



File/Ref CBD/111345(Pt 5)

Department of
Environment and
Heritage Protection

6 November 2013

Mr David Calvert
Director, Queensland 1 Section
Queensland and Sea Dumping Assessment Branch
Department of Environment
GPO Box 787
CANBERRA ACT 2601

Dear Mr Calvert *David*

Invitation to comment on referral 2013/7038 – Development of the Turtle Cove Haven Retirement Village & golf course, River Heads, Qld

Thank you for your letter dated 28 October 2013 requesting advice on whether the above action will be assessed in a manner described in Schedule 1 of the Agreement between the Commonwealth of Australia and the State of Queensland (the Bilateral Agreement) developed under Section 45 of the *Environment Protection and Biodiversity Conservation Act 1999*.

I advise the proposal will not be assessed using the EIS process in chapter 3 of the *Environmental Protection Act 1994*. Please find attached for your consideration, comments from the Department of Environment and Heritage Protection.

The Department of State Development, Infrastructure and Planning has reviewed the referral documentation and advised that the Coordinator-General has not received a request for declaration of this proposal as a coordinated project under Part 4 of the *State Development and Public Works Organisation Act 1971*.

Also, the Department of Local Government and Planning has advised the proposed development is unlikely to meet the requirements for assessment under Chapter 9, Part 2 of the *Sustainable Planning Act 2009*.

Should you have any further enquiries regarding this letter, please do not hesitate to contact Peter Blumke of the department on telephone (07) 3330 5599.

Yours sincerely


sch4p4(6) Personal information

Lindsay Delzoppo
Director, Statewide Environmental Assessments

EPBC 2013/7038 - Turtle Cove Haven Retirement Village, River Heads, Great Sandy Strait, QLD

The Department of Environment and Heritage Protection (EHP) have completed an assessment of the proposed Turtle Cove Haven Retirement Village with reference to the *Significance Significant impact guidelines v1.1*¹ - *Matters of National Environmental*. In conducting this assessment EHP have utilised additional information not contained in the referral that may assist the Commonwealth Minister's decision on whether the action should be 'controlled'. This additional information is detailed in the appendices to this report and relevant primary reports are recorded in the reference list (**Appendix 1**). The Matters of National Environmental Significance relevant to this proposal have been assessed both in the immediate area of the proposed action but also at its broadest scope. The assessment has therefore included the following additional matters not mentioned in the original application are:

- threatened ecological communities (subtropical saltmarsh RE 12.1.2, **Appendix 2**)
- threatened species (green turtle and dugong, **Appendix 3**) and migratory species (associated with a critical shorebird roost, **Appendix 4**) which are both features of:
- the Ecological character of the Great Sandy Strait Ramsar Area (**Appendix 5**); and
- the Outstanding Universal Value of the Great Barrier Reef (**Appendix 6**).

The Booral wetlands as the most significant seagrass meadow, within the most important dugong habitat south of Torres Strait, directly contribute to the ecological character of the Ramsar Area, and to the Outstanding Universal Value of the Great Barrier Reef (GBR) (Integrity) (refer to <http://www.environment.gov.au/heritage/places/world/great-barrier-reef/values.html>). The Booral wetlands immediately adjoin the proposed development and are likely to experience cumulative impacts potentially resulting in loss of this seagrass meadow due to changes to groundwater flow and surface / groundwater quality. The draft GBR referral guidelines² support referral of this application on the basis that:

1. Elements of the Outstanding Universal Value of the GBR are present in the area
2. The proposed activity includes current and potential threats of the GBR
3. Consideration needs to be given to the direct, consequential and cumulative impacts of the proposed action on the Integrity of the GBR

The inadequate buffers to the above MNES as proposed for this development are also likely to lead to impacts on critical shorebird roosts and other natural ecological processes required for maintenance of the MNES, and are likely to result in indirect and offsite impacts in addition to those listed by the applicant.

The assessment conducted by EHP, utilising additional information held by this agency, indicates that additional Matters of National Environmental Significance are present that have not been addressed by the applicant, and that the proposed activity would pose a risk to such matters.

¹ <http://www.environment.gov.au/epbc/publications/nes-guidelines.html>

² see <http://www.environment.gov.au/epbc/publications/pubs/draft-referral-guidelines-great-barrier-reef.pdf>

Appendix 1. References:

- Blair, D., McMahon, A., McDonald, B., Tikel, D., Waycott, M. and Marsh, H. (2013) Pleistocene sea level fluctuations and the phylogeography of the dugong in Australian waters. *Marine Mammal Science* in press.
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- Butler, I. R., Sommer, B., Zann, M., Zhao, J. X., & Pandolfi, J. M. (2013) The impacts of flooding on the high-latitude, terrigenoclastic influenced coral reefs of Hervey Bay, Queensland, Australia. *Coral Reefs*, 1-15.
- Cagnazzi, D. D. B., Harrison, P. L., Ross, G. J., & Lynch, P. (2011). Abundance and site fidelity of Indo-Pacific Humpback dolphins in the Great Sandy Strait, Queensland, Australia. *Marine Mammal Science*, 27(2), 255-281.
- Campbell, S.J. and McKenzie, L. J. (2004) Flood related loss and recovery of intertidal seagrass meadows in southern Queensland, Australia. *Estuarine, Coastal and Shelf Science* 60: 477-490
- Devlin, M., Brodie, J., Wenger, A., da Silva, E., Alvarez-Romero, J. G., Waterhouse, J., & McKenzie, L. (2012, July). Chronic and acute influences on the Great Barrier Reef: Impacts of extreme weather conditions. In *Proceedings of the 12th International Coral Reef Symposium* (pp. 9-13).
- Flint, M., Limpus, C. J., Patterson-Kane, J. C., Murray, P. J., & Mills, P. C. (2010). Corneal Fibropapillomatosis in Green Sea Turtles (*Chelonia mydas*) in Australia. *Journal of Comparative Pathology*, 142(4), 341-346.
- Grech, A., Sheppard, J., & Marsh, H. (2011). Informing species conservation at multiple scales using data collected for marine mammal stock assessments. *PLoS one*, 6(3), e17993.
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- Preen, A. and Marsh, H., 1995. Response of dugongs to large-scale loss of seagrass from Hervey Bay, Australia. *Wildl. Res.*, 22:507-519.
- Strydom, A. (2009) Nocturnally biased intertidal basking aggregation with site fidelity by foraging Green turtles (*Chelonia mydas*) in Great Sandy Marine Park, Queensland, Australia. A thesis submitted for the Graduate Certificate of Natural Resource Studies The University of Queensland June 2009, School of Natural and Rural Systems Management
- Zann M (2012) The use of remote sensing and field validation for mapping coral communities of Hervey Bay and the Great Sandy Strait and implications for coastal planning policy. M Phil. thesis, University of Queensland, St Lucia.

