SMITH BAY WHARF

DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX G

PREPARED FOR KANGAROO ISLAND PLANTATION TIMBERS BY ENVIRONMENTAL PROJECTS

JANUARY 2019

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APPENDIX **G**

APPENDIX G – COASTAL PROCESSES

Appendix G –
Coastal Process Impact Assessment – BMT

Smith Bay EIS - Coastal Process Impact Assessment

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Synopsis:This technical report presents a coastal process impact assessment for the proposed Kangaroo Island Plantation Timber Smith Bay wharf facility.

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1 Introduction

1.1 Project Description

Kangaroo Island Plantation Timbers (KIPT) propose to develop a deep-water wharf at Smith Bay on the north coast of Kangaroo Island (Figure 1). The wharf will be capable of accommodating 30,000 DWT bulk carrier ships. Although the primary purpose of the wharf will be to export timber from plantations on the island, KIPT proposes to make it available for other shipping uses.

The main features of the development at Smith Bay will be:

- A rock-armoured causeway extending approximately 250m offshore;
- A piled jetty extending further out to a floating wharf, approximately 340m offshore;
- Capital dredging of approximately 100,000 m^3 to create berth pockets adjacent to the wharf and additional dredging of approach regions; and
- The dredged material will be placed onshore and dewatered before being used to construct the core of the causeway.

The onshore component of the development at Smith Bay will entail constructing several level tiers over an area of approximately 8 ha to store logs, access roads and associated amenities.

In February 2017 the South Australian Minister for Planning declared Kangaroo Island Plantation Timbers' proposal a major development under s.46 of the Development Act 1993 (SA). Section 46 ensures that matters affecting the environment, the community or the economy to a significant extent are fully examined and taken into account in the assessment of the proposal. As part of the development application an Environmental Impact Statement (EIS) is being submitted to State and Commonwealth regulators.

1.2 Objectives and Purpose

BMT was commissioned to undertake an assessment of baseline conditions and potential environmental impacts for the project related to coastal processes. As part of these baseline and impact assessments. This report details the coastal process baseline and risk assessment for the Project.

The coastal process impact assessments described in this report have been based on the application of calibrated and validated numerical models developed for the KIPT Project. The numerical models and their application is detailed in the *Smith Bay EIS – Hydrodynamic Modelling Report* (BMT 2018b). The coastal process assessment has also been informed by the *Smith Bay Design Wave and Water Level Assessment* (BMT 2018a), which was undertaken to inform Project design studies. Construction phase and operational water quality impacts have been assessed separately in the *Marine Water Quality – Baseline and Impact Assessment* (BMT 2018c).

Figure 1-1 Proposed export facility at Smith Bay – Site plan

2 Baseline Conditions

2.1 Study Location

Smith Bay is located on the northern coastline of Kangaroo Island, facing onto Investigator Strait. The Yorke Peninsula coastline is approximately 50 km north of the Smith Bay coastline.

2.2 Bathymetry

Smith Bay is a relatively shallow (i.e. straight) embayment, flanked by headlands to the east and west. At the proposed Project site the offshore bathymetry slopes offshore from 0 mMSL and -10 mMSL at around 1 in 25. The offshore bathymetric gradient reduces to around 1 in 60 between -10 mMSL and -15 mMSL. Navigable depths for the Project design vessel occur around 600 m from the Smith Bay shoreline, while the proposed wharf structure is to be located around 340 m offshore. A bathymetric feature thought to be a remnant paleo channel is apparent in the offshore contours immediately inshore of the proposed wharf location.

2.3 Data Collection

The following data has been collected which inform the KIPT coastal process baseline and impact assessments:

- 12 months of wave and current profile data, to inform project design (MSI 2017).
- 12 months of turbidity and temperature data (BMT 2018c).
- 6 weeks of ADCP, turbidity and PAR measurements at 3 locations (BMT 2018b).
- Sediment sampling and analysis (COOE 2017).

The sampling and measurement locations are shown in Figure 2-3. Seawater intakes for the Yumbah aquaculture facility are also shown on this figure. These represent sensitive receptor locations relevant to the coastal process impact assessments.

