

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors



June 2018

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18-012 SHAWS BAY DREDGING – REVIEW OF ENVIRONMENTAL FACTORS

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1. INTRODUCTION

As part of the implementation of the Shaws Bay CZMP, Hydrosphere Consulting on behalf of Ballina Shire Council (BSC) is undertaking an investigation into the feasibility of dredging Shaws Bay. This investigation has been divided up into three broad stages:

1. Baseline Surveys and Data Analysis which aims to better define the dredging proposal through provision of an updated hydrographic survey, definition of the target dredging area, characterisation of the target sediments and the suitability for beach nourishment within the Bay as well as survey of target areas for the presence of seagrass which may influence the feasibility of dredging;
2. Dredging Options Assessment and Detailed Plan to identify and evaluate the best detailed methodology for dredging, considering agency stakeholder input, environmental, technical and financial constraints; and
3. Preparation of documentation required for works approval. This will include identification of the approvals pathway, preparation of assessment documentation (including this document: Review of Environmental Factors) and applications for required permits. This stage of work is intended to progress the project to the point where tenders for the physical works can be requested.

This report documents the Review of Environmental Factors and identifies the required approvals and permits for the proposed dredging and foreshore improvement works.

2. DESCRIPTION OF WORKS

BSC proposes to undertake maintenance dredging and foreshore management activities at Shaws Bay, East Ballina. An overview of the works is shown in Figure 1 (details in Appendix 1) and includes:

- Establishment of a large temporary works compound at the northern end of Pop Denison Park (Appendix 1 - Figure 1);
- Dredging of various areas within Shaws Bay (Appendix 1 - Figure 2);
- Processing (screening and silt separation) and dewatering of the dredged material;
- Disposal of fines and foreign material;
- Placement of clean dredged material at various sites around the Shaws Bay foreshore for erosion control and beach amenity (Appendix 1 - Figure 3);
- Enhancement of the ecological protection area at the north western end of Pop Denison Park (Appendix 1, Figure 4) including provisions for current and future saltmarsh growth, erosion control works and revegetation.
- Installation of boardwalk to span the new saltmarsh area (Appendix 1 - Figure 4) instead of a previously approved concrete path.

The proposed works have the primary aims of:

- Maintaining foreshore access to deep water;
- Reducing areas of sedimentation;
- Improving tidal flushing and reducing water quality risks;
- Improving foreshore beaches; and
- Ecological enhancement.

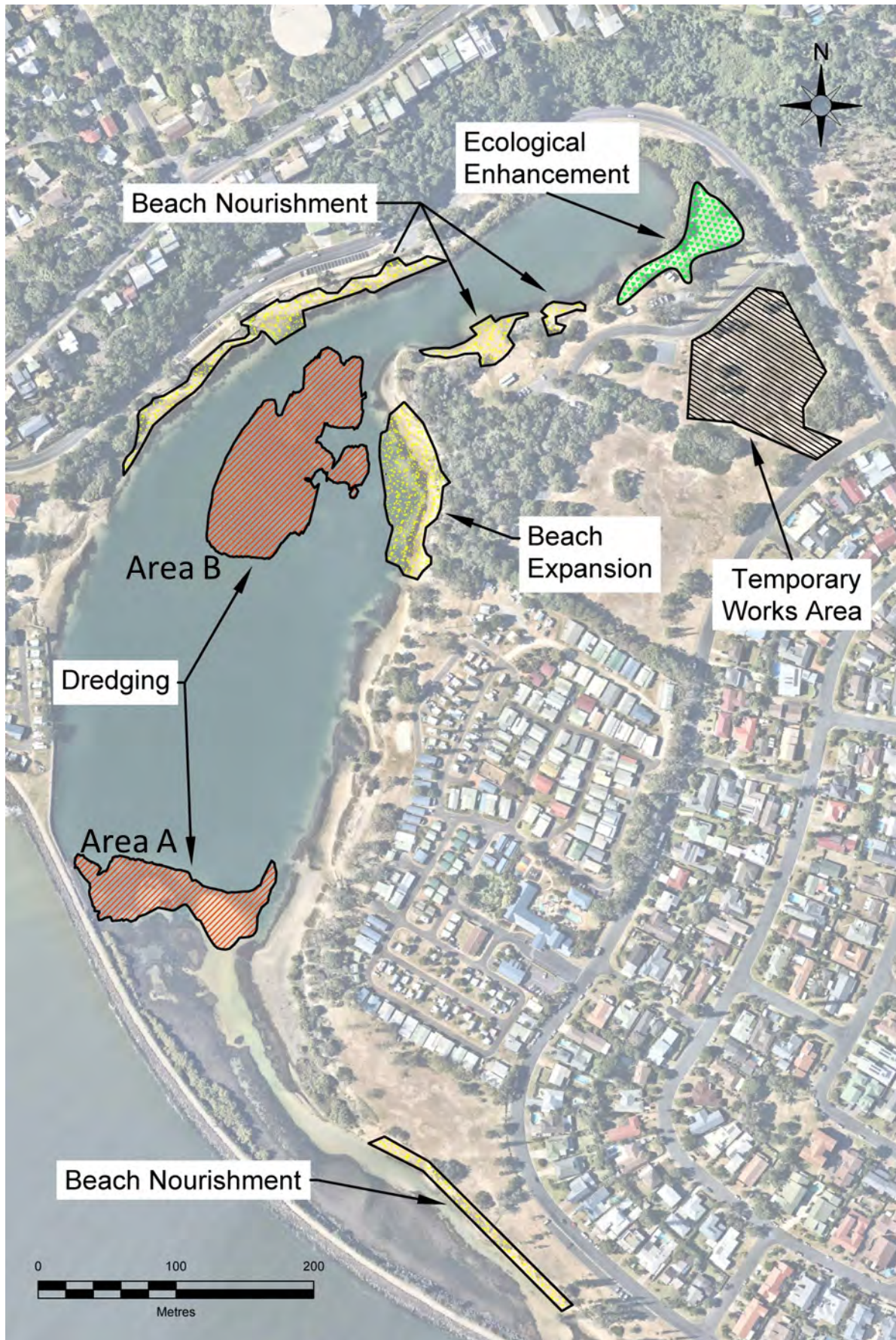


Figure 1. Overview of works areas

The proposed works methodology is detailed in the following sections.

2.1 Site compound

The site compound is to be established at the northern end of Pop Denison Park with an indicative layout shown in Appendix 1, Figure 1 and will involve:

- The installation of a hydrocyclone plant and associated pump, pipelines and bunded fuel tank. A typical setup is shown in Plate 4 of Hydrosphere (2018c);
- Creation of a large bund suitable for the control of all water and sediments to be contained by the geobags. Installation would typically involve the use of staked hay bales to form the basis of the bund perimeter, and then heavy duty plastic sheeting to line the bund floor and perimeter wall. The bund is to be sized to fully accommodate the maximum geobag volume with a 1.5x safety factor.
- A pump will access the sump at the low end of the bund and will be used to transfer water from the bund back to the Bay.
- Pipelines for the dredge slurry coming to the hydrocyclone and for the return water back to the Bay from the geobag bund will need to cross the Pop Denison Park access road. As it is intended that the Park can be utilised by the public during at least some parts of the operation, this pipeline will either have a ramp to enable cars to cross over, or will be trenched into the road.
- Establishment of a sand stockpile and truck loading area adjacent to the hydrocyclone and also a smaller area for screened debris and truck loading of this material.
- Truck access will be provided via the northern end of Fenwick Drive and a route across the flat grass park will be flagged to allow access to the stockpile area. Truck traffic control will be utilised to maximise public safety and reduce disruption at the entry/exit point. It is also intended to provide a truck wheel wash facility at this point to ensure soil is not dragged out on the public road by existing vehicles. This will involve the installation of a temporary coarse rock bed and presence of a water tanker truck.
- The entire perimeter of the works compound is to have temporary security fencing with a lockable gate at the entry/exit point. From time to time access to Pop Denison Park will also need to be restricted to allow local transfer of sand between the sand stockpile area and some of the target nourishment areas.

2.2 Dredging

Dredging will be undertaken utilising a cutter suction dredge which is the preferred methodology for this project as it limits plume generation during dredging and allows for efficient transfer of material for processing, without spillage. Due to the presence of overlying organic matter and buried rocks within proposed dredge targets the cutter component may need to be isolated at certain locations. A cutter-suction dredge is highly compatible with the preferred sediment dewatering and processing method (section 2.3). The dredge would be launched by crane from the existing hardstand area at the northern end of the western foreshore.

Two dredging areas, Area 1 (East Arm Depositional Delta) and 2 (Main Bay Shallows), within Shaws Bay will be dredged (Appendix 1 Figure 2). The maximum depth of dredging for both these areas is nominated as -2.5m AHD equating to a combined volume of approximately 9,100m³ although a lower volume is likely due to the presence of isolated rock outcrops in Area 2 which won't be removed. In order to balance dredging with the needs for localised beach nourishment a reduced cut depth may be implemented (-2.25m AHD). This would result in an estimated volume of 5,900m³, which (when accounting for production loss due to Area 2 rock) is expected to very closely match the required

beach sand volume. Area 2 would be dredged first and the resultant volume monitored, with the dredging depth for Area 1 and 2 modified accordingly (between -2.0 and -2.5m AHD) to ensure the desired beach nourishment volume has been achieved.

Table 1. Estimated Dredging Volumes

Target Area	Target Bed Level (m AHD)	Sediment Volume (m ³)	Dredge Footprint (m ²)
Area 1 – East Arm Depositional Delta	-2.0 to -2.5	1,800 to 3,600	<6,600
Area 2 – Main Bay Shallows	-2.0 to -2.5	1,900 to 5,500	<7,600
Totals		3,700 to 9,100	<14,200

Dredged material will be pumped, in the form of a slurry typically containing 10-20% solids, via pipeline to the onshore dewatering site. The pipeline may be floating and/or submerged on the estuary floor potentially secured by anchors if required. The pipelines are to avoid marine vegetation and present the best configuration to allow continued use of non-work areas of the Bay.

The main dredge vessel is likely to be serviced by a smaller (~7 m, nominally) outboard powered workboat. The workboat would be launched by crane at the same time as the dredge.

2.3 Sediment dewatering and separation

Due to the presence of potential acid sulfate soil (PASS), overlying silt and organic material within the target areas, a multi-faceted dewatering and processing strategy will be implemented. This will entail initial screening of the dredged material through a fine (e.g. 10 mm) grating which is intended to remove shell, coarse organic matter and other debris. The coarse screenings will accumulate in a pile beside the cyclone and will need to be periodically disposed of after waste classification. The remaining screened sediment drops into a hopper and then is pumped through a hydro-cyclone to separate the sand from the silt and liquid fraction. The dewatered sand would then be stockpiled adjacent to the hydrocyclone available for transport and use. The remaining silt slurry will be directed to a geobag located directly adjacent to the hydrocyclone, where it will gradually dewater. The geobag will be within the plastic lined bund, and filtrate from the bag will collect in a sump be monitored and discharged back to Shaws Bay as appropriate. At the completion of works and after full dewatering of the material, the contents of the geobag will be classified according to the relevant waste classification guidelines and trucked to and disposed of at an authorised location.

The proposed location for the sediment separation and dewatering site is at the northern end of Pop Denison Park, east of the park access road as shown in Appendix 1, Figure 1. A secondary settlement bund, with gravity drainage back to the Bay could be established on the western side of the park access road to 'polish' the discharge water and allow gravity discharge to the Bay if required. The need for this measure would need to be determined after initial monitoring of geobag performance.

2.4 Beach nourishment/sand placement

2.4.1 Placement locations

Six locations have been identified within Shaws Bay that require erosion control and/or would benefit from beach nourishment (Appendix 1 – Figure 3). These locations have been selected as they are either currently highly utilised or are anticipated to receive higher usage in the future as a result of

strategic planning and facility locations around the Bay. Most areas contain some active erosion including areas within the ecological enhancement area.

These 6 locations are:

1. Western foreshore – this beach is expected to receive increased use due to the recent upgrade of the parking and shared path arrangements at this site as well as upgraded access ramp and park facilities. The revetment wall at the back of the beach is too high to allow safe access directly to the beach from the park area and the beach is under-utilised because of this and the lack of beach available at high tide. Placement of sand on this beach will increase public safety near the revetment wall, increase the carrying capacity of the beach and provide additional areas at elevations suitable for saltmarsh growth.
2. East Beach – this area was identified in the CZMP as the main beach for enhancement and is a key component in the strategy to improve public access to areas of better water quality within Shaws Bay. Overland runoff through this area has resulted in erosion gully behind the bank which would be filled, and there is some foreshore erosion also requiring mitigation. Placement of sand on this beach will increase public safety through mitigation of erosion scars while increasing the carrying capacity and usability of this section of foreshore. Nourishment at this location would include offshore expansion and widening of the beach to increase beach area, carrying capacity and amenity.
3. South Pop Denison Park beach – this beach is currently highly utilised due to ease of accessibility within Pop Denison Park and the facilities currently available (i.e. carpark close to foreshore and covered BBQ area). Usage is expected to increase following the proposed improvement of facilities within the Park as part of the CZMP. This beach is used as an access point to the Bay by community members undertaking water based activities. Placement of sand on this beach will mitigate erosion issues present as a result of high usage and overland runoff, increase carrying capacity of the beach and improve accessibility to the water.
4. Middle Pop Denison Park beach – Overland runoff has resulted in active erosion of the area evident by the presence of erosion scars. Placement of sand on this beach will improve public safety, mitigate erosion issues, increase carrying capacity of the beach and provide areas for additional saltmarsh growth.
5. North Pop Denison Park beach – Erosion mitigation is required and as part of the ecological zone of Shaws Bay there will be revegetation and encouragement of saltmarsh in this area.
6. East Arm foreshore - The northern bank of the East Arm. Improvement works, as part of the Shaws Bay CZMP, are currently being implemented which will result in the improve amenity of this section through beach nourishment and erosion control. The works here include the establishment of three beaches bounded by rock groynes and it is anticipated that these beaches will require maintenance beach nourishment ‘top ups’ periodically into the future. It is likely that some sand from dredging would be beneficially placed at these locations but this will depend on the circumstances at the time of dredging.

If sand excess to the needs of Shaws Bay beach nourishment are dredged, the material will be temporarily stockpiled on site before being transported by truck to a suitable stockpile location at BSC Depot #2. The estimated volume of sand and approximate footprint area at the six locations are outlined in Table 2.

Table 2: Details of required sand nourishment and transport methods

Site	Estimated volume of sand required (m ³)	Approximate area of placement footprint (m ²)	Approximate <u>return</u> transport distance from processing site (m)	Sand transport methodology
Western Foreshore	1,200	3,300	1,600	Truck
South Pop Denison Park beach	300	1,100	430	Small dumper
Middle Pop Denison Park beach	100	360	280	Small dumper
North Pop Denison Park beach	100	420	200	Small dumper
East Beach	3,800	4,100	630	Small dumper
East Arm foreshore	400	1,500	1,400	Truck
Depot #2	Up to 3,200	-	9,000	Truck

2.4.2 Transfer methodology

Transport methodologies for each beach nourishment site are outlined Table 2.

Road transport via trucks will be used for transporting material to the Western Foreshore, East Arm (if required) as well as any off-site stockpile and disposal locations. This is a cost effective and logistically appropriate option for transporting dredge material. Truck loading would be undertaken as shown in Appendix 1, Figure 1 with trucks entering and leaving the site via Fenwick Drive.

Truck access to the Western Foreshore location is possible at two locations.

- The northern end extent of the current footpath, where a handstand area allows unimpeded access to the edge of the revetment wall. Material would be unloaded off the revetment wall onto the foreshore.
- Approximately 20 m east north east along the foreshore from the new ramp. An open area exists here where a truck could access and unload from the revetment wall onto the foreshore. Damage to the footpath is possible and may need to be repaired at the completion of works.

For nourishment sites in close proximity to the sand stockpile and where roads in public use can be avoided, plant will be utilised to transfer material in a way that minimises double-handling of material. Relatively small, side, front or rubber-tracked dumpers are likely to be used to carry sand between the processing site and East Beach and the other Pop Denison Park sites.

At the completion of works, waste material (i.e. shell, silt and organics) is to be transported via trucks to an appropriate waste facility. It is anticipated that approximately 9 m³ of material will be dewatered within the geobags and require disposal.

A traffic management plan will be developed to address all road safety issues and identify appropriate truck routes. Traffic management will be implemented to ensure safe turning at this location and appropriate separation of vehicles, bikes and pedestrian traffic from work vehicles.

2.4.3 Placement methodology

Clean sand suitable for beach nourishment will be transported by truck or dumper to each placement location (as outlined in Section 2.4.2). The sand will be unloaded at the site before being moved around and profiled on the beach by a combination of excavator and positrack loader.

Sand volumes and expected placement footprint areas are provided in Table 2 but may vary according to site conditions at the time of the works.

At all sites except for East Beach, it is intended that the fill profile is generally contained within the constraints of existing marine vegetation. On the downslope side, seagrass is often present and the fill area is to be offset from the edge of seagrass (*Zostera* and *Halophila*) by at least 2m with a grading of 1 in 6 or less at the downslope margin.

At the upslope margin, saltmarsh is often present and it is intended to create a bench in the beach that matches the lower elevation of this saltmarsh. There will be some areas where minor saltmarsh growth adjacent to erosion scarps will be affected as it intended to fill against the scarp and then re-contour the beach.

At East Beach, it is intended to significantly extend the beach offshore, thereby widening the beach. The existing seagrass on the downslope margin will be replaced by deposited sand and there is also saltmarsh in areas that will be required to be filled to address bank erosion at this location.

Access to each placement area will be as follows:

- Western Foreshore – trucks will dump sand directly over the existing revetment wall to saltmarsh-free areas. Trucks will need to cross the shared path along Compton Drive to access the more southern areas or will utilise the existing hardstand area immediately north of the current end of path. Dumped sand will initially be formed into a ramp to allow an excavator and/or positrack loader to access the beach and move the sand to the desired locations.
- South, Middle and North Pop Denison Park beaches – clear access to each of these beaches exists via the adjoining parkland grass and it is intended that dumpers transport sand directly from the sand stockpile to the final placement location on these beach with some minor re-contouring using an excavator and/or positrack loader. A single, saltmarsh-free access point will be utilised for each beach.
- East Beach – access to this beach will be via the degraded margin of the Pop Denison Park Coastal Cypress Pine forest. This area has been flagged for weed clearing, park establishment and vegetation regeneration in a vegetation management plan prepared for the area (Hydrosphere 2018a). The proposed clearing allows for suitable access, however it is likely that access will need to traverse one area of saltmarsh at the beach margin.
- East Arm foreshore- trucks will be used to transport sand directly to the upslope edge of the beach. Trucks will need to cross the newly formed shared path running along the East Arm to reach the edge of beach. An excavator and/or positrack loader will be required to spread the sand to the appropriate levels. It is intended that areas of saltmarsh, which are expected to colonise areas of the upper beach, are avoided by all activities.

2.4.4 Beach nourishment profiles

The target beach profile will vary with location and will be influenced by the presence of marine vegetation (see Figure 2). For all instances, except for East Beach, the bottom of the fill area will be offset at least 2m shoreward of the inner boundary of the seagrass, with a maximum slope of 1 in 4 within the first 4m of seagrass, further shoreward, the beach slope can be as high as 1 in 2, although typically a slope of less than 1 in 7 is more suited for recreational beach use. The upslope elevation of

the beach will be dictated by either the lower elevation of saltmarsh where present or the height of the top of bank (where eroded). For saltmarsh-free areas on the western foreshore, the beach fill height should not be higher than 0.5m below the crest of the revetment wall.

As the situation changes numerous times along any particular section of the beach, numerous profiles may apply and it will be necessary to determine the final beach form by blending the examples sections shown in Figure 2, with reference to the design criteria listed above.

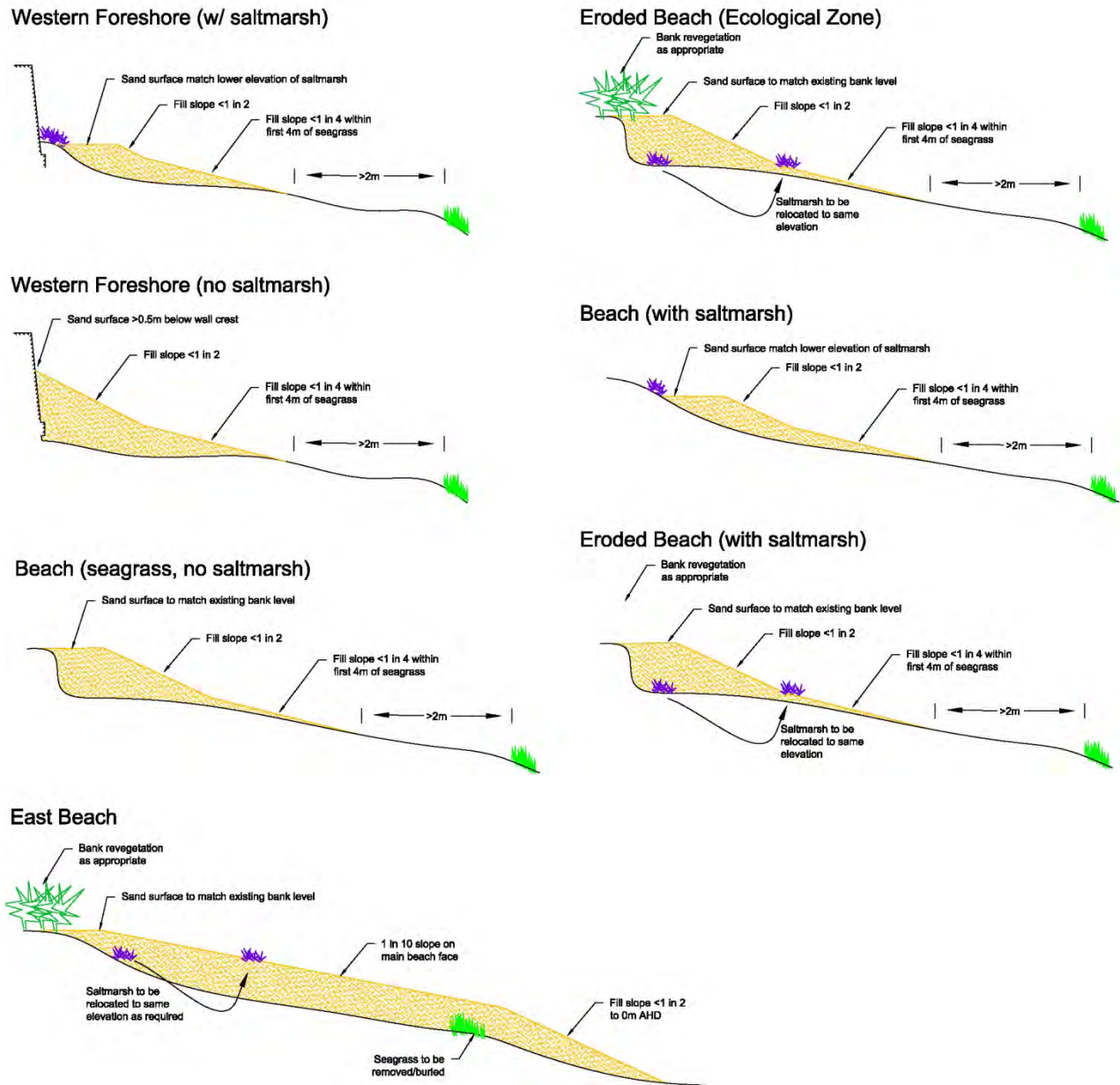


Figure 2. Examples of beach profiles for varying situations

2.5 Enhancement of ecological protection area

The northern section of Shaws Bay was identified in the CZMP as an ecological zone and it was also identified that saltmarsh migration into the low-lying area of the park on the north-eastern side of the Bay would be curtailed by current management of the Park (i.e. mowing). As part of this project it is intended to allow for and encourage growth of saltmarsh in this area, whilst also ensuring that the planned public shared path through this area does not restrict the upslope migration of this vegetation.

The works required are:

- Beach re-contouring and backfill against erosion scarp, as described in section 2.4.1;
- Minor re-contouring of a saltmarsh creation area as identified in Appendix 1 - Figure 4 to match the upper margin of current saltmarsh elevation. This will be achieved by scraping up to a maximum of 0.3m of grass/topsoil from this area.
- Use of scraped material to marginally raise and extend existing vegetated areas and planting of these areas with plant species consistent with Coastal Cypress Pine EEC.
- Selective planting on the beach boundary in this location to assist in reducing public access to ecological restoration areas.
- Establishment of low profile boundary fencing to delineate the boundary of the newly formed habitat areas from the rest of the park.
- Repurposing of the existing northern-most picnic pavilion to form a sheltered information display.

2.5.1 Boardwalk

The planned shared pathway along the eastern side of Shaws Bay will bisect the proposed saltmarsh creation area and without mitigation would restrict upslope migration of marine vegetation responding to sea level rise. It is proposed to replace part of the path with an elevated board walk that maintains the alignment of the path, but allows for free tidal exchange beyond the path. The boardwalk would replace a boardwalk that was initially proposed nearby in the Pop Denison Park Masterplan and would provide an ideal opportunity to showcase the evolving ecological zone.

The final design of the boardwalk has not been finalised but it is anticipated to approximately follow the alignment shown in Appendix 1, Figure 4 and have the following features:

- A design width of 2.5m.
- A length of 30-40m.
- A low-profile decking design that allows for some transmission of light and reduces the shading effects of the structure (e.g. a grid-like decking material similar to that used on the Angels Beach shared path).

The works required are:

- Installation of piles to support the path structure. Piling is likely to be done using an excavator either by vibratory means or by installation of screw-piles.
- Installation of beams and decking. It is anticipated that the decking panels will be pre-fabricated off-site, necessitating relatively minor on-site construction. An excavator or similar may be utilised to lift panels, and hand power tools (e.g. impact drivers) may be used in the final assembly.

Boardwalk installation would be best achieved in coordination with the initial saltmarsh creation earthworks (i.e. prior to actual saltmarsh establishment), which would maximise the opportunity to work in dry conditions whilst also allowing reference to the final ground profile.

2.6 Timing of works

The overall timeframe for the completion of the works is expected to be 3 - 4 months depending on weather and other project variables. A break-down of the anticipated timeframes and sequencing of each component of the works is outlined in Table 3.

Table 3: Indicative timeframe of proposed works

Works Component	Sequencing	Approx. Duration	Comment
Site establishment	1 – Prior to commencement of works.	2 weeks	Includes establishment of processing site, mobilisation of plant and equipment , erection of fences, barriers etc. and implementation of other site management measures
Dredging	2 - Commence after site establishment is complete.	4 weeks	Based on assumed dredging rate of 300 m ³ /day. Duration may vary depending on weather and other operational constraints.
Beach nourishment	3 – Expected to commence soon after (1 - 2 days) commencement of dredging, and sand stockpile can be established.	Up to 11 weeks	Based on calculations outlined in section 7.6. May be reduced depending on equipment used.
Ecological enhancement works	4 – Expected to commence after completion of dredging and towards the completion of beach nourishment works.	2 weeks	Timing of works may vary according to site needs. Earth works may be undertaken opportunistically depending on availability of machinery.
Site de-mobilisation and remediation	5 – Site remediation will occur at completion of the above works.	2 weeks	All equipment and works material will be removed from site and appropriately remediated at completion of works.

3. REASONS FOR THE ACTIVITY

A Coastal Zone Management Plan (CZMP) for Shaws Bay was prepared in 2014 (Hydrosphere Consulting, 2014). The main aim of the CZMP is to protect and enhance the key values of Shaws Bay by increasing resilience of the coastal zone and addressing key threats through efficient, effective and timely management. This will be achieved through the implementation of integrated, balanced, responsible strategies to restore and maintain the ecological health of Shaws Bay as well as the recreational and tourism activities associated with it.

The Shaws Bay CZMP identifies management issues in Shaws Bay and recommends a suite of actions working towards protecting and maximising the future value of the Bay. The CZMP actions and associated desired outcomes to be implemented or partly implemented as a part of this project are outlined in Table 4.

Table 4: Shaws Bay CZMP actions relevant to the proposed works

CZMP Action	Desired Outcome	Comments
Action 1 – Control of East Arm erosion and creation of sandy beach	Improved public safety and amenity of Fenwick Drive foreshore and reduced sedimentation in the Bay	The majority of this work will be already completed however sand dredged in this project will provide ‘top-up’ material for the created beaches to address any nourishment shortfalls or recent erosion.
Action 2 – Dredging of Main Section of Shaws Bay	Reduced infilling and improved water circulation	Dredging will fulfil this action.
Action 4 – Western foreshore improvements	Enhanced safety and recreational amenity of Compton Drive foreshore.	The provision of foreshore infrastructure (upgraded parking, park facilities and access ramp) will be already completed. Beach nourishment adjacent to Western foreshore will complement these works by improving community access and beach amenity.
Action 5 – Expansion of Pop Denison Park and improvement of access to eastern foreshore	Enhanced ecological value, foreshore access and recreational amenity at Pop Denison Park	Beach nourishment will improve community access and beach amenity. Provision of saltmarsh habitat at northern end of Pop Denison Park will enhance ecological value.
Action 17 – Hydrographic survey	Improved knowledge of sedimentation and infilling	A hydrographic survey has been undertaken during the planning stages of this project. Pre and post dredging hydrographic survey will also be undertaken.

This dredging and foreshore management project is therefore an integral component in the implementation of the Shaws Bay CZMP and integrates closely with numerous other initiatives also being progressed as part of strategic planning of the Bay, specifically:

- Pop Denison Park Masterplan – seeks to increase public usage and amenity of the Park. The initially proposed mangrove boardwalk (extending into the current mangroves) would be replaced by a more functional, easier to install and less intrusive path as proposed in this project.
- Vegetation Management Plan. This plan is an extension of the Masterplan and the CZMP recommendations. The plan identifies the exact route of the shared pathway through the Coastal Cypress Pine forest as well as numerous areas for public amenity clearing as well as enhancement of bush regeneration. The VMP allows for increased accessibility to East Beach as recommended in the CZMP.
- Western Foreshore Improvements. This improvement project was recommended by the CZMP and will maximise the amenity value of beach improvements on this foreshore. A raised beach profile proposed in this project will improve accessibility and public safety along the revetment wall, address areas where the wall is being undermined and allow for more

consistent saltmarsh growth (which is currently curtailed in areas by the low beach elevation and revetment wall in several areas).

- East Arm Foreshore Improvements. This major project was also a direct result of the CZMP and was aimed at reducing foreshore erosion and down-drift sedimentation from this reach. Having now addressed an important source of sediments, the dredging project is seeking to address some areas of accumulation. Beaches on the East Arm may require future top ups, and it is considered the dredged sand will be ideal for this purpose, thereby reducing the need to import sand to the site.
- Whilst many of the projects to date have sought to improve public amenity, the CZMP also recognises the need to balance this with ecological objectives. The saltmarsh creation and ecological enhancement component of the current project is a key initiative to maximise the environmental value of the northern section of Pop Denison Park and offset impacts associated with the continuing recreational popularity of the area.

3.1 Consideration of alternative options

A range of potential options for addressing management issues in Shaws Bay, including those addressed by the aims of this project, were developed and evaluated during the preparation of the Shaws Bay CZMP. Actions were developed from the options and were assessed considering the stated objectives, environmental impacts, costs, practicalities and expected benefits and overall outcomes. The preparation of the CZMP incorporated input from BSC, Hydrosphere Consulting, the local community, community groups and government agencies. The actions recommended by the CZMP are considered to be the most suitable actions to effectively address identified management issues within Shaws Bay.

Hydrosphere Consulting (2018c) provides a detailed discussion and evaluation of a wide range of technical options available to this project.

The scale of the project is considered to be a balance between the current and future needs of the community, the volume of sediment that can be accessed with relatively low environmental impact and the opportunities available. Such considerations included:

- Extent of dredging – Dredging to between -2.0 and -2.5m AHD is considered the optimal depth range in order to allow for continued deep water swimming and providing a buffer against on-going shallowing. Shallower dredging increases the probability of more frequent dredging and associated disturbance, as well as reducing the amount of sand available for foreshore management activities, whilst deeper dredging was not considered to add significantly more to the aims of the project.
- Sediment processing and dewatering areas. Numerous potential methods and areas were considered and are reported in the stage 2 report for this project (Hydrosphere 2018c). Direct pumping of sediments onto the target beaches was discounted due to likely impacts to water quality and seagrass. The park reserve at the east of the East Arm has some advantages as a processing site but was discounted due to distance from the Pop Denison and East Beach sites (all material would need to be double-handled), whereas a more central location behind Pop Denison Park was discounted due to interference with plans for a new playground development in that area.
- Extent of Pop Denison Park beach and foreshore works. The volume of sand identified for the Pop Denison Park beaches is based on a combination of the current erosion scarp elevations and the constraints of marine vegetation. Given that the level of disturbance to these beaches is likely to be similar for small or larger amounts of fill within these constraints, it is considered

that a strategy to maximise the opportunity associated with infrequent dredging is most appropriate. Addition of only small amounts of fill will not provide the longevity desired and would not warrant the disturbance associated with the works.

- **Extent of East Beach.** This substantial expansion is part of a strategic redirection of public activity from the northern section of Shaws Bay to the better water quality of this area. This beach was identified in the CZMP as a target for additional beach creation and corresponds to the areas of improved accessibility via the forest pathway and clearing areas. The proposed adjustment of the 0m AHD shoreline provides for a significant increase in beach area whilst still being consistent with the overall morphology of Shaws Bay. As there will be increased usage of this beach as a result of better access within the forest, the increased area of beach will allow for continued co-existence of saltmarsh with beach activities, whilst allowing for better protection of the banks of the adjoining Coastal Cypress Pine EEC. Whilst a reduced extent of beach would allow for these factors, it is unlikely that these advantages could be achieved within the constraints of marine vegetation at this site. The current proposal maximises the opportunity for beach creation within a defined impact area and is consistent with considerable community expectation of some seagrass-free beach areas. Expansion of the beach northward is not considered viable (due to the steep bed form and potential for reducing the channel cross-section at this point) and southward expansion would involve impacts to significantly more seagrass.

4. COMMUNITY AND AGENCY CONSULTATION

A significant amount of consultation has been undertaken during the planning of the Shaws Bay improvement works being considered in this REF. These consultation activities have ranged from public meetings, liaison with individual residents, discussions with regulatory agencies, provision of information and documentation on Council's website and public exhibition of plans.

Specific consultation activities undertaken for the project include:

4.1 Agencies

An agency consultation letter has been sent to Department of Primary Industries - Fisheries, Office of Environment & Heritage, Department of Industry – Lands & Water, NSW Environmental Protection Agency, Jali Local Aboriginal Land Council and NTSCorp. This letter outlines the scope of the project and invited comments on the proposal. Responses were received by DPI-Fisheries, NSW EPA and OEH and are provided in Appendix 3.

Telephone discussions have taken place with DPI-Fisheries and NSW EPA and there have been informal meetings with DPI-Fisheries on site to discuss various aspects of the project.

4.2 Adjoining property owners/residents

A letter and information pamphlet outlining the scope of the project and details on how to provide feedback was delivered to owners, regular club users of the Bay and potentially affected residents within the Shaws Bay estate. Adjoining property owners included the two caravan parks, Shaws Bay Hotel and Fenwick House. Clubs included Rainbow Region Dragon Boat Club, Northern Rivers Outrigger Canoe Club, Ballina Lighthouse & Lismore Surf Lifesaving Club and Titanic Winter Swimmers Club. Around 250 pamphlets and letters were provided to the residents within the Shaws Bay catchment and an online portal was established for community members to provide their response. A summary of responses is provided in Appendix 3.

