Estuary deepening Cox Bay, Falcon

Meiyu Australia Pty Ltd

Report and recommendations of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 549
July 1991

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ISBN 0 7309 3574 4
ISSN 1030 - 0120
Assessment Number 361

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Summary and recommendations

The project site is a currently undeveloped section of the shoreline and part of a shallow embayment on the western side of Peel Inlet, approximately 7km south of the Mandurah townsite. Part of the land is owned by Meiyu Australia Pty Ltd and part is vacant Crown land. The land boundary of the site is marked by the high water mark, which is also the municipal boundary between the City of Mandurah and the Shire of Murray.

The proponent wishes to develop and deepen Cox Bay through bunding and dry excavation to improve algal management, to create a recreation node, and to create an offshore island on which to dispose surplus sand. This island will also provide alternative waterbird habitat. The developer proposes to clear and fill the foreshore, to widen the beach by an average of 6m, and to drain and fill the foreshore in order to manage the mosquito problem

Cox Bay is identified within the draft Peel Inlet Management Programme Review as a site which should be developed and/or modified to provide for a range of recreational activities. This proposal is consistent with the intention of that programme and the Authority considers that this forms an important context for this project, as other portions of the Peel Inlet and Harvey Estuary have been proposed in the programme for protection and conservation. This proposal follows the intent of the plan presented in the draft Peel Inlet Management Programme Review and promoted by the Peel Inlet Management Authority. An important part of the philosophy of that plan acknowledges that degradation as a consequence of people use is occurring where there are no recreation nodes to direct and manage people away from fragile conservation areas. The Peel Inlet Management Programme Review identifies Cox Bay as such a recreation node.

The development site is characterized by the Vasse Soil System on the foreshore. Three wetlands have been identified within the foreshore, two saltwater wetlands, and a central freshwater wetland. The vegetation consists of salt and fresh water paperbarks, casuarinas, associated species such as samphires and rushes, and parkland cleared Tuart and Marri. A relict population of the threatened species the Southern Brown Bandicoot occurs near the freshwater wetland.

Cox Bay is shallow and nutrient enriched, causing an excessive growth of macroalgae, which leads to harvesting and odour problems. There are abundant estuarine fauna consisting of molluscs, worms, crustaceans, and fish. The nearshore shallow water areas, the beach and sandspits are valuable waterbird habitats.

The level of assessment for the deepening of Cox Bay was set as a Public Environmental Review (PER). Public submissions for the PER closed on 16th March, 1991. A revised proposal for the adjacent site, Lot 1147 Estuary Gardens, for a tourist and medium density residential development has been received recently, and informal advice has been given by the Authority.

A number of policies, conditions, plans and strategies apply to the area, including the Japan/Australia and the China/Australia Agreements for the Protection of Migratory Waterbirds, the RAMSAR Agreement for the Protection of Waterbirds, the draft Environmental Protection (Swan Coastal Plains Wetlands) Policy, the draft Peel Inlet Management Programme Review, and the draft Integrated Mosquito Control Strategy for the Peel-Harvey Region.

The Authority has accepted the principles outlined in the draft Peel Inlet Management Programme Review, as it provides for development as well as community facilities within the context of the significant conservation value of the whole of the Peel-Harvey Estuary system. The Authority reviewed the specific environmental implications of this proposal within that context. Six environmental issues were examined by the Environmental Protection Authority. These were loss of waterbird habitat, impact on the fishery, nutrient transport and the maintenance of water quality, loss of bandicoot habitat, mosquito control, and impact on the estuarine wetlands.

Following its evaluation of these issues, the Authority considers that the environmental issues associated with the project are manageable, and has therefore recommended accordingly, subject to compliance with the recommendations listed below, together with the commitments provided by the proponent.

Recommendation 1

The Environmental Protection Authority notes that this proposal is compatible with the Peel Inlet Management Plan Review, which identifies Cox Bay as a recreation and development node to take people pressure off the much more extensive conservation zones, and has concluded that the proposed deepening of Cox Bay and filling of the foreshore, 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 exceptions of the proposed island and the proposed filling of the wetlands.

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

- **waterbird habitat;**
- **the fishery;**
- **mosquitoes;**
- **bandicoot habitat;**
- **estuarine wetlands; and**
- **weed control.**

The Environmental Protection Authority notes that these environmental factors have been addressed adequately by either environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations given in this report.

Accordingly, the Environmental Protection Authority recommends that the project could proceed subject to the Environmental Protection Authority's recommendations in this report, and subject to the proponent's commitments to environmental management as detailed in Appendix 1 of the Public Environmental Review.

Recommendation 2

The Environmental Protection Authority recommends that the Peel Inlet Management Authority:

(1) proceed with the establishment of Waterways Protection Precincts in areas where the protection of waterway margins is of a high priority; and

(2) ensure the preparation and implementation of management plans for these areas which ensure the minimisation of environmental loss and the rehabilitation of environmental values as necessary.

Recommendation 3

The Environmental Protection Authority recommends that:

(1) deepening the Estuary should be permitted in accordance with the proposal;

(2) alternative waterbird habitat should be provided by the construction of shallows in the same location as the proposed island; and

(3) sediments used to create the shallows should be placed in the same order as existing sediments.

Recommendation 4

The Environmental Protection Authority recommends that the following programme for developing the foreshore should be implemented, such that:

(1) the two saltwater wetlands and the one freshwater wetland on the foreshore, their fringing vegetation and their functions are retained in their existing condition or are rehabilitated to the satisfaction of the Peel Inlet Management Authority;

(2) other areas of the foreshore could be filled in;

(3) the beach is not widened adjacent to estuarine wetlands;

(4) where possible, all large trees are retained on the foreshore and the fill is placed in such a manner as to ensure their survival;

(5) the proponent seek advice from the Department of Conservation and Land Management in relation to the bandicoot population;

(6) the excess stormwater drainage from Old Coast Road be disposed of either on the Estuary Gardens site or alternatively into the central freshwater wetland, provided that it can be demonstrated that the wetland values and functions and the bandicoot habitat will be retained;

(7) mosquito control measures must be consistent with the preservation of wetland values and functions; and

(8) any fill surplus to requirements for the shallows, the foreshore and the beach could be disposed of on the Estuary Gardens site.

Recommendation 5

The Environmental Protection recommends that prior to the commencement of construction, the proponent should prepare, to the satisfaction of the Peel Inlet Management Authority, a comprehensive development and management programme, including the management commitments made by the proponent shown in Appendix 1 and the recommendations in this report.

Recommendation 6

The Environmental Protection Authority recommends that the proposed project agreement should be finalised between the proponent and the ultimate managing authority or authorities, on the funding of the comprehensive development and management programme after the initial period of management by the proponent, to the satisfaction of the Minister for the Environment.

1. Introduction

The original proposal by the proponent Meiyu Australia Pty Ltd was for a tourist and medium density residential development on Lot 1147, Estuary Gardens, which was to be developed in conjunction with deepening an adjacent area in Cox Bay, filling the foreshore, widening the beach and creating an offshore island. The Environmental Protection Authority divided the proposal into two for assessment, because at that time it was considered that deepening the Bay and filling the foreshore would require more detailed assessment than the land based development.

The Authority required that a Public Environmental Review be undertaken for the deepening of Cox Bay, and filling the foreshore, and guidelines to assist the proponent in the preparation of the documentation were issued in March, 1990. The document was released for an eight week period for public comment ending on 16 March, 1991.

The concept of deepening the nearshore waters of Cox Bay to improve both water quality and the public amenity of this area, was recently proposed by the Peel Inlet Management Authority's study of the western foreshores (Waterways Commission, 1990) and in the Draft Peel Inlet Management Programme Review (Waterways Commission, 1990). This was based in part on a public survey, which identified a demand for additional recreational space. Of the various areas examined for improved water-based recreation, the Falcon-Novara area was placed in a high priority category. This proposal is based on the recommendations for this site in that review.

An important part of the philosophy of the draft Peel Inlet Management Programme Review is that it acknowledges that degradation as a consequence of people use is occurring where there are no recreation nodes to direct and manage people away from fragile conservation areas. Not only does it identify recreation and development nodes but also places considerable emphasis on other areas which should be protected and rehabilitated for their conservation value.

2. The proposal

The project site is an undeveloped section of the shoreline and part of a shallow embayment on the western side of Peel Inlet, approximately 7km south of the Mandurah townsite (see Figure 1). The site consists of land owned by Meiyu Australia Pty Ltd (Lot 1147) and vacant Crown land. The land boundary of the site is marked by the high water mark of Peel Inlet, which is also the municipal boundary between the City of Mandurah and the Shire of Murray.

The proponent wishes to deepen the Bay through bunding and dry excavation to improve algal management, and to create an offshore island on which to place surplus sand. The island would also provide an alternative waterbird habitat. The total excavation would be approximately 90,000 cubic metres of sand and limestone. Excavation in the Bay would be to a minimum depth of -1.1 AHD at the toe of the beach, deepening offshore until it reaches the natural basin depth of -1.3m AHD 350 metres offshore, as shown in Figure 2.

The proponent also wishes to clear and fill most of the foreshore adjacent to Lot 1147, to widen the beach by an average 6m in width to improve recreational opportunities, and to fill and drain the wetlands within the foreshore reserve in order to manage the mosquito problem. The developer proposes to plant the foreshore with grass and indigenous trees, and to construct a bike path, boat ramp and carpark.

Coincidental with the development, the Main Roads Department is to purchase part of Lot 1147 for the widening of Old Coast Road. Two road drainage sumps occur adjacent to the road, and a third drainage site is planned as a joint development by the Main Roads Department and the proponent to accommodate excess stormwater runoff from one of the other sumps. This sump is proposed to be a replacement for the northern wetland within the foreshore reserve.

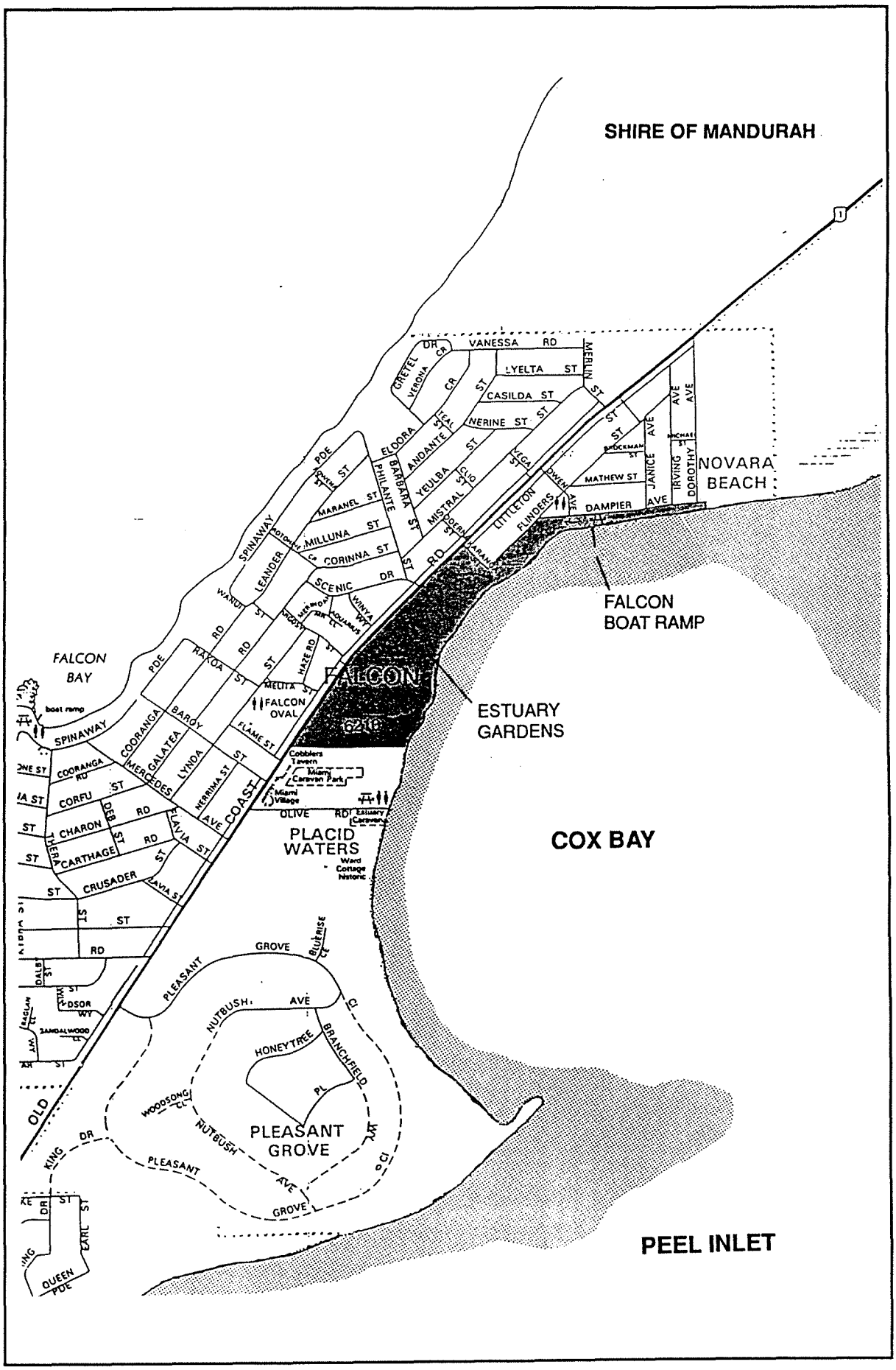

Figure 1: Locality Plan (BSD 1990)