Appendix 2

The proposed development involves reclamation and fragmentation of a threatened ecological community subtropical saltmarsh RE 12.1.2 (see figure 1).

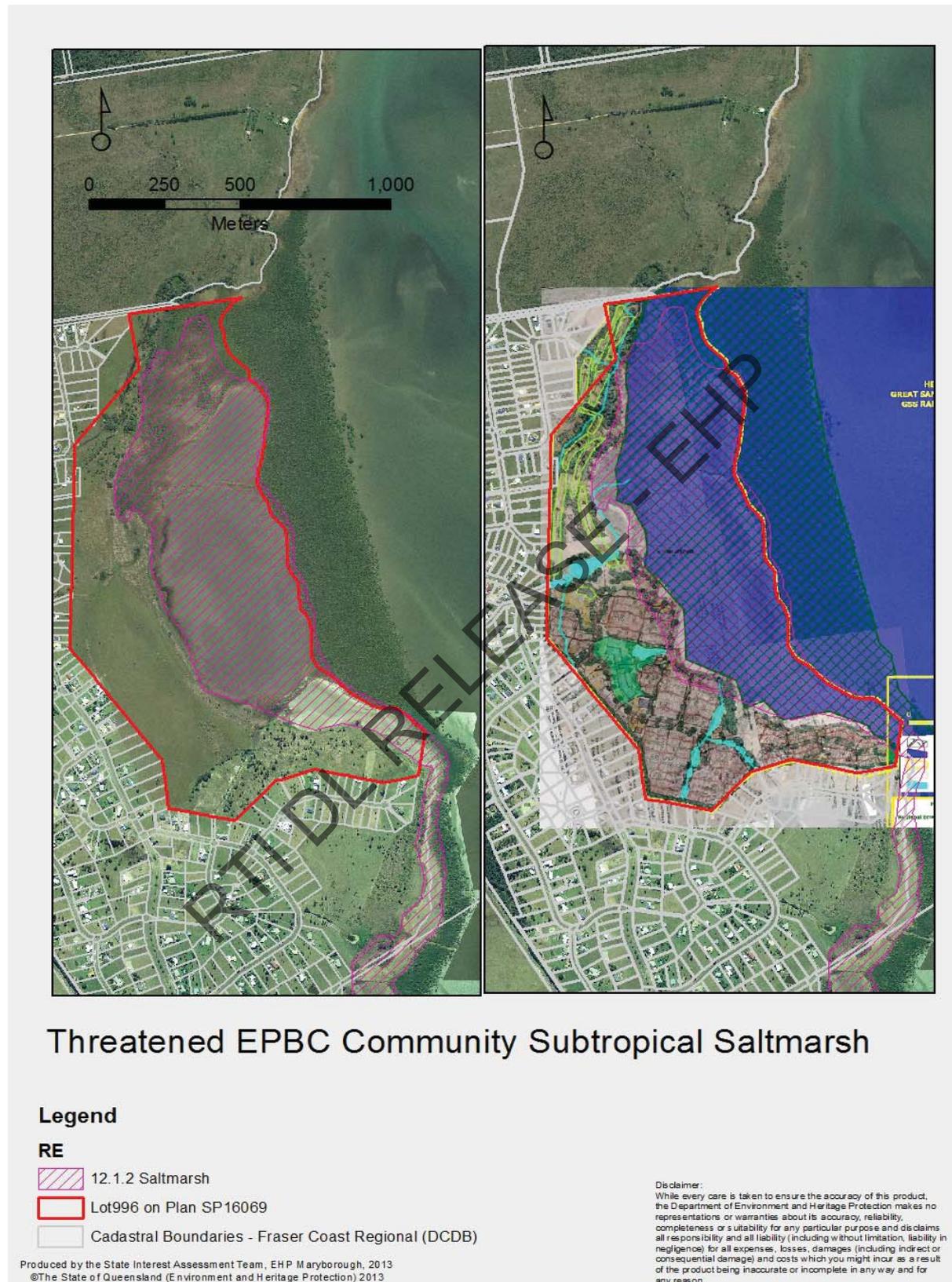


Figure 1 – Threatened EPBC community subtropical saltmarsh 12.1.2

Appendix 3

EPBC listed threatened species likely to be impacted by the development include:

(a) Green turtle *Chelonia mydas*. The subject site is basking habitat for aggregations of green turtles (Strydom 2012, 2009). The turtles bask in aggregations of up to 50 in small shallow pools and natural and modified creeks that penetrate no more than 50 m into the mangroves – at an average of up to 5 per km per night; and feed on seagrass meadows of the Booral wetlands (Fig 1). Risks from intensification of human habitation likely to occur as a result of the proposed development include: human and domestic dog activity, increased plastic ingestion, trapping and death in crab pots, increased boat strike, and declining water quality leading to fibropapilloma (observed on juveniles at the site) - linked to declining water quality in Moreton Bay (Flint et al.2010).

