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Monday, 13 May 2013

Appeal – EPA Report 1471

Mangles Bay Marina-Based Tourist Precinct

Dear Sir/Madam,

The Urban Bushland Council WA Inc. is writing to voice serious concerns relating to the EPA Report 1471 and the recommendation to the Minister for Environment to approve the development.

The Urban Bushland Council strongly opposes the excavation of a marina and canal estate at Point Peron that would result in the clearing of 40 ha of Bush Forever vegetation and alter the hydrology of Lake Richmond impacting upon the two endangered communities found there.

Canal estates have been banned in NSW and Victoria and there is a moratorium on new canal estates on the Gold Coast due to the significant impact upon coastal environments and the future liability from managing the effects of climate change on coastal communities.

The environment at Point Peron is of a very high conservation value and there has not been a strong cost:benefit analysis of this proposal, in fact the ongoing management costs of environmental offsets (rehabilitation programs, environmental monitoring) and maintenance dredging of the channel and marina do not appear to have been adequately assessed at all.

We therefore request that the EPA Chairman reassess the proposal and provide the Minister for Environment with a full account of the environmental values at Point Peron, the devastating environmental harm caused by canal estates such as this proposal and the likely success and cost of proposed offsets.

As the Urban Bushland Council celebrates its 20th Anniversary this year we look forward to the day we no longer have to write submissions against inappropriate development within Bush Forever areas, those significant regional bushland remnants that are the absolute jewels in Perth's natural environment.

Our grounds of appeal, major concerns and outcomes sought are outlined below.

President
Urban Bushland Council WA Inc.

Appeal Ground 1: Summary and Recommendations (page i) – Name of proponent. Proponent name does not match PER and supplementary documents.

Concern: The PER documents state that the proponent is Landcorp and Cedar Woods Properties Limited (PER Part I Executive Summary, page i). However the EPA Report states:

"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)."

Even on the Disclaimer and Limitations page of the supplementary document "Detailed Response to Matter Raised in Submissions on the Mangles Bay PER Rev1" the proponent is still being referred to as Cedar Woods.

It appears that Cranford Pty Ltd is a subsidiary of Cedar Woods Pty Ltd. It would be useful for the public if documents had consistent proponent names or if the proponent name is changed that the EPA Report make a note of the change or the use of a trading name (whichever is relevant).

http://www.epa.wa.gov.au/EIA/EPAREPORTS/Pages/1471-ManglesBayMarina-BasedTouristPrecinct.aspx

Outcome Sought 1: the EPA Chairman seek clarification from the proponent regarding the change in proponent (Cedar Woods Pty Ltd now Ranford Pty Ltd) or use of a trading name and include this in the EPA Report.

Appeal Ground 2: Summary and Recommendations (page i) – Precautionary Principal. Precautionary Principle not comprehensively applied.

Concern: The EPA Report states that the precautionary principle was *"considered by the EPA in relation to the proposal".*

The concept of the precautionary principle is that if an action or policy has a suspected risk of causing harm to the public or to the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is *not* harmful falls on those taking an act. In some legal systems, as in the law of the European Union, the application of the precautionary principle has been made a statutory requirement (wiki).

There are several instances where environmental risks are unknown and the EPA proposes developing impact monitoring programs, eg:

> *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;*

The Precautionary Principal if applied would require a threat assessment be made prior to granting approval of a development.

11 Residual impacts: Threatened Ecological Communities 11-1 Threatened Ecological Community Restoration Plan shall be developed and must identify: (5) completion criteria.

The Precautionary Principle would require completion criteria for rehabilitation of the TEC FCT 30a to be established and rehabilitation trials to have proved successful prior to granting an offset of TEC rehabilitation.

3.2 Benthic communities and habitat: 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. And,

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;

The Precautionary Principle would require the pilot study to be completed and deemed successful prior to approving seagrass transplantation as a suitable offset.

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

The Precautionary Principle would require rehabilitation trials to have been undertaken and deemed successful prior to accepting rehabilitation as a suitable offset.

In the "Detailed Response to Matters Raised in Public Submissions on the Mangles Bay PER" the proponent states (Section 1.1, 1):

Precautionary principle: The Proposal has been reviewed and refined based on the assessment of environmental risk. Decision making has taken the precautionary principle into account and thus the current Proposal represents the iteration with the lowest level of environmental impact.

We would like to contend that this statement isn't in the spirit of the precautionary principle at all; rather it seeks to justify selection of the environmentally "least worst" option.

Outcome Sought 2: The EPA Chairman reject the Proposal as comprehensive application of the Precautionary Principle indicates numerous examples where the level of environmental harm is

currently unknown, such as monosulphide black ooze, TEC rehabilitation success, seagrass pilot study and native vegetation rehabilitation success.

Appeal Ground 3: EPA Report Proposal Implementation 1-1. Lack of clarity on depth of dredging.

Concerns: Section 1 Proposal Implementation 1-1 of the EPA Report states "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."

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 Deepest depth -3.5 m AHD 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 Deepest depth of channel -3.5 m AHD
	Refer Figure 3 – Zone of High Impact	Loss of seagrass of not more than 5.24 ha

There is a concern that the depth of the marina water body has been reported as -3.5 m AHD (Table 2, EPA Report) and not as Mean Low Water Spring (MLWS); Australian Standard AS3962-1991 Guidelines for Design of Marinas, as reported in Environmental Guidelines for Marinas in the Great Barrier Reef Marine Park. The **mean low water spring** (**MLWS**) is the lowest level to which spring tides retreat on average over a period of time (often 19 years); http://en.wikipedia.org/wiki/Mean_low_water_spring.

There is a concern that the depth of the marina water body has been reported as -3.5 m AHD and not as Mean Low Water Spring (MLWS); Australian Standard AS3962-1991 Guidelines for Design of Marinas, as reported in Environmental Guidelines for Marinas in the Great Barrier Reef Marine Park. The **mean low water spring** (**MLWS**) is the lowest level to which spring tides retreat on average over a period of time (often 19 years); http://en.wikipedia.org/wiki/Mean_low_water_spring.

This is an issue as the Australian Height Datum (AHD) does not directly relate to Mean Sea Level (MSL) at all coastal areas. For example at Fremantle (1897 – 2010) the Mean sea level = 0.698 and average low tide is 0.265 m.
Other EPA reports use Chart Datum as an accurate description of the depth of dredging, such as in the Anketell Point Port Development, Antonymyre, Shire of Roebourne (EPA Report 1445, July 2012):

> *"Shipping channel 17.6 km long and 200 m wide (widening to 300 m at the seaward end) and dredged to a depth of -15.7 to -16.9 m Chart datum (CD)"*

From:
http://edit.epa.wa.gov.au/EPADocLib/Rep%201445%20Anketell%20Point%20Port%20PER%20300712-web.pdf

By not providing an accurate description of the depth of dredging there is concern that the EPA may not be fully briefed regarding the suitability of the proposal in relation to environmental impacts.

Outcome Sought 3: The EPA Chairman to seek clarification around the depth of proposed dredging as it related to MLWS and/or Chart Datum.

Appeal Ground 4: EPA Report 3.2 Benthic communities and habitat, Assessment (page 27). Lack of rigor regarding seagrass impact.

Concern: The Western Australian Auditor General's Report - Environmental Management of Cockburn Sound, Report 8 – September 2010, contains the following overview of seagrass and ecosystem health and recommended improvements to monitoring and management:

Seagrass is a key indicator of ecosystem health in Cockburn Sound

The temperate coastal waters of WA are recognised for containing one of the world's richest seagrass floras. Seagrasses are important primary producers. They provide food and shelter for many organisms, and are a nursery ground for commercially important prawn and fish species. The high primary production rates of seagrasses are closely linked to high production rates of associated fisheries. These plants support numerous food chains and are considered highly productive 'pastures of the sea'.

Monitoring needs to be strengthened to effectively manage ecosystem health

Findings

- Monitoring indicates that seagrass in Cockburn Sound remains under pressure.
- The monitoring methodology has allowed standards for measuring seagrass health to decline, without being reported or causing investigation of the potential causes.
- Monitoring does not adequately measure the total area of seagrass in Cockburn Sound.
- Total contaminant discharges into Cockburn Sound are not adequately monitored, reducing government's ability to target appropriate management action.
- There has been no recent environmental risk assessment for Cockburn Sound to focus monitoring and analysis in areas of greatest concern.

http://www.audit.wa.gov.au/reports/pdfreports/report2010_08.pdf

The current state of seagrass heath is dire; the EPA Report states (page 20-21):

> *Approximately 80 per cent of seagrasses have been historically lost in Cockburn Sound as a result of either change to water quality or direct physical impacts from the construction of facilities and anchor damage.*

While the WA state government has been working towards improving the health of the seagrass ecosystem there has been little improvement.

The EPA Report states on page 27:

> *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 WA government (Landcorp) together with their private enterprise partner are proposing a "net gain" of seagrass through this proposal. WA government funds towards any "net gain" in seagrass would be better invested in directly funding ecosystem management, rather than as an offset to environmental damage.

There is a concern among the scientific community and the public regarding the use of offsets as a mechanism of justifying environmental damage.

The seagrass ecosystems are badly degraded and the EPA approving further damage with the proviso of "offsets" does not do this valuable ecosystem justice.

Outcome Sought 4: The EPA Chairman to reject the proposal due to the value of seagrass ecosystems. The cost of state-funded environmental damage and subsequent funding of environmental offsets, that are inherent in this proposal, are a gross mismanagement of state

funds which would be better spent on management of the current seagrass ecosystems which are already in decline.

Appeal Ground 5: EPA Report 3.1 Marine environmental quality. Lack of rigor in assessment of algal blooms.

Concern: Algal blooms are a concern in the current environment of Cockburn Sound. In the State of the Environment Report, 2011 it states:

> *Chlorophyll a*
>
> *The High Ecological Protection did not meet the Environmental Quality Guidelines (the Guidelines) for chlorophyll 'a' concentrations which exceeded the Environmental Quality Criteria (EQC) at six of the thirteen sites in this Area.*

The significance of elevated chlorophyll a concentrations has been described thus:

"Phytoplankton productivity is one of the main forces regulating our planetary climate for via impacts on atmospheric carbon dioxide levels which are closely linked to the oceanic carbon dioxide concentrations. However, excessive water column productivity, expressed by high chlorophyll a concentrations, can supply large amounts of easily decomposition (i.e. labile) organic matter to the sediments. The decomposition of algal biomass can increase the diurnal amplitude of water column pH and dissolved oxygen fluctuations, and in some cases may lead to anoxic & hypoxic events. Moreover, elevated chlorophyll a levels indicate high numbers of phytoplankton and free floating macroalgae which can shade seagrass meadows leading to a decline in seagrass distribution. The above changes can translate into changes in animal and plant species diversity."

From: http://www.ozcoasts.gov.au/indicators/chlorophyll_a.jsp

The Australian and New Zealand guidelines for fresh and marine water quality (Volume 1 2000) state that for inshore marine areas the chlorophyll a trigger value is 0.7 and for estuaries it is 3. From: http://www.environment.gov.au/water/publications/quality/pubs/nwqms-guidelines-4-vol1.pdf

Tables 3.3.6–3.3.7 South-west Australia

The following tables outline default trigger values applicable to southern Western Australia. Where regional guideline trigger values have been developed, those values should be used in preference to the default values provided below. The WA EPA is currently developing site-specific environmental quality criteria for Perth's coastal waters. (Upland streams are defined as those at >150 m altitude.)

Table 3.3.6 Default trigger values for physical and chemical stressors for south-west Australia for slightly disturbed ecosystems. Trigger values are used to assess risk of adverse effects due to nutrients, biodegradable organic matter and pH in various ecosystem types. Data derived from trigger values supplied by Western Australia. Chl *a* = chlorophyll *a*, TP = total phosphorus, FRP = filterable reactive phosphate, TN = total nitrogen, NO_x = oxides of nitrogen, NH_4^+ = ammonium, DO = dissolved oxygen.

Ecosystem type	Chl *a*	TP	FRP	TN	NO_x	NH_4^+	DO (% saturation)[i]		pH	
	(µg L^{-1})	(µg P L^{-1})	(µg P L^{-1})	(µg N L^{-1})	(µg N L^{-1})	(µg N L^{-1})	Lower limit	Upper limit	Lower limit	Upper limit
Upland river[f]	na[a]	20	10	450	200	60	90	na	6.5	8.0
Lowland river[f]	3–5	65	40	1200	150	80	80	120	6.5	8.0
Freshwater lakes & reservoirs	3–5	10	5	350	10	10	90	no data	6.5	8.0
Wetlands[d]	30	60	30	1500	100	40	90	120	7.0[e]	8.5[e]
Estuaries	3	30	5	750	45	40	90	110	7.5	8.5
Marine[g,h] Inshore[c]	0.7	20[b]	5[b]	230	5	5	90	na	8.0	8.4
Offshore	0.3[b]	20[b]	5	230	5	5	90	na	8.2	8.2

na = not applicable

a = monitoring of periphyton and not phytoplankton biomass is recommended in upland rivers — values for periphyton biomass (mg Chl *a* m^{-2}) to be developed;

b = summer (low rainfall) values, values higher in winter for Chl *a* (1.0 µgL^{-1}), TP (40 µg P L^{-1}), FRP (10 µg P L^{-1});

c = inshore waters defined as coastal lagoons (excluding estuaries) and embayments and waters less than 20 metres depth;

d = elevated nutrient concentrations in highly coloured wetlands (gilven >52 $g_{440}m^{-1}$) do not appear to stimulate algal growth;

e = in highly coloured wetlands (gilven >52 $g_{440}m^{-1}$) pH typically ranges 4.5–6.5;

f = all values derived during base river flow conditions not storm events;

g = nutrient concentrations alone are poor indicators of marine trophic status;

h = these trigger values are generic and therefore do not necessarily apply in all circumstances e.g. for some unprotected coastlines, such as Albany and Geographe Bay, it may be more appropriate to use offshore values for inshore waters;

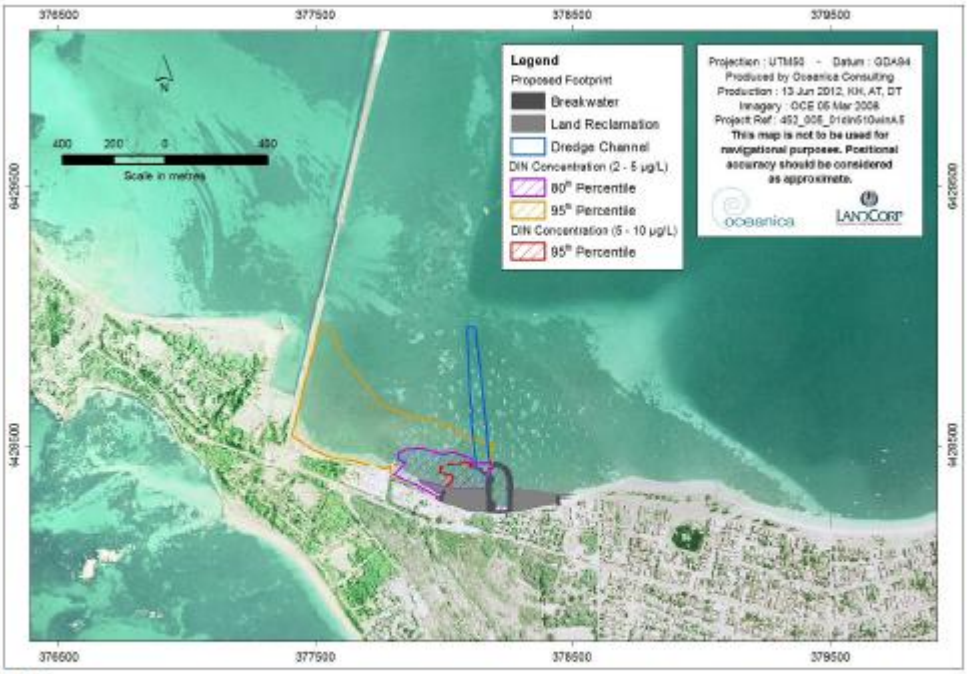
i = dissolved oxygen values were derived from daytime measurements. Dissolved oxygen concentrations may vary diurnally and with depth. Monitoring programs should assess this potential variability (see Section 3.3.3.2).

However, modelling indicates the chlorophyll a levels exceed the trigger points for modelling within the marina and outside the marina.

Table 4.1 Predicted chlorophyll-a concentrations in Mangles Bay marina waters

e-folding time	Ground-water DIN load	Sediment DIN load	Background chl.-a	Predicted increase in chl.-a	Final chl.-a	Level of increase in chl.-a
Summer (DIN to chlorophyll conversion efficiency of 1.0)						
Six days	0.1 kg/day	0	1.3 µg/L	0.8 µg/L	2.1 µg/L	1.6
			1.7 µg/L	0.8 µg/L	2.5 µg/L	1.5
			2.1 µg/L	0.8 µg/L	2.9 µg/L	1.4
		0.29 kg/day	1.3 µg/L	1.2 µg/L	2.5 µg/L	1.9
			1.7 µg/L	1.2 µg/L	2.9 µg/L	1.7
			2.1 µg/L	1.2 µg/L	3.3 µg/L	1.6
Eight days	0.1 kg/day	0	1.3 µg/L	0.8 µg/L	2.1 µg/L	1.6
			1.7 µg/L	0.8 µg/L	2.5 µg/L	1.5
			2.1 µg/L	0.8 µg/L	2.9 µg/L	1.4
		0.29 kg/day	1.3 µg/L	1.4 µg/L	2.7 µg/L	2.1
			1.7 µg/L	1.4 µg/L	3.1 µg/L	1.8
			2.1 µg/L	1.4 µg/L	3.5 µg/L	1.7
Autumn (DIN to chlorophyll conversion efficiency of 1.0)						
Six days	0.2 kg/day	0	1.3 µg/L	1.0 µg/L	2.3 µg/L	1.8
			1.7 µg/L	1.0 µg/L	2.7 µg/L	1.6
			2.1 µg/L	1.0 µg/L	3.1 µg/L	1.5
		0.29 kg/day	1.3 µg/L	1.4 µg/L	2.7 µg/L	2.1
			1.7 µg/L	1.4 µg/L	3.1 µg/L	1.8
			2.1 µg/L	1.4 µg/L	3.5 µg/L	1.7
Eight days	0.2 kg/day	0	1.3 µg/L	1.1 µg/L	2.4 µg/L	1.8
			1.7 µg/L	1.1 µg/L	2.8 µg/L	1.6
			2.1 µg/L	1.1 µg/L	3.2 µg/L	1.5
		0.29 kg/day	1.3 µg/L	1.4 µg/L	2.9 µg/L	2.2
			1.7 µg/L	1.4 µg/L	3.3 µg/L	2.0
			2.1 µg/L	1.4 µg/L	3.7 µg/L	1.8
Ten days	0.2 kg/day	0	1.3 µg/L	1.1 µg/L	2.4 µg/L	1.9
			1.7 µg/L	1.1 µg/L	2.8 µg/L	1.7
			2.1 µg/L	1.1 µg/L	3.2 µg/L	1.6
		0.29 kg/day	1.3 µg/L	1.8 µg/L	3.1 µg/L	2.4
			1.7 µg/L	1.8 µg/L	3.5 µg/L	2.1
			2.1 µg/L	1.8 µg/L	3.9 µg/L	1.9
Winter (DIN to chlorophyll conversion efficiency of 0.5)						
Six days	0.7 kg/day	0	0.6 µg/L	0.9 µg/L	1.5 µg/L	2.4
			0.8µg/L	0.9 µg/L	1.7 µg/L	2.1
			1.0 µg/L	0.9 µg/L	1.9 µg/L	1.8
		0.29 kg/day	0.6 µg/L	1.1 µg/L	2.4 µg/L	2.7
			0.8µg/L	1.1 µg/L	1.8 µg/L	2.3
			1.0 µg/L	1.1 µg/L	2.0 µg/L	2.1
Eight days	0.7 kg/day	0	0.6 µg/L	1.1 µg/L	1.7 µg/L	2.6
			0.8µg/L	1.1 µg/L	1.9 µg/L	2.3
			1.0 µg/L	1.1 µg/L	2.1 µg/L	2.0
		0.29 kg/day	0.6 µg/L	1.3 µg/L	2.0 µg/L	3.1
			0.8µg/L	1.3 µg/L	2.2 µg/L	2.6
			1.0 µg/L	1.3 µg/L	2.4 µg/L	2.3

From: Response to Key Marine and Groundwater Issues Raised in Submissions (page 26).