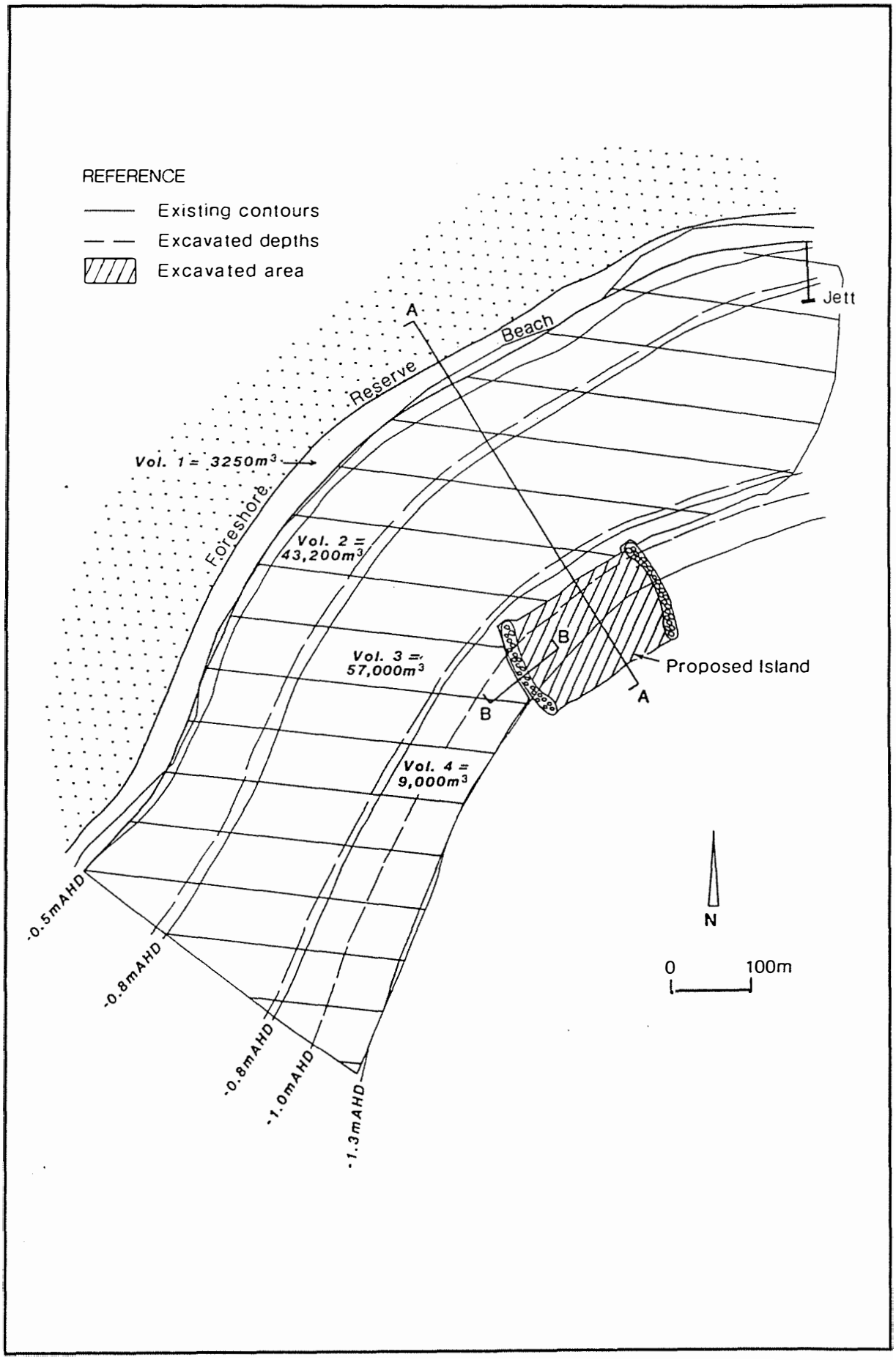

Figure 2: Plan of Proposed Excavation and Island Le Provost 1991

Meiyu Australia is proposing to establish a Management Body to maintain the foreshore area, and the Country Club facilities on the adjacent Lot 1147. The Management Body would be largely funded by contributions from residents within the estate, and would control any future additional development within the proposed residential zones, to ensure that environmental commitments such as nutrient input into the Peel Inlet are met. An environmental management plan is proposed, comprising an estuary management plan and a foreshore management plan.

After the closure of public submissions, the Main Roads Department put forward an alternative design concept for the northern wetland, which was to excavate the wetland down to permanent water table in order to accommodate overflow drainage from the new carriageway on Old Coast Road. This proposal is supported by the proponent if his proposal to fill the wetland is not approved, although the public has not had the opportunity to make comment.

3. Creation of the foreshore reserve

A narrow irregular strip of the foreshore adjoining the Inlet has already been reserved for Local Recreation under the City of Mandurah's Town Planning Scheme 1A.

As part of the proposal to rezone portion of Lot 1147, the developer proposes to give up free of cost an additional 5ha as foreshore reserve, as well as constructing additional car access to the foreshore and new jetties for the general community and residents of Estuary Gardens. This means that the Local Recreation foreshore reserve will be increased to an average width of 80 metres. The developer is also prepared to comply with the general objectives of the current Landscape Protection Area zoning, which applies to the first 50 metres of the foreshore, although he proposes to delete this zoning.

3.1 Adjacent land use and zoning

The site behind the foreshore is currently undeveloped, but is surrounded by urban development in the form of both residential and non residential land uses. The area immediately to the west and north of the site contains the residential suburb of Falcon. The site is bordered to the south by the Miami Caravan Park, and Cobblers Tavern and shopping centre.

This site has a dual zoning under the City's Town Planning Scheme No 1A. As shown in Figure 3, the western portion of the site is zoned Tourist, whilst the remaining eastern portion is zoned Rural. The rural portion of the land and the land immediately adjoining the Peel Inlet foreshore reserve are also designated as a Landscape Protection Area because of their proximity to the Inlet. Under the current zoning, and with the consent of Council, over half of Lot 1147 (known as the Estuary Gardens site) could be developed for a wide range of tourist related activities. The Town Planning Scheme also provides that residential development up to an R40 density is permitted within the Tourist zone. The developer proposes to retain the existing Tourist zoning over the southern portion of the site to enable development of the private hotel, but to rezone the remainder of the site for residential purposes with varying densities.

A revised proposal for the land based site has been received recently, and an informal level of assessment was set. Advice has been given by the Environmental Protection Authority to the Department of Planning and Urban Development and the City of Mandurah on that proposal.

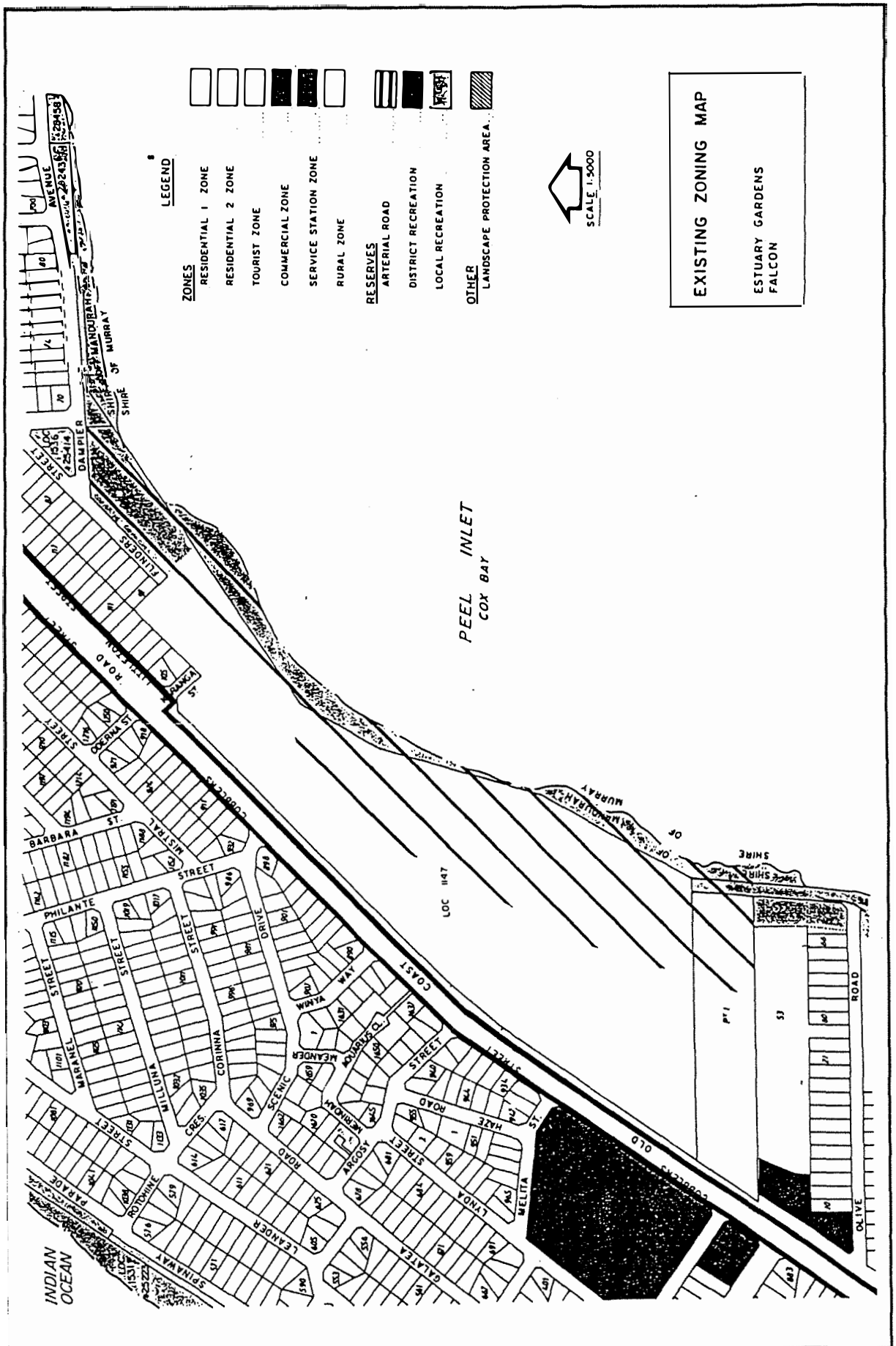

Figure 3: Current Zoning (BSD 1990)

4. The receiving environment

4.1 The terrestrial environment

The soil types of the foreshore are of the Vasse estuarine and lagoonal system, with sand flats characterised by leached white sand. Organic matter frequently occurs in swales and depressions. Soil characteristics of the Vasse system are a moderate profile permeability, very slow runoff, low topsoil nutrient retention and low nutrient retention ability (Wells, 1989).

A thin fresh-brackish lens of water occurs over saline groundwater with a localised mounding effect. This mound occurs approximately two-thirds of the way across the peninsula from the edge of the estuary to the ocean, and may shift in response to seasonal influences. Groundwater beneath the site is moving towards the Inlet, and as it appears that the groundwater contours are almost flat, they are moving at low velocity.

There are three identified wetlands within the foreshore shown in Figure 4 (Habitat Distribution). These are a saltwater paperbark area at the southern end of the foreshore, a freshwater wetland in the central part of the foreshore area, and a northern paperbark fringed seasonal wetland adjacent to the Falcon boat ramp.

4.1.1 Faunal habitats

In a 1991 survey prepared as part of the environmental investigations for this proposal, Ninox Wildlife Consulting divided the proposed foreshore reserve into four broad faunal habitats, defined by a suite of vertebrates seasonally or permanently associated with particular resources (Ninox Wildlife Consulting, 1991). Ratings of the habitat's potential richness for vertebrates are shown in Figure 5.

Faunal habitats rated A are relatively undisturbed, those rated B are moderately disturbed i.e. the ground cover consists mostly of introduced weeds, and those designated C are very disturbed, i.e. partially or mostly cleared, many vehicle tracks, and a ground cover mostly of weeds.

Habitat 1 consists of Saltwater Paperbark *Melaleuca cuticularis* woodland supporting other salt tolerant species including *Allocasuarina obesa* and samphire *Halosarcia spp.* on grey sand. The northern section, which is the wetland adjacent to the Falcon boat ramp, is periodically inundated during high tides. The value of the southern wetland, has been decreased by clearing of some of the woodland on an adjacent site. The potential vertebrate species richness of this faunal habitat is estimated to be 104 species.

Habitat 2, the central wetland, consists of *Jacksonia/Melaleuca raphiophylla* shrubland. This is a vegetation mosaic, with alternating patches of *Jacksonia sp.* occupying higher ground and *Melaleuca sp.* in the hollows, with *Acacia saligna*, sedges, grasses and patches of samphire on grey sand. In winter the lower lying areas are flooded, forming small freshwater wetlands. A section adjacent to Karanga Street contains young trees, mainly *Eucalyptus gomphocephala* and *Eucalyptus calophylla*. The potential vertebrate species richness of the faunal habitat is estimated to be 165 species.

Habitat 3 consists of unvegetated sandy foreshore. The potential vertebrate species richness of this faunal habitat is estimated to be 64 species.

Habitat 4 consists of parkland cleared *Eucalyptus calophylla* and *Eucalyptus gomphocephala* woodland with a weedy groundcover. The potential vertebrate species richness of the faunal habitat is estimated to be 134 species.

Thirty two species of bird, one native mammal, two introduced mammals and two reptiles were recorded within these habitats. With the addition of migrants, vagrants and secretive vertebrates, Ninox judges that the habitats of the project area have the capacity to support up to 190 species, many of which are seasonal visitors or migrants (Ninox Wildlife Consulting, 1991).

