# Report and recommendations of the Environmental Protection Authority

## Mangles Bay Marina-Based Tourist Precinct

Cranford Pty Ltd and

Western Australian Land Authority

Report 1471

April 2013

# Public Environmental Review
# Environmental Impact Assessment Process Timelines

| Date | Progress stages | Time (weeks) |
|---|---|---|
| 11/11/2010 | Level of Assessment set<br>(date appeals process completed) | |
| 07/02/2011 | Environmental Scoping Document (ESD) released for public review | **13** |
| 21/02/2011 | Public review period for ESD closed | **2** |
| 16/06/2011 | Final ESD approved | **16** |
| 13/02/2012 | Public Environmental Review document (PER) released for public review | **34** |
| 23/04/2012 | Public review period for PER closed | **10** |
| 14/11/2012 | Final proponents response to PER issues raised | **24** |
| 29/04/2013 | Publication of EPA report (3 days after report to Minister) | **23** |
| 13/05/2013 | Close of appeals period | **2** |

STATEMENT ON TIMELINES

Timelines for an assessment may vary according to the complexity of the project and are usually agreed with the proponents soon after the level of assessment is determined.

In this case, the Environmental Protection Authority did not meet its agreed timeline objective for the completion of the assessment and provision of a recommendation to the Minister.

Dr Paul Vogel
Chairman

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# Summary and recommendations

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for Environment on the proposal for a marina-based tourist development located in Mangles Bay at the southern end of Cockburn Sound by Cranford Pty Ltd and the Western Australian Land Authority (Landcorp).

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for Environment on the outcome of its assessment of a proposal. The report must set out:

- the key environmental factors identified in the course of the assessment; and
- the EPA's recommendations as to whether or not the proposal may be implemented, and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit.

The EPA is also required to have regard for the principles set out in section 4A of the EP Act.

**Key environmental factors and principles**

The EPA decided that the following key environmental factors relevant to the proposal required detailed evaluation in the report:

(a) Marine environmental quality;

(b) Benthic communities and habitat;

(c) Marine fauna;

(d) Terrestrial vegetation, flora and fauna; and

(e) Hydrological processes and inland waters environmental quality (Lake Richmond).

There were a number of other factors which were relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

The following principles were considered by the EPA in relation to the proposal:

(a) The precautionary principle;

(b) The principle of intergenerational equity;

(c) The principle of the conservation of biological diversity and ecological integrity;

(d) Principles relating to improved valuation, pricing and incentive mechanisms; and

(e) The principles of waste minimisation.

**Matters of National Environmental Significance**

The proposal is considered by the Commonwealth of Australia to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) because of potential significant impacts including listed threatened species and communities, and listed migratory species. The proposal is being assessed according to the Bilateral Agreement between the Commonwealth and State of Western Australia.

## Conclusion

The EPA has considered the proposal by Cranford Pty Ltd and the Western Australian Land Authority for a marina-based development located in Mangles Bay at the southern end of Cockburn Sound. The proposed development consists of a single entrance marina to accommodate up to 500 pens and moorings; and a surrounding land development comprising tourism, commercial, public open space and residential land uses.

The EPA notes that the proponents have made a number of modifications to the proposal including:

- shortening of one canal arm to reduce the potential for hydrological impacts and saline intrusion;
- reducing the depth of the navigation channel by 0.5 metre (m) to reduce the estimated seagrass loss from 5.66 hectares (ha) to 5.24 ha;
- reducing the maximum depth of the marina waterbody from -4.0 m Australian Height Datum (AHD) to -3.5 m AHD to improve flushing;
- changing the final location for the Lake Richmond outlet drain from the end of Hymus Street to the end of the breakwater; and
- modifying the offsets proposed, including increasing the ratio for seagrass replanting from 1:1 to 2:1.

### *Marine environmental quality*

Cockburn Sound is one of the most heavily used water bodies in Western Australia. Between the 1950s and 1970s the marine environment of Cockburn Sound was under significant development pressure and there was a decline in environmental values. In 1998 the EPA released strategic environmental advice regarding the cumulative environmental impact of marine-related infrastructure proposals as at the time there had been no significant recovery of seagrass since the 1970s. This led to the Government of Western Australia developing the *State Environmental (Cockburn Sound) Policy 2005* (SEP), the objective of which is to establish the basis on which Cockburn Sound and the environment of the adjacent land is to be managed

and protected. The SEP was a key consideration in the EPA's assessment of this proposal.

The proposal has the potential to impact on the quality of the water in the marina and subsequently could adversely affect the quality of external waters in Mangles Bay. To predict the potential impacts of the proposal on Mangles Bay, the proponents used a combination of hydrodynamic modelling and existing knowledge about water quality, nutrient inputs in groundwater and the ecology of Cockburn Sound.

The EPA notes that this proposal will most likely result in higher levels of phytoplankton production in the marina waterbody than in Mangles Bay. This is supported by the proponents' overall finding that chlorophyll-*a* concentrations in the marina will be typically about twice those of adjacent waters. This would in turn result in some nutrients and additional phytoplankton loads to Mangles Bay by the outflow of marina waters.

The proponents predict that the proposal would lead to an increase in chlorophyll-*a* concentrations (predicted increase in chlorophyll-*a* concentrations of 0.1 – 0.3 µg/L above background concentrations) over an area extending a few hundred metres from the marina entrance. The predicted impacts to marine water quality due to outflow from the marina would be occasional, slight and highly localised due to the effects of dilution once the outflow waters disperse into Mangles Bay. The proponents have therefore concluded that these impacts will have a negligible risk of causing adverse impacts on the ecology of Mangles Bay, particularly seagrass. Based on these predictions, it appears that the proposal would be a minor contributor of phytoplankton biomass to the existing load in Mangles Bay. However, this predicted small contribution from the proposal needs to be considered in the context of the SEP, the current stressed state of Mangles Bay and the fact that the Environmental Quality Standards in the SEP for chlorophyll-*a* and seagrass health have been exceeded in recent years.

The predicted chlorophyll-*a* contributions from the proposal, although considered by the proponent to be minor, could increase the risk of the environmental quality standards being exceeded in the southern end of Mangles Bay in the future. It is for this reason that the predicted impact on water quality in Mangles Bay is considered to be a residual risk for the proposal that requires an environmental offset. Nutrient-related offsets could include any treatment of groundwater or surface water in the catchment to offset the predicted increase in nutrient-related symptoms at the southern end of Mangles Bay. Accordingly, the EPA has recommended Condition 11-10 which requires the proponents to contribute funding to the Cockburn Sound Management Council (CSMC) for the purpose of implementing nutrient reduction strategies in the catchment of Mangles Bay.

In view of the above assessment, the EPA considers it appropriate that a moderate ecological protection area be designated for the portion of the proposal that coincides with the protected area in the SEP. This would apply to the marine waters between the breakwaters at the entrance of the marina.

A high ecological protection area could continue to apply in Mangles Bay beyond the mouth of the breakwaters. The EPA has therefore recommended Condition 7 which requires the proponents to manage marina water quality to ensure that a moderate level of ecological protection is met at the entrance channel of the marina and that, beyond the entrance channel, a high level of ecological protection is met, consistent with the objectives of the SEP. Contingency measures in the marina would need to be implemented by the proponents in the event the environmental quality criteria relevant to the moderate level of ecological protection are not being met.

In view of the proponents' predictions, the recommended conditions which require the preparation and implementation of a Marine Environmental Quality Management Plan, and recommended Condition 11-10 which require the proponents to contribute funding to the CSMC for the purpose of implementing nutrient reduction measures in Mangles Bay as an environmental offset, the EPA considers that the proposal is likely to meet its environmental objectives for the environmental factor of marine environmental quality.

***Benthic communities and habitat***

Approximately 80 per cent of seagrasses have been historically lost in Cockburn Sound as a result of either changes to water quality or direct physical impacts from the construction of facilities and anchor damage. Of the pre-European extent of 3760 ha, only approximately 768 ha remain. Given the significant cumulative loss of seagrass communities in Cockburn Sound, the EPA's environmental objective for Cockburn Sound is to ensure no net loss of seagrass habitat and communities and, where possible, to generate a net gain.

Dredging of the access channel, construction of the breakwaters, and changes to the shoreline profile will have direct impacts on the seabed and seagrass communities. There is an estimated 304 ha of seagrass in southern Cockburn Sound, with approximately 100 ha occurring in the shallow flats of Mangles Bay. While the proposal has been refined to minimise the loss of seagrass, its implementation would result in permanent and unavoidable impacts to 5.24 ha of seagrass. The proponents have also committed to undertake their best endeavours to further reduce seagrass loss to 5 ha through further detailed design of the foreshore.

Modelling of suspended solids was undertaken to predict the extent of indirect impacts associated with dredging. This modelling predicts that there will be no loss of seagrass outside the proposal footprint, which coincides with the Zone of High Impact (ZoHI). It also predicts a 10 m Zone of Moderate Impact (ZoMI) within which impacts (if any) are recoverable within a period of five years following completion of the dredging activities. The Zone of Influence (ZoI), which represents the maximum extent of the visible plume over the dredging period, will extend west of the Causeway into Shoalwater Islands Marine Park one per cent of the time. However the zone represents an area within which no ecological impacts are expected to occur.

The EPA considers that in view of the proponents' modelling, sediment characteristics, the small volume, short duration and timing of proposed dredging, the indirect loss of seagrass as a result of construction and dredging can be minimised.

The EPA has recommended Condition 8, which requires the proponents to monitor turbidity and light attenuation (the dredge-related pressure), and seagrass health (the ecological response) in the proponents' predicted ZoMI before, during, and after marine-related construction activities to demonstrate that the impacts on seagrass (if any) are reversible, and not greater than approved. Immediately outside the ZoMI, in the ZoI the proponents will need to monitor seagrass health with the objective of demonstrating that there are no detectible effects of dredging on seagrass communities in that zone.

The proponents have proposed an offset for the loss of seagrass and will replant 10.48 ha of seagrass over a five year period to meet 75 per cent cover 10 years after the initial transplanting. This will aim to achieve a net gain consistent with EPA policy. Donor material for the replanting is to be sourced from the footprint of the proposal wherever possible, and small scale trials are proposed to inform the rehabilitation conditions and identification of appropriate sites. The EPA considers that seagrass replanting trials should also be undertaken on the eastern shelf of Cockburn Sound, not just on Southern Flats.

In view of the proposed small scale trials to identify suitable rehabilitation sites, proposed contingency funding, and the recent success of seagrass rehabilitation for other projects, the EPA considers that the proponents will be able to achieve the proposed objective.

The EPA has recommended conditions 11-3 to 11-9, requiring the proponents to re-plant at least twice the area of seagrass lost by the proposal within five years of commencement of marine related construction activities and ensure that 75 per cent cover is reached 10 years after the commencement of marine-related construction activities. In the event that the objective of re-establishing at least twice the area of seagrass lost by the proposal to at least 75 per cent cover is not reached, the proponents must continue until the objective is achieved. The condition also requires that the rehabilitation site is to be located in the southern end of Cockburn Sound.

***Marine fauna***

Cockburn Sound, and in particular the sheltered water of Mangles Bay, provides habitat for marine fauna including fish, crustaceans, molluscs, cetaceans, sea lions, reptiles, sharks and birds. The key marine fauna likely to be affected by the proposal are fish, invertebrates, little penguins and dolphins.

Construction impacts associated with the proposal are primarily related to noise, animal entanglement, vessel strikes and impacts such as increased turbidity from the construction works. The EPA considers that the proposed limits to the timing of most marine-related construction activities (April to

September) will minimise the potential impact for most fish and invertebrate species, which spawn from late winter to late summer, and will also avoid the peak dolphin calving period.

The EPA notes that pile driving for jetties will be undertaken prior to the flooding of the marina basin, removing the in-water path for sound and thus the high energy frequencies that typically impact marine fauna.

The EPA recognises that dredging activities as proposed will coincide with peak breeding season for little penguins. To minimise impacts, the proponents propose to commence dredging prior to chick rearing and by planning the dredging sequence to commence at the seaward edge of the navigation channel and then moving shorewards. The EPA is of the view that the minimal predicted levels of turbidity associated with the proposal and sequencing of dredging will minimise the impacts to little penguin populations.

In considering the potential impact of construction activities on marine fauna, the EPA concludes that due to the short duration of activities, the management strategies proposed by the proponents, and the timing of activities, it is unlikely that construction activities will significantly affect any species in the long term.

The EPA has recommended conditions 8-2 and 9, which are to apply to all marine-related construction activities. These conditions require marine fauna observers for marine-related construction activities and limit the timing of activities to between the hours of sunrise and sunset and between the months of April and September.

Impacts from the operation of the proposal are mainly indirect and relate to increased fishing pressure and loss of habitat (fish and invertebrates), and the potential loss or change in prey species. The EPA considers that while there will be short-term loss of habitat, the seagrass offset proposed by the proponents would mitigate this issue, and it is unlikely to have a significant impact on marine fauna biodiversity or biomass in the long-term.

***Terrestrial vegetation, flora and fauna***

The majority of the land-based proposal area is vegetated, and is located within Bush Forever Site 355 and is vested with the Conservation Commission of Western Australia as part of the Rockingham Lakes Regional Park. Vegetation ranges in condition from Very Good to Degraded, with the majority of the site in Good or Very Good condition. Floristic community types (FCT) mapped at the site include FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands which is listed by the Department of Environment and Conservation as a Threatened Ecological Community (TEC); and FCT 29b *Acacia* shrublands on taller dunes and FCT 30b Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands which are both listed by the DEC as Priority 3 Ecological Communities.

No state listed or threatened fauna species were identified during the fauna surveys. However, one Priority 3 lizard *Lerista lineata* and a small number of

Commonwealth listed migratory birds were identified. Habitat for the graceful sun moth (*Synemon gratiosa*), which is a listed species under the EPBC Act, is present at the site, however only a few individuals were detected during surveys.

The impacts from the proposal are mainly direct impacts, resulting from the clearing of up to 40 ha of vegetation and the subsequent loss of fauna habitat. The EPA recognises that most of the vegetation to be cleared by the proposal is of conservation significance. FCT 29b covers most of the site, however this community is widespread across the Swan Coastal Plain. An area of FCT 30b will also be cleared, however, while not as widespread as FCT 29b, the amount to be cleared is relatively small (0.56 ha). The EPA therefore considers that the loss of this area will not affect the overall regional significance of the FCT 29b or FCT 30b.

The EPA acknowledges that the proposal will result in a net loss of TEC FCT 30a. The EPA considers that the mitigation measures proposed by the proponents, including the re-establishment, rehabilitation and consolidation of this community, and retention of this area within secure conservation tenure, will offset any significant residual impacts. To ensure the successful rehabilitation of FCT 30a, the EPA has recommended conditions 11-1 and 11-2 which require the proponents to prepare and implement a restoration plan.

The EPA has considered the indirect risks to FCT 30a from hydrological impacts, in particular saline intrusion, and notes that these have been minimised where possible through proposal design. While the EPA considers the risks to the community from reduced quality and/or quantity of groundwater is low, it nonetheless recommends Condition 10 to ensure the community is adequately surveyed and monitored to ensure that if any impacts were to occur, they can be detected and mitigated.

This proposal will result in a loss of vegetation from the Bush Forever system and from the Rockingham Lakes Regional Park. However, the EPA accepts that the identification of the land for a marina development has been long standing and predates the establishment of the regional park. In considering the offsets proposed to address the residual impacts, it is further recognised that they are in accordance with the guidance proposed by State Planning Policy 2.8. While the EPA acknowledges it will be difficult to conserve bushland in the local area, the FCTs that will be lost by the proposal have a large geographical range and achieving the offset objective of 'like for like' will still be able to be achieved. The EPA has therefore recommended conditions 11-12 to 11-15 to address the residual impacts to native vegetation with the Rockingham Lakes Regional Park through the development of a rehabilitation plan for 20 ha of land within the vicinity of the proposal, in addition to funding for the acquisition and management of land for conservation purposes.

The EPA acknowledges that the loss of vegetation from the site will also result in loss of habitat for fauna, however the EPA is of the view that the

implementation of the proposal will not impact the regional significance of any fauna species, including the graceful sun moth, and that implementation of the proposed Construction Environmental Management Plan as proposed by the proponents will minimise the risk of any direct impacts during construction. The EPA also considers that the proposal will not impact the overall population viability of the graceful sun moth.

The EPA considers that the proposal can be managed to meet its environmental objectives in relation to terrestrial vegetation, flora and fauna.

***Hydrological processes and inland waters environmental quality (Lake Richmond)***

Lake Richmond, located adjacent to the proposal area, is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and is classified as a Conservation Category wetland on the *Geomorphic Wetlands Swan Coastal Plain* dataset. Two TECs are found in association with Lake Richmond and both are listed as critically endangered by the State and endangered by the Commonwealth under the EPBC Act. These are:

- SCP 19 Sedgelands in Holocene dune swales of the southern Swan Coastal Plain; and
- Richmond-microbial – Stromatolite like microbialite community of coastal freshwater lakes.

The EPA notes that potential impacts to Lake Richmond from the proposal are mainly indirect impacts, resulting from changes to groundwater levels and from potential saline intrusion due to the construction of the marina. Modelling predicts that groundwater drawdown will result in a reduction in lake levels of 3.2 centimetres (cm) during construction and 3.8 cm during operation, with little potential for saline intrusion into the lake. The Lake Richmond outlet drain, which currently artificially maintains the lake level via a weir and flows directly into Cockburn Sound, will require relocation as part of this proposal and the proponents propose to relocate it to the end of the eastern breakwater.

The EPA has considered the likely impacts on Lake Richmond and its associated TECs. It recognises that all numerical modelling has inherent uncertainty and there are always risks that the predicted impacts will be greater than expected. The EPA has, however, considered the peer reviews of the modelling and predicted impacts and the advice from the Department of Water and concludes that overall the groundwater modelling is appropriate for this assessment and that a reduction of 3.8 cm in water levels is unlikely to significantly impact the TECs associated with Lake Richmond.

While the EPA does not expect significant impacts, the EPA does note that the proponents are also proposing a range of management and mitigation measures that include triggers should the impacts exceed what is predicted. The EPA has recommended Condition 10 which requires the proponents to establish baseline conditions for both TECs, and monitor the communities during construction and operation for at least 10 years. The proponents are

also required to develop management and/or contingency measures which include water supplementation measures for Lake Richmond.

The EPA has concluded that the proposal, as described, can meet the EPA's objectives, provided there is satisfactory implementation by the proponents of the recommended conditions set out in Appendix 4 and summarised in Section 4.

The EPA has also included other advice regarding:

- moorings in Cockburn Sound;
- noise and vibration impacts from construction;
- the Lake Richmond outlet drain;
- that the proponents should contribute to the annual water quality monitoring program in Cockburn Sound undertaken by the CSMC; and
- management of the water quality in the marina.

**Recommendations**

The EPA submits the following recommendations to the Minister for Environment:

1. That the Minister notes that the proposal being assessed is for a marina-based development located in Mangles Bay at the southern end of Cockburn Sound;
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3;
3. That the Minister notes the EPA has concluded that it is likely that the EPA's objectives would be achieved, provided there is satisfactory implementation by the proponents of the recommended conditions set out in Appendix 4 and summarised in Section 4; and
4. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

**Conditions**

Having considered the information provided in this report, the EPA has developed a set of conditions that it recommends be imposed if the proposal by Cranford Pty Ltd and the Western Australian Land Authority for a marina-based development, located in Mangles Bay at the southern end of Cockburn Sound is approved for implementation. These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

(a) restricting impacts to marine environmental quality from dredging and construction activities to spatially defined areas and managing construction activities to meet the objectives of the SEP (Condition 6);

(b) restricting impacts to marine environmental quality from ongoing operation activities to spatially defined areas and managing ongoing operational activities to meet the objectives of the SEP (Condition 7);

(c) restricting impacts to marine benthic communities and marine fauna from dredging and construction activities to spatially defined areas and time periods (Condition 8);

(d) minimising impacts to marine fauna during construction through requirements for Marine Fauna Observers (Condition 9);

(e) restricting impacts to TECs to spatially defined areas and ongoing monitoring and management requirements (Condition 10); and

(f) offsetting and residual impacts in relation to TECs, benthic primary producer habitat, marine environmental quality and regional parks (Condition 11).

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5. Summary of submissions and proponents' response to submissions

# 1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for Environment on the key environmental factors and principles for the proposal by Cranford Pty Ltd and the Western Australian Land Authority (Landcorp) for a marina-based development located in Mangles Bay at the southern end of Cockburn Sound. The proposal comprises a single entrance marina to accommodate up to 500 pens and moorings and a surrounding land development comprising tourism, commercial, public open space and residential land uses.

The proposal was referred to the EPA in August 2010. The EPA decided to assess the proposal at the level of Public Environmental Review (PER) with a 10 week public review period due to the potential impacts to biodiversity including significant flora, vegetation and fauna; marine water and sediment quality, benthic habitat, marine fauna and fisheries, surface water and groundwater and conservation reserves. The EPA also decided to advertise the draft Environmental Scoping Document (ESD) for a two week public review period. The draft ESD was advertised in February 2011 and the PER was available for public review from February to April 2012.

The proposal was determined to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in November 2010 as it may impact on Matters of National Environmental Significant (MNES). These matters include listed threatened species and communities (sections 18 and 18A) and listed migratory species (sections 20 and 20A). The proposal is being jointly assessed under the bilateral agreement between the Commonwealth and Western Australian Governments.

The EPA previously considered a proposal for a marina in Mangles Bay, and has provided advice on the environmental aspects of the development concept of a marina in this location several times previously. These previous considerations are briefly discussed below.

**EPA Report 693 – Mangles Bay Marina (July 1993)**

In 1989, the then Department of Marine and Harbours referred a proposal for a marina in Mangles Bay to the EPA. After refinement of the proposal, a PER document was released for public comment in 1992. The primary environmental issue associated with that marina proposal was the loss of 17-32 ha of seagrass. The EPA concluded in Report 693 that the proposed marina at Mangles Bay was environmentally unacceptable and should not proceed. In reaching this conclusion, the EPA identified the main environmental factor as the significant impact on the remaining seagrass in the Mangles Bay area and the ecological significance of preserving the small amount of seagrass that remains in Cockburn Sound. The Minister for the Environment did not issue a statement that the proposal could be implemented and the Mangles Bay Steering Committee was established to

consider potential options, taking into account the environmental issues associated with the area.

**EPA advice to the Mangles Bay Steering Committee (February 1998)**

As a result of appeal investigations from Report 693 and recommendations made by the Mangles Bay Steering Committee, a new proposal for a marina was suggested. Major modifications were made to the original proposal including reducing seagrass loss, making the marina inland rather than offshore and developing associated tourism on the adjacent land.

In February 1998, the Chairman of the EPA provided a statement to the Minister for the Environment and the Mangles Bay Steering Committee. The statement noted that: "*Because of past events, it would be very difficult to argue that any further reduction in areas of seagrass was acceptable from an environmental perspective. However, the EPA recognises that the environmental information is but one part of the information required in the decision-making process by Government. Noting the importance of seagrass there is a clear need to either avoid or at least minimise any further seagrass impact*".

**Advice to the Mangles Bay Point Peron Recreational Tourist Development Technical Committee (August 2002)**

In August 2002, the Chief Executive Officer of the then Department of Environmental Protection (DEP) advised Landcorp of the Department's views on water quality and seagrass issues associated with Mangles Bay. This advice noted that: "*most recent reports to the DEP indicate the seagrass meadows are under similar pressures as in 1998, if not increased. Seagrass in Mangles Bay continues to compare poorly with other sites in Cockburn Sound. The direct loss of seagrass therefore remains a primary issue for any proposal to develop the Mangles Bay Boat Harbour. The protection of Lake Richmond which is recognised for its conservation value, and nutrient inflow and pollutants from the Lake Richmond drain on the waters of Mangles Bay are also of concern*."

**EPA Report 1237 – Cape Peron Tourist Precinct Project: Strategic Environmental Advice (October 2006)**

The Cape Peron Tourist Precinct Steering Committee coordinated a strategic environmental review (SER) for the Cape Peron project in order to identify the key environmental issues associated with the project and to gather, at a strategic level, information on those environmental issues. The Committee put forward three options and the SER was advertised for four weeks public review.

The EPA identified three primary issues: seagrass and water quality; Lake Richmond; and terrestrial vegetation. The EPA evaluated the potential impacts of the proposal and advised on the investigations required should the proposal proceed. The EPA also advised on the expected outcomes or

impacts on the receiving environment the proposal should be designed to achieve.

The EPA has also provided advice regarding the marine environment of Cockburn Sound.

**EPA Report 907 – The Marine Environment of Cockburn Sound: Strategic Environmental Advice (October 1998)**

In October 1998, the EPA provided strategic advice under section 16(e) of the EP Act, in relation to the cumulative environmental impact of marine-related infrastructure proposals on Cockburn Sound. A number of proposals within or impacting on Cockburn Sound were under development at that time and, while the EPA had statutory obligations to assess the potential environmental impacts of individual development proposals, the EPA held a view that the marine environmental implications of each development proposal could not be considered in isolation from the effects of existing and approved developments. In its section 16(e) report, the EPA provided advice on the potential cumulative environmental impacts of multiple proposals in Cockburn Sound on water quality and seagrasses. The EPA noted that seagrasses not only have intrinsic value as marine flowering plants, but they also perform important ecological functions in the marine environment and, at that time, surveys showed that the area of seagrass in Cockburn Sound was in the order of 700 ha, indicating that there had been no significant recovery since the 1970s. The advice documented a proposed policy framework to protect marine waters from the cumulative effects of development pressures. It also reiterated the EPA's objectives of protecting the remaining seagrass meadows of Cockburn Sound and the need to retain those areas where seagrasses once grew (i.e. sand banks and sandy margins) so as not to lose future opportunities for re-establishment of seagrass if conditions became suitable in the future. The establishment and maintenance in Cockburn Sound of environmental conditions that are consistent with the survival, growth, restoration and expansion of seagrass cover were key environmental outcomes for the EPA.

EPA Report 907, together with continuing development pressure and declining environmental values, led to the establishment of the *State Environmental (Cockburn Sound) Policy 2005* (SEP). The objective of the SEP is to establish the basis on which Cockburn Sound and the environment of the adjacent land is to be protected. The SEP establishes five Environmental Quality Values, namely: ecosystem health; seafood safe for eating; aquaculture; recreation and aesthetics; and industrial water supply. Each Environmental Quality Value has an Environmental Quality Objective and quantitative benchmarks for measuring success against the objective, Environmental Quality Guidelines and Environmental Quality Criteria. The Cockburn Sound Management Council (CSMC) is responsible for managing the environmental quality of Cockburn Sound and coordinates the annual monitoring that takes place. The CSMC releases report cards and a 'State of the Sound' report annually, which outlines how sites fare against the specified criteria.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the key environmental factors and principles for the proposal. The conditions to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides other advice by the EPA.

Appendix 5 contains a summary of submissions and the proponents' response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process, and which have been taken into account by the EPA, appear in the report itself.

# 2. The proposal

The proposal is for a marina-based development located in Mangles Bay at the southern end of Cockburn Sound within the City of Rockingham (refer Figure 1). The proposal comprises an onshore, single entrance marina to accommodate up to 500 pens and moorings and a surrounding land development comprising tourism, commercial, public open space and residential land uses.

