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02nd April 2008

Emanate Legal
P.O. Box 1984
Townsville QLD 4810

Attention : Mr. Peter Cardiff

Dear Sir,

Townsville Ocean Terminal Project
Coastal Engineering Issues - TCC Comments on EIS

We refer to the request received from Emanate Legal (by email on 20th February 2008) to review and advise on issues raised in Townsville City Council's submission regarding the project's Environmental Impact Statement. In particular, Emanate Legal has requested we offer advice in relation to Section 2.2 and Appendix A of Council's document.

We note that many of the issues raised by Council in Section 2.2 are the same as those contained in Appendix A. That appendix was authored by Systems Engineering Australia (SEA) who were engaged by Council to review aspects of the EIS on its behalf. Consequently when providing our comments on an issue common to both Section 2.2 and Appendix A, we have elected to do so when providing comment on the most relevant of the two documents.

We trust that the attached notes assist Emanate Legal in preparing a formal response to Townsville City Council's submission.

Yours sincerely,

Paul O'Brien
Director - Coastal Engineering Solutions Pty. Ltd.

Studies

coastal processes

waves

tidal dynamics

water quality

siltation

effluent dispersion

dredging impacts

river entrance

Design

harbours

marinas

beaches

breakwaters

seawalls

reclamations

canal developments

2.2 Coastal Engineering Issues

2.2.1 Strand Beach Erosion

- Council states a requirement to identify and to monitor any future erosion that the proposed development may have on The Strand beaches.

- With regard to identifying future erosion impacts, the *Coastal Engineering Studies* undertaken for the EIS (presented as Appendix 13 of the EIS) has already identified that minor rotations to the plan orientation of some sections of the beaches will occur - with no overall net loss of sand from the various foreshore precincts. It was identified that these rotations would be subtle and likely to be masked by the natural fluctuations of the beach alignments (as they respond to the ever-changing seasonal and annual variability of local sea and weather conditions).

- As for monitoring any future impacts of the project on The Strand beaches, this could be achieved by periodic surveys of the foreshore. We understand that Council currently has a monitoring programme already implemented whereby cross sections are regularly surveyed at 21 locations along The Strand foreshore. These surveys have been undertaken approximately twice annually since The Strand rehabilitation works were completed in 1999 and are used by Council to monitor the need for any maintenance of the beaches by way of additional sand placement. The continuation of this survey/monitoring programme into the future would identify any unforseen impacts of the Townsville Ocean Terminal Project.

2.2.2 Storm Surge Events

- Council's comments refer primarily to the adoption of the 100 year Average Recurrence Interval event as the Designated Storm Tide Event (DSTE). This issue is also addressed by Dr. Bruce Harper in Appendix A to Council's submission. We offer the following observations with respect to the selection of the DSTE for the Townsville Ocean Terminal Project.

- The Queensland Environmental Protection Agency has produced a Guideline document entitled "*Mitigating the Adverse Impacts of Storm Tide Inundation*". The purpose of the document being to provide advice on the implementation of the "*Coastal Hazards*" Policy 2.2.4 of the State Coastal Management Plan in coastal areas vulnerable to storm tides. The Guideline utilises the concept of a Designated Storm Tide Event (DSTE) to define the extent of the storm tide hazard. At several locations

in the Guideline (e.g. Clause 5.5 and Clause A2.7) the DSTE is defined as "*the storm tide level adopted by local government for management of a particular locality*".

- As the local government authority, Council nominated the 100 year ARI storm tide event as the DSTE on adjacent projects (Mariner's Peninsula - Mirvac; and Saltwater Townsville - Resort Corp), and it is our understanding that the same advice has been received by the proponents of the Townsville Ocean Terminal Project. The EIS has therefore been prepared on the basis of the 100 year ARI event nomination by Council as being the DSTE. It appears from Council's comments that it may now be seeking to modify this requirement so as to require more a more severe DSTE. From an engineering perspective, we see no reason why the Townsville Ocean Terminal Project needs to be assessed against criteria that is different to other adjacent breakwater developments.

- Council also expresses concern regarding the hazard and risk assessment reported under Appendix B of A24 in the EIS. Coastal Engineering Solutions was not involved in the preparation of that Appendix and defers comment to its authors on the EIS team.