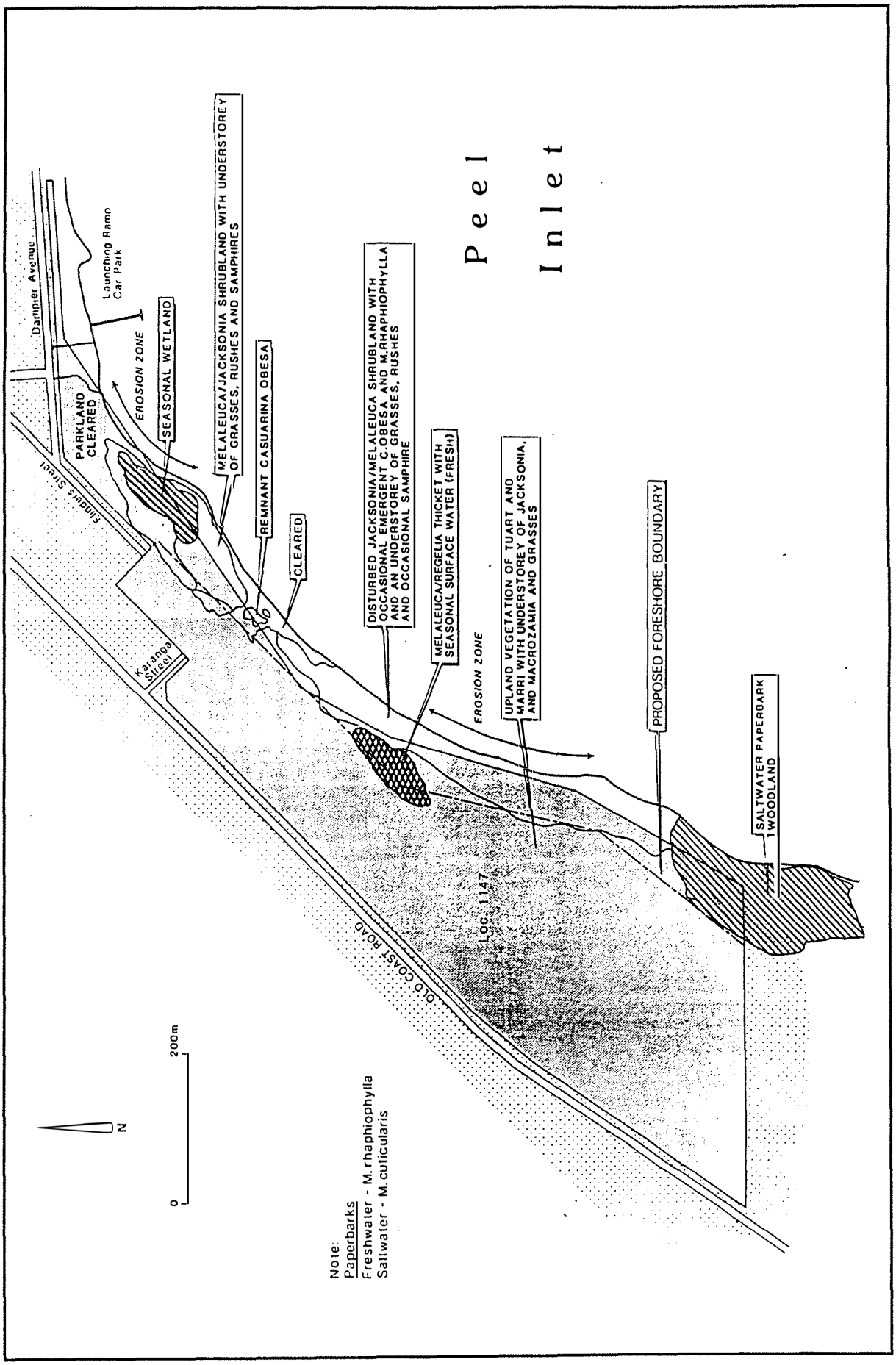

Figure 4: Habitat Distribution Le Provost 1991

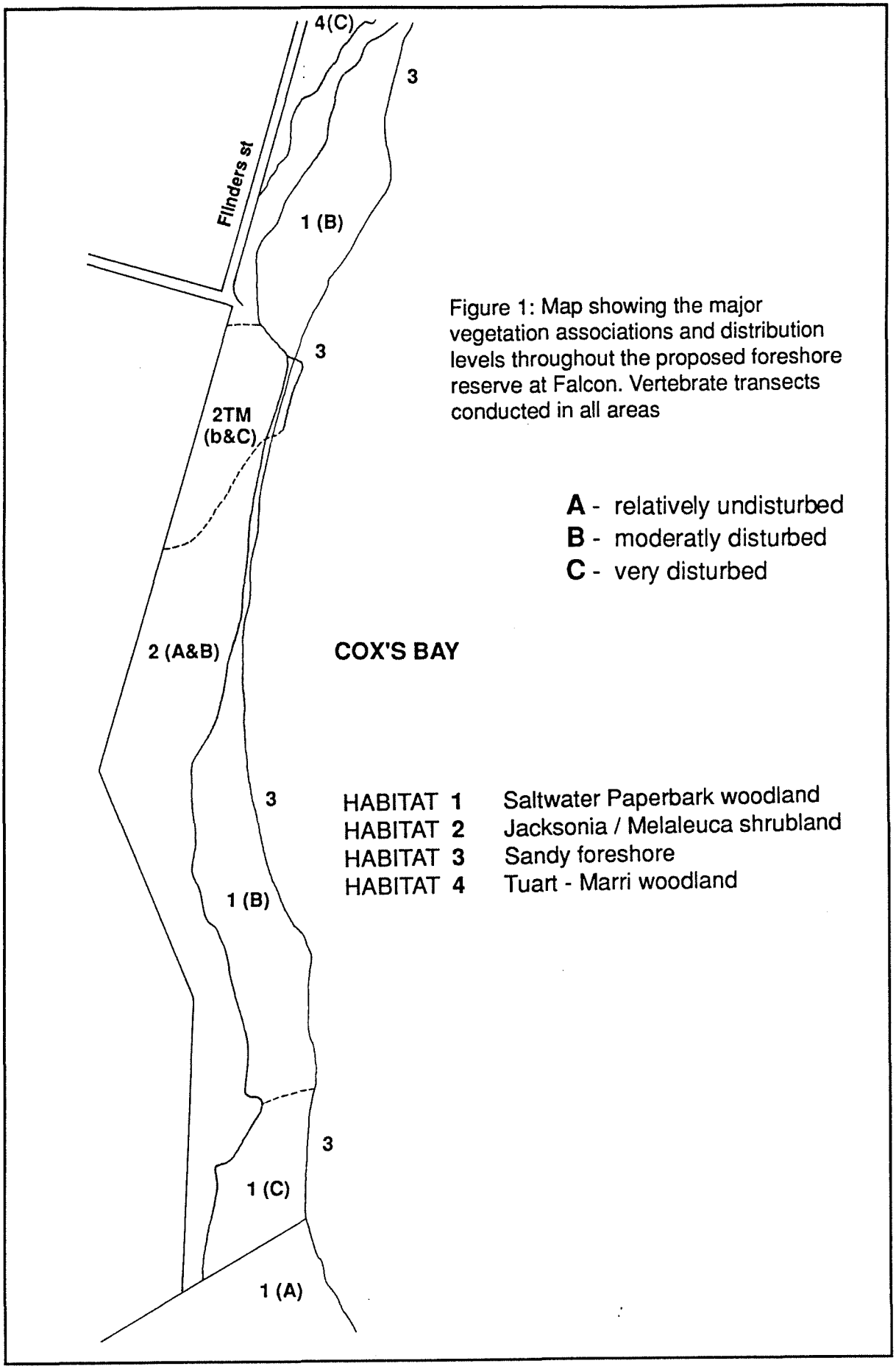

Figure 1: Map showing the major vegetation associations and distribution levels throughout the proposed foreshore reserve at Falcon. Vertebrate transects conducted in all areas

Figure 5: Habitat Ratings Ninox 1991

Ninox Wildlife Consulting (1991) reported that the site is substantially degraded, isolated from other bushland remnants, and the species list represents the best possible scenario for an area of land which primarily acts as a seasonal feeding area for a range of nomadic or migratory birds. Because of its small size, encirclement by urban development and continuing degradation through isolation, pre-existing clearing, rubbish dumping, and susceptibility to fire, resident species cannot be considered as secure in the long term. Management as a representative wildlife refuge would also be difficult for the same reason.

Ninox Wildlife Consulting (1991) considered that whilst the loss of the proposed foreshore area through landfill and landscaping represents a further, strictly local decrease in the limited natural resources surrounding the Peel Inlet, it is concluded that the development of the site will not represent a regional threat to any native vertebrate species. All have geographic ranges extending well beyond the confines of this locality, and all occur in the existing system of reserves throughout the State. Ninox Wildlife Consulting (1991) indicated that all the habitats in the foreshore area are represented elsewhere along the shores of Peel Inlet and Harvey Estuary, and some of these habitats occur within reserves along the eastern shores of the Inlet and Estuary.

4.1.2 Rare fauna

A relict population of the threatened species *Isoodon obesulus*, the Southern Brown Bandicoot, occurs in Habitat 2. The bandicoot population is estimated to be about six, and the male bandicoot is territorial, defending a territory of up to 7ha. This animal is listed on Schedule 1 of the Wildlife Conservation Act, which lists threatened species likely to become extinct or which are rare.

Ninox Wildlife Consulting (1991) considers that Habitat 2 is at best a marginal wetland for this species due to its isolation, seasonal nature, and sensitivity to wildfires, and that the site is too small to support a viable breeding population of bandicoots. A fire occurred in this habitat in February, and the consultants were requested to make an intensive search for this animal, and to consult with the Department of Conservation and Land Management to find out if translocation were possible.

Two rare species of birds, the Peregrine Falcon and Carnaby's Cockatoo may possibly occur. Ninox Wildlife Consulting (1991) does not consider that the project will have any discernible effect on these species because of their mobility, and the small size of the available habitats.

4.1.3 Mosquitoes

The mosquito *Aedes vigilax* is considered to be the principal vector of epidemic polyarthritis, also known as Ross River virus. By far the greatest proportion of its breeding takes place in tidal salt marshes where many waterbirds congregate. The abundance of waterbird species and individuals peaks in mosquito breeding areas during the summer months, and coincides precisely with an equivalent peak in populations of *Aedes vigilax*. Feeding is the major waterbird activity which takes place in mosquito breeding areas, and recent research indicates that mosquito larvae are an important part of the food chain for some bird species (Ninox Wildlife Consulting, 1990).

Mosquitoes are a major concern to Mandurah residents. Mosquito control measures such as filling, draining, fogging and larvicidal control of mosquito populations need to be directed primarily at these tidal salt marshes on a regional basis if these measures are to be effective (Chester and Klemm, 1990). Additional measures would be required if the proposed Dawesville Channel was constructed, as this would cause more frequent tidal inundation of foreshore areas, creating additional areas suitable for mosquito breeding.

BSD Consultants in their Rezoning Proposal for Lot 1147 Estuary Gardens state that the principal mosquito breeding sites within the foreshore are located within the wetlands. The saline wetlands at the north and south of the site are of greatest concern, because they support the species of mosquito most frequently associated with Ross River virus (BSD, 1990).

The planning consultants also state that the southern wetland drains toward the estuary, but water pools in localised areas to form mosquito breeding sites. The developer proposes to fill these depressions selectively, retaining the existing trees. The area would be rehabilitated progressively to a condition similar to the undisturbed paperbark wetland immediately south of the site.

The developer proposes to thin the central wetland vegetation so that the waterbody would be more open and less suitable as a mosquito breeding habitat. The surrounds to the waterbody would be planted with existing native plant species to form a semi-ornamental wetland.

The northern wetland floods seasonally, and dries out in summer to form a major breeding area. As it is not considered feasible to maintain water quality within this wetland, the developer proposes to fill the central wetland depression, whilst retaining the fringing paperbarks, and to grass the central area for passive recreation. Alternatively, Main Roads Department has proposed, as part of its plans for stormwater disposal for the upgrading of the Old Coast Road, to excavate this wetland to accommodate additional drainage.

Other mosquito breeding habitats occur in pools and depressions along existing tracks, and on the low lying areas adjacent to the estuary. These would be filled as part of the programme of foreshore redevelopment.

The developer proposes to treat the wetlands as shown in the Cross Sections in Figures 6 and 7.

4.2 The marine environment

The Peel Inlet is bathymetrically differentiated into a central basin 1.5m to 2m deep, and a shallow marginal shelf about an average 1 metre higher. At Cox's Bay the shelf slopes fairly uniformly from the shore to the basin floor, and varies from 300 to 800 metres in width.

The waters are eutrophic, and the elevated nutrient concentrations have caused excessive growth of macroalgae. This creates significant management problems, when the algae dies, washes up on the beaches and decomposes, causing odour. Exchange of water between Cox Bay and the main body of the Peel Inlet is poor, and is effectively restricted to that produced by the tides. As a consequence, materials entering the Bay tend to be trapped.

The estuarine biota of Peel Inlet comprises an aquatic flora of various seagrasses and algae, an abundant in-fauna of molluscs, worms and crustaceans, and a nektonic fauna of estuarine fish and crustaceans.

4.2.1 The fishery

The site is used for prawning and crabbing under suitable tidal conditions, and the professional fishermen set nets for cobbler during periods of high water in Autumn. The Fisheries Department reports that thirty licensed units fish the area for cobbler and mullet to a significant extent.

5. International agreements, environmental policies and strategies

The proximity of the Peel-Harvey catchment to Perth, the very high conservation value of the estuary system and the significant management issues that arise as a consequence of the interactions between these and other factors, all provided parts of the context within which the Authority has considered this proposal. This proposal affects both the estuary as well as foreshore land, which are subject to a number of agreements, policies and plans.

