

7 Marine Factors - Construction Impacts

7.1 Construction Background

This chapter describes the proposed seawater intake and brine discharge pipelines and diffuser for the SSDP, and then evaluates the potential impacts of the construction of these facilities and proposes management and mitigation actions to reduce impacts.

The SSDP is to be developed in two stages. However, to minimise the impacts of construction on the marine environment, including use of the beach and foreshore, the Corporation proposes to install the intakes and outlets (and pipelines to and from the shore-based pump station) for the ultimate capacity (100GL/yr) of the plant once only. Temporary structures (such as jetties and sheet piling) will be removed at the completion of construction.

The factors considered in this chapter are:

1. Benthic habitat;
2. Marine fauna;
3. Coastal processes;
4. Marine water quality and sediment quality; and
5. Wastes.

7.1.1 Intake Infrastructure

Figure 7.1 and Figure 7.2 show a schematic plan and long section of the concept design respectively for the proposed intake (and outlet) facilities. The concept design has separate seawater intake structures located between 400 and 600m offshore for Stage 1 and Stage 2 of the desalination plant. If two seawater intake structures are used, each intake structure will nominally comprise a large circular screen 7.5 m in diameter and 2 m high located 3.5 m below the surface where the water is about 9 m deep. The screen will be above the seafloor (to avoid sand and seaweed being drawn in) and below the ocean surface (to avoid air and floating material being drawn in, and allow boats to pass safely overhead). If a single intake structure is used it will have a diameter of around 15m. It is also possible that subsurface (ie buried) intake structures may be the preferred design, which result in less disturbance of the seabed during construction.

Locating the intake(s) between 400 and 600m offshore will ensure that there is no impact on sensitive benthic habitat or reef (there are no reefs along the proposed pipe alignment and seagrass does not begin to appear until 1 km or so offshore (UWA 2008a)).

Unless subsurface (buried) intake structures are used, there will be up to 4 intake pipelines of up to 3 m diameter which will convey seawater from the intake structure to the seawater pumping station about 150 m or more inshore from the shoreline, and hence be about 610 m or longer.

Across the beach, the pipelines will be buried 2 m beneath the lowest expected depth of beach erosion to avoid exposure of the pipes. The depth of burial will decrease with distance offshore but with sufficient cover to prevent the pipe being exposed with the erosion from a one in 100 year storm.

The top of the pipes will emerge from the seabed at approximately 6 m depth. This will ensure that the pipes are not visible from the beach and will not interrupt the longshore sand movement that occurs in the nearshore zone

Further offshore from the 6 m depth contour, the intake pipes will be partly or fully buried in the sand. The pipes will be held in position by a combination of anchor piles, rock protection and concrete mats, depending on the pipe material selected for use. To avoid disturbing currents and local sand movement, the top of the pipe and rock protection will not be more than 1 m above the seabed or 10 % of the local seawater depth (whichever is the smaller).

7.1.2 Outlet Infrastructure and Diffuser

Figure 7.1 and Figure 7.2 shows a schematic plan and long section of the concept design for the proposed outlet facilities. The main outlet items are as follows:

- Up to 4 pipelines of up to 3 m diameter will be used to convey brine to a diffuser where brine is released as a series of jets just above the seafloor; and
- The concept design assumes two identical 220m long diffusers, each designed to discharge a flow of 70 GL/yr of brine. Assuming a 100 m gap between the one intake and the beginning of the diffusers, one diffuser would be located from 580 to 800 m from shore and the other diffuser would be located from 800 to 1040 m from shore. Alternatively, a single 440 m long diffuser located from 580 to 1040 m from shore can be used (further details can be found in KBR 2008a and in Chapter 8.1).

Locating the diffusers within 1100 m of the shore on the proposed alignment (see Figure 8.1) will ensure that there is no impact on sensitive benthic habitat or reef (there are no reefs along the proposed outlet pipeline and diffuser alignment and seagrass beds does not begin to appear until 1.3 km offshore along the proposed alignment (UWA 2008a)).