4.3 Project webpage

Improvement activities at Shaws Bay have been highlighted on the project page on Council’s website and provide links to the Stage 1 and 2 reports as well as related information for management of the Shaws Bay precinct. A subsidiary web page on Hydrosphere Consulting’s domain provides a portal for community comment to be submitted directly to the project team.

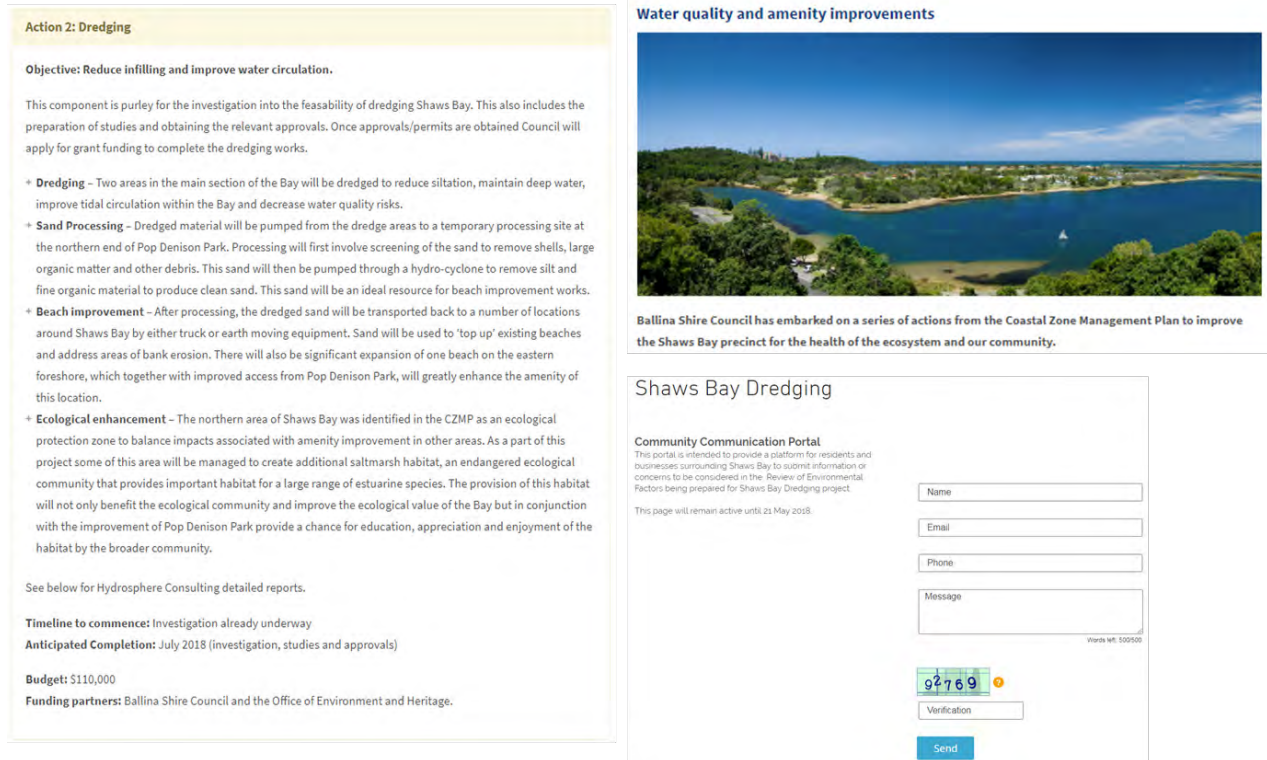


Figure 3. Views of the web pages set up for the project

4.4 Information flyer

A copy of the information flyer handed out to nearby residents and available on Council’s website is included in Appendix 3. The flyer provides a brief overview of the project and update on related projects as well as contact details for the project.

4.5 Shaws Bay CZMP

The following key consultation activities were undertaken during the preparation of the CZMP:

- Community survey – To engage the community and obtain input into the CZMP development, a survey was developed. The survey was available on-line and hard copy with 105 on-line and 18 hard copy surveys (123 total surveys) completed. Section 4.3, Volume 2 of the CZMP provides a summary of the survey results;
- Project webpage – A project webpage was used to introduce the project, provide a link to the on-line community survey, project updates and contact details for further information. The webpage address was communicated to community and stakeholders in media and other correspondence and a link was provided on the Ballina Shire Council as well as Hydrosphere Consulting’s websites;

- Community drop-in session 1 – Wednesday 9 April 2014 (during community survey period). The aim of the session was to encourage community involvement and completion of the survey and facilitate ideas for the CZMP development;
- Media and advertising – various forms of media were utilised to advertise the project and encourage community involvement in the survey and drop-in sessions. This included:
 - Media release - 24 March 2014 distributed to print, TV, radio and web-based media;
 - Council notices in the Advocate newspaper – 26 March 2014 and 2 April 2014; and
 - Article in Community Connect – distributed to Ballina Shire residents 7 April 2014.
- Targeted stakeholder consultation with key stakeholder groups. This included a phone call, email or letter informing stakeholders of the survey, webpage and inviting input. Follow-up meetings were held with the major stakeholders where necessary to discuss and clarify comments;
- Meetings with the Project Reference Panel (relevant Council staff and representatives from Fisheries NSW and the Office of Environment and Heritage, OEH) and ongoing liaison as required;
- Follow-up discussions with the relevant stakeholders as necessary on issues as they arise. This included members of the public who raised concerns or suggested approaches that had not been considered by the project team;
- Councillor workshop – The development of the draft CZMP was presented to Ballina Shire Councillors on 11 August 2014;
- Public Display - The Final Draft CZMP was placed on public exhibition for 21 days (as per legislative requirement) during September 2014. Formal (written) submissions on the Draft CZMP were sought from the community and stakeholder groups. Submissions were considered in the development of the Final CZMP; and
- Community drop-in session 2 – Thursday 11 September 2014 (during the public exhibition stage). This was an opportunity for informal discussions between the community, stakeholders and the project team to discuss issues and obtain feedback prior to formal submissions.
- The project was advertised in Council’s newsletter, Community Connect and in the Advocate newspaper as well as media releases to other media outlets.

5. REGULATORY CONSIDERATIONS

5.1 Legislative Requirements

The following section discusses legislation relevant to the proposed works.

5.1.1 Environmental Planning & Assessment Act 1979 and Regulations

The *Environmental Planning and Assessment Act, 1979* (EP&A Act) and the *EP&A Regulation, 2000* provide a framework for environmental planning in NSW. Environmental planning instruments (SEPPs and LEPs) are legal documents that regulate use and development under this legislation. An assessment of the likely impacts of a proposal which may have an impact on the environment is required under the Act prior to a decision to proceed with the proposal.

The Act imposes requirements for controlling development under two parts:

1. Part 4 of the Act controls development that requires consent or is prohibited under an environmental planning instrument; and
2. Part 5 of the Act imposes requirements for assessing the impact of development that does not require consent under an environmental planning instrument.

The proposed works do not require consent and are not considered to be prohibited under an environmental planning instrument (as outlined in the following sections) and therefore require assessment under Part 5 of the Act.

5.1.1.1 Ballina Local Environmental Plan 2012

The proposed works area is subject to the Ballina LEP (BLEP) 2012. The BLEP zoning for the study area is shown in Figure 4 and is as follows:

- Proposed extraction areas, East Arm delta and the north-central portion of the Main Bay, are both zoned as “Recreational Waterways” (W2);
- The potential dewatering sites are zoned as Public Recreation” (RE1); and
- Proposed beach nourishment areas fall on land zoned as W2 but may overlap landwards onto areas zoned as RE1 on the eastern banks.
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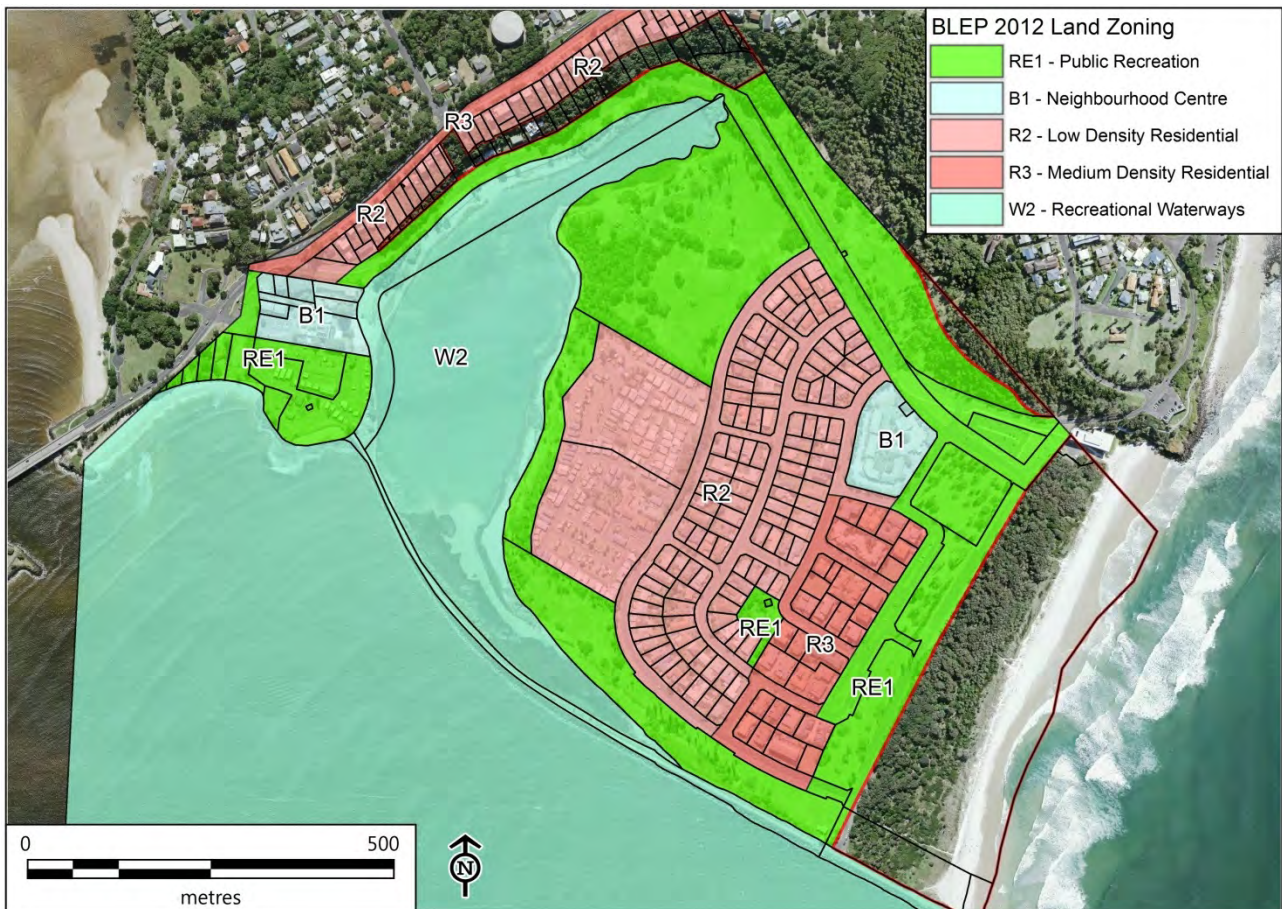


Figure 4: Ballina LEP 2012 land zoning

Under the Ballina LEP 2012 the Shaws Bay area is mapped as the following Acid Sulphate Soils (ASS) Classification (Figure 5):

- Proposed dredge areas East Arm delta and the north-central portion of the Main Bay – Class 1.
- The processing and dewatering site – Class 3.
- Proposed beach nourishment – Class 1 (majority) and Class 3.

Under the BLEP works on the following ASS classes require development consent:

- Class 1 – Any works.
- Class 3 – Works more than 1 metre below the natural ground surface.
Works by which the watertable is likely to be lowered more than 1 metre below the natural ground surface.
- Class 5 – Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.

To obtain development consent for works requiring consent (as above) an acid sulfate soils management plan must be prepared unless a preliminary assessment of the proposed works prepared in accordance with the Acid Sulfate Soils Manual indicates that an acid sulfate soils management plan is not required for the works. Development consent is not required if the works are carried out by a public authority and the works are minor works, being work that costs less than \$20,000 (other than drainage work) or the works that involve the disturbance of less than 1 tonne of soil and are not likely to lower the water table.

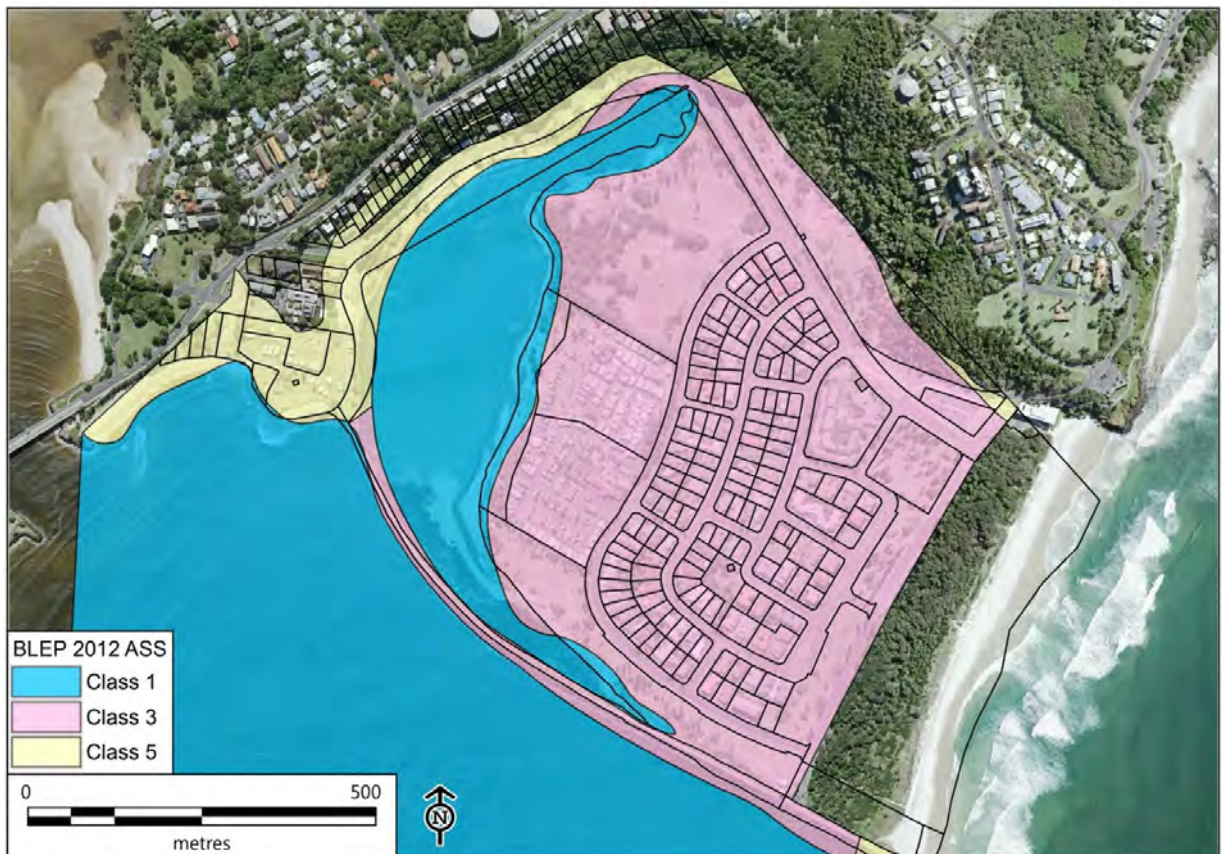


Figure 5: Ballina LEP 2012 ASS mapping

5.1.1.2 State Environmental Planning Policy (Infrastructure) 2007

The State Environmental Planning Policy (Infrastructure) 2007 (known as the Infrastructure SEPP) assists in providing infrastructure by modifying planning provisions to improve efficiency and service delivery.

Under Part 3 Division 25, Clause 129 of the Infrastructure SEPP:

“... development for the purpose of waterway or foreshore management activities may be carried out by or on behalf of a public authority without consent on any land.”

Under the Infrastructure SEPP - **waterway or foreshore management activities** means:

- (a) *riparian corridor and bank management, including erosion control, bank stabilisation, re-snagging, weed management, revegetation and the creation of foreshore access ways, and*
- (b) *instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows or tidal flows for ecological purposes, and*
- (c) *coastal management and beach nourishment, including erosion control, dune or foreshore stabilisation works, headland management, weed management, revegetation activities and foreshore access ways, and*
- (d) *salt interception schemes to improve water quality in surface freshwater systems, and*
- (e) *installation or upgrade of waterway gauging stations for water accounting purposes.*

The proposed dredging works for the purpose of waterway and foreshore management are permitted without consent under Division 25, Clause 129 of the Infrastructure SEPP. The dredging works aim to maintain/improve tidal flow within the Bay and utilise dredge spoil for erosion control and foreshore stabilisation in the form of beach nourishment.

The proposed ecological enhancement works are permissible without consent under Division 12, Clause 65 of the Infrastructure SEPP which states:

“Development for any of the following purposes may be carried out by or on behalf of a council without consent on a public reserve under the control of or vested in the council. including.... environmental management works.”

The proposed boardwalk is also permissible under without consent under Division 12, Clause 65 of the Infrastructure SEPP which states:

“Development for any of the following purposes may be carried out by or on behalf of a council without consent on a public reserve under the control of or vested in the council. Including ... pedestrian pathways...viewing platforms and pedestrian bridges.”

BSC is the proponent and determining authority responsible for deciding whether to approve or proceed with the activity. An environmental assessment in the form of a Review of Environmental Factors is required in accordance with Part 5 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and Section 111 of the Act, which requires that the proponent (BSC) take into account to the fullest extent possible all matters affecting or likely to affect the environment due to the proposed activity.

5.1.2 Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. To meet the primary objectives, Part 7 of the FM Act deals with the protection of aquatic habitats and Part 7A deals with threatened species conservation.

Under Section 200 of the FM Act, a permit is required for dredging or reclamation work carried out by a local government authority, unless these works are authorised by a relevant public authority (other than a local government authority) or under the *Crown Lands Act 1989*. If any marine vegetation (saltmarshes, mangroves, seagrass and seaweeds) is considered to be affected by the proposal, a permit to harm (cut, remove, damage, destroy, shade, etc.) marine vegetation under s205 would be required. Fisheries NSW policy and guidelines outline types of Key Fish Habitats (Table 5)

Table 5. Key Fish Habitats outlined in Policy and guidelines for fish habitat conservation and management (NSW DPI, 2013)

Table 1 – Key fish habitat and associated sensitivity classification scheme (for assessing potential impacts of certain activities and developments on key fish habitat types)

<p>TYPE 1 - Highly sensitive key fish habitat:</p> <ul style="list-style-type: none"> ▪ <i>Posidonia australis</i> (strapweed) ▪ <i>Zostera</i>, <i>Heterozostera</i>, <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds >5m² in area ▪ Coastal saltmarsh >5m² in area ▪ Coral communities ▪ Coastal lakes and lagoons that have a natural opening and closing regime (i.e. are not permanently open or artificially opened or are subject to one off unauthorised openings) ▪ Marine park, an aquatic reserve or intertidal protected area ▪ SEPP 14 coastal wetlands, wetlands recognised under international agreements (e.g. Ramsar, JAMBA, CAMBA, ROKAMBA wetlands), wetlands listed in the Directory of Important Wetlands of Australia² ▪ Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants ▪ Any known or expected protected or threatened species habitat or area of declared 'critical habitat' under the FM Act ▪ Mound springs 	<p>TYPE 2 – Moderately sensitive key fish habitat:</p> <ul style="list-style-type: none"> ▪ <i>Zostera</i>, <i>Heterozostera</i>, <i>Halophila</i> and <i>Ruppia</i> species of seagrass beds <5m² in area ▪ Mangroves ▪ Coastal saltmarsh <5m² in area ▪ Marine macroalgae such as <i>Ecklonia</i> and <i>Sargassum</i> species ▪ Estuarine and marine rocky reefs ▪ Coastal lakes and lagoons that are permanently open or subject to artificial opening via agreed management arrangements (e.g. managed in line with an entrance management plan) ▪ Aquatic habitat within 100 m of a marine park, an aquatic reserve or intertidal protected area ▪ Stable intertidal sand/mud flats, coastal and estuarine sandy beaches with large populations of in-fauna ▪ Freshwater habitats and brackish wetlands, lakes and lagoons other than those defined in TYPE 1 ▪ Weir pools and dams up to full supply level where the weir or dam is across a natural waterway
<p>TYPE 3 – Minimally sensitive key fish habitat may include:</p> <ul style="list-style-type: none"> ▪ Unstable or unvegetated sand or mud substrate, coastal and estuarine sandy beaches with minimal or no in-fauna ▪ Coastal and freshwater habitats not included in TYPES 1 or 2 ▪ Ephemeral aquatic habitat not supporting native aquatic or wetland vegetation 	

5.1.3 Biodiversity Conservation Act

The Biodiversity Conservation Act 2016 came into effect in August 2017 replacing the repealed Threatened Species Conservation Act 1995, Native Vegetation Act 2003 and National Parks and Wildlife Act 1974 (animal and plant provisions only). The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The Act provides provisions for the protection of threatened or protected animal and plant species, threatened ecological communities and areas of outstanding biodiversity value.

The Act sets out the assessment framework for threatened species and ecological communities, which are now listed under this Act, for activities and approvals under Part 5 of the Environmental Planning and Assessment Act 1979. To determine whether the proposed activity is likely to significantly affect threatened species or ecological communities, or their habitats a test of significance must be applied. If it is found that the proposed activity is likely to significantly affect threatened species or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement (SIS). If the proposed activity will

not have a significant impact on threatened species or areas of outstanding biodiversity value it will continue to be assessed under s.111 of the Environmental Planning and Assessment Act 1979.

5.1.4 Marine Estate Management Act 2014

The aims of the Coastal Management Act also support the aims of the Marine Estate Management Act 2014, as the coastal zone forms part of the marine estate. The Marine Estate Management Act 2014 provides for strategic and integrated management of the whole marine estate – marine waters, coasts and estuaries. The Act does this by:

- Providing for the management of the marine estate consistent with the principles of ecologically sustainable development;
- Establishing two advisory committees, a Marine Estate Management Authority and Marine Estate Expert Knowledge Panel;
- Requiring the development of a Marine Estate Management Strategy to address priority threats identified through threat and risk assessment;
- Facilitating the maintenance of ecological integrity, and economic, social, cultural and scientific opportunities;
- Promoting the coordination of government programs; and
- Providing for a comprehensive system of marine parks and aquatic reserves.

This Act mainly governs aquatic reserves and marine parks. No aquatic reserves or marine parks exist within Shaws Bay and the proposed works are not expected to impact any aquatic reserves or marine parks.

5.1.5 Coastal Management Act 2016

The *Coastal Management Act 2016* communicates the NSW Government's vision for coastal management. The Act reflects the vital natural, social, cultural and economic values of our coastal areas and promotes the principles of ecologically sustainable development in managing these values. The legislative and policy framework introduced by recent coastal reforms recognises natural coastal processes and the local and regional dynamic character of the coast and promotes land use planning decisions that accommodate them. The reforms ensure coordinated planning and management of the coast and support public participation in these activities.

The Act provides for the integrated management of the coastal environment of NSW consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the state. The Act:

- Establishes high level statutory objects for integrated coastal management in NSW, namely:
 - (a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and
 - (b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and
 - (c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and
 - (d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and

(e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and

(f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and

(g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and

(h) to promote integrated and co-ordinated coastal planning, management and reporting, and

(i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and

(j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and

(k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and

(l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and

(m) to support the objects of the *Marine Estate Management Act 2014*.

- Defines the NSW coastal zone as being made up of four distinct 'coastal management areas' and sets out specific management objectives for each of those areas;
- Establishes a new independent coastal advisory body, the NSW Coastal Council;
- Requires local councils to embed coastal management within the Integrated Planning and Reporting (IP&R) framework established in the *Local Government Act 1993*. This approach will ensure that coastal management needs inform, and are informed by, councils' overall service delivery, financial and asset management planning responsibilities; and
- Provides for public authorities to take into consideration the objectives and processes to achieve integrated management of the NSW coast.

5.1.5.1 Coastal Management SEPP

The Coastal Management SEPP is part of the new coastal management framework being developed and implemented by the NSW Department of Planning and Environment and the Office of Environment and Heritage, which integrates and builds previous coastal SEPPs – SEPP 14 (Coastal Wetland), SEPP 26 (Littoral Rainforest) and SEPP 71 (Coastal Protection) – which are now repealed. The CM SEPP includes areas mapped as CMA 3 (Coastal environment areas) and CMA 4 (Coastal use area) which the Shaws Bay area falls within (Figure 6 & Figure 7). Both the CMA 3 and CMA 4 areas are based on the current coastal zone as defined by the *Coastal Protection Act 1979*, with some modifications. The Coastal Management SEPP gives effect to the objectives of the Coastal Management Act 2016 from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

There is no change proposed to the permissibility of activities in the proposed new CMA 3 and CMA 4 areas. Matters which are currently permissible without consent under an environmental planning

instrument, and which can be determined under Part 5 of the *EP&A Act, 1979*, will continue to be determined under Part 5 (NSW Department of Planning and Environment, 2015).



Figure 6. CM SEPP Coastal Environment Area – CMA 3 (blue) and Coastal Use Area – CMA 4 (apricot). Note that CMA 3 overlaps CMA 4. Full extent of CMA 4 is shown in the next figure.



Figure 7: CM SEPP Coastal Use Area (CMA 4)

5.1.6 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) controls environmental pollution and regulates scheduled activities carried out in NSW. In relation to dredging activities, the provisions of the Act would primarily relate to preventing water pollution as well as ancillary matters such as noise and air pollution.

Dredging activities that involve the dredging of more than 30,000 m³ of material annually are scheduled activities which require an Environmental Protection Licence. The estimated amount of material to be dredged is less than 10, 000 m³.

The POEO Act also regulates waste classification, management, transport and disposal in NSW. Under the Act those who generate waste are responsible for classifying the waste. Waste is to be classified under the Waste Classification Guidelines (NSW EPA, 2014). Dredged material is considered to be 'waste'. Material to be used onsite, i.e. for beach nourishment, can be done so without classification and any associated approvals, however, material (silt, organics, shell etc.) dewatered within the geobag is considered to be waste and will need to be classified under these guidelines before appropriate disposal. Further, any waste material to be used for beneficial purposes off-site (i.e. excess sand for ocean beach nourishment), rather than waste disposal, a Waste Recovery Order and Exemption will be required. These are issued by the NSW EPA in accordance with clause 91, 92 and 93 of the *Protection of the Environment Operations (Waste) Regulation 2014*.

5.1.7 Water Management Act 2000

In stream works are regulated by the controlled activity provisions of the *Water Management Act 2000* (WM Act). The NSW Office of Water administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.

Under Section 38 of the *Water Management (General) Regulation, 2011* a public authority is exempt from Section 91E (1) of the Act in relation to all controlled activities that it carries out in, on or under waterfront land.

5.1.8 Environment Protection and Biodiversity Conservation Act, 1999

The *Environment Protection and Biodiversity Conservation (EPBC Act) Act 1999* provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the EPBC Act as matters of national environmental significance. The Act lists threatened species or ecological communities that are recognised as a matter of national environmental significance.

5.1.9 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974 (NPW Act)* provides for the statutory protection of Aboriginal cultural heritage places, objects and features.

5.1.10 Heritage Act 1997

All non-Aboriginal archaeological relics across NSW (including NPWS estate) over 50 years old are managed under the *Heritage Act 1977*. Any works or activities that may disturb non-Aboriginal archaeological relics must have an Excavation Permit, which is a separate approval under the *Heritage Act 1977*.

5.2 Shaws Bay Coastal Zone Management Plan

The Shaws Bay Coastal Zone Management Plan was adopted by Council in 2015, certified the NSW Minister for Planning and was Gazetted on 24 June 2016. The CZMP contains a number of recommended management actions to address key issues and protect and enhance the Bay. The

overall management goal for the Shaws Bay CZMP is: “to improve the recreational amenity of Shaws Bay and to ensure that the habitat and ecological values of the Bay are maintained within an acceptable range.” Nine improvement actions were recommended in the CZMP. The proposed works directly address or are significantly aligned with two of the CZMP actions as outlined in Table 4, Section 3.

5.3 East Ballina Reserves Vegetation Management Plan

The East Ballina Reserves Vegetation Management Plan (VMP) provides strategies and actions to assist in the restoration of native vegetation communities throughout Public Reserves in East Ballina. The plan included vegetation within the vicinity of Shaws Bay. A number of recommendations were made for the management of Shaws Bay reserves vegetation (within this study area). The proposed works are generally consistent with the VMP.

5.4 Legislative Summary

5.4.1 Approvals

All components of the proposed works are permissible without consent, if undertaken by or on behalf of a public authority (Council) under the *State Environmental Planning Policy (Infrastructure) 2007* as follows:

- Dredging - Part 3, Division 25, Clause 129
- Beach nourishment – Part 3, Division 25, Clause 129
- Ecological enhancement works- Part 3, Division 12, Clause 65
- Boardwalk - Part 3, Division 12, Clause 65

BSC is the proponent and determining authority responsible for deciding whether to approve or proceed with the activity. An environmental assessment in the form of a Review of Environmental Factors is required in accordance with Part 5 of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and Section 111 of the Act, which requires that the proponent (BSC) take into account to the fullest extent possible all matters affecting or likely to affect the environment due to the proposed activity.

5.4.2 Dredging and/or reclamation permit

Any person, business, company or local government authority proposing to dredge, excavate or remove material (including sand, mud, large woody debris, aquatic vegetation, boulders, gravel etc.) from a waterway, or reclaim or place fill within a waterway requires a permit from the Department of Primary Industries (DPI Fisheries) unless the work has been authorised under the Crown Lands Act 1989 or by a relevant public authority (not a local government authority). The permit is issued under Section 200 of the *Fisheries Management Act 1994*. An application will need to be completed and submitted to DPI Fisheries for approval along with a cash fee. DPI – Fisheries will require a determined REF for the project to accompany the permit application.

5.4.3 Harm marine vegetation permit

Any damage to, or destruction of, saltmarsh, mangroves, seagrasses or seaweeds growing on public water land or the foreshore of public water land up to Highest Astronomical Tide level requires a permit from DPI Fisheries. The permit is issued under Section 205 of the *Fisheries Management Act 1994*. An application will need to be completed and submitted to DPI Fisheries for approval along with a

payment of a cash fee. DPI – Fisheries will require a determined REF for the project to accompany the permit application.

5.4.4 Waste recovery order and exemption

If waste material, i.e. excess sand, is to be used off-site for beneficial purposes (e.g. ocean beach nourishment) a Waste Recovery Order and Exemption will be required. These are issued by the NSW EPA in accordance with clause 91, 92 and 93 of *the Protection of the Environment Operations (Waste) Regulation 2014*. The sand is unlikely to be considered excavated natural material or virgin excavated natural material and therefore it is anticipated that a specific resource recovery order and exemption will be required for the material.

6. DESCRIPTION OF EXISTING ENVIRONMENT

6.1 General site description

Shaws Bay is a popular recreational area of great importance to the local community. Shaws Bay and the adjoining foreshore areas have a long association with the leisure time pursuits of the residents of Ballina and visitors to the area stretching back to the early 1900's. The natural assets attract visitors to the area and the Bay is strategically important as part of Ballina's tourism industry, which is a key driver of the local economy.

Popular community uses of Shaws Bay are focussed on low impact aquatic activities such as swimming, snorkelling, and paddle boarding. Nature appreciation, utilisation of barbeque and picnic facilities as well as family use of playgrounds are also popular. A small number of anglers also fish in the Bay. Recreational use of the Bay is increasing due to an expanding population and proximity to SE Qld, particularly following the Pacific Highway upgrade. It also provides an alternative to local beaches, given the recent shark activity, and to Lake Ainsworth, which is sometimes affected by algal blooms.

6.2 Site location and ownership

All works areas lie within public reserves in the vicinity of Shaws Bay, East Ballina (Table 6, Figure 8).

Table 6: Location of proposed works sites

Site	Lot & DP	Reserve No.	Reserve Purpose/Land Use
Western Foreshore	Lot 7017 DP 1064314	R1010068	Public Recreation & Coastal Environmental Protection/ Public Reserve
Eastern Beach	Lot 7016 DP 1068899	R88004	Public Recreation/ Public Reserve
South, Middle and North Pop Denison Park Beach	Lot 7016 DP 1068899	R88004	Public Recreation/ Public Reserve
Processing Site	Lot 7016 DP 1068899	R88004	Public Recreation/ Public Reserve
Dredge Areas	Lot 7017 DP 1064314	R1010068	Public Recreation & Coastal Environmental Protection/ Public Reserve
	-	R69267 ^a	Public Recreation

^a R69267 is not mapped but encompasses the unmapped section of Shaws Bay (Figure 8). BSC records indicate the reserve was gazetted as a reserve for public recreation in 1940.



Figure 8: Crown reserve locations and Lot & DPs

6.3 Site Land Use

Shaws Bay is frequently utilised by the local community and visitors for a large range of recreational pursuits both within the water and the surrounding foreshore. The most common recreational activities undertaken include swimming, walking/exercise, picnicking, fishing, canoeing/kayaking/paddle-boarding, snorkelling and bird watching/nature appreciation (Hydrosphere, 2014). Pop Denison Park is used frequently by families. The following community groups also utilise Shaws Bay for recreational activities:

- Ballina Lighthouse and Lismore Surf Lifesaving Club – swimming and board/ski training;
- Scouts/girl guides;
- Boules club;
- Dragon Boat club;
- Triathlon club; and
- Swimming clubs

The proposed dredging areas are zoned W2 – Recreational Waterways and the sediment processing site RE1 – Recreation under the Ballina LEP 2012 (see Section 5.1.1.1). The ecological enhancement area and nourishment sites are a mixture of RE1 and W2.

6.4 Surrounding land use

BLEP 2012 land use zoning of the study area is discussed in Section 5.1.1.1.

6.4.1 North

To the north and north east of Shaws Bay lies parkland and further, bushland. North of the bushland, on the escarpment are residential properties.

6.4.2 East

To the east of Shaws Bay lies the Shaws Bay residential area. Residential properties, with some permanent residents, are located (at the nearest) approximately 85 m south east of the processing site. A caravan park is located on the eastern foreshore of Shaws Bay approximately 50 m south of the East Beach site, approximately 200 m south of the processing site.

6.4.3 South

Shaws Bay is bordered to the south, south east and south west by a training wall and the Richmond River. The training wall has a pathway and is used for recreational pursuits including walking/exercise, cycling, skating and fishing.

6.4.4 West

A caravan park, hotel and a residential apartment complex are located directly adjacent to the western foreshore of Shaws Bay. Further to the north, Compton Drive runs parallel to the foreshore. Several residential properties are situated on the opposite side of Compton Drive. More residential properties exist further to the north west.

6.5 Waterways

Shaws Bay is a modified tidal embayment that was once part of the Richmond River channel and entrance shoals. It was created by construction of the northern river training wall and reclamation of land for urban development. The Bay is hydrologically connected to the Richmond River estuary and tidal flows enter and exit through the rockwork of the training wall.

6.5.1 Tidal dynamics

This section is extracted from Hydrosphere Consulting (2014b).

The oceanic tidal influence on Shaws Bay is due to the open (porous) structure of the training wall separating Shaws Bay from the Richmond River estuary. The influence of the tide is visually apparent, particularly in the East Arm, where tidal flows can be observed, depending on the tide state, to be entering or exiting through the rockwork of the training wall. Within the Main Section of the Bay, tidal circulation is less observable but can be inferred from patterns in scour and sedimentation as well as the bathymetry of the Bay. The main circulation patterns during inflowing and ebbing tides are shown in Figure 9.