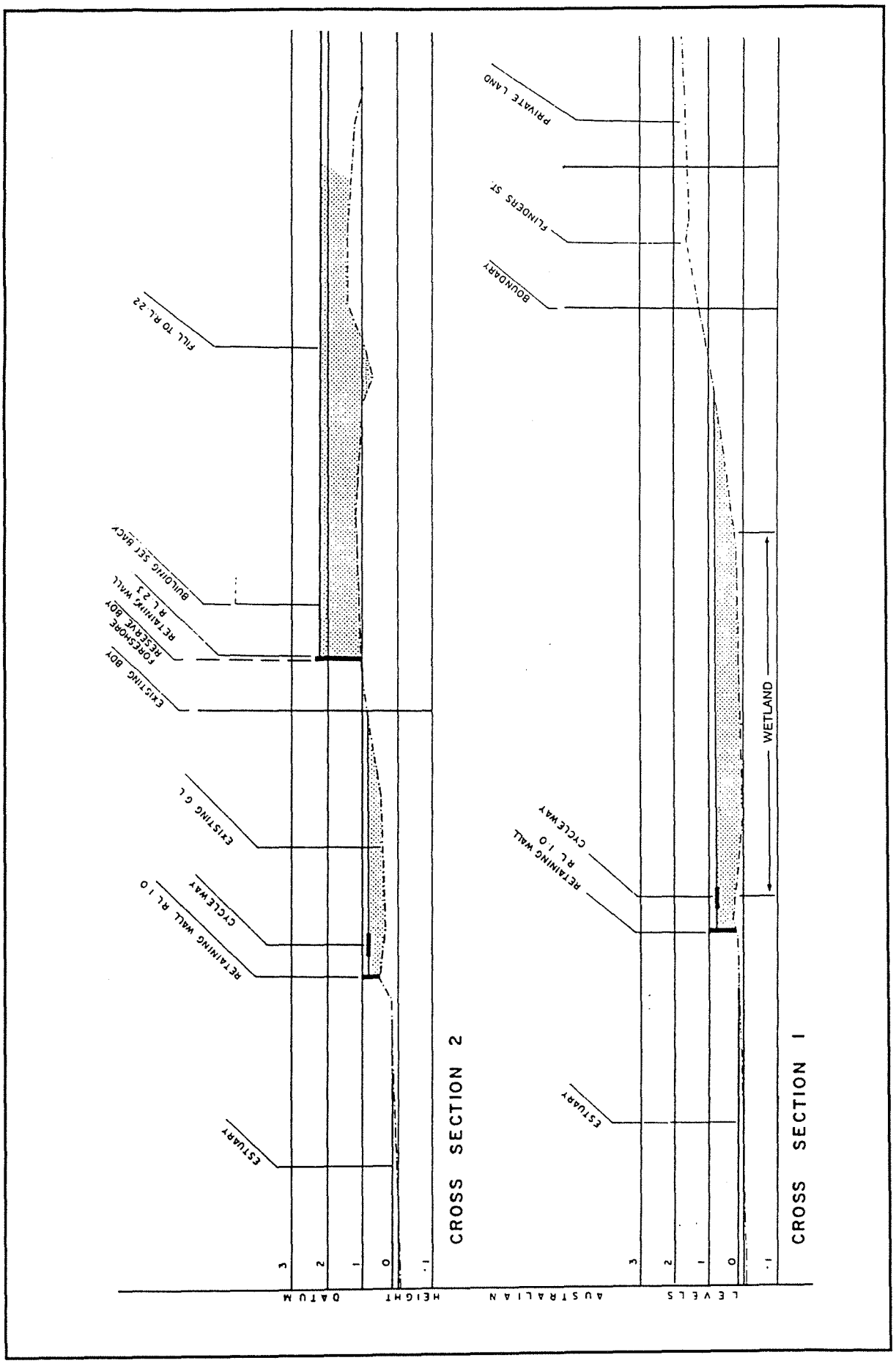

Figure 6: Cross Sections 1&2

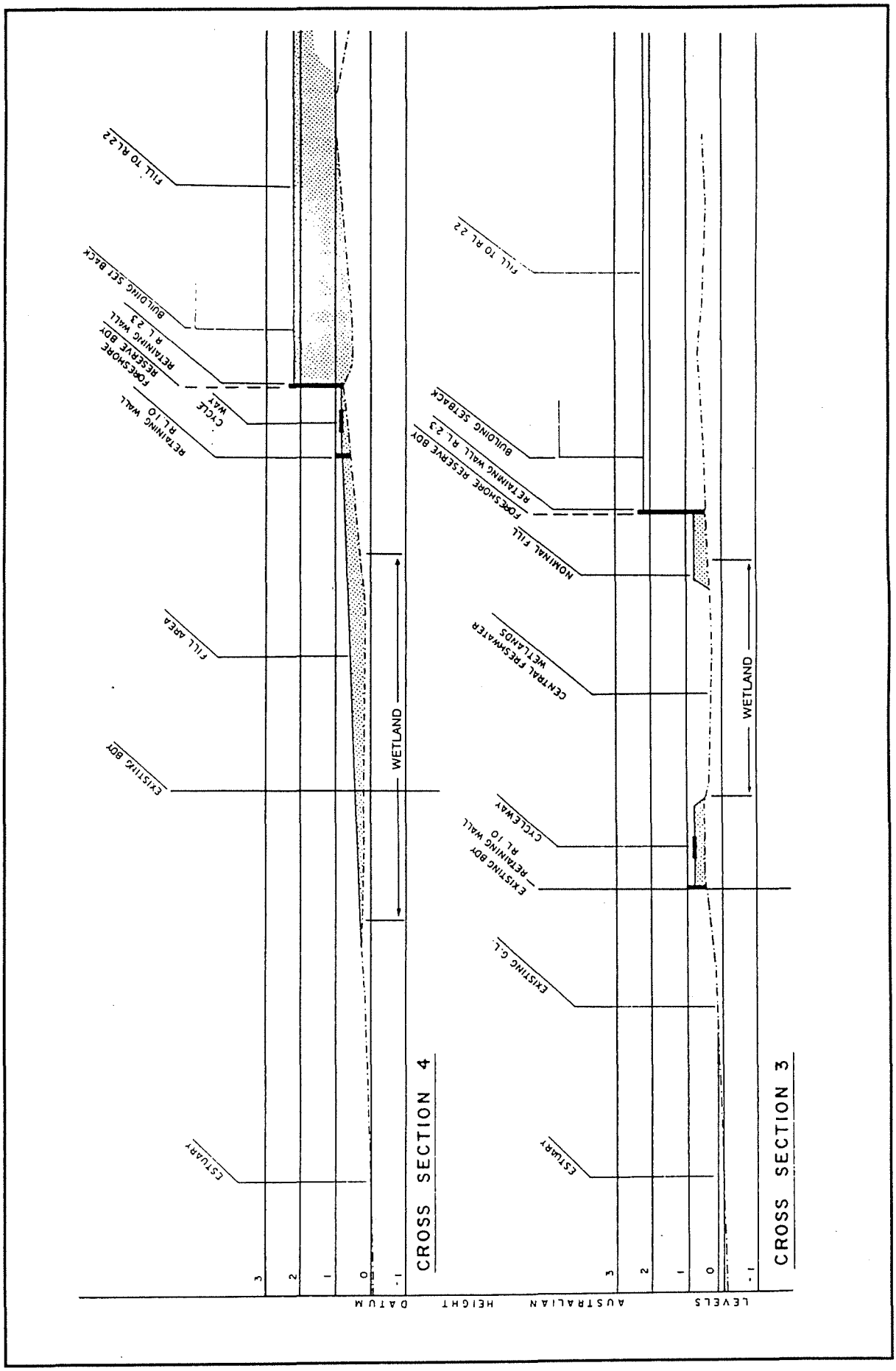

Figure 7: Cross Sections 3&4

5.1 Draft Peel Inlet Management Plan Programme Review

As mentioned earlier, this review provides a key context within which the Authority has assessed this proposal.

The aims of the draft Programme are to balance competing demands for use and development with the need to restore the nutrient balance of the Estuary, and to conserve it as a healthy, functional estuarine environment for present and future generations. This will be done by designating some areas of the foreshore for conservation, and by developing recreation nodes at others. 19% of the Peel-Harvey foreshores will be recreation reserves, and 81% will be conservation reserves.

The planning considerations and area recommendations for the Cox Bay area are included in Appendix 3. The two major recommendations are:

• **A 29** To amalgamate three very small reserves and adjoining vacant Crown land to create a reserve for recreation and foreshore management and vest in the City of Mandurah;

• **A 30** To undertake environmental, engineering and costing investigations associated with possible dredging and filling near the Novara foreshore to extend the foreshore reserve.

These recommendations were adopted by the proponent and used in his proposal. The proponent's proposal was supported by PIMA in its public submission.

5.2 Japan/Australia Migratory Birds Agreement (JAMBA) & China/Australia Migratory Birds Agreement (CAMBA)

The Australian and Japanese Governments and the Australian and Chinese Governments have signed agreements for the protection of migratory birds and birds in danger of extinction, and their environment. Article VI of the Australia/Japan Agreement states that each Government shall endeavour to take appropriate measures to preserve and enhance the environment of birds protected under the provisions of this Agreement.

The Peel-Harvey estuarine system is the most important water bird site in the South West (EPA, 1988). In 1990 Ninox Wildlife Consulting carried out a survey on the significance of mosquito breeding areas to the waterbirds of the Peel Inlet. Ninox Wildlife Consulting recorded 29 species of waterbirds at Cox Bay, representing 48% of species and 10% of individuals logged in Peel Inlet during the survey, and they found that nearshore shallow water areas less than 30cm deep, beach front areas and sandspits are the most important waterbird habitats in Cox Bay (Ninox Wildlife Consulting, 1990). At least four species of waterbirds sighted here are listed under JAMBA.

Another waterbird survey was carried out by Mr A Daw, a member of the Royal Australian Ornithologists Union, of the waterbirds seen within 200 metres of the foreshore and the bush birds in the adjacent swamp lands and vegetated areas. One species of waterbird listed under JAMBA/CAMBA was sighted in this survey.

5.3 RAMSAR Convention on International Importance Especially as Waterfowl Habitat

Signatories to the United Nations Educational, Scientific and Cultural Organization's Convention, (known as the RAMSAR Convention after the place where it was signed,) have agreed to designate suitable wetlands within their territories for inclusion in a List of Wetlands of International Importance, to ensure the conservation of wetlands and their flora and fauna, by combining national policies with co-ordinated international action (UNESCO 1971).

The Western Australian Government is proceeding with the implementation of RAMSAR recommendations with the listing of wetlands known to be significant waterbird habitats in the State. The Peel-Harvey Estuary has been nominated and accepted as a significant waterbird breeding area under the terms of the RAMSAR treaty.

5.4 Draft Environmental Protection (Swan Coastal Plains Wetlands) Policy

Wetlands have high environmental, social and economic values, but the values of more than two-thirds of wetlands on the Swan Coastal Plain have been reduced or destroyed since European settlement.

The purpose of the draft Environmental Protection Policy is to protect the values of wetlands on the Swan Coastal Plain from being reduced or destroyed by filling in, excavation, pollution or changes in drainage capable of reducing or destroying their values, any more than is absolutely necessary.

Wetlands included in the policy are those filled with water in December 1988. These three wetlands are not identified on the draft policy's maps.

5.5 Draft Integrated Mosquito Control Strategy for the Peel-Harvey region

This strategy was produced by the Waterways Commission in November 1990 at the behest of State Cabinet. The components of the strategy are:

- to research the ecology of Ross Rover virus and mosquito breeding fluctuations;
- to take into account potential mosquito problems prior to rezoning a land use to one which permits some form of residential use;
- to monitor mosquito populations;
- to use larvicidal agents; and
- in some carefully selected areas to use physical modification to reduce or eliminate mosquito breeding.

Interim guidelines for physical modification state that the flooding regime of the wetland(s) should be altered as little as possible, that the total number and volume of filled areas should be minimised, and that only areas of a wetland where mosquitoes breed should be modified.

6. Review of public submissions

The Public Environmental Review was available for an eight-week public submission period, which closed on 16th March 1991. Comments were sought from the public, community groups, conservation groups, and local and State Government Authorities. The submissions raised a number of issues, which were summarized under the following headings:

- Design of the foreshore and the island
- The need for the development
- Loss of wildlife
- Impact on the fishery
- Growth of macroalgae
- Disposal of sediment
- Vesting of the island, changes to shire boundaries and financial sureties.

A detailed list of issues raised in submissions and the proponent's response to these issues are included in Appendix 2 of this report.

As mentioned earlier, the Main Roads Department put forward an alternative design concept for the northern wetland after the closure of public submissions. This concept was to excavate the wetland down to permanent water table in order to accommodate overflow drainage from the new carriageway on Old Coast Road. Although the public has not had the opportunity to make

comment, the Authority decided to consider that concept within this assessment, mainly because it related to the same site and partly because the proponent was prepared to support it as an alternative to the proposal outlined in the PER. The Authority wanted to ensure that the issues needed to be addressed irrespective of who the proponent was.

7. Environmental issues

Following consideration of the Public Environmental Review, changes submitted since the release of the documentation, submissions from the public and government agencies, and the proponent's response to submissions, the Environmental Protection Authority has determined that the proponent has addressed the relevant issues associated with the proposed deepening and filling of the foreshore satisfactorily, and that the subsequent impacts can be managed. This environmental management can be achieved by a combination of the proponent's commitments and the Authority's recommendations.

Recommendation 1

The Environmental Protection Authority has concluded that the proposed deepening of Cox Bay and filling of the foreshore, 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 exceptions of the proposed island and the proposed filling of the wetlands.

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

- **loss of waterbird habitat;**
- **impact on the fishery;**
- **nutrient transport and the maintenance of water quality;**
- **mosquito control;**
- **loss of bandicoot habitat; and**
- **impact on estuarine wetlands.**

The Environmental Protection Authority notes that these environmental factors have been addressed adequately by either environmental management commitments given by the proponent, or by the Environmental Protection Authority's recommendations given in this report.

Accordingly, the Environmental Protection Authority recommends that the project could proceed subject to the Environmental Protection Authority's recommendations in this report, and subject to the proponent's commitments to environmental management as detailed in Appendix 1 of the Public Environmental Review.

The Authority's experience is that it is common for details of a proposal to alter through the detailed design and construction phase. In many cases alterations are not environmentally significant or have a positive effect on the environmental performance of the project. The Authority considers that such insubstantial changes may be provided for within this particular assessment.

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

7.1 Implementation of the Peel Inlet Management Programme Review

The Authority supports the aims of the draft Peel Inlet Management Programme, which is to balance competing demands for use and development, with the need to restore the nutrient balance of the Estuary, and to conserve it as a healthy functional estuarine environment for present and future generations. This will be done by designating some areas of the foreshore and substantial portions of the estuary for conservation, and developing recreation nodes at others. Cox Bay foreshore is one such proposed recreation area, and the Authority has endorsed the development of this site in Recommendation 1 of this report.

There has been a continuing loss of fringing vegetation on the western foreshore of the Peel-Harvey Estuary. These losses result from a range of activities including the illegal clearing and filling of foreshore land, indiscriminate boat launching, off road vehicle use and infestations of weeds and grasses. The Waterways Commission states that these activities are technically illegal under the Land Act, but in the absence of specific regulations, enforcement has not been practical.

The Authority wishes to support not only the establishment of recreation areas, but also the establishment of conservation areas as outlined in PIMA's Management Programme Review. Part of the philosophy of the draft Peel Inlet Management Programme Review is that it acknowledges that degradation as a consequence of people use is occurring where there are no recreation nodes to direct and manage people away from fragile conservation areas. Not only does it identify recreation and development nodes but also places considerable emphasis on other areas which should be protected and rehabilitated for their conservation value. The Authority endorses PIMA's early establishment of Waterways Protection Precincts in areas where the protection of waterway margins and the minimisation of environmental loss is of a high priority.

Recommendation 2

The Environmental Protection Authority recommends that the Peel Inlet Management Authority:

(1) proceed with the establishment of Waterways Protection Precincts in areas where the protection of waterway margins is of a high priority; and

(2) ensure the preparation and implementation of management plans for these areas which ensure the minimisation of environmental loss and the rehabilitation of environmental values as necessary.