Notes:
1. 50th percentile contour for 2-5 µg/L and 50th and 80th percentile contours for 5–10 µg/L not shown as they did not extend outside marina breakwaters

Figure 4.5 **Modelled 80th and 95th percentile contours for 2–5 µg/L and 95th percentile contour for 5–10 µg/L elevation in DIN concentrations above background in winter**

From: Response to Key Marine and Groundwater Issues Raised in Submissions (page 30).

The EPA has assessed the modelled chlorophyll a against the background levels of chlorophyll a and although the modelled levels exceed both the background levels and the trigger value finds the proposal acceptable.

Chlorophyll a Trigger Value ANZECC Guidelines (Vol 1, 2000)	Chlorophyll a Background Levels Dec-March 2009/2010 and 2010/2011 (PER Part ii Table 30)	Chlorophyll a Modelled Levels (PER Part ii, Table 32)
0.7	0.8 (nutrient related water)	Winter 1.5 – 2.4
	1.7-1.8 (phytoplankton biomass)	Autumn 2.3 – 3.9
		Summer2.1 – 3.5

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.

EPA Report (page 17-18).

It is incongruous that the current poor water quality in Mangles Bay somehow makes it acceptable to increase water pollution. Again, environmental damage is allowed via an "offset". Condition 11-10 details the financial arrangements totally $375,000 over 5 years. There is no calculation or estimates of what the nutrient treatment process will cost in capital and operating costs. Further there is no detail on how much of this funding will be paid by the State Government. Without an estimate of the total cost there is an unknown liability on the state government to fund nutrient treatment.

> *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.*

Outcome Sought 5: The EPA Chairman reject the proposal due to the modelled increase in chlorophyll a from the proposal. As the modelled chlorophyll a levels exceed both the background levels and trigger values the proposal is unacceptable due to the environmental harm this will cause. Further, the lack of information regarding the estimated costs of the proposed offsets (Condition 11-10: nutrient reduction strategies) and the financial liability of the State government (Landcorp) is unacceptable.

Appeal Ground 6: Figure 2 EPA Report. Figure lacks adequate key.
Concern: Figure 2 does not accurately depict the extent of the High Ecological Protection Area, part of the causeway is the same colour as the water. The State Environmental (Cockburn Sound) Policy Area EPA 2005 shows the High Ecological Protection Area a separate colour which is easier to identify. Incomplete figures make it difficult to assess and interpret the data presented.

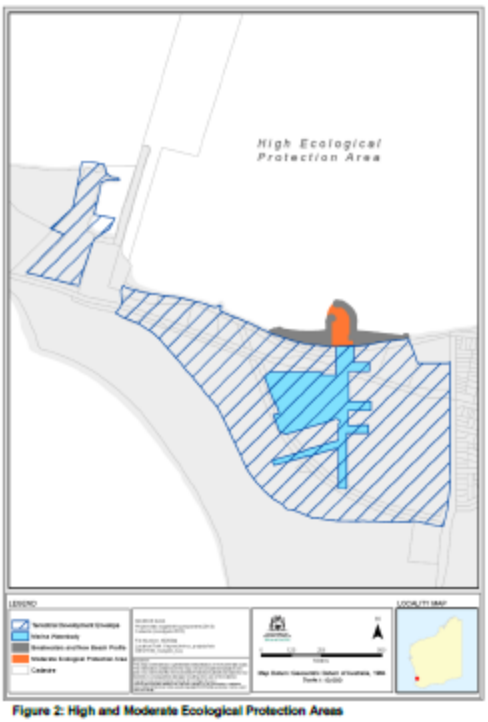
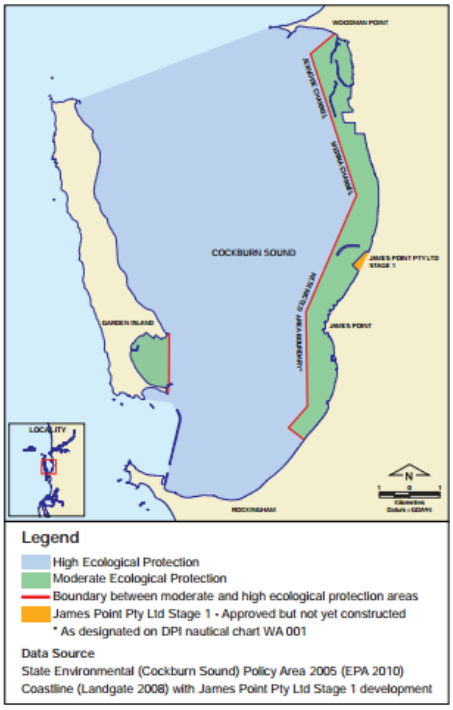


Figure 2: High and Moderate Ecological Protection Areas

EPA Report, Figure 2.



State Environmental (Cockburn Sound) Policy Area 2005.

Outcome Sought 6: The EPA Chairman request a revised Figure 2 which clearly depicts the High Ecological Protection Area.

Appeal Grounds 7: EPA Report 3.4 Terrestrial vegetation, flora and fauna. Lack of rigor regarding the conservation values of TEC's and Bush Forever site 355 and 358.

Concern: The proposal involves the clearing of significant conservation status vegetation and this has been recommended for approval with the proviso of environmental offsets. Offsetting the loss of intact vegetation communities by rehabilitation of cleared land elsewhere and the purchase of bushland elsewhere is unacceptable in this case.

The vegetation proposed to be cleared includes (from PER Part ii, Table 13; EPA Report Table 5):

Vegetation	Status	Proposed Area to be Cleared
SCP 29b *Acacia* shrublands on taller Dunes	Priority 3 Ecological Community (DEC)	33.75 ha
SCP 30a *Callitris preissii (*or *Melaleuca lanceolata*) forest and woodlands	Threatened Ecological Community – Vulnerable (DEC).	1.93 ha (4.27 ha in PER)
SCP 30b Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	Priority 3 Ecological Community (DEC)	0.56 ha
Bush Forever Site 355	Regionally significant bushland	40 ha

Threatened species and ecological community immediately adjacent to proposal (freshwater dependent at Lake Richmond):

Community	Status
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered under Commonwealth Environment Protection and Biodiversity Protection Act 1999
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)	Endangered under Commonwealth Environment Protection and Biodiversity Protection Act 1999

Sedgelands listing: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=19&status=Endangered

Thrombolite listing: http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=8&status=Endangered

Fauna of conservation significance (from PER Part ii, Table 21; EPA Report page vi-vii):

Fauna	Status
Reptiles of conservation significance	Perth lined skink (Priority 3; WA DEC) recorded as occurring within the Proposal area;
Endangered Invertebrate	Graceful Sun Moth(EPBC Act Endangered)
Commonwealth listed migratory birds	The five recorded species of conservation significant bird species are: • Pandion cristatus (eastern osprey) (Migratory) • Actitis hypoleucos (common sandpiper) (Migratory) • Xenus cinereus (terek sandpiper) (Migratory) • Charadrius leschenaultii (greater sand plover) (Migratory) • Haliaeetus leucogaster (white-bellied sea-eagle) (Migratory).

This is a significant area of conservation status vegetation to be cleared and the south-eastern boundary immediately abuts Bush Forever Site 358 Lake Richmond interrupting the bushland connectivity between the sites. Ecological corridors and linkages are essential for the sustainability of biodiversity.

The vegetation should be managed by the DEC to conserve and protect its natural values. The proponents propose to carry out 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" as an offset. Such work is the responsibility of the DEC who is managing the site and should not be divested to development proponents to use as an offset for vegetation clearing.

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

EPA Report, Figure 5.

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

EPA Report, Figure 4: Bush Forever Sites 355 and 358.

Outcome Sought 7: The EPA Chairman reject the proposal as the large scale clearing of Threatened Ecological Communities, Priority Communities, Regionally Significant vegetation (Bush Forever) and damage to habitat for a range of conservation significant fauna is unacceptable. Environmental offsets, including rehabilitation of other sites and purchase of bushland elsewhere, cannot replace the environmental values of the site.

Appeal Ground 8: EPA PER Report (page 5). Misrepresentation of Bush Forever Policy.

Concern: The EPA Report states:

> *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.*

Bush Forever areas are currently identified in the Metropolitan Region Scheme Map and are the subject of Bush Forever & Related Lands MRS Amendment No. 1236/57. This MRS Amendment was issued for public comment from 23 October 2012 to January 18 2013, and is due for gazettal June 2013 (Van Gessalt, 2012, UBC Bush Forever Conference presentation).

The amendment states:

3 Scope and content of the amendment

The MRS text amendment includes the following:

Clause 3 amended

In clause 3(1) insert in alphabetical order:

'Bush Forever area' means an area referred to in clause 28 A(2);

Clause 16 amended

Delete clause 16(1a)(a) and insert:

a) permitted development other than development in a Bush Forever area; or

ba) permitted development in a Bush Forever area carried out in accordance with -

(i) a written agreement between the Commission and the public authority; or

(ii) a management plan approved by the Commission; or

Part IVA inserted

At the end of Part III insert:

Part IVA – Bush Forever areas

28A. Bush Forever areas

(1) The purpose of this clause is to identify regionally significant bushland as Bush Forever areas.

(2) Land is identified as a Bush Forever area in the manner described in the Table column 1.

Column 1 Legend on Scheme Map	Column 2 Area
All land hatched	Bush Forever area

(3) The identification of an area as a Bush Forever area –

(a) operates in addition to the provisions of this Scheme applying to any underlying zone or reserve and any general provisions of the Scheme; and

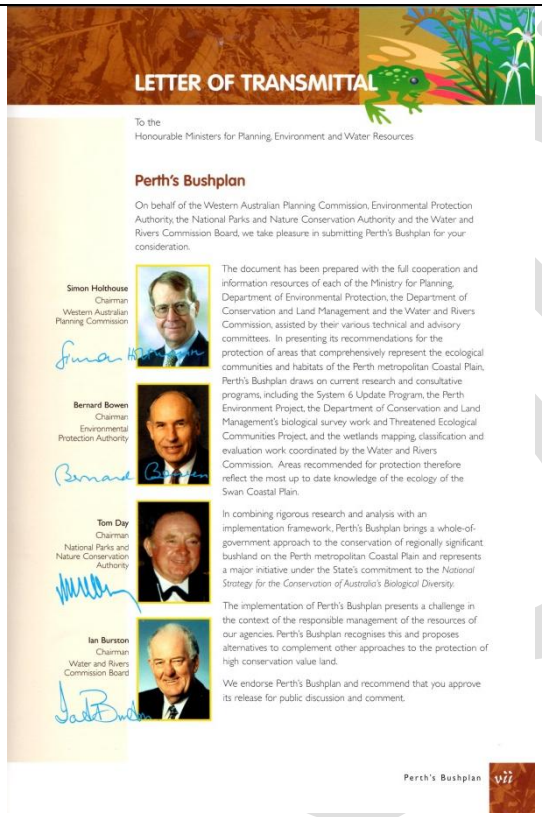
(b) does not operate to zone or reserve that area.

Public submissions on the text amendment closed on Friday 18 January 2013.

The MRS text has been published in the Government Gazette and is administered by the WA Planning Department under the provisions of the Planning and Development (Consequential and Transitional Provisions) Act 2005.

http://www.planning.wa.gov.au/dop_pub_pdf/Metro_Region_Scheme_text.pdf

There is a deep concern that by neglecting to include the immanent text amendment information in the Report the EPA may be dismissive of the significance of regionally significant remnant bushland. The new Minister Environment and Heritage should be provided with a full and frank disclosure of the type of ecosystems this development will destroy. Anything less is a disservice to the Minister and the people of Western Australia, not to mention the scientists who have worked for decades identifying and surveying these areas with astounding biodiversity and the Ministers who introduced the whole-of-government Bush Forever Policy in 2000 and the Bush Plan before it.



LETTER OF TRANSMITTAL

To the
Honourable Ministers for Planning, Environment and Water Resources

Perth's Bushplan

On behalf of the Western Australian Planning Commission, Environmental Protection Authority, the National Parks and Nature Conservation Authority and the Water and Rivers Commission Board, we take pleasure in submitting Perth's Bushplan for your consideration.

Simon Holthouse
Chairman
Western Australian Planning Commission

Bernard Bowen
Chairman
Environmental Protection Authority

Tom Day
Chairman
National Parks and Nature Conservation Authority

Ian Burston
Chairman
Water and Rivers Commission Board

The document has been prepared with the full cooperation and information resources of each of the Ministry for Planning, Department of Environmental Protection, the Department of Conservation and Land Management and the Water and Rivers Commission, assisted by their various technical and advisory committees. In presenting its recommendations for the protection of areas that comprehensively represent the ecological communities and habitats of the Perth metropolitan Coastal Plain, Perth's Bushplan draws on current research and consultative programs, including the System 6 Update Program, the Perth Environment Project, the Department of Conservation and Land Management's biological survey work and Threatened Ecological Communities Project, and the wetlands mapping, classification and evaluation work coordinated by the Water and Rivers Commission. Areas recommended for protection therefore reflect the most up to date knowledge of the ecology of the Swan Coastal Plain.

In combining rigorous research and analysis with an implementation framework, Perth's Bushplan brings a whole-of-government approach to the conservation of regionally significant bushland on the Perth metropolitan Coastal Plain and represents a major initiative under the State's commitment to the *National Strategy for the Conservation of Australia's Biological Diversity*.

The implementation of Perth's Bushplan presents a challenge in the context of the responsible management of the resources of our agencies. Perth's Bushplan recognises this and proposes alternatives to complement other approaches to the protection of high conservation value land.

We endorse Perth's Bushplan and recommend that you approve its release for public discussion and comment.

Perth's Bushplan vii

Perth's Bushplan "letter of Transmittal" signatories:

- Simon Holthouse Chairman Western Australian Planning Commission
- Bernard Bowen Chairman Environmental Protection Authority
- Tom Day Chairman National Parks and Nature Conservation Authority
- Ian Burston Chairman Water and Rivers Commission Board

Ministers' Foreword

We are pleased to present and endorse Bush Forever to the people of Western Australia as a policy position of the Government to guide future decision-making and to protect and manage Bush Forever Sites through the implementation mechanisms identified in this document.

Bush Forever fulfils the Government's commitment to prepare a strategic plan for the conservation of bushland* on the Swan Coastal Plain portion of the Perth Metropolitan Region*, as identified in the *Urban Bushland Strategy* (Government of Western Australia 1995). It also substantially meets the Government's commitments to the 1996 *National Strategy for the Conservation of Australia's Biodiversity*, signed by the heads of Government, in that it seeks to establish a representative system of protected areas.

Graham Kierath MLA
Minister for Planning

Cheryl Edwardes MLA
Minister for the Environment

Kim Hames MLA
Minister for Water Resources

Bush Forever is an implementation plan and a whole-of-government initiative designed to identify, protect and manage regionally significant bushland in order to achieve a sustainable balance between conservation of our bushland and development in metropolitan Perth. To achieve this aim the Government has committed up to $100 million over the next 10 years to ensure that our children and future generations will be able to appreciate and enjoy our natural heritage places.

Bush Forever is about protecting the quality of our environment. It is also about consultation, evaluation, negotiation, and in some cases compromise, to create opportunities for the shared protection and management of regionally significant bushland by governments, individual landowners and the community.

The theme of Bush Forever "Keeping the Bush in the City" illustrates its principal focus. Over the next 10 years the State Government will seek to protect an additional 17,800 hectares – this is in addition to the 33,400 hectares which already have some protection through existing reservation and/or tenure arrangements. This is a significant achievement and represents 18% of the original vegetation of the Swan Coastal Plain portion of the Perth Metropolitan Region. Bush Forever places Perth at the forefront of biodiversity conservation planning in metropolitan areas.

The draft *Perth's Bushplan* was initially released in November 1998 and was open for public comment for five months. More than 2,000 formal submissions were received, and many more commented through community groups, government agencies, workshops and public forums. Their contributions have ensured that the

Bush Forever v

Bush Forever "Ministers Foreword" signatories:

- Graham Kierath MLA Minister for Planning
- Cheryl Edwards MLA Minister for the Environment
- Kim Hames MLA Minister for Water Resources

Outcome Sought 8: The EPA Chairman to specifically include reference to Bush Forever status in the MRS Text Amendment, reflecting the imminent and long overdue, legislated status of Bush Forever. The EPA Chairman must convey the importance of the Bush Forever policy as promoted by the Minister for the Environment at the time, Liberal Cheryl Edwards MLA, in the forward to Bush Forever: "Bush Forever is about protecting the quality of our environment. It is also about consultation, evaluation, negotiation and in some cases compromise, to create opportunities for the shared protection and management of regionally significant bushland by government, individual landowners and the community." A compromise in this case would be the support of the already approved Port Rockingham Marina and full protection of Bush Forever Site 355.

From: Hands Off Point Peron Facebook page.

Appeal Grounds 9: EPA Report p17 Flushing times. Modelling of flushing times does not include worst case scenario.

Concern: The modelled flushing times indicated flushing of the marina waters may take up to 13 days (EPA Report, page 17):

> *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).*

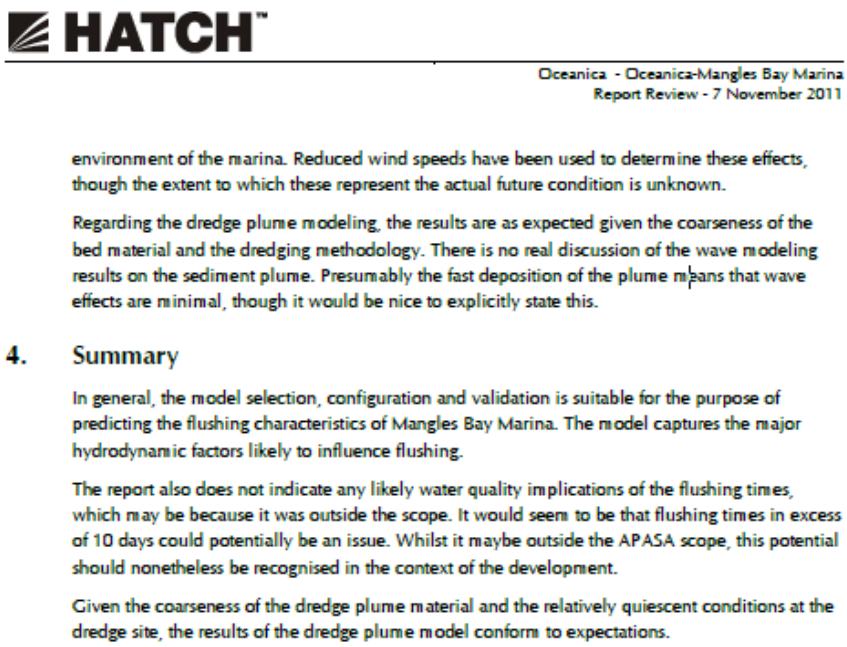
The EPA Report quotes from the peer review of the modelling study:

> *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).