2.4 Wind

All-year and seasonal wind roses for Smith Bay have been derived from the NCEP CFSR global reanalysis dataset and are shown in Figure 2-4 . These windroses demonstrate that the wind climate is highly seasonal.

During the May to October season the winds are predominantly from the WSW to N sector. Winds with a northerly component are onshore at Smith Bay. During this season wind speeds are frequently in excess of 20 knots.

During the November to April season winds are predominantly from the ESE to S sectors, which is offshore at Smith Bay. During this season wind speeds are generally mild and are very rarely in excess of 20 knots.

Title:
Study Location

Figure: 2-1

Rev: A

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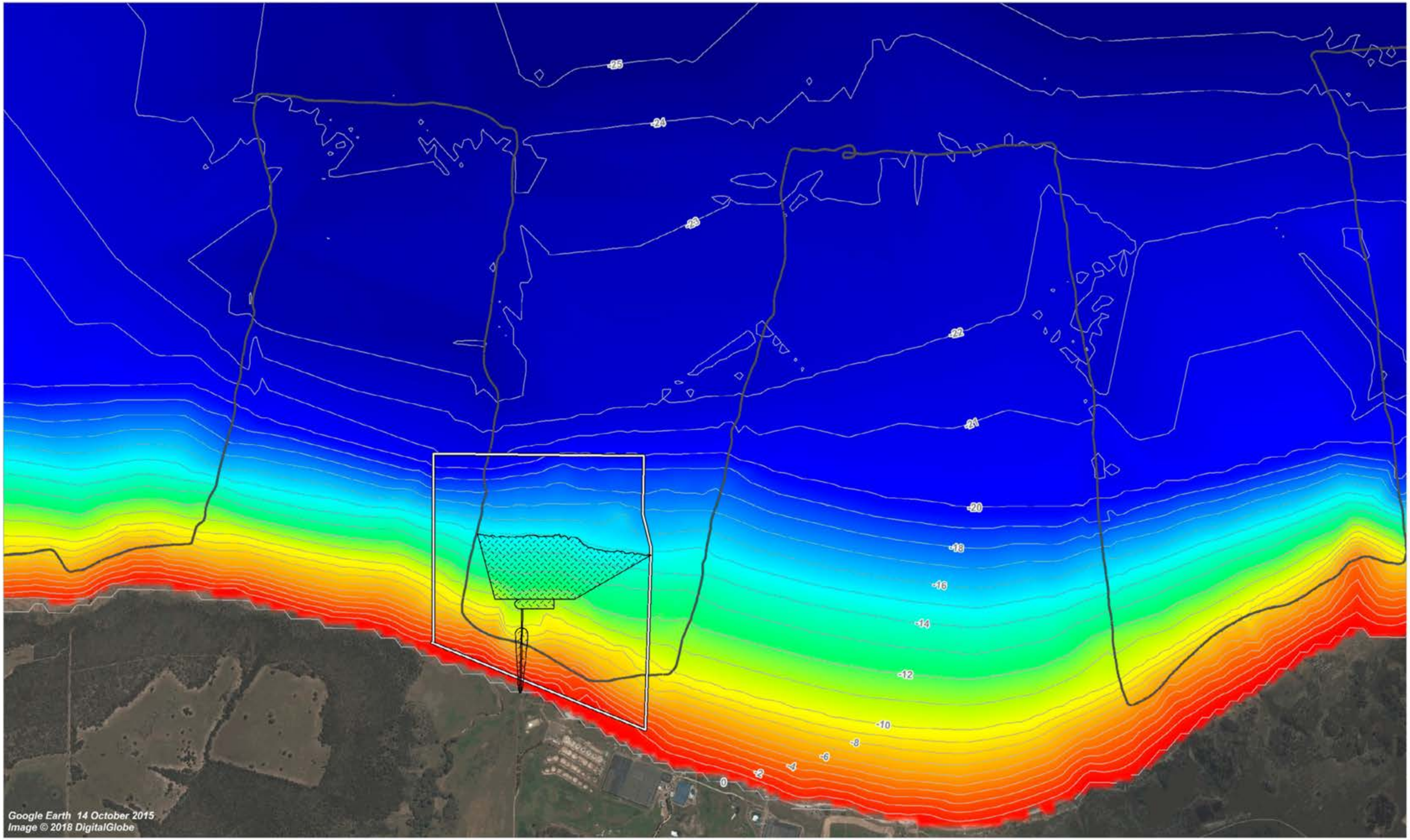