The brine discharge pipes will be buried under the beach, surf zone and near shore area – to at least the 6 m depth contour - with sufficient cover to prevent the pipe being exposed with the erosion from a 1 in 100 year storm.

The discharge pipes will gradually emerge from the seabed offshore from approximately 6 m depth. Offshore of the 6m contour, the pipe will be sufficiently buried so that it does not protrude above the seabed more than 1 m or 10 % of the ocean water depth at that point.

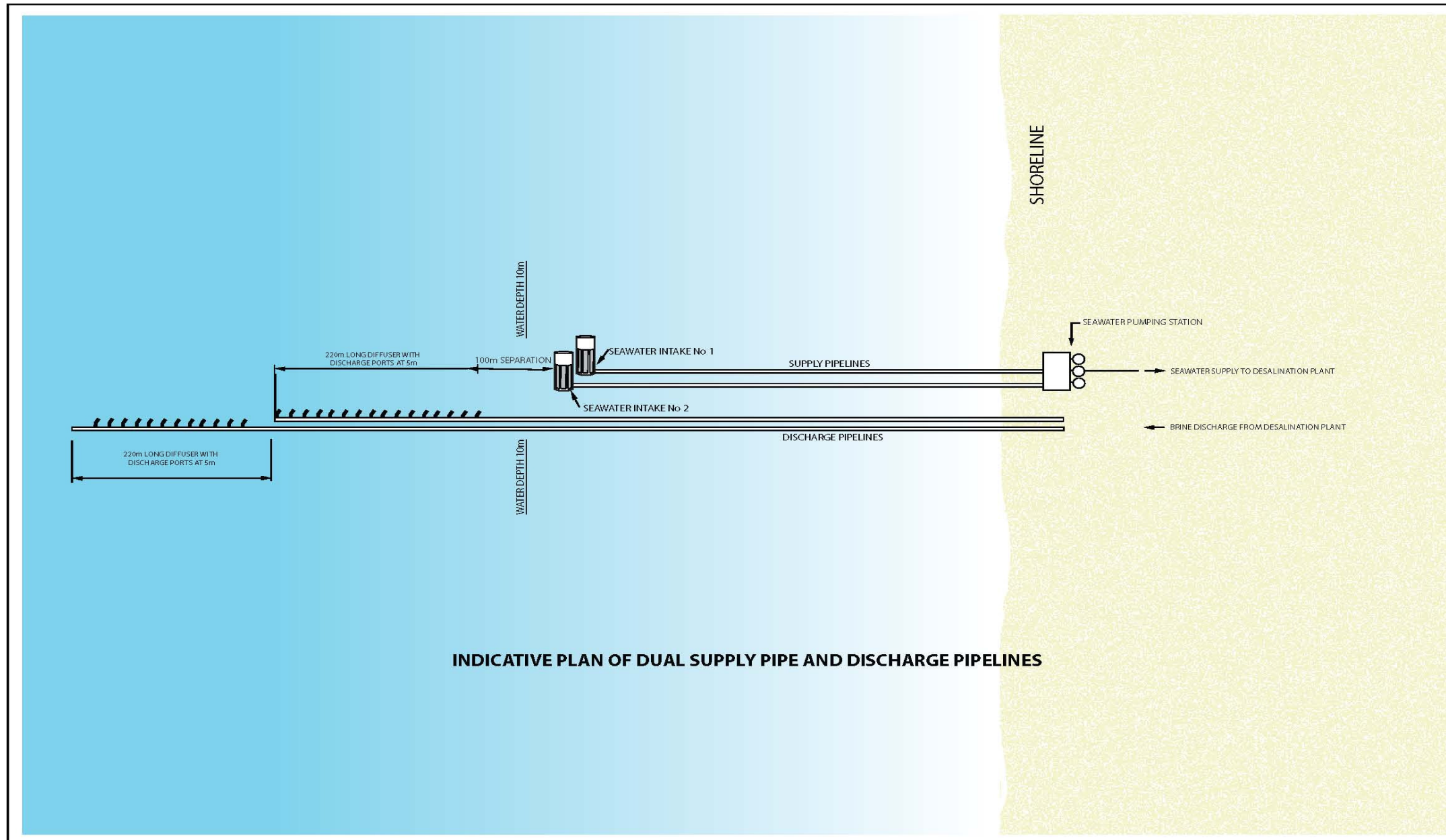


Figure 7.1 Indicative Concept Design for Intake and Outlet Facilities

7.1.3 Construction Options

Based on discussions with potential contractors and experience in other desalination and outlet projects, it is considered that the most feasible method to construct the intakes and brine discharge systems would be from a temporary trestle or jetty. Figure 7.2 shows the design concept for the temporary jetty which would extend from the base of the dune (about 4m AHD) to approximately 480m offshore. The temporary jetty would comprise two lines of steel piles at about 8m spacing, with a steel framework supported from the piles. There would be rails on the frame to allow cranes, dredges and other equipment to travel out and back on the jetty, and a personnel walkway on one side.

For safety reasons, the beach within 200 m either side of the jetty will be closed for the period of construction and there will be no public access to the jetty. A marine exclusion zone 500m north and south of the offshore pipeline(s) construction area will also be in place during construction.

It is expected that the intake pipelines will be installed on one side of the jetty, with the discharge pipelines installed on the other side of the jetty.

The main steps in the proposed marine construction sequence are likely to be as follows:

- Fabricate pipes at an appropriate location and bring to the site.
- Fabricate intake structures at an appropriate location ready to bring to site.
- Close beach and construct first two bays of jetty on the beach.
- Install sliding frame on the jetty and progressively move frame offshore to construct all offshore bays of the jetty.
- Drive sheet piles next to the jetty across the beach, excavate sand and install cross beam.
- Place pipes in trench within excavation surrounded by sheet piles (assume these are discharge pipes, although the contractor may install intake pipes first).
- Support pipes from cross beam and install backfill and rock protection around pipes.
- Remove sheet piles and drive again moving forward along the jetty.
- Excavate sand and install cross beam.