However the following, significant, paragraph from the peer was not included in the EPA Report:

The report also does not indicate any likely water quality implications of the flushing times, which may be because it was outside the scope. It would seem to be that flushing times in excess of 10 days could potentially be an issue. Whilst it maybe outside the APASA scope, this potential should nonetheless be recognised in the context of the development.



HATCH

Oceanica - Oceanica-Mangles Bay Marina
Report Review - 7 November 2011

environment of the marina. Reduced wind speeds have been used to determine these effects, though the extent to which these represent the actual future condition is unknown.

Regarding the dredge plume modeling, the results are as expected given the coarseness of the bed material and the dredging methodology. There is no real discussion of the wave modeling results on the sediment plume. Presumably the fast deposition of the plume means that wave effects are minimal, though it would be nice to explicitly state this.

4. Summary

In general, the model selection, configuration and validation is suitable for the purpose of predicting the flushing characteristics of Mangles Bay Marina. The model captures the major hydrodynamic factors likely to influence flushing.

The report also does not indicate any likely water quality implications of the flushing times, which may be because it was outside the scope. It would seem to be that flushing times in excess of 10 days could potentially be an issue. Whilst it maybe outside the APASA scope, this potential should nonetheless be recognised in the context of the development.

Given the coarseness of the dredge plume material and the relatively quiescent conditions at the dredge site, the results of the dredge plume model conform to expectations.

Above: Extract from the flushing peer review showing the quoted paragraph and the missing paragraph in the Summary, from "Response to Key Marine and Groundwater Issues Raised in Submissions" (Appendix 6, Dr. Jason Antenucci peer review of the adequacy and reliability of the APASA modelling investigations, Oceanica - Oceanica-Mangles Bay Marina Report Review - 7 November 2011 Section 4 Summary).
http://www.epa.wa.gov.au/EIA/EPAReports/Documents/1471/Response%20to%20Key%20Marine%20and%20Groundwater%20Issues%20Raised%20in%20Submissions.pdf

In the proponents "Response to Key Marine and groundwater Issues Raised in Submissions" (Appendix 2, page 26) the modelling was only undertaken for a maximum 8 days. The chlorophyll a levels predicted are reported as averages and do not provide the higher levels of chlorophyll a that would be found at the terminal ends of the marina.

Outcome Sought 9: The EPA Chairman request further modelling to predict seasonal chlorophyll a levels at the terminal ends of the marina at a flushing time of 13 days. A statement regarding the impact on the aesthetic quality of the water (smell, colour, BOD, insects) modelled at the terminal ends of the marina is also required to provide an indication of the suitability of such a design as a residential canal estate. (If it is the case that modelling was only done for 8 days due to the change in marina depth from 4 m to 3.5 m then this should be made explicit in the Report).

Appeal Grounds 10: EPA Report .Risk of environmental harm to Lake Richmond sedgelands listed as Endangered under the EPBC Act.

Concern: The Endangered Sedgelands in Holocene Dune Swales located at Lake Richmond have not been adequately assessed for environmental harm resulting from the marina and canal development proposal. This freshwater dependant community is located immediately adjacent to the proposed development which will alter the hydrology of the area by dredging the marina and canals plus changes are proposed to the outlet weir of the lake. The significant changes should not be considered appropriate for this area.

The proponent has provided information on the location of other communities of this type in the area as if that makes it ok to harm the Lake Richmond community. This is irrelevant, though, as all occurrences of the community are listed as Endangered.

From the Foreword of the INTERIM RECOVERY PLAN NO. 314, SEDGELANDS IN HOLOCENE DUNE SWALES RECOVERY PLAN September 2011 (Department of Environment and Conservation Species and Communities Branch):

> *Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Environment and Conservation (DEC) Policy Statements Nos 44 and 50.*
>
> *IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.*
>
> *Criteria for success:*
>
> *• an increase of one or more in the number of occurrences of this community managed for conservation and/or with conservation included in their purpose, and that leads to an increase in the completeness of a geomorphic age sequence,*
>
> *• representative areas of each geomorphic age sequence maintained in the same or improved condition (Bush Forever 2000 scales), and*
>
> *• 90% or more of the aerial extent of occurrences maintained at the same condition rank, or improved (Bush Forever 2000 scales)*
>
> *Criterion for failure:*
>
> *• Loss of all representatives of a geomorphic age group that contains the sedgelands in Holocene dune swales community or decline in condition of all members of that age group to degraded condition or poorer.*
>
> *Recovery Actions, include:*

- *Continue groundwater monitoring*
- *Identify all occurrences of the community*
- *Establish minimum and maximum threshold water*

- *levels, influence land management to maintain hydrology*
- *Continue to ensure any infrastructure does not impact the community*

The contingency plan of topping up the Lake with groundwater is an unsustainable option for protecting an Endangered community, especially in light of climate change and the predicted future temperature rises and reduced rainfall. The best option for protecting this Endangered community is to follow the recommendations in the Interim Recovery Plan such as maintaining the hydrology and minimising disturbances.

Outcome Sought 10: The EPA Chairman to reject the proposal as the unknown environmental harm from a marina and canal development adjacent to the Lake Richmond sedgelands, listed as Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Environmental harm to the Endangered sedgelands from changes to the natural saline groundwater above the sea water wedge have not been modelled plus environmental harm from the raising of the outlet drain of the Lake has not been adequately assessed.

Appeal Ground 11: EPA Report page 18 Mangles Bay. Lack of information on maintenance dredging of marina and channel.

Concern: Water quality impacts from the construction and operation of the marina have been reported as exceeding guideline trigger values for chlorophyll a and TSS. There is a lack of information about the anticipated dredging of the marina and channel to maintain the workable depth for boat access.

The TSS plume was reported as being of a minimal extent in part due to the coarseness of the bottom material. It may be expected that sediment build-up in the marina and channel would be of finer particle size and have a higher tendency to suspension in the water column during dredging operations.

There is also a lack of detail regarding the anticipated schedule of dredging and the TSS plume, potential impact on sea grass, other potential contaminants mobilised, the method of dredging (such as the cutter suction dredge) and the disposal of dredged material.

Outcome Sought 11: The EPA Chairman to request information from the proponent regarding marina and channel maintenance dredging, including anticipated schedule of dredging, TSS plume modelling, potential impact on sea grass, other potential contaminants mobilised, particle size of dredged material, the method of dredging (such as the cutter suction dredge) and the disposal of dredged material.

Appeal Ground 12: EPA Report, 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond). Water level manipulation at Lake Richmond weir with unknown effect on thrombolite TEC and contradictions in the Report regarding the need to raise the weir.

Concern: Lake Richmond has a weir that currently maintains winter water level at 0.58 m AHD and summer lake levels fall below the weir. The proposal will require the rerouting of the weir drain due to the marina excavation and it is proposed to direct the ocean outfall pipe to the end of the breakwater.

During construction of the marina the Lake level is predicted to drop 3.2 cm and during operation drop 3.8 cm. In an apparent effort to minimise the impact on the thrombolites the invert level of the weir is proposed to be raised by 3.8 m.

EPA Report, page 48:

> *The Lake Richmond outlet drain artificially maintains the lake level in winter to 0.58m 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).*

EPA Report , page 50:

> *Due to the predicted impacts from groundwater draw down, the proponents are proposing wet excavation of the marina water body 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,

> *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.*

This increase in lake level during winter and "greater storage of water" does not immediately appear to be of benefit to the thrombolites. There is little assessment of impact on the thrombolites and sedges of the increased winter water level in the lake.

There is a different reason for raising the weir level in the PER Part 1 Section 7.4.4, and that is the problematic intersection with another drain, the Water Corporation's Sepia Depression Ocean Outfall Landline (SDOOL):

> *The need to move the Outlet drain provides a degree of complexity due to the presence and proposed duplication of the Water Corporation's SDOOL. The intersection of the outlet drain and the SDOOL will require further engineering design with both operating at a similar topographical level. This detail will be managed during the town planning phase of the project; however, it provides a potential mitigation option for Lake Richmond whereby the height of the weir could be raised, thus providing an increase in the maximum height of water in the lake.*

It appears that the need to alter the Lake drain due to the proposal requires a change in elevation. The concept that this will assist the thrombolites is tenuous; further the EPA Report states (page 53):

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.

If the thrombolites are anticipated to be able to copy with a drop of 3.8 cm then there is no justification on their behalf to raise the weir. The following condition should be reassessed on the basis of no ecological justification and unknown environmental impacts from altering the Lake hydrology in Winter:

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.

Outcome Sought 12a: The EPA Chairman reject the proposal as changes to the Lake Richmond weir due to realignment with the SDOOL due to the marina excavation works, will require an increase in the weir height. There has been no assessment of what the change in weir height will have on the thrombolite and sedge TEC's during winter.

Outcome Sought 12b: EPA Chairman remove the following text from the Report (page 50) as it is unproven that raising the weir will mitigate any potential effects from changes to groundwater level:

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.

Appeal Ground 13: EPA Report, 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond), page 50. Uncertainty surrounding the water quality for Lake Richmond artificial supplementation.

Concern: The proposed contingency plan if water levels drop more than predicted states that ground water from the Tamala limestone could be pumped into the Lake and "should" be of suitable quality. Obviously a contingency plan for water pumping should have some confidence around the quality of the source water. More definition around the suitability of this water is required.

From: Additional Response to Lake Richmond and Groundwater Issues, page3:

3. The contingency action proposed if lake levels reduce to the extent that a threat to the survival of the sedgelands and thrombolites is identified is to artificially recharge the lake water to historic low water mark towards the end of summer by topping up from a suitable but deeper groundwater source nearby. ERM (Whincup P [ERM] 2012, pers. comm.) have suggested that groundwater quality in the Tamala limestone (TL) aquifer located >1 km to the east of Lake Richmond <u>should be adequate</u> for topping up lake levels and that getting approval to access that aquifer could be obtained quickly. A production bore could be installed and

operated at such time if water level trends in the lake indicated that the HLWM was about to be breached.

Pumping to maintain water levels in Lake Richmond will involve capital and operational costs which are not defined. Anticipated annual costs to the State of undertaking such a contingency action of pumping water into the lake (best/worst case scenario) should be presented in order to assess the likely financial impacts of ground water drop.

Outcome Sought 13a: The EPA Chairman to request further information on the suitability of the Tamala limestone aquifer to the east for topping up Lake Richmond during contingency action.

Outcome Sought 13b: The EPA Chairman seek an estimate of costs on the worst case scenario contingency of water supplementation to Lake Richmond (eg pumping for 3 months/yr to raise the Lake 5 cm depth, from aquifer 1 km away) and associated greenhouse gas emissions.

Appeal Grounds 14: EPA PER Report (p 44) BF Offsets. Lack of rigor in assessing suitability of environmental offsets.

Concern: There is a growing body of evidence that environmental offsets are not a suitable substitute for many instances of environmental harm. The net loss of environmental values from a development cannot simply be balanced with the purchase of land for conservation elsewhere (as rarely the environmental values would be comparable), most areas of conservation bushland are already provided environmental protection either formally or under clearing regulations, plus rehabilitation can never fully replicate complex biodiverse ecosystems. A lot of money has been spent on trying to rehabilitate land as an environmental offset which has then failed to meet rehabilitation success criteria.

The value of rare and threatened communities must be seriously assessed during development proposals. The TEC's, priority communities and Bush Forever remnant bushland areas should be assessed with a triple bottom line: outstanding environmental values, outstanding social values as natural places for a healthy community to visit and sustainable financial value as a tourism drawcard, carbon sink, natural water treatment and producer of fresh air. This should be compared fairly with the cost to build, operate and maintain a canal estate and marina plus pay for and maintain environmental offsets.

The Offsets proposed by the Proponent and set as conditions in the EPA Report are ill-defined and their probability of success unclear. Some of the offsets proposed in the Cedar Woods Response Letter (Sept 2012) Appendix 2 "Mangles Bay Offsets Strategy" includes:

1.93 ha FCT 30a Callitris preissii (or Melaleauca lanceaolata) – rehabilitation of a nearby cleared area. Described as "Like for like".

There is a lack of information regarding the soil type and other environmental conditions at the new site, the method of replanting (direct seeding, tube stock), seed treatments, fertilizer type and application rates, soil amelioration, soil microbe associations, species richness etc. To simply say

"like for like" is to deny the reality of recreating a TEC. Without further rigorous information on rehabilitation of FCT 30a community type this offset as proposed holds little value.

> *36.5 ha of Graceful Sun Moth habitat and "potential direct impact to individuals". Replanting 1000 seedlings within Port Kennedy Scientific Park. Also on page 8 it states that "monitoring of planting success until 90% survival of seedlings achieved".*

This suggested commitment does not make it into the EPA Report. 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. Project approval under the EPBC Act would require some offset for the loss of 36.5 ha of an endangered species. The proposed offset needs a time frame around the Lomandra replanting commitment. For example two years after planting if seedling survival is monitored and 98% of seedlings are found to be alive and the community self-sustaining.

> *Further, "Weed control will begin during rehabilitation and will continue for the length of management commitments."*

There is a lack of clarity around weed control once the "length of management commitments" is complete.

> *5.24 ha seagrass meadow. Replanting. Page 9 states "A 12 month pilot study will confirm the suitability of proposed transplant sites in Cockburn Sound before large scale transplanting commences."*

"Funding contributions" to key managers is stated on page 8 but no figures are provided. There is a lack of clarity around how much funding is proposed to be contributed by Land Corp and Cedar Woods and over what time frame.

> *~37 ha RLRP and BF site 355.*
>
> *Condition 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;*

There is a lack of information regarding the soil type and other environmental conditions at the new site, the method of replanting (direct seeding, tube stock), seed treatments, fertilizer type and application rates, soil amelioration, soil microbe associations, species richness etc. To simply say "like for like" is to deny the reality of recreating a regionally significant bushland community. Without further rigorous information on rehabilitation of the community type this offset as proposed holds little value.

> *Condition 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.*

The Proponents suggested a $450,000 contribution from Cedar Woods for ~20 ha rehabilitation and ~56 ha land acquisition. This suggestion has been watered down and no longer specifies 56 ha of

land acquisition. A calculation of the offset ratio of conservation status vegetation cleared to land acquired for conservation cannot be made as only the private partner funding of acquisition is specified. There are no details on whether the State Government (Landcorp) intends to fund land acquisitions as an offset. It would be unacceptable for Landcorp to offset any existing Bush Forever land it holds against the Mangles bay proposed clearing as all other Bush Forever areas have been identified for conservation already and should not be developed. Further, offsetting the clearing one Bush Forever site by transferring another into the conservation estate equates to a net loss of bushland and is unacceptable.

There is no way to assess whether the offset meet government guidelines for offset ratios without an acquisition target specified:

> *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).*

Outcome Sought 14: The EPA Chairman to reject the proposal as the offsets do not provide a net improvement to TEC's, threatened species, priority communities and regionally significant bushland when scrutinised. The rehabilitation offsets have no guarantee of success in re-establishing a functioning ecosystem and other purchase of land has dwindled from a 56 ha purchase of high conservation land as an offset to a Condition specifying only a $450,000 contribution from the private partner in the proposal, which is totally dismissive of offset ratios.

Appeal Grounds 15: EPA Report, EPA PER Report (p 44) Rehabilitation. Location of rehabilitation area in RLRP is ill-defined.

Concern: On page 44 of the EPA Report the proponent suggests an indirect offset of:

> *Rehabilitation of approximately 20 ha of native vegetation within the Rockingham Lakes Regional Park in the Cape Peron vicinity.*

The Indicative Land Use Plan (below) shows a rectangular patch of medium green with the key stating it is Rehabilitation Area. There is a concern that this area is partially cleared and would be suitable for rehabilitation, however from the aerial plan it clearly shows half of the area is currently vegetated. Figure 4 of the EPA Report shows that this area is within Bush Forever site 355. Clarification is required regarding the rehabilitation of this area as obviously clearing regionally significant bushland within a Bush Forever Area for rehabilitation is totally unacceptable.

There is a lack of clarity around the location of other rehabilitation areas within the RLRP that will make up the 20 ha of offsets, or the suitability of other areas.

Figure 1 Indicative Land Use Plan

From: Additional Response to Lake Richmond and Groundwater Issues (Figure 1).

Outcome Sought 15: The EPA Chairman to reject the proposal as rehabilitation of a vegetated Bush Forever site as shown in Figure 1 (Additional Response to Lake Richmond and Ground Water Issues) is totally unacceptable.

Appeal Grounds 16: EPA Report, page 48. 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond). Groundwater modelling does not use current baseline data for water quality.

Concern: The Lake Richmond thrombolite TEC is dependent upon the fresh ground water entering the lake. While modelling of the salt water wedge from the marina and canal estate development has been undertaken the presence of brackish water between the lake and the sea water wedge has been ignored.

It is of significant concern that movement of this brackish water has not been modelled as an incursion of saline water into the lake system would be potentially devastating for the TEC's located there.

The significance of this thrombolite Threatened Ecological Community cannot be overstated. The Thrombolite community of Lake Richmond is a unique assemblage that is found nowhere else in the world. It has been recognised by the Commonwealth government as a (TEC under the Environment Protection and Biodiversity Conservation Act.

This TEC is currently under threat from a range of environmental impacts including nutrient inflow from stormwater, ground water abstraction from domestic bores in the area, dumping of rubbish, disturbance by trampling and climate change.
There is a great concerned that the risks of excavating a marina development adjacent to this freshwater lake will have a catastrophic impact on the thrombolite TEC. The proposed marina development was flagged as a concern in the Interim Recovery Plan for the TEC in 2003.
The IRP's objective is to: "To maintain or improve the overall condition of the microbial community in the only known location."

The late Linda Moore spoke about the thrombolites of Lake Richmond and how they evolved from the stromatolites, as are currently found in Shark Bay WA, during an episode of ABC's Catalyst http://www.youtube.com/watch?v=liKu6rC80gU

<u>Thrombolite Habitat</u>

Current information from the "Interim Recovery Plan No. 122 Thrombolite Community of coastal freshwater lakes (Lake Richmond), Interim Recovery Plan" mentions the Habitat Requirements:

> *"The growth of the community is probably dependent upon continuing supply of fresh water rich in calcium, bicarbonate and carbonate. Calcium carbonate is precipitated out by the biological activity of the microbes. These microbes are likely to include cyanobacteria dominated by Dichothrix sp., and other photosynthetic bacteria that depend on light for growth and survival (L. Moore, pers. comm.). The source of the calcium in the waters of Lake Richmond is probably groundwater that has passed through sand dunes that surround the lake. The catchment for this groundwater is not known. The waters of Lake Richmond vary from 0.04 to 0.14% (0.4 to 1.4 parts per thousand (ppt)) salt and have a pH between 8.3 and 9.3, which is significantly alkaline (Moore 1993)."*

And,

> *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).*

And,

> *Criteria for failure: Significant and sustained detrimental changes to water quality or levels in Lake Richmond.*

From:
http://www.dec.wa.gov.au/pdf/plants_animals/threatened_species/irps/tec/lakerichmond_irp122.pdf

Water Quality of lake Richmond

The salinity of Lake Richmond has not been well defined. In the past salinities have varied as shown in the following table:

Lake Richmond Salinity	Reference
2,000 – 3,500 mg/L	PER Part 1: "Prior to the construction of the drains"; Passmore 1970; CALM 2003b.
400 – 1,400 mg/L	Interim Recovery Plan
1,000 – 1,400 mg/L	Response to Key Marine and Groundwater Issues raised in Submissions (Appendix 2, Figure 2
2,000-3,000 mg/L	Strategen, 2012a: "a zone of brackish groundwater with total dissolved salts (TDS) of 2,000-3,000 milligrams per litre (mg/L) at depth".
(approx. 3,000 – 4,200 mg/L?)	"..about 50 years ago lake salinities were three times higher than they are now and lake water levels were 0.5 m higher than they are at present (Goodale et al. 1998)." Page 3: Additional Response to Lake Richmond and Groundwater Issues.