LEGEND

Contours (1m interval)

BMT Depth Soundings

Dredge Area and Causeway Footprint

Detailed Bathymetry Extent

-30 -25 -20 -15 -10 -5 0

Elevation (m MSL)

Title:

Smith Bay Bathymetry

Figure: 2-2

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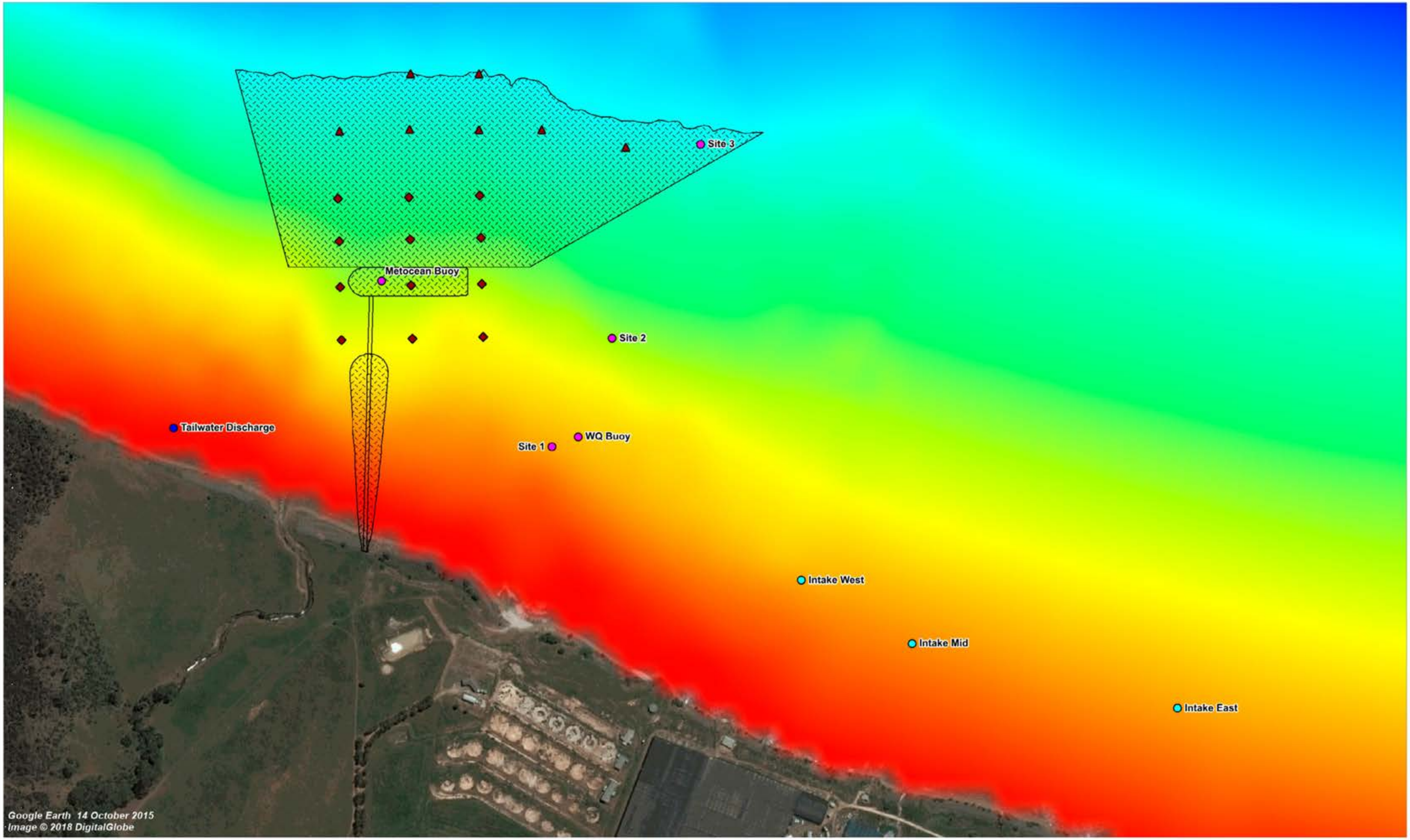