- Place pipes in trench within new excavation and connect to existing pipes.
- Continue process until about the 6 m depth contour.
- From about the 6 m depth contour shoreward, sheet piles may not be required and the trench can be excavated by a small dredge working from the jetty.

- Continue installing discharge pipes to the end of the jetty.
- Meanwhile, excavate the trench offshore from the jetty using either a clam shell bucket or a backhoe or similar, working from a barge or walking platform.
- Tow the offshore discharge pipes fitted with risers (with blank flanges) into position and sink them into the trenches.
- Secure the offshore pipe with piles and/or rock armour.
- Remove the blank flanges and install the discharge nozzles.
- Connect discharge pipes at the end of the jetty.
- Repeat the sheet piling and pipe installation process on the other side of the jetty to install the intake pipelines to about the 6 m depth contour.
- From about the 6 m depth contour, sheet piles may not be required and the trench can be excavated by a small dredge working from the jetty.
- Continue installing intake pipes to the length required (near the end of the jetty).
- Secure the intake pipelines with piles and rock armour.
- Tow the discharge structures into position, sink into position and connect to the intake pipelines.
- Secure the intake structure with piles and rock armour.
- Install scour protection around the intake structures.
- Remove temporary jetty.
- Reinststate the beach to the natural profile.
- Construct a new foredune in the blow out area and revegetate to prevent subsequent erosion.
- Remove all temporary facilities, equipment and materials and leave beach and coastal site in the same condition as at the commencement of construction (apart from the new foredune).

The pipelines beyond the jetty would be fabricated on the shore and towed into position. Shallow trenches would be excavated to provide a base for the pipes and to limit the protrusion of the pipes above the seafloor.

The jetty is likely to remain in place for up to 18 months, depending on the method of construction, difficulties encountered and the sequence of construction.

7.1.4 Excavation Issues

Sand removed during excavation will be dropped beside the trenches or either side of the jetty where ocean currents would redistribute it back to the original profile.

Rock removed from the trenches will be dropped beside the exposed pipelines further offshore to anchor them in place. No rock will be left on the beach or near shore zone closer to shore than the 5 m depth contour, except when it can be placed at the same depth from which it was removed.