7.2 Waterbird habitat

The Ninox Wildlife Consultants survey found that the nearshore shallow water areas less than 30cm deep, beach front areas and sandspits are the most important waterbird habitats in Cox Bay. (Ninox Wildlife Consultants, 1991).

The deepening of Cox Bay would cause a reduction in the area of available intertidal waterbird habitat under some tidal conditions. The proponent, in his response to public submissions, states that in the longer term, and on an estuary wide basis, the extent and frequency of exposure of the intertidal zone will increase following construction of the Dawesville cut, because of the greater tidal fluctuations (Appendix 2). Even if the Dawesville cut does not proceed, the Environmental Protection Authority considers that widening of the beach will create additional roosting habitat, and that if only part of the beach is filled, there will be only a partial loss of intertidal wading bird habitat from the foreshore.

The deepening will also cause a reduction in area of approximately 40ha of shallow water habitat, which is approximately 0.7% of the total shallow water area of the Peel-Harvey Estuary. The PER states that the loss of shallow water bird habitat would be replaced in the

long term by accretion of sand around an island, and that the island would have to be located in the centre of the eddies which flush Cox Bay, so as not to interfere with this process. However, it is not known whether an island would function as a feeding habitat in the short or long term, and it is likely that algal accumulation would occur on its shores, thus creating an additional management problem.

The Environmental Protection Authority also considers that an island would not provide a suitable alternative bird habitat, as it would be located too close to a foreshore which is designated for intensive recreation, and the fairly shallow water would still permit human access. The Authority believes that a more appropriate location for an island would be in the southern part of the Estuary which has been designated for conservation by Peel Inlet Management Authority (PIMA), and that there are likely to be long term problems with vesting and on-going management of an island in Cox Bay.

However, the Environmental Protection Authority considers that the provision of shallow water habitat offshore in the same location as an island would be beneficial, as it would replace the shallow water bird habitat lost through deepening, and would not offer the same management problems as an island.

As the RAMSAR Convention lists the whole of the Peel-Harvey Estuary as a strategic waterbird resource, and as only a small number of bird species listed under the JAMBA/ CAMBA Agreement use this site, the Environmental Protection Authority does not consider that the existence of these treaties is an actual impediment to this proposal.

The development of this area of waterbird feeding and roosting habitat is not significant in the regional sense, as it does not detract from the acknowledged conservation value of the estuarine system. In addition, the PIMA's Management Programme proposes to conserve large parts of the Estuary which have higher site specific value and have enhanced capacity to be managed for protection.

Therefore, the Environmental Protection Authority considers that this reduction of waterbird habitat is environmentally acceptable. Further, there is the opportunity create alternative shallow water bird habitat in the same location as the proposed island. Therefore its response to this issue is therefore contained in Recommendation 3 of this report.

7.3 The fishery

The deepening may also have some impact on professional and recreational fishing, prawning and crabbing. The Fisheries Department considers that frequent use of the harvesters and recreational boats will disturb sea mullet and yellow eye mullet using the Bay as a refuge, and that the increasing use of the Bay has the potential to affect commercial catches adversely. The Fisheries Department and public submissions also raised concerns about the possible loss of prawning, crabbing and fishing in shallower water.

However, the Department considers that the increased recreational values for boating because of deeper water, and less odour from decomposing algae on the foreshore, do not necessarily compensate for a possible decline in water quality, and the possible loss of prawning, crabbing and fishing in shallower water. The Fisheries Department concludes however, that the proposal will not exert any significant impact on the overall fishery of the Estuary, because of its small size.

The proponent's response to these concerns is that as the increase in depth due to the proposed excavation is minor, the area will retain its shallow water habitat characteristics, and that the effect on both the fishery and fish breeding and refuge areas will be minor and probably undetectable. The greater depth will be offset to some extent by the effects of greater tidal fluctuation brought about by the Dawesville cut.

In addition, the proponent considers that the anticipated frequency of harvester operations is such that disturbance to shallow water fish habitat during periods of macroalgal growth will be infrequent. The impact of weed harvester operations will be localised to the immediate vicinity of the operating harvester.

The Authority considers that the modification of 40ha of shallow water habitat is not an impediment to the proposal proceeding, as the area of affected estuarine habitat with its associated floral and faunal assemblages is neither large, nor unique on a regional scale. In addition, protection of other substantial shallow portions of the estuary will be achieved through implementation of the Peel Inlet Management Programme Review. Therefore the possible affect on the fishery is environmentally acceptable on a regional scale, and the Authority's response to this issue is contained in Recommendation 3 of this report.

7.4 Maintenance of water quality

7.4.1 Turbidity

The PER states that primary production may be limited in highly turbid waters by reduced light penetration of the water, and that deepening and filling levels may increase the natural background levels of turbidity beyond environmentally acceptable levels.

The PER also states that the proposed deepening will generate sediment plumes, and cause turbidity in local waters only during the initial construction and final removal of the main enclosing bund wall. Sediment plumes will not be generated during the dewatering operations in the main excavation period, since the turbid water within each compartment will be pumped into the lagoon created by the main bund wall. Nutrient release from the disturbed sediments is not expected to cause algal blooms within the lagoon, because the turbidity will significantly reduce light availability.

During a trial excavation and bund wall construction at the Falcon boat ramp by the proponent, the water was found to remain well oxygenated, and elevated turbidity was confined to a relatively small area. This was considered to be largely due to the low level of organic matter present within the sediments. The Authority considers that the results of the trial excavation indicate that turbidity generated during construction is manageable, provided that the proponent's management commitments are met.

7.4.2 Flushing

The PER states that excavation depths within the embayment are designed so that water circulation and exchange would tend to be enhanced, rather than restricted; that the retarding effect of bottom friction would be reduced as a result of the deeper water column; and that the proposed island would be placed so that any large eddies within Cox Bay would not be disturbed. The Authority considers that the uniformly increasing depth profile out to the central Peel basin should facilitate the offshore transport of pollutants.

Local water quality is not expected to deteriorate as a result of the project. Riedel and Byrne have investigated the flushing and circulation characteristics of Cox Bay, and have made predictions for the existing and altered embayment (LeProvost Environmental Consultants, Appendix 2). The deepening is predicted to have little impact on existing current patterns. The existing eddies should persist since the island or shallows would be located in the centre of their usual path. The estuary floor would be sloped into Peel Inlet so water would not stagnate. This feature should promote offshore transport by bottom density currents, that may be driven by nearshore evaporation. Evaporation would cause a local increase in salinity, and hence an increase in the density of waters in the shallows. The Authority considers that any localised accretion of organic detritus in the proposed deepened areas should be manageable by the PIMA harvesters, as a result of the increased accessibility to the Bay.

7.4.3 Nutrients

The level of nutrients in the deep, newly exposed sediments is expected to be similar to that measured in the surface sediments (LeProvost Environmental Consultants 1990, Appendix 7). The PER says it is considered unlikely that extensive algal growth will occur within Cox Bay

immediately following the re-introduction of estuary water, since any thin layers of highly enriched sediments (typically found in the top 2cm of the substrate,) will have been removed to the foreshore and to the island during the excavation operations.

The Authority considers that any release of nutrients from disturbed sediments will be short term and minor, and will have a small impact in a localized area. The impacts are therefore manageable, through the careful application of construction techniques, such as the construction of bunds, and the timing of construction, The sediment should be moved during winter, when the Estuary is full of river water which will wash the nutrients out of the system, and when nutrient release from the excavation will be minor compared to the existing river borne loads. In addition, nutrient release will have little impact if there is not much light available, and if the water is cold, as microbial growth rates are low under those conditions. However there might be an odour problem when the sediments are excavated, which will be transitory.

7.4.4 Weed harvesting

Algal accumulation is already a significant problem in Cox Bay, due to eutrophic conditions throughout the Peel Inlet and to poor flushing, and algae has a significant effect on water quality already. Public submissions have expressed concern about a possible increase in algae following the deepening of Cox Bay, based on the experience of deepening of the access channel to Falcon boat ramp. The proponent's response is that algae accumulation within the deepened boat ramp channel is a localised result of the lower water velocities across the channel due to eddies within Cox Bay, which allow algae and silt to settle within the channel. The proponent considered that deepening the Bay will not prevent existing algae accumulations from occurring, but rather will allow for the efficient removal of such accumulations.

At present, because of shallow water depths, the Peel Inlet Management Authority (PIMA) is unable to use the floating harvesters. PIMA has to wait until the algae blows ashore and accumulates, which is causing significant problems with odour as the algae decomposes. PIMA then collects it with front end loaders, which is causing beach erosion.

The PIMA is in favour of deepening the Bay to allow access for their harvesters, as off shore harvesting would reduce the odour problem caused by rotting algae on the foreshore, and remove a significant cause of beach erosion. The Authority accepts that it is important to deal with the immediate problem of algal accumulation, and its response to this issue is contained in Recommendation 3 of this report.

7.4.5 Nutrient input from the foreshore and associated development

To control nutrient input, it will be necessary to deep sewer Estuary Gardens, and minimise the application and loss of nutrients from both that site and the foreshore development sites.

The Environmental Protection Authority considers that environmental impacts from nutrient transport from either the foreshore or the adjacent development can be limited by environmental management, and will not make a significant contribution to water quality problems.

7.4.6 Water quality conclusion

The Environmental Protection Authority considers that the environmental impacts of the proposed deepening on the water bird habitat and the fishery are manageable, that water quality should improve and that there are benefits to be gained from permitting the proposal to proceed, especially in permitting other significant portions of the estuary and adjacent land to be protected.

The Authority notes that commitments have been made by the proponent in relation to monitoring and managing water quality during or after the deepening.

Recommendation 3

The Environmental Protection Authority recommends that:

(1) deepening the Estuary should be permitted in accordance with the proposal;

(2) alternative waterbird habitat should be provided by the construction of shallows in the same location as the proposed island; and

(3) sediments used to create the shallows should be placed in the same order as existing sediments.

7.5 Mosquito control

There is no specific solution to the mosquito problem throughout the Peel-Harvey Estuary. Land use controls are the most effective form of mosquito control, as they may ensure that residential areas are not adjacent to mosquito breeding areas. However, the option of allocating land use on this basis is not available, as the adjacent Lot 1147 has a tourist zoning over part of the site.

The draft Mosquito Control Strategy Interim guidelines for physical modification state that the flooding regime of the wetland should be altered as little as possible, that the total number and volume of filled areas should be minimised, and that only areas of a wetland where mosquitoes breed should be modified.

As mosquitoes have a long flying range, the proposal to fill and/or selectively clear these wetlands will not remove mosquitoes from the development, as it does not prevent their influx from other areas.

The application of larvicide to the wetlands would ameliorate the problem, but would affect the wetlands' value as bird habitat, as mosquito larvae are part of the food chain.

The Environmental Protection Authority considers that mosquito control measures for this area must be consistent with the protection of wetland values and functions as required by the draft Wetlands Environmental Protection Policy, and therefore the proposed modifications are environmentally unacceptable. Accordingly, the Authority's response to this issue is contained in Recommendation 4 of this report.

7.6 Bandicoot habitat

The Department of Conservation and Land Management considers that the development area is marginal for the low density population of Southern Brown Bandicoots within the area. Further, it appears that the site is not significant to the overall conservation of this species Nevertheless, the Department has indicated that, if the management strategies proposed by Ninox Wildlife Consulting in their March 1991 report, which include retaining the existing wetlands, are implemented as far as possible, the chances of survival of the bandicoot population will be maximized.

Accordingly, the Environmental Protection Authority considers that the Department of Conservation and Land Management should provide guidance to the developer and foreshore manager with regard to the bandicoots.

7.7 Impact on estuarine wetlands

The intention of the draft Environmental Protection (Swan Coastal Plain Wetlands) Policy 1991 is that no more filling in, mining, excavation, pollution or changes in drainage capable of reducing or destroying the values of wetlands on the Swan Coastal Plain will take place than is absolutely necessary.

In a report to the Mosquito Control Review Committee, Ninox Wildlife Consulting (1990) ranked the three estuarine wetlands on the foreshores of Cox Bay in terms of their significance to water birds. In their report on the proposed foreshore reserve Ninox rate two of the wetlands as of intermediate significance and one as of low significance, and comment that each of these small wetlands has dense enough vegetation to act as a refuge area for secretive waterbirds such as crakes and rails. (Ninox Wildlife Consulting, 1991).

Although these ratings are not high, the potential richness of the vertebrate species assigned by Ninox Wildlife Consulting (1991) to all the foreshore habitats other than the beach, would suggest that clearing and filling most of the foreshore is undesirable. Nor would clearing meet the intent of the existing Landscape Protection Zone, which is to retain the existing trees, nor the intent of the draft Environmental Protection Policy, which is to protect wetland values and functions.

Filling and widening the beach to a maximum of 6 metres would destroy the reed banks and other fringing estuarine vegetation in some areas, because the filling would cause changes in water levels and to the flushing regime on which the reeds are dependant. The Authority considers that this is undesirable, and that some compromise to the beach widening proposal is necessary in order to conserve wetland values.

The Main Roads Department proposal to excavate the Northern Wetland as a sump would also destroy wetland values, and although the Authority recognizes that it is possible to restore wetland vegetation around the proposed sump, the influx of fresh storm water would mean that the function of the new sump/wetland would change from a saline to a brackish, or possibly to a freshwater, sump/wetland. The Authority considers that this does not meet the intent of the Wetlands Environmental Protection Policy, and is therefore undesirable. The Authority also recognizes that disposal of stormwater into the Estuary is not acceptable, as it does not meet the requirements of the Peel-Harvey Ministerial Conditions which place a moratorium on the intensification of drainage into the Estuary. Accordingly, the Authority considers that the surplus stormwater drainage from Old Coast Road should be disposed of on the site of Estuary Gardens, or alternatively, into the central freshwater wetland on the foreshore, provided it can be adequately demonstrated that wetland function and values will be retained.

Recognising the need to strike a balance between a number of policies, plans and strategies which have implications for the area, the Environmental Protection Authority has concluded that filling all the foreshore except for the three wetlands, and widening the beach in the areas which do not adjoin the wetlands, is an environmentally acceptable option. This option will protect wetland values, allows for widening the beach in those areas which do not conflict with protecting wetland values, and allows for development of the area as a recreation node, thus supporting PIMA's Management Programme. It is acknowledged that filling only parts of the beach may not be completely sustainable in the long term, due to shoreline drift. However, it allows the fringing estuarine vegetation sufficient time to adjust to the changes in water level and to flushing, as any beach accretion will take place over a longer time scale.