The construction of the marina and canals will involve the excavation of up to 12 ha of land, construction of a marina access channel of up to 550 m and breakwaters to protect the marina entrance. The dredging will result in up to 50,000 $m^3$ of spoil, which the proponents propose to pipe to settlement ponds located on the proposal site for treatment and infiltration. Testing of the marine sediments determined that no contaminants would be present in the dredge spoil.

The land development component will encompass various land uses including tourist-based commercial uses, an aquatic club area, short-term accommodation, public open space and residential uses. Roads that service the area currently, such as Memorial Drive, will be upgraded to meet current urban road standards and increased traffic volumes resulting from the proposal. The proponents have also made a community commitment to upgrade the existing facility west of the Causeway though will not add or alter the jetty works.

The total footprint of the proposal is up to 77 ha and the proposal area is in the ownership of the State Government as a mix of Crown Land and Freehold. Approximately 37 ha of the area are within the Rockingham Lakes Regional Park and 40 ha are within Bush Forever site 355. The Rockingham Lakes Regional Park is a 'C' Class nature reserve vested with the Conservation Commission of Western Australia and managed by the Department of Environment and Conservation (DEC).

Bush Forever is a non-statutory regional policy endorsed by the Government of Western Australia which identifies 51,200 ha of regionally significant bushland on the Swan Coastal Plain. There are 284 Bush Forever sites across the Perth Metropolitan Area, most of which are within Government ownership. Statement of Planning Policy 2.8, *Bushland Policy for the Perth Metropolitan Region* (SPP 2.8) addresses the protection and management of regionally significant bushland identified for protection as Bush Forever (Government of Western Australia, 2009).

The remaining land is freehold and is owned by the departments of Regional Development and Lands, Transport and the Water Corporation and is vested for a variety of purposes including boating facilities and chalet accommodation. The area along the Mangles Bay foreshore is reserved as 'Port Installations' under the Perth Metropolitan Region Scheme.

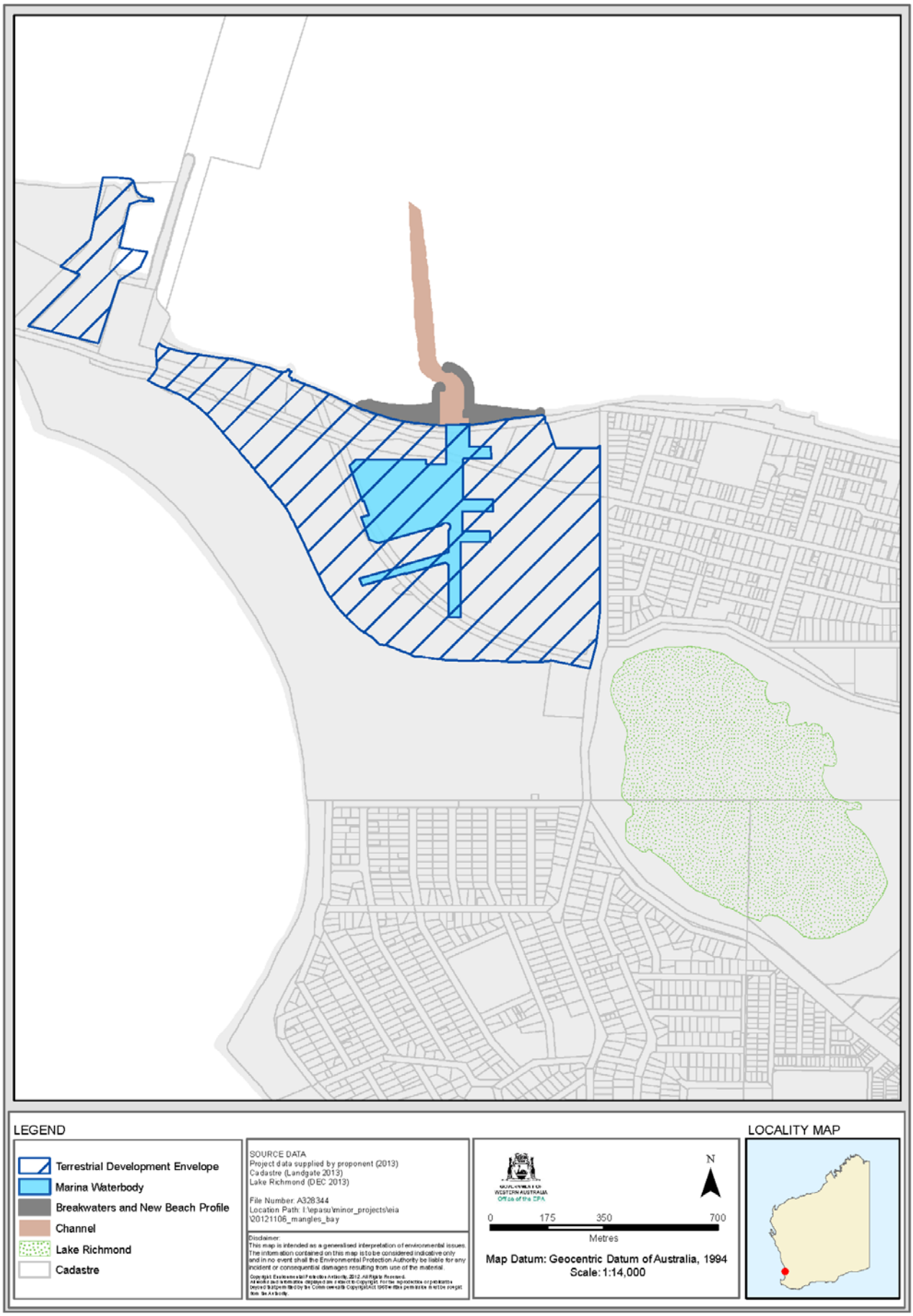


**Figure 1: The Proposal**

As the proposal site is not currently zoned for residential development under the Metropolitan Region Scheme or the City of Rockingham's Town Planning Scheme No. 2, amendments to both Schemes will be required. The rezoning will not be initiated until such time that the Minister for Environment determines whether the proposal may proceed and, if so, issues a Ministerial Statement.

Traversing the proposal footprint is the Water Corporation's Sepia Depression Ocean Outfall Landline (SDOOL). As part of this proposal, the proponents will be realigning the SDOOL to a new infrastructure corridor that will run parallel to the realigned Memorial Drive to the south of the proposal area. The proponents will also be relocating the ocean outfall pipe carrying stormwater from Lake Richmond to the end of the breakwater, where it will discharge into deeper water.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Section 3 of the PER (Strategen, 2012a)

**Table 1: Summary of key proposal characteristics**

| Element | Description |
|---|---|
| Main activities | Construction activities to include clearing, wet excavation of the marina and dredging of the access channel. Operational activities include marina operation and management and maintenance dredging. |
| Proposal area | • Up to 77 ha<br>• Total vegetation clearing up to 40 ha, including up to 1.93 ha of Floristic Community Type (FCT) 30a. |
| Marina waterbody | • Total water area of marina up to 12 ha<br>• Deepest depth in marina up to -3.5 m Australian Height Datum (AHD), shallowest -2.7 m AHD |
| Marine footprint | • Total channel length up to 550 m<br>• Total channel navigable width up to 30 m, including batters (the channel has a width of 55 m)<br>• Total channel depth up to -3.5 m AHD<br>• Total channel dredging up to 50,000 $m^3$ of spoil<br>• Dredged spoil material will be piped to the proposal area, where it will be settled, the water infiltrated and solid material treated and disposed of off-site if required. |
| Reclamation | • Total reclamation area up to 1.36 ha<br>• Total breakwater length up to 290 m<br>• Total breakwater width up to 40 m (includes breakwater batters of 1:5)<br>• Total breakwater area of up to 1.1 ha |
| Seagrass loss | • Total seagrass removal of up to 5.24 ha<br>• Total marine footprint up to 5.36 ha |
| SDOOL | • Length of pipeline up to 1.6 km |

| | |
|---|---|
| (Water Corporation asset) | • Width of the service corridor up to 45 m (includes batters, provision for a dual road and Water Corporation infrastructure) |
| Traffic | Provision of a dual-lane road as part of the service corridor |
| Outfall | Relocation of the Mangles Bay stormwater ocean outfall pipe to end of the eastern breakwater. |

Since the release of the PER, a number of modifications to the proposal have been made by the proponents. These include:

- shortening of one canal arm to reduce the potential for hydrological impacts and saline intrusion;
- reducing the depth of the navigation channel by 0.5 m to reduce the estimated seagrass loss from 5.66 ha to 5.24 ha;
- reducing the maximum depth of the marina waterbody from -4.0 m AHD to -3.5 m AHD to improve flushing;
- changing the final location for the Lake Richmond outlet drain from the end of Hymus Street to the end of the breakwater; and
- modifying the offsets proposed, including increasing the ratio for seagrass replanting from 1:1 to 2:1.

The potential impacts of the proposal initially predicted by the proponents in the PER document (Strategen, 2012a) and their proposed management are summarised in Table ES3 in the Executive Summary of the proponents' document.

# 3. Key environmental factors and principles

Section 44 of the EP Act requires the EPA to report to the Minister for Environment on the key environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the key factors selected for detailed evaluation in this report are summarised in Appendix 3. The reader is referred to Appendix 3 for the evaluation of factors not discussed below. A number of these factors, such as noise, air quality, heritage and traffic, are relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

It is the EPA's opinion that the following key environmental factors for the proposal require detailed evaluation in this report:

(a) Marine environmental quality;

(b) Benthic communities and habitat;

(c) Marine fauna;

(d) Terrestrial vegetation, flora and fauna; and

(e) Hydrological processes and inland waters environmental quality (Lake Richmond.

The above key factors were identified from the EPA's consideration and review of all environmental factors generated from the PER document and the submissions received, in conjunction with the proposal characteristics.

Details on the key environmental factors and their assessment are contained in sections 3.1 - 3.5. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

The following principles were considered by the EPA in relation to the proposal:

(a) The precautionary principle;

(b) The principle of intergenerational equity;

(c) The principle of the conservation of biological diversity and ecological integrity;

(d) Principles relating to improved valuation, pricing and incentive mechanisms; and

(e) The principles of waste minimisation.

## 3.1 Marine environmental quality

### Description

#### *Current condition of Mangles Bay*

The ecological condition of Cockburn Sound was at its lowest in the 1970s, with poor water quality, high chlorophyll-*a* levels and the loss of extensive areas of meadow-forming seagrass from the eastern margin of Cockburn Sound. Substantial amounts of time and resources have been invested by the Government, industry and the community to improve the environmental quality in Cockburn Sound since the late 1970s. During the mid to late 1980s and early 1990s chlorophyll-*a* concentrations and water clarity improved, and have generally stabilised since then (Strategen, 2012a).

The *State Environmental (Cockburn Sound) Policy 2005* (SEP) provides for an environmental quality monitoring program to be implemented in Cockburn Sound to determine if the established Environmental Quality Objectives[1] set for Cockburn Sound are being achieved, and therefore whether the Environmental Values[2] are being protected. Under the SEP, the CSMC has responsibility to oversee the environmental quality monitoring program and publicly reports the findings each year. In 2011, the CSMC prepared a *State of Cockburn Sound Report 2011* (in addition to the public reporting program), which was tabled in Parliament (Cockburn Sound Management Council, 2011).

Overall (based on the best available information and expert advice) there appears to have been no significant change in the overall health of Cockburn Sound since monitoring programs began in 2000. Data collected under the monitoring program was assessed against the Environmental Quality Criteria (EQC) for Cockburn Sound and a series of Report Cards were developed to inform stakeholders and the community on the health of the Cockburn Sound marine environment.

The Cockburn Sound Report Cards for 2011, produced from data collected during 2010-11, indicate that investigation and/or action was required in relation to a number of parameters monitored for ecosystem health in Mangles Bay: seagrass shoot density, chlorophyll-*a*, and light attenuation (Cockburn Sound Management Council, 2011).

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[1] Environmental Quality Objectives (EQOs) have been established by the SEP for each Environmental Value. EQOs are specific management goals for a part of the environment and are either ecologically based by describing the desired level of health of the ecosystem or socially based by describing the environmental quality required to maintain specific human uses.

[2] Under the SEP, Environmental Value means a particular value or use of the marine environment that is important for a healthy ecosystem or for public benefit, welfare, safety or health and which requires protection from the effects of pollution, environmental harm, waste discharges and deposits. The Environmental Values that apply to the Cockburn Sound policy area are listed in Clause 6 of the SEP.

The 2011 Report Cards highlighted that in the area of *High Ecological Protection*[3] in Mangles Bay:

- chlorophyll-*a* concentration, as an indicator of phytoplankton biomass, did not meet the Environmental Quality Guidelines (EQGs). Concentrations at Mangles Bay and two sites in southern Cockburn Sound exceeded the Environmental Quality Standards (EQSs) and were labelled red, requiring action;
- median light attenuation did not meet the EQGs at the two sites in Mangles Bay; and
- seagrass health did not meet the seagrass shoot density EQG. Overall however, all sites met the EQGs for seagrass depth limits and there were no observed reductions in the seagrass depth limits detected (Cockburn Sound Management Council, 2011).

More recent monitoring for 2011-12 together with the 2012 Report Cards highlighted that some of the environmental quality indicators monitored in southern Cockburn Sound were also at levels that required action to be taken. These indicators include nutrient enrichment EQGs as measured by chlorophyll-*a* and light attenuation coefficient (Cedar Wood Properties, 2012).

***Construction phase***

The proposal has the potential to temporarily impact on marine environmental quality during marine construction-related activities which for this proposal is defined as dredging and construction of breakwaters.

The proponents have calculated that up to 50,000 $m^3$ of sediments will need to be dredged for the new boating access channel and that this would occur during the winter months (between May and September). The sand will be pumped directly onshore to the development area (approximately 350 m from the coastline) and discharged to settlement areas and basins to allow infiltration. Hence there will be no placement of dredged sand material on either side of the proposed channel to reduce turbidity (Strategen, 2012a).

The proponents have investigated the capacity and dimension of the development area and infiltrations basins, and have concluded that there is sufficient land capacity and contingency measures in place to ensure that the dredge-return water can be managed in the development area. The use of final infiltration basins will further capture any surface flows closer the coastline. This effectively means that there will be no direct discharge of surface water flow to Mangles Bay from the onshore development area (Strategen, 2012a).

[3] For the EQO–'Maintenance of Ecosystem Integrity', there are three levels of ecological protection that apply. A High level of ecological protection allows for small changes in the quality of water, sediments and biota. The extent and boundary of the High Ecological Protection area within the policy area is shown in Schedule 2 of the SEP.

Therefore, the primary source of plumes and any potential environmental quality impacts will be from dredging of the channel and the construction of the breakwaters.

Sediment has been characterised in accordance with the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia, 2009). Levels for all contaminants in the dredge material are below the guideline thresholds and hence did not require further testing to determine bioavailability of contaminants. The proponents have therefore concluded that the risk for contaminant release during dredging and disposal is considered to be low. The proponents have also concluded that the potential release of acid is very low as soils to be excavated have been shown to be primarily alkaline with a significant amount of acid neutralising capacity (Strategen, 2012a).

In terms of evaluating the potential impacts of turbid plumes, the proponents have undertaken investigations of the sediment characteristics and demonstrated the moderate to large particle size and low concentration of fines in the sediments to be dredged. The proponents' modelling of sedimentation and total suspended solids (TSS) from the dredging works predicts potential impacts to be temporary and localised. The proponents have also committed to the use of silt curtains as a possible contingency measure during dredging, subject to weather and sea conditions (Strategen, 2012a).

The potential ecological impact of the predicted plumes on benthic communities and habitats such as seagrass is discussed in detail in Section 3.2 of this report.

***Operational phase***

The proposal is located within the Policy Area of the SEP and the proposed groynes and navigation channel are within the Protected Area of the SEP. The EQOs and the EQCs therefore will apply to the marine waters between the main breakwaters and navigation channel area (refer Figure 2). Water quality within the inland marina waterbody is not proposed to be governed by the SEP, but by the Western Australia Planning Commission's (WAPC) Development Control Policy 1.8 *Canal Estates and Artificial Waterway Developments*. This is discussed further in Section 5 Other advice.

The main determinants of water quality in the proposed marina are: the quality of external waters in Mangles Bay; the magnitude of nutrient inputs (from groundwater and land use); and the flushing and mixing rates of the marina (which is largely determined by marina sitting and design). If water and sediment quality in the marina are poor (due to inappropriate configuration and design, or inadequate management of nutrient inputs) this is likely to adversely affect the quality of external waters in Mangles Bay.

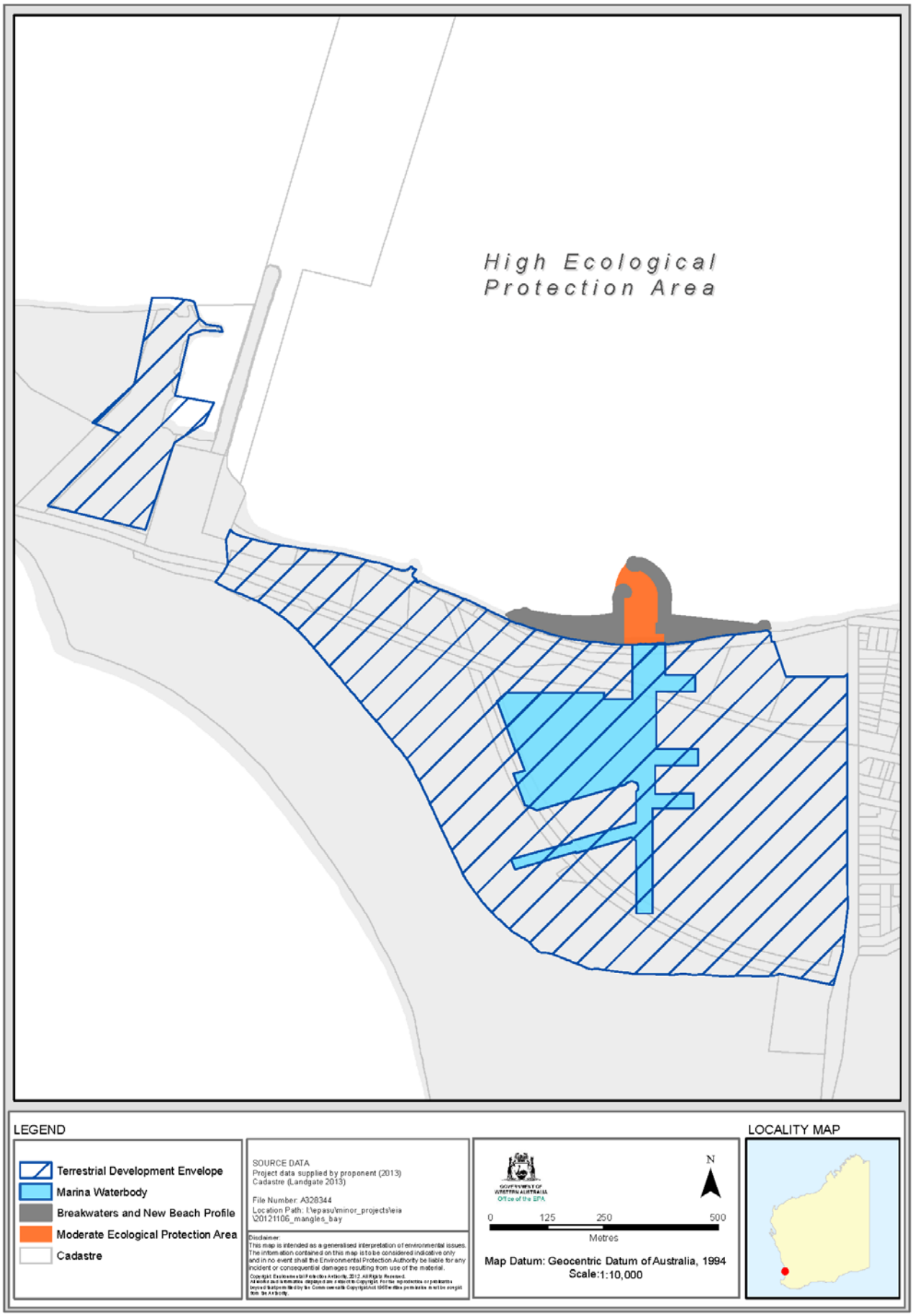


**Figure 2: High and Moderate Ecological Protection Areas**

In terms of the design of the marina and canals, it is the proponents' view that they have been designed to achieve the maximum flushing rate within the project constraints, in terms of its bathymetry (deeper waters at the marina entrance grading to shallow waters at the end of the canals, and no sills), and the length and orientation of the canals (to maximise fetch relative to prevailing winds) (Strategen, 2012a).

**Submissions**

The main issues raised in submissions were:

- lack of confidence in the modelled predictions that the marina will adequately flush and the consequential impacts this may have on seagrass and amenity;
- impacts of engine emissions, anti-fouling, sewage, rubbish and the accumulation of contaminants in sediments;
- impacts of maintenance dredging and ongoing spoil management;
- technical issues with the hydrological modelling and the interpretation of the modelled results;
- the ability of the marina to meet the requirements of the SEP during operation;
- compliance of the marina with the Development Control Policy 1.8; and
- impacts of relocating the stormwater drain to Hymus Street.

**Assessment**

The EPA's environmental objective for this factor is to maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected.

As mentioned above, the monitoring results presented in the CSMC's annual reports have highlighted several ongoing environmental quality issues in Cockburn Sound. This has led to concerns about seagrass health in Mangles Bay as the Environmental Quality Standards (EQSs) have been exceeded in recent years (Cockburn Sound Management Council, 2011).

Given the history of reduced water quality in Mangles Bay (in part caused by poor flushing of the bay) and the pressure this is evidently exerting on seagrass health in the vicinity of the proposal, any further nutrient-related deterioration of water quality will need to be carefully considered and mitigated by the proponents.

The proponents have used a combination of hydrodynamic modelling and existing knowledge about water quality, nutrient inputs in groundwater and the ecology of Cockburn Sound to make predictions about the potential impacts on environmental quality (Strategen, 2012a; Strategen, 2012b; Cedar Wood Properties, 2012).

***Construction phase***

The potential impacts during the marine construction related activities include;

- adverse effects of contaminant release and mobilisation from sediments during dredging on marine environmental quality; and
- potential effects of dredging on community uses and aesthetic issues in Mangles Bay.

*Contaminant release*

As mentioned above, the proponents have undertaken sediment quality investigations in areas to be dredged and have concluded that the risks to ecosystem and human use environmental values are low. Although the risk of contamination of marine water and sediment quality from the proposed dredging activities is low, the proponents have committed to sampling the dredge return water and stockpiled dredged sediments to confirm their low contaminant status. All EQOs in the SEP will apply during construction. The EPA recommends that the protocols for this sampling work be included in the Marine Construction Environmental Management Plan required by conditions 6-2 and 6-3.

*Potential impacts of plumes on community use and aesthetic issues*

The marine waters of Mangles Bay are extensively used by people for recreation including boating, fishing, swimming and tourism activities such as dolphin watching/interactions. Hence the SEP's Environmental Values of Ecosystem Health, Fishing and Aquaculture and Recreation and Aesthetics are particularly relevant to the EPA's assessment of construction impacts.

Based on the proponents' modelling, turbid plumes would be expected to be visible from time to time and likely to temporarily affect aesthetic values in Mangles Bay. The proponents' modelling of average TSS concentrations shows that Mangles Bay would be subject to some influence of plumes from dredging. The proponents have identified the extent of the visible plume to be where the combined TSS from the dredge plume and background TSS is above four milligrams per litre (mg/L). As background TSS values were identified as being 2-3 mg/L, a dredge generated TSS threshold of 2 mg/L was identified as the extent of the visible plume. Modelling of TSS shows values of 5 mg/L or less occurring outside the access channel footprint for one per cent of the time (Strategen, 2012a).

The proponents have identified and predicted a Zone of Influence (ZoI) consistent with the EPA's *Environmental Assessment Guideline for Marine Dredging Proposals No. 7* (EPA, 2011). This is further discussed in Section 3.2 of this report.

While the plumes in the ZoI are not predicted to have an ecological or health impact, they could affect amenity uses. The extent of the ZoI TSS plots do not mean that all of this area is likely to be subject to a plume at any one time, but that the TSS modelling indicates that a visible plume could appear anywhere within this area at some time during the dredging period. The

intensity of the plume would attenuate with distance from source and hence areas closer to the proposal are likely to experience higher concentrations of TSS and more often, than areas further away from the proposal (Strategen, 2012a).

It is noted that the ZoI extends west of the Causeway into the Shoalwater Islands Marine Park. However, this would only occur for very a small proportion of the time (less than one per cent of the dredging duration) and will be of very weak concentration (Strategen, 2012a).

In summary, the proponents have concluded that a visible plume is generally expected to be restricted to within the vicinity of the dredged channel, although a weakly concentrated plume may be visible up to 100-200 m away at certain times. It is expected however that water clarity will return to within natural variation following the completion of the dredging (Strategen, 2012a).

The effects of these plumes on social values will depend on the timing of the dredging. If dredging occurs in summer when background water turbidity is low and recreational usage is high, then the plumes are likely to be very noticeable. If it occurs in winter when turbidity is higher and recreational usage is low, then the plumes are less likely to be noticeable.

To reduce the impact on the local community and aesthetic values, the EPA recommends Condition 8-2 which reflects the proponents' commitment to undertake marine construction related activities in winter and avoid the months between October and March, when recreational usage is at its highest. This condition also serves to reduce the potential impacts of the marine construction-related activities on seagrass communities and marine fauna as discussed further in sections 3.2 and 3.3, respectively. In addition, the EPA has also recommended Condition 6-1 which requires that there be no direct discharge of the dredge return-water to the marine waters of Mangles Bay from the onshore development area.

To manage potential impacts during dredging and any perceptions of ecological and public health issues, the EPA recommends conditions 6-2 and 6-3, which require the proponents to prepare and implement a Marine Construction Environmental Management Plan. The purpose of the Plan is to ensure the proponents manage and monitor marine-related construction activities in order to demonstrate it is achieving the environmental quality objectives and levels of ecological protection in the SEP.

The Marine Construction Environmental Management Plan will need to include:

- the establishment of monitoring sites for water quality to determine EQOs have been achieved, including in areas of high recreational usage;
- the establishment of reporting procedures to inform the general public of water quality results, as well as the plume characteristics; and
- a framework for developing management and contingency actions to be implemented in the event trigger levels are not met.

The plan will also require the proponents to implement a reporting protocol for the monitoring results including making the monitoring results publicly available.

***Operation phase***

The proponents' predictions with respect to the inland marina and waters in Mangles Bay are summarised below.

*Inland marina*

The flushing time was assessed as the time it takes for the concentration of a dye at a series of locations within the marina to reduce to approximately 37 per cent of the original concentration (known as the e-folding time). The proponents' flushing studies predict that, under autumn conditions (when residence times are generally longest due to calm wind conditions), the greatest effect of the proposal is on flushing waters in the back end of the canals. Flushing of waters was predicted to be up to 13 days for areas at the end of the canals. The range of e-folding times calculated for the overall marina waters under autumn conditions was in the range of 6-13 days. The median e-folding time for all modelled locations and seasons is estimated at 6.8 days (Strategen, 2012a).

The proponents' modelling has been peer reviewed by Dr Jason Antenucci who concluded that *"in general, the model selection, configuration and validation is suitable for the purpose of predicting the flushing characteristics of Mangles Bay Marina"* (Strategen, 2012b).