Water salinity based on dissolved salts			
Fresh water	**Brackish water**	**Saline water**	**Brine**
< 0.05%	**0.05% – 3%**	**3% – 5%**	**> 5%**
< 500 mg/L	**500 - 30,000 mg/L**	**30,000 – 50,000 mg/L**	**>50,000 mg/L**

(from brackish water wiki)

Ground Water Monitoring at Cape Peron

A series of ground water monitoring bores have been installed at Cape Peron to monitor the depth and quality of ground water in the area.

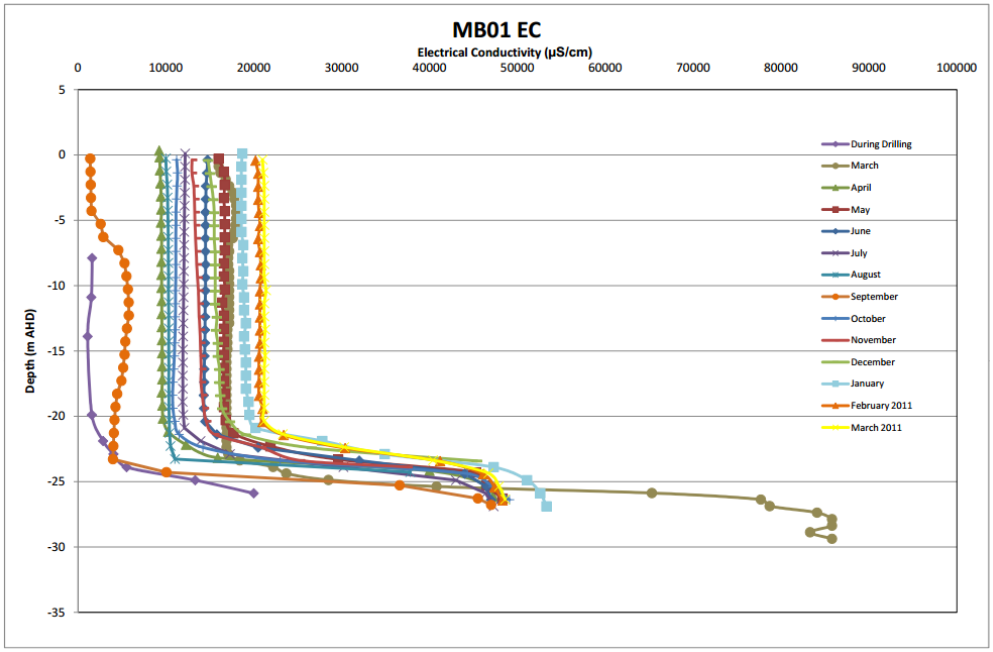
The proponents have included the ground water monitoring Annual Report 2011 on the following website:

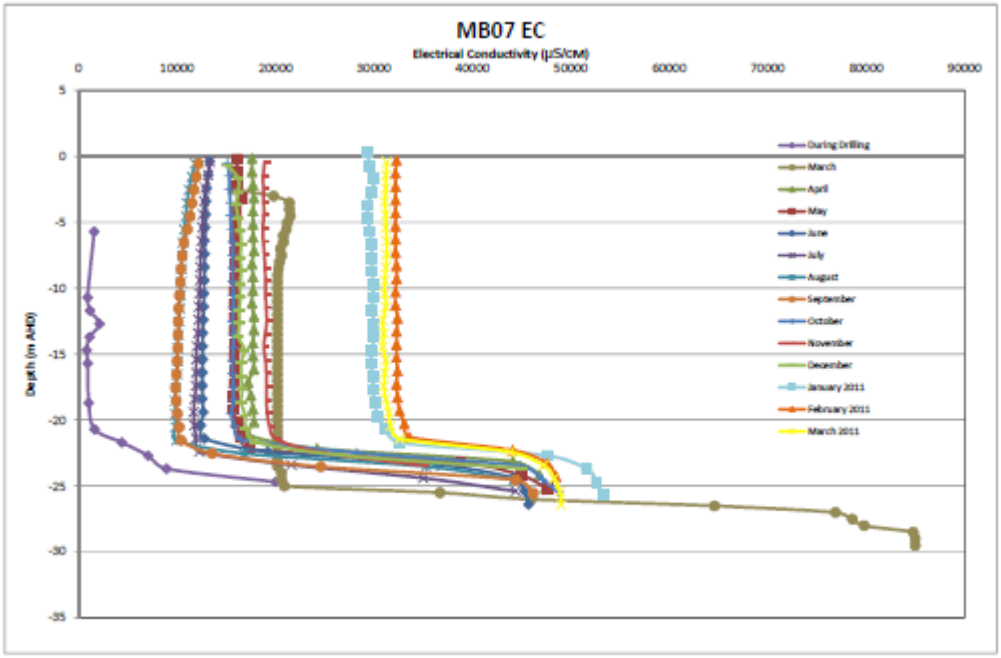
http://www.manglesbaymarina.com.au/sites/default/files/page/2011/11/groundwater_1_mwh_2011_annual_report.pdf

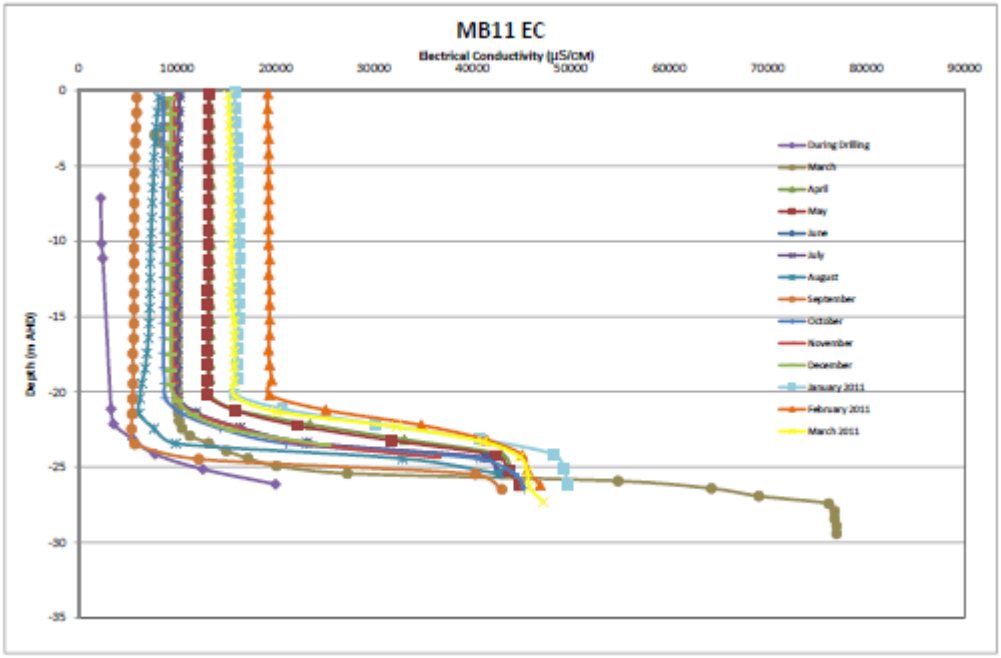
The electrical conductivity (a measure of the waters salinity level) from monitoring bores MB01, MB07, MB11 and MB12 are included below and show the change in salinity with bore depth from March 2010 – March 2011.

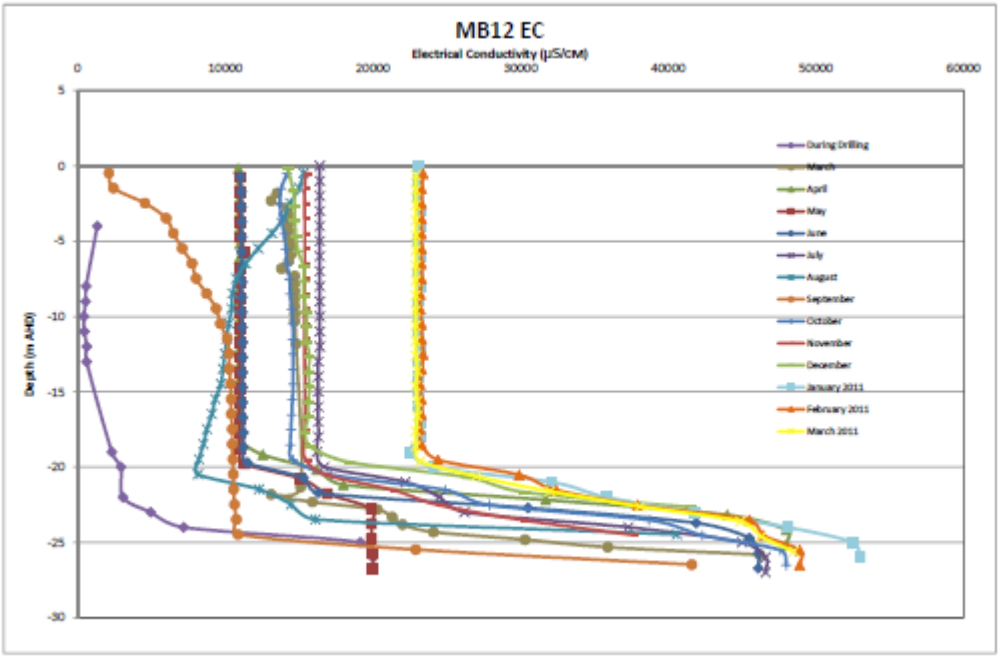
The layout of monitoring bores is shown below:

The salinities recorded from bores in the area have been reported in the "Annual Report - Cape Peron Groundwater Study Prepared for Strategen, MWH April 2011".
http://www.manglesbaymarina.com.au/sites/default/files/page/2011/11/groundwater_1_mwh_2011_annual_report.pdf




MB07 EC
Electrical Conductivity (µS/CM)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
Depth (m AHD)
5
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011


MB11 EC
Electrical Conductivity (µS/CM)
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
Depth (m AHD)
0
-5
-10
-15
-20
-25
-30
-35
During Drilling
March
April
May
June
July
August
September
October
November
December
January 2011
February 2011
March 2011

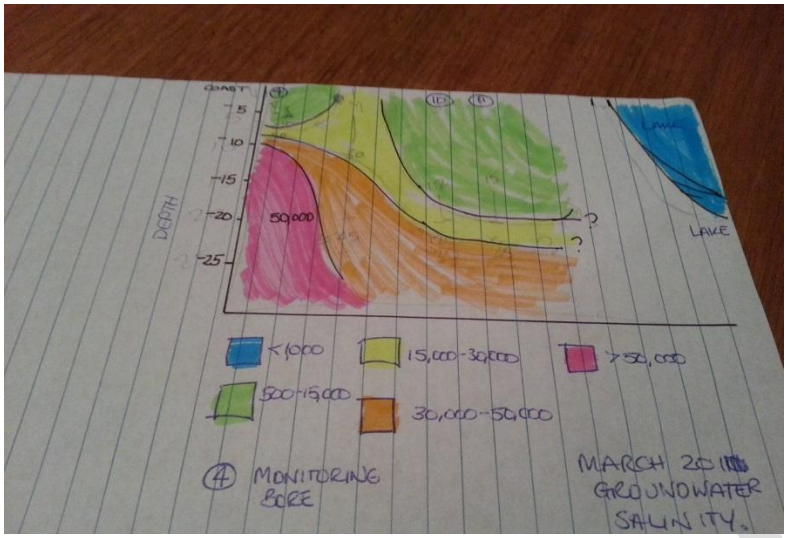


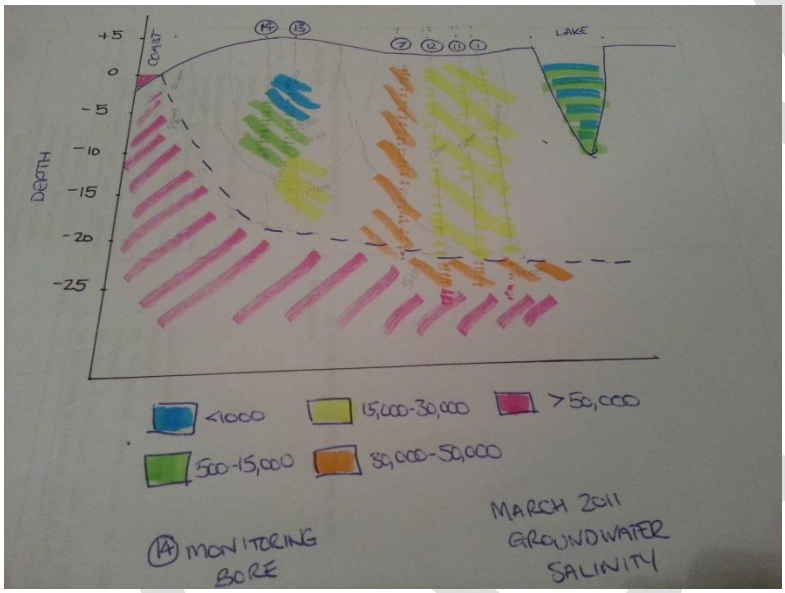
Almost all of the monitoring bores at Cape Peron show elevated salinities. The figure below shows the depth to saline water (>40,000 µS/cm which is equivalent to >25,600 mg/L TDS). Some of the bores with saline water a relatively shallow depths include: MB04 (7-9 m), MB06 (5-7 m) and MB08 (5-7 m); these bores are located adjacent to the coast.

Below: Summary of the range of ground water EC and TDS (0 – 20 m) for bores shown in Figure 3 (from MWS Annual Report 2011), showing brackish water in all monitoring bores.

Bore	EC µS/cm	TDS mg/L
MB01	100 – 20,000	64 – 12,800 mg/L
MB07	10,000 – 30,000	6,400 - 19,200 mg/L
MB11	5,000 – 20,000	3,200 – 12,800 mg/L
MB12	10,000 – 25,000	6,400 – 16,000 mg/L
Lake Richmond	1,000 – 1,400	640 – 896 mg/L
Fresh Water		< 500 mg/L
Brackish level 1		500 to 15,000 mg/L
Brackish level 2		15,000 – 30,000 mg/L
Saline		30,000 – 50,000mg/L
Sea water (brine)		>50,000 mg/L

Based on the Annual Report data for March 2011 the following two cross-sections graphically represent the salinity of groundwater between the sea and the Lake (see layout of bores earlier in this section):





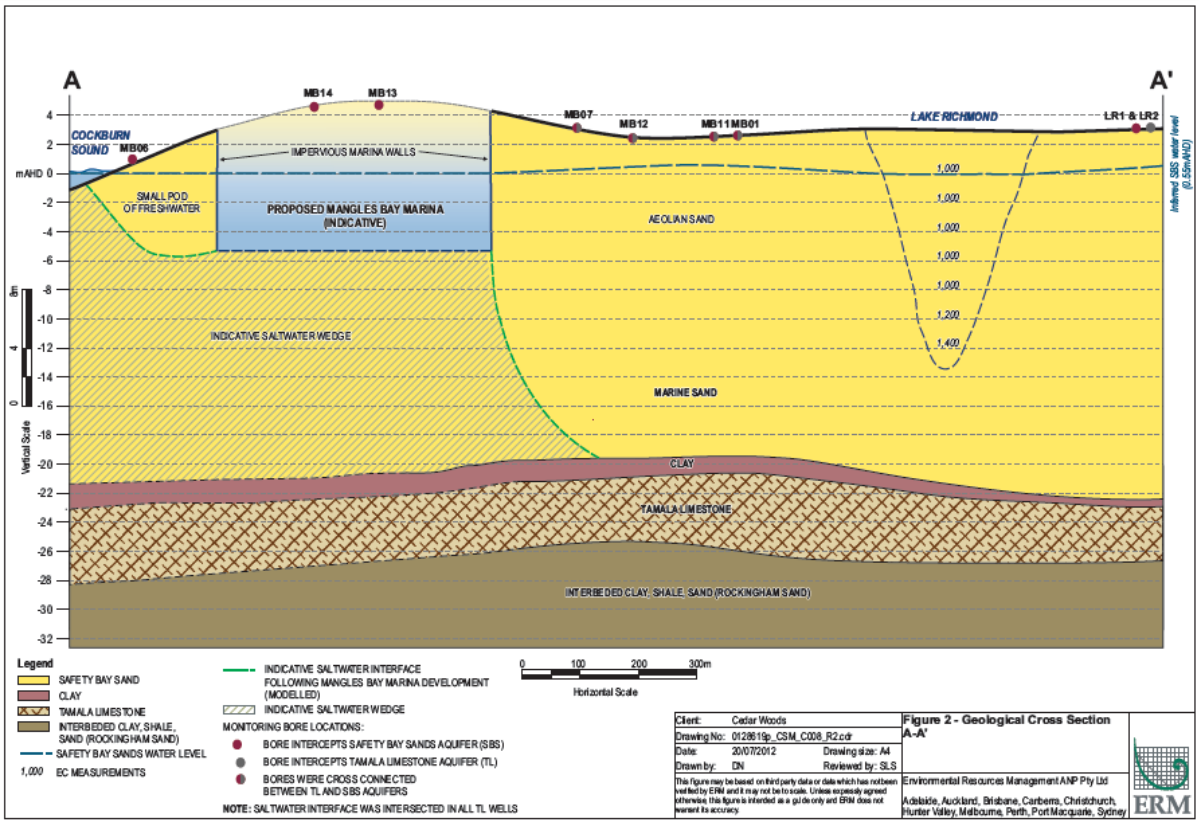
Above: two figures showing the ground water salinity from the Annual Report.

The first cross-section depicts the salinity from MB06, 14, 13, 7, 12, 11 and 1. The cross-section shows a zone of saline water from bores 7, 12, 11 and 1 (in the range of 15,000 – 50,000 µS/cm). The salinity gradient is complex between these bores and cannot be easily understood without further infill drilling with more monitoring bores. There appears to be higher salinities in bore 7 than in bores 14 and 13 which are closer to the coast.
The second cross-section from bores MB4, 3, 10 and 11 shows salinity of 15,000 µS/cm close to the lake from bores 10 and 11.

This salinity level of bores closest to the Lake (MB10, 11, 12, 1) are surprisingly high considering the salinity of water in the Lake is approximately <u>ten times less salty</u> at 1,000 – 1,400 µS/cm. The salinity gradient between these bores and the Lake appears complex and cannot be fully understood with only the current bore data.

<u>Sea Water Wedge Modelling</u>
The proponents commissioned modelling of movement of the sea water wedge intrusion from the coast further inland due to the excavation of the marina and canal development.