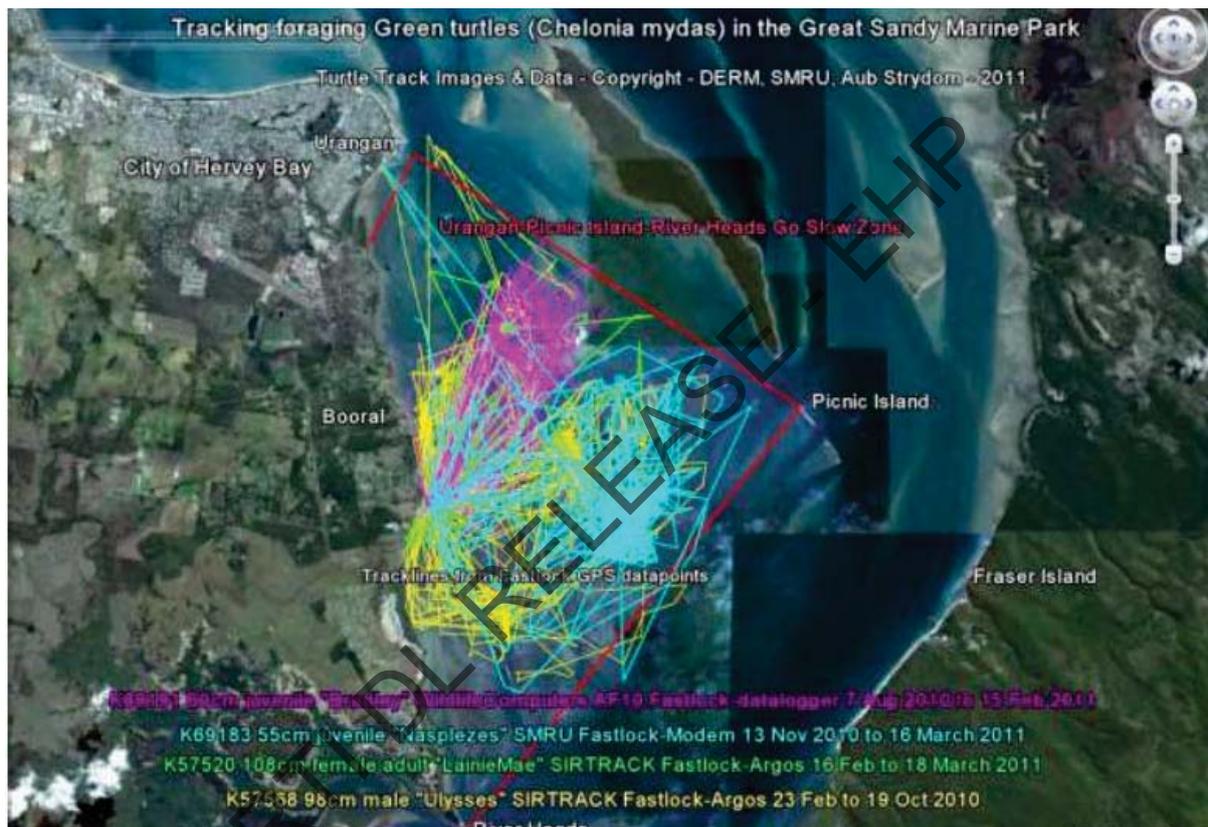
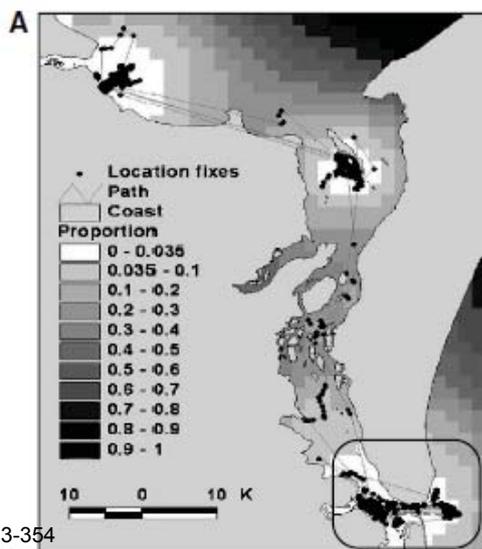


Figure 2 after Strydom 2012: Tracked basking green turtles also grazed on Booral seagrass meadows.



(b) Dugong *Dugon dugon*

Booral Wetland seagrass meadow is one of three core feeding habitats for dugong in Hervey Bay / Great Sandy Strait, based on satellite tagging of dugong at the Burrum Heads seagrass meadow (Sheppard *et al.* 2006).

Figure 3 after Sheppard *et al.* 2006: Tagged dugong hotspots in Hervey Bay and the Great Sandy Strait.

Appendix 4

Threatened EPBC community subtropical saltmarsh 12.1.2 is a critical high tide / king tide roost for migratory shorebirds. It forms part of the Australia-East Asia Flyway and is one of the major criteria for listing of the Ramsar area.

Insufficient buffer was identified by the development plan for these birds, which roost on lot 96 SP16069 during spring and king high tides (Mangrove Point South claypan – Harding *et al.* 2005).

It is essential that shorebirds are not disturbed while roosting or they may lose body mass impacting on their energy levels for the long migration to Asia. Harding *et al.* describe the importance of this roost to the region: “Hundreds of the species have been recorded on the flats in front of Mathieson Homestead (GSMH) on the outgoing tide and seen flying from the mangroves to the flats. Both Mathiesons (GSMH) and the (Mangrove Point South) claypan (GSMP) are linked as a roosting site for the waders. If this site is lost, there are no likely alternative sites and the feeding density of birds will drop as a result.” Harding *et al.* recommend a buffer distance of 200m from highest astronomical tide be maintained surrounding critical high tide roosts (see Fig. 4.)