Blasting of rock may be required in very short sections where there is very hard rock. If blasting is required, all precautions would be followed to minimize the impacts on marine life and public amenity in accordance with the EPBC Act.

7.1.5 Pipe Installation by Drilling

To progress construction during periods of rough seas, the marine contractor may elect to drill some of the pipes from the shore to the intake structures (in the case of the inlet pipes) or to the end of the jetty (in the case of the discharge pipes).

There are two basic methods for pipe construction by drilling:

1. Inclined drilling of a series of parallel smaller diameter pipes in a vertical curve from well behind the shore; and
2. Direct drilling and jacking, where larger diameter pipes are installed in a straight line.

Drilled pipes will have the benefit of avoiding excavation of the beach and near shore zone from the temporary jetty, but the disadvantages of possibly needing more pipes (particularly for inclined drilling) and a separate drilling area. Also, drilling equipment may be difficult to obtain. With inclined drilling, the work would commence about 100 m inland. With direct drilling, the work would commence in a vertical caisson on the site of the proposed seawater pumping station.

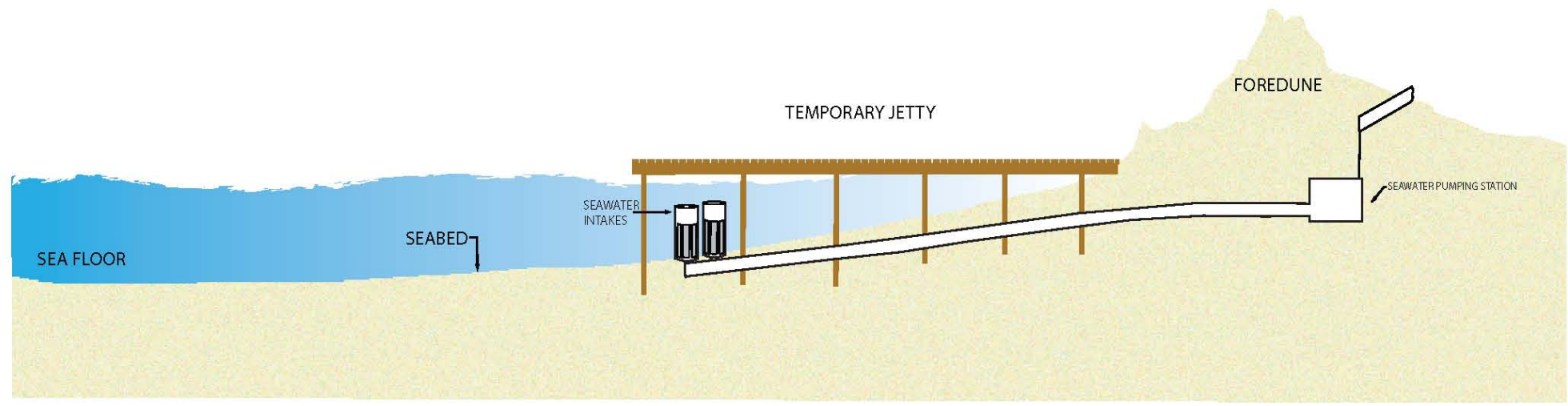
Drilling would require less excavation of the nearshore zone (and offshore zone, depending on the length drilled). It is expected that the drilling will be designed to intersect caissons installed at the end of the jetty, in which case there would be no loss of drilling mud into the ocean. However it is possible that the contractor may elect to drill and install HDPE pipes to the end of the jetty before the jetty or caissons are in position, in which case there would be a small discharge of drilling mud (in negligible concentrations) at the point where the borehole reaches the seabed.

