Submission to the Queensland Government – Department of State Development, Infrastructure and Planning

by

The Centre for Ecosystem Science, UNSW Australia
Executive Summary

The two proposals, the Dredging project (Abbot Point dredging and onshore placement of dredged material EPBC ref 2014/7355) and the spoil disposal project (The Abbot Point Port and Wetland Project, EPBC ref 2014/7356) will impact on the Caley wetlands, a Wetland of National Significance (listed in the Directory of Important Wetlands), a significant community of migratory shorebirds (Matter of National Environmental Significance, MNES), the endangered Australian painted snipe (Endangered- Environment Protection and Biodiversity Conservation Act 1999, MNES) and the Great Barrier Reef World Heritage Area (MNES).

- The environmental assessment is poorly documented with relatively little adequate assessment of a highly significant and potentially deleterious development to one of Australia and Queensland’s more important wetlands which is connected to the Great Barrier Reef World Heritage Area.

- The size of the project demands a fully developed, rigorous and transparent environmental assessment given its potential for significant impact to Matters of National Environmental Significance under the Environment Protection and Biodiversity Conservation Act 1999.

  o A significant migratory shorebird community (up to an estimated 1709 individuals)
    ▪ >0.1% of red-necked stints, sharp-tailed sandpipers and
  o Australian painted snipe, endangered species
  o Migratory waterbird species
    ▪ >1% of little tern population (omitted from preliminary documentation)
  o Great Barrier Reef World Heritage Area

- The Caley wetlands are listed in the Directory of Important Wetlands as nationally important for their size, complex mixture of wetland vegetation, extensive area, support of up to nearly 50,000 waterbirds, a significant community of migratory shorebirds, a significant population of the endangered the Australian painted snipe, two turtle species, 11 native frog species and 36 species of fish supported by a complex catchment system. They would qualify as a wetland of international importance under the Ramsar Convention.

  o The proposals will destroy 159ha of the wetland.
  o They have supported up to an estimated 1709 individual migratory shorebirds.
  o The proposals will fundamentally alter the hydrology through the building of bunds around the dredge spoil dump and embankments for the railway which cuts through the wetland. This will significantly impact on the wetland ecosystem, its functioning and its waterbirds, including migratory shorebirds and other organisms (fish, frog species, turtles, invertebrates, native vegetation).

  o The modelling of impacts to the wetland uses a two-dimensional hydrodynamic model for which there are few input data, no calibration and assumptions and extrapolations made about the bathymetry which considerably uncertain.

  o There is no evidence that the project is an overall wetland enhancement, as claimed by the Queensland Government. On the contrary, the project has considerable potential to severely degrade the Caley wetlands and their values, including habitat for migratory shorebirds. The removal of a historic bund wall and causeway will not balance the deleterious impact of destruction of 159ha of wetland, the building of an embankment
across the wetland and pollution of the wetland with tailwater, stormwater and leakage from the bund around the dredge material.

- The diversion of tailwater and stormwater directly into the wetland poses a considerable long-term risk given the potential mobilisation of acidity from acid sulfate soils and heavy metals, driven by extreme rainfall and wave action events, affecting the wetland ecosystem.

### Impacts to the Great Barrier Reef World Heritage Area

- Dredging of the port in the Great Barrier Reef World Heritage Area will mobilise fine sediment which will affect marine ecosystems and their fauna and flora, including coral reefs.
- Operation of the port will increase accidents with marine fauna, including whales and turtles, as well as increasing pollution.
- The wetland areas receiving pollutants from tailwater and stormwater, directly connect to the Great Barrier Reef World Heritage Area, increasing the potential pollutant impacts on the GBRWHA.

### The current assessment by the Queensland Government is inadequate, providing little confidence to the community or the Australian Government that some of our most important environmental assets will not be fundamentally degraded. In particular

- The hydrological assessment is inadequate, given the poor availability of real input data for models attempting to model a highly complex environment;
- The absence of any detail of the structure of the embankment and particularly the connectivity of aquatic ecosystems severed by this structure through the wetland;
- The absence of any information on the impact of the railway on the hydrology of the local catchments providing water into this system;
- There is poor temporal and spatial data coverage on water quality, biotic organisms and ecological processes critical for the functioning of the Caley wetlands;
- There is clear evidence of the potential for pollutant impacts from acid sulfate soils and mobilisation of heavy metals but little evidence of how this will be controlled or mitigated, given its proliferation;
- There is poor evidence for groundwater and surface water interactions and yet these are well connected allowing for the flow of pollutants.

### Mitigation measures

- The establishment of offsets will not adequately compensate for the loss of wetlands as there was insufficient demonstration of a net conservation benefit.
- The establishment of a nature reserve for the wetland may incur a long-term cost in terms of management for pollution and inadequate hydrological connectivity caused by the railway embankment and the bunds around the dredge spoil dump.

### The Centre for Ecosystem Science, UNSW make two key recommendations to make this project sustainable and not impact on the nationally important wetlands, the migratory shorebirds or the Great Barrier Reef World Heritage Area:

- 1. the dredge spoil be moved to a terrestrial area, preferably one that is already highly modified by human impact (e.g. agricultural or industrial land) where it is not connected to the wetland or Great Barrie Reef World Heritage Area and;
- 2. the Queensland Government implement best practice rehabilitation and mitigate the current proposed impacts of development on hydrological connectivity. Specifically,
- a. hydrological connectivity of the wetlands should not be severely interrupted by the railway embankment and so there should be a bridge over the wetlands to avoid this and;
- b. rehabilitation as specified should progress involving the removal of the Western Bund and Causeway to improve flushing of the wetlands.
**Introduction**

The Queensland Government’s information on Environmental Impact Statement in its Abbot Point Port and Wetland Strategy identifies key environmental aims to protect 1) the Great Barrier Reef “negating the need for offshore disposal of dredge material for the expansion of the Abbot Point into the Great Barrier Reef Marine Park” and 2) the wetlands – “enhancing the Caley Valley Wetland and remediating degraded hypersaline areas” (Volume 4, Appendix 1, Abbot Point Port and Wetland Strategy, 1.2.1).