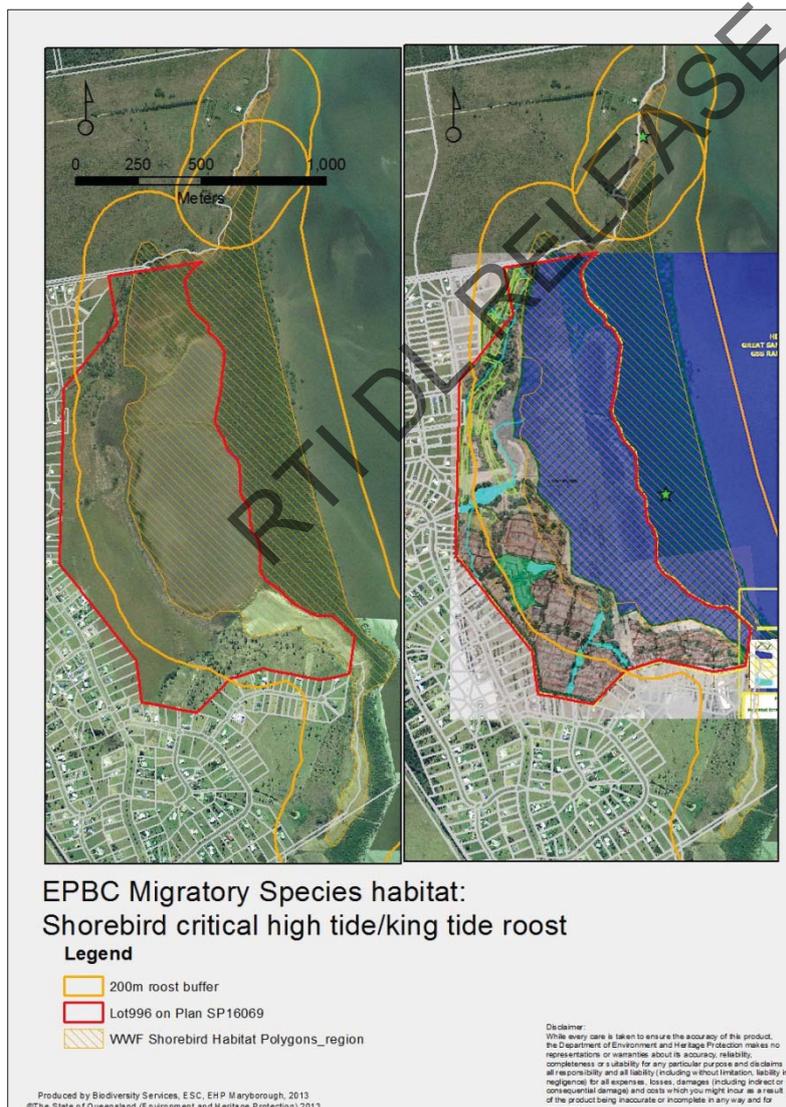


Figure 4: WWF's mapped critical high tide/king tide shorebird roost shows that insufficient buffer exists on the proposed development to adequately reduce the impact of disturbance by humans / dogs.

Table 1 Bird species and their migratory status under international agreements between Japan (JAMBA), China (CAMBA), the Republic of Korea (ROKAMBA) and the Bonn convention for migratory species – from Turtle Cove and Mathieson Homestead roost (regarded by Harding *et al.* as constituting the one roost).

NAME	Scientific Name	JAMBA	CAMBA	ROKAMBA	Bonn	EPBC	Maximum Count
Bar-tailed Godwit	<i>Limosa lapponica</i>	Yes	Yes	Yes			2100
Black-fronted Dotterel	<i>Elseya melanops</i>						3
Black-tailed Godwit	<i>Limosa limosa</i>	Yes	Yes	Yes			1
Black-winged Stilt	<i>Himantopus himantopus</i>						15
Bush Thick-knee	<i>Burhinus grallarius</i>						2
Caspian Tern	<i>Hydroprogne caspia</i>	Yes	Yes				75
Cattle Egret	<i>Ardea ibis</i>	Yes	Yes				2
Common Sandpiper	<i>Tringa hypoleucos</i> (<i>Acetitis hypoleucos</i>)	Yes	Yes	Yes			75
Common greenshank	<i>Tringa nebularia</i>	Yes	Yes	Yes			?
Common Tern	<i>Sterna hirundo</i>	Yes	Yes	Yes			2
Crested Tern	<i>Thalasseus bergii</i>	Yes					58
Curlew Sandpiper	<i>Calidris ferruginea</i>	Yes	Yes	Yes	Yes		120
Eastern Curlew	<i>Numenius madagascariensis</i>	Yes	Yes	Yes	Yes		1182
Great Egret	<i>Ardea modesta</i>	Yes	Yes				5
Great Knot	<i>Calidris tenuirostris</i>	Yes	Yes	Yes	Yes		1100
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Yes	Yes	Yes	Yes		60
Greenshank	<i>Tringa nebularia</i>	Yes	Yes	Yes	Yes		260
Grey-tailed Tattler	<i>Tringa brevipes</i>	Yes	Yes	Yes	Yes		1075
Grey Plover	<i>Pluvialis squatarola</i>	Yes	Yes	Yes	Yes		4
Intermediate Egret	<i>Ardea intermedia</i>	Yes	Yes				8
Lesser Crested Tern	<i>Thalasseus bengalensis</i>		Yes				2
Lesser Sand Plover	<i>Charadrius mongolus</i>	Yes	Yes	Yes	Yes		210
Little Curlew	<i>Numenius minutus</i>	Yes	Yes	Yes	Yes		1
Little Egret	<i>Egretta garzetta</i>						8
Little Tern	<i>Sternula albifrons</i>	Yes	Yes	Yes	Yes	E	24
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Yes	Yes	Yes	Yes		15
Masked Lapwing	<i>Vanellus miles</i>						48
Pacific Golden Plover	<i>Pluvialis fulva</i>	Yes	Yes	Yes	Yes		27
Pied Oystercatcher	<i>Haematopus longirostris</i>						70
Red-capped Plover	<i>Charadrius ruficapillus</i>						200
Rainbow bee-eater	<i>Merops ornatus</i>	Yes					?
Red-kneed Dotterel	<i>Erythronyx cinctus</i>						1
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>						70
Red-necked Stint	<i>Calidris ruficollis</i>	Yes	Yes	Yes	Yes		592
Red Knot	<i>Calidris canutus</i>	Yes	Yes	Yes	Yes		210

Ruddy Turnstone	<i>Arenaria interpres</i>	Yes	Yes	Yes	Yes		50
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Yes	Yes	Yes	Yes		60
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>						9
Terek Sandpiper	<i>Xenus cinereus</i>	Yes	Yes	Yes			800
Wandering tattler	<i>Tringa incana</i>	Yes	Yes		Yes		?
Whimbrel	<i>Numenius phaeopus</i>	Yes	Yes	Yes	Yes		650
Whiskered Tern	<i>Chlidonias hybrida</i>						95
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>		Yes				2

Dugong *Dugong dugon* and Indo-Pacific Humpback Dolphin *Sousa chinensis* (whose habitat are likely to be impacted by the development) are both listed as migratory in Appendix 2 of the Bonn convention.