7.1.6 Pipe Materials for Concept Design

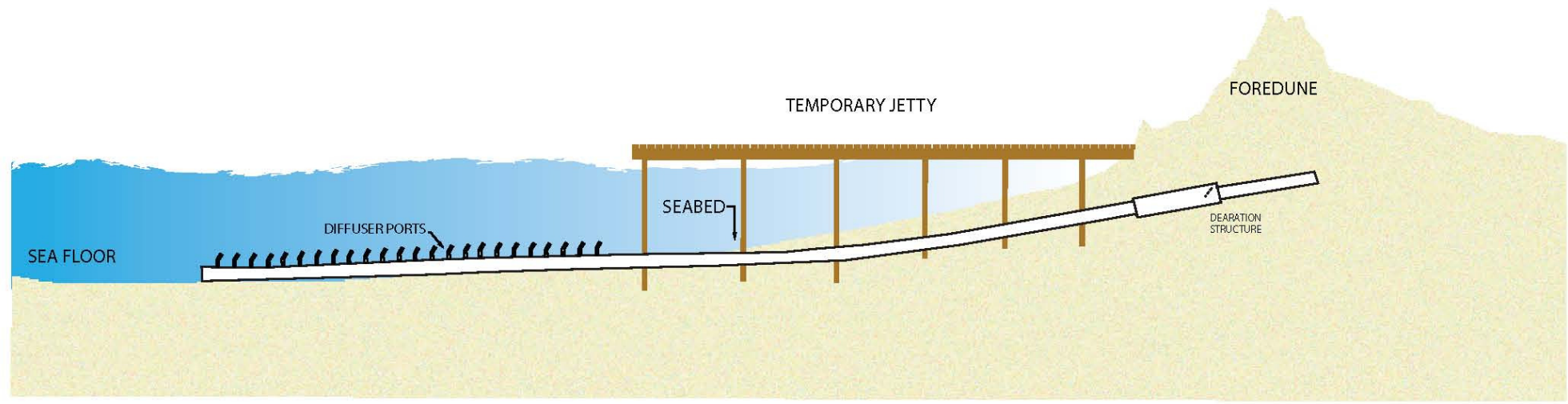
There are several pipeline materials that could be used, including steel (with cement mortar or epoxy or sintacoat lining); MDPE and reinforced concrete pipe. The pipe material must be selected in conjunction with a decision on the depth and extent of burial of the pipelines – buried pipelines are more likely to be MDPE while surface pipelines are more likely to be steel, to handle the forces from waves and currents.

7.1.7 Areas Potentially Impacted by Construction

The total length of pipeline from the shore to the end of the last diffuser will not be more than 1100 m. To provide some flexibility and also space for anchoring marine construction equipment, the potential corridor of disturbance is 1300 m long and 200 m wide, centred on the proposed pipeline alignment.



INDICATIVE SEAWATER INTAKE PIPELINE DIG AND LAY INSTALLATION



INDICATIVE BRINE DIFFUSER PIPELINE DIG AND LAY INSTALLATION

Figure 7.2 Indicative Concept Design for Temporary Jetty

7.2 Benthic Habitat (Flora)

7.2.1 EPA Objective

- To maintain the ecological function, abundance, species diversity and geographic distribution of benthic habitat in order to protect ecosystem health; and to protect marine flora consistent with the *Wildlife Conservation Act 1950*.

7.2.2 Potential Impact

Physical disturbance of the benthic habitat from machinery used to install marine infrastructure will be minimal as no seagrass beds were found until a distance of 1.3 km offshore along the proposed corridor of disturbance (UWA 2008a). Benthic habitat (flora) could be disturbed due to increased turbidity (for example, from dredging) shading seagrasses and limiting their ability to photosynthesis, or by smothering with sediment particles.

Construction is unlikely to result in any net impact to the regional ecological representation, health or functioning of marine flora (UWA 2008a).

Oceanica were commissioned to carry out a survey, investigating the impact upon Binningup seagrasses and sessile invertebrates as a result of dredging activities (Oceanica 2008b). This study has shown that seagrasses which naturally occur in the area (*Posidonia angustifolia* and *coriacea*) can survive long periods of sub-minimum light. As duration of the offshore portion of dredging at the site will total no longer than 4 months, will not be continuous, and plume movement over seagrass meadows will be intermittent according to current direction, turbidity associated with dredging for the SSDP is unlikely to result in the loss of seagrass. Furthermore, at Binningup, the main species to be affected by the proposed dredging will be *Posidonia angustifolia*, which appears to tolerate low light levels. There is some potential for temporary impacts on biomass and shoot density (Oceanica 2008b).