The proponents have also predicted increases in chlorophyll-*a* concentrations with the overall finding being that chlorophyll-*a* concentrations in the marina would typically be about twice those of adjacent waters in Mangles Bay (Cedar Wood Properties, 2012).

One issue which could cause the marina water quality to be poorer than expected would be due to the organic enrichment of sediments. This could subsequently increase sediment nutrient release to the water column under certain conditions and hence increase the risk of algal blooms. Although this was not accounted for in the proponents' modelling for marina water quality, they have recognised this to be a risk which warrants a contingency measure. In this case, the proponents commit to undertaking maintenance dredging to remove the top layer of sediments and have this measure included in their operational marina management plan (Strategen, 2012b).

Other threats and pressures on the water and sediment quality in the marina include sources of contaminants from stormwater and the increase in boats in the marina. Issues include nutrients, leaching of antifoulants from boat hulls and the accidental spills of fuels and sullage (Strategen, 2012b). The proponents have committed to preparing an Urban Water Management Plan (UWMP) to ensure there is no nutrient input from surface water drainage from the ongoing operations of the proposal. The EPA has therefore

recommended Condition 7-6 to reflect the proponents' commitment. It is expected that the approved UWMP would be given effect and implemented through the statutory planning process, i.e. the Structure Plan and subdivision stages.

Contingency measures that have been identified by the proponents to increase the flushing of the inland marina in the short term include pumping seawater into the marina using a dredge or dewatering pumps (Strategen, 2012a).

*Mangles Bay*

The proponents predict that impacts on water quality due to outflow from the marina are occasional, slight (increase in chlorophyll-*a* concentrations of 0.1 – 0.3 µg/L above background concentrations) and highly localised due to the effects of dilution once the outflow waters disperse into Mangles Bay (Strategen, 2012a). According to one modelled scenario, the water from the marina is expected to extend several hundred metres along the shallow near-shore waters west towards the causeway in autumn (Strategen, 2012b).

The proponents consider that changes in near-shore chlorophyll-*a* concentrations in Mangles Bay (predicted median of 17 per cent increase over background concentrations, over a range of 0-33 per cent) that may be attributable to the marina are considered to have a negligible risk of causing adverse impacts on the ecology of Mangles Bay, particularly seagrass. This is based on the results of the modelling undertaken, which demonstrate that the outflow from the marina will undergo rapid dilution and chlorophyll-*a* concentrations that are slightly above background levels only occur occasionally in shallow near shore areas where seagrasses are not light-restricted by water clarity. On this basis, the proponents consider that the proposal will not lead to a significant residual impact in terms of near-shore water quality in Mangles Bay (Strategen, 2012b; Cedar Wood Properties, 2012).

In summary, this proposal will most likely result in higher levels of phytoplankton production in the marina waterbody than in Mangles Bay. This is supported by the proponents' overall finding that chlorophyll-*a* concentrations in the marina are typically about twice those of adjacent waters in Mangles Bay. This would in turn result in some nutrients and additional phytoplankton loads to Mangles Bay by the outflow of marina waters (Strategen, 2012b; Cedar Wood Properties, 2012).

As mentioned above, the proponents predict that the proposal would lead to an increase in chlorophyll-*a* concentrations over an area extending a few hundred metres from the marina entrance. Based on the proponents' predictions it appears that the proposal would be a minor contributor of phytoplankton biomass to the existing load in Mangles Bay. However, the EPA considers this predicted small contribution from the proposal needs to be considered in the context of the SEP, the current stressed state of Mangles Bay, and the fact that the EQSs for chlorophyll-*a* and seagrass have been exceeded in recent years.

The predicted contributions from the proposal, although considered by the proponents to be minor, could increase the risk of the Environmental Quality Standards being exceeded in the southern end of Mangles Bay in the future. It is for this reason that the predicted impact on water quality in Mangles Bay is considered to be a residual risk for the proposal that requires an offset. Nutrient-related offsets could include any treatment of groundwater or surface water in the catchment to offset the predicted increase in nutrient-related impacts to the southern end of Mangles Bay.

To ensure that any offset contributions from the proponents are provided and implemented in the context of an appropriate management framework, the EPA has recommended that offset contributions be provided to the CSMC, noting that the City of Rockingham is a member of the CSMC. This would enable the prioritisation of nutrient reduction and catchment management measures that have already been identified for the southern end of Cockburn Sound by the CSMC as a management response to exceedences of the EQSs. It is also understood that the CSMC is in the process of finalising a contemporary contaminant inputs inventory for Cockburn Sound and that this would further assist in the identification and prioritisation of nutrient reduction measures. The EPA considers that offset measures should aim to achieve a net benefit (i.e. net reduction) in the nutrient loads in the local area.

In view of the above, the EPA has recommended Condition 11-10 which requires the proponents to contribute funding to the CSMC for the purpose of implementing nutrient reduction measures in the Mangles Bay catchment as an environmental offset. The EPA has also recommended that there be an ongoing cost component for the first five years to ensure that maintenance and monitoring costs associated with nutrient reduction measures are sufficiently covered.

In summary, all the EQOs established in the Cockburn Sound SEP will continue to apply in Mangles Bay. However, there will be a relatively small area of water between the breakwaters at the entrance channel of proposal where a moderate level of ecological protection area will need to be defined. A high ecological protection area will continue to apply in Mangles Bay beyond the mouth of the breakwaters. The EPA has therefore recommended Condition 7 which requires the proponents to manage marina water quality to ensure that a moderate level of ecological protection is met at the entrance channel of the marina and that, beyond the entrance channel, a high level of ecological protection is met, consistent with the objectives of the SEP. Contingency measures in the marina would need to be implemented by the proponents in the event the environmental quality criteria relevant to the moderate level of ecological protection are not being met.

In view of the proponents' predictions, the recommended conditions which require the preparation and implementation of a Marine Environmental Quality Management Plan, and recommended Condition 11-10 which require the proponents to contribute funding to the CSMC for the purpose of implementing nutrient reduction measures in Mangles Bay as an

environmental offset, the EPA considers that the proposal could meet its environmental objectives for the environmental factor of marine environmental quality.

Should the proposal be approved for implementation, the proponents would also need to contribute sufficient funds to the CSMC to establish additional sites adjacent to the marina to determine potential impacts of the proposal on the adjacent SEP protected area. This is further discussed in Section 5 of this report in other advice. The EPA has also provided other advice on the management of marina water quality through the planning process.

**Summary**

The EPA considers the key environmental factor of Marine Environmental Quality has been adequately addressed and the EPA's objectives for this factor are likely to be met provided that conditions are imposed requiring the proponents to:

- undertake marine construction related activities to avoid the months between October and March;
- prepare and implement a Marine Construction Management Plan which aims to ensure that the EQOs in the Cockburn Sound are met (conditions 6-2 and 6-3);
- manage marina water quality, to ensure that a moderate level of ecological protection is met at the entrance channel of the marina and that beyond the entrance channel, a high level of ecological protection is met, consistent with the objectives if the SEP. Contingency measures would need to be implemented in the marina by the proponents in the event the EQCs relevant to the moderate level of ecological protection are not being met (conditions 6 and 7); and
- offset residual risks to water quality in Cockburn Sound by contributing funding to the CSMC for the purpose of implementing nutrient reduction measures in the Mangles Bay catchment (Condition 11-10).

## 3.2 Benthic communities and habitat

**Description**

Benthic communities and habitats provide an important foundation for many ecosystem processes that underpin a healthy and productive marine environment. Dredging of the access channel, construction of the breakwaters, changes to the shoreline profile, altered patterns of sediment movement and hydrodynamics have the potential to affect benthic habitats.

The proponents have used existing information and undertaken studies to understand the impacts of their proposal on benthic communities and habitats. Habitat types in Cockburn Sound consist of bare sand, seagrass, reef and algae. Approximately 80 per cent of seagrasses have been historically lost in Cockburn Sound as a result of either changes to water quality or direct

physical impacts from the construction of facilities and anchor damage. Of the pre-European extent of 3,760 ha, only approximately 768 ha remain.

Seagrass mapping of Cockburn Sound in 2002 estimated that 304 ha of seagrass occur in the southern section of the Cockburn Sound. This included Mangles Bay, Southern Flats, the area in between and some seagrass meadows around the southeastern corner of Garden Island (DALSE, 2002). The shallow flats of Mangles Bay itself contain approximately 100 ha of seagrass, comprising the main area of seagrass meadow that remains on the eastern shore of Cockburn Sound between the Causeway and Woodman Point (Strategen, 2012a). The most recent habitat mapping of Cockburn Sound, undertaken by Fremantle Ports in 2008, indicates that the dominant habitats comprise of *Posidonia sinuosa*; *P.australis* and *P.corriacea*; mixed *P.australis* and *P. sinuosa*; and mixed *Amphibolis* sp. and *Posidonia* sp. (Strategen, 2012a).

The proponents undertook a baseline survey of seagrass health in 2010 and 2011, using shoot density counts of *P. sinuosa* which indicated that the seagrass health at the monitoring sites in Mangles Bay showed considerable spatial variability (Strategen, 2012a). The proponents note that variability in seagrass shoot density over time has been noted in routine seagrass monitoring undertaken by the CSMC in Mangles Bay with a failure to meet the high protection EQSs some years, but not in others (Strategen, 2012a).

Present boating activities in Mangles Bay have resulted in some seagrass loss, largely due to boat launching and associated keel drag, and anchor drag at moorings (Strategen, 2012a). This proposal is not expected to result in an increase in trailerable boat ownership other than that due to regional population growth, but will potentially result in an increase in non-trailerable boats in the medium term (by 2018). Non-trailerable boats are not expected to add to boat movements over seagrass meadows in Mangles Bay and the relocation of private boat ramps to within the proposal area, and cessation of boat launching from beaches, with the exception of junior sailors, is expected to reduce scouring damage and to allow natural regeneration of seagrass (Strategen, 2012a).

Elements of the proposal that would have direct and irreversible impacts on the seabed and seagrass include dredging of the access channel, construction of the breakwaters, and changes to the shoreline profile. The proposal will require the excavation of approximately 50,000 $m^3$ of marine sediments, over a three month winter period. Dredging is proposed to be undertaken using a cutter suction dredge with dredged material to be pumped to settlement infiltration basins located within the onshore proposal area. Solid material is proposed to be treated and disposed of offsite where necessary. Maintenance dredging may be required over the life of the proposal to maintain the access channel.

Indirect impacts of the proposal from sedimentation and light deprivation as a result of dredging are more difficult to predict and relies on undertaking simulation modelling to establish the extent and severity of pressure fields and

an understanding of the sensitivities of benthic communities to dredge-related pressures. The proponents have undertaken sampling and analysis of sediments in the area to be dredged, and modelling of dredge plume dispersion characteristics. These studies, namely the Mangles Bay Marina-Based Tourist Precinct Baseline Data (Oceanica, 2012a) and Mangles Bay Marina Marine Modelling Study (APASA, 2011) are presented in Appendix 5 of the PER.

The proponents have predicted the impacts of the proposal and spatially defined the extent of the boundaries for the Zone of High Impact (ZoHI), Zone of Moderate Impact (ZoMI) and Zo) (Figure 3) in accordance with Environmental Assessment Guideline *for Marine Dredging Proposals* No.7 (EPA, 2011). These zones are defined in Table 2 below.

**Table 2: Description of the zones used to define the effects of dredging on marine benthic communities.**

| | |
|---|---|
| **Zone of High Impact (ZoHI)** | The area where impacts on benthic organisms are predicted to be irreversible, meaning that impacts in this zone render the habitat incapable of returning to a state resembling that prior to impact within five years or less. This zone is associated with the direct footprints of infrastructure and generally extends a short distance from those footprints. |
| **Zone of Moderate Impact (ZoMI)** | The area within which predicted impacts on benthic organisms are sub-lethal, and/or the impacts are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the Zone of High Impact. The outer boundary of this zone is coincident with the inner boundary of the next zone, the Zone of Influence. |
| **Zone of Influence (ZoI)** | The area within which changes in environmental quality (e.g. suspended sediment levels) associated with dredge plumes are predicted and anticipated during the dredging operations, but these changes would not result in a detectible impact on benthic biota. The outer boundary of the Zone of Influence encompasses all of the predicted maximum extents of dredge plumes and represents the point beyond which dredge-generated plumes should not be discernible from background conditions at any stage during the dredging campaign. While these areas can be very large, at any point in time dredge plumes are likely to be restricted to a relatively small portion of the Zone of Influence. |

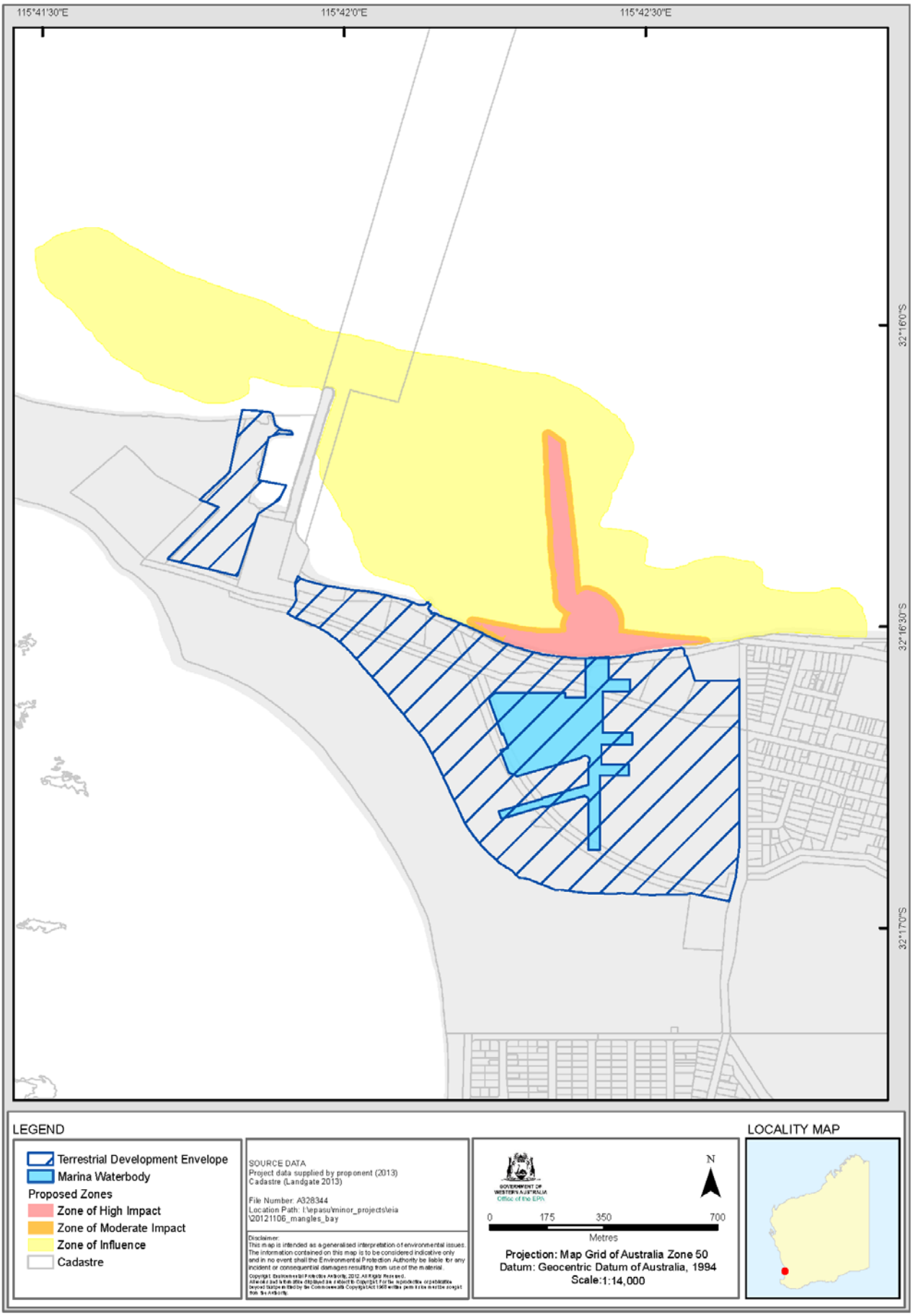


**Figure 3: Zones of High and Moderate Impact, and Influence**

The ZoHI is to be confined to the area of dredging for the access channel, construction of the breakwaters and changes to the shoreline profile. The PER predicted this would result in the direct removal of 5.36 ha of seagrass, and a halo effect of a further 0.3 ha of indirect loss as a result of altered patterns of sediment movement and hydrodynamics resulting in erosion or smothering of seagrass around the breakwaters. The proponents have based predictions of the extent of the halo effect on empirical evidence. Observations of other structures present in Mangles Bay show a halo effect of generally less than 10 m on the eastern side, with some evidence of a slightly greater effect on the western side. Accordingly a 15 m conservative approach was taken as breakwaters will have both eastern and western faces (Strategen, 2012b).

Since the release of the PER the proponents have reduced the depth of the navigation channel, which has a subsequent reduction in channel batters. As a result the estimated loss of seagrass is reduced from 5.66 ha as predicted in the PER to 5.24 ha of permanent loss within the ZoHI.

Based on the modelling of turbidity and sedimentation pressures, the proponents consider there is negligible risk of indirect loss of seagrass from construction and dredging. The sediments in the area to be dredged primarily comprise of fine to medium grained sands with only a small percentage of silts and clays (Oceanica, 2012a). Modelling showed that TSS concentrations are mainly restricted to the vicinity of the dredging channel (APASA, 2011), with concentrations of 5 mg/L or less only occurring outside the dredging channel for one per cent of the time (Strategen, 2012a). Based on these results the proponents also predict that there will be no loss of seagrass as a result of turbidity due to maintenance dredging (Strategen, 2012a).

No impacts to benthic communities and habitats are expected outside the ZoHI, however the ZoMI has been identified by the proponents as a notional 10 m buffer around the marine footprint of the proposal, which coincides with the ZoHI (Strategen, 2012a). The proponents have defined the ZoI using the 100$^{th}$ percentile of the area where a TSS threshold of 2 mg/L was exceeded, representing the maximum extent of the visible plume over the dredging period (Strategen, 2012a). The proponents propose to monitor water quality and seagrass health against pre-determined criteria at locations in the ZoMI and ZoI to demonstrate that impacts are not greater than predicted in these zones.

The proponents have also undertaken an assessment of the cumulative impacts in Cockburn Sound and presented these predictions in the context of Environmental Assessment Guideline No. 3 *Protection of Benthic Primary Producer Habitats in Western Australia's Marine Environment* (EPA, 2009). Table 3 shows the cumulative loss guidelines for benthic habitats within defined local assessment units for six categories of marine ecosystem protection. The cumulative loss values for the environmental impact assessment of proposals are the sums of proposed and historic loss/serious damage for each different benthic primary producer habitat (BPPH) within a defined sub-ecosystem scale area termed a 'local assessment unit (LAU).

**Table 3: Cumulative loss guidelines for BPPH within defined LAU for six categories of marine ecosystem protection**

| Category | Description | Cumulative loss guideline [1] |
|---|---|---|
| **A** | Extremely special areas | 0% |
| **B** | High protection areas other than above | 1% |
| **C** | Other designated areas | 2% |
| **D** | Non-designated areas | 5% |
| **E** | Development areas | 10% |
| **F** | Areas where cumulative loss guidelines have been significantly exceeded | No net damage / loss |

[1] Defined as a percentage of the original area of BPPH within a defined LAU.

For this assessment the LAU defined by the EPA encompasses Cockburn Sound and totals an area of 10,541 ha with the pre-European extent of seagrass estimated at 3,760 ha. Existing benthic habitat mapping indicates 768 ha of seagrass remains, which equates to an 80 per cent loss of the original extent. The proponents have calculated that cumulative losses of BPPHs as a result of both this proposal (5.66 ha) and existing approved projects in Cockburn Sound equate to 84.3 ha (Strategen, 2012a). Based on the revised seagrass loss of 5.24 ha, this would equate to 83.84 ha, taking overall cumulative loss to approximately 82 per cent.

Given the extensive historical losses of seagrass, Cockburn Sound is classified as Category F and the EPA's objective is for no net damage or loss. In view of this, the proponents have proposed to offset seagrass loss by replanting 6 ha for 5.66 ha of seagrass loss in the PER (Strategen, 2012a) with a ratio of approximately 1:1. Since the release of the PER the proponents have revised this ratio to 2:1.

The current offset for the loss of 5.24 ha of seagrass as a result of the proposal is as follows:

- 10.48 ha (using a 2:1 ratio) seagrass replanting at 1 m intervals to achieve 75 per cent cover within 10 years;
- 'like for like' seagrass planting, using predominately *P. sinuosa* but also *P. australis*;
- establishment of a contingency fund to ensure seagrass rehabilitation is achieved; and
- a commitment to undertake best endeavours to further reduce seagrass loss to 5 ha through further detailed design of the foreshore (Cedar Wood Properties Limited, 2012).

The proponents note that success of seagrass transplantation efforts are dependent on both transplanting methods and selected sites. The proponents propose to use methods previously developed and used in Cockburn Sound

and Albany with survival rates ranging from 50-90 per cent (Oceanica, 2011). The proponents are of the view that the transplantation methods already developed can be used to successfully transplant seagrass, regardless of whether this involves a small area of 1 ha or a large area of 10 ha (Cedar Wood Properties Limited, 2012).

The proposed transplantation sites for the pilot study will be determined in consultation with the Office of the EPA and the CSMC. The proponents have identified several sites which may be suitable including the eastern shelf in southern Cockburn Sound, such as to the east and north of the Rockingham Grain Terminal jetty, as well as areas in the Southern Flats (Cedar Wood Properties Limited, 2012). Sprigs for the transplantation will be sourced from the ZoHI as a priority, however there is unlikely to be sufficient material to achieve 10.48 ha of transplants and therefore additional material will need to be sourced from other meadows. Based on other seagrass trials, the proponents anticipate that impacts to donor meadows will take two to three years to recover (Oceanica, 2011).

**Submissions**

The main issues raised in submissions were:

- the lack of support for any loss of seagrass;
- the potential impacts of the proposal to seagrass health given the severe stress seagrass is currently experiencing and the poor health as shown by the CSMC's report cards;
- potential for the proposal to impact long-term stability of seagrass sediments and cause additional losses;
- inadequacy of the proposed seagrass offset ratio;
- lack of confidence that seagrass rehabilitation will be successful in the long term; and
- that conditions should be applied regarding monitoring the success of seagrass rehabilitation.

**Assessment**

The EPA's environmental objective for this factor is to maintain the structure, function, diversity, distribution and viability of benthic habitats at local and regional scales.

The EPA notes that the proponents have designed and further refined the proposal to minimise loss of seagrass, including reducing the depth of the navigation channel which has subsequently reduced the channel batters. Notwithstanding this, the implementation of the proposal would result in permanent and unavoidable impacts to 5.24 ha of seagrass.

The EPA notes that the proponents have undertaken modelling to predict the extent of indirect impacts associated with dredging, and do not expect any loss of seagrass outside the ZoHI, but have defined a 10 m ZoMI within which impacts are recoverable within a period of five years following completion of the dredging activities. The EPA has confidence in the proponents'

predictions and, in view of the modelling, small volume and short duration of dredging program (50,000 $m^3$ and three months respectively), the moderate to large particle size, low concentration of fines in sediments, and time of year (winter), considers that indirect loss of seagrass as a result of construction and dredging within the ZoMI will be minimised.

The EPA notes that the ZoI as shown in Figure 3, which represents the maximum extent of the visible plume over the dredging period, will extend west of the Causeway into Shoalwater Islands Marine Park one per cent of the time. However the zone represents an area within which no ecological impacts are expected to occur as the TSS is not sufficiently high to limit light availability.

The EPA has therefore recommended Condition 8 which requires the proponents to monitor turbidity and light attenuation (the dredge-related pressure), and seagrass health (the ecological response) in the proponents' predicted ZoMI before, during, and after marine-related construction activities to demonstrate that the impacts on seagrass which do occur (if any) are reversible, and not greater than approved. Immediately outside the ZoMI, in the ZoI, the proponents will need to monitor seagrass health with the objective of demonstrating that there are no detectible effects of dredging on seagrass communities in that zone.

As discussed above, the EPA's environmental objective for Cockburn Sound is "to ensure no net loss of benthic primary producer habitat and where possible, to generate a net gain in the area of benthic habitat and/or the associated benthic primary producer communities". This is due to significant cumulative loss of seagrass communities in Cockburn Sound from historical nutrient related pressures. The total estimated loss of seagrass within Cockburn Sound (including that from this proposal) is above 80 per cent. As such, a permanent loss of 5.24 ha will exceed cumulative loss thresholds.

The EPA notes that the proponents have proposed offsets to address the loss of seagrass with the aim of achieving a net gain. The proponents' commitment is to replant 10.48 ha over a five year period (maximum planting rate would be 2 ha/summer) to meet 75 per cent cover 10 years after initial transplanting.

The largest seagrass rehabilitation effort to date was undertaken by Cockburn Cement on Southern Flats in Cockburn Sound, where 3.1 ha of *P. australis* was planted. These transplantation trials had varying levels of success, with > 85 per cent in the middle and western sections but only 23 per cent in the eastern section (Oceanica, 2012b). Seagrass trials elsewhere have also shown varying degrees of success; seagrass replanting in Albany for a 1 ha offset has demonstrated high survival rates (>90 per cent), however a recent trial for the offset of the protected harbour development had no success due to macroalgae outcompeting the seagrass (Oceanica, 2012b). Other long-term monitoring sites in Albany show survival after eight years was close to 40 per cent for both *P. sinuosa* and *P. australis*, although estimates for the first five years had survival at 70 per cent (Oceanica, 2012b).

There is therefore some uncertainty regarding the proposal to offset the predicted seagrass loss, both in terms of scale of the rehabilitation required and the likelihood of long-term success. However, the proponents have proposed contingency funding to ensure that 10.48 ha is established in total, i.e. once the initial 10.48 ha is planted, if there are losses and low survival of transplants then this funding is to be set aside and would be used to replant until the 10.48 ha offset is achieved.

The time required for seagrass transplantation and the return of ecological function, is dependent on a number of factors including the health and quality of donor material and whether the donor material is sourced from within meadows or the actively growing rhizomes found on the edge of meadows. While sprigs from within meadows can be used for successful seagrass re-establishment, the time taken for shoot density to reach densities similar to natural meadows can take approximately three to six years longer (depending on environmental conditions) (Oceanica, 2011). Using actively growing rhizomes, however, generally results in a natural meadow in a shorter time, and studies have shown that donor meadows in Owen Anchorage and Albany were not adversely affected and recovered two to three years after harvesting (Oceanica, 2011).

Based on recent seagrass rehabilitation work, the EPA notes that there have been significant advances in seagrass planting techniques and that coalescence of sprigs and flowering has been observed in less than 10 years. The EPA has recommended Condition 11-5, which states that donor material should be sourced from the ZoHI as a priority to minimise impacts to donor beds. However the EPA recognises there is unlikely to be sufficient material to achieve 10.48 ha of transplants and therefore some material will need to be sourced from other meadows.