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Appendix 5

Potential impacts of the proposed development on the Ecological Character of the Great Sandy Strait Ramsar Area (summarised in the Table 2):

Ramsar criteria for listing	How Great Sandy Strait meets the Criteria	Likelihood that the proposed development impact on this aspect of ecological character
<p>Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.</p>	<p>The site includes a representative example of Ramsar Wetland Type F (estuary) which is the largest and least disturbed sand passage estuary in the South East Queensland (IBRA) biogeographic region.</p> <p>The site includes representative examples of Ramsar Wetland Type U (non-forested peatland/fen) some of which display pronounced patterning that is rare in the South East Queensland (IBRA) biogeographic region.</p>	<p>N/a</p>
<p>Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.</p>	<p>The site supports four species of marine turtle, each of which is threatened under national legislation.</p> <p>The site also supports Illidge's ant-blue butterfly (<i>Acrodipsas illidgei</i>) and dugong which are both threatened under state and international legislation.</p>	<p>Likely impacts on green turtle roosting / resting sites. Likely cumulative impacts on condition of a significant seagrass meadow supporting dugong population – Booral Wetlands (Campbell & McKenzie 2004).</p>
<p>Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.</p>	<p>In the context of the South East Queensland bioregion, the site supports a large or relatively large number of species from several plant and animal groups: waterbirds, marine turtles, marine mammals, fishes, crustaceans and other marine invertebrates, seagrasses and mangroves.</p>	<p>Likely impacts on diversity and populations of waterbirds due to disturbance / displacement of shorebirds. Likely impacts on seagrass, marine turtles, marine invertebrates at southern range limit (<i>Uca signata</i> – saltpan fiddler crab).</p>
<p>Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.</p>	<p>The site supports substantial populations of many animal taxa (migratory shorebirds, marine turtles, whales) during critical stages of migration and supports many additional taxa (dolphins, fishes, frogs, prawns) during the critical stage of breeding.</p> <p>Dugongs from adjacent populations in Hervey Bay have previously sought refuge in the Ramsar site when food (seagrass) resources in the Bay were depleted.</p>	<p>Likely impacts on a critical king tide / high tide roost – the most significant one in this part of the Great Sandy Strait.</p> <p>Likely impacts on seagrass and dugong. Because of depletion of seagrass due to chronic disturbance on the GBR (Devlin <i>et al.</i> 2012) Hervey Bay/ Great Sandy Strait is a refuge for seagrass, and the turtles and dugong feeding on it. Turtles bask in this area (Strydom 2012,2009).</p>
<p>Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.</p>	<p>The site has supported, on at least several occasions, between 20,000 and 40,000 waterbirds (mostly shorebirds).</p>	<p>The roost concerned has supported 2-3000 shorebirds in the past. An internationally significant population of Bar-tailed godwit is 3 250 and of eastern curlews.</p>

<p>Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.</p>	<p>The site is known to support, at least on the basis of maximum recorded count, at least 1% of the population of Far eastern curlew, whimbrel, bar-tailed godwit, greytailed tattler, (Common) greenshank, Terek sandpiper, Lesser sand plover and pied oystercatcher.</p>	<p>The roost has supported 1400 Bar-tailed godwits and 1100 far eastern curlews.</p>
<p>Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.</p>	<p>Thus far, at least 104 species of fish from 60 families have provisionally been recorded from the Site (Fisheries Research Consultants 1993 and 1994; Beumer & Halliday 1994). They include a highly diverse range of morphologies, reproductive types, life history strategies and ecological niches (eg., demersal, pelagic, planktivorous, herbivorous, omnivorous, predatory, scavenging, excavating, symbiotic, live-bearing, egg-releasing, hermaphroditic protogyny and protandry). These fish communities in turn support a diverse and complex range of other ecosystem components and processes, such as multiple food web interactions, algal grazing, bioturbation, re-cycling and breakdown of coralline materials.</p>	<p>Likely impacts to fish nursery habitats and spawning grounds supporting diversity and herb- ivory.</p>
<p>Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere.</p>	<p>The site provides nursery and feeding grounds for fishes, crabs and prawns that are subject to a substantial commercial and/or recreational harvest on-site, and is part of a migration path for prawns that are commercially harvested off-site.</p>	<p>Likely impacts to fish nursery habitats and spawning grounds.</p>

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Appendix 6

The application impacts on the Integrity of the GBR by impacting on two elements of its Outstanding Universal Value: green turtles, a dugong hotspot, and a significant seagrass meadow which is feeding habitat for both dugong and turtles.