PBP (2000) demonstrated that the level of high tides within Shaws Bay were approximately equal (<0.1m difference) and lagged slightly (<45 minutes) in comparison to the corresponding tides in the Richmond River, whereas the low-tides were truncated at around -0.3m AHD. Given these levels, and the bathymetry of the Bay, it was estimated that the volume of water (tidal prism) that is exchanged between the Richmond River and Shaws Bay is approximately 130,000m³ for spring tides and 90,000m³ for neap tides, which is approximately 30% and 23% respectively of the total Shaws Bay tidal prism (PBP, 2000).

Tidal exchange is maximised within the East Arm, with the entire volume of this section virtually drained during ebb and refilled during incoming tides twice daily, whereas the Northern Section, furthest from the tidal inflow/outflow through the training wall, is least flushed. Circulation patterns due to wind as well as the mixing/dispersal characteristics modelled by PBP (2000) showed that the flushing time for the Northern Section is around 5-8 days, and for deeper sections of the Main Section of Shaws Bay in the order of 4-7 days.

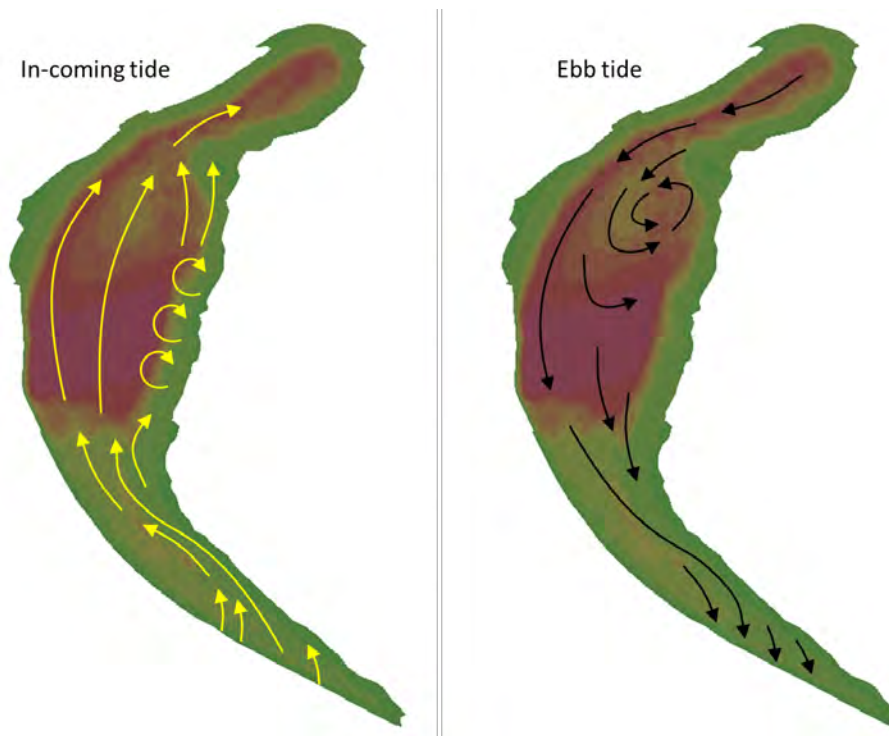


Figure 9: Conceptual diagram of tidal flow patterns in Shaws Bay (Hydrosphere Consulting, 2014b)

6.5.2 Geomorphology and bathymetry

This section is extracted from Hydrosphere Consulting (2014b).

With the construction of the training walls, Shaws Bay became a highly sheltered environment and the effects of wave energy, tidal currents and flood scouring was greatly reduced. Historical dredging during the 1970s, 1980s and 1990s maintained deep water in the centre of the Bay and the dredged sand was placed around the foreshores to create sandy beaches (PBP, 2000a). Since the cessation of dredging, Shaws Bay has gradually infilled with sediment. Comparison of the 1999 and 2013 bathymetric survey data indicates that the Bay had infilled by a calculated 12,265m³ over those 14 years (876m³/year).

Hydrographic survey was again undertaken in 2017 as part of the planning stages of this project and is presented in Figure 10. The infill between 2013 and 2017 was calculated to be 5,197m³, which equates to an infill rate of around 1,300m³/year. The majority of the observed infill was in the vicinity of the two proposed dredge areas (Figure 11). The 2017 survey identified an area of significant infill (approximately 2,500 m³ since 2013) extending the East Arm delta (northern end of East Arm). A deeper channel runs from the Northern Section into the Main section parallel to the western foreshore of the Bay, indicating that the scour from tidal exchange with the Northern Section is concentrated along this margin. The 2017 survey indicates that water depth in this channel has increased around the 'bottle neck' between the Northern Section and Main Section of the Bay. A summary of the geomorphic trends within the Bay is presented in Figure 12. Additional detail on the hydrographic survey and infill areas can be found in the Stage 1 report (Hydrosphere 2018b).

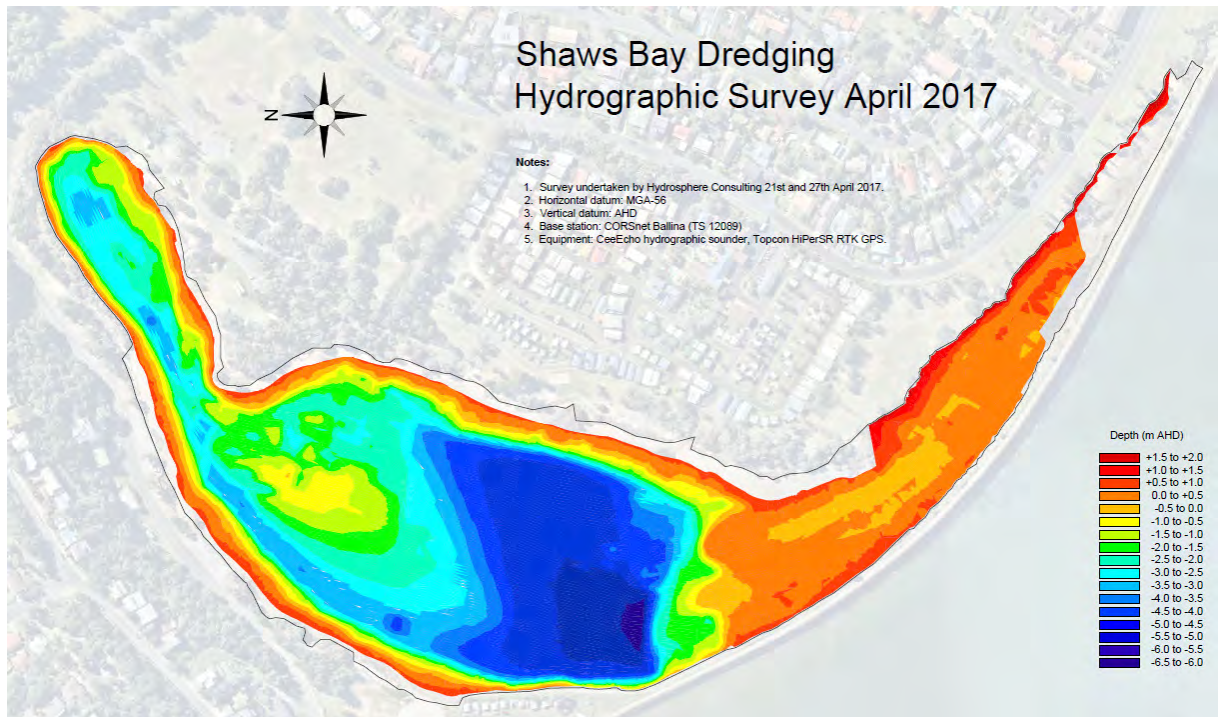


Figure 10: Shaws Bay bathymetry April 2017

Source: Hydrosphere (2018b)

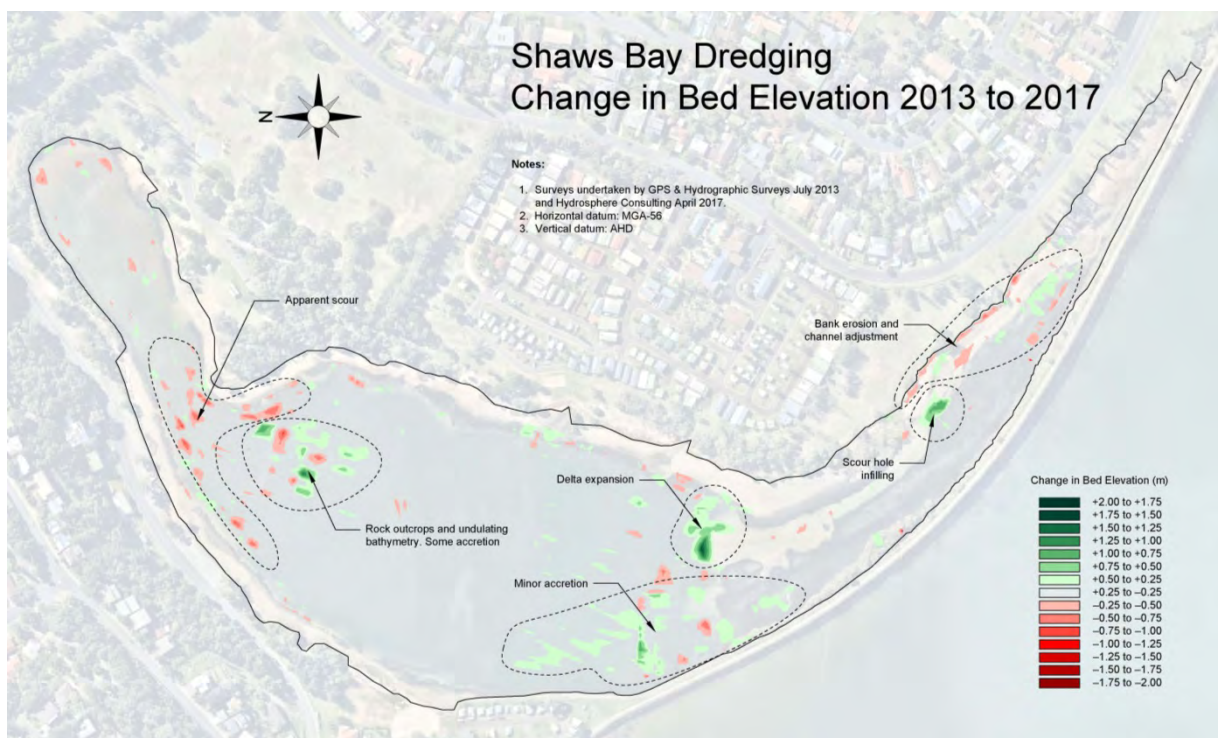


Figure 11: Shaws Bay bed level changes 2013 to 2017

Source: Hydrosphere (2018b)

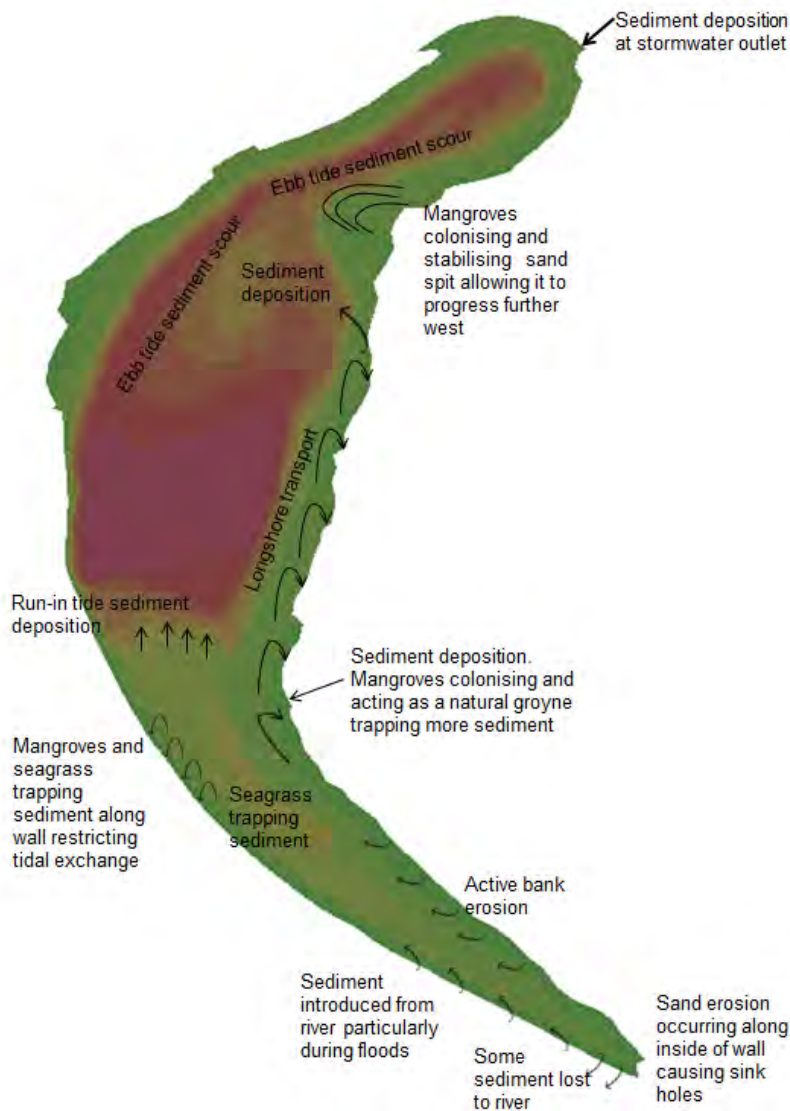


Figure 12: Summary of geomorphic trends in Shaws Bay (Hydrosphere Consulting, 2014b).

6.5.3 Water quality

Water quality in Shaws Bay is influenced by two sources, the Richmond River and localised stormwater runoff. Water quality within the bay is mainly driven by exchange with the Richmond River, except after significant rainfall events where stormwater discharge into the Bay strongly influences water quality. In general, due to reduced tidal exchange and stormwater inputs, water quality experienced within northern section Shaws Bay is of a poorer quality than that of the Main Section and East Arm. The best water quality occurs within the Bay after periods of low rainfall and/or during spring tides when oceanic influence is at its greatest.

Hydrosphere Consulting (2014b) provides a comprehensive amalgamation and assessment of Shaws Bay water quality data. A brief summary of this information is provided here.

Table 5 provides the median values for physio-chemical water quality parameters recorded in northern Shaws Bay over summer between 2005/06 and 2013/14. Conductivity ranged from levels consistent with freshwater to seawater as expected in a tidal system with freshwater catchment inputs. With a

median value of 47 mS/cm, conductivity was only slightly less salty than seawater during most samples. The median pH value recorded was 8.2, with no results recorded below pH7, indicating that acidity isn't experienced within Shaws Bay. The median value for DO was 8 mg/L, which is considered to be suitable for healthy ecosystem function. The Bay does experience events of low DO, which generally correspond to major flooding and widespread deoxygenation within the wider Richmond River. Overall, water quality results indicate that for the water quality indicators measured, the results are consistent with what would be expected from a healthy, functioning estuarine ecosystem.

Table 7: Median values for physio-chemical water quality parameters recorded in northern Shaws Bay over summer between 2005/06 and 2013/14 (Hydrosphere Consulting, 2014b)

Sample Year	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Temperature (° C)	No. samples
Guideline values:	7.5-8.5	-	<10 NTU	>6mg/L	-	
2005/06	8.30	51.90	2	7.29	26.10	18
2007/08	8.05	49.90	4	8.40	25.60	17
2008/09	8.31	51.75	2	8.25	24.90	20
2010/11	8.17	49.50	4	8.65	24.30	17
2011/12	8.18	46.00	3	7.85	23.95	14
2012/13	7.97	52.10	3	8.25	24.35	18
2013/14	8.19	48.90	4	7.63	25.10	17

6.6 Topography and soils

Current topography of the Shaws Bay catchment includes a steep heavily-vegetated escarpment to the west and north and flat delta shoals, back barrier beach and washover deposits which have been compacted for urban development. The escarpment above Shaws Bay represents former sea cliffs of basalt rock with a thin sand cover, remnant from former transgressive dune development and aeolian sand accumulation. The urban development and reserve areas have a natural substrate of marine sand with imported marine sand and loamy material with a thickness of 0.5m used as fill (PBP, 2000a).

A sediment investigation of the proposed dredge areas was undertaken by Hydrosphere Consulting (2018b). Results indicate that the material to be dredged is dominated by marine sands however is overlain by a silty/organic layer. Generally, sand quality improved with depth, with several cores displaying very clean yellow sand at depth, with gradually darker (anoxic) sediments towards the surface.

The majority of the sediment, including the clean sandy layers, has elevated oxidisable sulphur levels and is therefore considered as potential acid sulphate soil (PASS), despite having significant self-neutralising capacity. Sulfidic content was highest within the silty/organic material, but elevated levels (>0.03%) were also detected in clean sands. As a result, an ASS Management Plan will need to be prepared and implemented during dredging works.

The proposed onshore processing area is zoned as Class 3 and the ecological enhancement works area Class 1/ Class 3 ASS risk under the Ballina LEP 2012 (see Section 5.1.1.1).

6.7 Terrestrial vegetation

6.7.1 Processing site

The proposed processing operations including dredge pipeline, hydrocyclone, geobag, sand stockpile and loading areas are located on open grass. Areas of other vegetation, mainly mixed native woodland/shrubland (Figure 14) directly adjoin the processing site but will not be impacted.

6.7.2 Beach nourishment and access

No terrestrial vegetation exists directly within the footprint of the beach nourishment areas, however, estuarine vegetation is present (see Section 6.7.3). Sand transport routes to the nourishment sites will predominantly utilise the existing park roadway or traverse open grassed areas. Access to the Eastern Beach nourishment site will require traversing through mixed native woodland/shrubland including existing paths through Coastal Cypress Pine Forest EEC as well as areas of weed and scrub to be cleared as identified in the vegetation management plan for this area. The pathway selected follows either existing clear pathways or areas identified for clearing of weeds as part of the VMP for already approved works in this area.

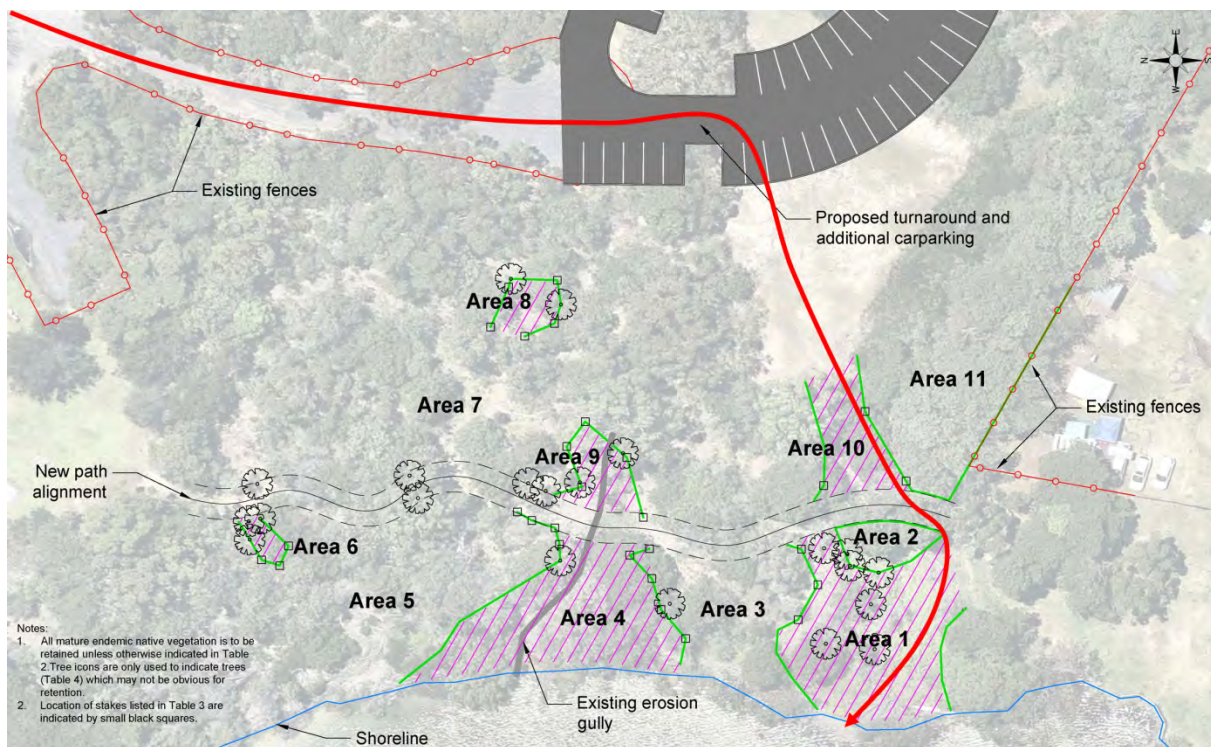


Figure 13. Access path route (red arrow) to East Beach

Source: Adapted from Hydrosphere (2018a)

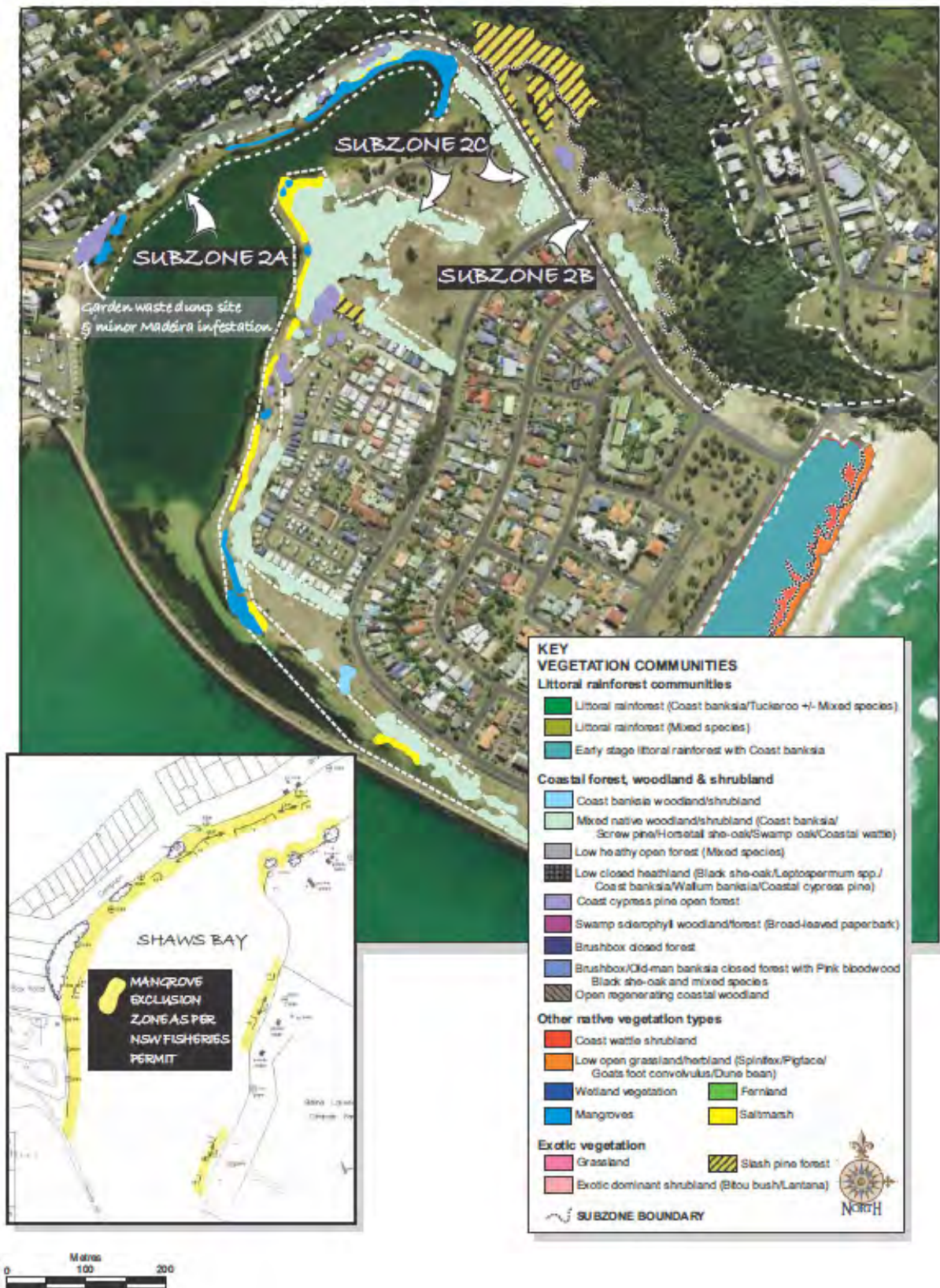


Figure 14: Vegetation communities within the vicinity of Shaws Bay (Blackwood Ecological Services, 2014)

6.7.3 Ecological enhancement works

Vegetation within the ecological enhancement works are is predominantly open grass. Small areas of mixed native woodland/shrubland are directly adjacent to the site. Roots from a large Swamp mahogany extend into the grass land towards the saltmarsh creation area and care will need to be taken to avoid these roots. Estuarine vegetation (see Section 6.7.3) is also within and directly adjacent to the site.

6.8 Estuarine vegetation

6.8.1 Seagrass

Shaws Bay supports relatively large areas of seagrass meadows. Seagrass communities within Shaws Bay historically have consisted of two species, *Zostera capricorni* and *Halophila ovalis*. The communities are overwhelmingly dominated by *Z. capricorni* with blades up to 50cm long). *H. ovalis* is a much smaller and delicate species which has small ovate leaves which grow very close to the bottom substrate, appearing generally around the margins of *Z. capricorni* meadows.

Seagrass surveys and mapping were undertaken in spring 2017 by Hydrosphere Consulting (2018b). Seagrass in Shaws Bay was mapped using ortho-rectified aerial imagery and ground-truthed utilising RTK GPS. Transect surveys were also undertaken to confirm presence and species composition of seagrass, particularly in deeper water where seagrass can become unclear on aerial photography. The transect surveys confirmed that no seagrass further offshore to that identified in the aerial photography mapping was present. The results also confirmed the presence of both seagrass species previously identified (*Zostera capricorni* and *Halophila ovalis*) and that *Z. capricorni* is still the dominant species. *H. ovalis* was found to be in very close vicinity to, and almost exclusively inshore of *Z. capricorni*.

Seagrass mapped during this project was again updated based on January 2018 aerial photography and is presented in Appendix 1, Figure 5. Mapping indicates that seagrass is present within the vicinity of all beach nourishment sites. Approximately 660m² of seagrass lies directly within the footprint of the proposed beach nourishment area on East Beach. Other beach nourishment works are not expected to directly encroach on seagrass at any other location. Less than 10m² of seagrass lies within the proposed dredge areas.

6.8.2 Saltmarsh

Saltmarsh communities are comprised of low growing hyper-saline adapted plant species and are often zoned within the community according to tide levels and frequency of inundation and subsequently salinity levels. Dominant species that are indicative of a saltmarsh community in NSW include Samphire (*Sarcocornia quinqueflora*) at the lower more frequently inundated levels, Saltwater Couch (*Sporobolus virginicus*) dominating the mid-level saltmarsh and Sea Rush (*Juncus kraussii*) which is usually dominating the drier plant communities at higher elevations (DPI, 2013). However, with over 200 plant species known to occur in Coastal Saltmarsh environments there are a number of possible combinations of plant species. Coastal Saltmarsh is currently recognised as being at very high risk of extinction in NSW and is classified as an Endangered Ecological Community (EEC) under the NSW Threatened Species Conservation Act 1995.

The saltmarsh communities in Shaws Bay are dominated by Saltwater couch (*Sporobolus virginicus*) and the succulent Shoreline purslane (*Sesuvium portulacastrum*). Other commonly occurring succulent species were Samphire (*Sarcocornia quinqueflora*) and Astral Seabite (*Suaeda australis*). Small patches of sedge and rush species including Club Sedge (*Schoenoplectus spp*) and Sea Rush

(*Juncus kraussii*) were observed sporadically around the perimeter, with one large sedge area just north of the beach area in front of the Shaws Bay Hotel.

Mapping conducted as part of the Shaws Bay CZMP (Hydrosphere Consulting, 2014) shows saltmarsh extending in fringing communities along much of the eastern foreshore of Shaws Bay as well as the western foreshore to a point approximately level with the Shaws Bay Hotel (Figure 15). Saltmarsh communities were mapped using 2013 aerial photography with the presence and composition of communities verified through on-ground survey in May 2014. Saltmarsh areas will have changed since 2014 however the distribution illustrated in Figure 15 is still indicative of the current extents.

Saltmarsh is present within the vicinity of all beach nourishment sites. In most cases, sand will be strategically placed at the beach nourishment locations so as not to directly impact saltmarsh habitat.



Figure 15: Distribution of saltmarsh and mangroves within Shaws Bay

6.8.3 Mangroves

Mangrove communities can comprise several species that inhabit the intertidal shores of sheltered subtropical and tropical waterways. Mangroves are adapted to saltwater, anoxic and sulfidic environments exhibiting several adaptations which allow them to thrive in such environments. Mangroves occurring in Shaws Bay consist of two species: River mangrove (*Aegiceras corniculatum*); and Grey mangrove (*Avicennia marina*). Mangroves appear to be in relatively good condition in Shaws Bay and are successfully colonising new areas along the foreshore where they are not being actively removed (under a permit from DPI-Fisheries).

Figure 15 provides an overview of the mangrove distribution mapped in the Shaws Bay CZMP (Hydrosphere Consulting, 2014). Mangrove areas will have changed marginally since this mapping however is indicative of the current distribution of mangroves within Shaws Bay. Mangroves occur within the vicinity of the proposed beach nourishment sites and removal of some mangroves at East Beach will be required to fully realise the scope of this project.

6.8.4 Macroalgae

Hydrosphere Consulting (2017) recorded large areas of the green macroalga *Microdictyon umbilicatum* present within Shaws Bay. The species is superficially similar to the sea lettuce *Ulva*, but grows significantly larger. It forms large thin lobate plates up to 45cm in diameter, which although seeming unattached, generally grow on the bed in protected areas and within seagrass beds. This alga tends to smother seagrass, and forms thick blankets of live and dead *Microdictyon* on the bed of the estuary. Blanket thickness of up to 80cm was observed during the seagrass surveys.

Small areas of brown macroalgae were also recorded within Shaws Bay. However, they were small isolated patches not within the dredging footprint.

6.9 Fauna

A search of the online Bionet database for threatened species recorded within Shaws Bay was undertaken. The search returned records of seven species, six bird and one plant species (See Appendix 5). A search of the EPBC Act Protected Matters Search tool was also undertaken (Appendix 6), with 58 species 'known to occur' or with 'habitat known to occur' within Shaws Bay.

6.9.1 Marine and shoreline

Fish

A range of aquatic habitats are present within and within the vicinity of the proposed works area including intertidal and sub-tidal sandy habitats, seagrass, mangroves, saltmarsh and hard structure including rocks, stormwater infrastructure and woody habitat. These habitats support a large range of recreationally popular fish species including Flathead, Bream, Whiting, Flathead, Trevally, Mangrove jack and Garfish. The training wall bordering Shaws Bay provides habitat for Estuary cod (*Epinephelus coioides*) which is listed as a protected fish in NSW under the *Fisheries Management Act 1994*.

There are numerous fish species which are known to occur within Shaws Bay but are relatively cryptic or associated with very specific habitats and hence are not observed regularly. Examples of such fish include Pacific blue-eye, which inhabit the stormwater drains and appear to depend on some level of freshwater flow from these pipes as they have not been observed elsewhere in the Bay. The rocky walls and new groynes often harbour a variety of sub-tropical reef fish and the seagrass beds harbour numerous species including pipefish and long-toms are strongly associated with seagrass beds as well.

Benthic Infauna

No specific invertebrate surveys have been undertaken as part of this study, however limited previous sampling was undertaken as part of the estuary processes study (PBP 2000). Benthic samples were taken at locations around Shaws Bay, including within the vicinity of beach nourishment areas. The intertidal sandbanks within the beach nourishment areas provide habitat for a range of benthic infauna species including polychaetes, gastropods, amphipods and to a lesser extent bivalves (Table 8). Although not recorded, higher sandy foreshores provide habitat for Ghost Crabs (*Ocypode spp.*) with intertidal areas often inhabited by Soldier Crabs (*Mictyris spp.*). Adjacent mangroves and saltmarsh habitats provide habitat for a number of other small crab species.

Table 8. Macroinvertebrates previously recorded by PBP (2000) within the vicinity of beach nourishment areas

Placement Area	Site	Depth	Sediment Description	Macroinvertebrate count
Pop Denison North	B3	Low water	Clean Sand	15 polychaetes
Pop Denison Middle	B6	Low water	Clean Sand	10 polychaetes
Western Foreshore	B10	Intertidal	Clean Sand	11 polychaetes, 4 amphipods, 4 gastropods
East Beach	B11	Intertidal	Clean Sand	11 polychaetes
Western Foreshore	B12	Intertidal	Clean Sand	12 polychaetes, 1 gastropod, 1 bivalve
East Arm	25	Intertidal	Clean Sand	10 polychaetes, 4 gastropods
East Arm	26	Low Water	Clean Sand	3 polychaetes, 10 gastropods
East Arm	27	Low Water	Clean Sand	2 polychaetes

Benthic macroinvertebrates are also likely to inhabit benthic habitat within the dredge areas. No specific invertebrate surveys have been undertaken as part of this study, however limited previous sampling was undertaken as part of the estuary processes study (PBP 2000). This winter survey showed that the majority of macroinvertebrates generally consisted of polychaete worms and various species of whelks (gastropoda). Sampling at that time was undertaken from a range of sites, several of which coincide with the proposed dredging locations/depths of the current project as shown in Table 9.

Table 9. Macroinvertebrates previously recorded by PBP (2000) in dredge areas 1 and 2

Dredge Area	Site	Depth	Sediment Description	Macroinvertebrate count
1	B22	3m	Anoxic Muddy Sand	Nil
1	B23	LWM	Slightly Muddy Sand	5 Bivalves
1	B24	LWM	Clean Sand	5 Polychaetes
2	B13	2m	Muddy Shelly Sand	32 Gastropods
2	B14	2.5m	Anoxic Muddy Sand	Nothing alive, many dead gastropods

Generally, the results of the PBP (2000) survey indicated that polychaete worms were nearly always associated with the clean sand, whereas the gastropods were in higher abundances where mud was present. This corresponds with observations during seagrass surveys undertaken for the current study (Hydrosphere 2018c) where large numbers of gastropods were evident grazing in seagrass areas, which were typically silty, whereas few live animals were observed on bare sand offshore from the seagrass.

6.9.1.1 Shorebirds

Shorebirds (often called waders) are birds that commonly feed by wading in shallow water or saturated substrate along the shores of lakes, rivers and the sea (Geering *et al.* 2007). Shorebirds are generally considered as either resident shorebirds (i.e. do not undertake large-scale migrations) or migratory shorebirds (i.e. undertake large migrations). Many migratory shorebirds that occur in Australia breed in the northern hemisphere during the southern winter before migrating to Australia for the summer to feed before migrating back north before the winter. Shorebirds migrating to and from Australia utilise what is termed the East-Asian Australasian Flyway.