The EPA also notes that, to address some of the uncertainties, the proponents have proposed a pilot study to inform the rehabilitation conditions and identification of sites. This study includes both the locations of the transplant sites and the source of donor material. For the pilot study, the EPA supports the use of sprigs from the ZoHI as well as from other donor meadows to determine the relative success of each seagrass source. The EPA also supports this study occurring over successive years, which may require the proponents to start trials prior to the commencement of construction. While the EPA recognises that material from locations other than the ZoHI will be required, it will still require the sourcing of as many sprigs as possible from the ZoHI should the pilot study prove it is suitable for re-establishment.

The pilot study locations include areas on the eastern shelf in southern Cockburn Sound as suggested by the CSMC, with possible sites identified near the Rockingham Grain Terminal jetty. Sites on the eastern shelf of Cockburn Sound are of greater environmental benefit and therefore the EPA will require the proponents to trial seagrass re-establishment in these areas. However the EPA does recognise that re-establishment of seagrass beds has

not yet been trialled on the shelf and locations might not be suitable for long-term establishment. Should the small scale trials on the eastern shelf show that the area is not suitable, the proponents propose rehabilitation on the eastern edge of the seagrass bed in Mangles Bay and/or Southern Flats. The EPA will require the rehabilitation effort be confined to the southern end of Cockburn Sound.

The EPA considers that the criteria used to determine the success of seagrass rehabilitation will need to be developed in consultation with the DEC, the CSMC and the Office of the EPA as part of the development of a Seagrass Rehabilitation Plan in Condition 11-3. Mortality rates of transplants, degree of coalescence between transplants, development of seagrass-associated communities and successful flowering of transplanted seagrass are all indicators that should be considered for defining success criteria.

Based on the proposed small scale trials to identify suitable rehabilitation sites, proposed contingency funding, and the recent success of seagrass rehabilitation for other projects, the EPA considers that the proponents will be able to achieve the proposed offset. The EPA has therefore recommended conditions 11-3 to 11-9 which require the proponents to re-plant at least twice the area of seagrass lost by the proposal within five years of commencement of marine-related construction activities and ensure that 75 per cent cover is reached 10 years after the completion of marine related construction activities. In the event that the objective of re-establishing at least twice the area of seagrass lost by the proposal to at least 75 per cent cover is not reached, the proponents must continue until the objective is achieved. These conditions also require a Seagrass Restoration Plan, which will identify the protocols and procedures used for replanting, the monitoring requirements, and the criteria to determine success.

While present boating activities in Mangles Bay have resulted in some seagrass loss, the EPA notes that this proposal is not expected to result in any further increase in trailerable boats, and the increase in non-trailerable boats is not expected to add to boat movements over seagrass meadows in Mangles Bay. The EPA has, however, provided other advice in Section 5 of this report regarding potential opportunities to reduce impacts from boating activities in Mangles Bay more broadly.

**Summary**

Having particular regard to the:

(a) sediment characteristics, small volume, short duration and timing of proposed dredging;
(b) the proponents' predictions that the permanent loss of seagrass will be limited to 5.24 ha;
(c) the proposed offsets and contingency funding which will generate a net gain in the area of BPPH;
(d) the significant advances in seagrass planting techniques; and
(e) the proposed small scale trials to identify suitable rehabilitation sites and recent success of seagrass rehabilitation for other projects in other areas,

it is the EPA's opinion that it is likely that the EPA's environmental objective for this factor can be achieved provided conditions are imposed requiring the proposal to:

- monitor turbidity and light attenuation in the ZoMI before, during, and after marine-related construction activities to demonstrate that the impacts on seagrass which do occur (if any) are reversible, and not greater than approved;
- monitor seagrass health immediately outside the ZoMI in the ZoI to demonstrate that there are no detectible effects of dredging on seagrass communities;
- re-plant at least twice the area of seagrass lost by the proposal within five years of commencement of marine-related construction activities and ensure that 75 per cent cover is reached 10 years after the completion of marine related construction activities;
- source donor material from within the ZoHI as a priority; and
- in the event that the objective of re-establishing at least twice the area of seagrass lost by the proposal to at least 75 per cent cover is not reached, the proponents must continue until the objective is achieved.

## 3.3 Marine fauna

**Description**

Cockburn Sound and in particular the sheltered water of Mangles Bay provides significant habitat for marine fauna, including approximately 130 fish species and an estimated 14 large crustacean and mollusc species (Strategen, 2012a). Accordingly, Cockburn Sound is considered a significant fisheries resource and Mangles Bay is a recognised and important nursery area for a range of fish species, including those heavily targeted by recreational and commercial fishers.

A number of larger marine fauna are also known from the vicinity of Cockburn Sound and/or Mangles Bay, most of which are listed under State and Commonwealth legislation. Potential impacts to protected marine fauna species was determined to be a controlled action for the Commonwealth Government's assessment of this proposal (refer Table 4).

**Table 4: Larger marine fauna of Cockburn Sound and Mangles Bay**

| **Species Name** | | **EPBC Act Status*** | ***Wildlife Conservation Act 1950 /* DEC listing*** |
|---|---|---|---|
| **Mammals** | | | |
| Blue whale | *Balaenoptera musculus* | E M | Rare / E |
| Humpback whale | *Megaptera novaeangliae* | V M | Rare / V |
| Southern right whale | *Eubalaena australis* | E M | Rare / V |
| Australian sea lion | *Neophoca cinerea* | V | Specially protected / - |
| Bryde's whale | *Balaenoptera edeni* | M | - |
| Pygmy right whale | *Caperea marginata* | M | - |
| Orca | *Orcinus orca* | M | - |
| Dusky dolphin | *Lagenorhynchus obscurus* | M | - |
| Common bottlenose dolphin | *Tursiops truncatus* | - | - |
| Indo-Pacific bottlenose dolphin | *Tursiops aduncus* | - | - |
| **Reptiles** | | | |
| Loggerhead turtle | *Caretta caretta* | E M | Rare / E |
| Green turtle | *Chelonia mydas* | V M | Rare / V |
| Leatherback turtle | *Dermochelys coriacea* | E M | Rare / V |
| **Sharks** | | | |
| Grey nurse shark | *Carcharias taurus* | V M | Rare / V |
| Great white shark | *Carcharodon carcharias* | V M | Rare / V |
| **Birds** | | | |
| Little penguin | *Eudyptula minor* | - | - |
| Southern giant petrel | *Macronectes giganteus* | E M | - / P4 |
| Northern giant petrel | *Macronectes halli* | V | - |
| Gibson's albatross | *Diomedea exulans gibsoni* | V | Rare / E |
| Shy albatross | *Thalassarche cauta* | V | Rare / V |

*E: Endangered; V: Vulnerable; M: Migratory; P4: Priority 4

For most of the species listed above, their occurrence within Cockburn Sound and Mangles Bay is infrequent or unlikely. Of those cetaceans listed above, the whale species are least likely to be found in the vicinity of Mangles Bay and only the southern right whale is likely to enter Cockburn Sound, but is

unlikely to be found in the southern area due to the restriction posed by the Causeway. Loggerhead turtles are the most likely reptile to be encountered in south-west Australia but are not expected to be impacted by the proposal as they are infrequent visitors due to the absence of nesting habitat or significant foraging habitat (Strategen, 2012a).

Approximately 29 species of EPBC Act listed migratory sea and shorebirds may potentially occur in the proposal area. It is also unlikely that these species, in addition to those conservation significant species of sea birds listed in Table 4, would be impacted by the proposal due to infrequent visitation and/or the absence of significant nesting, foraging or roosting habitat. The great white shark and grey nurse shark are also unlikely to be impacted by the proposal as these species do not use the Mangles Bay area as prime feeding or breeding habitat (Strategen, 2012a).

Male Australian sea lions reside in the Perth Metropolitan area during the non-breeding season and haul out on islands, the nearest of which are Carnac and Seal Islands. Australian sea lions are often seen in waters around Garden Island and Cockburn Sound, however the species is highly mobile and the Mangles Bay area is very shallow, has high boat traffic, and is not considered to be a key feeding or habitat area for the species (Strategen, 2012a).

The key marine fauna likely to be affected by the proposal are fish and invertebrates, little penguins, and dolphins. Mangles Bay is one of the few known nursery sites within Cockburn Sound, and high numbers of juveniles from a range of species have been recorded including commercially and recreationally important species such as pink snapper, King George whiting, baitfish, tailor, garfish, skipjack trevally, and blue swimmer crabs. Most fish species spawn from late winter to late summer, and larvae are more susceptible to the effects of turbidity and changes to water quality than adults (McLean, 2012).

There are two populations of little penguins within the Perth Metropolitan Area, Garden Island and Penguin Island, with the Garden Island population showing a greater breeding success. Little penguins typically lay a clutch of eggs either in June and/or in September with the critical foraging period occurring during chick rearing, approximately 36 days after the eggs are laid. During this period they travel smaller distances and return to land each night to feed the chicks. Breeding success is determined by the availability of prey species within a relatively short distance of the colony (Cannell, 2011).

Satellite tagging data has shown that the Garden Island population forages almost exclusively in southern Cockburn Sound during chick rearing. Little penguins from the Penguin Island population also use southern Cockburn Sound, including Mangles Bay although to a lesser extent than the Garden Island population. While data on little penguin prey species is limited, it does appear that Mangles Bay may serve as a consistent foraging ground although it is not possible to determine the overall importance of Mangles Bay compared to other areas in Cockburn Sound (Cannell, 2011).

The other species most likely to be affected by the proposal are bottlenose dolphins and long-term observations indicate that there is high site fidelity in the Cockburn Sound population, with little movement between the Swan-Canning River or Warnbro Sound populations. Within this relatively small home range individuals tend to be quite mobile, moving frequently between areas daily and seasonally, reflecting changes in the abundance and location of prey species. While mobile, one of the consequences of site fidelity is that individuals are highly unlikely to modify their ranging patterns and migrate elsewhere should impacts occur. Individuals will remain within their home range and attempt to compensate for the impact by changing aspects of their behavioural ecology. This is of particular importance if the duration or timing of the disruption is long or occurs over critical periods (Finn, 2011).

Construction impacts are primarily related to noise, animal entanglement, vessel strikes and impacts such as increased turbidity from the construction works. Impacts from the operation of the proposal are mainly indirect and relate to increased fishing pressure and loss of habitat (fish and invertebrates), loss or change in prey species, entanglement in fishing gear and debris (dolphins and little penguins), and vessel strike (little penguins). There is also a risk of bioaccumulation for all marine fauna.

Introduced marine pests have also been identified as a potential source of risk to marine fauna and marine environmental quality. The two primary mechanisms by which introduced marine pests can be introduced are through ballast water and biofouling. The most likely sources of introduced marine pests are from dredge and construction equipment and large ocean-going vessels during operation.

**Submissions**

The main issues raised in submissions were:

- the proposal has the potential to impact the important fish nursery of Mangles Bay;
- little penguins are showing elevated levels of contaminants in feathers and dredging has the potential to release contaminated sediments;
- there may be increased impacts to larger marine fauna such as dolphins, little penguins and sea lions from vessel strike, increased noise, physical disturbance and impacts to fish larvae distribution and abundance;
- the PER does not sufficiently describe the possible impacts of poor water quality, nutrient enrichment and bottom anoxia as well as the accumulation of metals and antifoulant biocides in the sediments of the marina;
- a quantitative assessment of the impact of losing 7 ha of habitat was not provided, particularly with regard to an objective assessment of impacts on food chains, food availability and impacts to ecosystem habitats;
- the development will remove important fishing grounds for commercial fisheries;
- increased fishing pressure is likely to result through additional people accessing the area; and
- the PER doesn't adequately address the threats associated with introduced marine pests.

**Assessment**

The EPA's environmental objective for this factor is to maintain the diversity, geographic distribution and viability of fauna at species and population levels.

***Construction***

The EPA considers that those activities likely to pose the biggest risk to marine fauna are short-term impacts. Dredging is expected to take approximately three months, and rock dumping for breakwater construction is also likely to take three months to complete.

Sediment sampling was undertaken by the proponents in accordance with the Commonwealth's NAGD (Commonwealth of Australia, 2009). Concentration of metals in the sediments did not exceed the levels set by the NAGD or the EQGs of the SEP (Strategen, 2012a). The risk of adverse ecological effects on marina fauna from dredged sediments in the water column is therefore considered low. The risk posed by introduced marine pests is also considered low as the proponents have committed to the inspection of dredge vessels by the Department of Fisheries in accordance with standard protocols.

The EPA recognises that construction works within the marina will include pile driving for the jetties. However, while pile driving ordinarily has the potential to cause injury to marine fauna, the proponents propose that pile driving will be undertaken prior to the flooding of the marina basin. The lack of water will remove the in-water path for sound and thus remove the high energy frequencies that typically impact marine fauna. While rock dumping and dredging will generate above background levels of underwater noise, both of these activities do not contain the high peak pressure waves of pile driving and hence is unlikely to result in physiological harm (Duncan *pers. comm*, 2011). Some avoidance behaviour may be exhibited by marine fauna but the activities are of a short duration and the EPA therefore considers it unlikely that any long-term impact will occur.

To minimise the potential construction impacts on marine fauna, the proponents propose the following management strategies:

- undertake dredging between May and July, with a possible extension into August/September if weather conditions are not favourable;
- the use of silt curtains (weather and sea conditions permitting);
- the use of marine fauna observers during marine related construction activities to verify that no cetaceans or pinipeds are within 300 m of the machinery prior to and during use;
- confining activities to daylight hours to ensure an adequate level of observation by the marine fauna observers; and
- standard Department of Fisheries protocols and procedures for introduced marine organisms.

The EPA recognises that the use of silt curtains and the timing of marine-related construction activities will minimise the potential impact for most fish and invertebrate species which spawn from late winter to late summer. The timing of the marine-related construction activities is also likely to minimise the

impacts on dolphins. Individuals are likely to avoid the area during construction due to increased turbidity and/or noise, however the timing of the works will also avoid the peak calving period, which is from September onwards. The EPA does expect, however, a short-term loss in fish biomass within Mangles Bay due to dredging activities as fish move away from areas of high turbidity. This is, in turn, likely to affect larger marine fauna presence in Mangles Bay due to a reduction in available prey species.

To address the risk of vessel strike and any potential negative interactions between fauna and construction equipment, the proponents propose to implement standard marine fauna observer protocols. This will ensure that no cetaceans, pinipeds or penguins are observed within 300 m of the marine activity 30 minutes prior to the commencement of activities as well as during the marine-related construction activity. The protocols also contain stop work procedures should a cetacean, piniped or penguin move within 300 m of the activity.

For most species, the timing of marine-related construction works will minimise any potential impact. However, the EPA recognises that dredging activities as proposed will coincide with the peak breeding season for little penguins, which is when the adults only forage in southern Cockburn Sound. Dredging and turbidity plumes could either result in little penguins avoiding the area or by affecting prey species.

The proponents propose to minimise the impact by commencing dredging prior to chick rearing (late autumn) and by planning the dredging sequence to begin at the seaward edge of the navigation channel and move shorewards. While the EPA accepts that it is not certain to what degree these activities will affect little penguin populations, by ensuring the dredging activities closest to Garden Island are largely completed by the time chick rearing will commence, the impacts will be minimised. In addition, the EPA also recognises that the predicted turbidity generated by the proposal will be minimal (refer Section 3.2 Benthic habitat).

In considering the likely impact of construction activities on marine fauna, the EPA concludes that the short duration of activities, the management strategies proposed by the proponents, and the timing of activities is unlikely to significantly affect any species in the long-term. The EPA therefore recommends conditions 8-2 and 9, which are to apply to all marine-related construction activities. These conditions require marine fauna observers for marine-related construction activities and limit the timing of activities to between the hours of sunrise and sunset and between the months of April and September.

***Operation***

The potential indirect impacts of operation are:

- loss of marine habitat and consequent potential changes in the availability of prey species;
- increased human use of the area and subsequent increased human-animal interaction and potential loss of prey species from fishing; and

- introduced marine pests on ocean going vessels using the marina.

*Loss of habitat*

Habitat loss and degradation is one of the primary causes of changes in species composition of ecological communities and it is not known what the loss of almost 80 per cent of Cockburn Sound's seagrass habitat between the 1950s and 1980s has had on fish and invertebrate communities. The EPA acknowledges that the removal of 5.24 ha of seagrass will cause a short-term loss of overall habitat. It may also potentially cause a corresponding short-term loss in marine fauna biomass due to dredging causing a reduction in fish stocks from egg loss and/or larvae mortality.

The removal of seagrass for the navigation channel will split the seagrass bed into two sections, however many fish and mobile invertebrate species are likely to cross over the channel. Most less mobile species still have a larval stage, and therefore the channel is unlikely to impact on the community's overall diversity. Sessile invertebrate species that do not have a larval stage form a relatively small part of the community and the EPA does not consider that the loss of habitat for these species will be significant.

The loss of 80 per cent of Cockburn Sound's seagrass has resulted in the seagrass in Mangles Bay being the only area remaining on the eastern shelf. The EPA notes that the proponents propose to mitigate the loss of habitat by replacing twice the amount lost due to the proposal and will be trialling seagrass re-establishment on the eastern shelf, with one possible location identified in the vicinity of the Rockingham grain terminal jetty (refer Section 3.2 Benthic habitat). It is estimated that approximately 100 ha of seagrass remain in Cockburn Sound and in this context the losses from the proposal area are unlikely to have a significant impact on the overall productivity of the Mangles Bay area or the availability of catch for fishers.

The short-term loss of biomass may have a consequential impact to dolphins and little penguins through reduced reproductive success and survivorship because of a reduction in prey availability, although noting that neither little penguins nor dolphins are confined to Mangles Bay.

While losses to biomass are likely to occur, it is considered that this impact will be minor in the short-term and the seagrass offset proposed by the proponents (described above) should address this issue in the long-term. The re-establishment of seagrass will also provide an additional resource for fishers in the long-term. The EPA therefore considers that the short-term loss of habitat resulting from the proposal is unlikely to have a significant impact on marine fauna biodiversity or biomass in the long-term.

*Increased human usage*

Increased public access has the potential to affect both fish and invertebrate species as well as larger marine fauna such as dolphins and little penguins. Increases in the number of boats have the potential to affect fish ecology through activities such as propeller damage to seagrass habitat and increased

boat wash disrupting egg and larval stages of species. It also has the potential to increase fishing pressure on popular species due to the greater access to facilities. This is of particular concern for some species such as pink snapper, which is a very popular species targeted by recreational fishers and is considered a species with a high risk of overfishing (McLean, 2012).

Increased boating and the additional marine habitats (e.g. rock groynes) provided by the proposal are also likely to increase the frequency of human-dolphin and human-penguin interactions. These include harassment, illegal feeding, increased litter, entanglement in fishing gear and increased risk of vessel strikes. Vessel strikes is of particular concern to little penguins as they swim much slower than boats and utilise the top few metres of the water column, thereby increasing the risk of strikes. Not all interactions are negative, as dolphins are likely to utilise the additional habitats provided by the proposal. For example, dolphins are likely to use the marina channel, waterbody and groynes as new feeding areas. However, the proposal will add to the human-related stress animals experience in this ecosystem (Strategen, 2012a).

While the EPA recognises the risk to popular species, the Perth Recreational Boating Facilities Study (Department of Planning and Infrastructure, 2009) examined the recreational needs of the Perth Metropolitan area to 2025, and predicted large rises in boat ownership in the southern Metropolitan and Rockingham area. This increase is irrespective of the implementation of the proposal. In the context of this study, the Mangles Bay Marina will not cause trailerable boat ownership to increase over that predicted, however there will be a potential increase in non-trailerable boats due to the increased availability of mooring pens for large boats, although the predicted increase is only small (one per cent). The proponents have identified a number of strategies within the PER to mitigate some of these effects, such as implementing educational measures for appropriate behaviour and prohibiting feeding of dolphins in the marina. (Strategen, 2012a). The EPA supports these strategies.

While the EPA acknowledges that the proposal will place more pressure on marine fauna, both through fishing effort and human-marine fauna interactions, it considers that the proposal can be managed to meet its environmental objectives.

The EPA realises that, as a consequence of the increase in boats in the Perth Metropolitan area, there will be a requirement to increase the emphasis on on-ground management, surveillance and enforcement and possible revision of bag limits should research indicate it is required. The departments of Transport, Fisheries and the DEC will continue to address these issues in the long-term to manage any potential negative impacts to marine fauna.

*Introduced marine pests*

Large ocean-going vessels pose an increased risk of introduced marine pests as they are relatively slow moving and could have been moored for long periods in foreign ports. The EPA recognises that the Department of

Fisheries is the responsible authority for managing introduced marine pests in Western Australia. The EPA notes that the proponents have committed to developing an introduced marine pests strategy as part of its Operational Environmental Management Plan in accordance with Department of Fisheries requirements. The EPA therefore considers that introduced marine pests can be managed to meet the EPA's objective for marine fauna (Strategen, 2012c).

**Summary**

Having particular regard to:
(a) the short duration of the proposed marine-related construction activities;
(b) the timing of the activities to avoid the peak spawning and breeding times for most species;
(c) the mitigation strategies proposed to minimise the risk of turbidity and the interaction of marine fauna with construction activities;
(d) the short-term loss of habitat and the replanting of seagrass to offset this loss;
(e) the issue that, while an increase in human usage will place more pressure on marine fauna, this impact is unlikely to affect species' populations; and
(f) the commitment of the proponents to manage introduced marine pests both during construction and operation in accordance with the Department of Fisheries requirements,

it is the EPA's opinion that it is likely that the EPA's environmental objective for this factor can be achieved provided conditions are imposed requiring the proposal to:

- only allow marine related construction activities to take place between 1 April and 30 September and only during daylight hours;
- provide for marine fauna observers during marine-related construction activities; and
- re-plant at least twice the area of seagrass lost by the proposal within five years of commencement of marine related construction activities and ensure that 75 per cent cover is reached 10 years after the completion of marine related construction activities.

## 3.4 Terrestrial vegetation, flora and fauna

**Description**

The majority of the land-based proposal area is vegetated, and is located within Bush Forever Site 355 and vested with the Conservation Commission of Western Australia as part of the Rockingham Lakes Regional Park. The proponents have considered both existing vegetation and flora surveys, and undertaken further surveys through most of Bush Forever Site 355, which encompasses the proposal area, the area of Bush Forever south and east of the site, and Cape Peron (Figure 4).

The proposal area contains vegetation of the Quindalup Complex as mapped by Heddle *et al*. (1980) of which approximately 47 per cent of its pre-European

extent remains on the Swan Coastal Plain, with approximately 5.2 per cent within secure conservation tenure. Vegetation ranges in condition from Very Good to Degraded, with the majority of the site in Good or Very Good condition. The high variability of the condition is reflected by the fragmentation of the area by different infrastructure, roads, tracks, weeds and rubbish (ENV, 2010).

Eight FCTs were mapped in the proposal area (Figure 5), including FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands which is listed by the DEC as a Threatened Ecological Community (TEC); and FCT 29b *Acacia* shrublands on taller dunes and FCT 30b Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands which are both listed by the DEC as Priority 3 Ecological Communities.

The FCT 30a is known from six locations from Trigg in the north to Point Peron in the south, as well as on Garden and Rottnest islands. A total of 627 ha remain, of which approximately 145 ha is on the mainland. Vegetation condition of the TEC on the proposal site ranges from Good to Degraded to Very Good. The current extent of the TEC on the proposal site is larger than that previously mapped and may be a result of either natural recruitment or rehabilitation works (or both) (Strategen, 2012a).

Approximately 87 ha of FCT 29b, and 2.32 ha of FCT 30b were mapped across the Cape Peron area, with 33.75 ha and 0.56 ha respectively being located within the proposal area (Strategen, 2012a).

No Declared Rare Flora or Priority Flora were found in the survey area, however six species considered under Bush Forever to be of significance for the Quindalup dune system were recorded at 11 locations in the wider survey area. Only two of these species, *Agonis flexuosa var.flexuosa* and *Callitris preissii*, are found within the proposal area (Strategen, 2012a).

Fauna surveys of the proposal and adjacent area identified four terrestrial fauna habitats; shoreline, coastal heath, woodland and wetland habitat (ENV, 2011). The wetland habitat is located outside the proposal area and primarily around Lake Richmond. No listed or threatened fauna species were identified during the surveys, however one Priority 3 lizard *Lerista lineata* and a small number of Commonwealth listed migratory birds were identified (Strategen, 2012a).

At the commencement of this assessment, the graceful sun moth (*Synemon gratiosa*) was a listed species under both State and Commonwealth legislation. Graceful sun moths have a bi-annual breeding cycle and the proponents therefore undertook two annual site surveys to determine the presence of the species on the proposal site and in adjacent bushland. The proponents also completed a habitat assessment to determine the extent and quality of the habitat. While suitable habitat, *Lomandra maritime,* is present, only one individual was located in the proposal area, with two being located outside (Strategen, 2012a).

Further research has greatly expanded the known range and population of the species and at the time of writing this report the species is no longer a declared threatened species under State legislation. However, the Commonwealth Government still lists the graceful sun moth as endangered under the EPBC Act and therefore is still a Matter of National Environmental Significance.

The impacts from the proposal are mainly direct impacts, resulting from the clearing of vegetation and the subsequent loss of fauna habitat. In total, the proposal will involve the clearing of up to 40 ha of vegetation (Figure 6). The majority of the vegetation in the area to be cleared comprises conservation significant FCTs as listed below in Table 5.

**Table 5: Conservation significant vegetation proposed to be cleared by the proposal**

| **Vegetation Unit** | **Amount to be cleared (ha)** | **Conservation significance** |
|---|---|---|
| FCT 30a<br>*Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands | 1.93 | TEC |
| FCT 29b<br>*Acacia* shrublands on taller dunes | 33.75 | Priority 3 |
| FCT 30b<br>Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands | 0.56 | Priority 3 |

FCT 30a predominately occurs within an area of the proposal that is to be retained (Figure 6), however some clearing of the northern portion of the TEC is required. The two occurrences of Bush Forever significant flora species within the proposal area are found in association with this TEC and will not be impacted by the proposal. To address the loss of the TEC, the proponents propose rehabilitation works to consolidate FCT 30a into a more sustainably shaped remnant, where the boundary-to-area ratio is improved compared to that which currently exists. Rehabilitation works include:

- retention of 1.12 ha of Very Good condition vegetation;
- rehabilitation of 1.61 ha that currently does not support FCT 30a; and
- rehabilitation of 1.22 ha of FCT 30a that has been identified as being in a Good-Degraded condition.

These proposed works will result in a net loss of vegetation of 0.35 ha, however an overall improvement in vegetation condition will occur (Cedar Wood Properties, 2012).


**Figure 4: Extent of flora and vegetation surveys Cape Peron**
Source: Figure 42 Strategen 2012a


**Figure 5: Mapping of Floristic Community Types**
Source: Figure 44 Strategen 2012a


**Figure 6: Vegetation to be cleared.**

Bush Forever Site 355 is 174.5 ha in area of which approximately 107.1 ha is vegetated, and Rockingham Lakes Regional Park is approximately 4,270 ha. The proposal will result in the loss of up to 37 ha of Bush Forever Site 355 and 40 ha of the Rockingham Lakes Regional Park. Sites recognised under the Bush Forever system are those with regional significance for flora, vegetation and/or fauna (Government of Western Australia, 2000). SPP 2.8 provides a policy and implementation framework for bushland management and protection in the Perth Metropolitan area and includes offset criteria for the loss of bushland from the Bush Forever system. For bushland of high conversation significance a net gain, i.e. at least 1.5 times of the habitat to be lost, is required to be offset (Government of Western Australia, 2010).