- However since we prepared the preliminary designs for the rock armoured protection works, we feel that comment is warranted with respect to Council's statement that:

  "*….. These differences may have resulted in the designers of the marine structures not incorporating sufficient mitigation measures to appropriately treat the storm tide risk.*"

- The preliminary designs (which will be further refined in the later operational works phase) have not utilised the Hazard and Risk Assessment prepared for the EIS. Standard coastal engineering design methodology utilised worldwide has been applied, wherein there is only a 5% damage level allowable for the 100 year ARI design event. Such damage criterion does not compromise the structural integrity or performance of the marine structures under the 100 year ARI storm event.

- With regard to other issues raised in Appendix A of Council's submission (prepared by SEA), we offer comment as follows:

Section 4 of the EIS document:

- SEA has identified a number of inconsistencies and errors with regard to Section 4 of the EIS document. Section 4 was not authored by Coastal Engineering Solutions. We understand that this Section will be amended so as to be consistent with the findings of the Coastal Engineering Studies presented in Appendix 13 of the EIS.

A13 Coastal Engineering Study:

Source of Wind Data:

- SEA suggests that the use of the wind data recorded by the Bureau of Meteorology's Automatic Weather Station (AWS) at Lucinda Point is unsuitable for hindcasting of Local Seas in Cleveland Bay - suggesting the wind data recorded Townsville Airport may be more appropriate. SEA states that the location of the Lucinda instrument is such that it is adversely affected by nearby infrastructure and that it may have been moved during the recording period.

- When undertaking the Coastal Engineering Studies, considerable effort was directed at identifying the most appropriate means of determining the Local Seas affecting The Strand beaches. It was identified that whilst the wind data recorded by the Lucinda Point AWS had some shortcomings, it was nevertheless the best source of data for the intended purpose of hindcasting Local Seas generated within Cleveland Bay. An assessment of the various other sources is offered in Section 3.3.2.1 (pages 30-32) of the Coastal Engineering Studies and is not repeated here.

- Following receipt of the comments by SEA (which include a discussion of the location of the Lucinda anemometer), we have reviewed our decision to utilise the wind data recorded by the Lucinda Point AWS. We do not share SEA's opinion of "*potentially poor directional wind data from this site*." We remain convinced that it is still the best data for hindcasting Local Seas in Cleveland Bay and offer the following as justification of that view.
    - It is important to appreciate the purpose for which the wind data is used. That is, to hindcast those waves reaching The Strand foreshore that are generated by winds blowing across local fetches within Cleveland Bay itself. The data is not used to hindcast the sea and swell waves that approach Cleveland Bay from across the open water fetches between the mainland and the Barrier Reef (these are termed Distant Seas in the Coastal Engineering Studies). Other techniques are used for that purpose and these are discussed in considerable detail in Appendix 13 of the EIS.

- The fetches across which the Lucinda wind data is applied to mathematically hindcast Local Seas on The Strand foreshore are listed in Table 3.2 of the Coastal Engineering Studies. They range from direction bearings of 330º (through 360º) to 110º - that is from approximately NNW (through North) to ESE. When hindcasting waves from these fetches it is therefore important that the wind data is sourced from an AWS that properly records winds from these same directions.
- We have undertaken enquiries of the Townsville-based Technical Officer of the Bureau of Meteorology who has direct responsibility for the maintenance of the Lucinda AWS and the integrity of the data collection. Advice received from that officer (in conjunction with the Bureau's Climatological Station Metadata for the Lucinda Point station) indicates that the anemometer is not sheltered from winds blowing across the directions used for hindcast purposes. A high sugar loading boom to the SE of the anemometer provides slight shelter to winds from that direction, but these SE winds are not critical to the hindcast of waves from the more northerly fetches that are of interest.
- We have also been informed by the Bureau of Meteorology that the Lucinda anemometer has been located in the same position since 1991 and has therefore not been moved during the period over which the wave hindcast was undertaken - as perhaps implied by SEA's comments. It is located quite high above sea level but corrections for the elevation of the recorded wind speed is part of the wave hindcasting methodology.

- As further justification for using the Lucinda records instead of those from the Townsville Airport AWS we note the following:
  - The 300m high Castle Hill is a significant topographical feature located less than 2.5kms to the ESE of the Townsville airport anemometer. Castle Hill therefore has an effect on the wind speed and direction recorded by the anemometer whenever winds are blowing from the sector of approximately E to SE. Rather than totally sheltering the instrument from these predominant winds, Castle Hill appears to cause E to SE winds to swirl around it and approach the airport anemometer with a more E to NE alignment than actually occurs. Using the resulting recorded winds for hindcasting purposes therefore causes an inaccurate bias of wave energy arriving from the E and NE fetches.
  - Also the Townsville Airport instrument is some 2.5kms inland and located at a height of 4 metres. It is recording "over-land" winds - which require modification for wave hindcasting purposes. Whereas the Lucinda anemometer is directly measuring "over-water" winds and requires no such modification to the data.