The Queensland Government has provided “Preliminary documentation” relevant to the proposals which are on public exhibition (http://www.dsdip.qld.gov.au/infrastructure-planning/abbot-point-strategy-public-comment.html) for two proposals: 1). the Abbot Point Development and Wetland Project and 2). the Abbot Point Dredging and onshore placement of dredged material. The material provided consists of four volumes ranging across assessments of the impacts of these two developments on the wetland ecosystem and the Great Barrier Reef World Heritage Area, developed by a range of consultants.

Submissions, including this one, will be provided to the Queensland Government by the 18th December 2014. At which point, the Queensland Government will summarise how comments have been addressed and report to the Department of the Environment of the Australian Government. From the 18th December, the Federal Minister for the Environment has a maximum of 40 days to either approve or not approve the two developments under the *Environment Protection Biodiversity and Conservation Act 1999* (EPBC). During this period, the Australian Government will consult with the Queensland Government. If the proposals are approved, dredging will begin in 2015.

**Abbot Point Port Development**

There are four proposals for the Abbot Point Port Development. The existing Terminal (T1) began operation in 1984 and was expanded in 2011 to increase export capacity, increasing to two berths. Two approved proposals relate to the development of two other port terminals (Terminal 3-GVK-Hancock; Terminal 0-Adani), approved by the Australian and Queensland Governments. The two current proposals for assessment, the Dredging project (Abbot Point dredging and onshore placement of dredged material EPBC ref 2014/7355) and the spoil disposal project (The Abbot Point Port and Wetland Project, EPBC ref 2014/7356) are the most significant in their scale and potential impact on the wetlands and the Great Barrier Reef World Heritage Area (GBRWHA). A total of 159ha of wetland will be directly destroyed and 97.1 ha of marine sediment will be dredged and damaged.

**Dredging project (EPBC ref 2014/7355)**

For coal tankers to access coal from the Galilee Basin, the Queensland Government has recommended that the port be deepened by dredging the marine environment adjacent to the port. This involves the dredging of 1.7 million m$^3$ of sediment from the seabed in the Great Barrier Reef World Heritage Area. This will piped to the onshore dredge spoil dump (Fig. 1) which is the subject of the second development proposal (the spoil disposal project, see below). During dredging operations, excess water from the ponds will be discharged to the ocean, through the return pipeline (Fig. 1). Once dredging is complete, the dredging project also includes a proposal to
construct a tailwater discharge pipe from the spoil disposal site to the wetland west of the port. Stormwater will be similarly discharged.

**Spoil disposal project (EPBC ref 2014/7356)**

This involves the building of storage ponds (305-335 hectares, capacity of up to 6 million m³) within a ‘the beneficial reuse area’ (dredge spoil dump (dashed line), Fig. 1). This would destroy 146 ha of the Caley Valley Wetlands, consisting of saltcouch grassland, samphire forbland and sedgelands. There will be embankments created and pipework to manage tailwater and stormwater into the wetlands. The embankments around the beneficial use area will not be lined.

In addition, increased rail access to the Abbot Point Port will be through the building of a railway line through the wetlands. Coal trains would be able to access the port along a new railway embankment (3.6 km long, 3 metres high, 8m wide, 20ha, Fig. 1) through the middle of the Caley Valley Wetlands, destroying 13 ha of wetlands, sometime in the future. In addition, there would be “a 12m wide access track along the alignment beside the embankment, to accommodate two-way traffic”. Dredge spoil will be used in the construction of the rail embankment from ‘borrow areas’ in the ‘beneficial use area’. The embankment will have a 20 year design life (Vol. 4, Appendix 13, p.44).

![Figure 1. Site of Abbot Point Port development proposals in northeastern Queensland, adjacent to the Great Barrier Reef World Heritage Area showing key issues that are the focus of this submission. The dashed green line provides an approximate boundary of Caley Wetlands; the white area is the ‘beneficial use area’ within which marine dredge material will be placed in the dredge spoil dump (dashed white line) from which excess water will be drained (return pipeline) back into the sea; the red lines show the placement of the railway embankment and the yellow dashed line the rail loop line and; small blue arrows indicate region for stormwater discharge; large blue arrows are the main creek systems that fill the Caley wetlands.](image-url)
Environmental assessment
There are clearly Matters of National Environmental Significance as well Matters of State Environmental Significance potentially affected by these two development proposals. The structure of this submission is to focus on key concerns for these matters. It follows the logic of using the background information provided by the Queensland Government in their Environmental Impact Statement for three key issues:

1. Caley Valley Wetlands and its dependent organisms (migratory shorebirds and other waterbirds, vegetation), its surface water and groundwater;
2. pollution (acid sulfate soils, metals) and;
3. the Great Barrier Reef World Heritage Area (GBRWHA).

Each is separately addressed, followed by a description of the Queensland Government’s assessment of risk and impact. Finally, each issue is critically assessed by the Centre for Ecosystem Science and in particular in relation to the risk to the wetland and GBRWHA.

Caley Valley Wetlands

Values – Queensland Government Assessment
The Caley Valley Wetlands are listed as nationally important in the Directory of Important Wetlands in Australia (Fig. 1). They cover about 5,154ha, making them one of the largest intact wetland systems between Townsville and Bowen. They are also a wetland of national significance for their size. They comprise a salinity gradient including a mosaic of freshwater, brackish and marine habitats and their dependent vegetation. Tidal regimes affect the western part of the wetlands, reaching a maximum of 2.4m at Abbot Point. The salinity of wetland ranges from turbid freshwater during floods to seawater salinity during dry periods. The wetlands can be 18km by 6km wide during the wet season and dry out during the dry season. Based on assessment by the Queensland Government, only 0.3% of the wetland is considered artificial or highly modified (http://wetlandinfo.ehp.qld.gov.au/wetlands/facts-maps/diwa-wetland-abbot-point-caley-valley/).

The wetlands have high nutrient levels indicative of high productivity, measured at nine sites in the wetlands (Oct-Nov, 2010).

The wetlands provide habitat for a range of animals and plants. There are “up to fifty species of mammal and reptile (including introduced species)...in and adjacent to the wetland”. There are two species of freshwater turtle in the wetland and eleven frog species. There are mudflats, forblands, grasslands and woodland as well as freshwater wetlands.