Shorebirds utilise a range of habitats in estuaries and open beaches including intertidal sandflats and mudflats, supratidal sand banks, mangroves, intertidal and upper areas of sandy beaches and foreshores, and rocky foreshores. The Shaws Bay shoreline provides a variety of shorebird habitat including intertidal sand and mud flats, rocky shorelines and mangrove areas. NSW Wildlife Atlas Bionet threatened species search results reveal a number of shorebirds species recorded within Shaws Bay (Appendix 5). Results from the EPBC Protected Matters Search Tool indicate that a number of shorebird species have habitat known to occur within Shaws Bay (Appendix 6).

Potential shorebird habitat within the works area includes intertidal sandflat and sandy shoreline areas within all five beach nourishment sites. The intertidal areas are likely to provide foraging habitat with the upper sandy foreshores providing potential roosting habitat. Although potential habitat is present within Shaws Bay, the area is highly disturbed by regular human activity. As such, shorebird habitat within Shaws Bay is considered to be minimal and not important or significant habitat. Large areas of better more suitable habitat exists throughout the broader lower Richmond River estuary (e.g. North Creek, main arm Richmond River, Mobbs Bay) and adjacent beaches (South Ballina Beach, Flat Rock).

6.9.2 Terrestrial

The proposed processing site location is on an open grassed area which offers little habitat value. This area is likely to be utilised by a small number of common species of birds (Magpie, Masked lapwing, Willy wag-tail, Magpie lark, Torresian crow etc.) and insects.

6.9.2.1 Koala Habitat

The Ballina Shire Koala Management Strategy (BSC, 2016) identifies koala habitat throughout the Ballina Shire and outlines strategies to effectively manage these areas and the local koala population. The strategy outlines koala planning areas and management precincts. The East Ballina Koala Management Precinct includes large areas of East Ballina including the East Ballina Escarpment located a short distance to the north east of Shaws Bay. The strategy also identifies preferred koala habitats throughout the Shire. A small area of preferred koala habitat is mapped at North Angels Beach with none recorded within Shaws Bay works areas.

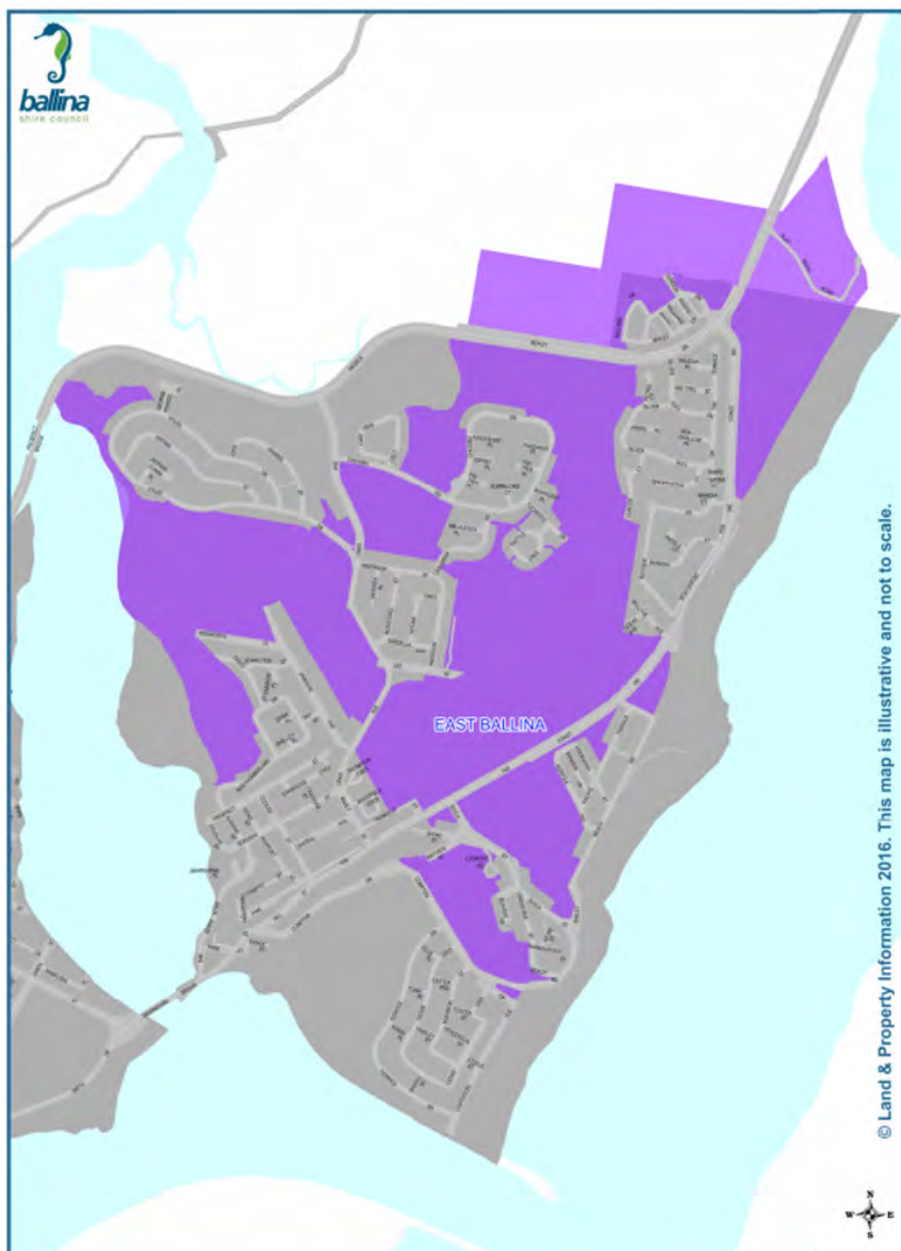


Figure 16: East Ballina Koala Management Precinct

6.10 Heritage

All of the works areas have been subject to significant previous disturbance through construction of the training walls, revetments, previous dredging and sand placement, import of fill and clearing. Much of the land around Shaws Bay was created due to isolation of the Bay from the shifting channel and shoals of the Richmond River by the construction of the training walls. Searches of the NSW State Heritage Database and Ballina LEP 2012 did not identify any heritage sites within the proposed works areas.

6.11 Aboriginal Cultural Heritage

Shaws Bay has been subject to significant previous disturbance through construction of the training walls, revetments, previous dredging and sand placement, import of fill and clearing. Much of the land around Shaws Bay was created due to isolation of the Bay from the shifting channel and shoals of the Richmond River by the construction of the training walls.

Despite this, all of East Ballina and the Richmond River estuary retain a cultural connection for Aboriginal people because of historic events known to have taken place there, and because for countless generations ancestors were known to have maintained and managed the food resources available in the area. Shaws Bay was an important source for gathering shellfish on the shallow sand flats and for traditional fishing practices in river channels. Despite the surrounding density of urban settlement, evidence for these traditions remains on the adjacent ridges of East Ballina, where numerous registered sites of camping places and middens are recorded including the East Ballina Aboriginal Place. Results from a search of the AHIMS database reveals no aboriginal heritage sites are recorded within the vicinity of Shaws Bay and the proposed works areas (Appendix 6).

Searches of the NSW State Heritage Database and Ballina LEP 2012 did not identify any cultural sites or places occurring in the proposed works areas (Appendix 6). No responses or concerns were raised by the Jali LALC or NTSCorp in response to letters inviting response.

7. IMPACT ASSESSMENT

This section identifies and characterises the likely potential environmental risks and impacts associated with the proposal. Suitable environmental management procedures and control measures have been identified to reduce the level of risk to an acceptable level.

7.1 Water Quality

Water quality impacts for all aspects of the project are discussed within this section.

As outlined in Section 6.5.2 water quality within Shaws Bay is considered to be consistent with what is expected of a healthy functioning estuarine environment. The maintenance of good water quality, both during works and into the future, is paramount to the overall ecological health of Shaws Bay.

No long-term negative water quality impacts are expected from the proposed works and there are several anticipated long-term benefits which arise from:

- Dredging of Area 1 aims to ensure that extension and shallowing of the East Arm delta does not occur and thereby will maintain and potentially improve tidal exchange between the East Arm, which is the conduit for virtually all of the tidal prism of Shaws Bay, and the main section of the Bay
- Dredging of material from Area 2 will deepen this depositional area and ensure that tidal flows remain unimpeded in this area. This will allow more efficient penetration of incoming tides to

the northern section of the Bay and better overall connection of this poorer flushed section with the main Bay.

- Removal of silt and organics from the bed of the Bay in two main depositional areas reduce the potential for such material to be resuspended and contribute to ongoing degradation of water quality.

Despite the anticipated benefits, there are several components of the proposed works which present potential water risks, which if unmitigated, have the potential to negatively impact water quality and the overall ecological health of Shaws Bay. Identified potential negative water quality risks and impacts are outlined and discussed in Table 10. The key risks relate to turbidity, potential for acid generation from sulfidic sediments and risks relating to spill of machinery fluids from mobile plant.

As discussed in Table 10, several construction phase water risks are presented by the project. However, with the development and implementation of the identified water quality measures (see Section 9.2) any water quality related impacts are expected to be minor and temporary.

Table 10: Assessment of potential project water quality impacts

Works component	Potential Water Quality Risk and Impacts	Assessment
Dredging	<p>Increased turbidity at dredge site potentially leading to:</p> <ul style="list-style-type: none"> • Sedimentation of seagrass. • Temporary reduction in light penetration of the water column. • Mobilisation of sediment nutrients. 	<p>Dredging will be undertaken using a cutter-suction dredge which has a revolving cutter head to cut and mobilise the sediment which is then vacuumed up via a suction pipeline. This system minimises turbid plume generation as turbid water is drawn into the pipeline through continuous pumping and a properly assembled system will have minimal leaks, thereby maximising the containment of sediment. Due to its effectiveness at reducing plumes, the use of this type of dredge is commonplace for dredging in NSW estuaries.</p> <p>With the use of this dredge type the impact of turbid water plumes is considered to be low as the majority of sediments are contained within the dredging stream. However, some turbid water may still be generated depending on sediment encountered and prevailing weather conditions. A suitable dredge site water quality monitoring program will be developed and implemented to monitor and mitigate turbidity at the dredge site.</p>
	<p>Disturbance and oxidation of PASS at dredge site potentially generating acidic and low dissolved oxygen water.</p>	<p>Elevated levels of sulphides were recorded within the sediments to be dredged, however no MBO's (highest risk ASS) were detected. Exposure of the sulphides to oxygen is likely to result in the oxidation of the sulphides and resultant generation of acid. As the material is not exposed to atmospheric oxygen at the dredging site (as it would be with mechanical excavation), the rates of oxidation will be low. Any acid generation is expected to be only in very low levels and is likely to be neutralised by the high buffering capacity of the surrounding water. As discussed above, the material is cut removed by the suction pipe with the majority of sediments and affected water contained within the dredging pipeline. The majority of oxidised sediments, if any, and associated acidity will be contained within the dredge slurry and can be managed at the dewatering site. Any ASS impacts at the dredge site are expected to be negligible, however, pH and dissolved oxygen will be incorporated into the water quality monitoring program at the dredge site.</p>

Works component	Potential Water Quality Risk and Impacts	Assessment
	<p>Potential for slurry pipe disconnection/rupture and spillage pumping of uncontained dredge slurry</p>	<p>If this was to occur, there would be a short amount of time where dredging was still occurring and slurry would still be pumped until the fault was noticed. During this time, water and sediment would spill from the pipe, leading to localised sand deposition as well as scour at the pipe outflow and turbid runoff. Such effects would generally be readily remediated and short term impact.</p> <p>The actual time where uncontrolled flow would occur would typically be very low as there would be an immediate change in pump rate which is monitored, as well as visual monitoring at the sediment processing site which would also detect a change. Radio communication between all areas of the worksite would facilitate immediate shutoff of the dredge.</p> <p>The slurry pipeline is constructed from short (12-20m) lengths which are bolted together at connecting flanges. The likelihood of the actual pipe material failing is very low. As the flanges are bolted together and don't use quick release connectors, it is also unlikely that a connection will be compromised either accidentally or maliciously. A daily pre-start inspection of the pipeline will be required to mitigate pipeline failure risks.</p>
	<p>Spills at the dredge site (fuel, coolant, lubricants, hydraulic fluids)</p>	<p>As with any mobile plant, there is a potential for spills of machinery fluids. The dredge will be required to carry a full spill containment kit including hydrocarbon booms to reduce the impact of any spill. The relatively sheltered nature of Shaws Bay will enable easier containment and recovery of spills than more exposed sites, but also raises the risk should large spills eventuate. Daily inspections of plant, minimisation of fluids on site, and proper procedures for refuelling and maintenance need to be observed. Operator vigilance, incident training and responsiveness to spills will need to be excellent. The environmental management plan for the project will need to evaluate all potential risks and document suitable mitigation measures.</p>
<p>Sediment processing</p>	<p>Increased turbidity at dredge site potentially leading to:</p> <ul style="list-style-type: none"> • Sedimentation of seagrass. • Reduction in light penetrating 	<p>As discussed in Section 2.3 fines will be separated from sand in the hydro-cyclone. Fines and water will be pumped to geobags to filter the fines from excess water (filtrate). The filtrate will then be pumped from the geobag bund back to Shaws Bay. The geobags are very successful at removing the majority of fines from the slurry resulting in a low turbidity discharge. Some fines may still occur in the filtrate from the bags but they often settle out within the bund before</p>

Works component	Potential Water Quality Risk and Impacts	Assessment
	<p>water column.</p> <ul style="list-style-type: none"> Mobilisation of sediment nutrients. 	<p>discharge. In the past, this process (geobag/bund) has produced filtrate within acceptable turbidity parameters. However, the extent of effectiveness depends on geobag material, sediment type and pumping rates and therefore there is a low risk of turbid filtrate. As a contingency, there is scope for further settling bunds to be established to treat any turbid filtrate if required. All filtrate is to be monitored prior to discharge and within acceptable turbidity levels (TSS - <50 mg/L) before being discharged. A suitable water quality monitoring program will be developed, implemented and incorporated into the project water quality management plan to achieve this. With the implementation of a water quality management plan and other identified mitigation measures any turbidity related impacts associated with the geobag discharge are considered to be minor.</p>
	<p>Acidic, low DO discharge from geobag(s)</p>	<p>See Section 7.3. ASS will be managed under an ASS Management Plan. The use of a hydrocyclone is a recognised method for reducing PASS content of sand. Hence, it is anticipated that the majority of PASS will be retained in the fines/organics which will be directed into the geobag(s). The geobags will allow for gradual dewatering of this material, but the bulk will remain moist and anoxic thereby reducing acid generation. Lime addition to the geobags during operation can also be utilised in the ASS management plan.</p> <p>Any ASS related water quality impacts are expected to be minor.</p>
	<p>Geobag failure</p>	<p>Geobags are commonly used for the dewatering of dredged material to great success. However, there is a risk that the geobags could fail (e.g. split) resulting in spillage of accumulated fines within the bag. To minimise the risk of failure geobags will be appropriately sized, sourced from a reputable supplier and bag integrity monitored regularly during use. Further, sharp objects (branches, rocks other debris etc.) will be removed from the dredged material by screening (prior to hydrocyclone). The use of multiple smaller bags may be warranted compared to a single large bag to reduce the impact of the failure of any one bag. The failure of a geobag for the Ballina Boat Harbour dredging project was deemed to be due to vandalism of the bag, and hence site security is a key component is risk minimisation. As a contingency for the failure of the bag(s), the bund will be sized to accommodate 1.5 x the volume of the geobags. This is considered sufficient to contain the contents of the bags in the</p>

Works component	Potential Water Quality Risk and Impacts	Assessment
		<p>case of a failure. Further, there is room to establish further bunds if necessary. With the application of these measures the risk of water quality and other associated impacts from a geobag failure is considered to be minor.</p> <p>The site selected for sediment processing and the geobag bund is not ecologically sensitive and is significantly removed from the waterway.</p>
	Erosion and turbid stormwater runoff.	<p>The processing site and general site compound may present an erosion risk due to uncovered material, such as sand stockpile and access tracks. Stormwater management and sediment and erosion controls across all works areas will be established as applicable from “<i>The Blue Book</i>” <i>Managing Urban Stormwater: Soils and Construction, 4th Edition Landcom, 2004</i> prior to commencement of works. As such any impacts from erosion and run-off are expected to be minor.</p>
Beach nourishment	Machinery/sand placement generated turbidity within the vicinity of the nourishment site.	<p>The majority of fines will be removed from the beach nourishment material during processing leaving only negligible levels of fines in the sand to be placed on the beach. Therefore the material is not expected to contribute to excess turbidity during natural movements of the material in the long term.</p> <p>Machinery movement on the native beach sediments are to be minimised to reduce squeezing of fines from those sediments. Instead, a raised sand bench constructed from the clean dredged sand is to be established along the beach to allow delivery of the sand to the extremities of the fill area. The swing radius of excavators will be used to move and contour sand wherever practical to avoid excessive tracking and disturbance.</p> <p>No nourishment works (including constructing work pads) are to take place in water (i.e. all beach works to be undertaken during lower tides), therefore, no machinery generated turbidity is expected. Water quality monitoring of the placement sites should be incorporated into the Water Quality Management Plan to confirm the effectiveness of these measures.</p>
Ecological enhancement	Erosion and turbid stormwater runoff during construction.	<p>These works will disturb soils that potentially contain PASS. Preliminary testing of sediments indicated minimal risk for excavation above 0.3m below current ground level, however some</p>

Works component	Potential Water Quality Risk and Impacts	Assessment
works and boardwalk		<p>deeper work will be required for the installation of boardwalk piles and additional testing is likely to be required but not considered likely to identify any significant risks. Any disturbance of PASS will need to be addressed by the ASS Management Plan for the project.</p> <p>Any non-native fill in the saltmarsh creation area is to be moved or capped with clean sand to reduce turbidity risks.</p> <p>Stormwater management and sediment and erosion controls should be established at the site as applicable from <i>“The Blue Book” Managing Urban Stormwater: Soils and Construction, 4th Edition Landcom, 2004</i> prior to commencement of works. As such any impacts from erosion and run-off are expected to be minor.</p>

Although not directly related to water quality, there is a potential risk of seepage of saline water from the sand stockpile. The clean sand, post processing, generally has the consistency of ‘moist to wet sand’ with no free water in the material as the majority of water stays within the fines stream from the hydrocyclone and is pumped to the geobag for dewatering and treatment. As a result, the volume of salt water within the sandy material is relatively low, and therefore the amount of seepage is expected to be low. Rainfall may leach salt from the stockpiled material, however, will also dilute the salt in the process. The low volume of salt expected to leach from the stockpile is not expected to be significant, nor sufficient to negatively affect groundwater in the area or significantly increase salt levels within the soil. Measures outlined in Section 9.2, such as minimising stockpile volumes and times will minimise the opportunity of salt seepage from the stockpiled material.

7.2 Coastal processes

Impacts of dredging and beach nourishment on coastal processes are discussed within this section. The processing site and ecological enhancement works are not expected to impact coastal processes.

7.2.1 Tidal dynamics

Tidal exchange is controlled by the varying porosity of the training wall at different elevations. The current project doesn't change this, but is fully consistent with any future projects that may aim to influence improve tidal exchange in the future. Instead, this project seeks to provide a buffer against sedimentation within the main part of the bay to ensure that circulation does not become compromised in the future. No changes in tidal levels are likely as a result of the dredging. There is no significant removal of the accumulated sediment and organics near the training wall, which would have an influence on the minimum ponding level of Shaws Bay.

Dredging of Area 1 will reduce tidal friction over the delta and may result in a minor reduction in the tidal differential between the East Arm and the main Bay. This difference was reported to be around 0.1m in PBP (2000), which still appears to be case for observed water levels during the various RTK GPS surveys of marine vegetation since then. The actual change in water level differential is unlikely to be measurable as the dredging is aimed at ensuring this area does not become more restrictive into the future rather than making a significant impact on the status quo.

Area 2 dredging will reduce the degree of separation of the North Arm from the main Bay and is expected to influence localised currents. This will mainly be through reduced deflection of flood tide currents, allowing better mixing of the northern section. Once again, dredging is aimed at reducing long-term circulation risks associated with continued siltation of Area 2 than having a marked immediate impact of existing flow patterns.

There will be a minor change in tidal prism as the inter-tidal volume will be reduced as sand taken from sub-tidal elevations will be placed in the inter-tidal zone. The maximum level of nett loss of inter-tidal volume (accounting for 9,100m³ dredging, beach fill and tidal groundwater volume) is 1,200m³ which is 0.92% of the spring tidal prism reported by PBP (2000). Whilst an increase in tidal prism (which would entail increased dredging of intertidal habitat) would be more desirable from a tidal exchange and water quality perspective, a minor reduction is considered acceptable given the benefits of maintaining efficient tidal flushing in the long-term.

7.2.2 Geomorphology

Dredging at the outside edge of the delta at Area 1 will create a localised sediment sink which has the potential to draw in sand from upslope areas of the delta. Existing bed slopes in this area are variable but are often greater than the 1 in 4 batters proposed for the dredge area. The dominant direction of sand movement is westwards towards the dredging area, however, it is likely that there will be some adjustment in the East Arm delta sand supply equilibrium as a result of the bank stabilisation works in the East Arm. This will reduce overall sediment supply from the East Arm, although there will be some continued shifting of sand from the East Arm beaches, as well as replenishment of those beaches (if needed at the time of commencement) through the current project. Overall, it is considered that the East Arm delta will experience reduced infill rates compared to previously. This will result in relatively low infill rates for the dredged area and this is expected to result in minor scour and channel deepening within adjoining portion of the main flood tide channel of the East Arm.

Removal of sediment from Area 2 could potentially reduce sediment supply and increase the scour of sediment from the channel leading into the northern section and could result in depletion of sand from the point at the northern end of East Beach. This effect is likely to be neutralised by the placement of sand on East Beach, which will gradually work northwards and tend to recycle back to Area 2 under the influence of ebb tide scour currents. The dredging proposed in this area will have side batters of 1 in 6 slope, which are anticipated to remain stable given the relatively low energy environment of this part of the Bay and hence the geomorphic effects outside of this area are expected to be minor.

The sand placed on the various beaches is expected to be more dynamic, reflecting the influence of wind waves on exposed sections as well as rainfall runoff effects in some areas as well as the impact of high human activity. Sand placed on the northern section beaches is expected to remain relatively stable, particularly in the ecological zone where plantings will reduce overland sheet runoff, which appears to be a key contributor to erosion in this section and there will be reduced human access and disturbance. The existing main beach at Pop Denison Park is currently influenced by high visitation rates which will continue to destabilise sand in this location, although erosion from terrestrial runoff can be somewhat addressed through better contouring of the beach berm – which can be undertaken at the same time as the beach nourishment works.

The increased rate of placement on East Beach will allow for better stabilisation of the current foreshore, which is eroded in several sections. This will be aided by re-establishment of significant areas of saltmarsh between access points, which will assist in trapping wind-blown sand and reducing the impacts of waves at high tides. Despite this, it is expected that sand placed on East Beach will be more mobile than in the northern arm due to greater levels of exposure to southerly and westerly winds. The lower margins of the beach are expected to flatten out over time, with mobilised sand moving both downslope towards but not extending as far as dredging Area 2 and in a gradual northerly direction. In the long-term, it is expected that East Beach will remain wider than current, resulting in a permanent but subtle realignment of the shoreline in this location.

Sand placed on the western foreshore beach will be exposed to the dominant south-easterly winds and wind-driven wave action. Waves reflecting from the near vertical revetment wall in this location have led to areas of sand depletion in this reach and it is likely that this phenomenon will continue. Erosion of sand in this location is leading to some undercutting of the wall foundation, scour below elevations suitable for saltmarsh colonisation and also increases the apparent height of the wall, which reduces accessibility and public safety. Raising the beach level will provide a buffer against these issues. The amount of sand that can be placed in this location is constrained by existing marine vegetation but should be maximised where possible. Some replanting of saltmarsh (which has been successful with the East Arm works) to assist in this may be appropriate and should be considered.

The effect of beach nourishment within the East Arm is expected to be minor. The three new groynes in this location will assist in stabilising these beaches. A minimal amount of sand was used in the initial reconstruction of these beaches and it is currently not known to what degree additional 'top ups' may be required. Early geomorphological monitoring of the third (most westerly) groyne surrounds indicates that the groynes are working as intended and hence likely stabilise any additional sand placed at these locations.

7.3 Soils

7.3.1 Dredging

The sediments to be dredged contain considerable levels of sulfur and are considered to be PASS as discussed in Section 6.5.2. Associated water quality risks during dredging are considered to be minimal due to the use of a cutter suction dredge.

7.3.2 Beach nourishment

The material to be used for beach nourishment will be post processed dredged material. Fines and other debris will be removed during processing to produce clean sand for beach nourishment. It is expected that any ASS risk will be removed with the fines, however, the material will be assessed under the ASS management plan to confirm the ASS status of the material prior to placement on the beach. As a result, any ASS risk associated with beach nourishment is considered to be minimal.

The removal of fines during processing will also reduce turbidity associated water quality risks of the material. Water quality impacts are assessed in Section 7.1.

7.3.3 Processing site

As discussed previously, the sediments to be dredged contain considerable levels of sulfur and are considered to be PASS. Sulfidic content was highest within the silty/organic material. This material will be separated from the sandy material via the hydrocyclone and pumped to geobags to dewater. The material will be contained within the geobag which will be within a plastic lined bund. During the dewatering of the material the material is likely to oxidise, to what extent will be governed by the conditions within the geobag, during dewatering. Any oxidisation of the material will produce acid of which some will be contained bound within the material in the geobag and some will leach out with the supernatant. The severity of acidity generation will be product of the extent of oxidisation of the sulfidic material and the buffering capacity of both the material and the supernatant. Any acidic discharge will be contained within the bund and treated as appropriate. An ASS management plan will be developed and implemented to effectively manage the material. Managed under a well implemented ASS management plan, any ASS risk associated with the dewatering of the dredged material is considered to be low.

Stockpiling of dredged material (clean sand) on the site prior to beach nourishment and formation of access tracks for machinery (imported or natural material) may present an erosion, including wind erosion, and sedimentation risk. However, if the material and site is managed appropriately using mitigation measures outlined in Section 9.2 any impact from erosion is considered to be negligible.

7.3.4 Ecological enhancement works

The proposed ecological enhancement works are within ASS risk areas as outlined in Section 6.5.2. Excavation within this area may pose potential ASS risks although the risk is considered low. Preliminary sampling of surface soils (<30cm) indicate surface samples do not contain PASS.

A preliminary ASS assessment of deeper soils (at least to depth of excavation) prepared in accordance with the Acid Sulfate Soils Manual should be undertaken on soils required to be excavated within the ecological enhancement works area to confirm ASS status and determine the need for an ASS management plan/ASS control measures.

7.4 Vegetation

7.4.1 Terrestrial Vegetation

Dredging

Dredging will have no impact on any terrestrial vegetation.

Beach nourishment

Some clearing of understorey weeds and low value trees (approved under another project) will be required to access the East Beach nourishment site. There is the potential for repeat dumper traverses to damage tree roots in some areas and measures to protect these roots (e.g. temporary boarding, track mats, sand cover) should be considered after initial monitoring.

Processing site

The establishment of the processing site will require temporary removal or disturbance to an area of open grass vegetation. No trees/shrubs are to be removed. At the completion of works this area will be restored to at least the original habitat condition. Given this, the large areas of similar habitat in the surrounding area and temporary nature of the works any negative impact on the vegetation from the processing site is considered to be negligible.

Ecological enhancement works

The proposed ecological enhancement works will involve the permanent removal and habitat conversion of in excess of 1,000 m² of open grass vegetation to saltmarsh. Open grass is considered to be a very low value habitat with large areas of similar habitat within the vicinity of Shaws Bay and the broader urban environment. Saltmarsh is listed as an Endangered Ecological Community and considered to be a high value habitat. The provision of this area of saltmarsh will improve the habitat and overall ecological value and resilience of the area. Although these works will have a very minor impact on terrestrial vegetation they are expected to have a positive impact on estuarine vegetation and overall vegetation value of the area in the long term.

7.4.2 Estuarine Vegetation

Dredging

Dredging has the potential to negatively impact estuarine vegetation (particularly seagrass) in a number of ways:

- Direct destruction of seagrass during dredging. Less than 10m² of seagrass will be directly removed by dredging. This is considered to be an insignificant area given the large areas of seagrass present within the bay. Nonetheless, it is still considered to be an impact, albeit minor, on seagrass;
- Loss of seagrass due to slumping of dredge area batters;
- Turbid water causing a reduction in light attenuation and siltation of seagrass leading to reduction in seagrass growth.
- Damage to seagrass by workboats (propeller damage) and;
- Damage to seagrass by dredge pipelines.

Mitigation measures have been outlined in Section 0 to minimise the impacts of dredging on seagrass. With the implementation of these measures it is expected that any impact on seagrass during dredging will be minor. The only likely impact expected, which is considered to be minimal, is the direct removal of less than 10m² of seagrass in dredge area 1.

The removal of material from dredge Area 2 is expected to improve or at least maintain tidal flow to the northern section of the Bay. This will maintain circulation of better quality water from the main section of the Bay to the northern section leading to a potential improvement in water quality in the northern section. Improved water quality may have a positive impact on seagrass within the northern section of Shaws Bay in the long term.

Beach nourishment

Beach nourishment has the potential to negatively impact estuarine vegetation during placement works and in the long term. Potential impacts during placement include:

- Small areas of saltmarsh will be damaged to gain access to the beach nourishment locations. Areas of saltmarsh damaged due to access is expected to be in the order of 30m². Recent works within Shaws Bay have demonstrated rehabilitation of saltmarsh via transplanting of saltmarsh plants can be successful. Any saltmarsh areas to be damaged due to access will be either revegetated or transplanted following completion of works and therefore any impact is expected to be minor and temporary. A detailed survey will be required of direct impact sites to inform a permit to harm marine vegetation.
- Smothering/destruction of seagrass, saltmarsh and mangroves during placement and profiling of the sand. Approximately 660 m² of seagrass lies within the footprint of and will be directly impacted by the East Arm beach nourishment works. This equates to approximately 2.5% of the 26,136m² total area of seagrass within Shaws Bay. Seagrass will not be directly impacted at any other nourishment sites. Saltmarsh is not expected to be impacted by direct smothering of nourishment material at any nourishment locations, although movement and transplanting of some saltmarsh near erosion scarps is recommended to allow the optimal fill profile.
- A relatively small number of juvenile mangroves on East Beach, particularly in the vicinity of the erosion gully, will be directly impacted by placement of material. A detailed survey will be required of direct impact areas to inform a permit to harm marine vegetation

Longer-term impacts may include:

- The smothering and damage of seagrass due to down slope movement of the nourishment material. If the down slope face of the beach is too steep and too close to seagrass, sand is likely slump potentially smothering seagrass. It will be important maintain a buffer zone between the sand placement works and shore-side boundary of any adjacent seagrass beds and ensure appropriate beach slopes as shown in Figure 2.
- Smothering and damage of seagrass due to the reworking and redistribution of the nourishment material via geomorphological processes over time. Tidal currents and wave action may rework the nourishment material offshore into seagrass areas.
- Changes in hydrology to existing saltmarsh. If the beach profile on the offshore side of saltmarsh habitat is profiled at a higher elevation than the saltmarsh, there is potential for there be beach to act as a barrier, restricting flows of water to saltmarsh habitats. Any changes to tidal regimes in saltmarsh may impact the integrity and health of the habitat. Beach nourishment has been designed with a bench profile that is at equivalent to or lower than the lowest saltmarsh elevations (Figure 2). Such a design will allow existing tidal regimes with adjacent saltmarsh to continue to occur.

Mitigation measures to minimise the impact of beach nourishment on estuarine vegetation are outlined in Section 0. It will be important that these mitigation measures are implemented effectively throughout the works to minimise any impacts on estuarine vegetation.

Processing site

Considering the various mitigation measures outlined in Section 0 the processing site is not expected to negatively impact estuarine vegetation. Discharge from the bund will be pumped back to the Bay and it is anticipated that the discharge pipe will be floated to a point offshore of the seagrass, with flow diffused such that bed disturbance and sediment resuspension does not occur.

Ecological enhancement works

The ecological enhancement works will result in the creation of in excess of 1,000 m² of saltmarsh habitat. Along the NSW coast saltmarsh is generally in decline due to a range of anthropogenic pressures. Shaws Bay, due to its young geomorphic age (created in the 1960's) has seen an increase in saltmarsh areas over time. However, saltmarsh faces further threats into the future including sea level rise. The provision of this area for saltmarsh habitat will provide saltmarsh habitat now and allow for expansion of the habitat into the future. These works are expected to have a substantial positive impact on estuarine vegetation within Shaws Bay and the broader Richmond River estuary.

7.5 Fauna

7.5.1 Terrestrial Fauna

Dredging

Dredging is not expected to impact terrestrial fauna.

Beach nourishment

No significant terrestrial fauna habitat values have been identified within the beach nourishment sites. However, although not considered to be significant, the sites do provide roosting and potential foraging habitat for a number of bird species. These species will be temporarily disturbed during placement works, however, given the temporary nature of the works at any site and the large areas of similar habitat around the Bay and broader Richmond river estuary any impact is expected to be minor and temporary.

Processing site

No significant terrestrial fauna habitat values have been identified within the processing site. Given the highly modified existing state of the site, no impacts to threatened species and communities are anticipated as a result of the processing works

Ecological enhancement works

No significant terrestrial fauna habitat values have been identified within the ecological enhancement works area. The creation of saltmarsh habitat and increased planting and weed management around the margins of the saltmarsh are expected to generally improve long-term fauna habitat within and within the vicinity of the works area.

7.5.2 Marine and shoreline fauna

Dredging

Dredging will take place on restricted areas of open sand/mud, which is a wide-spread habitat in Shaws Bay. Benthic communities within the dredge areas are likely to be marginal, however, are likely to be both directly (by direct removal) impacted and indirectly by altering the physical characteristics of the area (increasing water depth, change in sediment characteristics). A study undertaken by Hydrosphere (2016) evaluated the response of the benthic macroinvertebrate community to sub-tidal dredging within the Brunswick River estuary, which forms part of the Cape Byron Marine Park. Sampling was undertaken within dredging and reference areas, prior to and on two occasions after dredging. The results of this work also showed a prevalence of polychaetes on sandy sediments, although crustaceans (primarily various crabs, amphipods) and sometimes small bivalves were also found in relatively high abundances. The results of this study indicated that the benthic macroinvertebrate community recovered rapidly and in fact had higher diversity on the first post-dredging survey (February 2016), but then regained very similar levels to the pre-dredge survey (July 2015) by the 1 year anniversary (July 2016). The study concluded on a general level that the sub-tidal benthic macroinvertebrate population was generally sparse, recovered quickly following dredging and appeared to be more influenced by seasonal recruitment events than physical disturbance.

The impact of dredging on benthic fauna is considered to be minor and temporary given the surrounding areas of similar habitat and the relatively small area of habitat being disturbed. It is likely that due to the displacement of individuals, the benthic community assemblages will change within the dredge areas in the interim however, are expected to return to similar to pre-dredge levels in the long term.

Dredging will temporarily disturb fish species within the immediate vicinity of dredging operations. However any impact is expected to be very minor and temporary with species expected to recolonise the area immediately after dredging ceases. The training wall separating Shaws Bay from the Richmond River provides habitat for Estuary cod (*Epinephelus coioides*) however no impacts on this area are expected. There is a possibility that removal of sediments around buried rock in dredge Area 2 may provide additional cod habitat.

Marine mammals or reptiles are not known to be present within Shaws Bay therefore no impact on these species is expected.

Beach nourishment

The sandy foreshores of the beach nourishment sites and adjacent sandflats are considered to be shorebird habitat. A number of shorebirds may potentially intermittently utilise the sand flats wall for foraging and sandy foreshores for roosting, most likely during the summer months. However, these habitats are not considered to be important or significant shorebird habitats. Birds utilising these areas may temporarily be disrupted during construction works. Due to the relatively small area of habitat affected at any one time, temporary nature of disruption and large areas of nearby similar better quality habitat (North Creek, Richmond River, South Ballina Beach) any impact on foraging shorebirds is considered to be minor and temporary.