There are a range of construction techniques which could be used to install each of the seawater intake pipelines and the brine outfall pipelines. The possible impacts to marine flora from seawater pipeline construction can be grouped into the broad areas discussed below.

7.2.3 Damage to or Removal of Marine Flora through Construction

Construction of marine intake and outlet infrastructure is likely to cause physical disturbance to the seabed during site preparation and the construction of marine pipelines and structures. This is unlikely to have a significant effect on marine habitat in the Binningup Beach area as:

- There is no habitat reef in the areas in which the marine structures will be built (see Fugro 2008a and UWA 2008a); and
- There are no significant seagrass beds or other marine flora assemblages in the areas in which the structures will be built (UWA 2008a).

7.2.4 Introduction of Weed or Invasive Species

Weeds are marine flora that are not endemic or naturally occurring in the area. Some such weeds may invade or compete with native vegetation. This could potentially affect the marine ecological processes of the area. Weeds and non-endemic species may be introduced by marine vessels through ballast water discharge or through the inhabitation of marine vessel hulls.

7.2.5 Pollution of Marine Waters through Construction

Possible sources of marine pollution during construction include pollution through:

- Water pollution by fuels or drilling mud (resulting on physiology and functioning of marine flora)

7.2.6 Policy and Standards

- EPA Guidance 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.
- Perth Coastal Water Environmental Values and Objectives.

7.2.7 Management of Impacts

The Water Corporation proposes to locate marine infrastructure in an area which does not contain significant marine flora and/or ecological communities (UWA 2008a; Maunsell 2008), hence potential impacts to marine flora have been minimised through site selection processes.

The environmental management of possible construction impacts to marine flora is detailed in the management plans contained in the Construction Environmental Management Framework (Appendix C). The management actions in these plans include:

- Inspections to ensure that marine vessels at the construction site are free from introduced hull fouling organisms.
- Ballast water will be discharged in accordance with Australian Quarantine Inspection Services (AQIS) requirements; hence it will not impact upon the SSDP marine construction area.
- Light Attenuation Co-efficient (LAC) and turbidity monitoring will be undertaken during marine construction.
- Re-fuelling of marine vessels will not be allowed at sea. Any re-fuelling should occur at Bunbury Port.
- Only water based drilling muds will be used.

7.2.8 Predicted Outcome

The EPA objective of maintaining the ecological function, abundance, species diversity and geographic distribution of benthic habitat will be met through avoidance of significant marine habitat and management of adverse construction impacts as per the Construction Environmental Management Framework (Appendix C).

7.3 Marine Fauna

7.3.1 EPA Objective

- To maintain the ecological function, abundance, species diversity and geographic distribution of marine fauna in order to protect ecosystem health, in accordance with the values and objectives identified in Perth Coastal Waters Environmental Values and Objectives; and to protect marine fauna consistent with the *Wildlife Conservation Act 1950*.

7.3.2 Potential Impact

Construction techniques are unlikely to result in any net impact to the regional ecological representation, health or functioning of marine fauna (Maunsell 2008).

A study commissioned by the Water Corporation (Western Whale Research 2008) confirmed that there are cetacean species at Binningup include southern right whales and dolphins (most likely bottlenose). These are sometimes found as close as 200m offshore. Construction may cause some displacement, however the construction activities will be localised and temporary so some species may develop new movement or migratory patterns to avoid these activities. This is unlikely to impact on their population (Western Whale Research 2008).

Oceanica conducted a sessile invertebrate study to identify the likely impacts to marine invertebrates from construction activities such as dredging, which may reduce light availability to benthic organisms (Oceanica 2008b). It was found that natural levels of turbidity in bottom waters in the Binningup region encompass the range of turbidity likely to be generated by dredging. Sessile invertebrates in the region are therefore species able to cope with periodic elevations in turbidity. Furthermore, the assemblage of invertebrate species present are those adapted to a high degree of sediment movement, indicating that they recolonise quickly after disturbance, as such they should establish rapidly once dredging ceases. Impacts in the invertebrate communities are therefore expected to be minimal, highly localised and temporary (Oceanica 2008b).