To address the residual impact of the proposal from the loss of land from Bush Forever and the Rockingham Lakes Regional Park, the proponents propose both direct and indirect offsets:

- Acquisition of approximately 56 ha of suitable area for inclusion in the Conservation Estate. As a first priority, acquisition will focus on land as near as possible to Rockingham Lakes Regional Park. If this is not possible, land will acquired within the southern metropolitan/Peel regions based on the DEC priorities for conservation acquisition.
- Rehabilitation of approximately 20 ha of native vegetation within the Rockingham Lakes Regional Park in the Cape Peron vicinity.

Indirect impacts to vegetation are also possible through increased access and use leading to the spread of weeds, dumping of rubbish and potential edge effects. Vegetation likely to be affected includes that surrounding the proposal site in Bush Forever site 355 and those communities associated with Lake Richmond (Bush Forever site 358). However as part of this proposal, the proponents propose to improve visitor access facilities through the provision of hard paths, increased management presence in the area and the removal and rehabilitation of unnecessary paths. Therefore, the proponents do not expect increased visitor access to result in the impacts listed above.

Indirect impacts to vegetation are also possible through the lowering of the water table and the change in groundwater quality by the creation of a new saltwater interface. This has the potential to affect the remaining vegetation within the proposal site (TEC FCT 30a and PEC FCT 29b). These potential impacts are discussed in Section 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond).

Potential impacts to fauna are largely associated with the loss of habitat, however the proponents do not consider the proposal will impact the regional significance of any fauna species. The proponents propose to manage direct impacts to fauna during construction through implementation of a Construction Environmental Management Plan (Strategen, 2012a).

With regard to the graceful sun moth, only three individuals were located during the survey. Two were found within the proposal area and one was recorded outside the proposal area. Within the PER and the proponent's Response to Submissions document, management strategies were proposed

to address the residual impact to the species from the loss of habitat. These strategies included undertaking graceful sun moth surveys in Port Kennedy Scientific Park, rehabilitation and translocation of *Lomandra* habitat within the Rockingham Lakes Regional Park and research into appropriate fire regimes to favour *Lomandra* (Cedar Wood Properties, 2012).

**Submissions**

The main issues raised in submissions were:

- loss of public open space and Bush Forever/Rockingham Lakes Regional Park area for a housing development;
- fragmentation of bush and subsequent potential impacts for species connectivity;
- that impacts to fauna from the loss of habitat were understated, particularly for herpetofauna; and
- impacts to graceful sun moth, and the uncertainties regarding rehabilitation of *Lomandra* communities.

**Assessment**

The EPA's environmental objectives for this factor are to maintain:

- representation, diversity, viability and ecological function of flora and vegetation at the species, population and community level; and
- representation, diversity, viability and ecological function of fauna at the species, population and assemblage level.

The EPA recognises that most of the vegetation to be cleared by the proposal is of conservation significance, with FCT 29b covering most of the site. However the EPA also notes that this community is widespread across the Swan Coastal Plain, being found from the Yanchep area south to Yalgorup. In addition, this community is also found at Cape Peron and in Port Kennedy Scientific Park, both of which form part of the Rockingham Lakes Regional Park (Freeman *et. al*, 2009; DEC, 2010). The EPA does not consider the loss of this area will affect the overall regional significance of the FCT 29b.

A small portion (0.56 ha or 19% of the total mapped) of FCT 30b will also be cleared by the proposal. This community has been found from the Leschenault Peninsula south to Busselton, with an isolated atypical occurrence at Two Rocks (Freeman *et. al*, 2009). While this community is not as widespread as FCT 29b, given the small amount to be cleared by the proposal, the EPA does not consider the loss will affect the overall regional significance of the community.

The EPA recognises that the proposal will result in a net loss of TEC FCT 30a. Based on vegetation mapping carried out for the Strategic Environmental Review (Bennett, 2005), it is apparent the extent and condition of the community has increased over time due to either natural recruitment or rehabilitation works or both. However, large portions of the area are still in either a Good or Good-Degraded condition and rehabilitation works are likely to be required to either improve or even potentially maintain condition at this

level. The EPA also recognises that the community in its current shape leaves it more prone to degradation by a range of factors including weeds.

The proponents have proposed measures to mitigate the loss of FCT 30a, including the re-establishment of this community on land where it does not currently occur. The EPA considers that consolidating the extent of the community and undertaking rehabilitation works not only to improve the quality of the existing community but replanting the community will result in a positive outcome. In addition, the proponents now propose to retain this community within the Rockingham Lakes Regional Park, as opposed to vesting it with the City of Rockingham as was proposed in the PER. Maintenance of the community within conservation tenure is supported by the EPA. To ensure the successful rehabilitation of FCT 30a, the EPA has recommended conditions 11-1 and 11-2 which require the proponents to prepare and implement a restoration plan.

In considering the likelihood for indirect impacts to FCT 30a, the EPA notes that the proponents have attempted to minimise the potential for these impacts to occur by shortening the length and depth of the canal arms. This will thereby increase the distance between FCT 30a and the saline wedge and therefore minimise the risk of any potential hydrological impacts. While the EPA considers the risks to the community from reduced quality and/or quantity of groundwater is low, it nonetheless recommends Condition 10 to ensure the community is adequately surveyed and monitored to ensure that if any impacts were to occur, they can be detected and mitigated.

This proposal will result in a loss of vegetation from the Bush Forever system and Rockingham Lakes Regional Park. However, the EPA accepts that the identification of the land for a marina development has been long standing and predates the establishment of the regional park. Within both the draft 2003 management and the final 2010 management plan for the Rockingham Lakes Regional Park, the area has been identified as an “Area subject to further planning” (Department of Conservation and Land Management, 2003; DEC, 2010). In considering the offsets, the EPA acknowledges it will be difficult to conserve bushland in the local area, but the FCTs that will be lost by the proposal have a large geographical range, and achieving the objective of ‘like for like’ will still be able to be achieved. The EPA has therefore recommended conditions 11-12 to 11-15 to address the residual impacts to native vegetation within Rockingham Lakes Regional Park through the development of a rehabilitation plan for 20 ha of land within the vicinity of the proposal, in addition to funding for the acquisition and management of land for conservation purposes.

The EPA acknowledges that the loss of vegetation from the site will also result in loss of habitat for fauna, however the EPA is of the view that the implementation of the proposal will not impact the regional significance of any fauna species, and that the implementation of the proposed Construction Environmental Management Plan as proposed by the proponents will minimise the risk of any direct impacts during construction.

Prior to this assessment, the graceful sun moth was considered a threatened species due to its limited geographical range and highly specific breeding requirements. While recent research has greatly expanded its known habitat requirements, the occurrence of the graceful sun moth within the Perth Metropolitan area is generally within areas under development pressure. The EPA is uncertain what impact the proposal will have on the local population as a significant portion of the habitat utilised by the species will be lost. The graceful sun moth also has limited flying capabilities and therefore smaller home range requirements (DEC, 2011a). In addition, the current extent of the Bush Forever Site and its isolation from other areas of suitable graceful sun moth habitat would mean that any migration in or out of the reserve would be unlikely.

As the species is no longer a threatened species under State legislation, the EPA no longer requires offsets to address any long term residual impacts. The EPA also considers that the proposal will not impact the overall population of the graceful sun moth population. However, as it is still a Matter of National Environmental Significance, the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) may still require these offsets and will be able to condition them should the proposal be approved. The EPA has therefore not recommended conditions for the offsite offset measures proposed by the proponents.

**Summary**

Having particular regard to the:

(a) the current extent of vegetation communities FCT 29b, FCT 30a and FCT 30b on the Swan Coastal Plain in context of what will be lost as a result of the proposal;

(b) the recent de-listing of the graceful sun moth as an endangered species; and

(c) the offset strategies proposed to address the residual long term impacts of vegetation loss and risks to FCT 30a,

it is the EPA's opinion that it is likely that the EPA's environmental objectives for this factor can be achieved provided conditions are imposed requiring the proposal to:

- monitor the community FCT 30a to ensure that any potential impacts resulting from changes to groundwater quality and/or quantity are detected and managed; and
- implement the proposed offset strategies regarding rehabilitation of FCT 30a and the securing of 56 ha of land to be added to the conservation estate for the loss of Bush Forever.

## 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond)

### Description

Lake Richmond is a deep lake adjacent to the proposal site (Figure 1) but approximately 450 m from the nearest canal finger. It is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* and is classified as a Conservation Category wetland on the *Geomorphic Wetlands Swan Coastal Plain* dataset.

Lake Richmond interacts with both surface and groundwater and this interaction varies over the year. During winter, the lake acts as a recharge area, receiving large volumes of water from the catchment. The Lake Richmond outlet drain artificially maintains the lake level in winter to 0.58 m AHD as excess water overtops the weir and flows directly into Cockburn Sound. In summer as the lake levels drop, the lake becomes a groundwater sink with water flowing into the lake from the south and east. In an average year the water level in the lake varies from <0.2 m to 1.2 m AHD, with a mean water level of 0.74 m AHD (Strategen, 2012a).

Water quality is therefore predominately fresh, with salinity increasing as the lake dries in summer. Lake Richmond does, however, have a zone of brackish groundwater with total dissolved salts (TDS) of 2,000-3,000 milligrams per litre (mg/L) at depth. Due to the urban catchment, the total nitrogen and total phosphorus levels in the lake exceed the ANZECC/ARMCANZ (2000) guidelines for freshwater lakes in slightly disturbed ecosystems and contribute to poor water quality within Mangles Bay (Strategen, 2012a).

There are three main aquifers within the vicinity of the proposal, the superficial Safety Band Sands aquifer, the deeper confined Tamala Limestone aquifer and the deeper still Rockingham Sands aquifer. The Safety Bay Sands unconformably overlies the Tamala Limestone and a thin layer of clay (0.5 to 2 m thick) lies at the base of the Safety Bay Sands in the proposal area and acts as an aquiclude, effectively limiting water movement between the Safety Bay Sands and the Tamala Limestone. This limited interaction is supported by the different head pressures between the two layers. The Tamala Limestone then overlies the Rockingham Sands. The Safety Bay Sands range between -20 m AHD and -24 m AHD and neither the marina waterbody nor Lake Richmond are deep enough to intersect with the Tamala Limestone or the Rockingham Sands aquifer. The proponents therefore focuses the studies in the PER on the Safety Band Sands (Strategen, 2012a).

The proponents undertook groundwater monitoring through the construction of bores. Groundwater levels varied between 0.05 and 0.95 m AHD over the monitoring period, and changes in groundwater levels either responded to the in and outgoing tide or directly to rainfall, depending on the proximity of the bore to the coast. Groundwater in the Safety Bay Sands generally has a TDS of less than 1000 mg/L however within 200 m of the coast this tends to

increase to over 2000 mg/L (freshwater has a TDS of <1500 mg/L) (Strategen, 2012a).

There are two TECs found in association with Lake Richmond, both of which are considered groundwater dependent ecosystems. These are:

- SCP 19 Sedgelands in Holocene dune swales of the southern Swan Coastal Plain; and
- Richmond-microbial – Stromatolite like microbialite community of coastal freshwater lakes.

Both TECs are also listed as critically endangered by the State and endangered by the Commonwealth under the EPBC Act. The primary threatening processes to these communities are nutrient enrichment and increases in other pollutants, altered groundwater quality and quantity (groundwater abstraction, drawdown and salt water intrusion), increased runoff, smothering by weed infestations or sediment, and urban development (DEC, 2011b; English *et*. *al.*, 2003).

Sedgelands in Holocene dune swales is not limited to Lake Richmond but occurs in eight locations in the Rockingham Becher Plain and at two other locations in the south west, with a total estimated area of 130 ha. Approximately 11 ha occurs in a band around Lake Richmond. The hydrological regime is considered to be the primary non-biological factor that influences the characteristics of this TEC, with the depth, timing and duration of flooding and the length of the dry period affecting vegetation composition. This TEC has relatively specific water regime requirements to maintain its current biology but is tolerant of seasonal and longer-term variations that reflect natural climatic patterns (DEC, 2011b).

The Lake Richmond thrombolite community is a unique assemblage of microorganisms that aggregate in rock-like formations, formed by the deposition of calcium carbonate during growth and metabolic activity within the community's micro-environment. No formal mapping has occurred of the thrombolite community, however it occurs from perhaps 0 m AHD to within the vegetated fringes of the lake. The community is dependent upon light and a continuing supply of fresh water which is rich in calcium and bicarbonate/carbonate. The thrombolites appear to be adapted to fresh or brackish water and would be unlikely to survive major increases in salinity (English *et*. *al.*, 2003). Since the release of the PER, the proponents have commissioned Professor Lindsay Collins to map the locations of the thrombolites to inform the proposed management and mitigation measures described below.

Impacts to Lake Richmond are mainly indirect impacts, resulting from changes to groundwater levels and from potential saline intrusion due to the construction of the marina. The proponents undertook groundwater modelling to predict these impacts. A reduction in lake water levels is of potential significance as it may expose additional areas of the sill on the lake shore which may support thrombolites towards the end of summer. The saline

wedge has the potential to intersect the lake, causing an increase in salinity (Strategen, 2012a).

Due to the predicted impacts from groundwater draw down, the proponents are proposing wet excavation of the marina waterbody and the modelling results predicted:

- a reduction in Lake Richmond lake level of 3.2 cm during construction;
- a reduction in Lake Richmond lake level of 3.8 cm during operation; and
- the saline wedge being very much restricted to the marina footprint with little potential for intrusion into Lake Richmond.

This drop in lake levels is likely to occur at the end of summer, where it will compound the natural evaporation experienced, although the natural variation in Lake Richmond water levels is approximately one metre (Strategen, 2012a).

To mitigate any potential impacts caused by changes in groundwater and to manage the risks should the modelled predictions be greater than predicted, the proponents propose to raise the invert level of the Lake Richmond weir by 3.8 cm. This will allow greater storage of water and thereby balance the small reduction in groundwater levels predicted over the long-term. The proponent intends to implement raising of the weir level prior to construction of the marina waterbody. The proponents will undertake further groundwater modelling to confirm the effectiveness of such a mitigation option and to consult with the Water Corporation and confirm that the rise will not impact on the function of the drain to mitigate flooding (Strategen, 2012d).

In addition, while the proponents predict no long-term effects to the TECs, monitoring is proposed during both construction and operation. The monitoring plan for the Lake Richmond TECs will establish baseline conditions of the TECs and groundwater characteristics between the marina water body and Lake Richmond. Groundwater salinity, levels and TEC condition will be monitored prior to construction of the marina waterbody and also post-construction. The monitoring plan also proposes to confirm the sedimentary and stratigraphy of the Safety Bay Sands aquifer to confirm that no solution channels exist in the aquifer which would allow saline water to migrate towards the lake. The contingency action proposed should lake levels reduce to the extent that a threat to the survival of the TECs is identified would be to artificially recharge the lake water through a production bore into the Tamala Limestone aquifer (Strategen, 2012d).

To address the issue of stormwater management the proponents are required to prepare a District Water Management Strategy to the satisfaction of the DoW. The proponents have committed to designing the draining system to detain all 1 in 5 year rainfall events with rainfall events greater than this to be directed to the marina waterbody, where it will rapidly flush. The proponents have committed to ensuring that no stormwater from the proposal will enter Lake Richmond (Strategen, 2012c). The Lake Richmond outlet drain will require relocation as part of this proposal and the proponents propose to relocate it to the end of the eastern breakwater. This will result in the

stormwater discharging into deeper water, thereby increasing dilution (Cedar Wood Properties, 2012).

Within the project footprint are a number of Water Corporation pipelines that provide for water, wastewater and drainage services. These include the SDOOL, sewer pressure mains, water mains and a regional open drain. These pipelines will also need to be relocated as part of the proposal. The Water Corporation referred a proposal to duplicate the SDOOL to the EPA in February 2012 due to the potential impacts on native vegetation (clearing) and Lake Richmond (dewatering for pipe installation). At that time of referral, the EPA had not yet made a recommendation on whether the Mangles Bay Marina proposal could be implemented or not. The Water Corporation therefore undertook groundwater modelling of the replication of the SDOOL within its current existing alignment and its new proposed alignment along the re-routed Memorial Drive (should the Mangles Bay proposal proceed).

The Water Corporation proposed to manage the dewater by directly recharging into the pipeline trenches, therefore the predicted impact on Lake Richmond water levels would be less than 1 cm. In addition, the Water Corporation predicted that the water levels in Lake Richmond would return to natural levels within six months of the completion of construction. The EPA considered that as the potential impacts would be of a short duration and pose little risk to the TECs in Lake Richmond, therefore the proposal could be successfully managed by the Water Corporation. The EPA determined that the proposal should not be assessed in May 2012 and provided public advice.

Within the proposal footprint, no dewatering will be required to realign the SDOOL and duplication. Dewatering impacts from the realignment of the open drain to a close pipe system have been assessed by the proponent and will use the same construction techniques proposed by the Water Corporation, thereby limiting the impact. Dewatering is managed by the DOW under the *Rights in Water and Irrigation Act 1914* and a licence for dewatering requires a fully detailed Dewatering Management Plan first having been submitted to the DOW for approval.

**Submissions**

The main issues raised in submissions were:

- the lack of confidence in the proponent's hydrological modelling and the lack of best and worst case scenario predictions;
- the risk to thrombolites from the proposal resulting from changes to the local hydrology;
- the lack of confidence in the mitigation measures proposed should negative impacts resulting from the proposal occur;
- the lack of climate change modelling;
- a range of technical comments regarding the groundwater model inputs and outputs;
- the lack of adequate discussion regarding the impact of groundwater decline on groundwater dependent ecosystems;
- that offsets should be considered for residual impacts;

- that stormwater management should include works to minimise impacts to Lake Richmond, that contaminant levels need to be environmentally acceptable, that drainage works should be contained within the proposal area and that it also should address the relocation of the Lake Richmond outlet drain;
- that potential impacts to TEC 30a could be minimised by removing the closest canal finger; and
- suggested conditions for implementation of the proposal.

**Assessment**

The EPA's environmental objectives for this factor are to:

- maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected; and
- maintain the quality of groundwater and surface water, sediment and biota so that the environmental values both ecological and social, are protected.

The veracity of the hydrological modelling and its acceptability for environmental impacts assessment was a significant issue raised during the assessment process. To increase the confidence in the predicted results, the proponents engaged Dr Phil Wharton of Rockwater to undertake a peer review of the model and outputs for the PER document. To address the issues raised in submissions, Dr Wharton also reviewed the Response to Submissions report prepared by the proponents' consultant. He concluded that the groundwater model was appropriate and the predictions were reasonable (Appendix 5 Strategen, 2012b).

The proponents also engaged Professor Lindsay Collins of Curtin University to undertake a review of the likely impacts to the thrombolite community resulting from the modelled predictions. Prof Collins concluded that "*it is known that thrombolites can tolerate seasonal exposures to the atmosphere and therefore if any additional thrombolite communities are exposed by the small reduction in water levels predicted little impact is anticipated*" (Collins, 2012).

To address the issue of groundwater modelling, the EPA requested the DoW review the Response to Submissions report and determine how well the proponents had addressed the concerns raised in submissions. The DoW concluded that the:

- modelling undertaken is appropriate and the risk to the groundwater resource and associated lake levels is greatly reduced due to the absence of dewatering;
- proposed impacts to groundwater levels and quality are predicted to be low; and
- proposed contingency and mitigation measures are adequate and the impacts should be manageable.

In considering the likely impacts on Lake Richmond and its associated TECs, the EPA notes that all numerical modelling has inherent uncertainty and that

there are always risks that the predicted impacts will be greater than expected. However in considering the peer review undertaken by the proponent, the advice of Professor Collins and the advice of the DoW, the EPA concludes that overall the groundwater modelling is appropriate for this assessment and that a reduction of 3.8 cm in water levels is unlikely to significantly impact the TECs associated with Lake Richmond.

While the EPA does not expect significant impacts, the EPA does note that the proponents are also proposing a range of management and mitigation measures that include triggers should the impacts exceed what is predicted. The proponents will establish baseline conditions for both TECs, including the thrombolite community for which little information is currently available regarding its geographic extent or its composition. This information will be used to monitor the communities during construction and will continue for at least 10 years.

The EPA also notes that the proponents have identified contingencies should impacts from the proposal be different from those predicted in the PER. The final contingency is artificially raising the water levels in Lake Richmond should the water levels fall to below specific levels (Strategen, 2012d). Should these contingencies be required, the water used to supplement lake levels will need to be of appropriate quality, as thrombolites are highly likely to rely on inflow of appropriate volumes of alkaline groundwater. Therefore an effective program that will deliver supplementary water will need to consider both suitable quality and delivery to the appropriate parts of the lake. The EPA considers these management strategies are appropriate and will minimise the potential for the proposal to negatively impact the TECs.

The EPA has therefore recommended Condition 10-3 to ensure the weir is raised by the predicted drop in water levels and that the proponents' management and mitigation measures are implemented.

The EPA notes that the management of stormwater will be in accordance with DoW requirements. Nonetheless it expects the proponents to use best practice in the design of the drainage system and for detention basins to be used. Drainage of stormwater, including from the realigned road, should not enter Lake Richmond.

**Summary**

Having particular regard to the:

(a) small predicted drop in the Lake Richmond water levels;

(b) peer reviews and advice from DoW regarding the adequacy of the proponents' assessment; and

(a) proponent's proposed management and mitigation strategies,

it is the EPA's opinion that it is likely that the EPA's environmental objectives for these factors can be achieved provided conditions are imposed requiring the proposal to:

- raise the Lake Richmond weir by the predicted decline in lake levels;
- require the establishment of baseline conditions and require ongoing monitoring to detect impacts, should any occur; and
- implement the proposed mitigation measures should impacts be greater than predicted.

## 3.6 Environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the *Environmental Protection Act 1986.* Appendix 3 contains a summary of the EPA's consideration of the principles.

# 4. Conditions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for Environment on the key environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

## 4.1 Recommended conditions

Having considered the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Cranford Pty Ltd and the Western Australian Land Authority for a marina-based development located in Mangles Bay at the southern end of Cockburn Sound, is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

(a) restricting impacts to marine environmental quality from dredging and construction activities to spatially defined areas and managing construction activities to meet the objectives of the SEP (Condition 6);

(b) restricting impacts to marine environmental quality from ongoing operation activities to spatially defined areas and managing ongoing operational activities to meet the objectives of the SEP (Condition 7);

(c) restricting impacts to marine benthic communities and marine fauna from dredging and construction activities to spatially defined areas, and time periods (Condition 8);

(d) minimising impacts to marine fauna during construction through requirements for Marine Fauna Observers (Condition 9);

(e) restricting impacts to threatened ecological communities to spatially defined areas and ongoing monitoring and management requirements (Condition 10); and

(f) offsetting and residual impact measures in relation to threatened ecological communities, benthic primary producer habitat, marine environmental quality and regional parks (Condition 11).

It should be noted that other regulatory mechanisms relevant to the proposal are:

- licence to take water and construct or alter wells from the Minister for Water;
- approval to disturb or alter sites of Aboriginal significance from the Minister for Aboriginal Affairs;
- changing land tenure from the Minister for Lands;
- planning approval from the Minister for Planning;
- taking of protected flora on Crown Land from the Minister for Environment;
- undertaking activities on Department of Transport land from the Minster for Transport; and
- granting of a jetty licence from the Department of Transport;

## 4.2 Consultation

In developing these conditions, the EPA consulted in respect of matters of fact and matters of technical or implementation significance with the proponents and the:

- Department of Water;
- Department of Environment and Conservation;
- Department of Planning;
- Department of Transport;
- Department of Regional Development and Lands; and
- Department of Sustainability, Environment, Water, Population and Communities.

# 5. Other advice

### *Seagrass*

Seagrass loss within Cockburn Sound has been extensive between the 1950s and 1970s and today only approximately 20 per cent remains. The shallow flats of Mangles Bay contain approximately 100 ha of seagrass, however there has been an estimated loss of 3 ha due to inappropriate moorings which cause a scouring of the seabed and loss of seagrass around the mooring line.

The EPA strongly encourages other Government departments to look for opportunities to reduce impacts to seagrass meadows. Reducing the impacts to seagrass within Mangles Bay could be achieved by:

- removal of moorings commensurate with the number of pens provided within the marina; and
- placing a permanent cap on the number of moorings that will be provided in Mangles Bay.

### *Noise and vibration*

The impacts of construction noise and vibration from activities that include sheet piling have the potential to not only negatively impact local amenity, but the transient vibration produced by plant and equipment also has the potential to result in cosmetic or structural impact to nearby buildings. The likelihood of impact varies from site to site depending on the local geology, the source of the vibration (in relation to both magnitude and frequency) and the type of buildings in the vicinity. In this location, the sandy soils and shallow depth to groundwater will result in the noise and vibration effects travelling much further from the development.

The EPA recognises that the City of Rockingham, on the advice of the DEC, will be the principal agency responsible for managing construction impacts, noting that the Environmental Protection (Noise) Regulations 1997 provides for the regulation of construction noise. However the EPA remains concerned about the potential impacts from sheet piling, particularly vibration, and recommends the City of Rockingham require the proponents to implement best practice management measures to ensure that transmission of vibration through the ground is limited.

### *Lake Richmond Outlet Drain*

As described in the report, the Lake Richmond outlet drain will be realigned as part of this proposal. The stormwater from the drain contains nutrient and sediment levels that are above the background levels in Mangles Bay. The EPA notes that the proponents propose that the outlet to the drain will be located at the end of the eastern breakwater, thereby discharging into deeper waters. However, this location is yet to be confirmed as acceptable by the Water Corporation, which is the responsible authority for the Lake Richmond outlet drain.

The EPA advises that the Lake Richmond outlet drain should be located and designed to meet the following outcomes:

- no direct or indirect impacts to adjacent seagrass beds from the realignment of the drain;
- adequate dilution and mixing at the drain discharge point; and
- the drain should discharge into the ZoHI defined in Schedule 2 of the attached conditions.

***Annual monitoring in Cockburn Sound***

As described above in Section 3.1, the CSMC coordinates a range of environmental monitoring programs to assess the health of Cockburn Sound. Funding for these programs is sourced from not only the CSMC but other private and public groups including the Department of Health, the Commonwealth Department of Defence, Landcorp, Kwinana Industries Council, Fremantle Ports, City of Rockingham, Water Corporation and the Department of Fisheries.

The EPA recognises that environmental monitoring is primarily the responsibility of the CSMC. However, it does expect the proponents to contribute sufficient funds to the CSMC to establish additional sites adjacent to the marina to determine potential impacts of the proposal on the adjacent SEP protected area. This would be more efficient than a separate monitoring program and would allow the CSMC to incorporate the results from these sites into its annual State of the Sound reporting.

***Management of water quality in the marina waterbody***

Although the proposed inland marina is located in the SEP Policy Area, it is located outside the Protected Area of the SEP.

The EPA considers that ongoing management and monitoring of water and sediment quality by the proponents will be necessary to protect the environmental quality of external waters (in Mangles Bay) and demonstrate that the EQOs in the protected area of the SEP are being met. As mentioned in Section 3.1 of this report, recommended Condition 7-1 requires the proponents to monitor and manage the proposal to ensure EQOs (outside the marina) are being met.