LEGEND

- Instrument Locations
- Water Intake Locations
- Tailwater Discharge Location
- Sediment Sampling Locations
- Dredge Area and Causeway Footprint

-30 -25 -20 -15 -10 -5 0

Elevation (m MSL)

Title:

Smith Bay Instrument and Sediment Sampling Locations

Figure: 2-3

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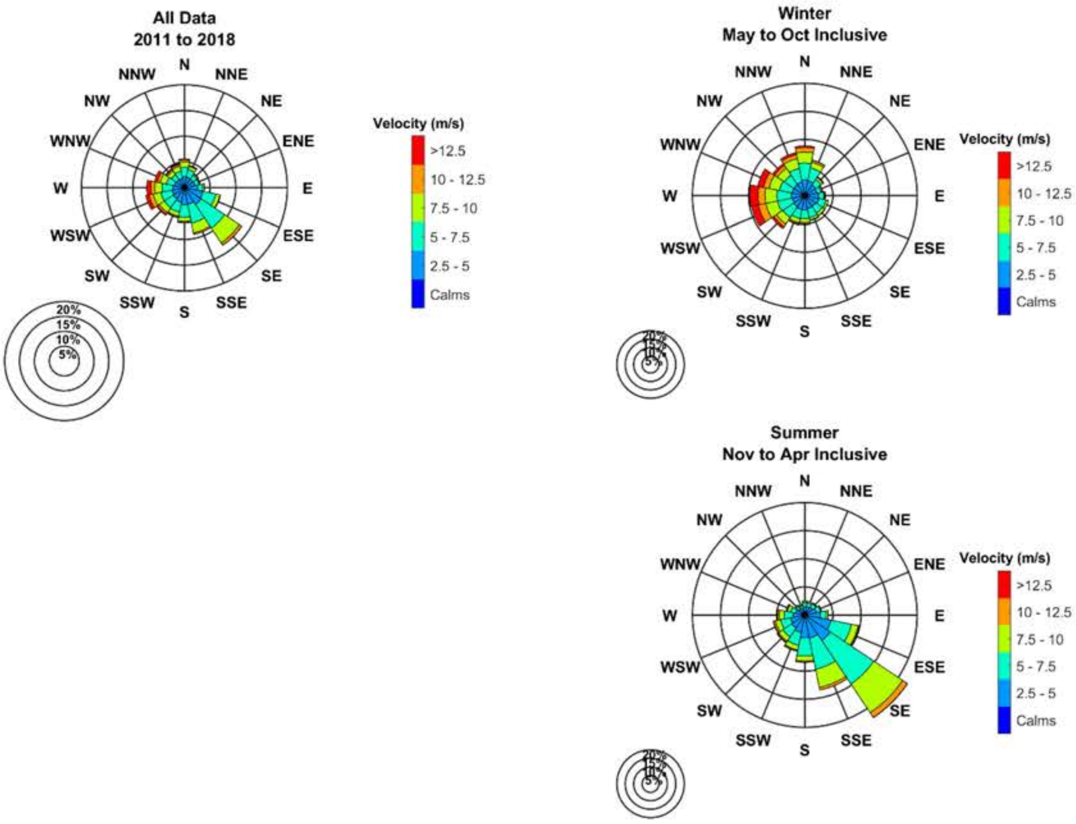

Figure 2-4 CFSR all-year and seasonal windroses for Smith Bay (2011-2018).

2.5 Water Levels

Water level variations at Smith Bay are driven a combination of tides, local wind stresses and storm surges propagating into Investigator Strait from the Southern Ocean. The tidal regime has a mixed semi-diurnal classification and exhibits significant diurnal inequality (height difference between successive high/low tides). Spring tidal range at Smith Bay is typically around 1 m, while very low amplitude 'dodge' tides occur mid-way between spring tide periods.

Non-tidal water level variations are generally driven by frontal storm systems, which are most active during autumn and winter. Storm surges exceeding 0.7 m above the predicted (astronomic) tide level are a relatively common occurrence during winter storms. Design water levels were derived for the wharf facility (BMT 2018a) and are summarised in Table 2-2.