Table 3. Elements of the Outstanding Universal Value of the Great Barrier Reef

Criterion	Element of Outstanding Universal Value present in the Booral Wetlands and Turtle Cove and surrounds (GBR value italicised)
(vii) - Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance	<ul style="list-style-type: none"> • <i>coral assemblages of hard and soft corals</i> : The Great Sandy Strait supports fringing coral communities and reefs • <i>migrating whales</i>: Humpback whales sightings during migration • <i>nesting turtles</i>: The Great Sandy Strait Ramsar area supports GBR nesting Green Turtles by providing important habitat for basking, feeding and mating.
(viii) outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;	<ul style="list-style-type: none"> • Booral wetlands seagrass meadows within the Great Sandy Strait represents one of the most extensive intertidal seagrass meadows in the GBR lagoon
(ix) outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;	<ul style="list-style-type: none"> • <i>cross-shelf, longshore and vertical connectivity</i> <ul style="list-style-type: none"> • Booral wetlands seagrass meadows provide vertical / longshore connectivity to GBR for dugong and turtle feeding and migration • Biological connectivity processes link Turtle Cove and the Booral Wetlandscoast to the GBR: migration of turtles, dugong, humpback whales, recruitment of coral and fish species
x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation	<ul style="list-style-type: none"> • <i>diversity supports marine and terrestrial species (global conservation significance)</i> – migratory shorebirds, turtles, dugong, dolphins • <i>Diversity of seagrass</i> • <i>green turtle breeding</i> • <i>dugong</i> – Mapped as a dugong hotspot with connectivity to GBR (See Appendix 4) • <i>species of whales</i> – Humpback whale sightings in the Great Sandy Strait during return migration from the GBR • <i>species of dolphins</i>- Indo-Pacific humpback and bottlenose dolphin habitat
Intactness: the extent to which the property: a) includes all elements necessary to express its outstanding universal value b) is of adequate size to ensure the complete representation of the features and processes which convey the property's significance c) suffers from adverse effects of development and/or neglect	<ul style="list-style-type: none"> • GBR waters are connectors between the two most significant dugong populations in Eastern Australia, Torres Strait and HerveyBay/Great Sandy Strait. The proposed development has likely impacts on the latter. • Nesting of green turtles occurs on GBR islands, but basking, feeding and mating occurs in the Great Sandy Strait including the mangroves and seagrass meadows adjoining the development. • GBR seagrass meadows are in poor condition and green turtle and dugong populations are impacted (Brodie <i>et al.</i> 2013, Devlin <i>et al.</i> 2012). Given migration to and from the GBR the Hervey Bay / Great Sandy Strait seagrass, turtle and dugong are thus a refugia for the GBR (Grech <i>et al.</i> 2011).

2. Current and potential threats

The following current and potential threats listed in the draft guidelines for EPBC referral are relevant to the current proposal i.e. Turtle Cove retirement village / shop/medical centre/ bowls club /storage for boats, caravans and RVs and golf course and constructed board walk

- *habitat degradation and fragmentation*; - the board walk will result in fragmentation of an endangered ecological community, subtropical saltmarsh
- *shipping and boating incidents including collisions with marine mammals and/or sea turtles*; Intensification of boat traffic on the Booral Wetlands expected with increased boat density may result in increased incidence of boat strike on turtles basking and feeding in the vicinity
- *poor water quality (for example, elevated nutrients and sediment concentrations)* Altered groundwater flows may result in impacts on seagrass meadows; an increase in nutrients encourages green algal overgrowth of seagrass meadows. Herbicide runoff from the golf course is likely to impact on seagrass growth.
- *from land-based erosion, run-off and waste discharge*); Increased freshwater runoff encourages green algal overgrowth of seagrass meadows.
- *and increased human presence (for example disturbance of sea turtle and bird nesting sites through noise, direct harassment, lighting and increasing vessel traffic –* Disturbance of shorebird roosting and green turtle basking through increased human presence / disturbance and / or predation by dogs
- *marine debris and litter*; -Increased litter such as plastic bags may result in ingestion by turtles
- *illegal fishing* – Increased density of crab pots may result in trapping and death of turtles

3. GBR Integrity and possible direct, consequential and cumulative impacts.

The EPBC draft guideline (s f, p. 13) states that *consideration should be given to the direct, consequential and cumulative impacts of a proposed action*; including the Integrity i.e. wholeness, intactness and threats. The GBR Statement of Outstanding Universal Value element *Integrity* notes that: “*Some of the key ecological, physical and chemical processes that are essential for the long-term conservation of the marine and island ecosystems and their associated biodiversity occur outside the boundaries of the property and thus effective conservation programs are essential across the adjoining catchments, marine and coastal zones*”.

Significant mortality of dugong and turtles on the GBR (Devlin *et al.* 2012) highlights the importance of Hervey Bay / Great Sandy Strait as a refugium for these species.

Green turtle connections with the GBR: There is a direct link between Turtle Cove and the GBR as the green turtles which bask, feed and mate in this region of the Great Sandy Strait nest on islands in the Capricorn-Bunker Group of the GBR. Already there is evidence of cumulative effects indicated by presence of fibropapilloma on juvenile turtles basking in the Turtle Cove area (Strydom 2012). Relatively healthy populations of green turtles still remain in the Great Sandy Strait, which may act as a refugium for GBR nesting green turtles.

Dugong connections with the GBR: Hervey Bay / Great Sandy Strait is the second most important dugong hotspot in Queensland. Seagrass remains within this region while dugong and seagrass are currently experiencing impacts ; dugong are known to migrate between this region and the GBR (Sheppard *et al.* 2006) hence this area is a dugong refugia for the GBR(Grech *et al.* 2011)