The modelling results indicate that the sea water wedge would extend from the marina excavation inland a short distance, meeting the current clay layer (-20 m) under the vicinity of MB07 and MB12, as shown in “Additional Response to Lake Richmond and Ground Water Issues” (Figure 3):



This figure unfortunately is somewhat misleading as the saturated zone is not well defined (saturated and non-saturated sand are both coloured yellow) and there is a simplistic representation of saltwater intrusion. This figure appears to indicate that the “Safety Bay water level” represents the top of a uniform body of ground water, which is far from reality, as we have seen with the ground water varying from fresh to highly saline (Annual Report, and our cross-sections in the previous section).
Further, the “small pod of freshwater” marked on the figure below MB06 is currently saline. March 2011 an EC result from MB06 has measured EC values of 23,000 – 40,000 µS/cm (0.5 – 7 m depth). This error appears to have been introduced during modelling as the scope of the modelling project did not include current salinities above the sea water wedge.
The salt water wedge figure gives the false impression that only the hatched area has increased salinity levels. However this is an over-simplification of ground water salinity in the area.

It is known that Lake Richmond is a freshwater lake on the Swan Coastal Plain and the EC (electrical conductivity, an indicator of salinity) ranges from an EC of 1,000 to 1,400 (0 to -14m), while MB01, which is located only 300 m away from the lake has EC’s ranging from 21,400 – 21,500 at the same depth. Salinity at MB01 rises to 48,400 at -29m (Groundwater modelling and impact assessment 2011, Figure 3 Geological cross-section A-A’).

Scope of Modelling – Assessing the impact of salt water intrusion into Lake Richmond

The real point of contention regarding the modelling of the sea water wedge is the scope of the work and its inadequacy to assess the impact of the development on the water quality in Lake Richmond.

To our great dismay the modelling has solely focussed on the intrusion of the sea water wedge and has ignored the fact that there is a significant saline gradient above and beyond the sea water wedge.

There have been careful words used to justify the use and adequacy of the SEAWAT model, stating that it is "fit for purpose". Of course if the purpose is to model the sea water intrusion but not if we wish to assess the movement of saline groundwater towards the Lake.

For example:

Appendix 4:

> *The Proponent's hydrological consultants (ERM) agree that SEAWAT is fit for purpose. It was developed by the US Geological Survey specifically for saltwater intrusion modelling.*

When looking for further information on the actual scope of the modelling we find a curious explanation, from "PER groundwater modelling and impact assessment" Page 11-12:

> *It should be emphasised that this SEAWAT saltwater intrusion model simulates the salinity that originates from the ocean along the shoreline. The model does not include other dissolved solids from land- and formation related dissolved solids sources (legacy salinity), including those for sodium chloride.*

UBC PLAIN ENGLISH: THE SEAWAT MODEL ONLY SIMULATES MOVEMENT OF THE SEA WATER WEDGE FROM THE COAST. IT DOES NOT INCLUDE EXISTING SALTS IN THE GROUNDWATER.

> *Because the legacy salinity is unrelated to that being provided by present-day saltwater intrusion, there was no need to incorporate this legacy salinity into the SEAWAT model developed for this project.*

UBC PLAIN ENGLISH: THIS MODEL IS ONLY LOOKING AT THE SEA WATER INTRUSION MOVEMENT NOT EXISTING GROUND WATER SALTS.

CONTENTION:

> *"the legacy salinity is unrelated to that being provided by present-day saltwater intrusion"* **RATHER THE GROUND WATER SALINITY IS HISTORICALLY RELATED TO THE SEA WATER WEDGE.**

>THE GROUND WATER SALINITY SHOULD BE INCORPORATED INTO THE MODEL IF THE AIM OF MODELLING IS TO DETERMINE THE CHANGE IN GROUND WATER SALINITY AND ITS POTENTIAL IMPACT ON LAKE RICHMOND GROUNDWATER DEPENDENT COMMUNITIES (ENDANGERED SEDGE LANDS AND THROMBOLITES).

>CURRENT MODELLING HAS ONLY SIMULATED THE MOVEMENT OF THE SEA WATER WEDGE AND HAS NOT ADDRESSED THE CHANGES TO GROUNDWATER BEYOND THE WEDGE AND POTENTIAL IMPACT ON LAKE RICHMOND.

>IF WE WERE TO EXTEND ERM'S "LEGACY SALINITY" CONCEPT FURTHER WE COULD ARGUE THAT THE SALTS IN SEA WATER ARE ALSO "LEGACY SALINITY" AND ARE UNRELATED TO THE PRESENT DAY MARINA DEVELOPMENT, THEREFORE WE COULD MODEL JUST THE FRESH WATER INTRUSION FROM THE SEA…

Legacy Salinity – a new concept in ground water modelling

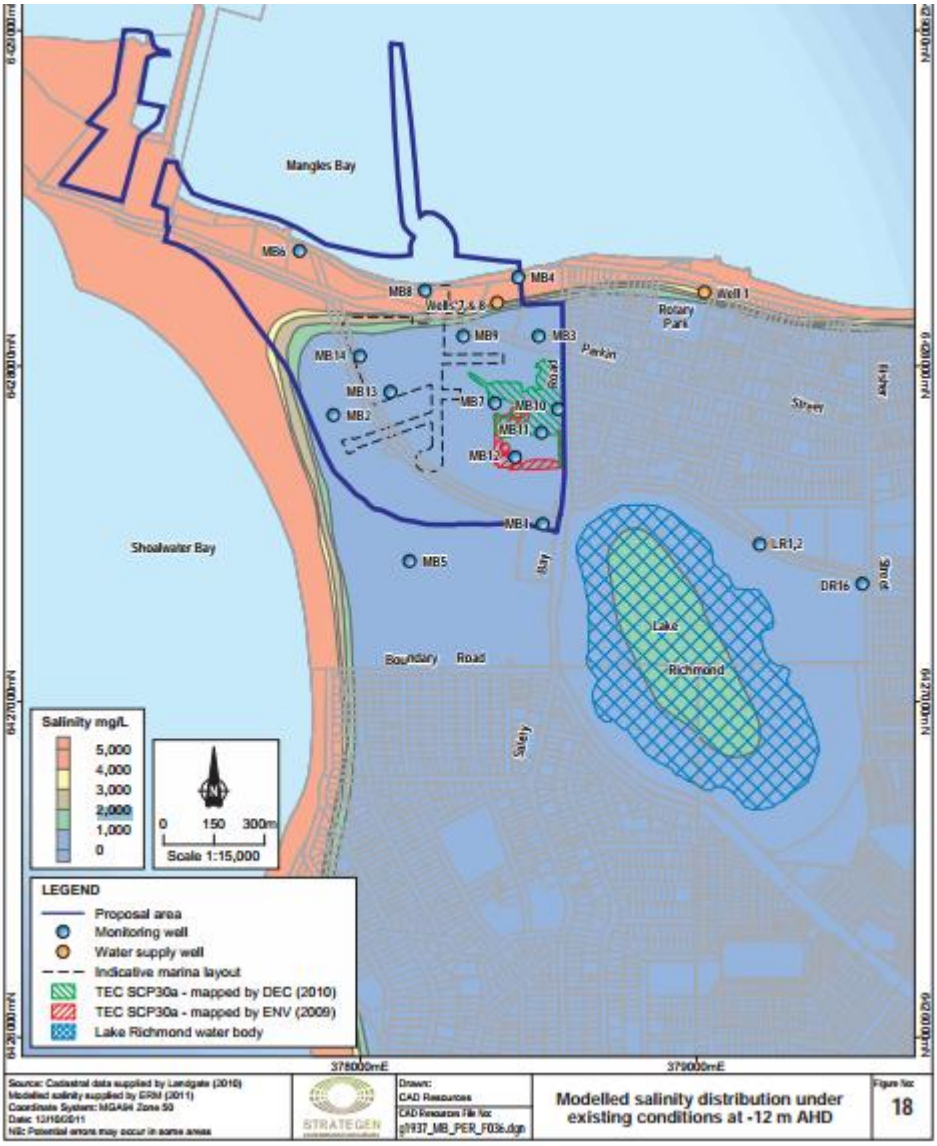
"Legacy salinity" is a new term that only generates 7 "hits" when typed into Google. Only three of these hits refer to groundwater and of those, two relate to this project. The only other reference to "Legacy salinity" is from a paper referring to the limited use of groundwater for production due to a "legacy salinity plume" in the Water Replenishment District of Southern California. There is no proposal to ignore the "legacy salinity" in Southern California in the same manner of ERM's modelling. See:
http://www.wrd.org/WRD%20GBMP%20NOP%20rv1%2009-12-2012.pdf

Given that "legacy salinity" appears to be a new concept in ground water modelling where baseline conditions are conveniently ignored during modelling of groundwater quality impacts, there needs to be a much more rigorous explanation of the concept, preferably in a peer reviewed journal. The authors of this concept should add their names and professional associations to their statements so that the public can make an adequate assessment of the appropriateness and validity of dismissing baseline conditions in this manner.

Ground water modelling results

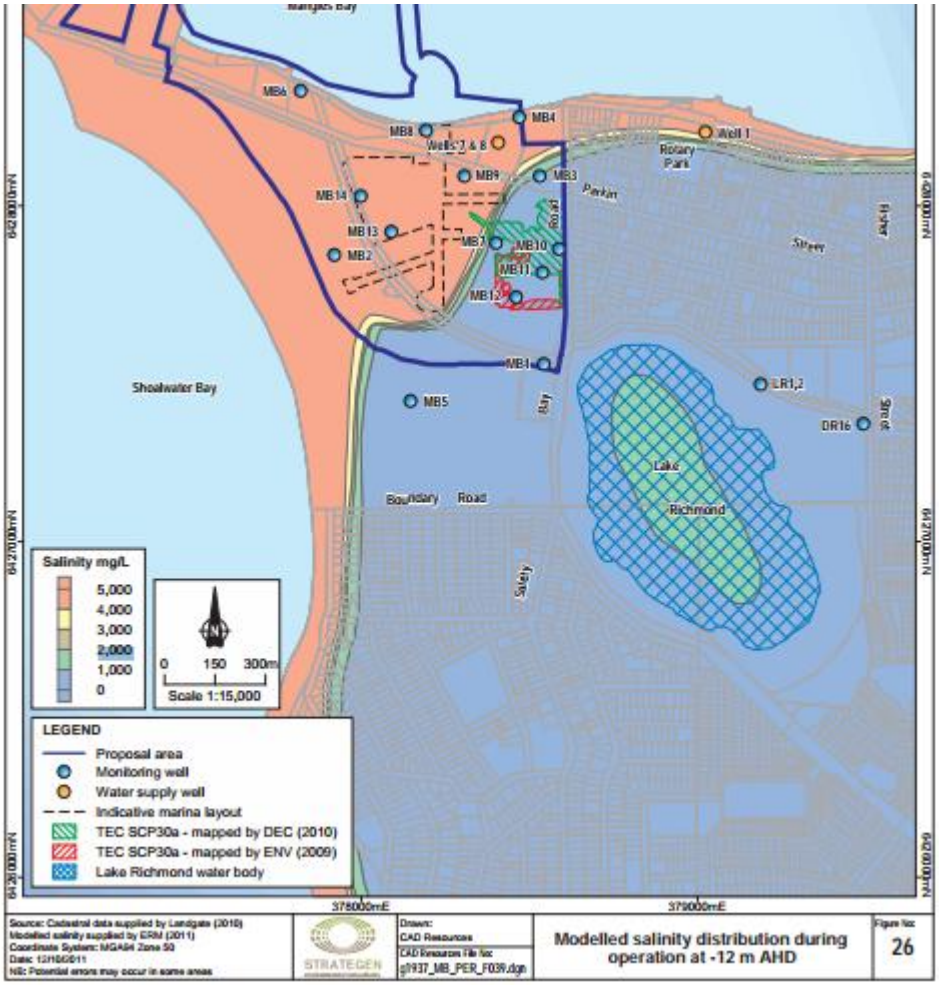
The proponent has presented a lot of information from the ground water modelling, even though the scope of the modelling precludes the use of baseline data on ground water salinity (as detailed above).
The first two figures reproduced below show the modelled salinity at -12 m during current conditions and during operation of the marina. The two figures are dominated by blue indicating an EC of <1,000.

Current salinity in all MB's except for 6, 8 and 4 are shown as <1,000 mg/L (640 µS/cm).
This data does not match the data presented in the Annual Report for ground water sampling where sampling in March 2011 indicated water was ABOVE 640 µS/cm for all bores except for 13 and 14.



Above: PER Part I, Figure 18 (does not match data in Annual Report).

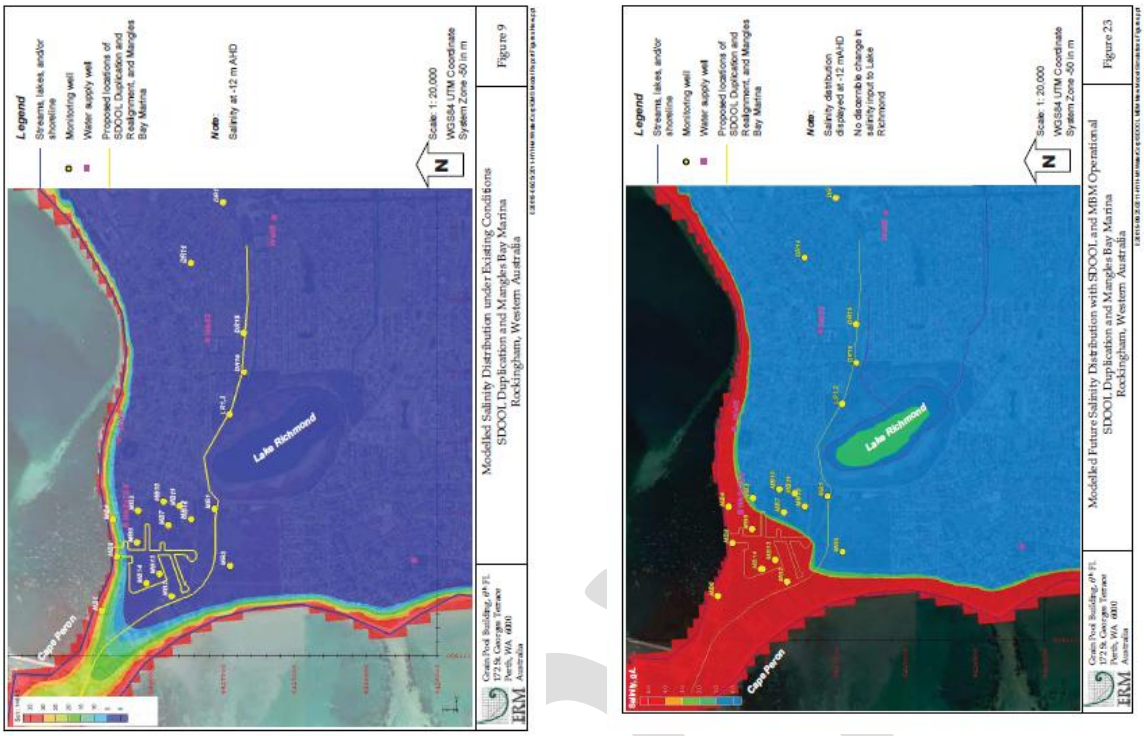
From:
http://www.manglesbaymarina.com.au/sites/default/files/page/2011/11/ced10088_mangles_bay_per_part_i.pdf



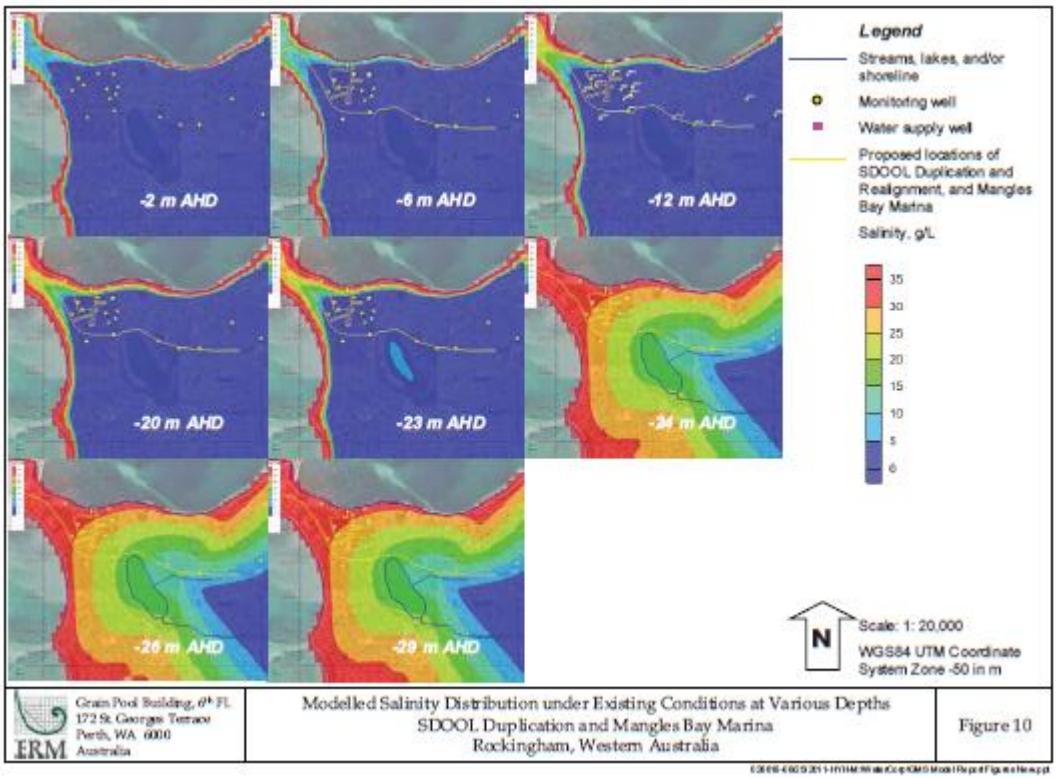
Above: PER Part I, Figure 26. (does not match data in Annual Report)

From:
http://www.manglesbaymarina.com.au/sites/default/files/page/2011/11/ced10088_mangles_bay_per_part_i.pdf

The erroneous salinity figures are further abused when modelling the current salinity for the SDOOL relocation. Salinity at -12 m again is depicted as being very low (key hard to read), which does not reflect reality as described in the Annual Report.



Above: modelled salinity under existing conditions (left) and duplication of SDOOL (right), at -12 m. (Data does not match that shown in Annual Report).



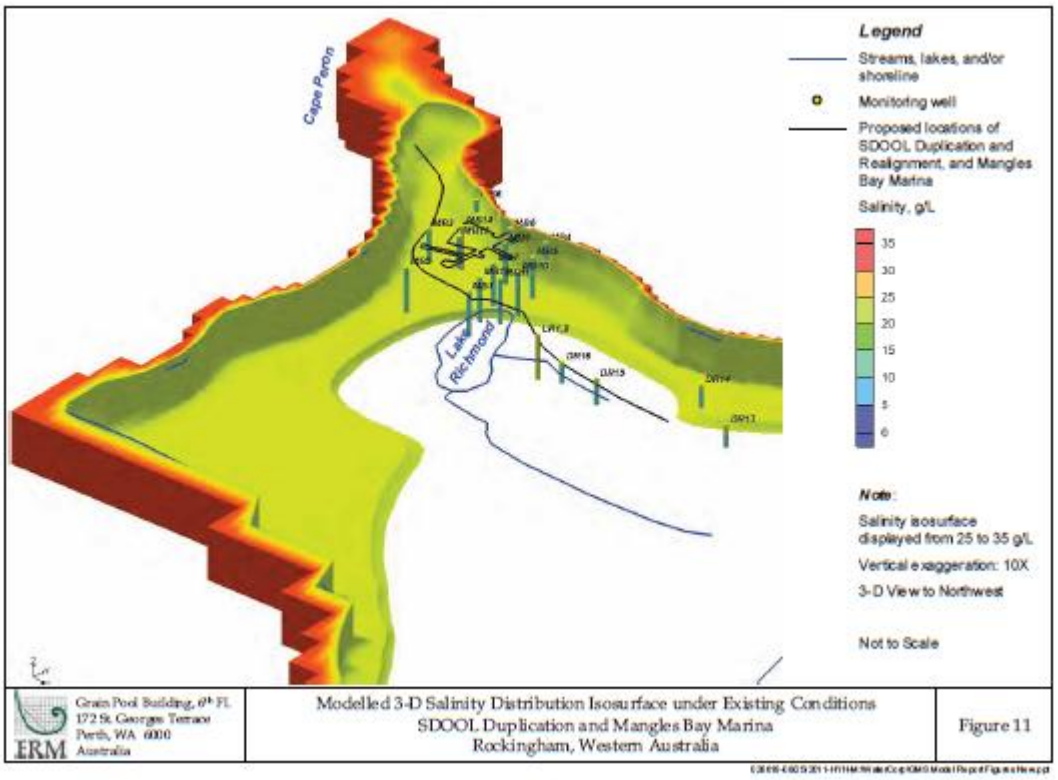
Above from: PER Part I (does not match data in Annual Report).