There are a range of construction techniques which could be used to install each of the seawater intake pipelines and the brine outfall pipelines. The possible impacts to marine fauna from seawater pipeline construction can be grouped into the broad areas discussed below.

7.3.3 Damage to or Removal of Marine Fauna through Construction

Construction of intake and outlet infrastructure is likely to cause physical disturbance to the seabed during site preparation and the construction of marine pipelines and structures. This is unlikely to have a significant effect on marine habitat in the Binningup Beach area as:

- Construction works will be localised and temporary and as such the effect on benthic invertebrates will not cause any permanent impact;
- There is no habitat reef in the area in which the marine structures will be built (Fugro 2008a; UWA 2008a);
- The fish and marine species in the immediate area of the proposed marine construction area are well represented in surrounding regions (Maunsell 2008);
- Sessile invertebrates readily recolonise;
- An ocean watch vessel will be deployed before any blasting or pile driving activities to observe for cetacean species. The advice of Western Whale Research will be retained during to construction period; and
- Mobile marine vertebrate fauna such as whales, dolphins and whiting are likely to avoid construction activities and equipment.

7.3.4 Introduction of Pests or Invasive Species

Pests are marine fauna that are not endemic or naturally occurring in the area. Some such pests may invade or compete with native fauna. This could potentially affect the marine ecological processes of the area. Pests and non-endemic species may be introduced by marine vessels through ballast water discharge or through inhabiting the hulls of marine vessel.

7.3.5 Pollution of Marine Waters through Construction

Possible sources of marine pollution during construction include pollution through:

- Water pollution by fuels or drilling mud

7.3.6 Policy and Standards

- EPA Guidance 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.
- Perth Coastal Water Environmental Values and Objectives.

7.3.7 Management of Impacts

The Water Corporation has determined a suitable area for marine infrastructure location, which does not contain significant marine fauna and/or ecological communities (UWA 2008a, Maunsell 2008), hence potential impacts to marine fauna has been minimised through site selection processes.

The environmental management of possible construction impacts to marine fauna is detailed in the management plans in Appendix C. These management actions include:

- Inspections to ensure that marine vessels at the construction site are free from introduced hull fouling organisms.
- Ballast water will be discharged in accordance with Australian Quarantine Inspection Services (AQIS) requirements; hence it will not impact upon the SSDP marine construction area.
- Light Attenuation Co-efficient (LAC) and turbidity monitoring will be undertaken during marine construction.
- Only water based drilling muds will be used.
- If possible, blasting will be avoided but in the event that it is required a Blasting Management Plan (see Appendix C), which will protect cetaceans such as whales and dolphins will be employed.

7.3.8 Predicted Outcome

The objective of maintaining the ecological function, abundance, species diversity and geographic distribution of marine fauna will be met by the SSDP project through the avoidance and management of adverse operational impacts and as such will protect ecosystem health and marine fauna.

7.4 Coastal Processes

7.4.1 EPA Objective

To maintain seascape and landform integrity, ecological functions and environmental values and to ensure that the development does not significantly impact upon coastal processes

7.4.2 Potential Impact

Measurement of beach profiles indicated that the beaches around Binningup are regularly eroded by winter storms and rebuilt during summer (UWA 2008b). The sheet piling and jetty structure have the potential to interrupt alongshore sediment movement, resulting in increased erosion and/or accretion.

7.4.3 Policy and Standards

- EPA Guidance 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.
- EPA Perth Coastal Waters Environmental Values and Objectives.
- WA Planning Commission Statement of Planning Policy no. 2.6
- EPA Guidance 33: Draft environmental guidance for planning and development.
- WAPC Development Control Policy 6:1 Country Coastal Planning Policy

7.4.4 Management of Impacts

A detailed bathymetric and seabed feature survey was conducted (Fugro 2008a) in the immediate vicinity and surrounds of the proposed SSDP marine infrastructure location (see Figure 2.11). The beach also been profiled (UWA 2008e) and will be profiled before and after construction. Management actions in the management plans (see Appendix C) include:

- Immediately restoring any areas of significant erosion or accretion that occur during construction
- Removing all jetties and sheet piling once construction is finished; and
- Restoring the beach and fore dunes at the conclusion of construction.