The wetlands are also important for fisheries of economic value. They provide ‘high quality habitat for fisheries of significance as well as a range of threatened and migratory species’. There are 36 fish species, including only one introduced species (mosquito fish Gambusia holbrooki). These include marine and estuarine species, dominated by small bodied and juvenile fish. Some of these fish use marine and freshwater environments. Nine species are found in the wetland system. There are also several crustaceans of economic value, including several prawn species (e.g. banana prawn Penaeus mareguensis) and mud crabs. The western estuary, coastal zones and Saltwater Creek are particularly important fisheries habitat.
Migratory shorebirds and other waterbirds
The wetlands supported 52 species of waterbirds, including an estimated 48,000 birds in March 2012. Such abundances in the Caley Valley wetland, “…particularly when migratory shorebirds are present over the summer months can be considered a superlative natural phenomenon” (Volume 2, p. 166). There are 15 migratory shorebirds recorded for the wetlands, a number which “…represents almost half the total number of migratory shorebirds listed under the EPBC Act” (Volume 4, Appendix 13, p. 21). Further, either the importance of the habitat or its perennial value for migratory shorebirds is indicated by the observation that “it is significant that over half the species found at Abbot Point were recorded on multiple occasions at Abbot Point” (Volume 4, Appendix 13, p. 22).

About 1700 migratory shorebirds were recorded in the wetlands. For two migratory shorebird species, red-necked stints and sharp-tailed sandpipers, numbers were above 0.1% level of national importance, respectively 0.75% and 0.38%. In addition, there were an estimated 63 Latham snipe recorded, well above the threshold of 18 considered for habitats of national importance.

Also, there were an estimated 35 Australian painted snipe, recorded (1.87% of the national population), endangered under the EPBC Act 1999. Historically the species also bred in the wetland, with the observations of family groups and breeding recorded in 1978 recording of breeding. Two other species occurred in nationally important abundances (>0.1%): Eastern great egret and Caspian tern.

Vegetation communities
There is an endangered EPBC community adjacent to the north of the containment pond but it is unlikely to be impacted. One local semi-evergreen vine thicket will be destroyed, representing a relatively small part of this vegetation community.

Surface water - Queensland Government Assessment
The wetlands are fed by many different creek systems including Plain, Splitters, Spring, Branch, Tabletop, Maria, Mount Stuart, Six Mile, Goodbye and Saltwater Creeks from a catchment of about 83,000 ha (Fig. 1). Saltwater Creek is actually a freshwater creek, providing the largest input of water and holding water most of the year. The hydrology is governed by spatial and temporal inundation patterns influenced by inflows, evaporation and tidal processes. Inflows are highly seasonal, filling with freshwater in the wet season, with considerable flooding in some seasons (Volume 4, Appendix 1, Hydrological setting, 2.3.2).

Groundwater - Queensland Government Assessment
Groundwater levels below wetlands “are largely unknown but expected to be shallow and generally within 5m or less of the ground surface” (Volume 4, Appendix 1, Hydrological setting, 2.3.2). Groundwater flowing north from east and west are believed to discharge into the wetlands, providing an important source of water to the wetlands during the dry season. It may “also interact with Wetlands surface water within the hyporheic zone beneath ephemeral waterways, indicated by the shallow depth to groundwater” (Volume 4, Appendix 1, Hydrological setting, 2.3.2), below some of the creeks. There are “likely, although unquantified, groundwater interactions. The pH in groundwater samples ranged from pH 4.3 to pH 6.3 indicating acidic conditions (Volume 4, Appendix 1, Wetland basin, 2.3.2.2).
**Historical impacts - Queensland Government Assessment**

A Western Bund on Mount Stewart Creek was built in the early 1980s (Fig. 1), restricting tidal movements to the northern section of the wetlands. It also restricts movement of aquatic fauna, reducing fish habitat. A causeway was also built in the 1950s and refurbished in the 1980s to provide “access for construction equipment to the Abbot Point Coal Terminal” ((Volume 4, Appendix 1, Wetland basin, 2.3.2.2, Fig. 1). Tides move through a small culvert and large floods would flood over the causeway. The bunds are believed to prevent movements of fish between the main wetlands and the western parts.

**Queensland Government**

**Risk and Impact Assessment**

The dredge spoil dump will result in the destruction of 146ha of wetland vegetation where “…adverse impacts to aquatic ecological values supported by the Wetlands are expected to occur at highly localised (measured in 100’s of metres – within the vicinity of the construction footprints)”. The railway embankment through the middle of the wetland will destroy 13ha of wetland and potentially affect hydrological flow (Volume 4, Appendix 1, World Heritage Area and Natural Heritage Place, 5.5.2).

With the wetland enhancement strategy including the removal of historic bunds and the causeway and installation of the embankments with flow control, “The timing, magnitude and frequency of flows is not significantly altered” (Volume 4, Appendix 1, Mitigation measures, 5.4.1). Further, it also provides “…a long term climate change adaptation mechanism for controlling ingress of saltwater associated with future sea level rise and storm tides…” (Volume 4, Appendix 1, Preferred Option, 6.1.3).

Mounding is “expected to be small in comparison to overall variability of water levels in the area...Potentially highly localised changes to salinity, and associated with this, aquatic ecosystem could occur within any areas of groundwater expression in the wetland basin. Any impacts are expected to be short-term” (Volume 4, Appendix 2, Water Quality, Executive Summary).

The “optimal flow regime for the Wetlands will need to be designed and implemented through a **Wetland Basin Hydrology and Flow Management Plan** which will be prepared prior to construction” (Volume 4, Appendix 1, Preferred Option, 6.1.3).

**Hydrological and ecological impacts**

To determine flow impacts of the embankment as well as potential removal of an old bund and causeway (wetland enhancement), a two dimensional computer model (TUFLOW-FV) was developed to assess tidal flushing and wetland enhancement that simulates “hydrodynamic, sediment transport and water quality processes in oceans, coastal waters, estuaries and rivers”. It was considered that the “three dimensional processes driven by salinity and/or thermal stratification are not significant issues for this study, even though they might occur from time to time”. “The primary source of the elevation data was 2009 LiDAR. The bathymetry based on LiDAR required considerable smoothing and manipulation, representing “a significant uncertainty in the modelling results”. Catchment runoff was modelled at major inflow locations, corresponding to local catchments, using Source. Water levels and conductivity were measured at two sites in Saltwater Creek (Oct-Nov, 2010) (Volume 4, Appendix 2, Water Quality, 2.3.2.3).
Significant changes to the hydrological regime, particularly wetting and drying regimes are unlikely because the key infrastructure have been designed to not interfere with the exchange of water through the Caley Valley Wetlands. This is to be done by “…limiting the impact to pond embankment, within catchment diversion drains or diversion bunds; ponding of water against the pond embankment from local catchment drainage, regional flood levels, storm surges and mean sea level rise; intercepting and diverting local drainage catchments around the pond embankment and maintaining positive catchment drainage and flow regime as close as possible” (Volume 4, Appendix 19, p.1).