This Figure is misleading as it states it is showing "Existing Conditions" but these conditions do not match the salinity results in the Annual Report. Salinity levels measured from the monitoring bores

in March 2011 shows a distinct increase in salinity at a depth of 20 m. This Figure shows the high salinity layer occurring at a depth of 24 m. It is assumed that this is an average level, although there is no date on the Figure. Figure 11 (below) is a cross-sectional view and shows the "Average salt water interface during monitoring" at 24 m, although again there are no dates on the Figure.

The ground water monitoring was undertaken during a very dry period with ground water levels lower than expected in an average year. This qualification should be included on the graphs together with the dates of the monitoring program from which the averages were derived. An "average" from a dry year is very different to a "long-term average". From PER Part i:

> *It is noted that 2010 was a particularly dry year in the Rockingham area. Average rainfall for the Kwinana BP Refinery between 1955 and 2010 is 748.9 mm/y r (MWH 2011a). During the one year monitoring period, only 419.6 mm of rainfall was recorded. In the southwest of WA, 2010 had the lowest annual and winter rainfall on record (BoM 2011). Because of this, groundwater and surface water levels were lower than what would be expected in an average year. As an example, water levels in Lake Richmond varied between approximately -0.1 and 0.85 mAHD over the monitoring period, as compared to an average range of 0.2 to 1.2 m AHD (MWH 2011b).*



Above: Modelled ground water salinity (existing conditions, no date). Does not match salinity levels in Annual Report.

EPA Response

The EPA Report states that the altered sea water wedge would not extend underground as far as Lake Richmond. This appears to indicate that the thrombolites can tolerate salinities up to that of seawater and disregards the existence of saline between the sea water wedge and the Lake.
In the Interim Recovery Plan there is mention of the thrombolites surviving in fresh to brackish water. If we accept that brackish water (TDS 2,000 – 8,000) is the upper limit of salinity tolerance then an assessment of the intrusion of seawater (TDS 40,000) is meaningless.

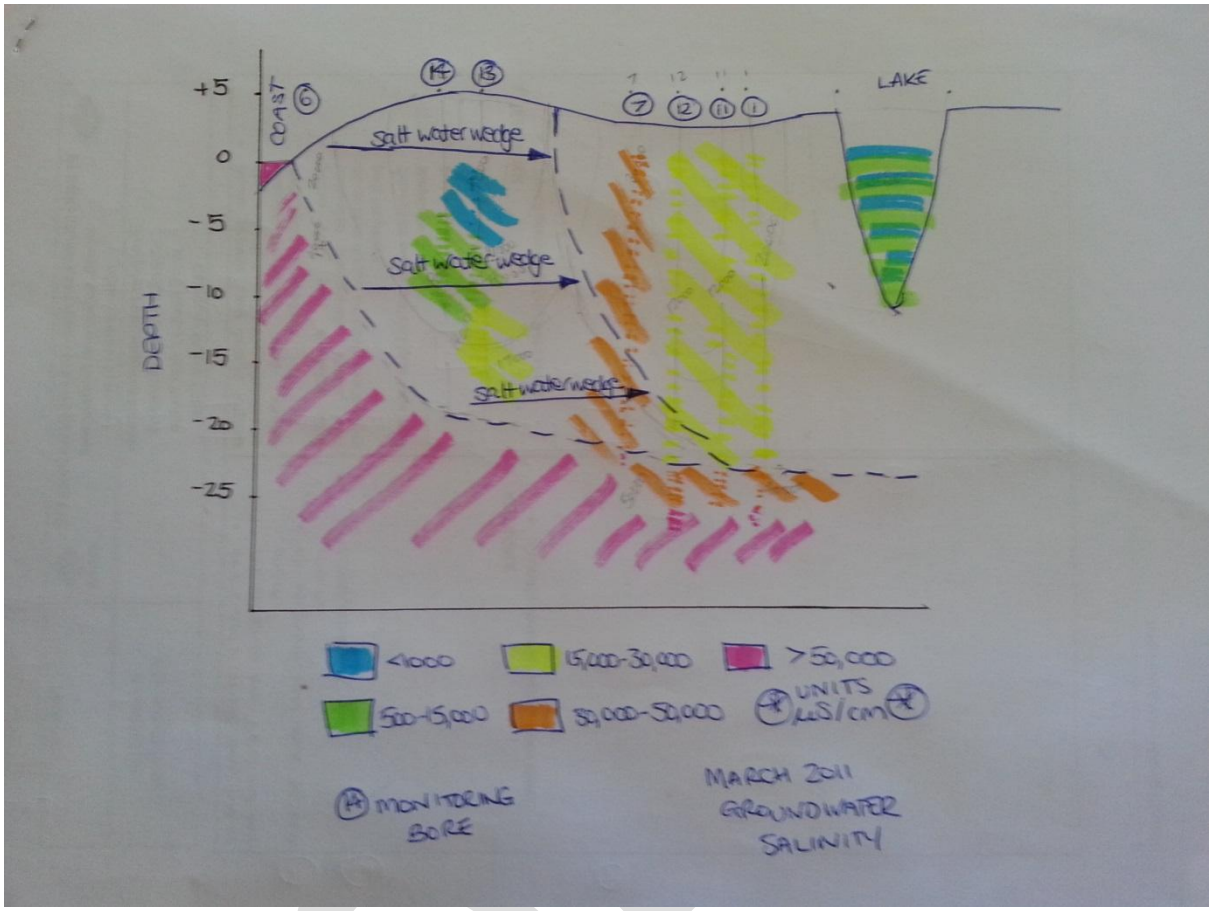
Of course by not including the current baseline levels of salt in the groundwater above the sea water wedge the modelling becomes meaningless and the results presented obfuscate the impact assessment process.

For example MB01, the closest bore to Lake Richmond on the ocean side has TDS ranging from 6,400 – 12,800 mg/L (10,000 – 20,000 µS/cm). This TDS is very high compared to the freshwater in Lake Richmond only 140 m from the Lake. (Conversion formula EC 100 µS/cm = 64 mg/L TDS).

Effect of the sea water wedge on saline ground water upslope

There has been no modelling of the movement of saline water above the sea water wedge which is very disturbing considering the endangered ground water dependant freshwater communities that are located at Lake Richmond, upslope of the development.

The figure below shows the modelled movement of the sea water wedge and the unknown effect on the saline water upslope (shown as orange and yellow). Intrusion of the dense sea water will of course displace the saline water in the soil water pores between the wedge and the lake. What is the nature of this displacement? Will the saline water be displaced upslope towards Lake Richmond increasing the salinity in the freshwater lake and impacting upon the two Endangered communities located there?



Above: Dashed lines show the proponents modelled movement of the sea water wedge and the unknown effect on ground water salinity located above the wedge (shown as orange and yellow).

Even if the salinities in MB's 11, 12, 7 and 1 have been overstated due to drilling through underlying stratigraphic units, the salinity from MB 13 at -10 m is >15,000 µS/cm and of significant concern.

Effect of ground water pH changes to Lake Richmond

Just as the modelled sea water wedge intrusion will move towards Lake Richmond will have an effect on the saline gradient in existing ground water above the wedge, so too will there be a potential impact on ground water pH. An alkaline pH of Lake Water is an essential habitat requirement of the Thrombolites. The change in pH gradient above the sea water wedge is unknown and of critical importance to protection of the Thrombolite community.

Outcome Sought 16a: The EPA Chairman to reject the proposal due to the serious lack of modelling on ground water quality impacts from the marina development proposal. Modelling to date has solely focused in the sea water intrusion from the marina but has specifically not considered any changes to the saline gradient in existing ground water. This is totally unacceptable considering the freshwater Lake Richmond sustains two ground water dependant Endangered communities.

The proponents report and the EPA Report each indicate the modelling is adequate and the results show no effect from the sea water intrusion. Scandalously the modelling not only does no consider the existing ground water salinity but replaces salinity data from the Annual report with the blanket presumption of freshwater, shown again and again as light blue in the colour figures generated by the model.

Peer review only indicates the model is fit for assessment of sea water intrusion not for modelling the impact on water quality of the Lake.

Outcome Sought 16b: The EPA Chairman to request modelling of the movement of brackish water towards Lake Richmond (above the sea water wedge) to assess the impact of groundwater quality on the TEC of Lake Richmond Thrombolites, including the effects of changes in EC, pH, calcium, bicarbonate and carbonate.

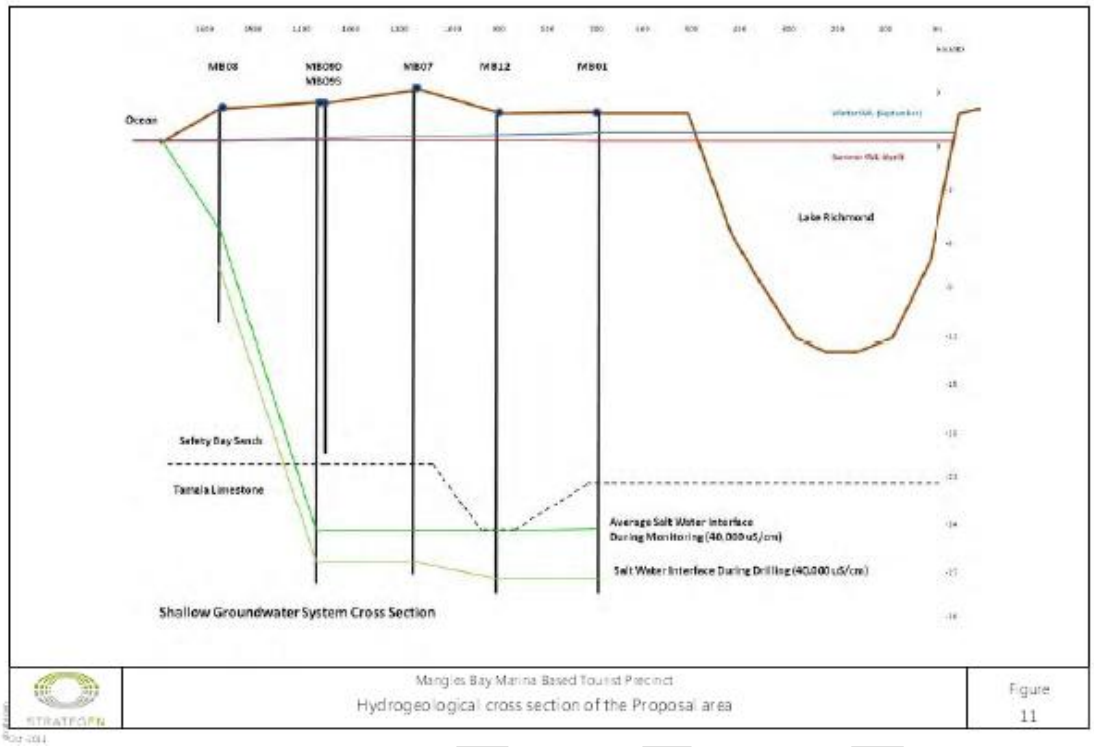
Appeal Grounds 17: Drilling through stratigraphic units may have contributed to higher salinities in ground water from certain bores.

Concern: The proponents have argued that ground water from some bores may be unnaturally high due to the bores being drilled through the underlying highly saline stratigraphic units.

In this case suitable bores must be drilled and the ground water sampled over an adequate time frame to allow assessment of the current baseline salinities in the Point Peron area.

An assessment of potential environmental impact cannot be undertaken if the baseline conditions are unknown.

It is of great concern that a development with potentially devastating impacts on the local environment would not be subject to a comprehensive environmental impact assessment. It is equally concerning that the EPA has not sought clarification from the proponents regarding baseline assessments.



Above: Monitoring bores drilled through stratigraphic units with differing ground water salinities.

Outcome Sought 17: The EPA Chairman request detailed baseline data on ground water quality that is not potentially affected by drilling through underlying saline stratigraphic units.

Appeal Grounds 18: EPA Report Marine Footprint, page 7. Dredged spoil disposal on land: very long settlement basin design which may not achieve design parameters for dewatering due to medium sand falling out of suspension close to single point outlet, affecting the 3 month dredging schedule.

Concern: Dredged spoil is proposed to be placed into a settlement basin with dimensions of 270 x 98 m. The solids would then be removed by excavator to be placed on building blocks around the canals. There are several issues with the proposed methodology:

Settlement of medium grained sand in the elongated settlement basin may occur close to the single pipe outlet and never extend to the far end, which will alter the dewatering parameters. Has settlement modelling been done on this basin design to ensure the 0.1 m maximum depth of material can be achieved? If deposition rates are affected what effect will this have on the duration of the 3 month dredging program?

The underlying sand is described as very porous allowing effective dewatering of the dredged material. What material will be used for the settlement basin bund walls? The bund walls will need to be compacted and water tight to ensure no surface runoff is produced via seepage through the walls. Is material to be brought onto the site for bund wall construction? From where?

The following condition has a potential typographic error:

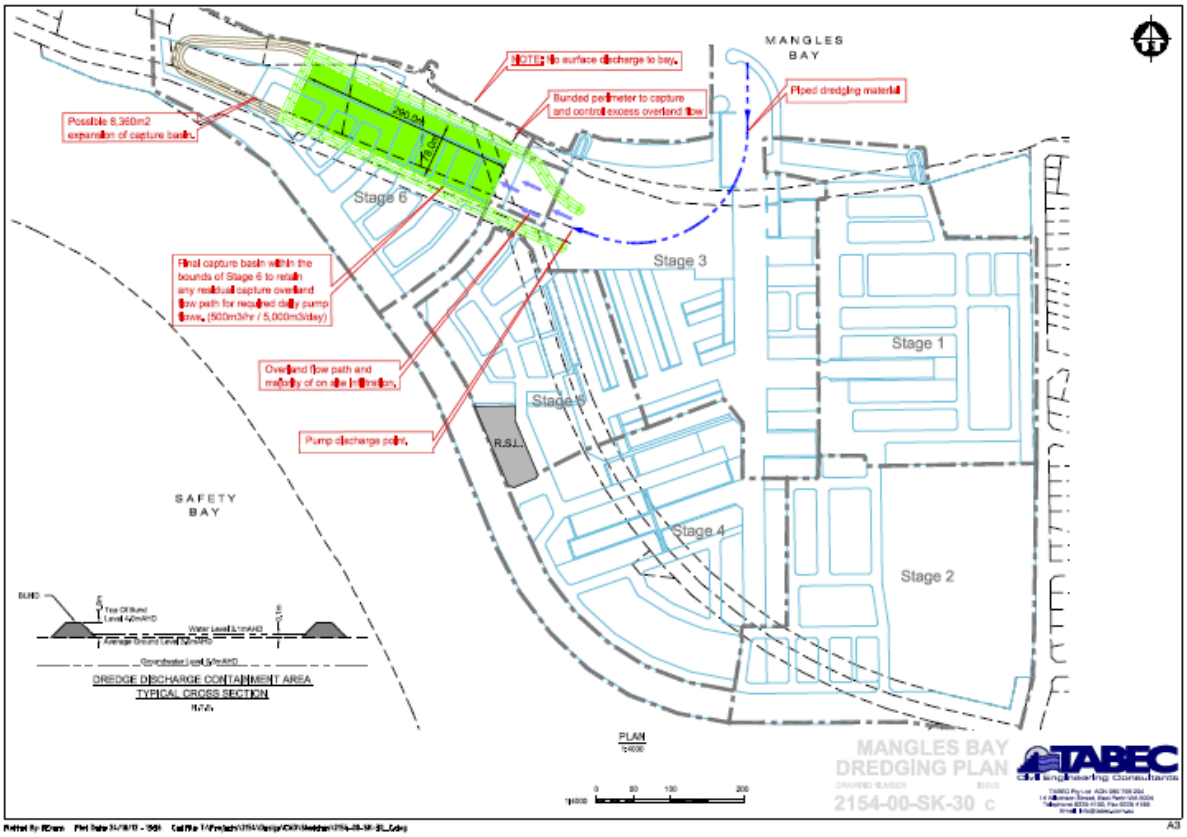
> *EPA Condition 6-1 During Marine-Related Construction Activities the proponent shall implement measures to ensure that there is no discharge of dredge <u>return water</u> to the waters of Mangles Bay, including from the piping of dredge spoil direct to land-based settlement basins.*

Should the underlined phrase be “decant water” or “dewatering”? If it is actually referring to “return water”, where will the water be returning to?

Cedar Woods Response, Appendix 2 (page 7). “Section D: mitigation measures”:

> *“following an assessment of suitability, dredge spoil will be disposed on the Marina site and sea water allowed to infiltrate sands on site and indirectly return to the ocean via groundwater seepage thereby minimising potential for adverse water quality impacts.”*

Is it possible that dredged spoil dewatering in the settlement basins could contribute to marine water quality issues, as the settlement basins are adjacent to the coast (50-100 m, Appendix 5 letter and figure) and ground water is very shallow in this area.



Additional Response to Marine Issues (Appendix 5 Figure)

From: http://www.epa.wa.gov.au/EIA/EPAREPORTS/Pages/1471-ManglesBayMarina-BasedTouristPrecinct.aspx

Outcome Sought 18: The EPA Chairman reject the proposal as it is not clear that the dewatering process will be possible in the specified timeframe given the settlement basin design.

Appeal Grounds 19: EPA Report page 7, Marine Footprint. Level of Tributyltin in sample S6 exceeded EQL for high conservation zones (PER Part ii, page 203-304) is not mentioned in the EPA Report and is not addressed in EPA Conditions.

Concern: There is also a lack of evidence that sediment contaminated with tributyltin (TBT), as identified in the PER Part ii (page 203 and 204), will be dealt with appropriately during dredging. There is a recommendation in the PER that the water in the infiltration ponds be monitored however that is not included in the EPA Report.

It is disturbing that there is no reference to TBT in the EPA Report even when the sample from S6 exceeded the EQG for high ecological protection (Commonwealth of Australia 2009).