Recommendation 4

The Environmental Protection Authority recommends that the following option for developing the foreshore should be implemented, such that:

(1) the two saltwater wetlands and the one freshwater wetland on the foreshore, their fringing vegetation and their functions are retained in their existing condition or are rehabilitated to the satisfaction of the Peel Inlet Management Authority;

(2) other areas of the foreshore could be filled in;

(3) the beach is not widened adjacent to estuarine wetlands;

(4) where possible, all large trees are retained on the foreshore and the fill is placed in such a manner as to ensure their survival;

(5) **the proponent seek advice from the Department of Conservation and Land Management in relation to conservation of the bandicoot population;**

(6) **the excess stormwater drainage from Old Coast Road be disposed of either on the Estuary Gardens site or alternatively into the central freshwater wetland, provided that it can be demonstrated that the wetland values and functions and the bandicoot habitat will be retained;**

(7) **mosquito control measures must be consistent with the preservation of wetland values and functions; and**

(8) **any fill surplus to requirements for the shallows, the foreshore and the beach could be disposed of on the Estuary Gardens site.**

7.8 Vesting and management

The Waterways Commission has agreed to accept vesting of the foreshore reserve with a power to lease to be obtained from the Lands Department. The Waterways Commission would lease the reserve to Meiyu Australia for 20 years, and Meiyu will be obliged to pass the lease on to the Corporate Body for Estuary Gardens as a condition of sale of the land.

Meiyu Australia Pty Ltd has made various commitments to monitor and manage the environmental impacts of the proposal for the adjacent Lot 1147 Estuary Gardens, the excavated portion of Cox Bay and the proposed foreshore reserve as shown in Appendix 1. The Authority considers that the proponent's commitments, and the Authority's recommendations based on its assessment of the proposal should be drawn together into a comprehensive environmental management programme for all components of the development.

The Environmental Protection Authority also considers that the proposed project agreement needs to be finalised early enough to ensure that appropriate funding arrangements are made for long term management of the foreshore. The Authority's considerations are contained in Recommendation 6.

Recommendation 5

The Environmental Protection recommends that prior to the commencement of construction, the proponent should prepare, to the satisfaction of the Peel Inlet Management Authority, a comprehensive development and management programme, to contain the management commitments made by the proponent shown in Appendix 1 and the recommendations in this report.

Recommendation 6

The Environmental Protection Authority recommends that the project agreement should be finalised between the proponent and the ultimate managing authority or authorities prior to the commencement of sale of any property, on the funding of the comprehensive development and management programme after the initial period of management by the proponent.

Conclusion

The Authority has conducted the assessment of this proposal within the regional context set by the Peel Inlet Management Programme. The Authority has stated that it wishes to support the aims of this Programme, to balance the competing demands for development with the need to conserve the Estuary as a healthy environment for future generations. By designating some areas of the foreshore for conservation and some for recreation.

Cox Bay foreshore is one such proposed recreation area, and the Authority endorses this use in the assessment report, provided that PIMA proceeds with implementing the Waterways Protection Precincts.

Whilst recognising the need to strike a balance between the different policies, plans and strategies which have implications for the area, the Environmental Protection Authority has therefore concluded that deepening the Bay, creating shallows for waterbird habitat, filling the foreshore except for the three wetlands, and widening the beach in the areas which do not adjoin the wetlands, is an environmentally acceptable option.

The Authority considers that all the environmental impacts associated with the proposal to deepen Cox Bay, and modify the foreshore as identified in this assessment report are manageable, subject to the recommendations made in this assessment report and the commitments provided by the proponent.

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Appendix 1

Commitments by the proponent

COMMITMENTS

1 BANK GUARANTEE

1.1 A bond of $20,000 will be lodged with the State for completion of the proposed project as described in this PER. The total amount to be refunded to the proponent upon completion of the earthworks for the project, initial vegetation planting of the foreshore and islands, and shoreline stabilisation works.

2 COMMITMENTS BY THE PROPONENT IN RELATION TO THE ADJACENT DEVELOPMENT ON PART LOCATION 1147

2.1 The development will be connected to a reticulated sewerage system.

2.2 Stormwater will be retained within the development area to a 1 in 10 year storm extent in compensating basin/s, with retention times of three to four days, and with no direct outfall to Peel Inlet or the proposed foreshore reserve with the exception of 1 in 100 year flood events.

2.3 Existing trees will be retained where feasible over the site.

2.4 A nutrient management programme will be developed and implemented over the development area.

2.5 Public access to the estuary will be provided through the development at two locations, which will include public car parking areas, in accordance with EPA recommendations.

2.6 The public car parking areas will directly adjoin the proposed foreshore reserve.

2.7 Physical and visual separation between the development and the foreshore reserve will be achieved by means of a retaining wall constructed to a level of 2.0 m AHD along the development boundary.

3 EXCAVATED BAY AREA MANAGEMENT

3.1 All works carried out within the boundaries of the Shire of Murray will be carried out to the specifications and satisfaction of Council.

3.2 Construction will be confined to daylight hours only.

3.3 The depth of excavation will range from 0.25 m to 0.45 m, as defined in the PER.

3.4 Excavation and island construction will take place within bund walling to minimise the generation of turbid plumes during construction.

3.5 Public access to the foreshore south of the Falcon boat launching facility will be denied only during the construction phase for safety reasons, with appropriate fencing and signage, as required by the City of Mandurah.

3.6 All exposed soil surfaces will be stabilised as necessary, to prevent the formation of a dust nuisance.

3.7 Deposition of the dredge spoil for filling of the foreshore and renourishment of the beaches will take place to the satisfaction of the Waterways Commission and Peel Inlet Management Authority.

3.8 The bay will grade into the deeper basin of Peel Inlet to ensure that it does not become a sink for detritus.

3.9 Water quality in the embayment and Cox Bay, and sedimentation processes in the embayment and local area will be monitored by the proponent to the satisfaction of the Waterways Commission and Peel Inlet Management Authority and reported annually.

Note: Following completion of the project debris and algal wrack accumulating within the embayment will continue to be removed by the Peel Inlet Management Authority.

4 ISLAND MANAGEMENT

4.1 Spoil used in the construction of the island and beaches will be tested to ensure the sand fraction is adequate for beach stability and to minimise the generation of turbid plumes.

4.2 Stone revetments at the northern and southern end of the island will be designed to meet Department of Marine and Harbour's standards.

4.3 The island armouring will be designed to cope with realignment of the shoreline due to storm events or longshore transport.

4.4 The island will be fully planted with native vegetation, supplemented with seeding and hydromulching as required, to the satisfaction of the Peel Inlet Management Authority and Waterways Commission.

5 FORESHORE MANAGEMENT

5.1 Foreshore filling will take place to the satisfaction of the Waterways Commission. All vegetation to be retained on the foreshore will be identified and marked prior to the commencement of filling. Specifically, this will include all mature trees.

5.2 As an alternative to filling, the Proponent is prepared to redevelop the northern wetland into a permanent wetland feature subject to agreement with the EPA and PIMA on design requirements and the maintenance of adequate water quality.

5.3 Foreshore protection and stabilisation work will be undertaken to the satisfaction of the Waterways Commission prior to the establishment of suitable public access areas.

5.4 The shoreline will be constructed to a stable profile and stability will be monitored to the satisfaction of the Waterways Commission.

5.5 Beaches will be graded to ensure that the resultant slopes comply with all requirements for safe access by the public.

5.6 The foreshore conservation areas will be rehabilitated with native vegetation to the satisfaction of the Waterways Commission.

5.7 The use of water for irrigation will be limited to 7,500 kL/ha/a on grassed areas and 5,000 kL/ha/a on areas planted with shrubs.

5.8 The proponent will construct a new boat ramp and car and trailer park adjacent to the existing Falcon boat ramp, subject to agreement with the relevant authorities.

5.9 A dual-use pathway will be constructed along the length of the foreshore around the embayment on an alignment acceptable to the Waterways Commission and the City of Mandurah.

5.10 Two jetty/groyne structures for public recreational purposes will by constructed by the proponent subject to approval of the relavent authorities and granting of jetty licences.

6 REPORTING SCHEDULE

The following components of project management will be reported upon:

(i) estuary management programme; and

(ii) foreshore monitoring programme.

Monitoring reports will include the results of all aspects of the monitoring programme as follows:

6.1 Estuary Management Plan

- water quality and the extent of turbidity during construction;
- crustacean and benthic invertebrate recolonisation of the dredged area and shallow water areas surrounding the island; and
- the bathymetry of the dredged area.

6.2 Foreshore Management Programme

- beach profiling and shoreline stability including the islands;
- vegetation surveys of the foreshore; and
- groundwater monitoring. Three piezometers will be installed within the foreshore for this purpose in accordance with PIMA requirements.

6.3 Timing

The results of the monitoring programme will be reported on an annual basis. At the end of the two year monitoring period, a final report will be prepared showing the results of the complete programme.

6.4 Reporting authorities

Results of the water quality monitoring, and the benthos and crustacean surveys will be reported to the EPA, Waterways Commission and PIMA. The results of construction monitoring including the bathymetry of the embayment, and sedimentation within the embayment will be reported to the Shire of Murray, City of Mandurah, EPA, Waterways Commission and PIMA.

The analyses of monitoring results for shoreline stability and vegetation surveys on the foreshore and island will be reported to the EPA, Waterways Commission, PIMA and the City of Mandurah.

Appendix 2

Issues Raised in Submissions on the PER and the Proponent's Response

SUMMARY OF PUBLIC SUBMISSIONS, ESTUARY DEEPENING, COX BAY

The following is a summary of issues and comments received by the Environmental Protection Authority on the above project.

The response by the Proponent to each comment follows in italicised type.

1 NEED FOR PROJECT

1.1 Pro-development

Some parts of our estuary should be developed and lived around, with due environmental respect Cox's Bay has nothing, it needs cleaning, tidying and people. It should not be left to the awful squelch I walked in today.

This comment reflects the Proponent's aims in proposing to undertake the estuary deepening and foreshore reconstruction work described in the PER.

1.2 Anti-development

No way are we in favour of the deepening or any other such developments.

We would like you people to appreciate what is already there and not allow the go-ahead and ruin what is already there.

These two comments reflect the alternative view to that expressed above, i.e. of maintaining the status quo. The proponent considers this option unworkable given the proposed use of this section of Cox Bay and the Peel Inlet foreshore for recreational purposes as described in the Peel Inlet Management Plan Review (1990), and the existing and proposed use of the adjacent land for tourist/residential purposes.

1.3 Delay the dredging

Dredging should be delayed until after the Dawesville cut has been completed. In the 1988 issue of the Peel Inlet Management Strategy, Stage 2, they state that the Estuary will rise 0.5 of a metre, and therefore dredging the Bay is not warranted. The new suction harvester used in Albany would be satisfactory to keep all the bays in the Estuary cleaned.

Reference to Section 7.2.1 and Figures 7.1 and 7.2 of the Peel Inlet and Harvey Estuary Management Strategy (Stage 2) indicates that the Dawesville cut 'would

have no significant effect on changes in water level attributable to the longer period meteorological and seasonal tides, although the response to meteorological tides, particularly to storm surge peaks might be accelerated.' Figure 7.1 indicates that average winter water levels would actually fall, while Figure 7.2 indicates that summer water levels, although similar on average to those at present, would be subject to greater daily tidal fluctuation.

Advice from the Waterways Commission is that for economical operation the suction harvester being used at Albany has the same operational restrictions as the conveyer harvesters in use in the Peel Inlet. That is, that the harvesters have similar flotational depth requirements and hence the existing problem in removing algae from the shallows would persist unless the deepening is carried out.

1.4 Wetlands

The degraded freshwater wetlands between Flinders Street and Cox's Bay should be developed for recreation.

This is the basis of the design philosophy adopted by Meiyu.

2 DESIGN OF PROJECT

2.1 Foreshore Reserve

Detailed design of the foreshore reserve development and the proposed island is to be to the satisfaction of the Peel Inlet Management Authority.

Meiyu is prepared to comply with this requirement.

2.2 Public Access

Vehicular access should be provided between the public car park proposed for the southern end of the adjoining development and the foreshore to enable future parking on the foreshore if required.

All of the proposed public car parks will directly adjoin the proposed foreshore reserve.

2.3 Irrigation

Water used to irrigate grassed areas be limited to 7,500 kL/ha/a and water use on shrubs be limited to 5,000 kL/ha/a.

Meiyu is prepared to make a commitment to restrict irrigation water use to within these limits.

Three piezometers should be installed on the eastern side of the grassed areas, and the water quality in the piezometers should be monitored for three years in accordance with PIMA.

Following clarification of this request with PIMA, Meiyu is prepared to install up to three piezometers on the foreshore in accordance with PIMA requirements.

2.4 Foreshore Protection

Spoil stockpiled for the proposed island should have a high sand fraction, confirmed by soil tests, to ensure beach stability and to minimise the turbid plume caused by the loss of fines over time. The proposed 1:10 beach slope will only be adequate for graded beach sand.

The extent of the proposed bay deepening has been adjusted so as not to extend into area not containing sands, so this is a valid point. The beach slope that has been selected at this stage is conservative, given the restricted wave climate at this site.

The 1:10 slopes identified in the report are maximum slopes determined by safety considerations. The final beach slopes, which may be less than 1:10, will be designed and constructed in accordance with the characteristics of the sands to be excavated from Cox Bay.

2.5 Foreshore and Island Protection

The stone revetment to protect the proposed island's northern and southern shores should be designed by a practising civil engineer experienced in marine structures and meet Department of Marine and Harbours' standards.

Design of the stone revetments is being carried out by PAM ENGINEERING CONSULTANTS, and will be to DMH standards.

The shoreline of the eastern beach of the island may recede during a storm event and a groyne at each end in line with the revetments should be designed and constructed to take this into account. The groynes should also be designed to cope with any realignment of the shoreline due to longshore transport.

Detailed design is being undertaken by PAM ENGINEERING CONSULTANTS.

2.5 Wastewater Disposal

Reticulated sewerage facilities are not presently available to the adjacent sewerage scheme. The financial and practicable viability of this connection should be investigated.