**Migratory shorebirds and other waterbirds**

The 15 migratory shorebirds species are considered ecologically similar and occupy the same parts of the site and so were assessed as a single group. There is a direct impact on habitat loss for Australian Painted Snipe of 114.3ha where the “…total residual impact area for the Australian painted snipe is 130.7ha” (Volume 4, Appendix 13, p.85). One individual Latham snipe was recorded in the dredge spoil dump. The railway embankment will cut across habitat used by red necked stints. There is a need for “… offsets to compensate for these residual impacts to migratory shorebirds and the Australian Painted Snipe …” (Volume 4, Appendix 13, p.86). The infrastructure will increase accessibility by feral animals and the establishment and operation of the infrastructure will affect feeding and roosting of migratory shorebirds.

For migratory shorebirds and Australian painted snipe - “The loss of habitat and the additional potential impacts to the wetland would be considered a significant impact...” (Volume 4, Appendix 21, p. vii). The loss of the northeastern portion is also considered “significant”. There are direct impacts of loss of habitat as well as disturbance to foraging and roosting birds. But in summation, “It is not expected that adverse cumulative impacts to threatened or migratory aquatic species would occur as a result of the project...” (Volume 4, Appendix 1, Executive Summary).

**Mitigation**

For the loss of wetlands destroyed by the dredge spoil dump, there will be an offset strategy but operation of the facility will “not cause a significant long term impact on the values of the adjacent wetlands...” (Volume 4, Appendix 1, Dredged material management areas, 4.2). This will be done through a wetland offset, best practice erosion and sediment control and management of flows through the embankment. The railway embankments will have a design providing active flow control. Flows and fish passage will be maintained with appropriate design and placement of culverts (smooth bed culverts, flow velocities <0.3m/s) and fish ladders within the railway embankments, designed for bi-directional flows within the Caley Valley Wetlands into downstream estuarine environments. These will be “measures that improve and maximise fish passage through the Wetland” (Volume 4, Appendix 1, Preferred Option, 6.1.3).

Further, removal of historic bunds will improve degraded wetlands and connectivity, including allowing two-way movement, with a weir system through bunds and embankments. Decommissioning of existing causeways will improve the flow regime and rehabilitate hypersaline areas. The Western Bund will be removed to restore the hypersaline area, through a two-step process, with the aim of restoring tidal flows by building three culverts. Currently, the Causeway also affects fish movements between the estuary and freshwater environments and would be removed once the embankment is in place.
There is an estimate of an offset for protection and enhancement of 1409 ha of existing, adjacent wetland habitat as well as 261.4 ha, including 38.2 ha of freshwater wetland habitat and 223.2 ha of saline influenced habitat.

Centre for Ecosystem Science Assessment
There will be a direct loss of 159 ha but there are also likely to be considerable indirect effects caused by major changes to flooding and drying patterns of the wetland caused by the development of embankments around the dredge spoil dump and the railway embankments. These are likely to impact on dependent organisms, including migratory shorebirds in many ways, including the reduction of habitat, decreased functioning of the wetland affecting the foodweb and increasing disturbance by equipment and people and access for feral animals.

Direct loss of wetland habitat
The direct loss of 146 ha of wetland will reduce foraging, roosting and breeding areas for migratory shorebirds and other dependent organisms. The Queensland environmental assessment of risk does not quantify the importance of this area, given the relatively poor data coverage. There is a need to have considerably greater understanding of the importance of this northeastern area of wetland to migratory shorebirds, given its destruction. Similarly, the loss of wetland areas destroyed by the embankment (13 ha) will also affect feeding and roosting areas of dependent organisms, including migratory shorebirds.

There is a commitment to establish an offset of 1409 ha (Volume 4, Appendix 21, page vii), but there is no information provided to adequately assess this benefit. Fundamentally, there is no establishment that protection of already existing wetland habitat confers a benefit, a key principal of offsets. To adequately do this, there needs to be clear demonstration that threats have been reduced.

Indirect hydrological and ecological impacts
There is little evidence that the assessment of little impact on the hydrology will occur. There is an assertion that alterations of flow to the wetland basin will have little impact on local hydrology but little detailed assessment or quantification of this flow and how it will be more damaging in dry periods compared to wet periods and the consequences of storm surges and flood and rainfall events. There is a concession that minor to moderate hydrological effects may occur within tens of metres of the bund wall.

The 3.6 km railway embankment is a significantly large structure which will considerably change the flow of water across the wetland and out to the Great Barrier Reef World Heritage Area. The Queensland Government offers argument that ‘culverts and fish ladders’ will ensure flooding and drying patterns are maintained. There is little detail provided to provide confidence for this assertion. This includes lack of detail on the positioning of culverts and how many in relation to flows. Most importantly, a model should be built to estimate the effects of such changes on flow patterns. Given that the culverts will inevitably restrict some flow, there will be inevitable impacts on the flooding and drying patterns of the wetlands. Further, these changed flow paths are likely to increase erosion and sedimentation patterns in different parts of the wetland. This is also likely to contribute to ongoing maintenance of flow management across the embankment.
The model used to assess hydrodynamics of the wetlands is primarily used for “…oceans, coastal waters, estuaries and rivers” but not wetlands. There were also clear inadequacies in the data availability for the modelling which was critical to assessing impacts of the railway embankment and the bunds around the dredge spoil dump. These included poor data input and considerable uncertainty. For example LiDAR coverage was not available for the “…north-western corner of the Wetlands”, a critical area for assessment that removal of the bund and causeway would result in significant enhancement as well as the area where stormwater would be diverted.