Table 2-1 Tidal planes at Emu Bay / Smith Bay (Austides 2018)

Tidal Plane	Level (m LAT)	Level (m AHD)
HAT	1.8	1.0
MHHW	1.5	0.7
MLHW	1.0	0.2
MSL	0.8	0.0
MHLW	0.7	-0.1
MLLW	0.2	-0.6
LAT	0.0	-0.8

Table 2-2 Smith Bay design water level summary (BMT 2018a)

Return Period (years)	Water Level [1] (m MSL)
1	1.18
10	1.46
100	1.61

[1] Water level does not include an allowance for future Sea Level Rise.

2.6 Waves

The Smith Bay shoreline faces north into Investigator Strait and is directly exposed to a ~50 km fetch across the Strait to the Yorke Peninsula. Greater fetch distances (~150 km) extend to the northwest and northeast into Spencer Gulf and Gulf St Vincent. Southern Ocean fetches extend to the south and west of Kangaroo Island, and while it is not directly exposed to these fetches the Smith Bay site is also influenced by heavily refracted Southern Ocean swells.

Ambient wave statistics were derived from a 10 year hindcast simulation (BMT 2018a). As shown by the buoy location waverose and scatter plots (Figure 2-5), the ambient wave climate at Smith Bay is dominated by waves from the NNW to NNE sectors. The modal wave condition at Smith Bay is a 0.25-0.5 m significant wave height from the 330-360 degree sector with a 12-14 s peak period.

Smith Bay often experiences a multi-modal sea state due to its complex fetch exposure. A scatter plot of peak-energy wave period (T_p) versus significant wave height (H_s) is shown in Figure 2-6 (BMT 2018a). There is a band of wave predictions characterised by a relatively short peak wave period (~6 s), which correspond to a wave steepness ratio of 1:30. There is also a band of waves with a longer peak period (up to 10-11 seconds) and characterised by a wave steepness curve of 1:65.

The median significant wave height at Smith Bay is 0.52 m. The 99th percentile significant wave height (exceeded on-average for 3.65 days per year) is 1.51 m. Design wave conditions were derived for the wharf facility (BMT 2018a) and are summarised in Table 2-3.

Table 2-3 Smith Bay design wave condition summary (BMT 2018)

Return Period (years)	Significant Wave Height, H_s (m) [1]	Peak Wave Period T_p (s) [2]
1	2.09	8.9
10	2.56	10.1
100	2.84	10.7

[1] Significant wave height at wharf location.

[2] Peak wave period based on a wave steepness of 1:65.

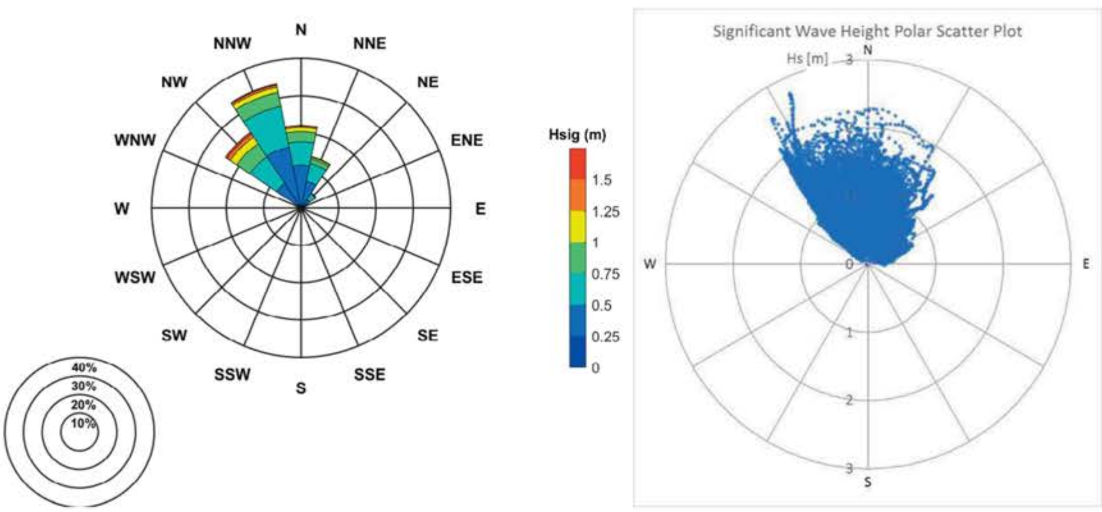

Figure 2-5 Smith Bay waverose and directional scatter plot (Wharf location)