- For the critical fetches of NNW (through North) to ESE the Townsville Airport anemometer is somewhat in the lee of Magnetic Island and Many Peaks Range. There are no such topographical obstructions across these fetches for the 10 metre high Lucinda instrument and therefore it is more likely to capture the true wind from these directions.

- The very good correlation between the calculated plan alignment of the beach compartments along The Strand (incorporating the significant influence of Local Seas, which have been hindcast using the Lucinda wind records) and actual beach alignments gives us further confidence that the hindcasting methodology is sound and the use of the Lucinda wind data is appropriate.

Extent of the Hindcasting Record:

- Winds recorded by the Bureau of Meteorology's AWS at Lucinda were used to calculate the Local Seas generated within Cleveland Bay by applying standard hindcasting techniques. The Distant Seas generated in offshore waters beyond Cleveland Bay (which subsequently propagate onto Townsville foreshores) were taken from the recordings of the EPA's Waverider buoy moored offshore of Cape Cleveland.

- Because Local Seas and Distant Seas can occur at the same time, the period of the wind data used to hindcast Local Seas is the same as the four years of available directional Waverider records used to define Distant Seas - namely October 2000 to September 2004. This is the only period during which the Waverider was measuring wave direction as well as wave height and period. Wave direction is a critical parameter required for assessing the local wave climate.

- It appears that SEA has perhaps misunderstood the application of the wind data - as evidenced by the statement: "*If the wind data provided a good match to the 4 years of Waverider data it is not clear why an extended period of hindcasting was not adopted*". We offer the following to clarify the wave hindcasting methodology.

- There was no comparison made of wind data to Waverider records as stated by SEA. Wind data was used to hindcast the *Local Seas* occurring at locations just offshore of The Strand beaches, whereas the Waverider records were used for *Distant Seas* (including swell effects) that occur at its moored location in deep water off Cape Cleveland. Consequently there is no need to use wind records to hindcast for waves arriving at the offshore Waverider site. Indeed it would serve no purpose to do so since this would not be testing the modelling methodology actually used for the *Coastal Engineering Studies*.

- With regard to SEA's comment that four years of 3 hourly time series "*seems a rather short period of time to assess ambient wind, wave and sediment behaviour*" we remain of the opinion that it is very adequate. The four years is used to identify and compare the various stable plan alignments of The Strand beaches under ambient conditions for both the pre- and post-development scenarios. In other words, it is used to identify differences between the two layouts. The selection of four entire years to represent typical ambient conditions occurring on local foreshores is in our opinion a rigorous means of identifying the differences between the two scenarios.

Storm Tide Hazard Zone

- Because the fill levels and perimeter seawalls throughout the proposed development are elevated above the designated storm tide level (and are therefore immune to inundation), the "hazard zone" is the area immediately behind the perimeter seawalls/breakwaters which experiences greenwater overtopping by cyclone waves during the DSTE.

- The width of this hazard zone (and therefore the distance that key infrastructure and buildings are set back from the perimeter walls) depends upon the design of the walls themselves. For example, high perimeter walls will have a narrower hazard zone behind them than will lower walls.

- SEA suggests that the hazard zone is not delineated in Appendix 13 of the EIS document. We point out that the extent of the hazard zone is defined by the width of the rock armour placed behind the crest of the perimeter walls - for the purpose of mitigating the hazard.

- Preliminary designs are presented in Section 6 of the Coastal Engineering Studies (EIS Appendix 13) which show varying extents of the hazard zone depending upon different wall options. The width of the hazard zone in each case is armoured by rock behind the seawalls/breakwaters. Even for a low wall height (at the crest level of the existing breakwater RL+4.4m AHD), the resulting requirement for a 10m wide hazard zone does not extend into areas of the development having key infrastructure such as roads or buildings.

- The preliminary designs presented in Appendix 13 of the EIS will be tested and refined by physical modelling during the ensuing operational works phase. As well as determining the structural characteristics of each length of each seawall / breakwater, the physical modelling will enable the extent of the hazard zone to be defined accurately.

- In fact, one of the most important design criteria for each structure is that its height, slope, armouring and crest arrangement must be such that the hazard zone behind it (as a consequence of any severe wave overtopping) does not intrude into areas where development is proposed.