The flooding and drying regimes of the wetlands depend primarily on sources of freshwater into the wetlands from the creek systems, including Euri and Saltwater Creeks for which flow data are “…largely unknown”. Correspondingly, “catchment inflow was uncalibrated except for one flow gauging station” (Volume 4, Appendix 1, Assumptions and limitations, 2.2.4). There is an extremely high range of annual flows of up to 500,000 ML but modelling underestimated these flows by up to 20\% (i.e. 2008). Such underestimates may have considerable impacts on understanding effects of flooding and drying patterns and altered flow paths.

Overall, there is a need for improved assessment, given that “significant analysis and survey would be required to better simulate these conditions”. Further, salt dynamics are “unknown” as is the mass of residual salt in the soil. Overall, there was a clear admission of the difficulties in modelling such a complex system, given little time: “There was insufficient time or data on hydrodynamic characteristics of the wetland system for calibration of the TUFLOW-TV model for either hydrodynamics or salinity”. Further, “…results of hydrodynamic modelling still need to be considered with a degree of uncertainty until they can be verified against measured conditions (flows, velocities, levels, salinities etc.)” (Volume 4, Appendix 1, Assumptions and limitations, 2.2.4).

Further, modelling of the complex inundation flooding and drying patterns were relatively poor, given absence of catchment inflow data and poor opportunities for calibration. This is one of the most critical aspects of the environmental assessment and yet the supportive documentation and modelling provides little confidence that the modelling of impacts is adequate. Worse, there is considerable understanding that establishing a major structure across a wetland will have significant effects on hydrological and ecological processes. Given the likely indirect impacts of altered hydrology on the wetland and its dependent organisms, should the proposals be approved, then consideration should be given to building a bridge across the wetlands for the railway line and access tracks to ensure that the long-term and cumulative impacts on hydrology and ultimately the functioning of the wetlands will not be affected, beyond that of the direct loss of wetland.

Critically, there is no discussion about the impact of the new rail line in cutting across the key infloowing catchments into Caley wetlands (see Figure 1, yellow dashed line). This may have impacts affecting flow patterns of the creek systems if not adequately addressed.

**Migratory shorebirds and other waterbirds**

Migratory shorebirds are in decline around Australia and this development will further contribute to this trend. There will be considerable direct loss of habitat and unknown secondary impacts to habitat for migratory shorebirds. Additionally, the construction of a bund wall around the dredge spoil dump, the dredge material itself and the embankments for the railway will impact the hydrology of the site. Together, these two actions have considerable potential to impact migratory shorebirds, which is relevant to Matters of Environmental Significance, compliant with the EPBC Act...
Further, it is the aim of the Australian Government, articulated in the draft migratory bird conservation plan to “maintain or improve, where possible, international obligations that concern migratory bird conservation”. These proposals have a net destructive effect on migratory shorebird habitat.

The lumping of all 15 migratory shorebird species into one group for assessment is inadequate given that migratory shorebirds are well known for their feeding adaptations which partition different niches across habitats. There is no discussion of the impact of altered hydrology on migratory shorebirds, even though as argued above, this is likely to be significant and uncertain. Altered hydrology will impact on migratory shorebird roosting and foraging areas by changing flooding and drying patterns and the functioning of the wetland. It is difficult to assess the extent of this impact because of poor confidence in the modelling and because of the lack of data for where different shorebirds feed and roost and how dependent they are on different parts of the habitat.

There is a clearly a significantly large and diverse waterbird population supported by the extensive wetlands and numbering up to about 48,000 individuals. These included an estimate of about 350 little terns *Sterna albifrons*, listed as endangered in Queensland (BMT 2012. Kaili (Caley) Valley Wetlands Baseline Report). The size of this population was not considered in the preliminary documentation prepared by the Queensland Government for assessment of the impact of the proposals. The Caley wetlands support more than 1% of this species, further underlining their importance. The species was found in the hypersaline area which is most likely affected by changes to hydrology and pollution.

Further, there are insufficient data to assess the estimate of offset habitat for Australian painted snipe. The EPBC Act Offsets Assessment Guide requires estimates of uncertainty, time lag, and area and condition of the offset or change in numbers of individuals as a result of the offset. This species requires specialist surveys to assess if it meets the 18 or more individuals required to be considered an internationally important site within the Caley Wetlands for this species. It is not clear whether this criterion has been met for the site to be destroyed. This requires survey effort to be 10 hours for 3 days for a site of 50ha, a set down by the Commonwealth Department of Environment (http://www.environment.gov.au/system/files/resources/107052eb-2041-45b9-9296-b5f514493ae0/files/survey-guidelines-birds.pdf).

**Pollution - Queensland Government Assessment**

There are significant sources of pollution which will impact on the nationally important Caley wetlands and the Great Barrier Reef World Heritage Area. In particular, these relate to Polychlorinated Aromatic Hydrocarbons (PAH), heavy metals, fine sediment with acid sulfate potential in the marine sediment to be dredged. There is potentially increased acidification (mobilisation of acid sulfate soils), heavy metal pollution, sedimentation and altered salinity. This will occur through the excavation of borrow pits in the dredge spoil dump, diversion of tailwaters, stormwater runoff, seepage through the bund walls into the wetlands from the dredge spoil dump and seepage into the groundwater.

Walls of the bunds in the dredge spoil dump will not be lined, producing seepage rates from bund walls calculated to be 220ML/yr (Volume 4, Appendix 1, Assumptions and limitations, 2.2.4). There
will be minor to moderate impacts to water quality may within 10’s of metres of the bund wall. There will also be seepage of dredge tailwaters into groundwater, producing temporary mounding 50-250m from the pond (Volume 4, Appendix 2, Executive summary).

There will be pipes to carry tailwaters from the dredge soil dump into the wetland. This will include draining of evaporated saline water back into the Great Barrier Reef World Heritage Area at 12,320 m³ per hour as well as seepage back into wetland groundwater. Also, as a long-term measure, a pipeline will carry stormwater into the Caley Wetlands to the west from the dredge spoil dump. “Stormwater will discharge from the beneficial reuse area, leading to more concentrated rates of runoff and potential routing of spills and contaminants into the Wetlands” (Volume 4, Appendix 2, Executive summary). Dredge spoil will also be used to build the railway embankment.

Water quality records for a number of samples were outside water quality guidelines, most consistently including “TSS, nutrients and dissolved oxygen (DO) and at a lesser frequency, chlorophyll a and pH during the wet season” (Volume 4, Appendix 15, p.2).