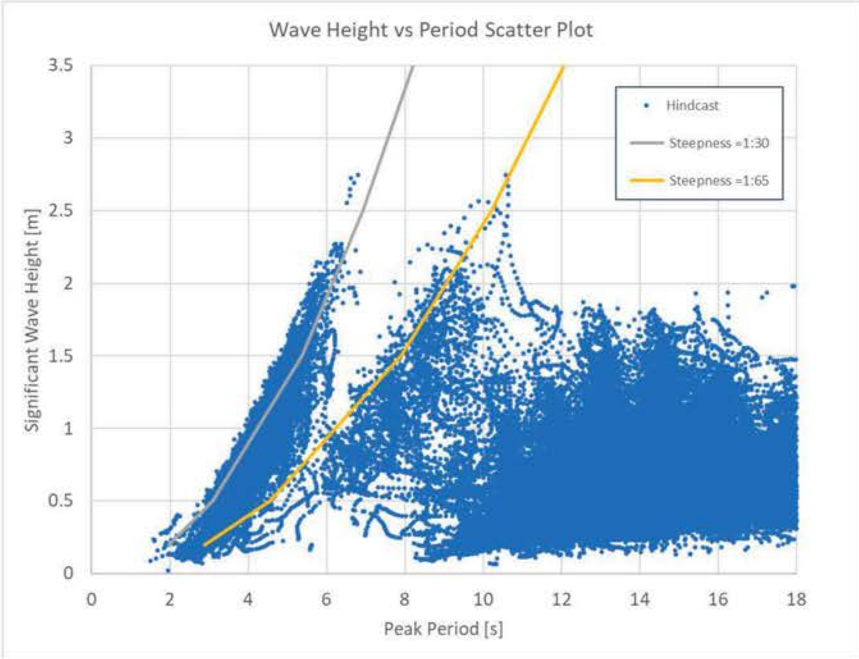

Figure 2-6 Wave height (Total) vs peak period scatter plot (Wharf Location)

2.7 Currents

Currents at Smith Bay are driven by a combination of tides, local wind stresses and storm surges. The currents are driven predominantly alongshore and are typically directed to the ESE on flooding tides and WNW on ebbing tides (Figure 2-7). Peak spring tide current speeds are typically around 0.3 m/s, while higher current speeds may occur under strong wind conditions (Figure 2-8). The mean current speed is 0.15 m/s and the maximum measured current speed recorded was 0.55 m/s.

As shown in Figure 2-9 a weak (~0.05 m/s) residual circulation to the west generally prevails under low wind summer conditions.

During the winter months, Southern Ocean frontal systems frequently drive significant storm surges into Investigator Strait. Under the stronger winter westerly wind conditions easterly current flows are more likely to prevail. Easterly residual currents of ~0.2 m/s occur at around for short periods during the passage of storm fronts.