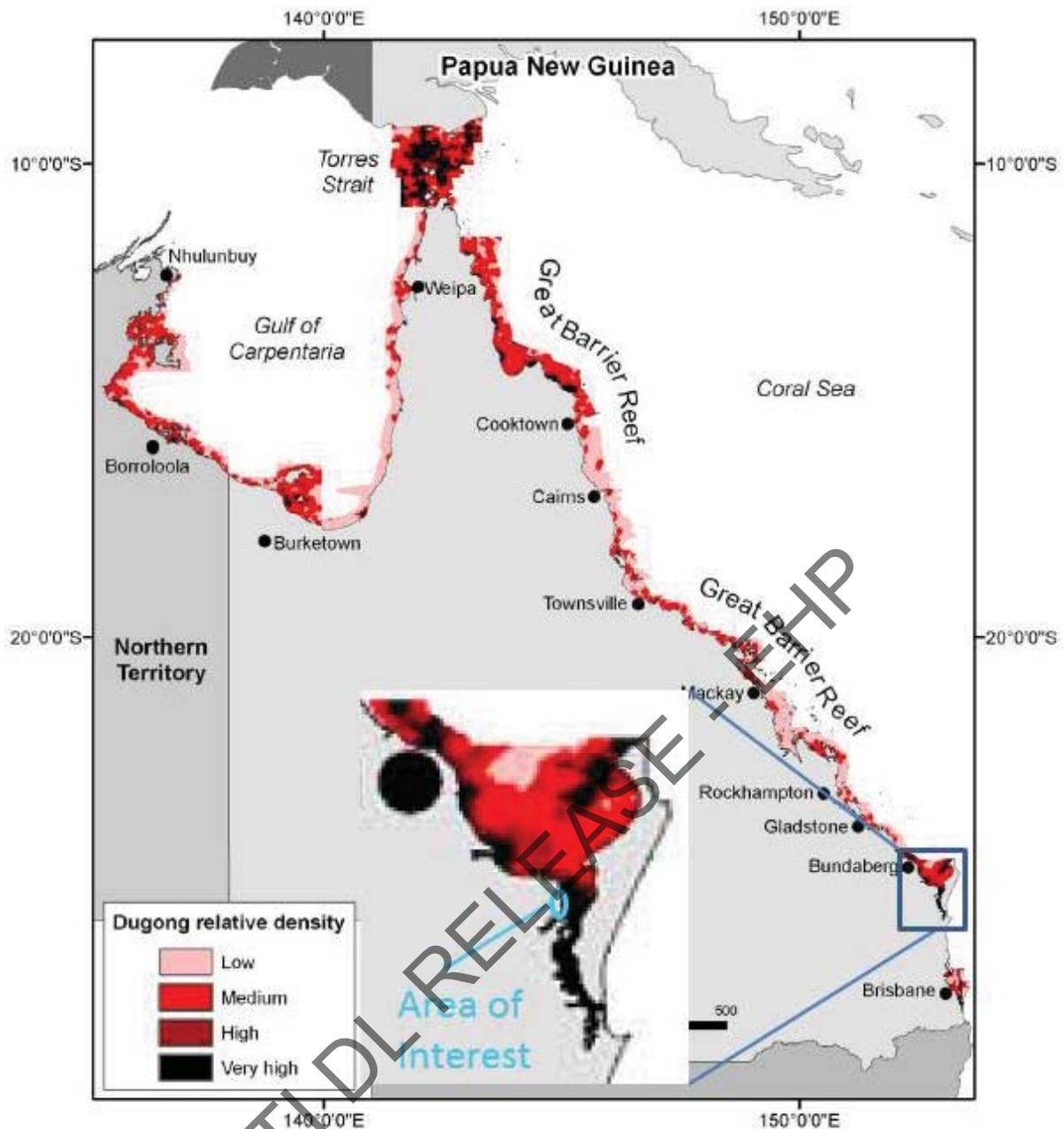


Figure 2. Spatially-explicit population models of dugong distribution and relative density in northeast Australia. The spatially-explicit models were interpolated from a 20-year time series of systematic aerial surveys of dugongs at the scale of 2 km * 2 km planning units. Planning units were classified as low, medium, high and very high dugong density on the basis of the relative density of dugongs estimated from the models and a frequency analysis. The model of dugong distribution and relative density in the southern Great Barrier Reef region is from Grech and Marsh (2007) [21].
doi:10.1371/journal.pone.0017993.g002

Figure 5 after Grech et al 2011, identifies the area of interest as having very high dugong density within the Hervey Bay/Great Sandy Strait dugong hotspot.

4. Supporting information addressing Elements of Outstanding Universal Value in the area

a) Poor water quality issues and Reef Plan. The Mary River is a ReefPlan catchment whose land-based pollutants already contribute to poor water quality within Great Barrier Reef waters –and discharge to the Great Sandy Strait – Booral seagrass meadows are just north of the mouth of the Mary River:

see <http://www.reefplan.qld.gov.au/resources/assets/reef-plan-2013.pdf>

When identifying which catchments contributed most to Great Barrier Reef water quality, the *2013 Scientific Consensus Statement on Land use impacts on Great Barrier Reef water quality and ecosystem condition* noted that “ *The highly valuable seagrass meadows in Hervey Bay, and the importance to associated dugong and turtle populations in the Burnett Mary region, were not included in the ranking analysis, as they are outside the Great Barrier Reef Marine Park boundaries*” and “*Fine sediment (less than 16 micrometres) material is the fraction most likely to reach the Great Barrier Reef lagoon, and is present at high proportions in monitored total suspended solids in the Burdekin, Fitzroy, Plane, Burnett, and Normanby catchments.*” <http://www.reefplan.qld.gov.au/about/assets/scientific-consensus-statement-2013.pdf>

Thus any further mobilisation of fine sediment in the water may counter improvements gained through land-based Reef Plan actions; and the Consensus Statement specifically flags biodiversity features of Hervey Bay in its comments on Reef Plan assets. Grech *et al.* 2011 identify the northern Great Sandy Strait as having high / very high dugong density thus seagrass habitat is likely within the wider area.

b) Several species and ecosystems listed in GBR criteria for outstanding universal value occur in waters off the Burnett River and contributing to the **Integrity** of the GBR, are also EPBC listed species:

- EPBC listed dugong are a potential MNES species not considered in the application. **Dugong habitat connections with GBR:** The Great Sandy Strait supports the Integrity of the GBR by possessing the highest dugong relative density within the most significant dugong population south of Torres Strait, in Hervey Bay (see Grech *et al* 2011 – showing the area of interest circled in blue). There is a direct connection between Hervey Bay/Great Sandy Strait dugong and GBR waters: tagged dugong perform long-distance movements to the waters of the GBR and by ultimately replenishing its depleted populations contribute to the Reef’s Integrity and maintain an element of its outstanding universal value (dugong). Genetically dugong of the Shoalwater Bay area of the GBR, Hervey Bay/Great Sandy Strait and Moreton Bay are thought to be the same population (Blair *et al.*, 2013; Meager *et al.* 2013). The Booral seagrass meadows adjoining the subject property are a significant seagrass habitat for dugong that is regularly impacted by flooding (Preen and Marsh 1995). After the 1998 flood recovered comparatively quicker than other seagrass meadows in Hervey Bay, demonstrating its resilience to the impacts of flooding and importance as a refugium (Campbell and McKenzie 2004).
- Inshore fringing reefs (C viii): Reefs of Woody, Round and Little Woody Island within the Great Sandy Strait suffered mortality in the 2011 flood (Butler *et al.* 2013). Connected habitats such as seagrass, mangrove and saltmarsh provide flood resilience for reefs through migration of herbivorous fish that reduce algal overgrowth of coral (Olds *et al.* 2012). Booral seagrass meadows and Turtle cove mangrove/saltmarsh provide connectivity for herbivorous fish to these fringing coral reefs of the Great Sandy Strait islands (Zann 2012, Zann *et al.* 2012).
- A diversity of marine species and ecosystems (C ix). The Great Sandy Strait Ecological Character Description documents diversity of marine species and ecosystems.