The relevant investigation has been completed by PAM Engineering Consultants. The project proposed on Location 1147 will be deep sewered.

2.6 Groundwater Use

The development on the adjacent site lies within the South West Coastal Groundwater Area, and will be subject to overall groundwater availability.

Meiyu is aware of the limitations on groundwater availability in this area and the adjacent development will be designed in accordance with these limitations.

2.7 Flood Protection

The minimum habitable floor level for the adjacent development site is 2.2 m AHD.

Meiyu propose a minimum fill height of 2.2 m on all building sites.

It is proposed to handle the expected increase in tidal range caused by the Dawesville cut by increased beach widths and elevations.

Protection of the foreshore from the effects of increased tidal range will be achieved in part by increasing the width of the foreshore, but principally by the partial filling and regrading of the foreshore which will both raise its level and promote better drainage, to prevent temporary innundation and the formation of mosquito breeding areas.

The adjoining development will be protected by a wall constructed to 2.2 m AHD constructed within the boundary of that development.

2.8 Boat Launching Facilities

The completed works will have little effect on the navigability of the Novara boat ramp channel, and it appears that access may be restricted during construction. A construction programme should be submitted which demonstrates that inconvenience to boat ramp users will be minimised.

The period of restricted access, during which time boat users will have to launch at alternative ramps, will be limited to approximately two weeks.

3 IMPACT OF PROJECT

3.1 Loss of Wildlife

There will be more speed boats in the area to chase away what wildlife is left, after the invasion of their breeding spot by dredging and bulldozers and the destruction of the low bush and trees.

Meiyu has put forward the proposal that strict boat speed limits should apply within the Bay and that larger vessels should be operated further offshore. Implementation of this recommendation is however the perogative of the relevant authorities.

The only important environmental issue is the wonderful bird population, of which the developers are much aware.

The presence of the estuary bird life is the reason for Meiyu's proposal to construct the island, which will provide a sheltered, predator free sanctuary.

The deepening will disturb the birds in the area, and may cause them to leave and never return.

Disturbance to bird life during the construction period will be of short duration and the birds will quickly return to take advantage of the new habitats once construction is completed. It is expected that some species will take advantage of food resources exposed as a result of the excavation work and will stay within the development area throughout the construction period.

3.2 Effect on Groundwater

We would like to know if studies have been done by the Water Authority as to whether the dredging will interfere with the underground freshwater streams, and the effect of bores in the area.

As far as Meiyu is aware no such studies have been undertaken by the Water Authority. As the area of excavation is located on the estuary side of the existing shoreline, and in view of the shallow depth of the proposed excavation, no impact on the location of the freshwater/saltwater interface or the movement of underground water is expected to be detectable outside of the development area.

3.3 Growth of Macroalgae

The proposed deepening will allow the algae harvesters better access and increase harvester availability to clear nuisance weed banks. However, the total volume of weed accumulation will increase by virtue of the increased depth of water. Cox's

Bay is an area of eddy currents with little opportunity for flushing by ebb and flood tides, and algae can be expected to take up at least part of the volume of excavated sand over time.

The continuous slope profile adopted for the embayment will assist in minimising the trapping of drift algae, while the ability to operate the weed harvesters within the Bay will assist in keeping weed accumulation down. Consequently, the rate of accumulation of organic matter is predicted to be acceptably small.

After dredging at the Novara boat ramp, the channel started to fill up with sand and weed almost immediately, and within 3-4 weeks PIMA had to clean the channel out with harvesters, removing 150 m^3. Along with this the entrance to the channel has turned into a black slimy mess which the harvesters cannot eradicate.

It is natural that any algae circulating within Cox Bay would accumulate within the deepened Novara Boat Ramp channel due to the lower water velocities in that area. Advice from the Waterways Commission, who operate the harvester on a routine basis in the Novara area, is that recently monthly volumes of algae removed from the Novara area (there is no data specifically for the channel area) vary between 0 and 430 m^3. Their inspectors have not reported any unusual accumulations and the boat channel is considered a success.

Cox's Bay has never been cleaner, and although there are times when the algae is prominent, so it is along all of the bays in the Estuary.

The current state of the Estuary is the result of favourable seasonal conditions (i.e. a set of conditions which have proven unfavourable for algal growth). Favourable growth conditions may be expected to give rise to algal blooms in future years until nutrient levels within the Estuary are significantly lowered.

Meiyu state that macroalgal growth may become more luxurient within Cox's Bay following excavation, as fluctuations in water temperatures will be less extreme and exposure during low tides will not occur. This situation could exist until nutrient levels are reduced by improved flushing following construction of the Dawesville Cut.

As stated, the potential for increased algal growth within the Bay is acknowledged in the PER. It is, however, considered that the ability to use the algal harvesters within the deepened embayment will facilitate the maintenance of water quality in the Bay and provide for an improvement over the existing situation.

3.4 Impact on the Fishery

Deepening of the Bay is likely to provide a sink for detritus which could lead to unacceptable water quality and an unacceptable environment for fish species.

The excavated embayment has been designed to have continuous grades into the deeper basin of the Estuary to ensure that it does not become a sink for detritus and thus become an unacceptable environment for fish.

Thirty of the 42 licenced fishery units fish the area to a significant extent. If used frequently the weed harvesters will cause disturbance to the bay which will not encourage fish, such as sea mullet and yellow-eye mullet, to use it as a refuge. Similarly, greater usage by recreational boats will also disturb the fisheries environment of the bay. However, because Cox's Bay is only a small area it is not expected that the project will exert any significant impact on the overall fishery in the Peel-Harvey Estuary.

As with the other bays of the Estuary algae harvesting will only occur to the extent necessary to maintain the bay in an acceptable condition, the frequency being determined by seasonal algal growth.

It is Meiyu's preference that the embayment should be used only by small boats and sailcraft and that larger boats and higher boat speeds should be excluded from the area in the interests of the safety of recreational users and for the maintainance of the environment. Implementation of this recommendation will, however, be subject to the agreement of the relevant authorities.

Over the last 30 years we have enjoyed the prawning and crabbing seasons at Cox's Bay. This bay has been used for years by residents for crabbing and prawning so why should Meiyu be given approval to dredge this area?

Due to the marginal (0.25 m to 0.45 m) increase in depth, the deepening proposed by Meiyu is not expected to have any adverse impact on prawning or crabbing. On the contrary it should make crabbing and prawning areas more accessible for amateur fishermen.

I have a fishing background, and have fished around Mandurah for five years and believe any improvements will ruin the prawning and crabbing for the amateur fisherman in this area.

The deepening proposed by Meiyu is marginal, ranging from 0.25 m to 0.45 m, and is not expected to have any adverse impact on crabbing and fishing.

Fish and crabs have to have shallow water to breed, and like the environment they live in now. When Meiyu start interfering with the depth of water the fish and crabs will depart from the area.

The deepening proposed by Meiyu is of an average of only 0.25 m overall and, consequently, Cox Bay will continue to be a shallow water habitat after excavation and will continue to provide a habitat for the estuary fish species which presently use this area.

3.5 Disposal of sediment

Council was against disposal of sediment on the foreshore, so now their intention is to make an island which in time will add to closure of the river mouth sand bar.

We are unaware of any such Council policy. During the excavation of the Novara Boat Ramp channel it was under the direction of the Waterways Commission/PIMA that spoil was placed along the foreshore to the east of the boat ramp and jetty, to replenish an area from which sediment had been lost over time during weed removal.

Construction of the island is a contribution by Meiyu to the provision of sheltered waterbird habitat within the Estuary. Should this proposal not be acceptable to the authorities Meiyu has stated that it is prepared to use the excavated sand within its own (terrestrial) development site.

It is impractical to consider that any erosion and sediment transport that would occur on this new island would contribute to the closure of the Peel Inlet entrance channel at Mandurah.

If the sediment is disturbed it will smell horrible and make life unpleasant for those who live nearby.

Experience with the trial excavation programme carried out during the investigation showed that the sand to be excavated from Cox Bay produced no noticable odour during the construction period and no subsequent odour following the completion of works.

The suggested 10 m^3 per year gross longshore transport rate for the site seems too low, although the sediment transport rate along the beach would be relatively small compared to the supply of sand proposed.

The calculated volume of 10 m^3 per year is indeed small but it has been determined by using standard sediment transport prediction methods and it reflects the very low wave climate at the site.

3.6 Safe Swimming

Over the last 30 years we have grown up appreciating being able to swim in safety, and we do not want to lose this.

The grades adopted for all slopes will be such as to ensure that access to and from the water will be safe. In addition it will be possible to swim closer to the shore than is presently possible, which will provide increased safety for swimmers.

4 OTHER

4.1 Bank Guarantee

A Bank Guarantee should be provided to 75% of the total cost of the project, and the guarantee to be reducible pro rata for work completed.

Costing by Meiyu indicates that there is no stage at which the work in progress would cost more than $30,000 to stop work and reinstate the site (i.e. to remove the bund walls). Consequently any excessive Bond requirement would be considered unacceptable.

4.2 Shire Boundaries

There should be no amendment to Shire of Murray boundaries as a result of the development if it proceeds.

Meiyu has no objection to this requirement.

All works within the existing boundary of the Shire of Murray are to be carried out to the satisfaction and specifications of Council.

Meiyu will comply with this requirement.

4.3 Dawesville Cut

This development should contribute to the cost of the Dawesville Cut project.

Meiyu regards the proposal to deepen Cox Bay and to provide increased access to, and management of, the foreshore as an equitable contribution to the management of the estuary.

4.4 Vesting

The Shire of Murray is to be informed at an early date as to vesting proposals for any new island, details of development, and control and future use of Crown land being established by this proposal.

To simplify future management, Meiyu would prefer that overall management of the foreshore and island be given to PIMA, in order to avoid having several management bodies, each with different, but overlapping, responsibilities. PIMA is currently represented by all of the parties concerned.

EPA QUERIES ON THE ESTUARY DEEPENING PROPOSAL, COX BAY

1 Provide further explanation on the relationship between wading bird use and foreshore area available. Include reference to the area of similar habitat available within the Peel Harvey.

Following completion of the the proposed excavation and construction programme the length of intertidal shoreline available to wading birds will increase from about 1100 m to approximately 1500 m, due to the contribution to shoreline length made by the construction of the island. The additional shoreline length is designed to compensate, in part, for the effects on the mainland shoreline brought about by increased recreational use.

The area of intertidal habitat available as a feeding resource is not readily defined as it varies constantly, being affected in the short term by astronomical and barometric tides and in the longer term by the seasonal flood level of the estuary, and only a small part of the total intertidal zone is available to wading birds at any given time. On an evenly sloping beach, the available intertidal area is determined by the length of the shoreline and consequently an increase in shoreline length would result in an increase in intertidal area. Due to variability in the level of the estuary floor within the near shore part of Cox Bay it is anticipated that in the short term there will be a reduction in the area of available intertidal habitat under some tidal conditions. In the longer term, and on an estuary wide basis, however, the extent and frequency of exposure of the intertidal zone will increase following construction of the Dawesville cut because of the greater daily tidal fluctuations permitted by the cut (Peel Inlet and Harvey Inlet Management Strategy, ERMP Stage 2).

Based on current levels the proposed development will affect approximately 40 ha of the shallow water habitat of the Peel-Harvey estuary system, shallow water habitat in this instance being defined as those areas lying between the water line and the 0.5 m contour on the Department of Marine and Harbours chart for Peel Inlet and Harvey Estuary. Using this definition the total shallow water area within the Peel-Harvey has been calculated as being 44% of the 131 km^2 total water area (Draft Peel Inlet Management Programme Review), i.e., an area of 5764 ha. The percentage of shallow water habitat affected by the development is therefore approximately 0.69%.

Further reference to the same chart indicates that the part of the proposed excavation area which is indicated as possibly dry at low tide comprises a much smaller percentage (i.e. <0.69%) of similar such areas within the estuary.

2 Comment on the change in the shallow water habitat with respect to the fishery, including fish breeding and refuge areas for juveniles.

As the increase in depth due to the proposed excavation is minor, i.e. in the order of 0.25 m on average, the area will retain its shallow water habitat characteristics and the effect on both the fishery and fish breeding and refuge areas will be minor and probably undetectable. The increased length of shoreline contributed by the proposed island will provide additional sites for the schooling of juvenile fish, while the greater depth will to some degree offset the effects of greater tidal fluctuation brought about by the Dawesville cut.

3 Confirm the effect of weed harvester operations on the refuge value of the embayment.

The change in weed harvesting technique from a shore orientated grader and loader operation to a programme involving the use of floating harvesters will have the effect of reducing both the proximity and frequency of disturbance to intertidal wading bird habitat, while at the same time slightly increasing the impact on shallow water fish habitat. The anticipated frequency of harvester operations is such that disturbance to shallow water fish habitat during periods of macroalgal growth will be infrequent. The impact of weed harvester operations is localised to the immediate vicinity of the operating harvester.

4 What is the extent of mosquito breeding in the *Jacksonia/Melaleuca* fringe around the margins of the wetlands ?

Wright (1988) identifies the principal nuisance mosquito breeding in the wetland near the Falcon boat ramp is Aedes camptorhynchus. This species is described as breeding in all kinds of temporary swamps and ground pools during autumn, winter and especially spring. This species is also reported to replace Aedes vigilax in saltmarsh habitats during the wetter months when the tidal pools are brackish instead of saline, and the prevailing temperatures are lower. Consequently this species can be expected to breed in any temporary pool within the foreshore area, including the Jacksonia/Melaleuca fringe. There are no details available on the contribution of this area to the overall level of breeding on this site.

5 What action will be taken with respect to the possible presence of the Southern Brown Bandicoot, a species listed as rare and endangered, in the wetland areas ?

The presence of the Southern Brown Bandicoot has been referred to the Department of Conservation and Land Management (Rare Fauna Officer) for advice as to the significance of this occurrence and for recommendations on further action.

6 Which trees will be retained on the foreshore reserve ?

It is proposed to retain all of the mature healthy trees presently found on the foreshore.

7 Comment on the effects on estuary water quality with respect to algal accumulation.

The Peel Inlet Management Authority's conveyor harvesters are currently prevented from operating near to shore in Cox Bay by lack of water depth and the presence of occasional exposed limestone pinnacles. Improved management of the algal accumulation problem requires the use of the harvesters and this is only possible if the excavation programme is carried out. At the same time, it is recognised that the use of the harvesters will be required at times in order to maintain acceptable water quality in the Bay.