**Acid sulfate soils (ASS) and heavy metal pollution - Queensland Government Assessment**

Acid sulfate soil investigation identified actual and potential acid sulfate soils 1-0m AHD, with the highest concentrations in the central and southern portions of the dredge spoil dump. Further, “acid sulfate soil analysis has indicated that there is potential for acid to be generated from the dredged material...” (Volume 4, Appendix 20, p.25). Actual and potential acid sulfate soils were identified in the wetlands, with highest actual acid sulfate soils “in the lower lying portions of the Wetland (central and south western end) below 1m AHD” (Volume 4, Appendix 1, Water quality effects, 5.3.1). “Potential acidity was detected in 50 samples ranging in acidity (0.055-2.1%S) occurring from approximately -0.5 to -1.25mAHD” (Volume 4, Appendix 4, p.10). “These results confirm the presence of PASS, typically occurring from 1 to 0 mAHD...”. The northeast corner of the wetland has “either mildly acidic of mildly alkaline waters’, while pH in Lake Caley varied between 6 and 9.5 ((Volume 4, Appendix 2, Water quality, 2.3.3.4).

Actual acid sulfate soils “may be disturbed during shallow excavations during construction activities, and these areas will require lime treatment”. This includes the construction of the railway embankment. Such excavation may expose acid sulfate soils, resulting in acidification of ground water (Volume 4, Appendix 2, p.2/4).

In addition, acid sulfate soils will generate acid pollutants, mobilising the heavy metals within the sediment. Heavy metals were present in the sediment and also in the dredge material including chromium, copper, nickel and zinc detected in four soil samples but below criteria for residential settings. “Most dissolved concentrations of metals were similar between seasons with the exception of Aluminium which had much higher (2-4 times) concentration in the dry season compared to the wet season” (Volume 4, Appendix 15, p.92). Further, there was evidence that “…the highest concentrations of Copper which exceeded the ANZECC Guideline value for 95% species protection were observed at a number of sites spread through the area”. It is not clear how these levels compare to background levels as no assessment was provided of background levels in marine sediments away from a major port or for wetlands that were not adjacent to this port. There
is a need to identify how much pollution has already occurred on these wetlands and the marine sediments, given there has been a 30 year history of port operation at Abbot Point.

Trace metals varied over time in the wetlands, with the Saltwater Creek and western estuarine zone having the highest concentrations of most trace metals. In particular in Saltwater Creek, “concentrations of aluminium, chromium, copper and zinc which exceeded freshwater trigger levels”. Further, surface water monitoring in the wetlands showed that concentrations of aluminium, boron, chromium, cobalt, copper, iron, lead, nickel, vanadium and zinc at a number of sites in the wetland “exceeded the ANZECC guideline”. Concentrations of metals were highest in the wet season. (Page 36, vol 4, Appendix 1)

Queensland Government

Risk assessment and impact
The marine sediments’ “acid generating potential and the volume of material to be dredged places this project in the extra high treatment level category” (Volume 4, Appendix 4, Preliminary acid sulfate soil management plan, 4.0). A sediment study identified that marine sediments with potential acid sulfate soils contained a natural neutralising capacity, likely due to the presence of shell and other calcareous materials through the sediment” (Volume 4, Appendix 4, p.11). Dredge material was considered of low risk of developing acid drainage and negligible heavy metal and metalloid concentration and will be naturally saline. Further, although ASS were present below the dredge spoil dump, “the saline groundwater was likely to buffer acid flushes from ASS” (Volume 2, p.72). There is likely to be minor to moderate impacts to water quality may occur within 10’s of metres of the bund wall. The dredge spoil will saline although “the salinity of the spoil slurry is currently unknown”. There is “negligible heavy metal and metalloid concentrations within the dredge area” (Volume 2, p. 70).

Drainage to wetlands would have a negligible effect because the receiving environment in the immediate vicinity of the dredge material management area is saline to hypersaline, with groundwater throughout averaging about 1.5 times seawater concentrations and sometimes 2.5 times seawater in places. “…there is sufficient acid neutralizing capacity present in sediments to neutralise the amount of acid produced. On that basis, the risk of release of low pH (acidic) water to the environment due to acide generation from the dregdge material placement in the dredge material management areas is considered low” (Volume 4, Appendix 22, p.9)

During construction, “...there is a greater likelihood that sediment will be mobilised but it will then be mixed with the naturally turbid catchment runoff” (Volume 4, Appendix 1, Water quality effects, 5.3.1). This will be managed with sediment and erosion controls. A dam break would adversely impact on downstream wetlands due to mobilisation of contained solids and subsequent deposition in the wetland. Seepage of dredge water through bund walls is considered at low risk of developing acid drainage and negligible heavy metal and metalloid concentrations will be naturally saline. The construction of the railway embankment may excavate or fill with ASS but potential mitigation measures are available.

There will be a short term pulse of recharge to the groundwater but this will be small scale compared to overall variability. There is an estimated seepage of about 220ML per year as well as vertical seepage of “778m$^3$/ha/day for areas in situ sandy subgrade, and 78m$^3$/ha/day for in situ..."
clayey subgrade” (Volume 4, Appendix 2, Potential impacts, 5.2.1). The increased groundwater levels could affect the EVNT coastal vegetation community but this is not considered likely. Groundwater alkalinity and salinity is considered sufficient to buffer acidity. Seepage is likely to be localised “...due to low horizontal and vertical seepage rates, and the limited duration of seepage (i.e. during and shortly after the project).”

Construction of temporary tailwater return pipe and pipeline into the wetland to the west to allow for the discharge of stormwater, based on an agreed stormwater plan. For tailwater, “discharge into the western estuarine section of the Wetlands are considered from an environmental perspective as the most appropriate option...Discharge into the Wetlands would have impacts to wetland values from infrastructure construction, changes to hydrology and water quality during tailwater release...” (Volume 4, Appendix 2, Water quality, Executive summary). Tailwater discharge option is preferred because the wetland environment is similar in salinity, well flushed and allows mixing. The dry season output of the pipeline is 188ML per day compared to natural flow of less than 10ML per day. This “tailwater volume (and TSS load) is equivalent to a natural catchment runoff volume/load that is exceeded for only about 15% of the time”. This will increase suspended solid concentrations within the estuary. “It is expected that the high dilution and dispersion capacity of the ocean” make this the best option (Volume 4, Appendix 2, Preliminary assessment of Option B, 4.3.3). The effects of stormwater runoff “…are expected to have localised, short-term changes to water quality but with possible long-term and highly localised changes to physical habitats due to occur” (Volume 4, Appendix 2, Executive summary, p.ii). The dredge tailwaters are not expected to have contaminants that impact on flora and fauna.