Beach nourishment works have the potential to impact foreshore benthic macroinvertebrates in a number of ways:

- The use of machinery on the foreshore and sandflats during beach nourishment works may directly impact benthic macroinvertebrates by directly crushing individuals and indirectly by temporarily compacting the sand.

- The placement of material on the beach may smother macroinvertebrate habitat. Larger, stronger more mobile macroinvertebrates (such as Ghost Crab species) are less likely to be impacted.
- The nourishment works will change elevations of the habitat potentially altering macroinvertebrate species assemblages (different species require different tidal regimes). It is likely that there will be some changes in species assemblages, although, are not expected to significantly differ from the current.

The material to be used for nourishment is considered to be similar to that of the placement site and therefore is not expected to significantly alter sediment structure and potential suitability for invertebrates.

Benthic macroinvertebrates of ocean beaches are considered to be quite resilient to beach nourishment/scraping impacts. Given their mobile nature, well adapted to dynamic environments, they tend to recolonise disturbed areas quite quickly. Smith *et al.* (2011) determined that the effect of beach scraping on a north coast ocean beach was not discernible even one day after the impact event. Similarly, Schlacher *et al.* (2012), regarding beach nourishment in this instance, found that communities lower on the beach, although more diverse, experienced lesser impacts and generally recovered quicker. However, infauna communities of the upper beach experienced significant impacts and were slower to recolonise.

Although recovery is likely to take longer than this within a less dynamic environment such as Shaws Bay, this once again indicates that benthic macroinvertebrates are highly responsive and will readily colonise new habitats quickly. Given the relatively small nourishment areas and similar surrounding habitat it is expected that benthic macroinvertebrate species from surrounding areas are likely to begin recolonising the affected areas soon after works have ceased.

It should also be noted that the nourishment works are remedying erosion at many of the placement sites where over time erosion has reduced potential benthic macroinvertebrate habitat, particularly upper intertidal and supratidal habitats. The nourishment works may temporarily impact current benthic macroinvertebrate habitat, as outlined above, but the works will reinstate and increase potential benthic macroinvertebrate habitat in the long term, particularly in the upper intertidal and supratidal zones providing greater overall benthic habitat.

Mitigation measures outlined in Section 0 will minimise the impacts of beach nourishment works on estuarine fauna. Nonetheless, there will be an impact on benthic macroinvertebrate communities at the beach nourishment sites although the scale of impact is considered to be low and temporary.

Processing site

No direct impacts on marine or shoreline fauna from the processing site are envisaged.

Ecological enhancement works

The ecological enhancement works will provide in excess of 1,000 m² of saltmarsh habitat. Saltmarsh provides important direct habitat for a large range of estuarine species, not only aquatic species whilst inundated but also for other species such as shorebirds. Saltmarsh also plays an important role in the broader estuarine ecosystem by providing carbon and nutrient inputs, acting as filters for surface runoff and helps minimise erosion. The provision of such habitat is expected to have a long term positive impact on estuarine fauna within Shaws Bay.

7.6 Traffic

Various stages of the works may cause temporary traffic disruptions and result in increased traffic on Fenwick Drive and Compton Drive during the works.

Dredging

A temporary and minor traffic disturbance may occur during the launch and retrieval of the main dredge vessel.

Beach nourishment and processing site

All heavy vehicles entering and exiting the works site would do so on Fenwick Drive (Appendix 1, Figure 1). The route to the east arm would be along Fenwick Drive. Vehicles destined for the western foreshore or the offsite stockpile location would turn left onto Compton Drive.

Table 11 provides a summary of the anticipate truck movements associated with the transfer of dredged material to nourishment sites (western foreshore and east arm) and stockpile location requiring trucks on public roads. Transport of material to beach nourishment sites on the eastern foreshore (i.e. Pop Denison Park beaches and East Beach) will be undertaken using small dumpers and will not require the use of trucks on public roads.

The transport of nourishment material by truck to an offsite stockpile location (if required and depending on the volume of material dredged) is likely to require the most truck movements. If the maximum volume of material is dredged it is anticipated that up to 180 truck (and dog) loads over 7 weeks would be required to transport the material offsite. The current intention is to only dredge what is required for beach nourishment on site. To transfer the material over to the western foreshore for beach nourishment it is anticipated that in the order of 135 truckloads will be required over up to 3 weeks. The East Arm is expected to require approximately 45 truckloads and could take up to one week.

Table 11: Estimated dredged material transfer associated heavy vehicle movements

Destination	Estimated volume (m ³)	Estimated truckloads and return trips	Total duration of transport works
Western Foreshore ^a	1,200	135	Up to 3 weeks
East Arm ^a	400	45	Up to 1 week
Offsite stockpile location ^b	Up to 3,200	180	Up to 7 weeks

Notes:

^a based on a single 9m³ capacity truck

^b based on a single 18m³ capacity truck and dog

These volumes of heavy vehicles movements would lead to a significant increase in heavy vehicle traffic on the proposed routes (Fenwick Drive and Compton Drive). Such an increase is likely to pose associated safety risks and place increased pressure on road infrastructure. Traffic disruptions are also expected to occur within the vicinity of the western foreshore during the unloading of sand. Due to space constraints trucks are likely to require use of the west-bound lane whilst unloading causing a disruption to traffic moving through the area.

The increased heavy vehicle movements and unloading requirements are likely to impact road infrastructure and disrupt traffic on Fenwick Drive and Compton Drive. Management measures

outlined in Section 9.6 are expected to mitigate these issues. Any impact on traffic and traffic related infrastructure is expected to be only minor and temporary.

Ecological Enhancement works

No significant impacts on traffic are anticipated as a result of the ecological enhancement works.

7.7 Access

Dredging

The dredging, processing and beach nourishment works will at various stages of the works restrict community access to some foreshore areas and Pop Denison Park. Community access to water in Shaws Bay within the vicinity of dredge infrastructure will be restricted during work operations. Due to the relatively small area of restricted access and short duration, dredging operations are anticipated to take up to 6 weeks, any impact on water access during dredging works is expected to be only minor and temporary.

Beach nourishment

Beach nourishment works are expected to significantly improve community access to the Shaws Bay foreshore in the long term. The nourishment with clean sand at the placement locations will remedy current bank erosion at several locations which hinders community access, broaden and lengthen beaches to enable broader areas of clear access to the water and also provide areas of access to the water unimpeded by seagrass (East Beach only). This will improve the access to Shaws Bay around its perimeter having an overall positive impact on community access.

Although beach nourishment works will have a positive impact on community access in the long term, there will be restrictions to access to foreshores at beach nourishment locations during nourishment works. Areas of Pop Denison Park and access to Pop Denison will also be restricted to provide construction access to beach nourishment areas. Mitigation measures outlined in Section 9.1 are expected to minimise any disruptions to community access during nourishment works. Restrictions to access during nourishment works are expected to have a minor and temporary impact on community access however in the long term the works are expected to provide an improvement to and have a positive impact on community access to Shaws Bay.

Processing site

Access will also be restricted to the northern end of Pop Denison Park within the vicinity processing site. Access to this area will be for the entire duration of works however due to the underutilised nature of this area of the park, any impact on access is considered to be only minor and temporary.

Ecological enhancement works

Ecological enhancement works will impact community access both during works and in the long term. Public access to the far northern end of Pop Denison Park will be restricted during the construction of the ecological enhancement area. Alternative access arrangements will be provided and any impact is expected to be minor.

The conversion of the area from open grass to saltmarsh will ultimately change the access to and through the area. This northern area is currently used as a thoroughfare from Pop Denison Park to Compton Drive. The establishment of saltmarsh will restrict access through the area, relative to current access. However the provision of the boardwalk will still allow access through the area, from Pop Denison (and the wider Shaws Bay precinct) to Compton Drive and the western foreshore of the Bay.

The provision of the boardwalk, in conjunction of existing and planned pathways, will provide a continuation of formalised networks of pathways around the Shaws Bay precinct. The provision of the boardwalk also creates opportunities for the wider community to view saltmarsh habitat creating ecological awareness and education opportunities. Therefore, although the proposed works may alter current localised access arrangements at the northern end of Pop Denison it is expected that the provision of the boardwalk will have a positive impact on access to/around and overall experience of Shaws Bay.

7.8 Air Quality

The potential for minor air quality impacts may arise during the works from generation of exhaust from trucks, dredge and plant and airborne dust from exposed earthworks (particularly the processing site). With the control measures in place during construction (Section 0), these short-term and minor air quality impacts are not expected to significantly impact the community.

7.9 Noise

The level of construction noise at the site is likely to be above the ambient noise level at all proposed works sites location. Noise monitoring has not been conducted at the site but it is reasonable to assume that background noise levels are low to moderate given the urban residential and recreational nature of the area. Distances to nearest residences for the proposed works are presented in Table 12.

Table 12: Distance to nearest residence to works sites

Works	Approximate distance to nearest residence
Dredging	85m (Compton Drive)
Processing	85 m (Fenwick Drive)
Beach nourishment – eastern foreshores	30 m (caravan park)
Western Foreshore	25 m (Compton Drive)

The noise level and duration of 'noisy works' generated by the construction works is governed by the contractor's choice of methodology, plant and equipment. Typical noise levels from construction equipment likely to be used are outlined in Table 13. An increase in the noise levels provided can be expected when multiple equipment are operating concurrently. No noise monitoring or modelling has been undertaken for this REF.

Table 13: Typical noise levels (dB[A]) of construction equipment. Source: a- NSW Public Works (2011), b – calculated (SPL-10log(2πr²))

Construction Equipment	Sound Power Level (SPL)	SPL at 10 m ^a	SPL at 20 m ^a	SPL at 35 m ^b	SPL at 50 m ^a	SPL at 85 m ^b	SPL at 100 m ^a	SPL at 200 m ^a	SPL at 300 m ^a
Excavator	110	82	76	71	68	63	62	56	50
Backhoe	107	79	73	68	65	60	59	53	47
Delivery truck	117	89	83	78	75	70	69	63	57
Light vehicle	98	70	64	59	56	51	50	44	38
Tip truck	111	83	77	72	69	64	63	57	51
Generator	107	79	73	68	65	60	59	53	47
Dredge ^b	110	82	76	71	68	63	62	56	50
Booster Pump ^b	110	82	76	71	68	63	62	56	50

Note: previous assessments indicate that noise levels emitted from dredge vessels and booster pumps are within the vicinity of 110dBA at source.

Under the EPA's *Interim Construction Noise Guideline* (DECC, 2009) the noise affected construction noise level criteria is the rating background noise level plus 10 dB (represents the point above which there may be some community reaction to noise) and the highly noise affected criteria is 75 dB (represents the point above which there may be strong community reaction to noise). The background noise at the closest residences is currently unknown however can be assumed to be 45 dB(A) (NSW EPA, 2015). Given this, it is expected that noise levels at nearby residences will exceed the 'noise affected' criteria and possibly the 'highly noise affected' criteria at various stages throughout the duration of the construction works. Such effects will be intermittent, temporary and only during standard work hours

7.10 Waste

Silt, organics, shell material and other debris collected during dredging and dewatered within the geobag is expected to be in the order of 9m³. At the end of dredging and once the material has sufficiently dewatered will be treated as required (PASS), classified under relevant guidelines and trucked to a suitable landfill facility. Excavated soil material will be generated during the construction of the ecological enhancement area however will be re-used on site for revegetation purposes. Other general construction and personnel waste will be generated during the proposed works although it is expected to be minimal. The waste management measures recommended in Section 0 will manage these impacts.

Through the provision of improved an foreshore environment and facilities it is expected that the use of the Shaws Bay foreshore will increase and consequently waste production/litter within the area can also be expected to increase. The waste management measures recommended in Section 9.2 will manage any waste related impacts.

7.11 Visual Amenity

The dredging, processing and beach nourishment works are likely to negatively impact the visual amenity of Pope Denison Park and the main and northern sections of Shaws Bay. The presence of associated machinery and equipment during the works is likely to detract from the natural aesthetics of Shaws Bay and the surrounding reserves. However, any impact is expected to only occur during works and the natural aesthetic will return post works. The beach nourishment and resultant creation of sandy beaches is expected to improve beach access, beach amenity and overall visual amenity of the Shaws Bay foreshore in the long term. It is anticipated that dredging, in conjunction with other management actions, is likely to improve water quality and therefore visual amenity of Shaws Bay over time. Further, the provision of the large area of saltmarsh in the ecological protection zone, in conjunction with the planned boardwalk, is expected to improve the natural aesthetic and attractiveness of the northern end of Pop Denison Park.

Although some minor negative impacts to visual amenity can be expected during the works, the overall visual amenity of Shaws Bay is expected to improve in the long term as a result of the proposed works.

7.12 Cultural Heritage

No specific cultural heritage values/sites have been identified at the site. However given the extensive indigenous history of the area and the location of the East Ballina Aboriginal Place within close vicinity of Shaws Bay there is potential for aboriginal cultural heritage values to exist within the proposed works areas. The measures recommended in Section 0 will inform the management of any potential Aboriginal Cultural Heritage Values.

8. SUMMARY OF IMPACTS

A summary of impacts discussed in Section 7 is provided in Table 14. The project is considered likely to result in minor, temporary localised adverse water quality, estuarine vegetation, benthic macroinvertebrate, traffic, access, visual amenity and noise related impacts. These impacts are restricted to the construction phase of works, with no long term-impacts envisaged. However, the works will also result in a range of positive outcomes and impacts including:

- Provision of a significant area of saltmarsh habitat;
- Remediation of erosion;
- Improved foreshore access; and
- Improved beach and overall amenity of the area.

Table 14: Summary of anticipated project impacts

Impact	Summary of assessment
Water quality	No long term water quality impacts are expected. Short-term, localised minor impacts may occur within the vicinity of the dredge and beach nourishment areas. Long-term reduction in water quality risks expected.
Coastal processes	Localised impacts to geomorphology are likely but are of low environmental impact and beneficial to the on-going use of Shaws Bay. Minor additional scour of the East Arm delta channel may occur but this is not likely to lead to any other impacts.
Soils	ASS associated risks are considered to be minimal.
Terrestrial vegetation	A small number of trees may need to be trimmed as part of bankside works. Ecological enhancement works will result in permanent loss of open grass areas. Any impact is expected to be negligible or positive.
Estuarine vegetation	Dredging and beach nourishment will have a direct adverse impact on seagrass at one defined location totalling around 2.5% of the seagrass within the Bay. Ecological enhancement works will have a substantial long-term positive impact on saltmarsh habitat.
Traffic	Minor temporary disruptions are anticipated during material transfer works.
Access	Minor temporary restrictions will occur during works. However, improvements to overall public access at the completion of works are expected (provision of boardwalk, remediation of erosion scarps, and increase in sandy beaches).
Air quality	Temporary localised air quality impacts could potentially occur during works. This is likely to be negligible.
Noise	Construction related noise impacts can be expected at nearby sensitive receivers. Any impacts are expected to be temporary and restricted to construction work hours.
Waste	The main waste to be generated is shell, silt and some organics which will be separated from the dredged sand. Waste management measures will effectively manage any waste related impacts.
Visual amenity	Short-term reductions in visual amenity are expected to occur during works. However, it is anticipated that the works will improve the visual amenity of the area in the long-term.
Cultural heritage	No cultural heritage impacts are expected.

9. RECOMMENDED ENVIRONMENTAL PROTECTION MEASURES

To ensure an acceptable level of impact from the works, it will be necessary to implement a range of risk mitigation measures as outlined below.

9.1 General measures

- Adjoining property owners and residents to be informed at least 1 week in advance that construction is about to commence. Residents should be informed of the nature, expected noise level, duration of the works and be provided with a relevant contact;
- Construction hours of operation for any noise generating activity (Monday to Friday 7.00am to 6.00pm, Saturday 8.00am to 1.00pm);
- Works should not be undertaken during peak use periods such as school holidays and long weekends to reduce impacts on public amenity and usage of key facilities/areas;
- All waste including construction waste and litter, food scraps, etc. are to be removed from site and disposed of at appropriate waste management facilities;
- At completion of works, all equipment, signage, fencing, waste and any other materials will be removed from the site; and
- An application for a permit for dredging and reclamation should be made to DPI-Fisheries. This permit is required for dredging and any earth works (i.e. beach nourishment) within tidal areas.
- All contractor personnel to be briefed on environmental issues, sensitive areas and application of all relevant management plans.

9.2 Water quality and erosion control

- Stormwater management and sediment and erosion controls across all works areas to be established as applicable from *"The Blue Book" Managing Urban Stormwater: Soils and Construction, 4th Edition Landcom, 2004* prior to commencement of works;
- A construction erosion and sediment control plan should be prepared by the earthworks contractor and approved by the supervising engineer;
- Management of sand stockpile wind erosion should be addressed in the erosion and sediment control plan and include measures, if required, such as minimising stockpile heights, minimising duration of stockpile (i.e. use material as soon as possible), use of sprinklers and other wetting methods, use of high silt fences to contain any windblown material on site and other measures as required.
- A wheel wash facility should be provided at the exit of the processing site to avoid tracking soil onto public roads;
- A project Water Quality Management Plan should be developed to address water quality risks at all phases of the works including the dredge site, processing site and beach nourishment sites. At a minimum the plan should include:
 - Details of mitigation/avoidance measures to be implemented;
 - Details of a water quality monitoring program for all relevant sites (dredge site, geobag discharge, beach nourishment) including turbidity, pH, dissolved oxygen and

visible pollutants. This should include identification of monitoring sites and schedule and be consistent with relevant guidelines/methods.

- Adoption of the following criteria for the discharge of water:
 - Total suspended solids: <50mg/L
 - pH: 6.5 - 8.5
 - Dissolved oxygen: >4 mg/L
 - Oil and grease: Nil visible
- Stop work procedures and contingency measures should discharge limits be breached.
- An ASS management plan should be prepared to appropriately manage the material to be dredged. This should at a minimum address dredge water quality related risks, specify sampling requirements to characterise the separated material post processing (both the sandy material and geobag contained material) and outline management measures including sampling regime, trigger levels and appropriate responses for the geobag contained.
- A geobag spill contingency plan should be developed and implemented and at a minimum, should include the following measures:
 - Source appropriately sized geobags from a reputable supplier;
 - Conduct regular assessments of the integrity of the bags prior to and during use;
 - Size bund to at least 1.5x the volume of the geobags;
 - Have scope for the establishment of further bunds if required.
- Earthworks not to be undertaken during heavy rainfall;
- Material (nourishment material) stockpiles to be appropriately contained to avoid sediment and turbid water discharge to waterways;
- All nourishment works below or where access is required below MHWM to be undertaken during low tides only (i.e. works and/or access area is not to be inundated during works);
- All works below or where access is required below MHWM where susceptible to erosion is to be undertaken in small sections so as works can be completed during one low tide event;
- Works areas should not be left in a condition susceptible to erosion, or in a manner that may pose a risk to public safety.

9.3 Pollution

- A spill contingency plan is to be developed and adopted as part of the CEMP. This should address risks associated with spill of fuel, lubricants, coolants and hydraulic fluids;
- Any storage of fuel, lubricants or other compounds to occur within appropriately bunded/secured areas.
- Appropriate spill kits (aquatic and land spills) to be present on site and/or within all vehicles.
- No refuelling and maintenance (except emergency repairs) is to be conducted within 50 m of waterway or drains leading to a waterway unless under the guidance of specific measures incorporated into the CEMP;

- A sufficient number of rubbish bins should be provided throughout improved foreshore areas (including parking areas) and an appropriate service plan implemented to reduce potential for increased litter entering Shaws Bay due to higher usage of the areas.

9.4 Estuarine vegetation and fauna

- An application for a permit of harm marine vegetation should be made to DPI-Fisheries. The permit requires exact documentation of saltmarsh, mangroves and seagrass that may be affected. No works of potential relevance should be undertaken until this permit is secured and all contractors are to be familiar with the identification of these communities and the conditions of the permit.
- Boundaries between areas of vegetation that are able to be impacted and areas to be protected are to be clearly demarcated (visible to machinery operators) by suitably qualified personnel prior to commencement of works;
- Dredge pipelines are not to traverse any areas of mangroves, seagrass or saltmarsh.
- All dredged areas are to incorporate batters as per the dredging design and are not to exceed 1 in 4 (Area 1) and 1 in 6 (Area 2).
- Any ancillary workboats are not to traverse areas of seagrass. Designated work boat beaching and docking areas are to be defined outside of seagrass, saltmarsh and mangrove areas. No dredge, workboat or pipeline anchors/fixtures are to be placed in seagrass areas.
- Beach nourishment construction access footprint through saltmarsh at all nourishment sites to be minimised and is only to occur at areas identified in the permit to harm marine vegetation.
- Minimise machinery/plant movements on intertidal habitats to avoid unnecessary compaction/disturbance. Efficient use of excavator reach is preferable to tracking, even on beach areas;
- Created beaches to be suitably profiled below saltmarsh habitat (see Section 2.4.3). Ensure sand is not to be piled up higher than saltmarsh habitat elevation so as to block flow of water to the habitat during higher tides.
- The toe of all beach nourishment profiles (except East Beach) is to be at least 2 m from seagrass.

9.5 Terrestrial vegetation and fauna

- Where possible and appropriate, all endemic native vegetation to be removed for works (e.g. *Lomandra*) should be reused/replanted at a suitable location on site;
- All trimmed vegetative matter (except weeds) that cannot be replanted should be mulched and reused on site for appropriate landscaping purposes;
- Any weedy vegetation cleared would be removed from the site and disposed of in an appropriate facility;
- Noxious weeds would be controlled as per Ballina Shire Council/ Far North Coast Weeds guidelines;
- Beach nourishment construction access footprint (to East Beach) and movement of equipment within forest to be minimised to clearly demarcated accessways;

- All bare/excavated and disturbed surfaces will be reinstated with appropriate vegetative cover as soon as possible following works to minimise weed colonisation;

9.6 Traffic, access and public safety

- A site compound should be established using safety fencing that excludes public access from the sediment processing and truck loading area. Hazard flagging should also be installed at the boundaries to all work areas and access ways.
- Temporary signage should be displayed to inform the public of suitable routes and areas to allow use of Shaws Bay away from active works areas.
- All pipelines, including any anchor lines or other obstructions in the water way should be clearly marked such that the hazard area is apparent to swimmers utilising the Bay.
- Suitable traffic control/traffic management will be required to be developed prior to and implemented during works to address all road safety issues and identify appropriate truck routes. Traffic management will be required to ensure safe turning at work access locations and ensure appropriate separation of vehicles, bikes and pedestrian traffic from work vehicles.
- Beach nourishment works should be planned and staged/so as to reduce the area of reserve and foreshore closed to public access. Such areas should be completed and returned to public use as quickly as possible.
- Any damage to public infrastructure (e.g. footpaths) caused by access to the site will be restored to the pre-works condition.
- All vessels, site sheds, etc. should be made secure at the end of each work day. The need for after-hours site security should be considered.

9.7 Aboriginal/Cultural Heritage

- Ensure that site personnel are aware of the requirements in the case of an unexpected find of an item of Aboriginal Heritage. The procedures as set out on page 13 of the NSW Office of Environmental and Heritage (OEH) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH, 2010) must be followed; and
- Any suspected artefacts or human remains should be protected and notified to NPWS and NSW Police (for remains) in accordance with this code of practice.

9.8 Visual Amenity

- Any permanent signage required (e.g. parking areas, informational signage, etc.) should be low-key and in keeping with the generally natural habitat of Shaws Bay;
- Consideration should be given to colours utilised for the boardwalk to facilitate blending with the natural environment;
- Any public lighting (car park, pathway) to be designed and constructed under relevant guidelines as to reduce light nuisance to residents.

9.9 Management plans and monitoring

The measures outlined in sections 9.1 to 9.8 above are ideally incorporated into a number of management plans to be prepared for the works. These plans should include but are not necessarily limited to:

- Construction Environmental Management Plan
- Erosion and Sediment Control Plan
- Pollution Spill Management Plan
- Acid Sulfate Soils Management Plan
- Marine Vegetation Offset and Monitoring Plan
- Water Quality Management Plan
- Traffic/Pedestrian Management Plan
- Geobag Spill Contingency Plan
- Work Health and Safety Plan

Each plan should be prepared according to relevant guidelines and requirements and detail aspects such as but not limited to:

- The issues being managed;
- Risk mitigation measures to be implemented;
- Relevant work procedures;
- Responsibilities;
- Scheduling/timing as appropriate;
- Competencies and training; and
- Monitoring and performance.

10. CONSIDERATION OF FACTORS UNDER CLAUSE 228 OF THE EP&A REGULATION 2000

Clause 228 of the *EP&A Regulation 2000* indicates, for purposes of Part 5 of the Act, the factors that must be taken into account when consideration is being given to the likely impact of an activity on the environment. The various factors and findings following the environmental impact assessment and considering the environmental control measures of the proposed works are presented below.

a) Any environmental impact on a community

Construction phase of the works will have a temporary impact on visual amenity, traffic and community access across the work sites. The works are expected to have significant long-term positive impacts for the community through the provision of improved foreshore access, foreshore facilities and amenities. The works will diversify the areas available for public recreation and allow for the environmental offset of the increasing impacts of human activity at this popular location.

b) Any transformation of a locality

Whilst the overall nature of Shaws Bay will remain unchanged, the works are expected to significantly improve and increase the attractiveness of the areas for recreational activities.

c) Any environmental impact on the ecosystem of the locality

The construction phase of the project will localised minor adverse impacts on estuarine vegetation (seagrass, mangroves saltmarsh) and sandflat communities (benthic macroinvertebrates). Several ecosystem benefits are anticipated including provision of significant areas suitable for saltmarsh colonisation (now and with sea level rise), creation of additional Coastal Cypress Pine Forest planting area, remediation of erosion and reducing the intensity of human activity in any one area.

d) Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality

The works are expected to have a significant positive impact on the recreational value of Shaws Bay. The works may have minor temporary impacts on the environmental quality of the area during construction however will improve the environmental quality over the long term through provision of increased saltmarsh habitat, restoration of bank erosion, increased erosion control and improvements in water quality. The primary negative impact of the works will be the proposed removal of seagrass at East Beach. Seagrass fringes the majority of the Bay and is much more prevalent than it was when Shaws Bay was formed. Creation of a seagrass-free area at East Beach will offset the community's desire to create ad hoc tracks through seagrass in other nearby locations and the creation of other marine vegetation habitats within the ecological zone will also mitigate this impact.

e) Any effect on a locality, place or building having aesthetic, anthropological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations

No impacts anticipated.

f) Any impact on the habitat of protected fauna (within the meaning of the National Parks and Wildlife Act 1974)

No significant impacts anticipated.

g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air

No significant impacts anticipated.

h) Any long-term effects on the environment

No impacts anticipated.

i) Any degradation of the quality of the environment

No impacts anticipated. The project is anticipated to lead to a long-term improvement of the environment.

j) Any risk to the safety of the environment.

No impacts on public safety are anticipated. Significant improvement in public safety is envisaged by reducing fall heights on the western foreshore revetment, address erosion holes and bank instability and providing unimpeded access to swimming areas of better water quality.

k) Any reduction in the range of beneficial uses

No impacts anticipated. Significant improvement in beneficial use is envisaged.

l) Any pollution of the environment

No impacts anticipated. All pollution risks during construction can be managed through standard measures.

m) Any environmental problems associated with the disposal of waste

No impacts anticipated. All waste can be readily contained, classified and disposed of effectively.

n) Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply.

No impacts anticipated. The project will generate clean marine sand which is in scarce supply and will be used as a resource for foreshore improvement. The project may generate excess sand which would be made available for other environmental improvement projects should this occur.

o) Any cumulative environmental effect with other existing or likely future activities.

No impacts anticipated. Other projects will be implemented over time in order to improve facilities, public amenity or the environment at Shaws Bay, however there are no cumulative effects that are considered to be significant.

p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions.

No impacts anticipated. All works have considered climate change impacts. Project features such as the saltmarsh ecological enhancement area are planned to directly allow for sea level risk impacts.

11. CONCLUSION

The Shaws Bay Dredging and Foreshore Improvements project is a highly beneficial project which seeks to implement key recommendations made by the Shaws Bay Coastal Zone Management Plan. The works include dredging areas of the main section of Shaws Bay, processing and utilising the dredged material for sandy beach nourishment and creation of a significant area of saltmarsh habitat. The project will reduce accumulated siltation within the Bay, improve foreshore access and long-term water quality outcomes, enhance beach amenity and will create significant areas of new valuable saltmarsh habitat. The project can be undertaken with minor environmental and social impacts.

Pursuant to the provisions of the Environmental Planning and Assessment Act, 1979 (EP&A Act), this Review of Environmental Factors (REF) has been prepared by Hydrosphere Consulting on behalf of Ballina Shire Council. The applicable environmental planning instrument for the proposed works is State Environmental Planning Policy (SEPP) (Infrastructure), 2007. Under this SEPP, the works do not require development consent and therefore have been assessed under Part 5 of the EP&A Act. Ballina Shire Council is the determining authority for the proposed works. Under Part 5 of the EP&A Act, Ballina Shire Council must examine and take into account to the fullest extent possible all matters which are likely to affect the environment if the activity goes ahead.

Consideration has been given to the likely impact of the activity on the environment, having regard to all relevant factors. With application of site specific environmental control measures the expected environmental impacts of the proposal are considered to be localised, short-term and minor. Based on

the outcomes of the assessment presented in this REF it is concluded that by adopting the identified measures, it is unlikely that the proposal would result in significant adverse environmental impacts.

To progress the proposed works the following are required:

- Ballina Shire Council is to consider this REF and determine the proposed activity under Part 5 of the EP&A Act.
- A Permit to Harm Marine Vegetation and for Dredging and Reclamation under Part 7 of the Fisheries Management Act.

Numerous management plans as outlined in Section 9.9 are to be developed at the time of implementation, considering specific work methods to be implemented by the contractor.

REFERENCES

- Chitra, E. (2002). Bionomics of *Culicoides molestus* (Diptera:Ceratopogonidae): A Pest biting Midge on the Gold Coast. Thesis. School of Environmental and Applied sciences, Griffith University.
- Dale, P. E. R., Knight, J., Kay, B. H., Chapman, H., Ritchie, S. A., Brown, M. D. (2008) Habitat Characteristics and Eggshell Distribution of the Salt Marsh Mosquito, *Aedes vigilax*, in Marshes in Subtropical Eastern Australia. *Journal of Insect Science*, 8(25):1-8.
- Hydrosphere Consulting (2014a). Coastal Zone Management Plan for Shaws Bay, Ballina. Volume 1: CZMP
- Hydrosphere Consulting (2014b). Coastal Zone Management Plan for Shaws bay, Ballina. Volume 2: Supporting Information.
- Hydrosphere Consulting (2016) Brunswick River Dredging – post-dredging monitoring Spring 2016. Report for Department of Industry – Lands.
- Hydrosphere Consulting (2018a) Pop Denison Park Pathways and Amenities Project Vegetation Management Plan, Report for Ballina Shire Council.
- Hydrosphere Consulting (2018b) Shaws Bay Dredging Baseline Surveys and Data Analysis, Report for Ballina Shire Council
- Hydrosphere Consulting (2018c) Shaws Bay Dredging Options Assessment and Dredge Plan, Report for Ballina Shire Council
- PBP (2000) Shaws Bay Estuary Management Plan, Volume 2 - Estuary Management Plan, Issue No. 3, Final, prepared for Ballina Shire Council
- ANZECC (2000). Australian and New Zealand water quality guidelines for fresh and marine waters. A publication by the Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).
- DECCW (2009). Waste Classification Guidelines Part 1: Classifying Waste.
- NSW EPA (2015). Draft Industrial Noise Guideline.
- NSW Fisheries (2013). Fisheries NSW Policy and Guidelines for Fish Habitat Conservation and Management (2013 update).
- Slacher, T. A, Noriega, R., Jones, A., Dye, T. (2012). The effects of beach nourishment on benthic invertebrates in eastern Australia: Impacts and variable recovery. *Science of the Total Environment*. 435-436.
- Smith, S.D.A., Harrison, M.A. and Rowland, J. (2011) The effects of beach scraping on the infauna of New Brighton beach, northern NSW. Report prepared for Byron Shire Council. National Marine Science Centre, Southern Cross University, Coffs Harbour. June 2011.
- Wright, A. E. (2002). Mosquito Life cycles, ecology and Behaviour.

APPENDIX 1: PLANS AND DRAWINGS

Figure 1. Sediment processing site temporary works area

Figure 2. Dredging areas

Figure 3. Beach nourishment and/or erosion control areas

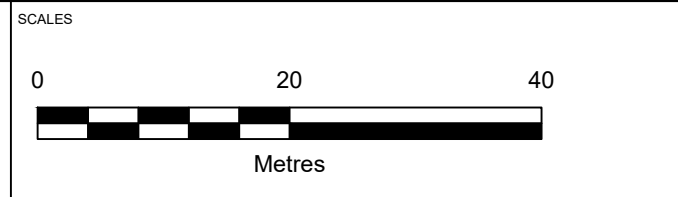
Figure 4. Ecological protection zone and saltmarsh creation area

Figure 5. Seagrass extents (January 2018)



Y:\18-012 Shaws Bay Dredging\Drawings\REF Fig 1 north east loading area.dwg

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CLIENT
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SHAWS BAY DREDGING
 NORTHERN TRUCK LOADING AREA

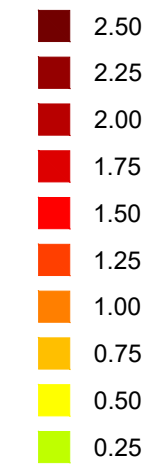
JOB NUMBER
 18-025

REVISION	DATE	DESCRIPTION	DRAWN
	2018-03-20	REV 0	MH

DRAWING NUMBER
FIGURE 1
 SHEET 1 OF 1

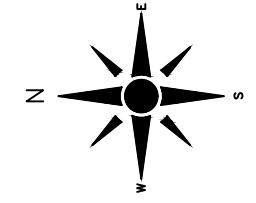


Max Cut Depth (m)



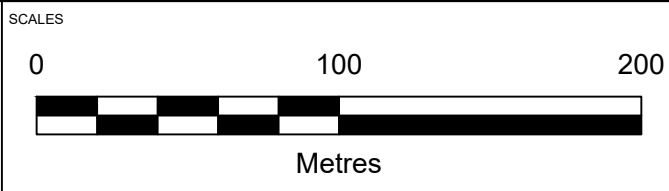
Notes:

1. Contours and volumes based on hydrosurvey undertaken April 2017 by Hydrosphere Consulting.
2. Standard contour interval 1.0m.
3. Dredge parameters:
 - Target bed elevation minimum: -2.5m AHD
 - Batter slope: 1 in 4 (Area 1), 1 in 6 (Area 2)
4. Maximum volume: 3,100m³ (Area 1), 5,500m³ (Area 2). Area 2 volume likely to be over-estimated due to constraints imposed by presence of bedrock.