Algae accumulation within the deepened boat ramp channel is a localised result of the lower water velocities across the channel, due to eddies within Cox Bay. The lower velocities allow algae and silt to settle within the channel. Section 5.4 of Appendix 2 explains that the bay deepening will not prevent the existing algae accumulations from occurring as they do now, but rather will allow for the efficient removal of such accumulations. Some localised fall-out may occur at the edges of the deepened area.

8 What is the proposed vegetation structure of the island ?

It is proposed that the island vegetation structure will duplicate, as far as possible, that found on the adjacent mainland shoreline. That is, a shoreline fringe of rushes immediately above the high water line, grading into bunch grasses and flowering shrubs (Melaleuca spp. and Regelia spp.) with small trees (Melaleuca cuticularis and Casuarina obesa) on the higher parts of the island. It is proposed that the rushes, and some of the trees, will be transplanted as semi-mature specimens from parts of the mainland foreshore which will be cleared as part of the foreshore development.

ESTUARY DEEPENING COX BAY, FALCON

ALTERNATIVE PROPOSAL - NORTHERN WETLAND

[This document is to be read in conjunction with Section 3.1.4 of the PER and Section 7.1 of the Draft Foreshore Management Plan]

As an alternative to the Proponent's preferred option of filling the wetland immediately to the south of the Novara Boat Ramp, the possibility of deepening the central, non-vegetated, part of this wetland to create a permanent water body is put forward as an alternate proposal. This option had previously been considered by the Proponent, but rejected, due to uncertainty as to the possibility of maintaining adequate water quality. However, given that the Environmental Protection Authority has subsequently endorsed a draft policy for the protection of wetlands of the Swan Coastal Plain, a reconsideration of the option of maintaining the wetland would be considered to be warranted.

In order to implement this option, given the constraints of needing to achieve a satisfactory control of the mosquito problem and to cope with occasional flood events, the following works would be undertaken:

(i) the mature paperbarks and rush beds would be retained, generally in their present form;

(ii) the central section of the wetland, which does not support permanent vegetation would be deepened to form a permanent water body to support mosquito larvae predators;

(iii) within the vegetated part of the wetland minimum recontouring and drainage channel construction would be undertaken to ensure that pools isolated from the permanent water body do not form following periods of heavy rainfall;

(iv) the storm-berm deposit along the shoreline would be raised from its present height of about 0.5 m AHD to a height of approximately 1.0 m AHD to control the periodic over-topping from the estuary, which occurs principally during winter flood periods;

(v) the proposed dual-use path would be constructed along the crest of this raised berm; and

(vi) vehicles would be excluded from this part of the foreshore to prevent the formation of new breeding sites.

Final design of the wetland would depend on an assessment by the EPA, of drainage studies currently being undertaken by the Main Roads Department's engineering and environmental consultants, but will conform with the above criteria.

Design proposals for the remainder of the foreshore, which include filling and regrading to promote effective drainage and prevent the formation of temporary pools in which mosquito breeding occurs, are not affected by this proposal.

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19 JUN 1991

ATTENTION

JOB 3192	
JLP	IRS
PC	JR
DG	ARB
RWH	PAM
JM	TJW
PY	AMS

Mr P Collins
Le Provost Environmental Consultants
PO Box 217
COMO WA 6152

Dear Mr Collins

I refer to your letter of 6 May 1991 concerning estuary foreshore development at Falcon and the occurrence of the Southern Brown Bandicoot, a declared threatened species.

The supplementary survey report by Ninox Wildlife Consulting of 3 May 1991, in combination with the original survey report enclosed with your letter of 26 April 1991, indicates that the habitat subject to development is marginal for the Southern Brown Bandicoot species. Furthermore, the evidence presented demonstrates that the site is not significant to the overall conservation of this species.

The reports have shown that the development area is itself not amenable to conservation management for the low density population of bandicoots determined to be digging within the area. Nevertheless, if the impact management strategies proposed by Ninox at Section 5.1 of the March 1991 report, including infilling the most disturbed habitats and retaining existing wetlands as far as possible, are adopted the chances of survival of the remnant bandicoot population will be maximised. In these circumstances, considering the evidence provided, this Department would have no significant concern for the impact of the proposed foreshore development in terms of bandicoot conservation.

Yours sincerely

Syd Shea
EXECUTIVE DIRECTOR

13 June 1991

GW:dmg
GW100

cc Ms Gabby Corbett, EPA

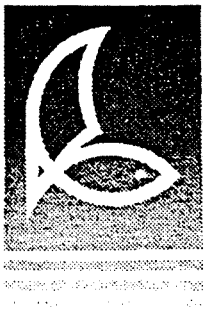
Appendix 3

Draft Peel Inlet Management Programme Review (1990) recommendations for Cox Bay

DRAFT PEEL INLET

MANAGEMENT PROGRAMME REVIEW

Prepared for the Peel Inlet Management Authority by the Waterways Commission



WATERWAYS COMMISSION

REPORT 18

AUGUST 1990

6.3 MAP 2

NOVARA BEACH AREA

Planning Considerations

1. The existence of reserves

	Area ha	Vest Auth
A24729 Recreation	0.5453	No
28458 Recreation	0.3326	CM
28243 Recreation	0.3490	CM
27999 Recreation	0.9230	CM
37706 Public Recreation	6.0265	CM
38249 Public Recreation	0.8203	No
38146 Public Recreation	1.0290	No
39756 Public Recreation	0.5838	No
39788 Public Recreation	5.3786	No
28349 Recreation	3.5056	No
34293 Recreation	0.3913	CM
36087 Boat hire	0.0330	CM
25099 Storage	0.1442	CM
A2851 Recreation/Camping	120.04	CM

2. An expected increase in demand for foreshore space as a result of the subdivision and development of land to the north-west, which is separated from the estuary by the proposed conservation reserve.

3. Wide shallow estuary margins with limited capacity for recreational use.

4. Inadequate boat launching facilities near 28243.

5. Degraded shoreline vegetation and beaches at Novara as a result of beach cleaning.

6. Valuable fringing vegetation comprising *Casuarina*, *Melaleuca* and *Juncus*, south-west of Novara.

7. Areas of sparse sea grass and macroalgae drifting onto beaches under some wind conditions.

8. The need to rationalise foreshore reserves and acquire additional reserves during the subdivision and development process.

9. The need to retain a vegetation buffer between unsewered development in the Pleasant Grove Estate and the estuary.

10. The need to provide deep water access and sheltered beaches to cater for growing urban populations in the neighbourhood.

11. The existence of under developed recreation areas.

12. The possibility of major environmental changes associated with the construction of the Dawesville Channel.

13. The need to address the issue of equestrian access across the proposed Dawesville Channel.

14. The presence of relatively deep water close to the foreshore toward the southern end of the area and wide shallow estuarine margins to the north.

15. Poor road alignment of Estuary Drive.

16. Reserve A2851 of conservation interest to CALM.

Area Recommendations

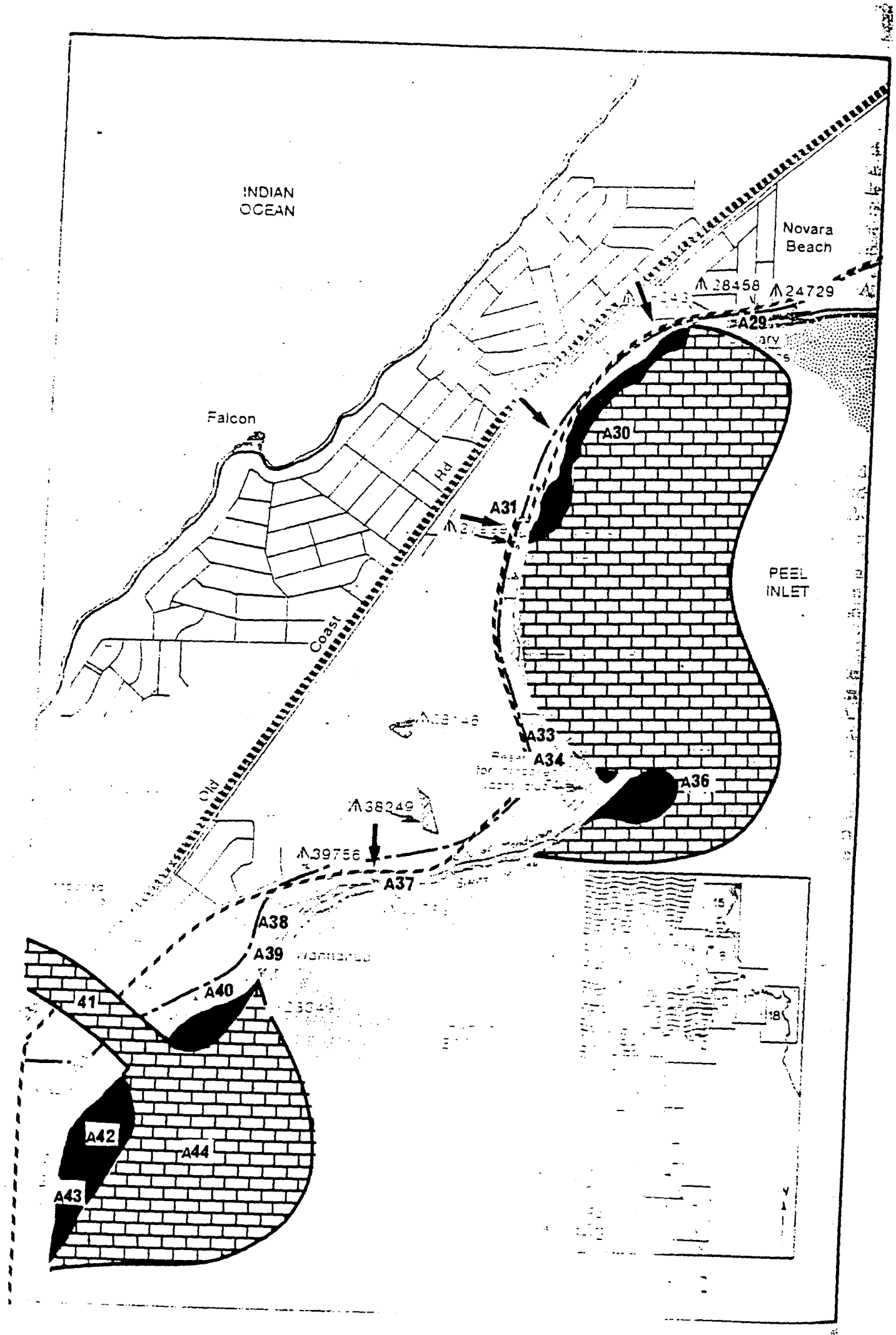
A.29 Amalgamate reserves 24729, 28458, 28243 and adjoining Vacant Crown Land to create a reserve for recreation and foreshore management and vest in the City of Mandurah (DOLA, CM).

A.30 Undertake environmental, engineering and costing investigations associated with possible dredging and filling near the Novara foreshore to extend foreshore reserve as shown (PIMA, CM, DMH, SWDA).

A.31 Acquire an appropriate foreshore reserve as a condition of subdivision of location 91 (DPUD, CM, PIMA).

A.32 Plan for dual use path in accordance with guidelines and construct as resources become available (CM).

A.33 Acquire 28.07 POS, shown on the plan prepared by TS Martin for subdivision of Murray Locations 109, Pt 1339 and 124 for Pleasant Grove Pty Ltd and dated January 1980 and incorporate into reserve 37706, as a condition of subdivision. In addition, incorporate adjoining VCL into extended reserve 37706 and vest in CM for recreation and foreshore management purposes (DPUD, DOLA, CM).


INDIAN
OCEAN
Novara
Beach
28458
24729
A29
Falcon
Rd
A30
A31
PEEL
INLET
Coast
Old
A33
A34
A36
38249
39756
A37
A38
A39
A40
41
A42
A44
A43

A.34 Acquire a Special Use Reserve of 2.8 hectares at Pt Ward and vest for recreation in the CM (DPUD, DOLA, CM).

A.35 Prepare and implement a management plan for the above-mentioned areas as a condition of subdivision (Dev).

A.36 Undertake environmental, engineering and costing investigations associated with dredging and filling near Olive Road and Point Ward to extend foreshore reserve (PIMA, DMH).

A.37 Incorporate adjoining VCL into reserves 39756 and 39788, amalgamate and vest in the City of Mandurah to prepare a management plan (DOLA, CM, PIMA).

A.38 Acquire additional foreshore reserve as a condition of rezoning or subdivision of location Pt 1130 (DPUD, CM, PIMA).

A.39 Close existing boat launching area at the bottom of Estuary Place, move car park back from the foreshore and rehabilitate area, after new boat ramps have been constructed nearer proposed Dawesville Channel (CM, PIMA).

A.40 Incorporate adjoining VCL into reserve 28349 and vest in the City of Mandurah for recreation and foreshore management purposes (DOLA, CM).

A.41 Construct proposed Dawesville Channel (DMH, PIMA).

A.42 Create a foreshore area as shown using spoil from construction of the proposed Dawesville Channel (DMH).

A.43 Modify spoil disposal proposals shown on Figure 6.2 of the ERMP - Stage 2 to increase the width of the foreshore area in reserve A2851 (DMH, PIMA).

A.44 Dredge outward from proposed Dawesville Channel to the 1.0 m bathymetric contour to accommodate access to and from the Channel (DMH, PIMA).

A.45 Incorporate foreshore area created by filling during construction of the proposed Dawesville Channel into the reserve 28349 and prepare management plan for the entire area (DOLA, CM, DMH, PIMA).

A.46 Construct dual use path and consider the issue of equestrian access as part of the overall development of Dawesville Channel (CM, DMH, PIMA, Dev).

A.47 Realign Estuary Road if Recommendation A.41 is implemented (CM, PIMA).

A.48 Rehabilitate and protect fringing vegetation in all newly created and existing foreshore areas (PIMA, CM, DMH).

A.49 Implement General Recommendations 23 and 51 relating to Waterways Protection and Public Access Precincts, respectively (PIMA, WWC).

A.50 Carry out works in accordance with the Mosquito Control Strategy (HD, PIMA, CM).

A.51 Acquire appropriate foreshore reserves as a condition of any rezoning or subdivision (DPUD, PIMA, CM).