Mitigation
There is also a need “for the geotechnical design and construction methodologies to minimise...” the risk of ASS material. Soils have “little to no buffering capacity” and so there is a need to “rely upon the neutralising capacity provided by groundwater and other water sources” (Volume 4, Appendix 2, p. 2/4). Groundwater alkalinity and salinity is considered sufficient to buffer acidity. There will be “inline pH adjustment pumps for treatment of low pH waters (<pH 5.5) prior to the discharge”. There may be a need to “utilise cut off walls or installation of lime trenches ore permeable reactive barriers across groundwater flow paths” (Volume 2, p.129). Lime neutralisation treatment will be conducted on excavated AASS and/or PASS with “a treatment facility constructed within the containment pond” (Volume 4, Appendix 18, p.20). A contingency management measures (e.g. fine ground agricultural lime)

Contaminants (fuels and chemicals) associated with machinery will be managed to “ensure that water leaving the work sites will be of similar quality to that of receiving waters” (Volume 4, Appendix 1, Water quality effects, 5.3.1). For mitigation measures of tailwaters and stormwater, there should be monitoring of water quality and vegetation impacts to determine if rehabilitation of vegetation is required.

Centre for Ecosystem Science Assessment
There is clearly considerable potential for major pollution impacts caused by acid sulfate soils, given their prevalence (actual or potential) in the wetland and marine sediment. There will be excavation of borrow pits and excavation of the embankment area which are likely to mobilise acidification. There are also considerable concerns about the interaction and mobilisation of heavy metals,
present throughout the wetland and in marine sediments that might occur with acidification. This acidic pollution of tailwater and stormwater will then be diverted into the wetlands and GBRWHA.

There is a strong claim made that the marine sediments are naturally buffered and any acidification will be buffered by the strong salinity and alkalinity of the groundwater. Few data or scientific evidence or back up are provided for the clearly important process. There is also evidence provided of high acidity in the groundwater as well as interactions between groundwater and surface water in the Caley Wetlands. Increasing acidification of groundwater is likely to interact with the surface water affecting the integrity and functionality of the Caley Wetlands and their dependent organisms, including migratory shorebirds.

There is also potential for coal dust to affect the wetland ecosystem and invertebrates which form the food source for migratory shorebirds. There are few data or modelling provided about the potential composition of sediment and its discharge down the tailwater and stormwater pipes to the wetlands and the GBRWHA. There are likely to be a range of pollutants including PAHs from 30 years of coal port operation and heavy metals. The effectiveness and capability of the tailwater and stormwater process to deal with significant rainfall events and storm surges is of considerable concern. Inevitably acidic soils and water will seep through the bund walls or over the top into the wetlands as well as reaching the wetlands via the stormwater pipe. The assertion that dredge tailwaters are not expected to have contaminants that impact on flora and fauna is poorly supported, given the evidence that these sediments will contain acid sulfate soils and heavy metals and high salinity. There is considerable concern that this pollution will impact on the functioning of the wetland and its dependent organisms. Importantly, the discharge of tailwater and stormwaters will go directly back into the GBRWHA.

**Great Barrier Reef World Heritage Area (GBRWHA) - Queensland Government Assessment**

The GBRWHA is well connected to the Caley Wetlands through the estuaries and flow paths of creeks. There are also ecological and natural heritage connections, particularly migratory shorebirds and other animals that use the Caley wetlands, including turtles and fish. Areas of international importance for migratory shorebirds both adjacent to and within the WHA are important natural heritage attributes of the GBRWHA.

There are three World Heritage Criteria attributes of the GBRWHA represented in the Abbot Point Area, including two of the four natural heritage criteria. Some relate to birds: connectivity between the wetlands and the GBRWHA; an important wetland for migratory shorebirds, waterbirds, including threatened species, foraging areas on the beaches and intertidal areas of the GBRWHA and; aggregations of birds in the wetlands. Many of the bird species inhabiting the wetland would directly use the beaches and intertidal areas within the GBRWHA for foraging at different times. The Caley Valley Wetlands also support threatened species, including Australian painted snipe and is deemed to contain important and significant natural habitats for in situ conservation of bird diversity (criterion 10). For marine mammals, the area has inshore habitats for dolphin species (snubfin and Indo-Pacific humpback dolphin), dugongs and migrating humpback whales. “The conservation importance of Australian Snubfin and Indo-Pacific Humpback Dolphins in a local context should therefore be considered as high” (Volume 4, Appendix 22, p.17)
There are also attributes of relevance in relation to Outstanding Universal Value. These relate to integrity, natural values and the significant ongoing biological and ecological processes of terrestrial, fresh water and marine ecosystems, clearly exemplified by the interactions between Caley Wetlands and the Great Barrier Reef.

There are direct and indirect impacts to the GBRWHA. Direct impacts are related to the dredging impacts and changes to hydrology of the wetlands, given that “Parts of the western estuarine zone and the coastal section of the Wetlands are in the GBRWHA” (Volume 4, Appendix 1, Executive Summary). Indirect impacts relate to potential long-term impacts of pollution on GBRWHA, resulting from the tailwater and stormwater runoff from the spoil disposal dump.

Queensland Government

Risk assessment and impacts
The developments for the project “…have the potential to cause beneficial and adverse indirect effects to environments within the GBRWHA during construction and operational stages” (Volume 4, Appendix 1, Executive Summary). During dredging of the marine floor, suspended sediment will be transported north-west and south-east. It is estimated that the area affected by increased Total Suspended Solids (>5mg/L) is estimated to cover an area 8.2 km by 1.2km from the dredge. Recent surveys found no seagrass in this dredge area. The development area is “within a region identified as ‘High Priority’ foraging habitat for Green Turtles within the GBRMP” (Volume 2, p. 142), but no turtles were observed within the dredge footprint. “Based on the application of mitigation measures, it is expected that there will be no residual impacts in relation to habitat loss or fragmentation, marine water quality, sedimentation, suspended solids, light attenuation, under water noise or vessel strike for any species of national environmental significance as a result of the relatively short term dredging component of the project” (Volume 4, Appendix 22, p. vii).