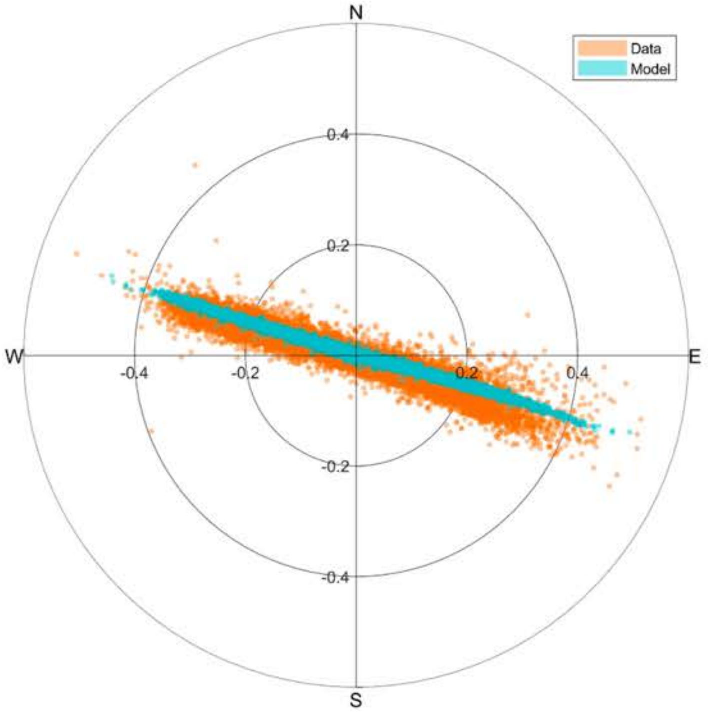

Figure 2-7 Depth-averaged current scatterplot at Wharf Location for the period July 2016 to November 2017.

Figure 2-8 Depth-averaged current magnitude and direction timeseries at Wharf Location.

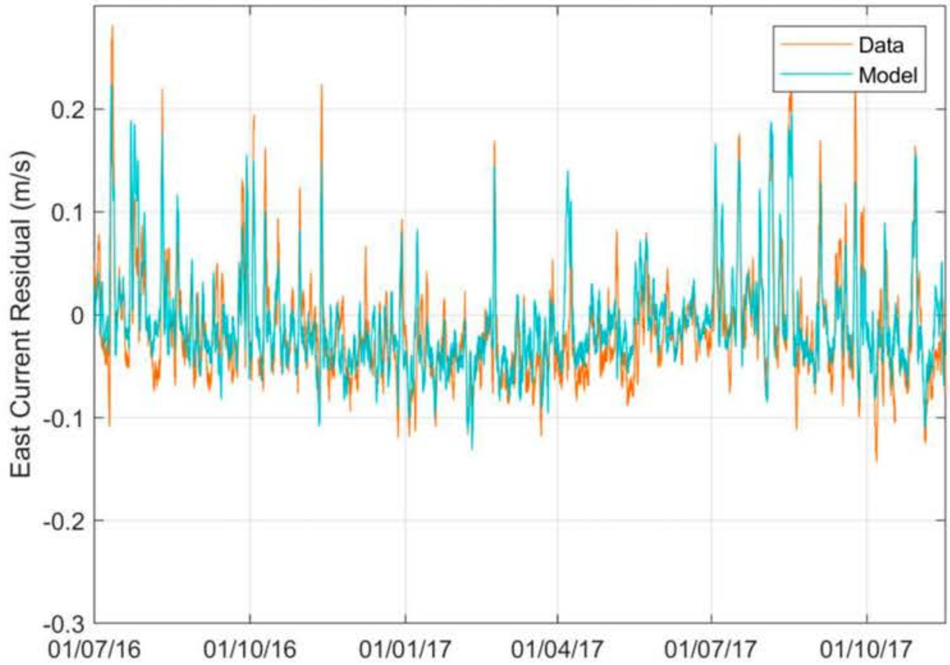

Figure 2-9 Residual current easterly component at Wharf Location.

2.8 Water Temperature

Water temperature at Smith Bay is driven by exchange of Southern Ocean water as well as solar heating of the relatively shallow waters within Investigator Strait and Gulf St Vincent. Water surface temperature measured at Smith Bay (MSI 2017) is shown in Figure 2-10. Peak summer temperatures were in the range 21-23 ºc, while winter minimum temperatures were around 14 ºc.