7.4.5 Predicted Outcome

As the marine construction will be localised and temporary with appropriate management actions and monitoring in place, the seascape and landform integrity will be maintained. Ecological functions and environmental values will also be maintained as construction will not significantly impact upon coastal processes.

7.5 Marine Water Quality and Sediment Quality

7.5.1 EPA Objective

- To maintain the overall marine water and sediment quality; and
- To protect objectives defined in the ANZECC water and sediment quality guidelines.

7.5.2 Potential Impact

There are a range of construction techniques which could be used to install each of the seawater intake pipelines and the brine outfall pipelines. The possible impacts to marine water quality and sediment during construction relate seawater infrastructure construction is related to pollution.

7.5.3 Pollution of Marine Waters through Construction

Possible sources of marine pollution during construction include pollution through:

- Water pollution by fuels or drilling mud.

7.5.4 Policy and Standards

- Australian and New Zealand Water and Sediment Quality Guidelines.
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting.
- EPA Perth Coastal Waters Environmental Values and Objectives.
- EPA Guidance 29: Benthic Primary Producer Habitat Protection for Western Australia's Marine Environment.
- EPA Guidance 33: Daft Environmental Guidance for Planning and Development.

7.5.5 Management of Impacts

Relevant management actions in Management plans (see Appendix C) include:

- Only water based drilling muds will be used.

7.5.6 Predicted Outcome

The overall marine water and sediment quality will be maintained throughout the construction of the SSDP and as such the objectives defined in the ANZECC water and sediment quality guidelines will be protected.

7.6 Wastes

7.6.1 EPA Objective

- To maintain the integrity, ecological function and values of the environment and to ensure that emissions do not adversely affect health, welfare and amenity of people and land uses;
- Manage wastes in accordance with the Waste Hierarchy; and
- To take all reasonable and practical measures to minimise the generation of wastes and discharge into the environment.

7.6.2 Potential Impact

The construction works will produce a range of liquid and solid wastes. These wastes include:

- Spoil and/or surplus rock from construction activities or backfilling.

- Used lubricating oils from marine machinery maintenance.
- Human wastes.

Inappropriate waste disposal has the potential to contaminate the marine waters and sediments and could in turn lead to impacts upon marine flora, fauna and habitat.

7.6.3 Policy and Standards

- Environmental Protection (Controlled Waste) Regulations 2004 (WA).
- Country Sewerage Policy (Health Department of Western Australia et al. 1999).
- *Health Act 1911.*

7.6.4 Management of Impacts

A detailed Waste Management Plan is provided in Appendix C. Waste management actions include:

- Wastes associated with construction, which are not native to the marine environment, will not be disposed of at sea.
- All wastes will be recycled where possible, unless an appropriate facility does not exist within 50 km of the construction area.
- The lowest level of hydrocarbons (oil, grease, petrol, diesel, drilling mud) practicable will be stored on site.
- Hydrocarbons will be managed by a Controlled Waste Contractor licensed under the Environmental Protection (Controlled Waste) Regulations 2004 (WA). All waste hydrocarbons will be collected and stored in labelled collection drums. The drums will be disposed of off-site by a licensed waste disposal company, utilising a licenced Waste Transportation Company to transfer and treat the waste by a licensed Waste Receiver.
- Reporting of incidents of hydrocarbon spills of greater than 20L will follow incident management procedures.
- The uncontrolled release of more than 250L of any chemical stored, will be reported to the DEC within 24 hours of becoming aware of the release.
- Domestic wastewater (including human wastes) will be treated onsite in a commercial packaged wastewater treatment plant (e.g. Bio-Max or Eco-Max) or connected to sewer for treatment at the Binningup Wastewater Treatment Plant.

7.6.5 Predicted Outcome

The ecological function and values of the Binningup marine environment will be maintained and the health, welfare and amenity of people and land uses will not be impacted through wastes generated by the construction of the desalination plant.