In terms of the monitoring and management of water quality within the inland marina and canals themselves, the EPA considers that this should not be managed through the SEP, or Ministerial conditions under the EP Act, but through the planning processes set out in the WAPC's Development Control Policy 1.8 for Canal Estates and Artificial Waterways Developments (WAPC, 2012). This is particularly the case where the issues of concerns relate to aesthetics and amenity of artificial waterways.

The Development Control Policy aims to facilitate the long-term sustainability of canal estates and artificial waterways in Western Australia and sets out requirements of the WAPC for the assessment of marinas and canal estates

proposals. It also sets out the roles and responsibilities of related State Government agencies and local government. Proponents wishing to undertake marina and canal estate proposals would be required to consider the general principles and procedures set out in the Policy.

Under the policy, a prerequisite to rezoning of the site under the Metropolitan Region Scheme will be the requirement for the proponents to enter into a draft deed of agreement concerning future waterways management. The deed will need to state the waterways manager and be endorsed by all affected parties prior to rezoning being finalised.

The purpose of the deed is to agree to a range of matters including:

- monitoring and management of water quality to specific requirements;
- funding sources for construction and maintenance work, which may include a development contribution plan where necessary;
- provision of a sustainable maintenance program including obligations for water quality and sediment monitoring programmes, monitoring water depths, dredging, monitoring erosion; and
- arrangements regarding a source of revenue for ongoing maintenance.

In addition, the proponents have stated that it will manage the marina for a period of at least five years after the completion of the marina. On completion of the five year period, the maintenance and management of the marina will be transferred to the nominated marina manager. The marina manager will undertake environmental monitoring of the marina in accordance with the approved environmental management plans (water and sediment quality, maintenance dredging etc.).

The proponents have advised that on completion, the marina is to be transferred to the Crown with current options for marina management including the City of Rockingham or the establishment of a Management Authority.

Hence it is noted that an amendment to the planning scheme would be conditional on a marina manager being nominated with a satisfactory sustainable marina management plan being prepared. The EPA therefore considers that a Deed of Agreement provides the most appropriate mechanism to ensure that ongoing environmental management, including any monitoring and management of water quality in the marina waterbody, is adequately funded and managed.

During the development of the Deed of Agreement it would be the proponents' responsibility to consult with the various agencies such as the Office of the Environmental Protection Authority (OEPA), the City of Rockingham, the DEC and the CSMC on an environmental management and monitoring plan for the marina. It is expected that such a plan would include best-practice management of inputs into the marina and canal waters. At this stage of the statutory planning process, the EPA considers that the proponents should consult closely with the OEPA and the CSMC on the environmental quality criteria and the measures to apply in the marina and canal waterway.

# Appendix 1

## List of submitters

**Organisations:**

Cape Peron Community Vision Working Group
City of Rockingham
Cockburn Sound Management Council
Conservation Commission of Western Australia
Conservation Council of Western Australia
Department of Environment and Conservation
Department of Fisheries
Department of Health
Department of Planning
Department of Transport
Department of Water
Hands Off Point Peron
Maritime Union of Australia, Western Australian Branch
Naragebup Marine Working Group
Preserve Point Peron for the People
Recfishwest
Urban Bushland Council of Western Australia
Water Corporation
Western Australian Fishing Industry Council
Wildflower Society of Western Australia

**Individuals:**

K Allen & P Marie
D Alpers
M Ambrese
J Anderton
P, R, C & S Baker
C Balinski
A Balinski
J & D Balinski
D Balinski
H Barrett
L Barrett
R Barritt
H Beck
D & E Bell
S Bellman
P Best
G Blair
J Blyth
K Booth
A Bower
L Bradstreet
J & M Bramley
K Breckmann
M Brennan
J Brodie
R Brown
T Brunswick
T Bryant
G Buckland
C Bulbeck
G Burns
J Byrne
G Bywaters
J & B Cairns
A Callaghan
C Cameron
B Campbell
S Chapman
V R Clegg
C Clitheroe
T Clitheroe
H Coleman
V Connolly
T Connolly
MA Connolly
T Connor
C Coombs
R Croeser
A Cummins
S Davies
B Day
M Day
R Day
H de Boorder
N Demunck
H Dent
P Dilley
D Donaldson
K Dravnieks
L du Boulay
D Dwyer
D Edwards
J Enevoldsen
W Forster
V Foster
D Frances
U Fuchs
E Fuller
M Gardner
L Gauntlett
J Gaynor
S Geard
P Godfrey
G Godfrey
P Godfrey
R Goodale
H Gray
G Green
A Greensmith
M Greenwood
N Gribble
D Griffiths
E Grogan
A Hall
P & M Hanley
T & J Hannaby
T Hannaly
H Hardisty
S Hartley
J Hayden
J Hayes
L Healy
E Healy
B Hermann
T Hick
A Hill
T Hill
J Hilton
G Hilton
D Hitchins
B Hobbs
N Hodgkinson
P Holland
L Jack

D James & B Fremlin
S Jamieson
R Jeakes
D Jecks
J Jenkins
P Jennings
P Jobber
M Kay
L Kaye
A Kaye
K & D Kell
D & T Kelly
A Kenwright
G Kewan
J Killen
S La Puma
I, T & M Lachmund
V Law
H Lee
R Lewis
J Lickfold
C Lieb
K Lindgren
L Lowe
J Lutz
M MacDonald
L MacLaren MLC
O Maddock
V Magan
W Magan
G Malcolm
D Manners
J Marie
C Marks
S Marwick
B Mathews
E McCready
F McGeorge
C McLean
D Mcswain
L Mertz
J Middlemiss
S Miller
P Mioduszewski
G Moir
T Moore
C Moore
C & S Morton
A Muhling
J Mumme
J Murray
P Nairn
Name withheld
J Nelson
J & B Nielsen
T Noakes
M Numerz
R O'Dwyer
M O'Dwyer
M Osbourne
C & M Osbourne
R Palmer
W Parkinson
N Passmore
K Penley
A Pettit
R Phillips
J Phillips
N Phvenbailee
L Pillinger
N Pipe
J Pommerin
D Poole
F Preston
D Pritchard
B & A Rabone
J Rainnie
M A Rath
K Regenauer-Lieb
J Ripngah
B Ritchie
I &H Roberts
G Roberts
D Rocca
T Roots
J Rose
P Rowe
R Sallur
D Sanderson
N Saraswati
A, T, S & B Saude
S Schmidt
B Schultz
A Sebgregts
P & G Sefton
D & K Seymour
M & R Skeet
D Slowley
P & B Smith
L Smith
A Solmon
R Speight
G Spencer
S Spiers
A Stanners
J Starley
H Stewart
K Stickland
L Stubbs
M Sutherland
K Taylor
S & M Telford
J Terpstra
S Terpstra
P Thomson
S Trowell
R & B Usher
C Valentine
N Valentine
M van Keulen
I Viapree
D Vickery
E Vis
G Vladich
L Vunghans
T Wearne
I Weston
K Wheatley
P Whitehead
J Whitney
K Whyte
J Wilcox
D Wilcox
M Williamson
D Worth
C Worth
S Young

# Appendix 2

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# Appendix 3

**Summary of identification of key environmental factors and principles**

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| **BIOPHYSICAL** | | | |
| Marine environmental quality | Impacts from dredging, construction of breakwaters, outflow of lower water quality from the marina, spillage of fuel or sullage and increased boating activities. | <u>Public and non-government organisations</u><br>• Water quality sampling was not done over sufficient time. Real time computer modelling has not been used.<br>• Research has shown canals promote stagnation, poor water and sediment quality as well as depauperate biological community and creating one in Mangles Bay is a risk for these reasons;<br>• The effectiveness of flushing is reduced as it would be exchanging water with the already eutrophied, enclosed water within southern Cockburn Sound.<br>• Creating a canal estate with only one entry risks creating stagnant water with eutrophication risks as seen at Hillary's marina. Anoxia is a risk for marina waters<br>• Poor water quality outflows have the potential to breach the management objectives of the Shoalwater Islands Marine Park.<br>• Additional impacts to water quality are expected from engine emissions, anti-fouling paints, sewage and other waste discharges and littering. This impact should be quantified and assessed.<br>• Modelling of marina flushing appears sufficiently slow to allow significant development of | **Considered to be a key environmental factor and is discussed in section 3.1** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | phytoplankton blooms, which will result in the release of exceedingly poor water quality over adjacent seagrass meadows.<br>• The shallow seagrass meadows may result in enhanced draining flow into the channel, the impacts of which are unknown.<br>• The impacts of dredging in winter and increased turbidity needs to be clarified.<br>• Concerned about maintenance dredging and ongoing spoil management and the consequential affects on environmental quality.<br>• Believes turbidity during dredging has been underestimated due to leakage of plumes.<br>• Sediment sampling in Mangles Bay were taken from areas not containing seagrass – these areas do not contain the fine sediments which will be dredged which are also likely to contain pollutants. Mooring scar areas are likely to be scoured of these fine sediments.<br>• The accumulated mud sediments and their stratigraphic and hydrogeological properties have not been considered in the PER.<br>• The potential for acid generating material in the marina area has not been adequately considered.<br><u>Cockburn Sound Management Council</u><br>• The PER states that water quality within the marina | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | will be worse than that in adjacent marine waters, which could be sufficient to lead to long-term seagrass loss.<br>• The CSMC made significant detail comment regarding the hydrological and marina flushing models, including regarding calibration, data used for the models, performance of the model, underlying assumptions of the model and lack of justification regarding the interpretation of outputs.<br>• There is insufficient information in the PER to clarify the effects of increased phytoplankton production on background water quality.<br>• Discharges to Cockburn Sound must meet ANZECC guidelines and not exceed SEP guidelines and there must be sufficient monitoring.<br>• There is insufficient information regarding the impacts of relocating the Hymus Street drain.<br>• Recommends conditions regarding contaminant accumulation in marina sediments and introduced marine pests.<br><u>Department of Health</u><br>• Additional impacts to water quality are expected from engine emissions, anti-fouling paints, sewage and other waste discharges and littering. This impact should be quantified and assessed.<br>• The Department must be advised if any trigger | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | levels are exceeded.<br>• Discharges to Cockburn Sound must meet ANZECC guidelines and not exceed SEP guidelines and there must be sufficient monitoring.<br>• There is insufficient information regarding the impacts of relocating the Hymus Street drain.<br>• Sediment sampling in the proposed marina and canal area should be done to confirm whether release of contaminants will occur.<br>• Recommends conditions regarding monitoring for microbial and chemical pollutants in marina waters<br><u>Department of Planning</u><br>• The proposal should be compliant with the Development Control Policy 1.8.<br><u>Department of Water</u><br>• Any modification to the Hymus Street drain must involve adequate characterisation of discharge water and it is uncertain whether this is appropriate.<br>• Statements in the PER regarding hydrocarbons in stormwater are misleading and incorrect.<br><u>Department of Fisheries</u><br>• Recommends conditions regarding post construction water quality monitoring. | |
| Benthic communities and habitat | Loss of 5.24 ha of seagrass from breakwater, | <u>Public and non-government organisations</u><br>• Removing so much seagrass is not supported, particularly since seagrass is difficult to re- | **Considered to be a key environmental factor and is discussed in section 3.2** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | reclamation, channel, batter construction and indirect losses | establish, particularly on this scale<br>• A recent study found *Posidonia sinuosa* is declining worldwide at an alarming rate. While the proponents are proposing an offset, they are going to replant *P. australis* which has ecological differences.<br>• Problems have been found with recent CSMC annual report card and therefore they cannot be relied on to determine baseline health.<br>• Seagrass health in Mangles Bay is compromised and vulnerable to disturbance. Shoot densities have significantly fallen and elevated chlorophyll-*a* levels, increased epiphyte loads, increase light attenuation due to dredging and changes in hydrology could trigger a collapse in the remaining seagrass population in Mangles Bay.<br>• The loose nature of the sediments in Mangles Bay presents a risk to the long-term stability of the seagrass meadows in the area as they are susceptible to disturbance. The proposal may increase seagrass loss through erosion of the boating channel and seagrass may become destabilised.<br>• Recommends conditions regarding monitoring of the success of seagrass rehabilitation given the limited success it has had in other locations. | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | • Offsets for seagrass are difficult to establish, expensive and not guaranteed. It will be hard to establish in the area due to the poor water quality experienced. There hasn't been enough information provided about the offsets proposed and the ratio of 1:1 is inadequate.<br><u>Cockburn Sound Management Council</u><br>• The numbers of moorings and mooring scars appears to be inaccurate. The assumption that mooring scars will recolonise over 5 to 7 years also appears to be in doubt since some scars have been in existence longer than this. The issue of replanting in mooring scars and the removal of replacement moorings needs to be confirmed.<br>• Seagrass in Mangles Bay are already severely stressed and while the PER indicates that there would only be a marginal increase in turbidity associated with dredging, it is unknown if existing seagrass meadows can tolerate further stress. There is no data on physiological health and dredging and propeller wash has the potential to erode seagrass edges and affect resilience.<br>• Recommends conditions regarding monitoring of the success of seagrass rehabilitation, particularly regarding the likely further loss due to increased stress. | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | • Commented on the inadequacy of the offset package proposed, particularly regarding the offset ratio and the lack of information on management measures, performance standards and criteria.<br><u>Department of Environment and Conservation</u><br>• Recommends conditions regarding monitoring of impacts to seagrass in Shoalwater Islands Marine Park.<br>• Offsets for the impact to marine fauna should be considered.<br><u>City of Rockingham</u><br>• Recommends conditions regarding monitoring of the success of seagrass rehabilitation given the limited success it has had in other locations. | |
| Marine fauna | • Potential changes to water quality during construction and operation<br>• Direct and indirect loss of habitat<br>• Increased fishing pressure and | <u>Public and non-government organisations</u><br>• Fragmentation and removal of foraging area for larger marina fauna will place pressure on these animals which catch prey species found in the seagrass meadows.<br>• Long-established research indicates that Mangles Bay is an important fish nursery for both commercial and recreational species. The proposal has the potential to impact on the nursery values on Mangles Bay.<br>• Little penguin numbers are reducing, with some evidence pointing to lack of food. This development | **Considered to be a key environmental factor and is discussed in section 3.3** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | potential impacts to food availability<br>• Increased potential for vessel strike | will place further pressure on the population. Further research shows elevated levels of mercury in feathers and Mangles Bay may be a sink for contaminants. Dredging may release these sediments.<br>• Impacts to larger marina fauna from vessel strike, increased noise and physical disturbance and disturbance of fish larvae could all result from this proposal.<br>• The PER understates the possibility of poor water quality, nutrient enrichment and bottom anoxia as well as the accumulation of metals and antifoulant biocides in the sediments of the marina. The impacts of these are not sufficient described to estimate the effects on marine fauna.<br>• A simple desk top study on marina fauna is insufficient to determine the impacts of dredging and additional fishing pressure. A survey specifically focused on fish and invertebrate fauna within the zone of impact and influence is required. Dredging should not take place after mid-October due to King George whiting larvae migration.<br><u>Cockburn Sound Management Council</u><br>• There is a lack of quantitative data, in particular on standing crop biomass, productivity or marine flora and fauna. Calculation of biomass would have | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | enabled impacts on the fauna and productivity to be better assessed. A quantitative assessment of the impact of losing 7 ha of habitat is not provided. An objective assessment of impacts on food chains, food availability and impacts to ecosystem habitats has been difficult and there is insufficient evidence to eliminate concerns.<br>• There is no discussion of the change in biomass expected because of the marina.<br>• Boat strikes to penguins and dolphins is a growing risk. We believe the marina will result in more than "some increase" in recreational boat traffic and no calculations or documentation has been provided to estimate the increase in quantitative terms.<br>• The PER understates the possibility of poor water quality, nutrient enrichment and bottom anoxia as well as the accumulation of metals and antifoulant biocides in the sediments of the marina. The impacts of these are not sufficient described to estimate the effects on marine fauna.<br>• The PER doesn't adequately address the threats associated with introduced marine pests.<br><u>Department of Fisheries</u><br>• The proposal will result in a significant increase in recreational and boat based fishing. The proponents are encouraged to promote public | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | awareness of sustainable recreational fishing practices.<br>• The large ocean going recreational vessels that the marina will cater for pose a biosecurity risk. Introduced marine pests is likely to be enforced on recreational vessels in the future and the proponents would be required to work with the Department to enforce these strategies.<br>• The PER doesn't adequately address the threats associated with introduced marine pests.<br>• Recommends conditions regarding finfish and crab populations, to remove existing swing moorings, seagrass offset ration of 1:2 and that dredging be undertaken in consultation with peak fishing bodies.<br><u>Department of Environment and Conservation</u><br>• It should be clarified whether recreational fishers will be permitted to fish along the breakwaters. Dolphins are known to forage along these structures, competing with fishers for the resource and risking entanglement. Dolphins in Cockburn Sound already have significant stresses resulting from development and fishing pressure in the Sound.<br>• Recommends conditions regarding minimising impacts of underwater marine noise on fauna. | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| Terrestrial vegetation, flora and fauna | • Proposed clearing of up to 40 ha, including up to 1.93 ha of TEC FCT30a<br>• Loss of up to 40 ha /37 ha of Rockingham Lakes Regional Park/Bush Forever.<br>• Loss of up to 40 ha of fauna habitat. | <u>Public and non-government organisations</u><br>• Believes the area is distinct and unique floristically in SW Australia due to convergence of tombolos, Pleistocene limestone and Quindalup dune vegetation.<br>• Climate change modelling should be done to determine likely impacts on vegetation.<br>• A large proportion of the vegetation impacted is of high quality and hosts important species.<br>• A fuller vegetation survey should be undertaken, the PER states that the flora taxa report is not an accurate representation.<br>• Recommends conditions regarding weed management.<br>• The proposed offset ratio of 1:1.5 is unrealistic and the proposal lacks sufficient detail.<br>• Area should be kept as Bush Forever and designated as an A Class Reserve for everyone's enjoyment. Sites such as these are becoming more valuable due to clearing on the Swan Coastal Plain. The project is irreconcilable with the natural values of the site.<br>• The changes proposed will benefit the privileged few and not the majority. It is socially irresponsible.<br>• Additional development will only further impact and degrade the remaining bushland. | **Considered to be a key environmental factor and is discussed in section 3.4** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | • The proposal could affect the resilience of the remaining bush areas due to fragmentation and increased impacts from people.<br>• Fragmentation is a serious issue and there is little option for fauna resettlement. There will be reduced habitat availability and connectivity.<br>• Coastal areas on the Swan Coastal Plain are especially rich in herpetofauna, and populations are likely to be intact even in degraded areas of the site and is a critical asset and should be protected and retained.<br>• Submissions identified the importance of the site for priority species *Lerista lineata*, carpet python, *Ctenotus gemmula*, *Isoodon obesulus* and that there should be no impacts to these species given uncertainty of populations and existing clearing on the Swan Coastal Plain.<br>• Submission identified the use of the site by black cockatoo species and the threats faced by the species, including loss of areas of long-term and recent foraging and nesting habitat. Submission believed all remaining habitat should be retained.<br>• Submissions believe insufficient work was undertaken regarding amphibians and priority insect species.<br>• Submission expressed concern regarding the | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | impacts to GSM in a local context and the uncertainties regarding the proponent's proposal to rehabilitate Lomandra species offsite.<br><u>Cockburn Sound Management Council</u><br>• Insufficient attention has been paid to ecosystem services offered by the terrestrial vegetation. No impacts to these services due to the loss of vegetation (loss of both structure and function) have been assessed.<br>• Recommended that any voids exposed during excavation be assessed for stygofauna and troglofauna.<br><u>Department of Environment and Conservation</u><br>• DEC should be consulted on an appropriate offset from the loss of approximately 52 ha from the conservation estate.<br>• A trial *Lomandra* translocation program should be developed as a mitigation measure for the loss of this habitat as a result of the development.<br>• Connectivity is important to facilitate fauna movements over the long-term. A vegetated ecological connection should be maintained between Cape Peron and Lake Richmond.<br>• Believes the fauna conservation values have been understated. DEC considered the Cape Peron area to be regionally significant and has the highest | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | fauna values compared to other similar sites on the Swan Coastal Plain. Is concerned about the impact to a number of range limited species.<br>• Recommends conditions regarding fauna translocation and to address the risk of fauna entrapment in trenches.<br><u>City of Rockingham</u><br>• Doesn't believe seasonality of fauna species has been adequately addressed.<br><u>Department of Planning</u><br>• Bush Forever site 358 should be protected in its entirety and not be impacted.<br>• The proposal is inconsistent with State Planning Policy 2.8 as it will impact a TEC, graceful sun moth habitat and clearing of regionally significant bushland. It is not supported.<br>• Expressed concern regarding whether impacts to shoreline habitat and coastal vegetation would significantly impact fauna species. | |
| Hydrological processes and inland waters environmental quality (Lake Richmond) | Potential changes to ground and surface water quality and quantity which could affect vegetation | <u>Public and non-government organisations</u><br>• Believes the proposal has the potential to disrupt the hydrology of the bushland through changes to local drainage and resultant changes to mirco-habitats which hosts specific flora and fauna. Changes in groundwater conditions will be expected to impact the root zones of coastal | **Considered to be a key environmental factor and is discussed in section 3.5** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | communities | vegetation and consequently integrity of ecosystems. Factor not properly assessed.<br>• Proponents have downplayed risks to thrombolites by suggesting thrombolites are tolerant of higher salinities, however evidence is contrary to this. Saltwater intrusion will fundamentally change the ecosystem.<br>• Impacts to tuarts and TECs particularly the thrombolites are unacceptable. The proposal poses too great a risk to the thrombolites.<br>• Questioned the contingency measures available, and their relative success, if greater drops in lake levels are observed.<br>• Specified that climate change had not been considered and that modelling should be undertaken to determine if the proposal would worsen the impacts on Lake Richmond.<br>• Drainage does not appear to be adequately considered, particularly in regard to greater than 1:1 events, water destination and pollutants. These have the potential to affect Lake Richmond and vegetation.<br>• A realistic risk assessment should be undertaken to determine likelihood of impacts to vegetation and Lake Richmond.<br>• Proponents have not undertaken modelling of best, | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | worst and most likely scenarios of the proposal as specified in the ESD.<br>• Leakage of groundwater into the marina has not been conservatively considered.<br>• Groundwater flow has considerable variability and no discussion on how it was calculated or sensitivity analysis has been conducted.<br>• Adequate consideration of the cumulative effects of marina construction and SDOOL construction has not been undertaken.<br>• The Peer Reviewer makes a number of negative comments regarding the groundwater model that do not appear to have been addressed and hence affect reliability of model predictions.<br>• Comment was received on technical issues with regard to the groundwater model, including lack of sufficient monitoring period, inadequate information regarding a large number of factors such as aquifer parameters, inadequate calibration and sensitivity analysis and inadequate understanding of the hydrogeography/stratigraphy. Additional modelling and analysis is required.<br><u>Department of Water</u><br>• Decline in Lake Richmond water levels are likely to impact the groundwater dependant ecosystems – these require periodic inundation and an estimate | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | on the loss of habitat for these should be provided.<br>• Offsets should consider the impacts to decreased groundwater levels and increased saline intrusion on environmental assets.<br>• Stormwater management should include adequate works to minimise impact to Lake Richmond. Enough information is not available regarding management and/or monitoring in the PER.<br>• Wetland buffer of Lake Richmond is inadequate.<br>• A District Water Management Strategy is required.<br>• Converting the open storm water drain to a closed system will not allow water treatment and the impacts of this have not been addressed in the PER.<br>• Modelling to determine the drop in Lake Richmond water levels is based on insufficient monitoring data and there is an inherent risk of inaccuracy. The assumption that there will not be an impact because impacts are within inter-annual variations for water level is not a valid statement.<br>• There is not enough information to determine that there are not hydrocarbons in stormwater. Statements in the PER are inaccurate.<br>• Not enough baseline is available to determine that better stormwater management will result from the proposal. | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | • Comment was received on technical issues with regard to the groundwater model, including lack of sufficient monitoring period, inadequate information regarding a large number of data input factors such as aquifer parameters, inadequate calibration and sensitivity analysis and inadequate understanding of the hydrogeography/stratigraphy. Additional modelling and analysis is required.<br>• Recommends conditions regarding the preparation of an Urban Water Management Plan, post construction management, bore monitoring post and during construction.<br><u>Department of Planning</u><br>• Stormwater contaminant levels need to be environmentally acceptable. Drainage works should be within the proposal area.<br>• Specified that climate change had not been considered and that modelling should be undertaken to determine if the proposal would worsen the impacts on Lake Richmond and vegetation of the Bush Forever area.<br><u>Department of Environment and Conservation</u><br>• Impacts to TEC30a could be avoided by removing the closest canal finger – this would also reduce the potential impacts of saltwater intrusion.<br>• Recommends conditions regarding limiting impacts | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | to and monitoring of the thrombolite community, sedgelands in Holocene dune swales and the *Callitris preissi* wwodlands communities.<br>• Decisions about environmental impacts to Lake Richmond should be based on the position of the saltwater interface not drops in Lake water levels.<br>• Specified that climate change had not been considered and that modelling should be undertaken to determine if the proposal would worsen the impacts on Lake Richmond and vegetation of the Bush Forever area.<br>• Comment was received on technical issues with regard to the groundwater model, including lack of sufficient monitoring period, inadequate information regarding a large number of data input factors such as aquifer parameters, inadequate calibration and sensitivity analysis and inadequate understanding of the hydrogeography/stratigraphy. Additional modelling and analysis is required.<br><u>Water Corporation</u><br>• Data and information used in the PER regarding the SDOOL duplication proposal are inaccurate.<br><u>Cockburn Sound Management Council</u><br>• Comment was received on technical issues with regard to the groundwater model, lack of sufficient monitoring period, inadequate information | |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
|---|---|---|---|
| | | regarding a large number of data input factors such as aquifer parameters, inadequate calibration and sensitivity analysis and inadequate understanding of the hydrogeography/stratigraphy. Additional modelling and analysis is required.<br><u>City of Rockingham</u><br>• Recommends conditions regarding groundwater monitoring during and post construction. | |
| Coastal processes | • Changes to longshore sediment transport<br>• Accumulation of seagrass wrack against breakwaters | <u>Public and non-government organisations</u><br>• Was concerned about the impact the breakwaters and access channel would have on natural long-shore transport, erosion and accretion; impacts to seagrass meadows, maintenance dredging and wrack build-up. This was of particular concern given the issues faced at Geography Bay Marina.<br>• Climate change modelling should be undertaken to determine if issues like increased storminess and sea level rise would impact erosion and accretion.<br>• Did not believe the setback was sufficient and highlighted that it did not comply with State Coastal Planning Policy 2.6.<br>• Raised that dredging an access channel could result in destabilisation of the seagrass meadow and the release of sediment. Boat wash could cause further destabilisation and this may affect coastal erosion processes. | To address the issues raised regarding the predicted impacts to coastal processes, further advice was sought from the DoT. The DoT concluded that the proponent's response to submissions and the peer review largely addressed and clarified its concerns. The EPA therefore concluded that further examination of the impacts to coastal processes and the modelling in the report was not warranted.<br><br>With regard to the determination of setback requirements in accordance with State Coastal |