“Impacts from the project are localised and either temporary in nature or will be adequately compensated for through the offset strategy. Overall it is considered highly unlikely for there to be a loss of Outstanding Universal Value or decline in integrity of the GBRWHA as a result of the project” (Volume 4, Appendix 22, p.23). The Government “is committed to achieving a net positive benefit for the project in its relationship to the Great Barrier Reef World Heritage Area by offsetting the loss of the potential seagrass habitat” (Volume 1, p.16).

In summary, the two major projects under consideration (Dredging and Spoil projects) “…are not expected to result in the loss of any of the GBWRHA environmental values at even highly localised spatial scales”. Specifically, it is not expected that one or more World Heritage values will be lost, degraded, damaged or notably altered, modified, obscured or diminished. Also, “…adverse impacts to relevant local expressions of the Outstanding Universal Value of the GBRWHA (see Table 3-1) are not expected, even at highly localised scales”. Contrastingly, as a result of management measures, it is expected that there will be “…a localised beneficial effect to the Outstanding Universal Value of the GBRWHA…” (Volume 4, Appendix 1, World Heritage Area and Natural Heritage Place, 5.5.2).

Mitigation
“The dredge footprint will permanently remove 97.1 ha of potential seagrass habitat, which is less than 0.35% of the potential seagrass habitat available in Abbot Point. While no significant residual impacts are expected for this species, the proposed offsetting of the loss of 97.1 ha of potential
seagrass habitat (see Section 3) will also result in a net benefit from this project for Dugong” (Volume 4, Appendix 22, p.18).

**Centre for Ecosystem Science Assessment**

There are some major inconsistencies and underestimation of direct and indirect impacts of the two proposals on the GBRWHA. These relate to the direct impacts of loss of habitat, long-term impacts of increased ship traffic, loss of habitats for migratory shorebirds and impacts of pollution through discharge of tailwater and stormwater into the GBRWHA, through the Caley Wetlands.

There is broad statement of little impact on GBRWHA values given the mitigation efforts and yet these are poorly articulated. There is considerable uncertainty in the modelling of the sediment plume in relation to drift and settling rates. These assessments should be supported by explicit laboratory modelling, similar to that required for estimating impacts of hydrological alterations caused by the loss of the wetland area for the dredge spoil dump and the railway embankment.

Also the direct impacts of the dredging are poorly assessed. For example, there is an observation that “no turtles were observed within the dredge footprint” neither was there seagrass (Volume 1, p.16). Distribution and abundance of these two organisms is temporally and spatially highly variable and so such observations may only reflect sampling bias. The development area is “within a region identified as ‘High Priority’ foraging habitat for Green Turtles within the GBRMP” (Volume 4, Appendix 22, p.18). The preliminary documentation does not suggest any management to avoid, mitigate or offset the impacts of the proposed development on turtles or dolphins, only further research.

There is a proposal to offset impacts on seagrass: “Continuing consultation with DoE and the relevant State Government authorities will determine the nature and quantum of offsets that will provide a net benefit commensurate with the proposed loss of potential seagrass habitat” (Volume 1, p.16). “The dredge footprint will permanently remove 97.1 ha of potential seagrass habitat, which is less than 0.35% of the potential seagrass habitat available in Abbot Point. While no significant residual impacts are expected for this species, the proposed offsetting of the loss of 97.1 ha of potential seagrass habitat (see Section 3) will also result in a net benefit from this project for Dugong” (Volume 4, Appendix 22, p.18). These statements provide little detail beyond a financial arrangement which does not benefit seagrass, turtle or dugong populations directly.

In summary, there is evidence that the values of the GBRWHA will be directly affected through the dredging and its pollutant effects both in terms of sediment drift but also when pollutants come back into the GBRWHA after being discharged by from the dredge spoil dump through the tailwater and stormwater pipes into the Caley Wetlands. There will also be direct impacts on migratory shorebirds through direct loss of habitat and indirect loss caused by alterations of flows. In addition, there will be impacts caused by direct impacts of pollution and collisions with more ship traffic on marine organisms, including turtles, dugongs, dolphins and humpback whales.

**Summary – Centre for Ecosystem Science**

The Minister for Economic Development Queensland is the proponent on behalf of the Queensland Government. As well as developing the Abbot Point Port, the Queensland Government aims to “help protect the unique environment values of the Great Barrier Reef”. There is little evidence that this development will do this. On the contrary, the size of this development and its impact on the wetlands connected to the Great Barrier Reef mean that it will significantly impact deleteriously on the environment.
Further the environmental assessment process lack rigour and transparency. There are few data for adequate analyses of long term environmental consequences to the Great Barrier Reef and the nationally important Caley wetlands, migratory shorebirds, the endangered painted snipe and other waterbirds and dependent organisms. A full Environmental Impact Assessment would at least provide some of this rigour and transparency but this has not occurred.

The Queensland Government aims to protect 1) the Great Barrier Reef “-negating the need for offshore disposal of dredge material for the expansion of the Abbot Point into the Great Barrier Reef Marine Park” and 2) the wetlands – “enhancing the Caley Valley Wetland and remediating degraded hypersaline areas”. There is no evidence that these two proposals contribute to either of these aims. Further, there is considerable evidence that the proposals will significantly degrade the Great Barrier Reef World Heritage Area and impact deleteriously on the ecological health of the Caley wetlands, affecting migratory shorebird habitats.

- The Centre for Ecosystem Science, UNSW make two key recommendations to make this project sustainable and not impact on the nationally important wetlands, the migratory shorebirds or the Great Barrier Reef World Heritage Area:
  1. the dredge spoil be moved to a terrestrial area, preferably one that is already highly modified by human impact (e.g. agricultural or industrial land) where it is not connected to the wetland or Great Barrie Reef World Heritage Area and;
  2. the Queensland Government implement best practice rehabilitation and mitigate the current proposed impacts of development on hydrological connectivity. Specifically,
    a. hydrological connectivity of the wetlands should not be severely interrupted by the railway embankment and so there should be a bridge over the wetlands to avoid this and;
    b. rehabilitation as specified should progress involving the removal of the Western Bund and Causeway to improve flushing of the wetlands.