PER Part ii, page 203:

> *Re-analysis of the surf ace layer of site S6 confirmed the same sediment concentration of TBT, and an elutriate concentrations exceeded the EQG for high ecological protection (Commonwealth of Australia 2009, EPA 2005a). Although the dredged material will be placed in land-based infiltration ponds at the Proposal area (removed from the marine environment) and meets the TBT screening level, the results f or site S6 surface sediment indicate it would be prudent for the CEMP to include monitoring of water in the infiltration ponds to confirm predictions that overall TBT concentrations will meet marine guidelines.*

PER Part ii, page 204 (Table 36):

Table 36 TOC and TBT concentrations in Mangles Bay sediments S1-S12

Analyte	Sediment				Sediment elutriate TBT
	TBT - original analysis[1]	TBT – re-analysis	TOC	TBT original analysis[1], normalised to 1% TOC[2]	TBT
Units	µgSn/kg	µgSn/kg	%	µgSn/kg	µgSn/L
Laboratory limit of reporting	0.5	0.5	0.01	N/A	0.005
EQG	N/A	N/A	N/A	5.0 (value) 72 (re-sampling trigger)	0.006
NAGD screening level	N/A	N/A	N/A	9.0	0.006
Sites sampled for dredged sediment characterisation					
S1 S	<0.5	-	0.3	0.8	-
S1 M	<0.5	-	0.3	1.0	-
S2 B	<0.5	-	0.3	1.9	-
S2 S	<0.5	-	0.3	0.9	-
S2 M	<0.5	-	0.2	1.1	-
S3 S	0.8	-	0.3	2.5	-
S3 M	0.6	-	0.2	2.7	-
S3 B	1.1	<0.50	0.2	**6.9**	<0.005
S4 S[1]	<0.5	-	0.5	0.5	-
S4 M[1]	<0.5	-	0.2	1.3	-
S4 B[1,*]	<0.5	-	0.2	1.3	-
S5 S	<0.5	-	0.2	1.0	-
S5 M	<0.5	-	0.2	1.3	-
S5 B	<0.5	-	0.1	1.3	-
S6 S	11	11	0.3	**34.4**	**0.74**
S6 M	<0.5	<0.5	0.2	1.3	-
S6 B	<0.5	<0.5	0.2	1.3	-
S7 S	<0.5	-	0.3	0.9	-
S7 M	<0.5	-	0.2	1.3	-
S7 B	<0.5	-	0.2	1.3	-
S8 S[1,*]	<0.5	-	0.3	0.8	-
S8 M[1]	<0.5	-	0.2	1.3	-
S8 B[1]	<0.5	-	0.2	1.3	-
S9 S	<0.5	-	0.5	0.5	-
S9 M[*]	<0.5	-	0.2	1.3	-
S9 B	<0.5	-	0.2	1.3	-
S10 S	<0.5	-	0.5	0.5	-
S10 M	<0.5	-	0.2	1.3	-
S10 B	<0.5	-	0.2	1.3	-
S11 S	<0.5	-	0.5	0.5	-
S11 M	<0.5	-	0.3	0.7	-
S11 B	<0.5	-	0.2	1.3	-
S12 S	<0.5	-	0.4	0.6	
S12 M	<0.5	-	0.4	0.7	-
S12 B	<0.5	-	0.2	1.3	-
Mean	*NA*	*NA*	*NA*	2.3	*NA*
Standard deviation	*NA*	*NA*	*NA*	5.7	*NA*
95% UCL of mean	*NA*	*NA*	*NA*	4.2	*NA*

Notes: [1] Average of data for three field replicates
[*] Average of data for two laboratory duplicates
[2] If TOC was < 0.2%, TBT data were multiplied by five, as per Commonwealth of Australia (2009)
Exceedance of guidelines by individual samples highlighted in italicised bold text

PER Part ii, page 197 (Figure 65) Showing location of S6 sample point (high TBT levels):

Figure 65 Sediment sampling sites within the vicinity of the proposed channel footprint

Outcome Sought 19: EPA reject the proposal as the level TBT exceeds the EQG for high ecological protection (PER Part ii, page 203-304) for channel dredging sample S6. There is no further sampling proposed to determine the extent of TBT contamination or sampling of infiltration water from the dredged material placed in the settling pond creating an unknown risk of environmental harm from The EPA Report does not contain any reference to the high TBT level which is a significant issue the Minister for Environment should be made aware of.

Appeal Grounds 20: EPA Report Section 3.5 Hydrological processes and inland waters environmental quality (Lake Richmond), Submissions: Climate Change (page 51). Climate change impact was intentionally not assessed by the proponent and the EPA has failed to request an assessment.

Concern: The WAPC's Development Control Policy 1.8 "Canal estates and artificial waterway developments" (Section 7.2 Canal Walls and breakwaters) states:

> *"For all artificial waterways, all land retaining structures and breakwaters shall:*
>
> *…take account of predicted climate change sea level rise under State Coastal Planning Policy 2.6."*

However, even with this prompting the cumulative environmental impact of climate change and the marina proposal was dismissed by the Proponent as "not necessary". This is highly unusual and appears to have been accepted by the EPA without question.

The key unprofessional and shocking statement can be found in the proponent's submission "Response to Key Marine and Groundwater Issues Raised in Submissions" in Appendix 4 (page 3): "ERM/Strategen detailed response to key groundwater submissions":

> *"It is true that scenarios to account for future climatic conditions have not been undertaken. This is because such scenarios are not necessary. Any potential impacts from climate change are unrelated to the marina."*

This position does not take into account the cumulative impacts of the marina development and climate change. The canal development will increase the salt water wedge inland towards Lake Richmond, as shown in Figure 1. Climate change may affect the salt water wedge due to sea level rise and reduced rainfall and associated fresh groundwater recharge. Surface inflow has also been predicted to be reduced due to the development. These are significant issues that deserve to be analysed, modelled and assessed for environmental impact on the TEC's and priority vegetation.

The numerous reported instances of environmental harm and associated environmental "offsets" listed in the EPA Report demonstrates the massive disturbance of the natural environment this proposal will have if approved. The compounding impact of climate change due to increased ground water salinity, surface water temperature increases, heat stress and water stress on rehabilitation areas are also highly significant issues with unknown impacts.

The environmental offsets of re-establishing TEC's and priority vegetation is a difficult task in the best conditions, however when considered in the context of a drying climate and increasing ambient temperatures there needs to be some consideration to the impact that climate change will have on rehabilitation success.

The tree deaths caused during the 2010-2011 summer shocked residents of Perth and the number of mature trees that turned brown and died was irrefutable proof of the devastating effects of climate change. At this time, as custodians of the natural environment in Western Australia, we need to be diligent in protecting our remaining natural areas from disturbance and maintaining and enhancing ecological corridors to allow movement of fauna and flora genetic material during times of stress and climate change. Management of fire, feral animals, weeds, land clearing and dieback all require research and operational funding. To be considering a state funded marina and canal estate in an area of natural coastal bushland is incongruent with the urgent funding issues of environmental sustainability.

The EPA Report does not contain any specific assessment of climate change issues related to the proposal. Climate change is only listed in the Report (Appendix 3) as an issue raised by government agencies and public comments and that these issues are covered in sections 3.4 and 3.5; again these sections do not contain any assessment of potential climate change impacts to vegetation or ground water.

It is very difficult to believe that the WA EPA does not consider climate change to be an issue worthy of consideration when a development of this size is impacting on such a large area with high conservation values and approval has been recommended based on rehabilitation offset conditions.

Also on page 3 of Appendix 4 is this dismissive and highly unusual statement regarding climate change and predicted sea level rise:

> *"The Western Australian Planning Commission, Draft State Planning Policy 2.6 – State Coastal Planning Policy (February 2012) confirms that allowance for sea level rise should be based on a vertical sea level rise of 0.9 metres over a 100-year planning timeframe to 2110. A sea level rise of 0.9 m will inundate any coastal areas which are <0.9 m above present sea level. It is not known if there are such areas present on Cape Peron however, these areas may be easily identified from a topographic map."*

This response is not detailed enough. Of course there will be areas of Cape Peron that are less than 0.9 m, as it is a coastal area with beaches and dunes, no sea cliffs. A topographic map indicating areas at Point Peron <0.9 m above present sea level could have easily been provided by the proponent as topography should be a key factor in the description of the existing environment.

It is the responsibility of the proponent to provide information to the public and the EPA regarding the existing environment and impact assessment. If the proponent does not do this the EPA should point out the omissions to the proponent. Development applications should not be recommended for approval by the EPA if this information is not provided.

Does the Minister and the Public have to Google where to buy a topographic map of Cape Peron to determine the distribution of land below 0.9 m elevation? Figure out the height of the marina walls, model ground water impacts on the environment due to sea level rise?

This gaping hole in the EPA Report is disappointing and can only result in the public becoming disenchanted with the EPA environmental assessment process and its ability to protect Western Australia's environmental values.

Outcome Sought 20: The EPA Chairman to reject the proposal as it does not address the cumulative impact of the proposal and climate change, in regards to issues such: as sea level rise and impact to ground water dependant vegetation and communities, predicted rehabilitation success of environmental offsets in a drying and warming environment plus loss of ecological linkages for movement of fauna and flora in a changing environment, effect of bushfire incidence and changes to weed invasion.

Appeal Grounds 21: EPA Report, page 5 Soil Contamination. Misrepresentation of soil sampling results.

Concern: There has been a misunderstanding by the EPA of the data collected by the proponent in regards to soil sampling, EPA Report page 5:

> *Testing of the marine sediments determined that no contaminants would be present in the dredge spoil.*

This comment cannot be true as the maximum depth of soil sampling for acid sulphate soils was 3 m and proposed dredging is to a depth of -3.5 m. Section 7.2.2 of the Contaminated Soil / Acid

Sulphate Report specifically states that <u>further sampling will be required if marina excavations extend below 3m.</u>

Acid sulphate soil sampling guidelines specify:

> *6.4 Depth of sampling points: Soil sampling locations need to extend to at least one metre below the maximum depth of disturbance.*

As sampling was only to only to 3 m maximum and dredging is proposed to 3.5 m, the extra + 1 m from the guidelines equal 4.5 m sampling for acid sulphate soils.

Also the Contaminated Soil / Acid Sulphate Soil Report Section 7.2.1 describes hotspot areas yet to be sampled:

> *Strategen makes the following recommendations:*
> *1. That the sampling within the Mangles Bay Fishing Boat Club and Cruising Yacht Club (identified 'hot-spot' areas) be conducted prior to development of the site. The additional sampling is required to determine whether the soil in these areas meets assessment criteria for the re-use or disposal of excavated soil during development of the site(s). Sampling is recommended at the following locations:*
>
> *(a) Above ground fuel storage tanks (Plate 9, Plate 10 and Plate 15). Analysis for Hydrocarbons (TPH, BTEX and PAH).*
>
> *(b) Floor of re-painting area (Plate 17). Analysis for Metals (Cadmium, Chromium, Copper, Lead, Mercury and Zinc) and Organotins (Monobutyltin, Dibutyltin and Tributyltin).*
> *(c) Floor of winch-house (Plate 22). Analysis for Hydrocarbons (TPH, BTEX and PAH).*

Further the statement "*Testing of the marine sediments determined that no contaminants would be present in the dredge spoil"* is a disturbing overstatement as contaminant sampling was only undertaken at 1 m depth (Section 6.1.2).

Outcome Sought 21: The EPA Chairman to request soil sampling for acid sulphate soils below 3 m for sediments to be dredged for marina construction. Delete text on page 5 of EPA Report "*Testing of the marine sediments determined that no contaminants would be present in the dredge spoil".*

Appeal Grounds 22: EPA Report page 52. Funding Expert Advisors research on condition of a positive outcome.

Concern: Professor Lindsay Collins of Curtin University provided an assessment of the impact of decreased water table on the thrombolites of Lake Richmond (a threatened ecological community under the Commonwealth EPBC Act) plus a peer review of the groundwater assessment. EPA Report page 52:

> *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).

Professor Collins peer review is referred to in "Additional Response to Lake Richmond and Ground Water Issues", page 2:

> and during the slow isolation of the lake system over the last 2-3,000 years. The PER presented a description of the stratigraphy of the groundwater bores that were installed between the project and the Lake and concluded that there was no indication of the occurrence of such a channelway. In his peer review of the groundwater assessment in the PER, Professor Lindsay Collins of Curtin University, acknowledged that,
>
> > The preparatory work undertaken in advance of the project and its planned excavation of a marina basin is adequate and consideration is given to risks such as saltwater intrusion and lake outflows, including issues such as potential karst development in the Tamala Limestone and assessment of porous and permeable pathways in the Safety Bay Sand. However as part of risk mitigation it would be appropriate to undertake additional geotechnical assessments before commencement of marina excavations.

The detail of the proponent engaging Professor Collins to study the thrombolites is described in "Response to Key Marine and groundwater Issues Raised in a Submissions", page 10, together with future funding of research:

> However to add further confidence to these predictions, the Proponent has engaged researchers from Curtin University, led by Professor Lindsay Collins to:
>
> - determine the geodetic survey level within which thrombolites exist on the margins of Lake Richmond
> - map the location and condition of the thrombolite community all around the Lake margin to serve as a baseline for future monitoring and investigation of effects of water level fluctuations on thrombolites.
>
> Furthermore, the Proponent has indicated willingness to contribute a funding grant to Curtin University for research into thrombolite ecology and population dynamics in South Western Australian lakes. Professor Collins has also reviewed the above assessment of likely impact on the thrombolite community and has given qualified support to the assessment (pers. comm.). Professor Collins' peer review and research proposal are anticipated in the near future and will be provided once received. Conclusion

That the funding is conditional on approval of the project as quoted in the Report "Additional Response to Lake Richmond and Groundwater Issues" page 5:

> *"immediately the Project commences construction the Proponent will establish a funding grant to Curtin University for research into thrombolite ecology and population dynamics in South Western Australian lakes"*

Please note there is no accusation of interference of any expert opinion in this proposal. However, is it normal practice to seek expert advice which comes with the overt promise of ongoing research funding to the expert if the proposal is approved? There is a risk of skewing independent advice when financial inducements are offered dependent upon a particular development outcome.

Outcome Sought 22: The EPA Chairman to ensure the independence of expert opinion by requesting that the proponent, in regards to impact on the thrombolite TEC:

- **Engage an independent expert to carry out a peer review of the work; or**
- **Guarantee future research funds independent of the development application outcome; or**

- **Add a declaration to the EPA Report that the expert will have future research projects funded by the proponent if the project is approved (this is the least desirable option, but it is an important fact to include in the EPA Report to the Minister if the first two suggestions cannot be fulfilled).**

This outcome is required as future funding of thrombolite research is conditional upon a development approval as described in the Proponents "Additional Response to Lake Richmond and Groundwater Issues" page 5.

Appeal Grounds 23: EPA Report, page 7 Key Proposal Characteristics: Marina Design. Does not comply with best practice marina design specified in the WAPC's Development Control Policy 1.8 "Canal estates and artificial waterway developments" (Section 7.10 Maintenance Dredging).

Concern: The WAPC's Development Control Policy 1.8 specifies the requirements for developers of canal estates to consider the impacts of maintenance dredging. The EPA Report addresses the modelling of and impacts arising from marina and channel construction dredging, however it does not address ongoing maintenance dredging to maintain navigable depths in the marina and channel.

This is significant as the impacts assessed for the construction dredging have been assessed as a one-off disturbance event over a period of 3 months. The schedule and duration of ongoing maintenance dredging is unknown and therefore environmental impacts to marina fauna, sea grass and water quality cannot be assessed with any accuracy.

What is known is that the channel and marina proposal has not been designed to minimise the need for maintenance dredging as required by Section 7.10 (below). Best practice marina and canal design includes "Basin depths that are not deeper than the open water or channels to which the basin is connected and never deeper than the marina access channel" (Guidelines for Marinas in the Great Barrier Reef Marine Park). This proposal has a marina basin and channel of 3.5 m depth (minimum marina depth 2.7 m), EPA Report page 7.

> *7.10 Maintenance dredging*
>
> *Proponents shall minimise the need for maintenance dredging in their designs, particularly in the connecting channel. The volume, cost, nature of the maintenance dredging material and disposal options shall be clearly identified prior to the finalization of the local scheme amendment.*
>
> *The proponent shall also clearly identify any environmental impacts associated with maintenance dredging prior to project approval. This shall include changes to water quality, risks to marine fauna and impacts on benthic habitats. The proponent shall also prepare a maintenance dredging monitoring and management plan (Including cumulative impact of repeated dredging) that includes environmental values to be protected, environmental quality objectives, levels of protection and environmental quality criteria to be achieved and contingency management strategies for ensuring these objectives are met.*

Mangles Bay is relatively shallow in the vicinity of the proposed marina and channel, as stated in "Response to Key Marine and Groundwater Issues Raised in Submission" (Appendix 2, page 28):

"Effects are mainly in the very shallow waters (i.e. 1–2 m deep) west of marina."

Outcome Sought 23: The EPA Chairman reject the proposal based on the lack of detail regarding maintenance dredging as required <u>prior to project approval</u> by the WAPC's Development Control Policy 1.8, Section 7.10 Maintenance Dredging.

Appeal Grounds 24: EPA Report, page 7 Marina Design. Proposal does not meet the WAPC's Development Control Policy 1.8, "Canal estates and artificial waterway developments", and canal estates have been banned in several states of Australia.

Concern: There are a number of best practice marina design standards that do not appear to be applied in this proposal. Additional Response to Lake Richmond and groundwater Issues, November 2012 (Figure 1):

7.12 Public Open Space - The foreshore reserve shall ensure public access to the natural waterway unless conservation requires otherwise.

Figure 1 shows a chandlery, boat club and residential land immediately adjacent to the waterway, in direct contravention of allowing public access.

Flushing of waters was predicted to be up to 13 days for areas at the end of the canals.

Canal estates have been banned in NSW and Victoria and there is a moratorium on new canal estates in Queensland. Why are canal estates being proposed for Western Australia when modern thinking sees these developments as environmentally unsustainable?

A proposal to dredge a natural landscape to create shallow warm water gutters with high nutrient levels is ludicrous. That the canals will have stagnant water with 13 day flushing times creates a horrendous vision.

See: http://www.legislation.nsw.gov.au/fullhtml/inforce/epi+596+1997+cd+0+N

1 Name of Policy:

This Policy is State Environmental Planning Policy No 50—Canal Estate Development.

2 Aims, objectives etc

This Policy aims to prohibit canal estate development as described in this Policy in order to ensure that the environment is not adversely affected by the creation of new developments of this kind.

And From: http://tasmaniantimes.com/index.php/article/victoria-bans-canal-estates

The Victorian Coastal Strategy 2008, launched yesterday, prohibits the development of housing estates around man-made canals in a bid to protect estuarine environments. Development will also be avoided in low-lying coastal areas.

This follows an earlier ban on canal estates in NSW and a moratorium on canal estate construction on Queensland's Gold Coast.

Professor Bruce Thom AM, FTSE, (Member, Wentworth Group of Concerned Scientists; President, Australian Coastal Society) gave a talk in 2010 (before the ban in Victoria) titled: "COASTS: how best can we adapt to the challenges of climate change?" in it he stated:

"While canal estates are banned in one state (NSW), they flourish in others causing damage to ecosystems and placing properties at risk of future inundation."

And,

In a recent report, it is conservatively estimated that 250,000 residential properties are at risk of inundation or erosion if sea level rises by 1.1m by 2100 (Department of Climate Change, "Climate Change Risks to the Australian Coast", November, 2009).

And,

Coastal management and planning into the future should not be seen as just a problem for natural resource managers. It is much more. It is connected with a range of government interests and as such must be "mainstreamed" into finance, audit, infrastructure, economic

management, social welfare, health, amenity provision and education as well as Natural Resource Management (NRM). The coast under global warming represents a total societal challenge affecting where we as Australians work, live and play.