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| | | • Recommends conditions regarding removal of accumulated wrack on breakwaters.<br><u>Department of Planning</u><br>• Raised the non-compliance with the State Coastal Planning Policy 2.6, particularly with regard to significant less setback than recommended.<br><u>Department of Transport</u><br>• Did not believe the setback and the coastal protection measures proposed are adequate.<br>• Believes the sediment transport model lacks credibility due to the absence of key information in the PER. Recommends additional modelling.<br>• Recommends conditions regarding a siltation monitoring program.<br>• As part of the Response to Submissions, the proponents had the coastal process modelling peer reviewed by Dr Matt Eliot of Damara WA Pty Ltd. Given the significance of the comments raised by the Department of Transport (DoT), the EPA requested further advice and provided the DoT with the proponent's response to DoT's submission and the peer review of the coastal process modelling. The DoT concluded that its concerns had been largely addressed and clarified.<br><u>City of Rockingham</u><br>• Recommends additional modelling as the results | Planning Policy 2.6, given that the parameters to determine a foreshore boundary are for the consideration of the Department of Planning and DoT, the EPA concludes that this issue can be adequately managed through the subsequent planning process.<br><br>**Not a relevant environmental factor.** |

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| | | did not discuss sediment fluxes or ambient wave climate impacts on the development. | |
| Terrestrial Environmental Quality | | <u>Public and non-government organisations</u><br>• Concerns were raised about the risks of acid sulphate soils impacting on infrastructure and risks to the threatened ecological communities due exposure of soils caused by falling Lake Richmond Lake levels.<br>• Will acid sulphate soils impact the rich bicarbonate water required by the thrombolites.<br><u>Department of Health</u><br>• The possible areas of sediment contamination in the vicinity of the Cruising Yacht Club, Mangles Bay Fishing Club and holiday camps should be adequately and soils mitigated if required.<br>• Clarification and further testing should be carried out to determine whether there is the possibility of the former, existing or uncontrolled fill containing asbestos.<br><u>Department of Environment and Conservation</u><br>• Recommends conditions regarding ongoing management of monosuflidic black oozes. | Soil analysis by the proponents in the proposal footprint and the area surrounding Lake Richmond confirmed the minimal risk of acid sulphate soils forming due to the significant acid neutralising capacity of the soil.<br><br>The marina waterbody will be managed in accordance with Development Control Policy 1.8 and conditions will be applied as part of the planning process. Conditions regarding monosulfidic black ooze can be applied at this point if deemed appropriate.<br><br>Three sites in the proposal footprint were identified as being potentially contaminated in the Preliminary Site Investigation. The proponents will undertake further testing in these three |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | | locations prior to construction. Should further testing indicate the sites are contaminated, a condition requiring remediation and management can be applied as part of the planning process. Contaminated sites are managed by the DEC and in accordance with the *Contaminated Sites Act 2003*.<br><br>**Not a relevant environmental factor.** |
| Air quality and noise | | <u>Public and non-government organisations</u><br>• The impact of construction, particularly noise, vibration and the movement of large trucks on local residents should be considered and modelled.<br>• What effects will the dust from the excavated rock and soil have on nearby residents.<br>• Seagrass accumulating against the breakwaters could result in unacceptable odours being released.<br><u>Department of Health</u><br>• Visual inspection of dust levels is not an effective measure. Further information on how the impacts of dust will be managed should be included in a dust management plan and provided to the Department | Noise is regulated through the *Environmental Protection (Noise) Regulations 1997* and the proponents have committed to managing construction noise. Operational noise, such as from traffic, will be the subject of an Operational Environmental Management Plan and this issue can be addressed through the subsequent planning process.<br><br>Large amounts of seagrass are not predicted to accumulate |

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| | | and the City of Rockingham for review.<br>• It is essential that the groynes/breakwaters are designed to minimise the accumulation of seagrass. The decomposition of seagrass releases hydrogen sulphide and requires investment by local and state government to alleviate health concerns.<br><u>Department of Environment and Conservation</u><br>• The traffic volume on the upgraded Memorial Drive will result in an increase of noise levels on the road by at least seven decibels at sensitive premises. This may be result in unacceptable noise levels and impacts to all sensitive premises will need to be assessed and managed by the proponent. | against the breakwaters and therefore hydrogen sulphide is not considered to be an issue.<br><br>Dust from construction is likely to be of a short-term duration (within the construction stages). This issue can be adequately managed through the planning process.<br><br>**Not a relevant environmental factor.** |
| Recreational access | | <u>Public and non-government organisations</u><br>• The area of boat hardstand will be reduced as part of the proposal and will exacerbate the problem of not enough boating facilities in the Rockingham area.<br>• The importance of human-nature contact and the effects on human well-being have not been incorporated into the assessment.<br>• The beach is currently in good condition and access is unrestricted, which will not be the case post development. | This is not an environmental impact to be considered by the EPA. Further consideration of these issues can take place during the Local Structure Plan stage of the planning process.<br><br>**Not a relevant environmental factor.** |
| Heritage | | <u>Public and non-government organisations</u><br>• The area has significant cultural and natural | The proponents have consulted with relevant heritage site |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | heritage value for the Aboriginal people. Many of these values and/or sites (Mooribirdup Ceremonial Grounds and Rotary Park Rockingham site) such as will be impacted or even destroyed by this development.<br>• The proposal also threatens European heritage values and sites including the Turtle Factory and the Alfred Hines Children's Home.<br>• There has not been open, transparent and equitable communication with all affect local Aboriginal groups. Some of the local groups oppose the development because of the impacts on their values of the area and have been unable to speak up.<br>• The heritage value of the AIW camps has been overlooked.<br>• The intangible heritage values of the site, as defined by UNESCO, has not been acknowledged in the PER. | informants and Native Title Claimants for the area throughout the process. The proponents will apply for a section 18 consent under the *Aboriginal Heritage Act 1972* to undertake ground disturbing works within the proximity of the heritage sites. The Minister for Aboriginal Affairs is considered a Decision Making Authority for this proposal due to the presence of sites of Aboriginal Heritage (Appendix 4).<br><br>It is acknowledged that some buildings with heritage value, such as the turtle factory, will be lost due to the proposal. The proponents will undertake a heritage impact assessment to obtain approval to remove the buildings.<br><br>**Not a relevant environmental factor.** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| Amenity | | <u>Public</u><br>• The development will suffer a definite loss of appeal. Although vegetation is disturbed, it is still a feature of the area that makes it a desirable place to recreate and compliments the adjacent beaches and ocean.<br><u>Cockburn Sound Management Council</u><br>• The amenity survey could have included a viewpoint from the Anchorage lookout to provide a realistic viewscape in the medium to long term. | Impacts to visual amenity are noted however the proponents will manage the impacts through landscape location, orientation, materiality and height.<br><br>**Not a relevant environmental factor.** |
| Commercial fishing and aquaculture | | <u>Western Australian Fishing Industry Council</u><br>• Fishers in the Cockburn Sound Line and Pot primarily target squid and octopus and approximately 75% of their octopus catch and 35% of their squid catch come from Mangles Bay. Fishing is spread out across the Sound to prevent overfishing stocks. Existing fishing grounds and licence holders' viability will be reduced as a result of this development.<br>• Fishers in the Cockburn Sound Crab Fishery catch approximately 20% of their crab catch from the shallow sea grass area of Mangles Bay. These licence holders will be the most affected commercial fishery by this proposed development in terms of loss of fishing access.<br>• It highly inappropriate that a development of this | **Considered to be a key environmental factor and is discussed in section 3.3** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | scale is proposed in Mangles Bay. Particularly as this area has been identified by the Department of Fisheries as a fishery nursery of Statewide significance and that it likely acts as a source for fisheries located well beyond the immediate area | |
| Traffic | | <u>Public</u><br>• Predicted traffic volumes are speculative as the data used is 6-8 years old, and it was felt that the predicted increase in traffic volumes from HMAS Stirling were not accounted for.<br>• Concern was raised over the predicted construction traffic, particularly in terms of large truck movements.<br>• Impacts to the community from increased traffic volumes and traffic taking short-cuts through local streets were raised from amenity and comfort, safety, noise and emergency access perspectives.<br><u>City of Rockingham</u><br>• The consultant's report fails to demonstrate that construction traffic will not have a significant impact on local roads and that local traffic implications have been adequately considered.<br>• Traffic volumes used in the assessment have been under-estimated due to the age of the data.<br>• Data regarding local road conditions; and construction is not accurate. | This is not an environmental impact to be considered by the EPA. These matters will be managed during the Local Structure Plan stage of the planning process.<br><br>**Not a relevant environmental factor.** |

| Preliminary Environmental Factors | Proposal Characteristics | Government Agency and Public Comments | Identification of Key Environmental Factors |
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| | | • Insufficient traffic planning has been undertaken to cope with increased volumes and to comply with current standards for access for cyclists and buses. | |

| **PRINCIPLES** | | |
|---|---|---|
| **Principle** | **Relevant Yes/No** | **If yes, Consideration** |
| 1. The precautionary principle<br>*Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.*<br>*In application of this precautionary principle, decisions should be guided by –*<br>*(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and*<br>*(b) an assessment of the risk-weighted consequences of various options.* | | |
| | Yes | In considering this principle, the EPA notes the following:<br>• Investigations of the biological and physical environment should provide background information to assess risks and identify measures to avoid or minimise impacts.<br>• The assessment of these impacts and management is provided in Section 3 of this report.<br>• Conditions have been recommended as considered necessary. |
| 2. The principle of intergenerational equity<br>*The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.* | | |
| | Yes | The proposal would result in the loss of up to 40 ha of vegetation and 5.24 ha of seagrass, and potential impacts to marine water quality from marina operation and potential hydrological impacts to Lake Richmond and its associated TECs. These values are relevant environmental factors and discussed in this report and conditions have been recommended to ensure minimal impact. |
| 3. The principle of the conservation of biological diversity and ecological integrity<br>*Conservation of biological diversity and ecological integrity should be a fundamental consideration.* | | |
| | Yes | The proposal would result in impacts to vegetation and seagrass |

| | | |
|---|---|---|
| | | and fauna and has the potential to affect the environmental quality of marine waters and Lake Richmond. These impacts have the potential to affect biological diversity/integrity. Marine environmental quality, benthic habitat, marine fauna, vegetation, flora and fauna, and Lake Richmond are key environmental factors discussed in this report. |
| 4. Principles relating to improved valuation, pricing and incentive mechanisms<br>*(1) Environmental factors should be included in the valuation of assets and services.*<br>*(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.*<br>*(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.*<br>*(4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximize benefits and/or minimize costs to develop their own solution and responses to environmental problems.* | | |
| | Yes | Rehabilitation, ongoing management of the proposal and residual impact management will be a financial cost and will be the responsibility of the proponent. |
| 5. The principle of waste minimisation<br>*All reasonable and practicable measures should be taken to minimize the generation of waste and its discharge into the environment.* | | |
| | Yes | The marina waterbody have the potential to change marine environmental quality through the discharge of water of a lower quality. This is a key environmental factor of this report and appropriate conditions have been recommended. |

# Appendix 4

## Identified Decision-making Authorities and Recommended Environmental Conditions

## Identified Decision-making Authorities

Section 44(2) of the *Environmental Protection Act 1986* (EP Act) specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA's recommended conditions and procedures.

Section 45(1) requires the Minister for Environment to consult with decision-making authorities, and if possible, agree on whether or not the proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified for this consultation:

| Decision-making Authority | Approval |
|---|---|
| Minister for Water | *Rights in Water and Irrigation Act 1914* – 5C Licence to take water and 26D licence to construct or alter wells. |
| Minister for Indigenous Affairs | *Aboriginal Heritage Act 1972* – s18 approval |
| Minister for Planning | *Town Planning and Development Act 2005* – Local and Metropolitan Region Scheme Amendment |
| Minister for Environment | Taking of protected flora on Crown Land under the *Wildlife Conservation Act 1950* |
| Minister for Lands | Change of land reservation under the *Lands Administration Act* |
| Minister for Transport | Activities on Department land |
| Department of Transport | Granting of a jetty licence |

Statement No. XXX

RECOMMENDED ENVIRONMENTAL CONDITIONS

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED**
**(PURSUANT TO THE PROVISIONS OF THE**
***ENVIRONMENTAL PROTECTION ACT 1986)***

MANGLES BAY MARINA BASED TOURIST PRECINCT

**Proposal:** The proposal is to construct and operate a single entrance onshore marina to accommodate up to 500 boat pens and moorings and a surrounding land development comprising tourism, commercial, public open space and residential land uses.

**Proponent 1:** Cranford Pty Ltd
Australian Company Number 009 373 068

Level 4
66 Kings Park Road
WEST PERTH WA 6005; and

**Proponent 2:** Western Australian Land Authority
Australian Business Number 34 868 192 835

Level 3 Wesfarmers House
40, The Esplanade
PERTH WA 6000

**Assessment Number:** 1846

**Report of the Environmental Protection Authority Number:** 1471

This Statement authorises the implementation of the Proposal described and documented in Columns 1 and 2 of Table 2 of Schedule 1. The implementation of the Proposal is subject to the following implementation Conditions and procedures and Schedule 2 details definitions of terms and phrases used in the implementation Conditions and procedures.

## 1 Proposal Implementation

1-1 When implementing the proposal, the proponent shall not exceed the authorised extent of the proposal as defined in Column 3 of Table 2 in Schedule 1, unless amendments to the proposal and the authorised extent of the Proposal has been approved under the EP Act.

## 2 Contact Details

2-1 The proponent shall notify the CEO of any change of its name, physical address or postal address for the serving of notices or other correspondence within 28 days of such change. Where the proponent is a corporation or an

association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State.

## 3 Time Limit for Proposal Implementation

3-1 The proponent shall not commence implementation of the proposal after the expiration of 5 years from the date of this statement, and any commencement, within this 5 year period, must be substantial.

3-2 Any commencement of implementation of the proposal, within 5 years from the date of this statement, must be demonstrated as substantial by providing the CEO with written evidence, on or before the expiration of 5 years from the date of this statement.

## 4 Compliance Reporting

4-1 The proponent shall prepare and maintain a compliance assessment plan to the satisfaction of the CEO.

4-2 The proponent shall submit to the CEO the compliance assessment plan required by Condition 4-1 at least six months prior to the first compliance assessment report required by Condition 4-6, or prior to implementation, whichever is sooner.

The compliance assessment plan shall indicate:

(1) the frequency of compliance reporting;

(2) the approach and timing of compliance assessments;

(3) the retention of compliance assessments;

(4) the method of reporting of potential non-compliances and corrective actions taken;

(5) the table of contents of compliance assessment reports; and

(6) public availability of compliance assessment reports.

4-3 The proponent shall assess compliance with Conditions in accordance with the compliance assessment plan required by Condition 4-1.

4-4 The proponent shall retain reports of all compliance assessments described in the compliance assessment plan required by Condition 4-1 and shall make those reports available when requested by the CEO.

4-5 The proponent shall advise the CEO of any potential non-compliance within seven days of that non-compliance being known.

4-6 The proponent shall submit to the CEO the first compliance assessment report 15 months from the date of issue of this Statement addressing the 12 month period from the date of issue of this Statement and then annually from the date of submission of the first compliance assessment report.

The compliance assessment report shall:

(1) be endorsed by the proponent's Managing Director or a person delegated to sign on the Managing Director's behalf;

(2) include a statement as to whether the proponent has complied with the Conditions;

(3) identify all potential non-compliances and describe corrective and preventative actions taken;

(4) be made publicly available in accordance with the approved compliance assessment plan; and

(5) indicate any proposed changes to the compliance assessment plan required by Condition 4-1.

## 5 Public Availability of Data

5-1 Subject to Condition 5-2, within a reasonable time period approved by the CEO of the issue of this statement and for the remainder of the life of the proposal the proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) relevant to the assessment of this proposal and implementation of this Statement.

5-2 If any data referred to in Condition 5-1 contains particulars of:

(1) a secret formula or process; or

(2) confidential commercially sensitive information;

the proponent may submit a request for approval from the CEO to not make this data publically available. In making such a request the proponent shall provide the CEO with an explanation and reasons why the data should not be made publically available.

## 6 Marine Environmental Quality (Construction Phase)

6-1 During Marine-Related Construction Activities the proponent shall implement measures to ensure that there is no discharge of dredge return water to the waters of Mangles Bay, including from the piping of dredge spoil direct to land-based settlement basins.

6-2 Prior to the commencement of Marine-Related Construction Activities, the proponent shall prepare a Marine Construction Environmental Management Plan subject to the approval of the CEO.

The purpose of this plan is to ensure that the proponent shall manage activities associated with construction of the proposal with the aim of achieving the environmental quality objectives and levels of ecological protection defined in the *State Environment (Cockburn Sound) Policy 2005,* as amended or replaced from time to time, outside the Zone of High Impact as shown in Figure 3.

6-3 The Marine Construction Environmental Management Plan shall include:

(1) the location of impact and reference monitoring sites;

(2) protocols and procedures for monitoring and evaluating the quality of water and sediment in marine waters consistent with the *Manual of Standard Operating Procedures for the Environmental Monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004)*, as amended or replaced from time to time;

(3) reporting procedures, including the format, timing, and frequency for the reporting of monitoring data against the relevant trigger levels and environmental quality objectives;

(4) a framework for the development of management and contingency actions to be implemented in the event that any trigger levels referred to in 6-3(3) are not met;

(5) protocols and procedures for mapping turbidity plumes and reporting the realised extent of the Zone of Influence to the CEO.

(6) protocols and procedures for the monitoring of water quality within the marina waterbody during construction; and

(7) management protocols for the removal of the bund which separates the marina waterbody from Mangles Bay to ensure that the environmental quality objectives and levels of ecological protection defined in the *State Environment (Cockburn Sound) Policy 2005*, as amended or replaced from time to time, are met.

6-4 Prior to the commencement of Marine-Related Construction Activities, the proponent shall implement the approved plan required by Condition 6-2, unless otherwise agreed by the CEO.

6-5 In the event that monitoring required in Condition 6-3 indicates that the environmental quality objectives or levels of ecological protection in the *State Environment (Cockburn Sound) Policy 2005*, are exceeded, or likely to be exceeded, the proponent shall:

(1) report such findings to the CEO and the CSMC within 5 working days of the exceedance being identified;

(2) investigate to determine the likely cause(s) of the trigger levels in Condition 6-3(3) not being met and report such findings to the CEO within 10 working days of the report in Condition 6-5(1) being submitted;

(3) if determined by CEO to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken until the trigger levels in Condition 6-3(3) are met to the CEO; and

(4) the actions to meet the trigger levels shall be undertaken upon approval of the CEO.

6-6 The proponent shall provide spatial data for the constructed marine footprint and marina waterbody as set out in Column 1, Table 2 of Schedule 1 to the CEO within 2 months of completion of Marine Related Construction Activities.

## 7 Marine Environmental Quality (Operation Phase)

7-1 During the operation of the proposal, the proponent shall manage activities associated with the operation of the proposal to meet the environmental quality objectives and levels of ecological protection as outlined in Schedule 2 and spatially defined in Figure 2 and the *State Environment (Cockburn Sound) Policy 2005*, as amended or replaced from time to time.

7-2 Prior to the commencement of the operation of the proposal, unless otherwise approved by the CEO, the proponent shall prepare a Marine Environmental Quality Management Plan subject to the approval of the CEO.

The objective of the Marine Environmental Quality Management Plan is to ensure that the operational activities of the proposal are managed to ensure the requirements of Condition 7-1 are met.

7-3 The Marine Environmental Quality Management Plan shall include:

(1) a threat assessment to determine key cause-effect pathways and indicators to be monitored, including iron monosulfide black oozes;

(2) baseline sediment and water quality data for indicators relevant to identified threats, collected prior to the commencement of Marine-Related Construction Activities, over a number of tidal cycles and seasons;

(3) environmental quality indicators relevant to the identified threats and associated 'trigger' levels (i.e. environmental quality guidelines and environmental quality standards) based on the guidelines and recommended approaches in the *Environmental Quality Criteria Reference Document for Cockburn Sound (2003 - 2004)*, as amended or replaced from time to time, for assessing performance against the environmental quality objectives and associated levels of ecological protection set out in Schedule 2 and the *State Environment (Cockburn Sound) Policy 2005*, as amended or replaced from time to time;

(4) the location of impact and reference monitoring sites;

(5) protocols and procedures for monitoring and evaluating the quality of sediment and marine waters over incoming and outgoing tides, in the area specified in Schedule 2 consistent with the *Manual of Standard Operating Procedures for the Environmental Monitoring against the Cockburn Sound Environmental Quality Criteria (2003-2004)* and *Environmental Quality Criteria Reference Document for Cockburn Sound (2003 - 2004)*, as amended or replaced from time to time;

(6) the reporting procedures, including the format, timing, and frequency for the reporting of monitoring data against the relevant trigger levels and environmental quality objectives; and

(7) a framework for development of management and contingency actions to be implemented in the event that any trigger levels referred to in 7-3(3) are not met.

7-4 The Proponent shall implement the approved plan required by Condition 7-2.

7-5 In the event that monitoring required in condition 7-3 indicates that the environmental quality objectives or levels of ecological protection established through Condition 7-1 and described in Schedule 2 and the *State Environment (Cockburn Sound) Policy 2005*, are exceeded, or likely to be exceeded, the proponent shall:

(1) report such findings to the CEO and the CSMC within 5 working days of the exceedance being identified;

(2) investigate to determine the likely cause(s) of the trigger levels in Condition 7-3(3) not being met and report such findings to the CEO within 10 working days of the report in Condition 7-5(1) being submitted;

(3) if determined by CEO to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken until the trigger levels in Condition 7-3(3) are met, to the CEO; and

(4) the actions to meet the trigger levels shall be undertaken upon approval of the CEO.

7-6 Prior to commencement of operation the proponent shall prepare an Urban Water Management Plan, to the satisfaction of the CEO on advice of the Department of Water, which aims to ensure there is no nutrient input from surface water drainage into the marina waterbody as a result of the operation of the proposal.

## 8 Benthic Primary Producer Habitat

8-1 The proponent shall ensure that the construction of the proposal does not cause mortality of, or serious damage to, seagrass communities, in the Mangles Bay area outside the Zone of High Impact as shown in Figure 3.

8-2 The proponent shall not undertake Marine-Related Construction Activities between 1 October and 31 March inclusive.

8-3 Prior to Marine-Related Construction Activities, the proponent shall prepare a Scope of Works for a Seagrass Baseline Survey to the satisfaction of the CEO.

8-4 The Scope of Works for the Seagrass Baseline Survey required pursuant to Condition 8-3 shall:

(1) identify the sampling protocols and the location of permanent impact and reference monitoring sites within the Zone of Moderate Impact and Zone of Influence and outside the Zone of Influence as shown in Figure 3;

(2) determine the pre-construction baseline for at least the time of year and duration that Marine-Related Construction Activities will be undertaken for turbidity, light attenuation and seagrass health for the permanent monitoring sites required by Condition 8-4(1);

(3) determine the environmental quality criteria for seagrass, based on the $5^{th}$ and $20^{th}$ percentiles of baseline seagrass shoot density, relevant to the period(s) that Marine-Related Construction Activities will be undertaken; and

(4) map seagrass cover for the area which coincides with the Zones of Moderate and High Impact, and Influence as shown in Figure 3.

8-5 Prior to the commencement of Marine-Related Construction Activities, the proponent shall undertake the Seagrass Baseline Survey according to the approved Scope of Works required by Condition 8-3 and submit the results of that survey to the CEO.

8-6 Prior to Marine-Related Construction Activities, the proponent shall prepare a Seagrass Monitoring and Management Plan.

8-7 The Seagrass Monitoring and Management Plan required pursuant to Condition 8-6 shall include:

(1) the parameters identified in Condition 8-4(2) to be monitored both during and after Marine Related Construction Activities at a frequency that will be identified in this plan;

(2) the following criteria to apply:

(a) during Marine-Related Construction Activities the median seagrass shoot density for each impact monitoring site is greater than either the:

(i) $5^{th}$ percentile of pre-dredging seagrass shoot density determined for each impact site; or

(ii) $5^{th}$ percentile of reference sites located outside the Zone of Influence;

(b) five years from the completion of Marine-Related Construction Activities:

(i) median seagrass shoot density at each impact monitoring site measured in January is greater than the appropriate Environmental Quality Criteria for seagrass health as specified in the *State Environment (Cockburn Sound) Policy 2005* as amended or replaced from time to time; or

(ii) mean seagrass shoot density at each impact monitoring site measured in a month between December and March is not significantly different to the mean seagrass shoot density of the reference site(s) in Cockburn Sound measured during the same month of the year.

(3) mapping of seagrass cover for the area surveyed pursuant to Condition 8-4(4) and calculation of the loss of seagrass cover resulting from the construction of the proposal, within six months of the completion of Marine-Related Construction Activities;

(4) mapping of seagrass cover for the area surveyed pursuant to Condition 8-4(4) and determination of the loss of seagrass cover caused by the construction of the proposal to demonstrate that the proposal has not caused a loss of seagrass beyond that authorised by Schedule 1, five years after the completion of Marine-Related Construction Activities;

(5) management actions and strategies to be implemented should the criteria defined in Condition 8-7(2) be exceeded.

8-8 Prior to the commencement of Marine-Related Construction Activities, the proponent shall implement the approved Seagrass Monitoring and Management Plan and continue implementation until otherwise agreed by the CEO.

## 9 Marine Fauna

9-1 The Proponent shall engage dedicated Marine Fauna Observers during Marine-Related Construction Activities who shall:

(1) demonstrate knowledge of Marine Fauna in the Perth Metropolitan region and their behaviours;

(2) have the capacity, subject to safety considerations, to move and make observations and other relevant records independently within the vicinity of Marine-Related Construction Activities;

(3) be on duty during all Marine-Related Construction Activities; and

(4) maintain a log of:

(a) observations of cetaceans in a format consistent with the National Cetacean Sightings and Strandings Database;

(b) observations of cetaceans, pinipeds and penguins, including injured or dead cetaceans, pinipeds and penguins, within 300 metres of any Marine Related Construction Activities;

(c) observations of cetaceans, pinipeds and penguins behaviour, in particular any behaviour that could be in interpreted as a display of disturbance or distress;

(d) management response by the Proponent in relation to observation of disturbed or distressed fauna, and injured or dead fauna; and

(e) observation hours in relation to the duration of the Marine-Related Construction Activities.

9-2 Within six months of completing Marine-Related Construction Activities the Proponent shall lodge marine fauna records with the DEC.

9-3 A Marine Fauna Observer shall be on each vessel undertaking Marine-Related Construction Activities and will be trained in marine fauna observations and mitigation measures, including the requirements of the *Wildlife Conservation (Closed Season for Marine Mammals) Notice 1998*, as amended or replaced from time to time, and maintain a watch and a log of fauna observed during transit and construction activity consisting of: GPS coordinates; species (if known); and behaviour.

9-4 No Marine-Related Construction Activities shall commence until the Marine Fauna Observer (or observers) required by Condition 9-1 have verified that no cetacean(s), piniped(s) or penguin(s) have been observed within 300 metres from any Marine-Related Construction Activities during the 30 minute period immediately prior to commencement of Marine-Related Construction Activities.

9-5 If the Marine Fauna Observer(s) required by Condition 9-1, or any other person, observes a cetacean, piniped or penguin enter within 300 metres of Marine-Related Construction Activities, those operations are to be suspended.

9-6 Operations that have been suspended in accordance with Condition 9-5 shall not recommence until the cetacean, piniped or penguin has moved beyond 300 metres from the suspended marine operation and has not been observed within the exclusion zone for a period of 30 minutes.