Y:\18-012 Shaws Bay Dredging\Drawings\REF Fig 2 Dredging Areas.dwg

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SHAWS BAY DREDGING
 TARGET AREAS

JOB NUMBER
 18-012

REVISION	DATE	DESCRIPTION	DRAWN
	2018-02-15	REV 0	RC
	2018-04-06	REV 1	MH

DRAWING NUMBER

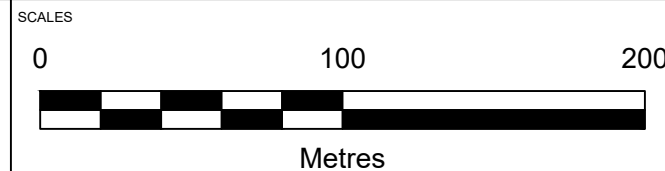
FIGURE 2

SHEET 1 OF 1



Y:\18-012 Shaws Bay Dredging\Drawings\REF Fig 3 fill areas.dwg

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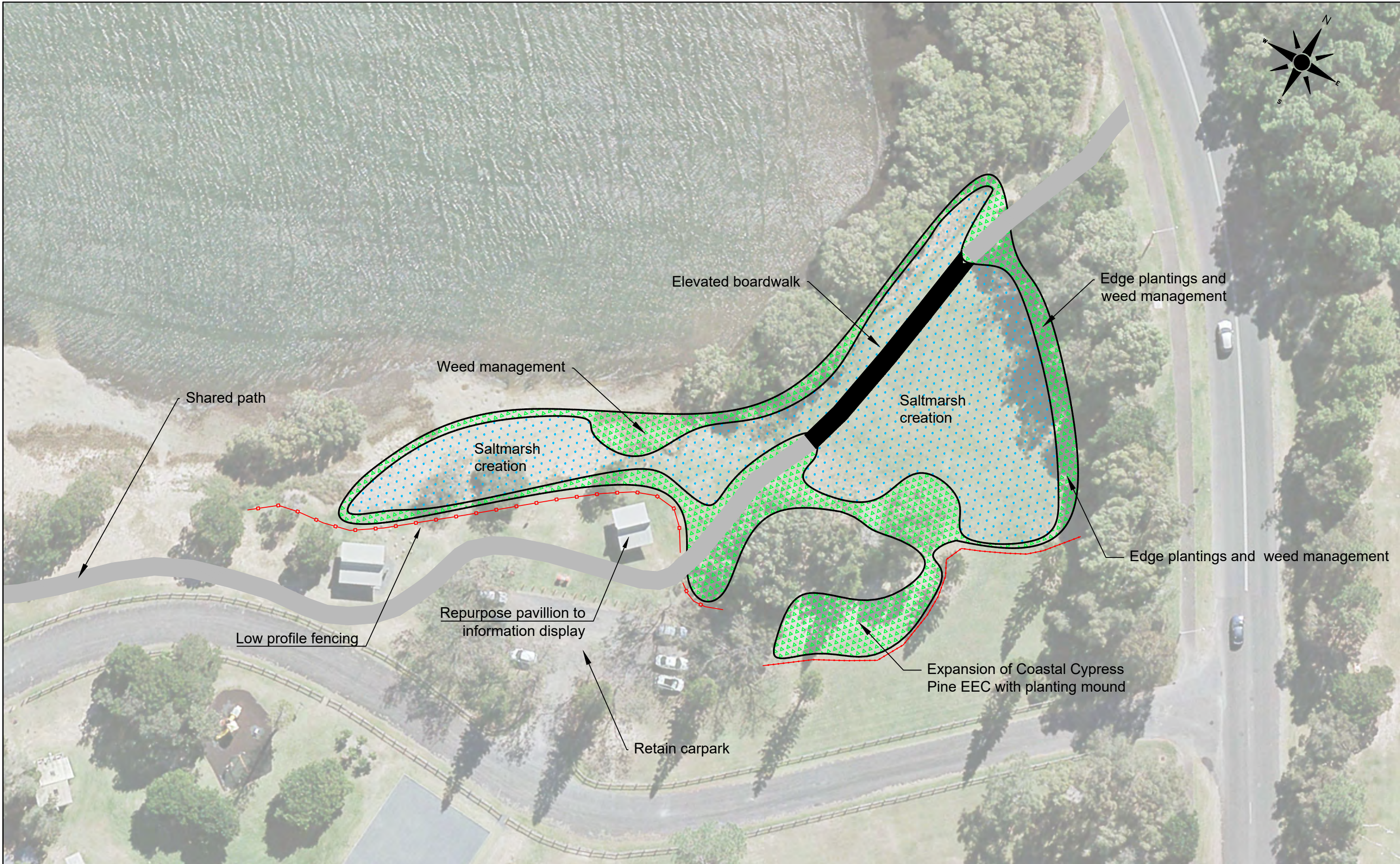
CLIENT
BALLINA SHIRE COUNCIL

JOB NUMBER
 18-012

SHAWS BAY DREDGING
 FORESHORE MANAGEMENT AREAS

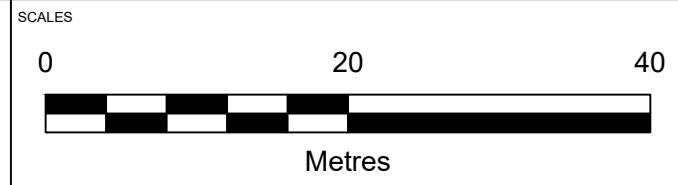
REVISION	DATE	DESCRIPTION	DRAWN	DRAWING NUMBER
	2018-05-28	REV 0	MH	

FIGURE 3
 SHEET 1 OF 1



Y:\18-012 Shaws Bay Dredging\Drawings\REF Fig 4 Ecological Enhancement area.dwg

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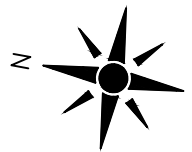
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SHAWS BAY DREDGING
 ECOLOGICAL ENHANCEMENT AREA

JOB NUMBER
 18-012

REVISION	DATE	DESCRIPTION	DRAWN
	2018-04-06	REV 0	MH

DRAWING NUMBER
FIGURE 4
 SHEET 1 OF 1



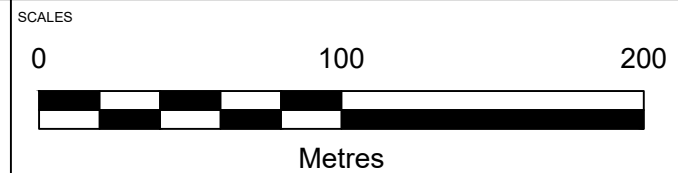
Legend:

- ⊙ GPS edge of seagrass
- Shore-based transects
- Open water transects
- Seagrass extents

Aerial photography January 2018
supplied by DI-Lands & Water

Y:\18-012 Shaws Bay Dredging\Drawings\REF Fig 5 seagrass.dwg

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JOB NUMBER
 18-012

**SHAWS BAY DREDGING
 SEAGRASS TRANSECTS AND MAPPING**

REVISION	DATE	DESCRIPTION	DRAWN
	2017-11-04	REV 0	MH
	2017-11-09	REV 1	MH

DRAWING NUMBER

FIGURE 5

SHEET 1 OF 1

APPENDIX 2: SITE PHOTOS



Photo 1: North Pop Denison Park Beach



Photo 2: Middle Pop Denison Park Beach



Photo 3: Erosion to be remediated by beach nourishment at Middle Pop Denison Park Beach



Photo 4: Erosion to be remediated by beach nourishment at South Pop Denison Park Beach



Photo 5: South Pop Denison Park Beach, looking north



Photo 6: South Pop Denison Park Beach, looking southwest



Photo 7: East Beach, looking south



Photo 8: East Beach, looking north



Photo 9: Northern Pop Denison park within the vicinity of the processing site



Photo 10: Northern Pop Denison park within the vicinity of the ecological enhancement works area



Photo 11: Southern end of Western foreshore



Photo 12: Western Foreshore Ramp



Photo 13: East Arm beach

APPENDIX 3: CONSULTATION

Stakeholder Consultation

As part of the REF for the Shaws bay Dredging and Foreshore Improvement Works, a series of key agency and community stakeholders were contacted with regard to the proposal and invited to provide comment. Stakeholder responses were received in writing by letter or email and followed up with telephone conversations where necessary to clarify any issues. The intention of stakeholder consultation is to ensure that issues raised by stakeholders are addressed in the preparation of the REF. The feedback received as part of this process is summarised below as well as being discussed in the relevant REF sections as indicated below.

Agency/Organisation/ Name	Summary of Submission	Comments/Response	Relevant section in REF
DPI Fisheries	Activities should closely follow guidance from CZMP	All proposed works are closely aligned to objectives in the Shaws Bay CZMP.	Section 3
	Detail how Division 25 of the Infrastructure SEPP is relevant to the development activities.	All components of the proposed works are permissible without consent, if undertaken by or on behalf of a public authority (Council) under various sections of the <i>State Environmental Planning Policy (Infrastructure) 2007</i> . The relevant clauses and wording are quoted in the REF.	Section 5.1.1.2
	With regards to habitat, provide details on the how the hierarchy of avoidance, minimisation, and mitigation has been considered and applied.	The aforementioned hierarchy was applied to the project throughout the planning phases as detailed in Shaws Bay Dredging Options Assessment and Dredge Plan (Hydrosphere Consulting, 2018). The planning has gone through numerous iterations to minimise impacts and provide the best opportunity for an optimal outcome.	
	Disturbance to key fish habitats should be carefully considered in relation to the overall intent of the project.	Impacts on key fish habitats were carefully considered throughout project planning and assessment. The proposed works are considered to be the most appropriate to achieve project aims whilst minimising impacts on habitats.	Section 7.4.2, 7.5.2

Agency/Organisation/ Name	Summary of Submission	Comments/Response	Relevant section in REF
	Detail how the dredging component is limited to an acceptable degree of trade-off between the associated negative impacts on Shaws Bay and its ability to achieve the primary project aims.	Several dredging options were assessed in (Hydrosphere Consulting, 2018). The scale of dredging is considered to be a balance between the current and future needs of the community, the volume of sediment that can be accessed with relatively low environmental impact and the opportunities available.	Section 3.1
	Detail the design batters and buffers, and sufficiently justify instances where adequate buffers cannot be achieved.	Suitable batters and buffers have been incorporated into the design of dredging and beach nourishment. Batters are often below slopes naturally occurring in those areas. Buffer distances have been determined with consideration of the risk, natural slopes and with reference to experience with seagrass monitoring for other projects.	Sections 2.2, 2.4
	Concerned that beach nourishment of Pop Denison Park middle and north beaches will promote recreational use in these areas, not ecological protection. Suggest directing the public away from these areas.	Bank nourishment is considered necessary in these locations to restore bank erosion. Suitable beach profiles and revegetation will be applied to increase ecological value of the beach areas. The proposal includes planting and fencing to clearly delineate environmental areas and promotion of more recreationally attractive alternative areas. It should be noted that ecological protection does not mean the wholesale exclusion of people from these areas.	Section 2.4.4

Agency/Organisation/ Name	Summary of Submission	Comments/Response	Relevant section in REF
	Carefully consider beach nourishment options at East Beach to avoid impacts to seagrass including reducing footprint and placing sand shoreward of seagrass.	<p>Whilst sand placement to be only shoreward of the seagrass is possible, this is not considered to meet the community's desire for seagrass-free access to deep water at key swimming locations.</p> <p>Although the CZMP does indicate sandy beach creation inshore of the seagrass, further consideration of the overall objectives indicated that beach expansion with the loss of around 2.5% of the Bay's seagrass was appropriate.</p> <p>The project incorporates a significant ecological enhancement component to balance the negative impacts of the proposal.</p>	
Office of Environment and Heritage	Recommend an appropriate level of Aboriginal cultural heritage assessment.	An appropriate level of assessment has been undertaken and due diligence measures will be incorporated into the project CEMP	Sections 6.11, 7.12
	Outline measures to minimise sediment plumes and measures to minimise impacts from the processing site and provide details of a monitoring regime.	Appropriate measures have been identified.	Section 9
	Describe the ASS status and measures to manage associated impacts.	See relevant sections of REF.	Sections 6.6, 9.2
	Details of an Environmental Management Plan	A Construction Environmental Management Plan will be prepared prior to works.	Section 11
	Details of an Ecological Restoration Plan for the ecological enhancement works and other site rehabilitation.	Ecological enhancement and restoration works are described.	Sections 2.4, 2.5
	Consultation with DPI Fisheries is required.	DPI Fisheries has been consulted.	
NSW EPA	Require an adequate assessment of the following:		
	<ul style="list-style-type: none"> • Water quality management at the dredge and dewatering sites 	Water quality impacts have been adequately assessed and mitigation measures developed.	Sections 7.1, 9.2
	<ul style="list-style-type: none"> • Contingency plan for geobag failure 	Appropriate contingency measures have been identified and will be included in a geobag spill contingency plan.	Sections 7.1, 9.2

Agency/Organisation/ Name	Summary of Submission	Comments/Response	Relevant section in REF
	<ul style="list-style-type: none"> • Sediment quality, an adequate pre-dredge assessment is required 	A sediment investigation has been undertaken.	Section 6.6
	<ul style="list-style-type: none"> • Waste management – dredge spoil is regarded as waste 	Appropriate management measures and required approvals have been identified in consultation with EPA	Sections 5.4, 7.10
	<ul style="list-style-type: none"> • Noise impacts including a noise impact assessment. 	An adequate assessment of noise related impacts has been undertaken. A detailed noise impact assessment is not considered to be required.	Section 7.9
	<ul style="list-style-type: none"> • Air quality impacts 	An adequate assessment of potential air quality impacts has been undertaken.	Section 7.8
	<ul style="list-style-type: none"> • Soil and water management 	A range soil and water management measures have been identified.	Section 9
Department of Industry and Lands	No response.		
NTSCorp	No response.		
Jali LALC	No response.		
Shaws Bay Hotel	No response.		
Reflections Holiday Parks – Shaws Bay	No response.		
Discovery Parks – Ballina (Ballina Lakeside Holiday Park)	No response.		
Ballina Lighthouse and Lismore Surf Lifesaving Club	No response.		
Northern rivers Outrigger Canoe Club (formerly Kawaihae Outriggers Canoe Club)	No response.		

Agency/Organisation/ Name	Summary of Submission	Comments/Response	Relevant section in REF
Titanic Winter Swimmers Club	No response.		
Rainbow Region Dragon Boat Club Inc.	No response.		
Local residents	Two responses were received and are summarised below.		
	Provide an explanation of how the proposed dredging fulfils the stated primary aim of “improving tidal flushing and reducing water quality risks”.	The benefits of dredging are discussed in Hydrosphere Consulting (2018) and within the REF.	Section 3
	Provide an explanation for why the mangrove forest that has established itself on sediments along the wall in recent years is now considered essential for the ecology of the bay.	Not relevant to this scope of works.	
	Provide an explanation for the extreme differences between the current Shaws Bay CZMP and the previous Shaws Bay Estuary Management Plan.	The CZMP is highly consistent with the previous EMP and there is no description of what the extreme differences are or why they are an issue	
	Undertake a survey of the current perched low tide level in the bay.	Surveys (for other purposes) have been undertaken and the tidal levels reported in PBP 2000 are still appropriate. The request for this information is related to the effect of the mangroves which is not a part of the current project.	
	A shame that water quality has deteriorated and water depth reduced.	A number of measures were identified in the CZMP to address water quality issues and are currently being implemented. Dredging areas of the main section as proposed is expected to increase water depth and improve water in parts of the Bay.	
	Why is dredging along the wall to allow tidal flow not being considered?	Several dredging options were assessed in (Hydrosphere Consulting, 2018). The proposed dredging program is considered to be a balance between the current and future needs of the community, the volume of sediment that can be accessed with relatively low environmental impact and the opportunities available.	



OUR REF: C18/177

3 May 2018

Ballina Shire Council
C/- Uriah Makings
Hydrosphere Consulting
PO Box 7059
BALLINA NSW 2478
Via email: uriah.makings@hydrosphere.com.au

Dear Mr Makings

Re: Environmental Study Requirements for proposed dredging and foreshore works, Shaws Bay

I refer to your letter of 9 April 2018 seeking comments from DPI Fisheries in relation to the preparation of a review of environmental factors (REF) for proposed dredging and foreshore works within Shaws Bay, East Ballina in accordance with the Part 2, Division 1 of the *State Environmental Planning Policy (SEPP) Infrastructure 2007*.

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is “no net loss” of key fish habitats upon which they depend. To achieve this, the Aquatic Ecosystems Unit assesses activities under Part 4 and Part 5 of the *Environmental Planning and Assessment Act 1979* in accordance with the objectives of the *Fisheries Management Act 1994* (FM Act), the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the FM Act, and the associated *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)* (DPI Fisheries P&G). This document is available online at: www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit. In addition, DPI Fisheries is responsible for ensuring the management of sustainable commercial fisheries, quality recreational fishing and viable aquaculture within NSW.

It is understood that the subject proposal forms part of a suite of activities being undertaken by Ballina Shire Council to implement the Shaws Bay Coastal Zone Management Plan (CZMP) which was gazetted in 2013. The primary aims of the subject proposal are:

- Reducing siltation;
- Improving tidal flushing and reducing water quality risks;
- Maintaining foreshore access to deep water;
- Improving foreshore beaches; and
- Ecological enhancement.

In light of this, the proposed development activities should closely follow the guidance and meet the objectives of the CZMP. Considering this link, the REF would benefit from the proposed development activities being clearly linked to one or more of the CZMP management objectives listed on page 9 of the CZMP.

It is also understood that the works are intended to be undertaken without consent in accordance with Part 3, Division 25, Clause 129 of the *State Environmental Planning Policy (SEPP) Infrastructure 2007*. The REF should reiterate this, and should also detail how Division 25 of the Infrastructure SEPP is relevant to the development activities with respect to the proposal aims listed above.

Fisheries Management Act 1994 approvals and general information requirements

The works will directly impact on key fish habitats and will consequently require approval under the FM Act. The table below indicates the types of actions that would require a permit under the FM Act for impacts to key fish habitats. DPI Fisheries' standard minimum information requirements for environmental assessment are clearly detailed in section 3.3 (pg. 26) of *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)*. Please ensure that these requirements are addressed as part of the environmental studies. This will facilitate effective assessment of the permit application and reduce delays. The table below outlines actions that trigger sections of the FM Act. Please consider whether components of the project involve these works.

Sections	Description of action	Legislative trigger
198-202	Dredge (digging) and / or reclamation (filling) of land permanently or periodically inundated by water (including wetlands).	Digging and / or filling below the Highest Astronomical Tide (~1m AHD) in estuaries. Digging and / or filling within the high bed of 3 rd order watercourses (based on 1:25,000 scale maps). Draining water from land for its reclamation. Activities described in cl 263 Fisheries Management (General) Regulation 2010
205	Harming marine vegetation (seagrass, mangroves and kelp)	Gather, cut, pull up, destroy, poison, dig up, remove, injure or otherwise harm marine vegetation or any part of it. Activities described in cls 260-262 Fisheries Management (General) Regulation 2010
218-220	Obstructing free passage of fish, in waterways	Construction or alteration of a dam, floodgate, causeways or weir or otherwise creation of an obstruction

As a general principle, DPI Fisheries requires that proponents should, as a priority, aim to **avoid** impacts upon key fish habitats. Where avoidance is impossible or impractical, proponents should then aim to **minimise** impacts. Any remaining impacts should be mitigated using best practice techniques. All unavoidable impacts should then be **offset** with compensatory works as agreed by DPI Fisheries. Compensation to offset fisheries resource or habitat losses will be considered "*only after it is demonstrated that the proposed loss is unavoidable, in the best interests of the community in general and is in accordance with the FM Act, Regulations and the policies and guidelines*". It should be noted that the requirement to offset unavoidable impacts to marine vegetation within Shaws Bay was previously indicated within DPI Fisheries' final comments on the CZMP. When outlining specific details of the proposal, the REF should provide details on the how the abovementioned hierarchy of avoidance, minimisation, and mitigation has been considered and applied.

It is highlighted that in the Department's policy and guidelines that saltmarsh and seagrass are considered TYPE 1 *Highly Sensitive Key Fish Habitat*, and mangroves are considered TYPE 2 *Moderately Sensitive Key Fish Habitat*. DPI Fisheries calculates habitat compensation on a minimum 2:1 basis for all key fish habitat. For disturbances to seagrass, monetary compensation is required due to a lack of scientifically proven on-ground offset techniques. Compensation for disturbances to seagrass is currently calculated at \$53.89/m² (which equates to \$107.78/m² to meet the 2:1 offset ratio).

It is highlighted that seagrasses play an important part in addressing some of the issues concerning the community. Seagrasses contribute to improving water quality due to their significant role in nutrient cycling and trapping and stabilising sediments, and also due to the three dimensional habitats that they provide for a range of species which directly contribute to water flushing. It is recommended that any proposed disturbance to key fish habitats is carefully considered in relation to the overall intent of the project, and that all environmental compensation costs and associated monitoring are budgeted for as part of the cost of the development.

Dredging

DPI Fisheries notes the decision not to dredge within sensitive areas such as the East Arm, and in areas with high fines contents which can exacerbate risks to nearby sensitive receivers, for example seagrass, and negatively impact water quality in the short term. While the proposed dredging campaign is closely linked with the need for beach nourishment material, the REF should detail how the dredging component is limited to an acceptable degree of trade-off between the associated negative impacts on Shaws Bay and its ability to achieve the primary aims stated above, and not dredged to simply fulfil the required beach nourishment volumes. Insurance over-dredging volumes should be carefully calculated and provide a balance between avoiding excessive depths and the need for frequent maintenance dredging campaigns.

Adequate dredge batters (approximately 1:6) and buffer zones (i.e. 50m non-impact areas between the edge of the dredge batter and adjacent sensitive receivers) are important in reducing the impacts of dredging activities on nearby sensitive receivers such as seagrass. Batters and buffers should be designed to prevent slippage resulting in smothering or slippage of seagrass beds. The REF should detail the design batters and buffers, and sufficiently justify instances where adequate buffers cannot be achieved.

Beach nourishment

The proposal includes the creation/enhancement of sandy beaches at five locations including North Pop Denison Park Beach (location 5) and Middle Pop Denison Park Beach (location 4). However, in contrast to the current proposal, the CZMP identifies locations 4 and 5 as 'Ecological Protection' areas (refer to Attachment 1 for comparative mapping of the current proposal against the CZMP). This change should be acknowledged and explained in the REF. It is acknowledged that locations 4 and 5 will be nourished to remediate erosion of the foreshore, although as these areas are identified within the CZMP as ecological protection areas, DPI Fisheries is concerned that nourishment of these areas will promote public use and consequently reduce the level of protection afforded to these areas (note: some high use areas in Shaws Bay already exhibit low or absent seagrass and saltmarsh communities).

DPI Fisheries recommends that the erosion at locations 4 and 5 is remediated in manner consistent with the approved CZMP that will promote ecological outcomes as an ecological protection area. Installation of fencing, signage and educational material are generally effective measures to achieve this outcome.

With regard to the proposed impact to 660m² of seagrass at the East Beach site (location 2), the CZMP indicates the potential for this area to be maintained as a clean sandy beach which would be achieved through regular use, as access through the seagrass beds at low tide would be expected to be maintained by the continued trampling of these areas. This is similar to that of other highly used areas of Shaws Bay which have maintained themselves as seagrass-free through regular usage. Furthermore, Figure 17 within the CZMP (refer to Attachment 2) clearly shows the nourishment area landward of the existing seagrass. Policy section 3.2.3.3 (10) of the DPI Fisheries P&G states:

“NSW DPI will generally not approve activities or projects that will harm marine vegetation associated with habitat modification (e.g. creation of sandy beaches for amenity, creation of wader bird habitat and mangroves in other tidal habitats, creation of saltmarsh) unless the activity or project aims to restore a “natural” estuarine habitat that supports the rehabilitation of wader bird or other threatened species habitat.”

In consideration of the above, the REF and its nourishment plan for this site should be carefully considered to determine whether it aligns with the potential future management options listed within the CZMP, and whether opportunities exist to avoid impacts to seagrass, for example, reducing the footprint of the beach or creating it landward of the shoreline rather than seaward.

Ecological protection

DPI Fisheries acknowledge that this proposal and previous projects have incorporated components that aim to achieve a range of the objectives within the CZMP. However, most activities undertaken to date and those that are imminently proposed have predominantly focused on CZMP *Objective 4: To maintain and improve public access and use of Shaws Bay*. DPI Fisheries encourages a greater emphasis on works that contribute to achieving CZMP *Objective 1: To protect and enhance ecological values in Shaws Bay*. The Northern Section has been identified as an ecological protection zone and preparation of an REF that closely aligns with this objective would be consistent with Division 25 of the Infrastructure SEPP. Directing the public away from locations 4 and 5 and towards other areas with better water quality (e.g. the East Beach and East Arm) will assist in accelerating ecological protection efforts.



Department of Primary Industries

DPI Fisheries look forward to liaising with Council throughout all phases of the Shaws Bay Foreshore Improvement Works project and recommends frequent consultation regarding any changes to the project scope and all proposed compensation works.

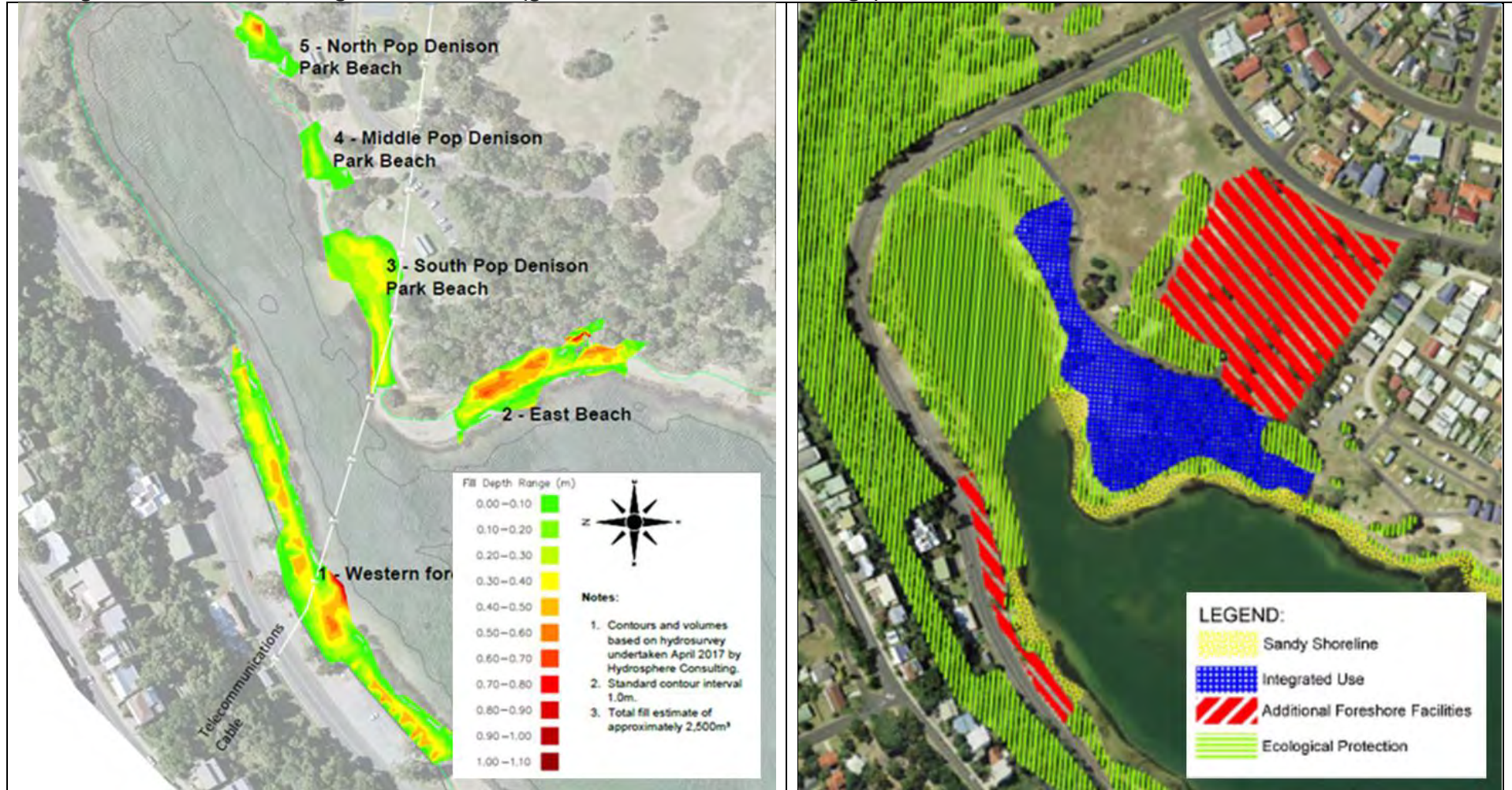
If you have any further enquiries please contact me on 0447 537 168 or jonathan.yantsch@dpi.nsw.gov.au.

Yours sincerely

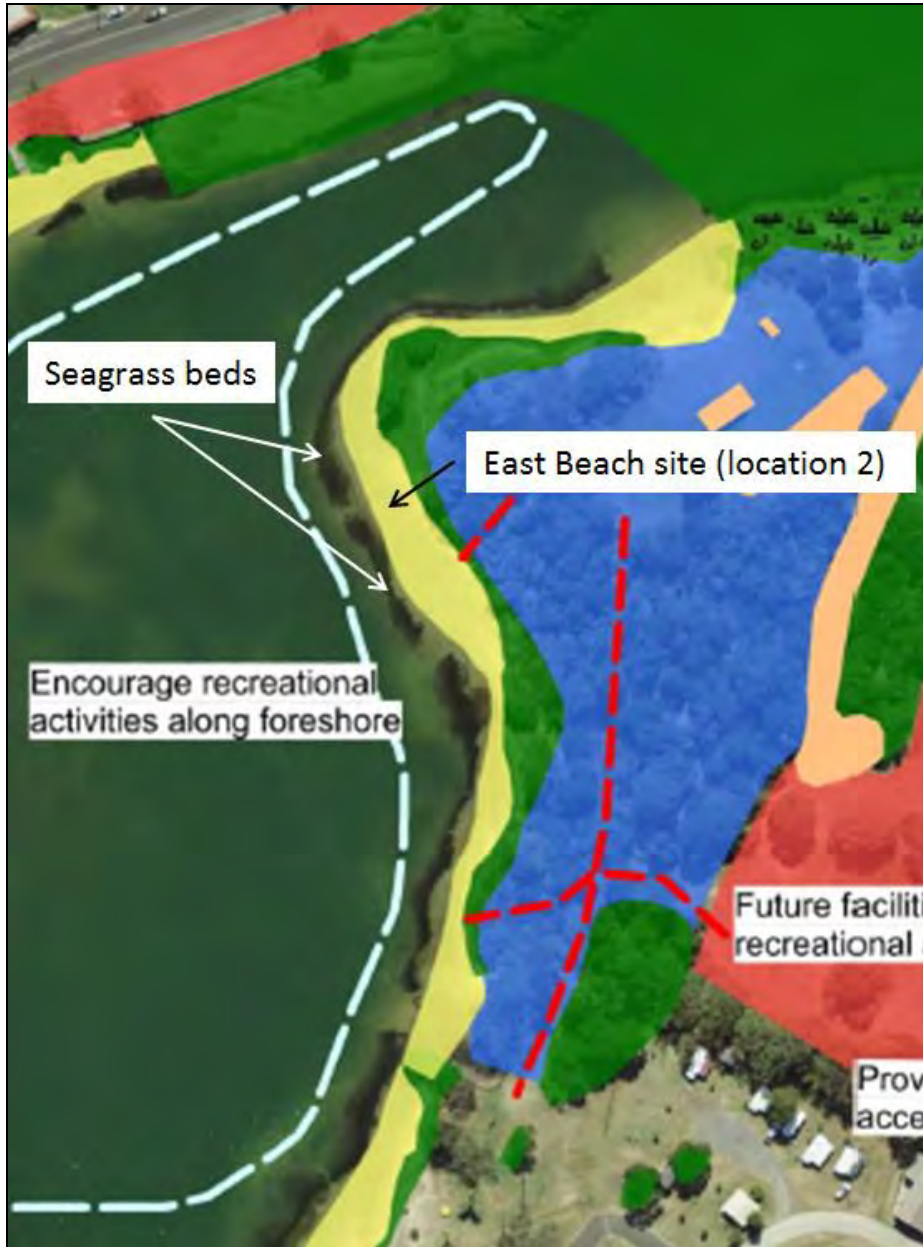
A handwritten signature in black ink, appearing to read 'Jonathan Yantsch', written over a horizontal line.

Jonathan Yantsch
Fisheries Manager, Aquatic Ecosystems (North Coast)
Aquatic Environment, Primary Industries NSW

Attachment 1: Comparison of locations 4 and 5 showing current proposed beach nourishment works (left image) and the CZMP management focus of 'Ecological Protection' (green shaded area in left image).



Attachment 2: Excerpt from Figure 17 of CZMP showing East Beach site (location 2) landward of existing seagrass beds.





Uriah Makings
Environmental Scientist
Hydrosphere Consulting
PO Box 7059
Ballina NSW 2478

uriah.makings@hydrosphere.com.au

File Number: DOC18/210179

Re: Shaws Bay Dredging and Foreshore Management Works REF

I refer to the Shaws Bay Dredging and Foreshore Management Works REF referred to the Environment Protection Authority (EPA) on 6 April 2018.

In summary, the EPA's key information requirements for the proposal include an adequate assessment of:

1. Water Quality Management – Dredge site and dewatering site;
2. Contingency Plan for the potential failure of bunded geobags.
3. Sediment Quality – An adequate pre-dredge assessment is required;
4. Waste Management – Dredge spoil (slurry) is regarded as a waste under NSW waste regulations;
5. Noise impacts – A Noise Impact Assessment must be conducted;
6. Air quality impacts - Particularly relating to dust management; and
7. Soil and water management – At dewatering sites, landfilling sites and pipeline routes.

Given the volume of sediment proposed to be dredged maximum volume of 9,100m³, the proposal will not require an Environment Protection License.

If you have any queries regarding this matter please contact Peter Lynch of the Grafton office on 6640 2502.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'J. Bancroft', written over a horizontal dotted line.

Janelle Bancroft

A/Head Environmental Management Unit

North - North Coast

ATTACHMENT A:

Requirements for the Shaws Bay Dredging and Foreshore Management Works REF.

A. Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B. The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
 - a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
 - b) a life cycle approach to the production, use or disposal of products
 - c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
 - d) the staging and timing of the proposal and any plans for future expansion
 - e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
 - a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
 - b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
 - a) measures to minimise waste (typically through addressing source reduction)
 - b) proposals for use or recycling of by-products
 - c) proposed disposal methods for solid and liquid waste
 - d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points
 - e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.
 - f) soil contamination treatment and prevention systems.
- Outline construction works including:
 - a) actions to address any existing soil contamination
 - b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)
 - c) construction timetable and staging; hours of construction; proposed construction methods

- d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.

Air

- Identify all sources of air emissions from the development.
Note: emissions can be classed as either:
 - point (eg emissions from stack or vent) or
 - fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).
- Provide details of the project that are essential for predicting and assessing air impacts including:
 - a) the quantities and physio-chemical parameters (eg concentration, moisture content, bulk density,
 - b) particle sizes etc) of materials to be used, transported, produced or stored
 - c) an outline of procedures for handling, transport, production and storage
 - d) the management of solid, liquid and gaseous waste streams with potential for significant air impacts.

Noise and vibration

- Identify all noise sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters:
 - a) including the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on www.environment.nsw.gov.au/ieo, using technical criteria derived from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZECC 2000)
 - b) the management of discharges with potential for water impacts
 - c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.
- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.
- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

- Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (NSW EPA, 1999).
- Provide details of liquid waste and non-liquid waste management at the facility, including:
 - a) the transportation, assessment and handling of waste arriving at or generated at the site
 - b) any stockpiling of wastes or recovered materials at the site

- c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site
 - d) the method for disposing of all wastes or recovered materials at the facility
 - e) the emissions arising from the handling, storage, processing and reprocessing of waste at the
 - f) facility
 - g) the proposed controls for managing the environmental impacts of these activities.
- Provide details of spoil disposal with particular attention to:
 - a) the quantity of spoil material likely to be generated
 - b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil
 - c) the need to maximise reuse of spoil material in the construction industry
 - d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material
 - a) designation of transportation routes for transport of spoil.
 - Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
 - Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.
 - Reference should be made to the guidelines: *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (NSW EPA, 1999).