And,

4. Provide for a secure, long term funding base in the form of a Commonwealth Adaptation Fund similar to the Futures Fund for Commonwealth employees which would be available to assist local and regional communities meet the structural adjustment needs that they will encounter as the new climate "era" adversely impacts on property, infrastructure, jobs and lifestyles (for instance the need to build barrages like those on the Thames and to nourish beaches).

http://www.wentworthgroup.org/uploads/BruceThomSTCTalkApril2010.pdf

There does not appear to have been a rigorous assessment of what a canal estate means for both the environmental health of the terrestrial and marine environment at Cape Peron/Mangles Bay and the socio-economic impacts of a canal estate in a climate of rising sea levels.

The State appears to be happy to create a huge financial liability for tax-payers for such a reckless coastal development when environment protection is already underfunded in WA, eg Bush Forever was not been fully implemented within 10 years as promised.

Basin Design: Minimise vertically faced structures. Vertically faced structures lead to reflection of wave energy, causing confused seas and high wave energy within the berthing area.

The impermeable poly-vinyl sheeting walls of the marina to allow wet excavation are presumably vertical. Has the high wave energy from this design been considered by the proponent?

Marina Entrance

Entrance channels should be straight; aligned into prevailing winds; and not in an area of shoaling. The entrance channel should be as straight as possible and follow an existing natural channel if available. The entrance channel should also be aligned in the direction of prevailing winds to promote mixing. The entrance should not be located in areas of shoaling as increased maintenance dredging is required and sills between the marina and open water can form causing reduction in flushing.

The entrance through the breakwater has a very tight corner. What impact will this have on non-motorised sailing boats trying to enter the breakwater, especially during times of high wind, such as summer afternoons? What impact will this have on motorboats in high wind conditions trying to enter the breakwater that have to make a sharp turn?

What is the risk to boats entering and exiting the breakwater due to the tight curve in terms of visibility and passing distance?

A tightly curved breakwater entrance does not meet the guideline for straight entrances aligned with prevailing winds.

Entrance channel width should conform to AS3962-1991. While the width of entrance channels is clearly dependent on many factors, AS3962-1991 states that the channel should be the greatest of 20 m, or, the length of the longest boat to use the marina plus 2 m, or 5 times the beam of the broadest monohull to use the marina. For marina basins of say 200 to 300 berths the entrance channel should have a minimum navigable width of 30 to 50 m in exposed conditions.

What is the width of the entrance channel opening in the breakwater?

Fuelling Facilities - The location of a fuelling facility is a critical decision with respect to safety. It should be located to be easily accessible by visiting and passing boats, without access through the main berthing area. The facility should be located to leeward of the marina with respect to the prevailing wind in the boating season and to leeward of exits to permit safe evacuation of boats in the event of fire. They should preferably be in the area of greatest flushing in order to minimise water quality impacts.

Are the refuelling facilities located near the chandlery? If so they will be on the western side of the marina and pose a danger to boats exiting the marina in the case of a fire at the refuelling facilities during summer afternoon when the Fremantle Doctor blows from the west. If not, where are they to be located?

These guidelines are from Environmental Guidelines for Marinas in the Great Barrier Reef Marine Park:

http://www.gbrmpa.gov.au/outlook-for-the-reef/great-barrier-reef-outlook-report/outlook-online?sq_content_src=%2BdXJsPWh0dHAlM0ElMkYlMkZ3d3ctcmMuZ2JybXBhLmdvdi5hdSUyRl9fZGF0YSUyRmFzc2V0cyUyRnBkZl9maWxlJTJGMDAxNyUyRjIwOTYlMkZtcF8wMTNfbWFyaW5hX2Rlc2lnbi5wZGYmYWxsPTE%3D

Outcome Sought 24: EPA Chairman to reject the marina and canal estate proposal as canal estates are banned in NSW and Victoria and a moratorium has been placed on new canal estates on the Gold Coast. The risk of sea level rise and best practice marina design has not appeared to have been fully considered along with vertical marina walls not dissipating wave energy, high flushing times, straight opening to breakwater creating difficulties for boats during high wind conditions and access to public open space. The EPA should advise the Minister for Environment to ban canal estates in Western Australia.

Appeal Grounds 25: EPA Report to Minister of Environment. Ongoing Maintenance Costs to the State of Western Australia not fully assessed.

Concerns: There are a number of ongoing maintenance issues with the marina and canal development that have not been estimated and presented during the Public Environmental Review. The EPA Report does not include any detail on the economic and social cost:benefit of the proposal which creates a vacuum when trying to balance the high cost of environmental harm from the proposal against an unknown social/economic benefit.

The high cost of developing the proposal includes the initial costs that have already been incurred such as planning approval documentation, environmental studies, community and other agency consultation. The construction costs if the proposal goes ahead will be very high due to the large scale marina development, road and residential lot construction and pipeline realignments.

Environmental offsets proposed are of a major size and complexity and includes sea grass research, rehabilitation trials of terrestrial flora, ground water and marine water monitoring, funding research of the thrombolite community of Lake Richmond.

Ongoing maintenance costs will include: dredging the marina and channel for boat access, potential treatment of stagnant water in the marina, topping up Lake Richmond if the ground water drops, weed control on rehabilitation sites, and the extraordinary condition of re-establishing twice the amount of sea grass lost to at least 75% coverage: "the proponent shall continue to implement the project until this objective is achieved".

Under the Western Australia Environmental Protection Amendment Bill 2002, section (2a):

> *The Authority may, if it thinks fit, include other information, advice and recommendations in the assessment report.*

http://www.parliament.wa.gov.au/Parliament/bills.nsf/91FE5B9DE49BF32848256C0E001492D8/$File/Bill131-3.pdf

This is a clear case where the EPA should provide the Minister with information regarding the long-term economic sustainability of the proposal in regards to the numerous ongoing financial commitments required for environmental protection. That the proponent has not outlined the risks and liabilities involved to the State, the private proponent and the management agency who will be taking on many of these commitments, creates a grey area regarding the probability that the commitments will be met.

At the very least these commitments should be listed and a financial feasibility study undertaken by the proponent and reviewed by the EPA to provide the full financial commitment the Minister for Environment will be committing to on behalf of the government. The Minister for Environment should make himself fully aware of the capacity of the government agency Landcorp and the private partner in meeting these financial commitments, possibly by requiring a financial bond should the private partner enter into receivership or Landcorp's future budget be restricted due to the prevailing financial position of the State.

Some examples of proposed EPA conditions:

> *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.*
>
> *11-10 Nutrient reduction strategies in the catchment of Mangles Bay. Contingency measures to manage environmental water quality criteria above specified levels (page iv).*

Outcome Sought 25: The EPA Chairman reject the proposal as there is no guarantee that ongoing financial commitments related to rehabilitation and monitoring of environmental offsets or the cost on maintenance dredging and potential mitigation actions can be furnished by the proponents in the future. The EPA has not requested and the proponent has not offered any financial feasibility assessments of these ongoing costs or offered to lodge financial bonds to cover the many environmental conditions proposed by the EPA.

Appeal Grounds 26: Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina, page 15. #47 The significant geoheritage of this site has been dismissed by the proponents.

Concern: The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 15, #47) states:

> *"The Proponent accepts that the Point Peron tombolo including Lake Richmond, may have geoheritage significance as well as conservation value. As noted in the submission, the project will only affect about 45% of the Tombolo and will not affect Lake Richmond adversely. Hence the geoheritage values will not be lost as a result of the project proceeding. However to mitigate disturbance of half the tombolo, prior to commencement of excavation works, and as part of geotechnical investigations, the Proponent will obtain quality stratigraphic and geomorphic information from across the site to capture data that may be used to further inform the community on the geological evolution of the area, and particularly the formation of Lake Richmond. This work will be supervised and interpreted by an appropriately experienced sedimentologist. It is therefore considered that a study of the geoheritage impacts is not required."*

Geoheritage issues needed to be sorted out BEFORE publishing the PER (Dr V. Semeniuk, pers comm). From the wording above from the Consultants' responses to the submissions, it appears they do not know what geoheritage is. And specifically it is incorrect for them to state that: "will only affect about 45% of the Tombolo and will not affect Lake Richmond adversely. Hence the geoheritage values *will not be lost* (my italics) as a result of the project proceeding."

The geoheritage significance of the Point Peron area was not dealt with adequately in the PER and when the FOPP/HOP submission highlighted this point the response from the Consultants also was wholly inadequate. The bottom line is that the entire limestone island and tip of the tombolo complex is a site of geoheritage significance, and preserving only half of it comprises the island-and-tombolo complex as a site. Removing half of it is essentially the same as quarrying half of Uluru and justifying loss of half by stating only 45% will be quarried. Quarrying any part of Uluru, and by the same token, removing any part of the island-and-tombolo complex compromises its geoheritage value.

Outcome Sought 26: The EPA Chairman reject the proposal as geoheritage has not been adequate assessed.

Appeal Grounds 27: Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina, page 15. #49 Sediment transportation has not been adequately addressed.

Concern: The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 15, #49) states (our comments in upper case):

> *"It is acknowledged that sediment transport around the tip of Point Peron can at times be substantial. Progradation of the shoreline to the west of the Point Peron boat launching ramp and the regular need to remove accumulated sand is testament to that. It is likely that some sediment enters the Sound through the trestle bridge opening in the causeway – as evidenced by the sediment scours aligned with the bridge. But fine sediment is likely to settle in the deeper waters of Cockburn Sound to the immediate east of the bridge. However, very little alongshore sediment movement occurs inside Mangles Bay now because the Causeway stops sediment movement (THIS IS INCORRECT)*

As noted in the PER, after construction of the causeway, the beach receded due to a lack of sediment supply (this is now trapped and removed at the Pt Peron Boat ramp). The beach has now stabilised at the receded shoreline and longshore drift at the site is very small (750m^3/year estimated by MPR 2008). The proposal recognises some of this small amount of drift will collect either side of the structures forming the new beach shape indicated in the concept layout" (THIS DOES NOT ADDRESS THE ORIGINAL ISSUES RAISED IN THE SUBMISSION BY FOPP/HOP):

"Sedimentation in the marina is a difficult matter to quantify and there is marked and complex sand transport that will find its way into a marina. In spite of the apparent sheltered mature of this coastal region, there is much sediment transport as traction load sand, shoreline in suspension, and as mud in suspension. Rates of transport presented below are based on stratigraphic evidence, transport rates from Semeniuk (1983, 1985), and historical information (Semeniuk & Semeniuk 2011). Semeniuk & Semeniuk (2011) describe how the northern shore of Warnbro Sound, the location of the former Peel Harbour (surveyed by John Septimus Roe in 1839, and re-surveyed by Commander Archdeacon in 1878) that rapidly infilled with coastal sediments during the period 1839 to 1878 was an area of beach slacks, underlain by calcareous quartzose sand. This is the equivalent to the formation of Lake Richmond. I estimate that in years of low wave dominance sedimentation transport can be 5000 cubic metres per year. The average can be 100,000 cubic metres per year, and the extreme can be 200,000 cubic metres per year. This sand component can be transported around the tip of Point Peron. Similar transport occurs around the tip of Point Becher (Semeniuk 1995). Mud transport rates are calculated from stratigraphic evidence of rates of accumulation of 1000s of years. These point to transport rates at a MAXIMUM of 50 mm/year, and at a MINIMUM of 2.5 mm/year."

Outcome Sought 27: The EPA Chairman to request a detailed assessment of sediment transportation in the Cape Peron area and the impact of the marina channel and breakwater construction as this issue has not been adequately addressed and contains some potential errors.

Appeal Grounds 28: Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina, page 40. #103 and page 66 #178. Stratigraphy is little understood by proponents leading to errors in modelling assumptions.

Concern: The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 40, #103) states (our comments in upper case):

> *"The paper that discusses different stratigraphic divisions is known, however, it was not included as part of PER as it was not considered relevant to the assessment for this proposal."*
>
> *and*
>
> *"Stratigraphy and lithology are not considered to be of consequence in defining the hydrologic parameters used for the conceptual and numerical hydrogeological models. The parameters used are similar to those widely used to determine the average parameters within defined model layers. If thin muddy sand layers and lenses do occur in the Becher Sand (but have not been identified on downhole geophysical logs) this would be a conservative factor in determining the water level drawdown associated with the marina."*

Further in The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 66, #178) states (our comments in upper case):

> *"The comments on the slotting are considered valid and are recognised. However the variations in microstratigraphy and lithology are not considered to be of consequence in defining the broad hydrologic parameters used in the numerical model. The parameters used for the SBS are similar to those used in other regional numerical models and of necessity defines average parameters within defined model layers. If thin muddy sand layers and lenses do occur in the Becher Sand (but have not been identified on downhole geophysical logs) this would be a conservative factor in determining the water level drawdown associated with the marina."*

The Consultants are not addressing the issues, or do not understand the submission presented in relation to stratigraphy and sampling (Dr V. Semeniuk, pers comm).

Stratigraphy IS FUNDAMENTAL TO UNDERSTANDING HYDROLOGICAL PROCESSES, and the papers referred to show there are fundamental lithological differences in the sediments that the Consultants have not addressed. And as C A Semeniuk (2007) shows, microstratigraphy is critical to the understanding of the maintenance of wetlands (and Lake Richmond is a wetland). So a statement such as "Stratigraphy and lithology are not considered to be of consequence in defining the hydrologic parameters used for the conceptual and numerical hydrogeological models" is fundamentally flawed when dealing with small scale hydrology. The model used may have "generalised" the stratigraphy for purposes of the model, but that is not how nature works at the small scale stratigraphic level. In this context, the Consultants are making a major error.

We have no problems in hydrologists modeling groundwater dynamics to understand the GROSS patterns (i.e. large scale patterns) of groundwater for purposes of extracting, for example, groundwater for urban systems, or for industrial use, but such gross approaches, and the modeling groundwater in such a gross approach will not work at the small scale for ecological purposes. Microstratigraphy and a thorough understanding of the local stratigraphy and lithology are ESSENTIAL to understanding the groundwater dynamics for ecological purposes. In this case, to provide a detailed understanding of hydrology that underpins internationally significant stromatolites (thrombolites) and Lake Richmond, the consultants simply have got it wrong.

How can one conclude that "microstratigraphy and lithology are not considered to be of consequence in defining the broad hydrologic parameters used in the numerical model", if in fact there are no data to support that assertion. As noted in the criticism of the PER by FOPP/HOP, the sampling was inadequately spaced at a one-metre interval. I cannot emphasise this more - sampling at a one-metre interval is too gross to provide refined data to understand hydrological processes and functioning to understand and maintain Lake Richmond and the stromatolites/thrombolites – it might provide gross patterns which may be adequate for extracting water for urban and industrial purposes but not for understanding ecological underpinning.

In regards to the stratigraphy or inadequacy of it, and identification of stratigraphic units in the PER, it should be re-iterated from the FOPP/HOP submission that:

"Clearly, the PER did not know of these stratigraphic subdivisions, or ignored them. At any rate, they are real stratigraphic subdivisions and have hydrogeological and environmental implications. It is a measure of the inadequacy of the stratigraphy of the PER that they have been omitted, and the extant environmental consequences and the consequences of exhuming fossil equivalents of these units of these stratigraphic units have not been addressed."

The above statement still stands.

Outcome Sought 28: The EPA Chairman reject the proposal due to the lack of rigor regarding assessment of stratigraphy which underpins an understanding of the hydrology of the area. Modelling based on generalised assessments of stratigraphy is inadequate when assessing hydrology impacts on the Cape Peron environment.

Appeal Grounds 29: Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina, page 68 #180.

Concern: The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 68, #180) states (our comments in upper case):

> *"The Proponent's consultants (ERM) dispute the assertion that the groundwater modelling undertaken for the impact assessment was not rigorous enough. The data used to calibrate the model included historical Department of Water (DoW) water level records for the Cape Peron area spanning a period of some 38 years, PLUS two years of water level data from a monitor bore east of Lake Richmond (1985/86) , PLUS 12 months of onsite monitoring water level data. These longer term data sets are more than sufficient to account for the rainfall conditions experienced at the site in the past 12 months."*

Again, a sampling strategy that involves sampling at one-metre intervals where the below-groundwater stratigraphy can be complex, and the around-the limestone-island stratigraphy will be particularly complex, already is a problem. The Consultants can "*dispute the assertion that the groundwater modelling undertaken for the impact assessment was not rigorous enough*" as much as they like, but they simply do not have the refined data when they have sampled at a one-metre interval, and are stating that the model works although they have collected gross data. This is an example of principle 'garbage in – garbage out'. In essence, the model was not run with microstratigraphy as a parameter.

The Consultants state: *"The data used to calibrate the model included historical Department of Water (DoW) water level records for the Cape Peron area spanning a period of some 38 years",* but my understanding of that bore is that it penetrates the Kwinana Group and is wholly inappropriate to be used as a calibration as it penetrates several aquifers within the so called *"superficial; aquifer"* when what we are looking at in the Point Peron area is hydrology wholly residing in Holocene sands. The Consultants further state they have two years of water level data from a monitor bore east of Lake Richmond (1985/86) – we am not familiar with that bore, and to assess its adequacy we would need to view the manner of its construction and what aquifers it had penetrated; if it was emplaced in 1985/1986, it may be inadequately emplaced to be of use; and merely having a water level in this area is insufficient – we are assessing hydrological flows, not just water levels in the region. The Consultants state they have *"12 months of onsite monitoring water level data*", but water levels on the lake should not to be used to calibrate subsurface water phenomena. In this context, the Consultants' claims and responses to the submission comments are irrelevant and not valid.

Further, on page 15 the Response by the Consultants is: *"..... the Proponent will obtain quality stratigraphic and geomorphic information from across the site to capture data that may be used to further inform the community on the geological evolution of the area, and particularly the formation of Lake Richmond....."*. If the Consultants had read the literature they would have found out that there has been drilling and radiocarbon age-determinations around Lake Richmond to determine the Lake's formation. Moreover, *"quality stratigraphic*" data should have been collected for the hydrological studies before the PER was written, not after the PER was finalised (and then in an exercise to determine geotechnical data).

Outcome Sought 29: The EPA Chairman to reject the proposal due to the lack of rigorous water modelling inputs. Modelling results cannot produce quality assessments of a development impacts if input data is lacking in quality and detail.

Appeal Grounds 30: Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina, page 67 #179.

Concern: The Detailed Response to Matters Raised in Submissions on the Mangles Bay Marina (page 67, #179) states (our comments in upper case):

> *"It is not considered that any implied facies changes will critically influence the interpretation and management of the hydrogeology within the scale adopted for the numerical model."*

This is incorrect (Dr V. Semeniuk, pers comm). Of course facies changes will have a major influence on model. Stratigraphy and lithology are the foundation of hydrological responses. In the FOPP/HOP submission, it was written that "My interpretation is that there has been a misidentification of carbonate grains, and this may signal a change in drillers, or drill core loggers, or even drill retrieval techniques. If we are correct, it shows the inconsistency of data collection across the area. If we are incorrect, it shows the rapid facies change that can occur within small scales stratigraphically. These rapid facies changes have not been addressed in the PER as intimated above, and they would be crucial to interpreting and managing hydrogeology." IN ESSENCE, THESE ISSUES HAVE NOT BEEN ADDRESSED BUT JUST DISMISSED WITHOUT DATA.

The statement in the FOPP/HOP submission can only be repeated: "*the stratigraphy and hydrology undertaken in the PER are not of sufficient quality to assess and predict the impacts of altered hydrology on Lake Richmond and the stromatolites/thrombolites."*

Outcome Sought 30: The EPA Chairman to reject the proposal due to confusion over drill log data leading to rapid facies changes which have not been addressed in the PER or an inconsistency of data collected during drilling. In either case the quality of hydrogeology assessment has been compromised.