirements. Following their construction, navigation aids will be the responsibility of that authority.

Measures proposed to minimise nutrient input to the groundwater in areas maintained by the proponent include the use of slow release fertilisers, planting of low maintenance vegetation species and education of residents in fertiliser practices by means of a brochure.

Runoff from all roads and other paved surfaces is proposed to be contained on site in an artificial wetland, designed to accommodate a minimum one in ten year storm event for three to four days prior to leaving the site. An emergency outfall is proposed to discharge into the boat haven in the event of an extreme storm event.

The proponent will comply with the provisions of the *Aboriginal Heritage Act 1972-80* if any Aboriginal site is located within the study area during the construction period.

It is proposed to recognise the Aboriginal values of the area with a suitably worded plaque, following consultation with the Western Australian Museum.

The proponent is prepared to assist in educational programmes aimed at managing fish stocks in consultation with the Department of Fisheries.

Contingency plans for navigable entrance, water quality maintenance and storm and flood damage will be documented and implemented in an emergency situation.

The proponent will be responsible for undertaking all management actions for the first five years of operation.

Monitoring results will be reported annually and reviewed following five years of operation.

8.2 FORESHORE MANAGEMENT PROGRAMME

Erosion prevention structures in the form of small timber piers or groynes are proposed to be constructed along the foreshore to the satisfaction of the EPA, PIMA, DMH and the City of Mandurah.

Shoreline stability will be monitored on an annual basis.

The dual-use pathway will be positioned to avoid environmentally-sensitive and eroding areas of the foreshore, and to link up with the pathway proposed within the Bridgewater Foreshore Management Plan.

Public barbeque facilities are proposed along the foreshore, and signs warning of the potential toxicity of the water during *Nodularia* blooms will be erected.

The foreshore will be rehabilitated with suitable indigenous species.

A contingency plan for extreme climatic events will be detailed.

Physical disturbance to waterbirds will be minimised by implementation of the management proposals contained within the Bridgewater Foreshore Management Plan which include:

- barrier fencing along the foreshore boundary adjacent to the Chimneys Spit;
- barrier fencing along the western boundary of the Sticks wetlands to the development site boundary; and
- firebreak following the fence line where there is no existing firebreak.

The Bridgewater Foreshore Management Plan also recommends for the future development of the Erokine foreshore that a management committee, comprising representatives from government departments, local residents, and landowners, should determine and implement long-term management initiatives. These could include:

- the provision of boardwalks and bird "hides";
- possible vehicular access to the estuary;
- carpark(s) adjacent to the estuary;
- weed and feral animal control;
- maintenance of fencing, pathways and public facilities;
- additional pedestrian access through the reserve; and
- provision of public facilities.

In addition, barrier fencing and advisory signposting will be erected along the western site boundary by the proponent.

Lighting within the development will be directed away from the wetlands.

The proponent will remove algal wrack accumulating along the shoreline within the proposed development area.