Ecologically Sustainable Development

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving Ecologically Sustainable Development (ESD), including:
 - a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations
 - a) proper valuation and pricing of environmental resources
 - b) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Plans for rehabilitation of the site must be provided. This should allow for a progressive rehabilitation program that maximises groundcover over the site. The plan should also accommodate the long term preservation (stockpiling) of topsoil and the revegetation of the site with endemic species.

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
 - a) sites and site layouts
 - b) access modes and routes
 - c) materials handling and production processes
 - d) waste and water management
 - e) impact mitigation measures
 - f) energy sources
 - g) Selection of the preferred option should be justified in terms of:
 - h) ability to satisfy the objectives of the proposal
 - i) relative environmental and other costs of each alternative
 - j) acceptability of environmental impacts and contribution to identified environmental objectives
 - k) acceptability of any environmental risks or uncertainties

- l) reliability of proposed environmental impact mitigation measures
- m) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C. The location

1. General

In preparing the site description the proponent should consider:

- Using map(s) showing the locality of the proposed development in a regional and local context. Local context maps should be based on 1:25000 topographic plans. Photographs of the site's key attributes may provide useful documentation.
- The area subject to development should be clearly identified on an appropriately scaled plan. This includes all ancillary works such as buildings and other structures, parking areas, loading / processing / treatment areas, access roads, and material stockpiling areas.
- The applicability or otherwise of Local Environment Plans (LEP), Regional Environment Plans (REP) and State Environmental Planning Policies (SEPP).
- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
 - a) meteorological data (eg rainfall, temperature and evaporation, wind speed and direction)
 - b) topography (landform element, slope type, gradient and length)
 - c) surrounding land uses (potential synergies and conflicts)
 - d) geomorphology (rates of landform change and current erosion and deposition processes)
 - e) soil types and properties (including erodibility; engineering and structural properties; dispersibility;
 - f) permeability; presence of acid sulfate soils and potential acid sulfate soils)
 - g) ecological information (water system habitat, vegetation, fauna)
 - h) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Provide and analyse site representative data on following meteorological parameters:
 - a) temperature and humidity
 - b) rainfall, evaporation and cloud cover
 - c) wind speed and direction
 - d) atmospheric stability class
 - e) mixing height (the height that emissions will be ultimately mixed in the atmosphere)
 - f) katabatic air drainage
 - g) air re-circulation.

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically, the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective.

- The Water Quality and River Flow Objectives on the website: www.environment.nsw.gov.au/ieo should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination.

D. Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
 - a) relevant NSW government guidelines
 - b) industry guidelines
 - c) EISs for similar projects
 - d) relevant research and reference material
 - e) relevant preliminary studies or reports for the proposal
 - f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
 - a) all issues identified including local, and regional impacts.
 - b) key issues which will require a full analysis (including comprehensive baseline assessment)
 - c) issues not needing full analysis though they may be addressed in the mitigation strategy
 - d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E. The Environmental Issues

1. AIR QUALITY

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (eg potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.
- Reference should be made to *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (EPA, 2001); *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (EPA, 2001).

Describe management and mitigation measures

- Outline specifications of pollution control equipment (including manufacturer’s performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

2. NOISE AND VIBRATION

Any residences that surround the proposed site could be subject to unacceptable noise impacts if not managed appropriately. A Noise Impact Assessment (NIA) for the proposal must be conducted by an appropriately qualified acoustics consultant. The NIA must be conducted in accordance with the State Government's *Noise Policy for Industry (2017)* and address the potential impacts of dredging and dewatering operations on any nearby receivers.

Describe baseline conditions

- Determine the existing background (LA90) and ambient (LAeq) noise levels in accordance with the *Noise Policy for Industry (2017)*.
- Determine the existing road traffic noise levels in accordance with the *NSW Road Noise Policy*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:
 - a) details of equipment used for the measurements
 - b) a brief description of where the equipment was positioned
 - c) a statement justifying the choice of monitoring site, including the procedure used to choose the site,
 - d) having regards to the definition of ‘noise sensitive locations(s)’ and ‘most affected locations(s)’
 - e) details of the exact location of the monitoring site and a description of land uses in surrounding areas
 - f) a description of the dominant and background noise sources at the site
 - g) day, evening and night assessment background levels for each day of the monitoring period
 - h) the final Rating Background Level (RBL) value
 - i) graphs of the measured noise levels for each day should be provided
 - j) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring
 - k) determination of LAeq noise levels from existing industry.

Assess impacts

- Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:
 - a) determination of the intrusive criterion for each identified potentially affected receiver
 - b) selection and justification of the appropriate amenity category for each identified potentially affected receiver
 - c) determination of the amenity criterion for each receiver
 - d) determination of the appropriate sleep disturbance limit.
- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible effects on sleep. Where LA1(1min) noise levels from the site are less than 15 dB above the background LA90 noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required. Additional guidance is provided in Appendix B of the *NSW Road Noise Policy*.
- Determine expected noise level and noise character (eg tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:
 - a) site establishment
 - b) construction

- c) operational phases
- d) transport including traffic noise generated by the proposal
- e) other services.

Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).

- Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.
- The noise impact assessment report should include:
 - a) a plan showing the assumed location of each noise source for each prediction scenario
 - b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site
 - c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc
 - d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated
 - e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions
 - f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate
 - g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived
 - h) an assessment of the need to include modification factors as detailed in Section 4 of the *Noise Policy for Industry (2017)*.
- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:
 - a) locations where the noise level exceeds the criteria and extent of exceedence
 - b) numbers of people (or areas) affected
 - c) times when criteria will be exceeded
 - d) likely impact on activities (speech, sleep, relaxation, listening, etc)
 - e) change on ambient conditions
 - f) the result of any community consultation or negotiated agreement.
- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration (ANZECC, 1990)* should be undertaken. The following details of the blast design should be included in the noise assessment:
 - a) bench height, burden spacing, spacing burden ratio

- b) blast hole diameter, inclination and spacing
- c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.
- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:
 - a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage
 - b) control of traffic (eg: limiting times of access or speed limitations)
 - c) resurfacing of the road using a quiet surface
 - d) use of (additional) noise barriers or bunds
 - e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern
 - f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quite' trucks and/or trucks to use air bag suspension
 - g) driver education
 - h) appropriate truck routes
 - i) limit usage of exhaust breaks
 - j) use of premium muffles on trucks
 - k) reducing speed limits for trucks
 - l) ongoing community liaison and monitoring of complaints
 - m) phasing in the increased road use.

3. WATER

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).
- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: www.environment.nsw.gov.au/ieo. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal.
- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (<http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html>)
NB: While specific guidelines for groundwater are not available, the ANZECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.
- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the

Healthy Rivers Commission Inquiries (www.hrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (www.dlwc.nsw.gov.au/care/salinity/#Strategy).

- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality / river flow / groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:
 - a) lake or estuary flushing characteristics
 - b) specific human uses (e.g. exact location of drinking water offtake)
 - c) sensitive ecosystems or species conservation values
 - d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc
 - e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment
 - f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act 1997* (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils and/or acid forming rock.
- Containment of spills and leaks shall be in accordance with Australian Standard 1940-2004 Storage and Handling of Flammable & Combustible Liquids. Containment should be designed for no-discharge.
- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:
 - a) will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and
 - b) will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.
- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.

- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact. Reference should be made to *Managing Urban Stormwater Soils and Construction: Volume 1 and Volume 2 E. Mines and quarries*, and *Guidelines for Fresh and Marine Water Quality (ANZECC 2000)*.

Describe management and mitigation measures

- A Water Quality Management Plan must be developed that details how ambient water quality will be protected at all active dredge locations.
- A Wastewater Management Plan should be developed which details how the dewatering of dredge slurry will be managed to prevent pollution. The Wastewater Management Plan should:
 - Describe the proposed wastewater treatment process (settlement ponds, centrifuge, etc.);
 - Specific management measures that will be implemented to manage fine silts;
 - Provide the location of wastewater discharge points;
 - Be based on meeting the following minimum standards for wastewater discharging to the environment:
 - Total Suspended Solids: <50 mg/L
 - pH: 6.5 – 8.5
 - Dissolved Oxygen: >4mg/L
 - Oil & Grease: Nil visible
 - Include daily monitoring, inspection and maintenance arrangements;
 - Include stop work procedures that will be implemented if wastewater discharge limits are breached;
- An Erosion and Sediment Control Plan (or similar) must be developed and applied to all areas used for sediment filling. The selection of control measures must be appropriate for the scale of each fill area and for the sediment type, and be based on *Managing Urban Stormwater Soils and Construction: Volume 1 and Volume 2 E. Mines and quarries*. Sediment basins must meet the design and operational standards of *Managing Urban Stormwater Soils and Construction: Volume 1 and Volume 2 E. Mines and quarries*.
- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DECCW 2004)*.

4. SEDIMENT, SOILS AND CONTAMINATION

Describe baseline conditions

- A comprehensive assessment of sediments and sediment quality (including potential contaminants) must be conducted for all areas proposed to be dredged.
- A comprehensive assessment of soil and soil quality must be conducted for all proposed fill sites.
- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from dredge, processing and fill operations, including the likelihood of:
 - a) disturbing acid sulfate or potential acid sulfate soils
 - b) disturbing any existing contaminated soil
 - c) contamination of soil by operation of the activity
 - d) subsidence or instability
 - e) soil erosion
- Under NSW waste regulations dredged sediment is considered a waste, therefore any reuse and landfilling proposal must be assessed and managed accordingly. The EPA grants Orders and Exemptions where the application of a waste material to land is a bona-fide re-use opportunity rather than a means of waste disposal. Therefore, it must be demonstrated that the material is 'fit for purpose' and poses minimal risk of harm to the environment or human health.

Describe management and mitigation measures

- An Acid Sulfate Soil Management Plan must be developed and be based on the *Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines v4.0, DSITIA 2014*. The NSW EPA considers these Guidelines to be the most up-to-date guideline in relation to best practice management of acid sulfate soils ('ASS').
- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:
 - a) erosion and sediment control measures
 - b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)

5. WASTE AND CHEMICALS

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to <http://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classification-guidelines>

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

6. CONTINGENCY PLAN. POTENTIAL FAILURE OF BUNDED GEOBAGS.

- The Contingency Plan should detail measures to minimize impacts for the potential failure of banded geobags.

7. CUMULATIVE IMPACTS

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (eg water and sewerage services, transport infrastructure upgrades).
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (eg travel demand management strategies).

F. List of approvals and licences

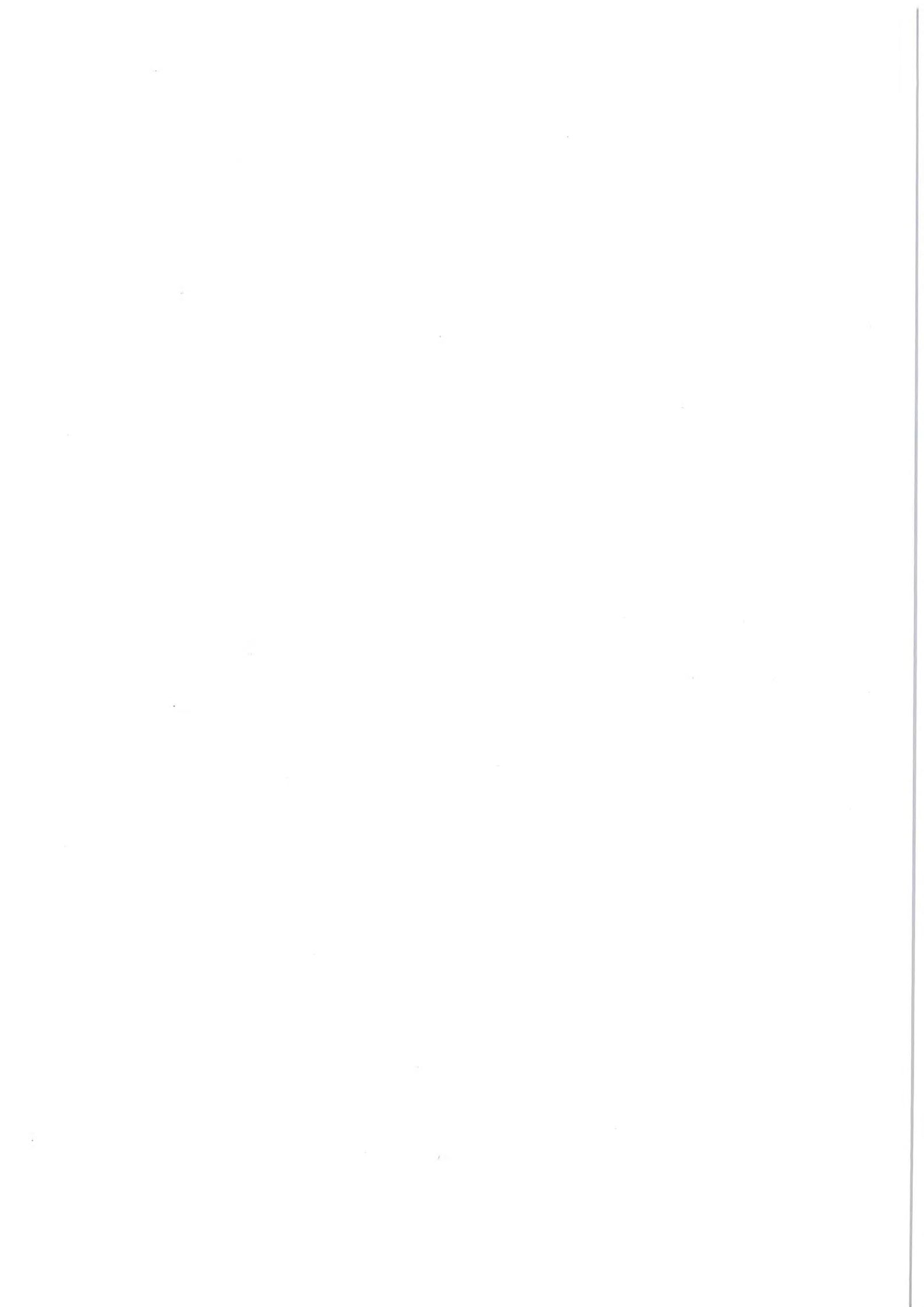
- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- An overarching Environmental Management Plan should be developed that details how the proposal and its environmental protection measures and sub-plans will be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.





Our Ref: DOC18/218433
Your Ref: REF Shaws Bay Dredging

Hydrosphere Consulting
PO Box 7059
Ballina NSW 2478

Attention: Uriah Makings

Dear Mr Mick Howland

Re: Request for OEH Review of Environmental Factors Environmental Assessment Requirements – Proposed dredging and Foreshore Works Shaws Bay, East Ballina

Thank you for your letter dated 6 April 2018 about the proposed dredging and foreshore works at Shaws Bay, East Ballina seeking Environmental Assessment Requirements (EARs) from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide input.

We note that the project will be assessed in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Review of Environmental Factors (REF) EARs provided by the OEH relate to our statutory responsibilities of Aboriginal cultural heritage, biodiversity, OEH estate, historic heritage, acid sulphate soils, flooding, stormwater and coastal erosion.

The full list of our requirements that may need to be addressed in the REF is provided in **Attachment 1**. In preparing the REF, the proponent should refer to the relevant guidance material listed in **Attachment 2**.

The proponent should ensure that the REF will be sufficiently comprehensive to enable unambiguous assessment of all direct, indirect and uncertain impacts of the proposal. The REF should include an assessment of impacts on biodiversity (threatened species, populations, ecological communities, or their habitats) likely to occur on or near the subject site, as well as Aboriginal cultural heritage values, acid sulfate soils and estuary processes.

To accord with our attached requirements, we consider that the REF should describe:

1. the Aboriginal cultural heritage values of the area especially due to the proximity of the East Ballina declared Aboriginal Place (gazetted 27 July 2012) to the proposal. We note the significance of the Aboriginal Place and its surrounding environment to the local Aboriginal community and highlight that this area contains landforms that have in the past yielded a significant volume of evidence of Aboriginal occupation. Therefore, we recommend an appropriate level of assessment to determine the potential of the proposed activities to impact directly or indirectly on Aboriginal objects or the values of the nearby Aboriginal Place.

2. relative to the proposed works:
 - a. the measures to be implemented during dredging and beach nourishment works to ensure sediment plumes are minimised. The measures should include the use of sediment curtains, and possibly stop work protocols if the sediment plumes become extensive or impact on water quality or marine vegetation.
 - b. how the sand processing area will be managed to prevent environmental impacts. Particularly, how the stockpile of clean sand (although de-watered) will be managed to prevent seepage of excess water into the ground and/or groundwater which may result in impacts to sensitive receptors (areas of high biodiversity value).
 - c. how long the clean sand stockpile is intended to be stored at the site, and what methods will be utilised to manage the potential impact of windblown sand from the stockpile.
 - d. how the monitoring regime will be implemented by council. The monitoring regime should consider the behaviour of the beach nourishment material e.g. sediment movement, erosion etc.
3. relative to acid sulfate soils:
 - a. the total volume of ASS (including PASS, Monosulfidic Black Oozes (MBOs)) potentially to be disturbed and the spatial distribution and variability of ASS.
 - b. the potential for oxidation of ASS in the dredged materials and the potential acidity of the dredged or disturbed sediments if they were oxidised.
 - c. the potential for deoxygenation of waters due to rapid oxidation of MBOs.
 - d. the potential release of metals, metalloids or nutrients that may impact water quality around the dredging area and dredge material placement locations.
 - e. the location of the proposed dredge, deposition and dewatering sites in relation to sensitive receptors (e.g. aquatic ecosystems, especially seagrass beds and breeding habitat of threatened or migratory shorebirds).
 - f. the mitigation and management measures that will be used to prevent or minimise potential impacts from the disturbance of ASS at dredge, dewatering and deposition sites.
 - g. the dredge material management, including stockpiling, separation and management of fines.
 - h. the contingency planning required, monitoring, verification and reporting goals.
 - i. the potential impacts on human and environmental health from the onshore placement of dredge materials;
 - j. how the proposal is assessed in accordance with any relevant guidelines in the Acid Sulfate Soils Manual 1998, including the Assessment Guidelines. Samples should be tested according to procedures in the Acid Sulfate Soils Laboratory Methods Manual 2004.
4. the details of an Environmental Management Plan to ensure council staff, contractors and on ground works staff are aware of all potential environmental impacts of the works, the management and mitigation measures applied to all stages of the proposal, including the dredging, de-watering, material storage, beach nourishment, including their monitoring and any required contingency planning.
5. the details of an Ecological Restoration Plan, which should incorporate the creation, rehabilitation or enhancement of plant communities as outlined in the proposal. The plan should also include the proposed creation of 1200m² of saltmarsh habitat, rehabilitation of the foreshore impacted by the proposed works and enhancement of areas identified as high ecological value, located on the periphery of the proposal.

The OEH notes that proposal will result in the removal of 660m² of seagrass beds. Hence, consultation with the Department of Primary Industries - Fisheries NSW on this matter should be undertaken relative to both the direct impacts and the ecological offsets as stated in the proposal.

If you have any further questions about this issue, Ms Rachel Binskin, Senior Conservation Planning Officer, Regional Operations, OEH, can be contacted on 6659 8247 or at rachel.binskin@environment.nsw.gov.au.

Yours sincerely

A handwritten signature in blue ink that reads "Dimitri Young" followed by the date "8 May 2016".

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Regional Operations

Contact officer: RACHEL BINSKIN 6659 8247

Enclosure: OEH REF EARs - Shaws Bay Dredging and Foreshore Works East Ballina; Attachment 2 - REF Guidance Material

Attachment 1

OEH's Recommended Environmental Assessment Requirements (EARs)

Review of Environmental Factors

Shaws Bay Dredging and Foreshore Works East Ballina

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A. The Proposal

The Review of Environmental Factors (REF) should clearly describe the proposal and identify its environmental objectives. These environmental objectives will guide decisions on environmental controls and management throughout the life of the proposal.

The objectives of the proposal should be clearly stated and refer to:

1. the size and type of the proposal and its operation;
2. all anticipated environment impacts, both direct and indirect, including level of vegetation / habitat clearing
3. the anticipated level of performance in meeting required environmental standards;
4. threatened species, populations, ecological communities and their habitats impacted upon;
5. the staging and timing of the proposal; and
6. the proposal's relationship to any other proposal.

The REF should fully identify all the processes and activities intended for the site and during the life of the proposal, including details of:

7. the location of the proposal and details of the surrounding environment;
8. the proposed layout of the site;
9. appropriate land use zoning;
10. ownership details of any residence and/or land likely to be affected by the proposal;
11. maps/diagrams showing the location of residences and properties likely to be affected and other industrial developments, conservation areas, wetlands, etc. in the locality that may be affected by the proposal;
12. all equipment proposed for use at the site;
13. chemicals, including fuel, used on the site and proposed methods for the transportation, storage, use and emergency management;
14. waste generation, storage and disposal;
15. a plan showing the distribution of any threatened flora or fauna species and the vegetation communities on or adjacent to the subject site, and the extent of vegetation proposed to be cleared should be provided; and
16. methods to mitigate any expected environmental impacts of the proposal.

B. Environmental Impacts of the Proposal

Impacts related to the following environmental issues need to be assessed, quantified and reported:

- Aboriginal cultural heritage
- Biodiversity
- OEH Estate (land reserved or acquired under the *National Parks and Wildlife Act 1974*)
- Historic heritage
- Acid Sulfate Soils
- Flooding, Stormwater and Coastal Erosion
- Cumulative Impacts

The REF should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at **Attachment 2**.

C. Aboriginal Cultural Heritage

The REF should contain:

1. A description of the Aboriginal objects and declared Aboriginal places located within the area of the proposal.
2. A description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposal, and the significance of these values for the Aboriginal people who have a cultural association with the land.
3. A description of any consultation with Aboriginal people regarding the proposal and the significance of any Aboriginal cultural heritage values identified through that consultation. The OEH advises that the proponent may utilise the OEH's *Aboriginal Consultation Requirements for Proponents 2010* as best practice guidelines for such consultation (these OEH requirements for consultation must be followed if the proposal requires an Aboriginal Heritage Impact Permit or the Aboriginal heritage assessment requires archaeological testing).
4. The views of those Aboriginal people regarding the likely impact of the proposal on their cultural heritage. If any submissions have been received as a part of the consultation requirements, then the report must include a copy of each submission and your response.
5. A description of the actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposal, with reference to the cultural heritage values identified.
6. A description of any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places.
7. A description of any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.

In addressing these requirements, the proponent may refer to the following documents:

- a) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH, 2010) - www.environment.nsw.gov.au/resources/cultureheritage/ddcop/10798ddcop.pdf. These guidelines identify a process that could be used to prepare Aboriginal cultural heritage assessments for activities assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*.
- b) *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH, 2010) - www.environment.nsw.gov.au/licences/consultation.htm. This document further explains the consultation requirements that are set out in clause 80C of the National Parks and Wildlife Regulation 2009. The process set out in this document must be followed and documented in the REF if the proposal requires an Aboriginal Heritage Impact Permit or the Aboriginal heritage assessment requires archaeological testing.
- c) *Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH, 2010) - www.environment.nsw.gov.au/licences/archinvestigations.htm. The process

described in this Code should be followed and documented where the assessment of Aboriginal cultural heritage requires a archaeological testing to be undertaken.

Notes:

- An Aboriginal Site Impact Recording Form (<http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm>) must be completed and submitted to the Aboriginal Heritage Information Management System (AHIMS) Registrar, for each AHIMS site that is harmed through archaeological investigations required or permitted through these environmental assessment requirements.
- Under section 89A of the *National Parks and Wildlife Act 1974*, it is an offence for a person not to notify OEH of the location of any Aboriginal object the person becomes aware of, not already recorded on the Aboriginal Heritage Information Management System (AHIMS). An AHIMS Site Recording Form should be completed and submitted to the AHIMS Registrar (<http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm>), for each Aboriginal site found during investigations.

D. Biodiversity

The REF should include a detailed biodiversity assessment, including assessment of impacts on threatened biodiversity, native vegetation and habitat. This assessment should address the matters below.

1. A field survey of the site should be conducted and documented in accordance with relevant guidelines, including:
 - a. the *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians* (DECC, 2009)
<http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf>
 - b. *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004),
<http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf>
 - c. Field survey methods and assessment information on the OEH website:
<http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/surveys-and-assessments>

If a proposed survey methodology is likely to vary significantly from the above methods, the proponent should discuss the proposed methodology with the OEH prior to undertaking the REF, to determine whether the OEH considers that it is appropriate.

Recent (less than five years old) surveys and assessments may be used. However, previous surveys should not be used if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the subject species are unlikely to be detected or present, or
- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate for detecting the target subject species, unless these differences can be clearly demonstrated to have had an insignificant impact upon the outcomes of the surveys.

If a previous survey is used, surveys for any additional entities listed under the *Biodiversity Conservation Act 2016* since the previous survey took place, must be undertaken and documented.

The list of potential threatened species, populations, ecological communities, or their habitats for the site should be determined in accordance with:

- the *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft* (DEC, 2004), and
- The OEH Threatened Species website
<http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species> , and
- the *Bionet Atlas of NSW*
<http://www.environment.nsw.gov.au/wildlifeatlas/about.htm> , and
- the Vegetation Information System (BioNet Vegetation Classification)
<http://www.environment.nsw.gov.au/research/Visclassification.htm> , and

- Other data sources (e.g. PlantNET, Online Zoological Collections of Australian Museums (<http://www.ozcam.org/>), previous or nearby surveys etc.) may also be used to compile the list.
2. The REF should contain the following information as a minimum:
 - a. Description and geo-referenced mapping of the study area (and spatial data files), e.g. overlays on topographic maps, satellite images and /or aerial photos, including details of map datum, projection and zone, all survey locations, vegetation communities (including classification and methodology used to classify), key habitat features and reported locations of threatened species, populations and ecological communities present in the subject site and study area.
 - b. Description of survey methodologies used, including timing, location and weather conditions.
 - c. Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of impacts.
 - d. Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.
 - e. Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts. Wherever possible, quantify these impacts such as the amount of each vegetation community or species habitat to be cleared or impacted, or any fragmentation of a wildlife corridor.
 - f. Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts, including details about alternative options considered and how long term management arrangements will be guaranteed.
 - g. Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected (see the requirements for this at point 4 below).
 3. An assessment of the direct and indirect impacts of the proposal on threatened biodiversity known or considered likely to occur in the study area, based on the presence of suitable habitat, must be undertaken in accordance with Part 7 of the *Biodiversity Conservation Act 2016* and the guidance provided by the *Threatened Species Assessment Guideline – The Assessment of Significance* (DECC, 2007) which is available at:
<http://www.environment.nsw.gov.au/resources/threatenedspecies/tsaguide07393.pdf>
 4. The proposal must be designed to avoid and minimise impacts on biodiversity to the fullest extent possible and offset remaining direct and indirect biodiversity impacts. In determining an appropriate offset package, it is recommended that the REF should:
 - a. Accord with the 13 OEH offsetting principles available at <http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm>.
 - b. Use the Biodiversity Assessment Method to determine the type and quantum of offsets required to compensate for those remaining biodiversity impacts.
 - c. Identify the conservation mechanisms to be used to ensure the in-perpetuity protection and management of proposed offset sites.

- d. Include a specific Statement of Commitments for the proposed offset package which is informed by a., b. and c. above and by any consultation with OEH.

Note:

For the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the REF should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.

E. OEH Estate

The REF should address the following with respect to land reserved under the *National Parks and Wildlife Act 1974*.

1. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the *National Parks and Wildlife Act 1974* should be considered. Refer to the *Guidelines for developments adjoining land managed by the Office of Environment and Heritage* (OEH, 2013). The guideline is available at:

<http://www.environment.nsw.gov.au/resources/protectedareas/development-land-adjoining-130122.pdf>

2. The OEH has clear guidelines for assessing the environmental impact of developments and activities proposed within OEH managed lands. These include guidelines for the preparation of an REF for activities proposed on land reserved under the *National Parks and Wildlife Act 1974*, including national parks and nature reserves. The *Guidelines for preparing a Review of Environmental Factors* provides information on how to determine whether certain activities are permissible, as well as specific information on matters for consideration during the preparation of an REF. The guidelines can be found at

<http://www.environment.nsw.gov.au/research-and-publications/publications-search/guidelines-for-preparing-a-review-of-environmental-factors>

3. For those proposals within OEH managed areas that seek a lease or licence under Section 151 of the *National Parks and Wildlife Act 1974*, in addition to an REF, applications must also be accompanied by a sustainability assessment. The assessment must address the criteria adopted by the Chief Executive of the OEH. Templates for completing a Sustainability Assessment can be found at:

<http://www.environment.nsw.gov.au/protectedareas/sustainabilityassessments.htm>

Note: Proposals which may impact marine protected areas should be referred to the Department of Primary Industries to determine the assessment and approval requirements.

F. Historic Heritage

The REF should address the following:

1. The heritage significance of the site and any impacts the proposal may have upon this significance should be assessed. This assessment should include natural areas and places of Aboriginal, historic or archaeological significance. It should also include a consideration of wider heritage impacts in the area surrounding the site.
2. The Heritage Council maintains the State Heritage Inventory which lists some items protected under the *Heritage Act 1977* and other statutory instruments. This register can be accessed through the OEH Heritage webpage (<http://www.environment.nsw.gov.au/topics/heritage>). In addition, lists maintained by the National Trust, any heritage listed under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* and the local council should be consulted to identify any known items of heritage significance in the area affected by the proposal. These lists are constantly evolving and items with potential heritage significance may not yet be listed
3. Non-Aboriginal heritage items within the area affected by the proposal should be identified by field survey. This should include any buildings, works, relics (including relics underwater), gardens, landscapes, views, trees or places of non-Aboriginal heritage significance. A statement of significance and an assessment of the impact of the proposal on the heritage significance of these items should be undertaken. Any policies/measures to conserve their heritage significance should be identified. This assessment should be undertaken in accordance with the guidelines in the NSW Heritage Manual. The field survey and assessment should be undertaken by a qualified practitioner/consultant with historic sites experience.

The Manager, OEH Heritage Division Conservation Team, can be contacted on telephone (02) 9873 8599 for a list of suitable consultants.

G. Acid Sulfate Soils

The REF should address the following:

1. The potential impacts of the proposal on acid sulfate soils must be assessed in accordance with the relevant guidelines in the *Acid Sulphate Soils Manual* (Stone et al. 1998) and the *Acid Sulphate Soils Laboratory Methods Guidelines* (Ahern et al. 2004).
2. Describe mitigation and management options that will be used to prevent, control, abate or minimise potential impacts from the disturbance of acid sulfate soils associated with the proposal, and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

H. Flooding, Stormwater and Coastal Erosion

The REF should include an assessment of the following referring to the relevant guidelines in Attachment 2:

1. The potential effect of coastal processes and coastal hazards including potential impacts of sea level rise:
 - a. on the proposal; and
 - b. arising from the proposal.
2. Whether the proposal is consistent with any coastal zone management plans.
3. Whether the proposal is consistent with any floodplain risk management plans.
4. Whether the proposal is compatible with the flood hazard of the land.
5. Whether the proposal will significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties.
6. Whether the proposal will significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
7. Whether the proposal incorporates appropriate measures to manage risk to life from flood.
8. Whether the proposal is likely to result in unsustainable social and economic costs to the community as a consequence of flooding.
9. The implications of flooding over the full range of potential flooding, including the probable maximum flood, should be considered as set out in the NSW Government Floodplain Development Manual. This should include the provision of:
 - a. Full details of the flood assessment and modelling undertaken in determining any design flood levels (if applicable), including the 1 in 100 year flood levels.
 - b. A sensitivity assessment of the potential impacts of an increase in rainfall intensity and runoff (10%, 20% and 30%) and sea level rise on the flood behaviour for the 1 in 100 year design flood if applicable.
10. All site drainage, stormwater quality devices and erosion / sedimentation control measures should be identified and the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the proposal should be detailed.

I. Cumulative Impacts

The REF should include an assessment of the following:

1. The cumulative impacts, including both construction and operational impacts, from all clearing activities and operations, associated edge effects and other indirect impacts on cultural heritage, biodiversity and OEH Estate in accordance with the *Environmental Planning and Assessment Act 1979*.
2. The cumulative impacts, including both construction and operational impacts, of the proponent's existing and proposed development and associated infrastructure (such as access tracks etc.) as well as the cumulative impact of the development in the context of other developments located in the vicinity.

Attachment 2 – REF Guidance Material

Title	Web address
<u>Relevant Legislation</u>	
<i>Coastal Protection Act 1979</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+13+1979+cd+0+N
<i>Commonwealth Environment Protection and Biodiversity Conservation Act 1999</i>	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
<i>Floodplain Development Manual</i>	http://www.environment.nsw.gov.au/floodplains/manual.htm
<i>Environmental Planning and Assessment Act 1979</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
<i>Fisheries Management Act 1994</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
<i>Marine Parks Act 1997</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
<i>National Parks and Wildlife Act 1974</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
<i>Protection of the Environment Operations Act 1997</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
<i>Biodiversity Conservation Act 2016</i>	https://www.legislation.nsw.gov.au/~view/act/2016/63
<i>Biodiversity Conservation Regulation 2017</i>	https://www.legislation.nsw.gov.au/~view/regulation/2017/432
<i>Biodiversity Conservation (Savings and Transitional) Regulation 2017</i>	https://www.legislation.nsw.gov.au/~view/regulation/2017/433
<i>Water Management Act 2000</i>	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
<u>Aboriginal Cultural Heritage</u>	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/consultation.htm
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/licences/archinvestigations.htm
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm

Biodiversity

Biodiversity Assessment Method (OEH 2017)	http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf
Biodiversity Assessment Calculator	https://www.lmbc.nsw.gov.au/bamcalc
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna -Amphibians (DECCW, 2009)	http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
Field Survey Methods	http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/about-threatened-species/surveys-and-assessments/field-survey-methods
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
OEH Threatened Species website	http://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species
Atlas of NSW Wildlife	http://www.environment.nsw.gov.au/wildlifeatlas/about.htm
BioNet Vegetation Classification (NSW Vegetation Classification System)	http://www.environment.nsw.gov.au/research/Visclassification.htm
PlantNET	http://plantnet.rbgsyd.nsw.gov.au/
Online Zoological Collections of Australian Museums	http://www.ozcam.org/
Threatened Species Assessment Guidelines: the Assessment of Significance (DECC 2007)	http://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-species-assessment-guidelines
Principles for the use of biodiversity offsets in NSW	http://www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

OEH Estate

Land reserved or acquired under the NPW Act

List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
OEH Revocation of Land Policy	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/protectedareas/10509devadjdeccw.pdf

Water and Soils

Acid sulphate soils

Acid Sulfate Soils Planning Maps

<http://canri.nsw.gov.au/download/>

Acid Sulfate Soils Manual (Stone et al. 1998)

Manual available for purchase from:

<http://www.landcom.com.au/whats-new/the-blue-book.aspx>

Chapters 1 and 2 are on DPI's Guidelines Register at:

Chapter 1 Acid Sulfate Soils Planning Guidelines:

<http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Planning%20Guidelines.pdf>

Chapter 2 Acid Sulfate Soils Assessment Guidelines:

<http://www.planning.nsw.gov.au/rdaguidelines/documents/NSW%20Acid%20Sulfate%20Soils%20Assessment%20Guidelines.pdf>

Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)

<http://www.derm.qld.gov.au/land/ass/pdfs/lmg.pdf>

This replaces Chapter 4 of the Acid Sulfate Soils Manual above.