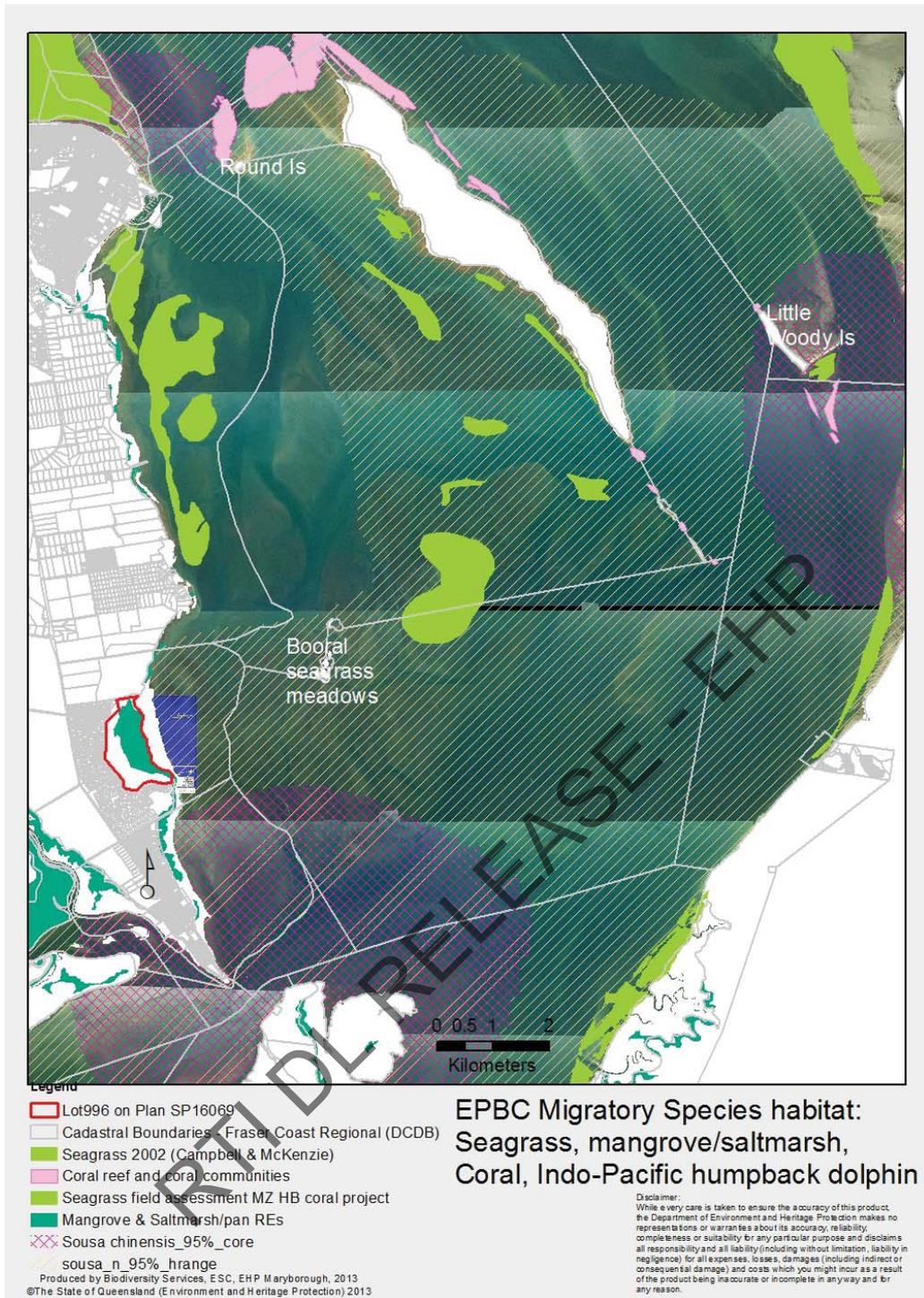


Figure 6: Relationships between mangrove/ saltmarsh, seagrass and reef habitats. Booral seagrass meadows are also core / home range habitat for Indo-Pacific humpback dolphin, *Sousa chinensis* (spatial data after Cagnazzi *et al.* 2011).

5. Nature and extent of likely impact.

a) Cumulative impact issues related to the existing condition of the species and ecosystems post flood and the likely cumulative impacts of dredging are relevant to the GBR. The applicant would need to list sensitive receptors and address the nature of the likely impact the extent and importance of ecosystem processes. For example:

- Cumulative impacts on coral communities were already experienced after flooding during 2011 (Butler *et al.* 2013) and 2013 (Butler pers. comm). Brodie and Waterhouse (2012) and Devlin *et al* (2012) document recent cumulative impacts on GBR turtles and dugong. The applicant had not addressed the need to monitor seagrass meadows before and after the development.
- Scheduled High Ecological Value waterways and their accompanying scheduled water quality objectives were addressed, but the impact of exceedence of acidity was not addressed. Whilst the proponent addresses water quality modelling on the site, maintaining the habitat values within HEV waterways should also be the objective of monitoring. The development plan fails to identify a minimum 200m vegetated buffer required to HAT to maintain water quality as well as to reduce the likelihood of shorebird disturbance.

b) Extent of the impact, taking into account cumulative and consequential effects.

Although the development only impacts on a small area of coastline, the values within this area are of such significance to both the Great Sandy Strait Ramsar Area (a critical shorebird roost) and the Great Barrier Reef (green turtle basking habitat / integrity of a critical seagrass refugia for green turtle and dugong) that there may be consequential effects on resilience of green turtles and dugong populations of the southern GBR.