9-7 The proponent shall not undertake Marine-Related Construction Activities between sunset and sunrise.

## 10 Terrestrial Flora and Vegetation

10-1 The proponent shall ensure that changes to ground and surface water quality and quantity resulting from the proposal does not cause any loss or measurable degradation of the following Threatened Ecological Communities:

(1) SCP19 Sedgelands in Holocene Dune Swales of the southern Swan Coastal Plain as identified in Figure 4;

(2) Richmond-microbial – Stromatolite like microbialite community of coastal freshwater lakes as identified in Figure 4; or

(3) FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands as identified in Figure 4.

10-2 To minimise impacts of the proposal on the hydrology of Lake Richmond, the proponent shall ensure that the marina waterbody referred to in Schedule 1 is constructed as a wet excavation with no dewatering to be undertaken.

10-3 The proponent shall raise the invert level of the Lake Richmond weir to a height to be approved by the CEO on advice from the DEC and the Water Corporation.

10-4 The proponent shall prepare and submit a Scope of Works for the Baseline Threatened Ecological Communities Study two years prior to the construction of the marina waterbody to the satisfaction of the CEO on advice from the DEC.

10-5 The Scope of Works for the Baseline Threatened Ecological Communities Study required pursuant to Condition 10-4 shall include:

(1) protocols and procedures to monitor groundwater quality and levels, including seasonal variation, between the proposal area and Lake Richmond and in the vicinity of the vegetation community referenced in Condition 10-1(3);

(2) protocols and procedures to confirm sedimentation and stratigraphy of Safety Bay Sands in the vicinity of the proposal;

(3) protocols and procedures to establish soil moisture levels, including seasonal variation, between the proposal area and Lake Richmond and in the vicinity of the vegetation community identified in Condition 10-1(3);

(4) protocols and procedures to identify water quality and water levels, including seasonal variation, within Lake Richmond

(5) indicators to detect saline intrusion between the proposal area and Lake Richmond, and within Lake Richmond;

(6) protocols and procedures to determine the condition, composition and occupied area of the:

(a) SCP19 Sedgelands in Holocene Dune Swales of the southern Swan Coastal Plain as identified in Figure 4;

(b) Richmond-microbial – Stromatolite like microbialite community of coastal freshwater lakes as identified in Figure 4; and

(c) FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands as identified in Figure 4.

10-6 The proponent shall undertake the Baseline Threatened Ecological Communities Study in accordance with the approved Scope of Works required by Condition 10-5 two years prior to construction of the marina waterbody, unless otherwise agreed by the CEO.

10-7 Prior to the construction of the marina waterbody, the proponent shall prepare a Threatened Ecological Communities Monitoring and Management Plan to the satisfaction of the CEO, on advice from DEC.

10-8 The Threatened Ecological Communities Monitoring and Management Plan required pursuant to Condition 10-7 shall include:

(1) the location of monitoring and references sites;

(2) indicators to quantitatively determine the health of the communities identified in Condition 10-1;

(3) protocols for construction and ongoing monitoring of the parameters detailed in Condition 10-5;

(4) protocols for comparing the construction monitoring results in Condition 10-8(3) against modelled predictions;

(5) protocols for re-modelling groundwater drawdown in the event that the comparison of construction monitoring results against modelled prediction required by Condition 10-8(4) show that groundwater levels during construction are reducing at scales greater than predicted;

(6) the criteria to trigger implementation of management and/or contingency measures to prevent any loss of Threatened Ecological Communities identified in Condition 10-1;

(7) management and/or contingency measures, including but not limited to water supplementation measures for Lake Richmond, to be implemented in the event that criteria identified pursuant to Condition 10-8(3) have been triggered. Supplementation measures must consider the suitability of the water quality and supplementation to the appropriate geographical area of Lake Richmond; and

(8) revision of the triggers and contingency measures referred to in Conditions 10-8(6) and 10-8(7) if re-modelling of groundwater drawdown is required as per Condition 10-8(5).

10-9 The proponent shall implement the approved Threatened Ecological Communities Monitoring and Management Plan for a period of at least ten years from the commencement of construction of the marina waterbody, unless otherwise agreed by the CEO.

10-10 In the event that the triggers and contingency measures require revision pursuant to Condition 10-8(8) the proponent shall submit the Threatened Ecological Communities Monitoring and Management Plan to the CEO within 30 days for approval.

10-11 In the event that the implementation of the Threatened Ecological Communities Monitoring and Management Plan as required by Condition 10-9 indicates the criteria defined pursuant to Condition 10-8(6) are triggered, the proponent shall:

(1) immediately implement the management and/or contingency measures identified pursuant to Condition 10-8(7) and continue implementation until criteria pursuant to Condition 10-8(6) are no longer triggered, or until advised otherwise by the CEO;

(2) investigate to determine the likely cause(s) of the criteria defined pursuant to Condition 10-9(6) being triggered; and

(3) submit the findings of the investigation to the CEO within 7 days of identification of the criteria defined pursuant to Condition 10-9(6) being triggered.

## 11 Residual impacts

*Threatened Ecological Communities*

11-1 In order to mitigate the significant residual impacts to the Threatened Ecological Community FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands, the proponent shall develop a Threatened Ecological Community Restoration Plan in consultation with the DEC and submit the Threatened Ecological Community Restoration Plan to the CEO for approval twelve months prior to construction. The Threatened Ecological Community Restoration Plan must identify the:

(1) area subject to the plan;

(2) performance objectives of the restoration and related milestones;

(3) composition of the FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands to be restored;

(4) monitoring requirements; and

(5) completion criteria.

11-2 Once approved, the proponent must implement the Threatened Ecological Community Restoration Plan required pursuant to Condition 11-1.

*Benthic communities and habitat*

11-3 In view of the significant residual impacts and risks as a result of implementation of the proposal to seagrass, the proponent shall prepare and submit a Seagrass Restoration Plan to the CEO for prior to the commencement of construction.

The objectives of the Seagrass Restoration Plan are to re-plant at least twice the area of seagrass lost by the proposal within five years of the commencement of Marine-Related Construction Activities, in the southern end of Cockburn Sound, and ensure that ten years after the commencement of Marine-Related Construction Activities, twice the amount seagrass lost by the proposal has been re-established to at least 75 per cent cover of *Posidonia* spp.

11-4 The Seagrass Restoration Plan required by Condition 11-3 shall include:

(1) a Seagrass Transplant Pilot Study to test the suitability of selected transplant sites and seagrass from the Zone of High Impact and from other donor locations within Cockburn Sound, which shall commence at the start of construction;

(2) areas where seagrass will be re-planted and re-established and areas where seagrass donor material will be sourced;

(3) protocols and procedures to undertake a baseline seagrass survey of the areas identified in condition 11-4(2);

(4) objectives of the restoration, related milestones and success criteria;

(5) composition of the seagrass to be restored with *Posidonia sinuosa* to be the dominant species;

(6) protocols, procedures and locations for harvesting donor material;

(7) monitoring requirements for both the restoration sites and donor seagrass beds; and

(8) reporting requirements in accordance with Condition 11-8.

11-5 The proponent shall source as much donor material as practicable from the Zone of High Impact for seagrass restoration required by Condition 11-3.

11-6 Prior to the commencement of Marine-Related Construction Activities, the proponent shall revise the approved Seagrass Restoration Plan required by Condition 11-3 and submit to the revised plan to the CEO for approval. The revised plan shall be based on the findings of the Seagrass Transplant Pilot Study referred to in Condition 11-4(1).

11-7 Once approved, the proponent must implement the Seagrass Restoration Plan required by Conditions 11-4 and 11-6 until the objective stated in 11-3 is achieved.

11-8 The proponent shall monitor the success of implementation of the Seagrass Restoration Plan required by Conditions 11-4 and 11-6 and provide a written report, including monitoring data, to the CEO and the CSMC every two years on the progress of this project. The first report must be submitted to the CEO and the CSMC within 12 months of commencement of Marine Related Construction Activities.

11-9 Should the objective of re-establishing twice the amount seagrass lost by the proposal to at least 75 per cent cover of *Posidonia* spp. as required by Condition 11-3 not be achieved at the ten year point, the proponent shall continue to implement the project until this objective is achieved.

*Marine Environmental Quality*

11-10 In view of the significant residual impacts and risks as a result of the implementation of the proposal on the marine environmental quality of Mangles Bay, the proponent shall provide an initial $250,000 to the CSMC within 12 months of commencement of construction and an ongoing operational fund of $25,000 per year for a period of 5 years. The purpose of the funding is for the implementation of nutrient reduction strategies within the

catchment of Mangles Bay in order to improve the environmental quality of Mangles Bay.

11-11 The proponent shall report annually on the provision of funding as required in Condition 11-10 as part of its compliance reporting as required in Condition 4.

*Regional Parks*

11-12 In view of the significant residual impacts and risks as a result of implementation of the proposal to native vegetation within Rockingham Lakes Regional Park, the proponent shall prepare and submit a Rehabilitation Plan to the DEC within 12 months of the commencement of construction.

The objective of the Rehabilitation Plan is to identify and undertake rehabilitation of 20 hectares of native vegetation within Rockingham Lakes Regional Park in the Cape Peron vicinity to the satisfaction of the DEC.

11-13 The Rehabilitation Plan as required pursuant to Condition 11-12 shall:

(1) identify an area of 20 hectares within Rockingham Lakes Regional Park in the Cape Peron vicinity to be rehabilitated;

(2) objectives and targets to be achieved;

(3) timeframes and responsibilities for implementation;

(4) funding schedule and financial arrangements; and

(5) monitoring, reporting and evaluation mechanisms.

11-14 The proponent shall implement the Rehabilitation Plan as required pursuant to Condition 11-13.

11-15 The proponent shall provide $450,000 to the DEC within twelve months of commencement of construction. The purpose of the funding is for the acquisition and management of land for conservation purposes within the Swan Coastal Plain Interim Biogeographic Regionalisation of Australia region.

**Schedule 1**

**Table 1: Summary of the Proposal**

| | |
|---|---|
| **Proposal Title** | Mangles Bay Marina-Based Tourist Precinct |
| **Short Description** | The proposal is to construct and operate a single entrance onshore marina to accommodate up to 500 boat pens and moorings and a surrounding land development comprising tourism, commercial, public open space and residential land uses. Construction activities to include clearing, wet excavation of the marina, breakwater construction and dredging of the access channel. Supporting infrastructure includes:<br>• Improvement works to the area west of Garden Island Causeway, including an upgrade to the car park, boat ramp and jetty platforms;<br>• Service corridor of 45 ha for re-routing of the Water Corporation Sepia Depression Ocean Outfall Landline;<br>• Pump station for the Water Corporation for the Sepia Depression Ocean Outfall Landline;<br>• Re-routing of Memorial Drive along the southern boundary of the proposal footprint as a dual-lane road;<br>• Relocation of the Lake Richmond Outlet Drain. |

**Table 2: Location and authorised extent of physical and operational elements**

| **Column 1** | **Column 2** | **Column 3** |
|---|---|---|
| **Element** | **Location** | **Authorised Extent** |
| Terrestrial Elements | Refer Figure 1 | Terrestrial Development Envelope of not more than 77 ha |
| | Refer Figure 4 - Clearing Area | Vegetation clearing of not more than 40 ha |
| | Refer Figure 4 - FCT 30a within Clearing Area | Loss of not more than 1.95 ha of FCT 30a *Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands |
| Marina waterbody | Refer Figure 1 | Marina waterbody area of not more than 12 ha<br>Deepest depth -3.5 m AHD<br>Shallowest depth -2.7 m AHD |
| Marine Elements | Refer Figure 1 – Channel, Breakwaters and New Beach Profile – must be located in the Zone of High Impact | Marine Disturbance Footprint of not more than 5.36 ha<br>Deepest depth of channel<br>-3.5 m AHD |
| | Refer Figure 3 – Zone of High Impact | Loss of seagrass of not more than 5.24 ha |

**Table 3: Abbreviations**

| **Abbreviation** | **Term** |
|---|---|
| AHD | Australian Height Datum |

| **Abbreviation** | **Term** |
|---|---|
| FCT | Floristic Community Type |

| Abbreviation | Term |
| --- | --- |
| ha | hectare |

| Abbreviation | Term |
| --- | --- |
| m | metres |

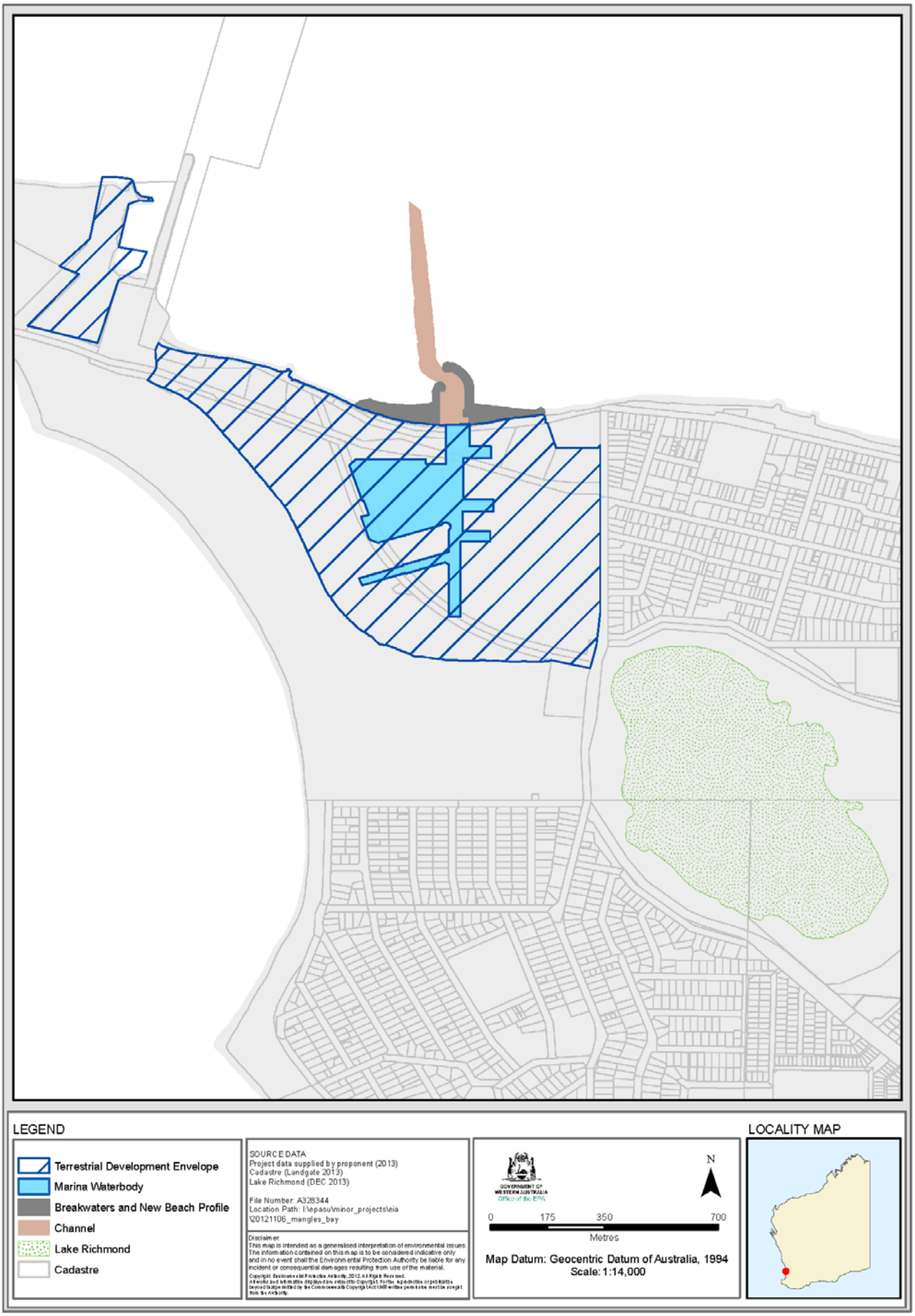


**Figure 1: Location of the Proposal**

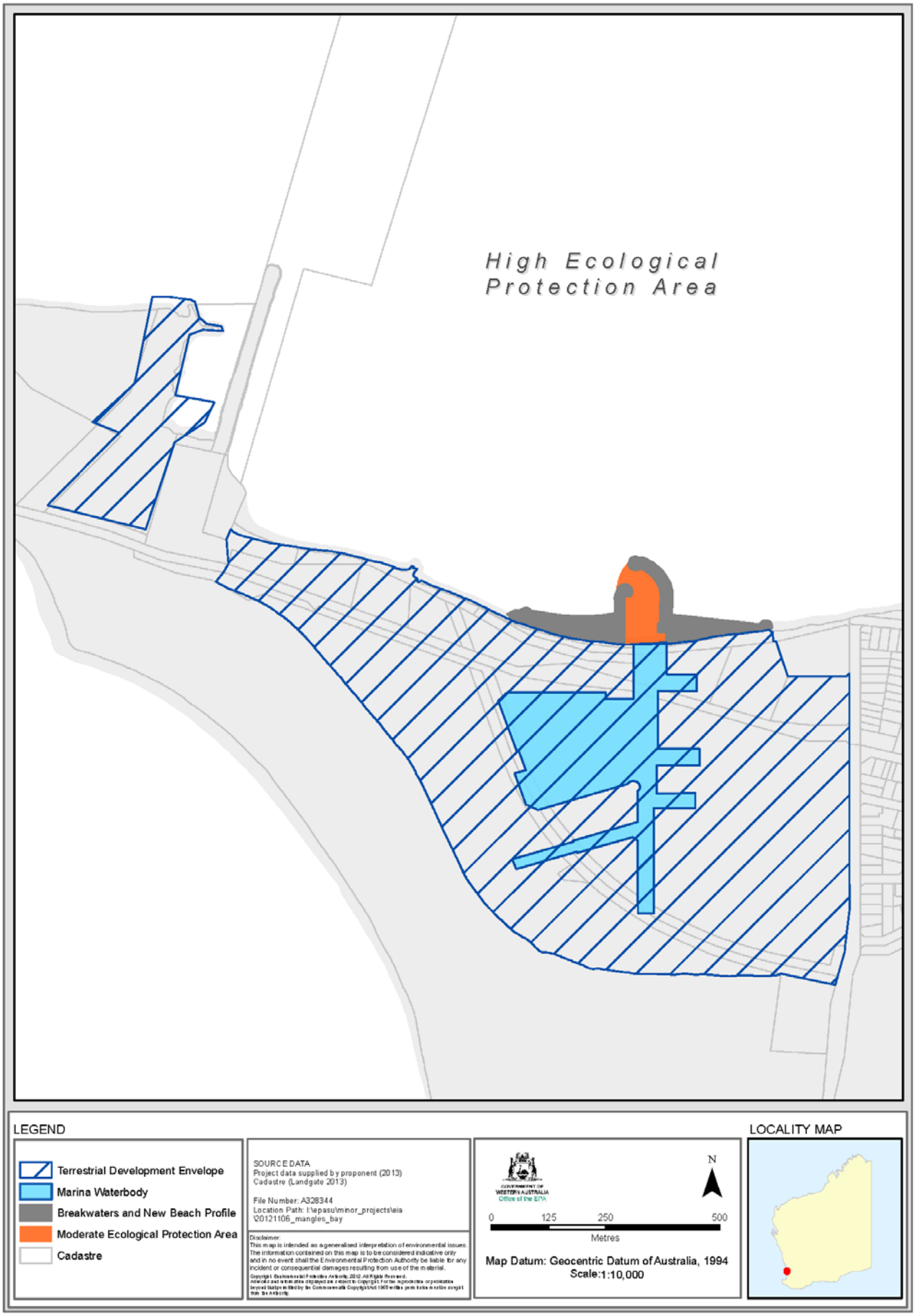


**Figure 2: High and Moderate Ecological Protection Areas**

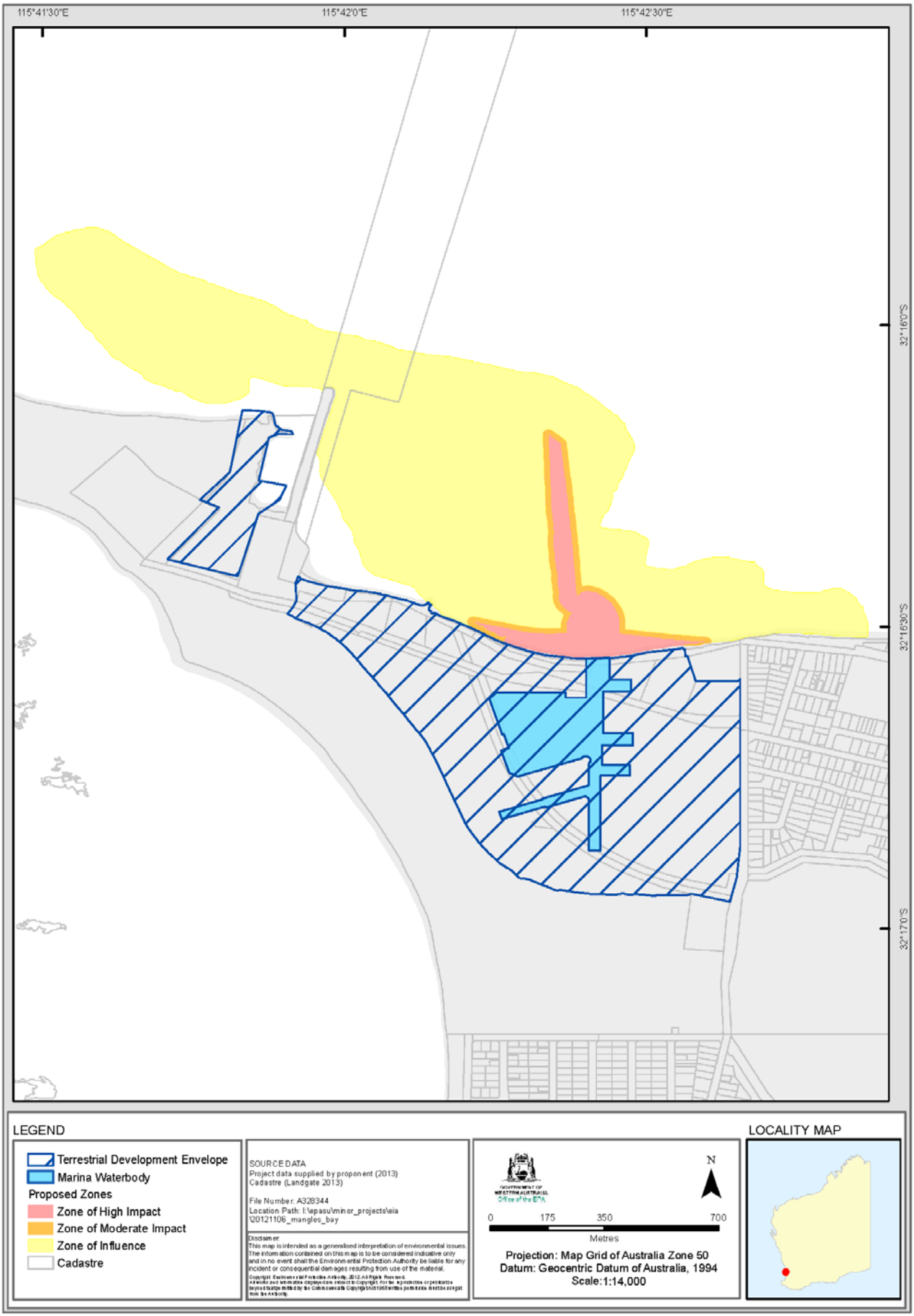


**Figure 3: Zones of High and Moderate Impact and Zone of Influence**


**Figure 4: Threatened Ecological Communities**

| Term or Phrase | Definition |
|---|---|
| CEO | The Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986*, or his delegate. |
| DEC | Department of Environment and Conservation |
| EPA | Environmental Protection Authority |
| EP Act | *Environmental Protection Act 1986* |
| CSMC | Cockburn Sound Management Council |
| Marine Related Construction Activities | Those construction activities that take place in the marine environment that include:<br>• dredging;<br>• rock dumping for breakwater construction.<br>Construction of the marina waterbody is not considered part of Marine Related Construction Activities. |
| Zone of High Impact | Is that area depicted in Figure 3 and defined by Coordinates in Schedule 3. |
| Zone of Moderate Impact | Is that area depicted in Figure 3 and defined by Coordinates in Schedule 3. |
| Zone of Influence | Is that area depicted in Figure 3. |
| Southern end of Cockburn Sound | Is an area with Cockburn Sound to the south of James Point and Carine Bay. |

**Schedule 2**

**The Environmental Quality Objective and Level of Ecological Protection to be achieved in marine waters for the Proposal (Condition 7)**

| **Area** | **Environmental Quality Objectives** | **Level of Ecological Protection for Maintenance of Ecosystem Integrity** |
|---|---|---|
| Marine waters between the breakwaters (Figure 2) | • Maintenance of ecosystem integrity.<br>• Maintenance of seafood for human consumption.<br>• Maintenance of aquaculture.<br>• Maintenance of primary contact recreation.<br>• Maintenance of secondary contact recreation.<br>• Maintenance of aesthetic values.<br>• Maintenance of cultural and spiritual values.<br>• Maintenance of industrial water supply. | **Moderate** – To allow moderate changes in the quality of water, sediment and biota (i.e. moderate changes in contaminant concentrations that could cause small changes, beyond natural variation in ecosystem processes and abundance/biomass of marine life, but no detectable changes from the natural diversity of species and biological communities).<br><br>For this protection level the criteria for a Moderate Level of Ecological Protection as specified *Environmental Quality Criteria Reference Document for Cockburn Sound* as amended or replaced from time to time, shall apply. |

**Schedule 3**

# Mangles Bay Marina

## *Co-ordinates that define the Zone of High Impact and Zone of Moderate Impact.*

Reference “Mangles Bay Marina Tourist Based Precinct - *Zone of High Impact and Zone of Moderate Impact*” Document No 20121106_Mangles_Bay_A328344 zone-prop-influence, Revision 1.2, Dated 20130118.

**Notes**

The following notes are provided for information and do not form a part of the implementation Conditions of the Statement:

- The proponent for the time being nominated by the Minister for Environment under section 38(6) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal unless and until that nomination has been revoked and another person is nominated.
- If the person nominated by the Minister, ceases to have responsibility for the proposal, that person is required to provide written notice to the Environmental Protection Authority of its intention to relinquish responsibility for the proposal and the name of the person to whom responsibility for the proposal will pass or has passed. The Minister for Environment may revoke a nomination made under section 38(6) of the *Environmental Protection Act 1986* and nominate another person.
- To initiate a change of proponent, the nominated proponent and proposed proponent are required to complete and submit *Post Assessment Form 1 – Application to Change Nominated Proponent*.
- The General Manager of the Office of the Environmental Protection Authority was the Chief Executive Officer of the Department of the Public Service of the State responsible for the administration of section 48 of the *Environmental Protection Act 1986* at the time the Statement was signed by the Minister for Environment.
- The implementation of this Statement will result in changes to the Ecological Protection Areas listed in Schedules 2 and 3 of the *State Environmental (Cockburn Sound) Policy 2005*. Schedules 2 and 3 will be updated to reflect the implementation of this statement.

# Appendix 5

## Summary of Submissions and Proponent’s Response to Submissions