Flooding and Coastal Erosion

Reforms to coastal erosion management

<http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm>

Floodplain development manual

<http://www.dnr.nsw.gov.au/floodplains/manual.shtml>

Guidelines for Preparing Coastal Zone Management Plans

<http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf>

Climate Change Impacts and Risk Management

<http://www.environment.gov.au/climate-change>

Water

Water Quality Objectives

<http://www.environment.nsw.gov.au/ieo/index.htm>

ANZECC (2000) Guidelines for Fresh and Marine Water Quality

http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality

Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones

<http://deccnet/water/resources/AWQGuidance7.pdf>

Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)

http://www.environment.nsw.gov.au/resources/legislation/approved_methods-water.pdf

RESIDENT 1

It is great to see that there are improvements being made to the Shaws bay area and that the local residents are being informed and being asked for feedback.

We actually live up at Ballina Heights and have used the bay often over the past 20 years for swimming and snorkelling.

However, over the last 5 years this has dwindled to actually never swimming there at all, and only having an occasional snorkel when we can manage to be there at the turn of a very high tide. On these occasions it is one of our favourite snorkelling experiences with plenty of fish to impress and educate our kids.

I find it a great shame that the deteriorated water quality and reduced water depth has forced a once beautiful swimming area to be minimally used.

So, I am wondering why dredging along the wall to allow tidal flow is not being considered?

I am aware that this would have to incorporate the removal of the mangroves that have grown in this man-made area.

This was actually suggested by consultants Patterson Britton & Partners to be carried out in 2010.

As this has not been adhered to, it is no wonder that our family and friends find Shaws Bay unsuitable for a refreshing swim in 2018.

Such a loss to all Ballina residents and tourists who visit our area!

RESIDENT 2

My opinions are encapsulated in my letters in the Advocate. The first appeared on Wed 18 April 2018.

The second (reproduced below) unfortunately missed the deadline for this week but will appear on Wednesday 16 May 2018.

Dredging Fait Accompli 7 May 2018

I wish to comment on two documents recently delivered to residents in the Shaws Bay subdivision regarding proposed dredging in the bay. This letter augments my previous letter in the Advocate on 18 April 2018.

The first document, a P/R handout prepared by Ballina Council and entitled "Shaws Bay Precinct Dredging Feasibility Study", advises that a dredging feasibility investigation is currently being undertaken by Hydrosphere Consulting. The second document, a letter from Hydrosphere

Consulting, advises that an environmental review is currently being prepared (due end of May) for which public feedback is being sought via "hydrosphere.com.au/shawsbay". Oddly, both documents present a dredging proposal as a fait accompli without any attempt at rationalisation.

I contend that the study and/or review should include the following information:

1. An explanation of how the proposed dredging fulfils the stated primary aim of "improving tidal flushing and reducing water quality risks". Water quality is almost totally dependant on adequate tidal flow through the voids in the dumped rock river training wall (the only flow path). Tidal flow is being inhibited by ever increasing sediments along the wall that have built up since it was last dredged in year 1990. Significantly, no dredging is proposed along the wall.
2. An explanation for why the mangrove forest that has established itself on sediments along the wall in recent years is now considered essential for the ecology of the bay. I understand that, for this reason, DPI Fisheries will not issue a licence for the removal of the mangroves, thus preventing dredging along the wall. The bay is a man-made unnatural environment requiring special consideration. The rigid administration of environmental legislation relevant to the normal situation is not appropriate for the the unique conditions that exist in the bay..
3. An explanation for the extreme differences between the current Shaws Bay CZMP and the previous Shaws Bay Estuary Management Plan, August 2000, by consultants Patterson Britton & Partners (PBP), with respect to mangroves and dredging along the wall.
4. A survey of the current perched low tide level in the bay. This would give valuable information on the restriction to tidal flow that has occurred as a result of sedimentation along the wall since the last survey by PBP in year 2000.

I urge everyone who has concerns about the water quality in Shaws Bay to respond to the public feedback survey.

» Shaws Bay Precinct dredging feasibility study



April 2018



Ballina Shire Council has embarked on a series of actions from the Coastal Zone Management Plan to improve the Shaws Bay precinct.

» Introduction

Shaws Bay is a popular recreational area for the local community and visitors. The Bay provides a sheltered waterway which is ideal for a range of recreational activities. The Bay is used year-round and its popularity is expected to increase as the shire grows, especially during peak holidays periods.

Shaws Bay also has significant environmental factors and there are numerous competing challenges for this waterway. To ensure a healthy environment at Shaws Bay Council needs to ensure the water quality is maintained, public amenity and carrying capacity are optimised whilst protecting the important ecological areas of the Bay.

» History to Study

The shallowing of Shaws Bay due to sediment build up is leading to reduced water movement and is a key cause of many issues for its long-term management.

Siltation and shoaling is considered as one of the highest priority issues within Shaws Bay. As part of the community consultation for the Coastal Zone Management Plan (CZMP) 78% of survey responses indicated that siltation/shoaling was either a “very important” or an “important” issue for management within Shaws Bay.

Further, when asked about priority for funds allocation, respondents raised numerous preferences with water quality improvement ranking highest. Dredging of the main section of Shaws Bay was listed as the second highest priority improvement action in the Shaws Bay CZMP.

» History of dredging at Shaws Bay

Dredging of the Bay was carried out in the 1960s to provide fill for the construction of Compton Drive, which now borders the Bay to the north.

In the mid-1970s targeted dredging of the Bay was completed which involved pumping dredged sand onto the foreshore to form beaches. In the 1980s a similar method was used and involved the removal of material to a depth of 3 - 4 metres within the Bay and then utilised as beach nourishment. This dredging program predominately targeted the northwest corner of the Bay.

Following this dredging, wind generated waves gradually transported sand from the nourished beaches back into the deeper sections of the Bay in a northerly direction. In the 1990s a long-reach excavator was used to again pull sand back onto the beach areas. Since then, the shoreline has become relatively stable although localised erosion and sediment inputs continue to contribute to infilling of the Bay.



» Objectives

The Shaws Bay CZMP recommends a suite of actions working towards protecting and maximising the future value of the Bay. As part of the implementation of this CZMP, Hydrosphere Consulting is undertaking an investigation into the feasibility of dredging Shaws Bay on behalf of Council with the primary aims of:

- Reducing siltation;
- Improving tidal flushing and reducing water quality risks;
- Maintaining foreshore access to deep water; and
- Improving foreshore beaches.

In doing this, there are several significant anticipated benefits and it is important that any future dredging is undertaken in a way that maximises these benefits, whilst balancing numerous technical, ecological, legislative and financial factors.

» Planning considerations

Numerous dredging scenarios were considered, taking into account community views expressed during the drafting of the CZMP. The areas to be dredged were determined to provide the best balance between environmental protection and achieving the long-term objectives of dredging.

Sediment coring has been undertaken and the sediments have been tested for all the common domestic, agricultural and industrial chemical pollutants, and were found to be completely uncontaminated.

The cores revealed that the sediments are on average 99.9% marine sands with some areas of silt.

A key component of the project is to create enhanced sandy beaches for public recreation. Therefore, it is proposed to screen the dredged sand to remove silt, large shell and other organic matter, leaving sand ideal for creating beach nourishment.

» Other Shaws Bay works

Action 1: Control bank erosion and siltation into the bay

Objective: Improve the water quality of the bay and the recreational amenity of the reserve. Improve access from the reserves to the bay.

The erosion control works, bank stabilisation and creation of sandy beaches within the east arm have been completed. Council is also finalising the design plans to continue the walkway through the reserve to improve public access. The plans will also include the installation of recreational facilities such as picnic shelters and seating. These works are due to commence early to mid May 2018.

Action 3: Improve Compton Drive

Foreshore

Objective: Enhance safety and recreational amenity of the foreshore and improve stormwater systems and treatments.

These works are to be completed shortly with the final stages currently being installed.

» More information

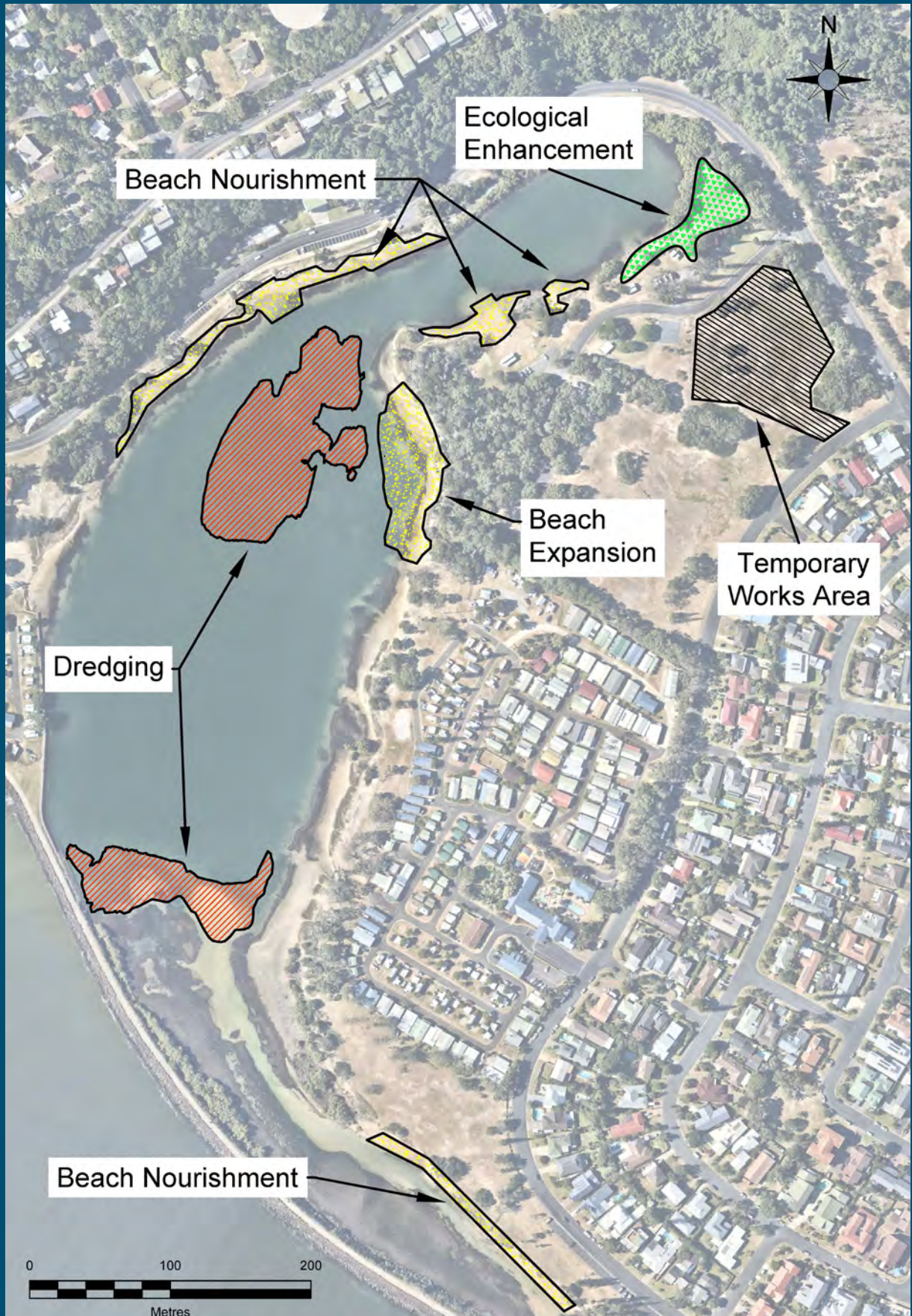
To read the full Dredging Feasibility Report or further information about Shaws Bay Precinct works visit ballina.nsw.gov.au and search Shaws Bay. Or telephone Ballina Shire Council's Public and Environmental Health Group on 1300 864 444.



» ***If you have any questions please contact:***

**Ballina Shire Council, Development and Environmental Health Group ph 6686 1210
View the Shaws Bay Coastal Zone Management Plan (CZMP) on Council's website
ballina.nsw.gov.au (search Shaws Bay)**

Shaws Bay Precinct dredging target areas



Shaws Bay Precinct east arm pathway



picnic table and shelter location*



seat location*



shower location*



proposed pathway



*approximate location (to be determined)

© NSW Spatial Services 2018. This map is illustrative and not to scale.

APPENDIX 4: BIONET SEARCH RESULTS

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Waterbird	Particular affinity with floodplains. Feed in floodplain swamps, wetlands, billabongs and watercourses. Construct large nests in tall trees situated close to water.	-	Endangered	-	Unlikely	No
Curlew Sandpiper	<i>Calidris ferruginea</i>	Shorebird	This species occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. Curlew Sandpipers forage on mudflats and nearby shallow water. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds. Breeds in Siberia, migrating to Australia between August and November for the summer before leaving again between March and mid-April. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin.	-	Endangered	Critically Endangered Migratory Species	Unlikely	No
Eastern Osprey	<i>Pandion cristatus</i>	Marine Bird	Range of habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes. Construct nests in a variety of natural and artificial sites including in dead or partly dead trees or bushes; on cliffs, rocks, rock stacks or islets; on the ground on rocky headlands, coral cays, deserted beaches, sandhills or saltmarshes; and on artificial nest platforms, pylons, jetties, lighthouses, navigation towers.	-	Vulnerable	Marine, Migratory	Unlikely	No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Mangrove Honeyeater	<i>Gavicalis fasciogularis</i>	Bird	<i>The primary habitat of the species is mangrove woodlands and shrublands but Mangrove Honeyeaters also range into adjacent forests, woodlands and shrublands, including casuarina and paperbark swamp forests and associations dominated by eucalypts or banksias. Mangrove Honeyeaters eat nectar, from flowers, and invertebrates, including marine snails and crabs. Breed in late winter and early summer, from about August to December, nearly always building their nests in a densely foliated mangrove tree.</i>	-	Vulnerable,	-	Unlikely	No
Pied Oystercatcher	<i>Haematopus longirostris</i>	Shorebird	<i>Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.</i>	-	Endangered,	-	Unlikely	No
Scented Acronychia	<i>Acronychia littoralis</i>	Plant	<i>Found between Fraser Island in the north and Port Macquarie in the south. Occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest.</i>	-	Endangered	Endangered	Unlikely	No
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	Shorebird	<i>Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels. Breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks</i>	-	-	-	Unlikely	No

APPENDIX 5: EPBC ACT SEARCH TOOL RESULTS

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Australasian Bittern	<i>Botaurus poiciloptilus</i>	Waterbird	<i>Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spikerushes.</i>	-	Endangered	Endangered		No
Red Knot	<i>Calidris canutus</i>	Shorebird	<i>Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps.</i>	-	-	Endangered, Marine, Migratory		No
Curlew Sandpiper	<i>Calidris ferruginea</i>	Shorebird	<i>This species occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. Curlew Sandpipers forage on mudflats and nearby shallow water. Curlew Sandpipers generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds. Breeds in Siberia, migrating to Australia between August and November for the summer before leaving again between March and mid-April. Occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin.</i>	-	Endangered	Critically Endangered Migratory Species		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Great Knot	<i>Calidris tenuirostris</i>	Shorebird	Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Most birds return north in March and April, however some individuals may stay over winter in Australia. Forages for food by methodically thrusting its bill deep into the mud to search for invertebrates, such as bivalve molluscs, gastropods, polychaete worms and crustaceans.	-	Vulnerable,	Critically Endangered, Marine, Migratory		No
Greater Sand Plover, Large Sand Plover	<i>Charadrius leschenaultii</i>	Shorebird	The species is almost entirely coastal, inhabiting littoral and estuarine habitats. Breeds in the northern hemisphere and heads south for the boreal winter. apparently rare on the east coast, usually found singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries. Greater Sand Plovers mostly eat molluscs, worms, crustaceans (especially small crabs and sometimes shrimps) and insects.	-	Vulnerable	Vulnerable, Marine, Migratory		No
Lesser Sand Plover, Mongolian Plover	<i>Charadrius mongolus</i>	Shorebird	Usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge. Breeds in the northern hemisphere and heads south for the boreal winter. It also sometime occurs in short saltmarsh or among mangroves. It eats invertebrates, such as molluscs (especially bivalves), worms, crustaceans (especially crabs) and insects.	-	Vulnerable	Endangered, Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Eastern Curlew	<i>Numenius madagascariensis</i>	Shorebird	<i>The Eastern Curlew is found on intertidal mudflats and sandflats, often with beds of seagrass, on sheltered coasts, especially estuaries, mangrove swamps, bays, harbours and lagoons. The Eastern Curlew is a migratory species, moving south by day and night, usually along coastlines, leaving breeding areas from mid-July to late September. They arrive in north-western and eastern Australia mainly in August. Large numbers appear on the east coast from September to November. Most leave again from late February to March. They eat mainly small crabs and molluscs, foraging mudflats by day and night.</i>	-	-	Critically Endangered, Migratory		No
Fairy Prion (southern)	<i>Pachyptila turtur subantarctica</i>	Bird	<i>The southern subspecies of the Fairy Prion is a marine bird, found mostly in temperate and subantarctic seas. Fairy Prions (including other subspecies) are often beachcast on the south-eastern coast of Australia, and are commonly seen offshore over the continental shelf and over pelagic waters.</i>	-	-	Vulnerable		No
Humpback Whale	<i>Megaptera novaeangliae</i>	Marine Mammal	<i>Humpback Whales are ocean dwelling marine mammals. The population of Australia's east coast migrates from summer cold-water feeding grounds in Subantarctic waters to warm-water winter breeding grounds in the central Great Barrier Reef. They are regularly observed in NSW waters in June and July, on northward migration and October and November, on southward migration. While they are known to occasionally enter estuaries, the majority of their time is spent in the open ocean.</i>	-	-	Vulnerable		No
Koala	<i>Phascolarctos cinereus</i>	Mammal	<i>Inhabit eucalypt woodlands and forests</i>	-	Vulnerable	Vulnerable		No
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Mammal	<i>Occur in rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas. Forage on fruits and blossoms of more than 80 species of plants. Prefer eucalypt blossom with native figs being the most popular fruit. Chew leaves and appear to eat the salt glands</i>	-	Vulnerable	Vulnerable		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
			<i>from mangroves. Congregate in large camps of up to 200,000 individuals from early until late summer usually in gullies close to water.</i>					
Loggerhead Turtle	<i>Caretta caretta</i>	Reptile	<i>Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months</i>	-	<i>Endangered,</i>	<i>Endangered</i>		No
Green Turtle	<i>Chelonia mydas</i>	Reptile	<i>Ocean-dwelling species spending most of its life at sea. Eggs laid in holes dug in beaches throughout their range.</i>	-	<i>Vulnerable,</i>	<i>Vulnerable</i>		No
Leatherback Turtle	<i>Dermochelys coriacea</i>	Reptile	<i>A pelagic feeder, found in tropical, subtropical and temperate waters venturing close to shore mainly during the nesting season in which they require sandy beaches to nest.</i>	-	<i>Endangered</i>	<i>Endangered, Migratory, Marine</i>		No
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Reptile	<i>Hawksbills nest on insular and mainland sandy beaches throughout the tropics and subtropics. They are highly migratory and use a wide range of broadly separated localities and habitats during their lifetimes including major gyre systems, neritic developmental foraging habitat that may comprise coral reefs or other hard bottom habitats, sea grass, algal beds, or mangrove bays and creeks or mudflats.</i>	-		<i>Vulnerable</i>		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Flatback Turtle	<i>Natator depressus</i>	Reptile	<i>The Flatback turtle is endemic to Australia and all known breeding sites of this species occur only in Australia. Flatback turtles have a preference for shallow, soft-bottomed sea bed habitats away from reefs. Flatback turtles nest only in northern Australia on inshore islands and the mainland from Mon Repos in southern Queensland to Exmouth in northern Western Australia. On the east coast of Queensland, Flatback turtles nest from Mon Repos in the south to Herald Island near Townsville in the north. Major rookeries include four islands on the inner shelf of the southern Great Barrier Reef, Peak, Wild Duck, Avoid and Curtis Islands. Nesting activity reaches a peak between late November and early December, and ceases by late January. Hatchlings emerge from nests from late December until about late March, with most hatching during February. The Flatback turtle is carnivorous, feeding mostly on soft bodied prey such as sea cucumbers, soft corals and jellyfish. They feed mainly in subtidal, soft-bottomed habitats.</i>	-	-	Vulnerable, Marine, Migratory		No
Great White Shark	<i>Carcharodon carcharias</i>	Shark	<i>Great white sharks are found throughout the world's oceans mostly in temperate and sometimes warm waters but occasionally in cold environments. Coastal and offshore waters of the continental and insular shelves and offshore continental islands</i>	-	-	Vulnerable		No
Streaked Shearwater	<i>Calonectris leucomelas</i>	Bird	<i>This species is found in the western Pacific, breeding on the coast and on offshore islands of Japan, Russia, and on islands off the coasts of China, North Korea and South Korea. It migrates south during winter, being found off the coasts of Vietnam, New Guinea, the Philippines and Australia.</i>	-	-	Marine, Migratory		No
Lesser Frigatebird, Least Frigatebird	<i>Fregata ariel</i>	Bird	<i>A pelagic species found over tropical seas often far from land.</i>	-	-	Marine, Migratory		No
Great Frigatebird, Greater Frigatebird	<i>Fregata minor</i>	Bird	<i>Large seabird which feeds of fish taken in flight from the sea surface (mostly flying fish). Feed in pelagic waters within 80km of breeding colony or</i>	-	-	Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
			roost areas.					
White-throated Needletail	<i>Hirundapus caudacutus</i>	Bird	Migratory terrestrial aerial bird that roosts in trees.	-	-	Migratory Species		No
Black-faced Monarch	<i>Monarcha melanopsis</i>	Bird	Migratory terrestrial bird species found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	-	-	Migratory Species		No
Spectacled Monarch	<i>Monarcha trivirgatus</i>	Bird	The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	-	-	Migratory Species		No
Rufous Fantail	<i>Rhipidura rufifrons</i>	Bird	Occurs in coastal and near coastal areas. Prefers areas of rainforest and sclerophyll forests. Also occur in paperbark and mangrove swamps.	-	-	Marine, Migratory		No
Common Sandpiper	<i>Actitis hypoleucos</i>	Shorebird	In Australia, the Common Sandpiper is found in coastal or inland wetlands, both saline or fresh. It is found mainly on muddy edges or rocky shores. They are migratory, generally breeding in Eurasia during the Australian winter. Eats small molluscs, aquatic and terrestrial insects	-	-	Migratory Species		No
Ruddy Turnstone	<i>Arenaria interpres</i>	Shorebird	Found in most coastal regions and occasionally inland. Prefers open coastlines and beaches with exposed rock, stony or shell beaches, reefs or wave platforms. Also is known to inhabit estuaries, bays and lagoons. Feeds between lower supralittoral and lower littoral foreshore zones, with a particular affinity with seaweed wrack.	-	-	Marine, Migratory		No
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Shorebird	Prefers the grassy edges of shallow inland freshwater wetlands. It is also found around flooded fields, mudflats, mangroves, rocky shores and beaches. A summer migrant from Arctic Siberia, being found on wetlands throughout Australia.	-	-	Migratory Species		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Sanderling	<i>Calidris alba</i>	Shorebird	Found on open sandy beaches at the edge of the waves, on sandbars and spits. They roost on bare sand in the dunes or behind piles of kelp. Migratory species breeding mostly in Siberia, moving south to Australia in mid-July to mid-August, staying for the summer before leaving by May (although some may overwinter in Australia). They eat mainly insects and other arthropods and small crustaceans	-	Vulnerable	Migratory Species		No
Pectoral Sandpiper	<i>Calidris melanotos</i>	Shorebird	Breeds in the northern hemisphere, northern Russia and North America, before migrating to Australia for the southern summer. Prefers shallow fresh to saline wetlands hat have open fringing mudflats and low, emergent or fringing vegetation,. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	-	-	Marine, Migratory		No
Red-necked Stint	<i>Calidris ruficollis</i>	Shorebird	Mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. An omnivorous species, it forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water on a range of marine worms, molluscs, snails and slugs, shrimps, spiders, beetles, flies and ants.	-	-	Marine, Migratory		No
Long-toed Stint	<i>Calidris subminuta</i>	Shorebird	Breeds in the northern hemisphere before migrating to Australia for the southern summer. Forages in the shallows of freshwater and brackish wetlands and less commonly in estuaries. More often around core of low vegetation than on open flats.	-	-	Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Great Knot	<i>Calidris tenuirostris</i>	Shorebird	Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms. Migrates to Australia from late August to early September, although juveniles may not arrive until October-November. Most birds return north in March and April, however some individuals may stay over winter in Australia. Forages for food by methodically thrusting its bill deep into the mud to search for invertebrates, such as bivalve molluscs, gastropods, polychaete worms and crustaceans.	-	Vulnerable,	Critically Endangered, Marine, Migratory		No
Double-banded Plover	<i>Charadrius bicinctus</i>	Shorebird	found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands, pasture and seagrass areas. The species breeds only in New Zealand in July-September, with part of the population migrating to Australia in non-breeding season. It eats molluscs, insects, worms, crustaceans and spiders and sometimes seeds and fruits	-	0	Marine, Migratory		No
Oriental Plover, Oriental Dotterel	<i>Charadrius veredus</i>	Shorebird	Breeds in the northern hemisphere before migrating to Australia for the southern summer. Mostly occurs on the north-west coast and at a few scattered sites elsewhere, seldom recorded in southern Australia. Usually forage among short grass or on hard stony bar ground but also on mudflats or beaches.	-	-	Marine, Migratory		No
Lesser Sand Plover, Mongolian Plover	<i>Charadrius mongolus</i>	Shorebird	Usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. Roosts during high tide on sandy beaches, spits and rocky shores; forage individually or in scattered flocks on wet ground at low tide, usually away from the water's edge. Breeds in the northern hemisphere and heads south for the boreal winter. It also sometime occurs in short saltmarsh or among mangroves. It eats invertebrates, such as molluscs (especially bivalves), worms, crustaceans (especially crabs) and insects.	-	Vulnerable	Endangered, Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Latham's Snipe, Japanese Snipe	<i>Gallinago hardwickii</i>	Shorebird	<i>They usually inhabit open, freshwater wetlands with low, dense vegetation but can also occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers. Omnivorous species forages mudflats and shallow water feeding on seeds and plant material as well as invertebrates including insects, earthworms and spiders.</i>	-	-	Marine, Migratory		No
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Shorebird	<i>Breeds in northern Siberia before migrating south to the southern summer. In NSW the main site for species is the Hunter River estuary with birds occasionally reaching the Shoalhaven estuary. Favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Roost on sheltered sand, shell or shingle beaches.</i>	-	Vulnerable	-		No
Bar-tailed Godwit	<i>Limosa lapponica</i>	Shorebird	<i>Migrates from northern hemisphere. Inhabits coastal mudflats, sandbars and shorelines. Prefer exposed sandy substrates on intertidal flats, banks and beaches. Also prefer soft mud, often with beds of eelgrass <i>Zostera</i> or other seagrasses. Roosts on sandy beaches, sandbars, spits and also in near-coastal saltmarsh.</i>	-	-	Marine, Migratory		No
Black-tailed Godwit	<i>Limosa limosa</i>	Shorebird	<i>The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. forages on wide intertidal mudflats or sandflats, in soft mud or shallow water and occasionally in shallow estuaries. Omnivorous feeding on eating annelids, crustaceans, arachnids, fish eggs and spawn and tadpoles of frogs, and occasionally seeds. Breeds in the northern hemisphere and then migrates to Australia in August before leaving again in March. It is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Frequently recorded in mixed flocks with Bar-tailed Godwits.</i>	-	Vulnerable	Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Little Curlew, Little Whimbrel	<i>Numenius minutus</i>	Shorebird	Most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used. The Little Curlew is omnivorous, mainly eating insects, but also seeds and berries	-	-	Migratory Species		No
Whimbrel	<i>Numenius phaeopus</i>	Shorebird	Regular migrant to Australia from breeding grounds in Alaska. Feeds on mudflats of estuaries and lagoons.	-	-	Marine, Migratory		No
Osprey	<i>Pandion haliaetus</i>	Marine Bird	Coastal waters and estuaries	-	-	Marine, Migratory		No
Ruff	<i>Philomachus pugnax</i>	Shorebird	The Ruff breeds in Europe from north Russia to north-west Kazakhstan before migrating south. It is a rare but common visitor to Australia. The Ruff forages on exposed mudflats, in shallow water and occasionally on dry mud, preferring to roost amongst shorter vegetation.	-	-	Marine, Migratory		No
Pacific Golden Plover	<i>Pluvialis fulva</i>	Shorebird	Inhabits coastal mudflats, sand flats, beaches and saltmarsh. Only rarely occurs inland.	-	-	Marine, Migratory		No
Grey Plover	<i>Pluvialis squatarola</i>	Shorebird	In non-breeding ground in Australia they occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. Usually roost in sandy areas on sheltered beaches or estuaries. Forage exposed mudflats and beaches of coastal estuaries and lagoons.	-	-	Migratory Species		No
Grey-tailed Tattler	<i>Heteroscelus brevipes</i>	Shorebird	Forages on mudflats, sandflats, beaches and also rock ledges and reefs. Often perches on branches, seawalls, jetties and pontoons. In Moreton Bay, Queensland, it is most abundant in areas with dense beds of seagrass.	-	-	Marine, Migratory		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Wood Sandpiper	<i>Tringa glareola</i>	Shorebird	Breeds in the northern hemisphere before migrating to Australia for the southern summer. Generally found inland around freshwater swamps and wetlands, lakes, flooded pasture-usually well vegetated. Infrequent around brackish water and typically do not frequent coastal flats, occasionally mangroves.	-	-	Marine, Migratory		No
Wandering Tattler	<i>Heteroscelus incanus</i>	Shorebird	Almost entirely confined to rocky shorelines, wave-washed tidal platforms and exposed reefs around headlands or high islands.	-	-	Migratory Species (J)		No
Common Greenshank	<i>Tringa nebularia</i>	Waterbird	Recorded in most NSW coastal regions and is widely distributed west of the Great Dividing Range. On the coast it inhabits sheltered estuaries with extensive mudflats, mangrove swamps and muddy shallows. Inland it inhabits billabongs, swamps and the like.	-	-	Marine, Migratory		No
Marsh Sandpiper, Little Greenshank	<i>Tringa stagnatilis</i>	Shorebird	Lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks. The Marsh Sandpiper usually forages in shallow water at the edge of wetlands. They probe wet mud of mudflats or feed among marshy vegetation on insects, molluscs and crustaceans.	-	-	Migratory Species		No
Terek Sandpiper	<i>Xenus cinereus</i>	Shorebird	Mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. Preferring to roost in or among mangroves, birds may perch in branches or roots up to 2 m from the ground. Have been recorded eating crustaceans, insects, seeds, molluscs and arachnids. A rare migrant to eastern and southern Australia. The main sites for the species in NSW are the Richmond River estuary and the Hunter River estuary.	-	Vulnerable	Marine, Migratory		No
Common Sandpiper	<i>Actitis hypoleucos</i>	Shorebird	In Australia, the Common Sandpiper is found in coastal or inland wetlands, both saline or fresh. It is found mainly on muddy edges or rocky shores. They are migratory, generally breeding in Eurasia during the Australian winter. Eats small molluscs, aquatic and terrestrial insects	-	-	Migratory Species		No

Shaws Bay Dredging and Foreshore Improvements: Review of Environmental Factors

Common Name	Species	Type	Habitat & Ecology	Conservation Status			Potential to be affected	Assessment of significance required?
				FM Act	BC Act	EPBC		
Great Egret	<i>Ardea alba</i>	Waterbird	Migratory wetland bird species that inhabits inland and coastal wetlands and frequents river margins, lakes shores, marshes and flood-plains.	-	-	Marine, Migratory		No
Ruddy Turnstone	<i>Arenaria interpres</i>	Shorebird	Found in most coastal regions and occasionally inland. Prefers open coastlines and beaches with exposed rock, stony or shell beaches, reefs or wave platforms. Also is known to inhabit estuaries, bays and lagoons. Feeds between lower supralittoral and lower littoral foreshore zones, with a particular affinity with seaweed wrack.	-	-	Marine, Migratory		No
Sanderling	<i>Calidris alba</i>	Shorebird	Found on open sandy beaches at the edge of the waves, on sandbars and spits. They roost on bare sand in the dunes or behind piles of kelp. Migratory species breeding mostly in Siberia, moving south to Australia in mid-July to mid-August, staying for the summer before leaving by May (although some may overwinter in Australia). They eat mainly insects and other arthropods and small crustaceans	-	Vulnerable	Migratory Species		No
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Marine Bird	Usually coastal areas including beaches, normally seen perched high in a tree, or soaring over waterways and adjacent land.	-	-	Migratory Species		No
Black-winged Stilt	<i>Himantopus himantopus</i>	Shorebird	Black-winged Stilts are a wader, preferring freshwater and saltwater marshes, mudflats, and the shallow edges of lakes and rivers. feed mainly on aquatic insects, but will also take molluscs and crustaceans.	-	-	Marine		No
Wood Sandpiper	<i>Tringa glareola</i>	Shorebird	Breeds in the northern hemisphere before migrating to Australia for the southern summer. Generally found inland around freshwater swamps and wetlands, lakes, flooded pasture-usually well vegetated. Infrequent around brackish water and typically do not frequent coastal flats, occasionally mangroves.	-	-	Marine, Migratory		No

APPENDIX 6: HERITAGE SEARCH RESULTS

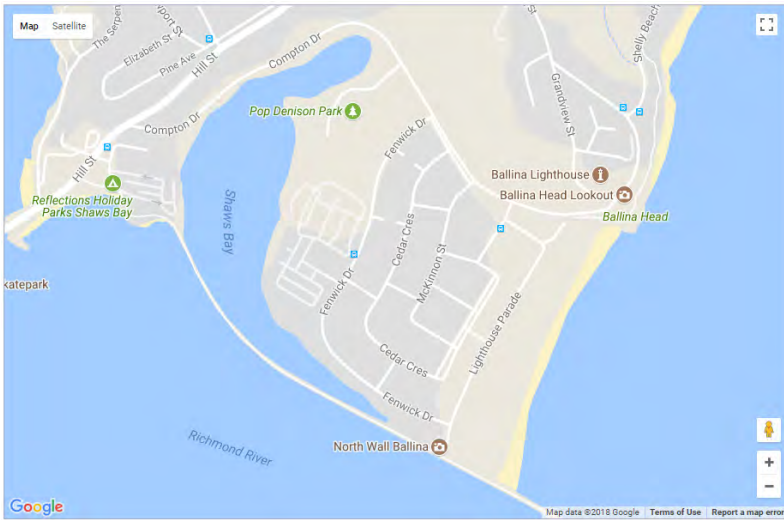


Figure 17: State Heritage Register search results (no results within search area)



Figure 18: Ballina LEP 2012 heritage items



AHIMS Web Services (AWS) Search Result

Purchase Order/Reference : Shaws Bay
Client Service ID : 332688

Hydrosphere Consulting
P O Box 7059
Ballina New South Wales 2478
Attention: Uriah Makings
Email: uriah.makings@hydrosphere.com.au

Date: 09 March 2018

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat. Long From : -28.8746, 153.5745 - Lat. Long To : -28.8621, 153.5944 with a Buffer of 50 meters, conducted by Uriah Makings on 09 March 2018.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

4 Aboriginal sites are recorded in or near the above location.

1 Aboriginal places have been declared in or near the above location. *

ID	Aboriginal Place Name
82	East Ballina (Angels Beach)