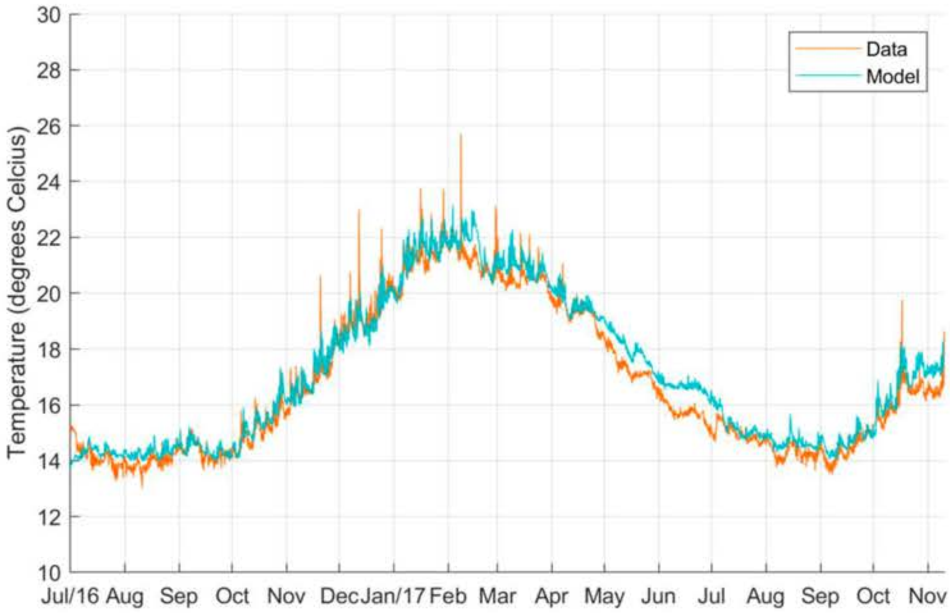

Figure 2-10 Surface temperature at MSI Buoy

2.9 Seabed and Sediment Characteristics

The beach and dune system are composed of cobble-sized sediment (Figure 2-11). Immediately offshore of the beach system the seabed is comprised of mixed sandy and coarser sediments (Figure 2-12). The sediment Particle Size Distribution of shallow core samples is summarised in Figure 2-13 and confirms the predominantly sandy offshore marine surface sediments.

The Smith Bay seabed is widely covered with dense macroalgae and seagrass communities, which become sparse in deeper water further offshore (Figure 2-14). The dense benthic flora assemblages will act to stabilise the seabed and limit active sediment transport.

Figure 2-11 The beach at Smith Bay is formed from cobble sized sediment.

Figure 2-12 Sediment cores from COOE (2017) sampling. Left – prevailing silty sand material, showing relatively coarse grain size. Right – sandy silt material with high organics content from SB7.2.

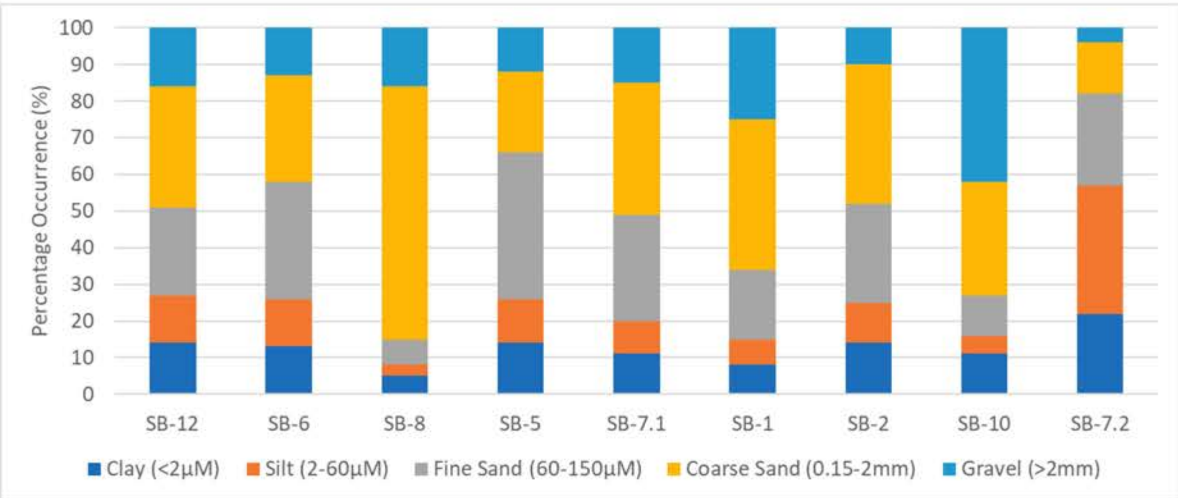

Figure 2-13 Particle size distribution summary from COOE (2017).

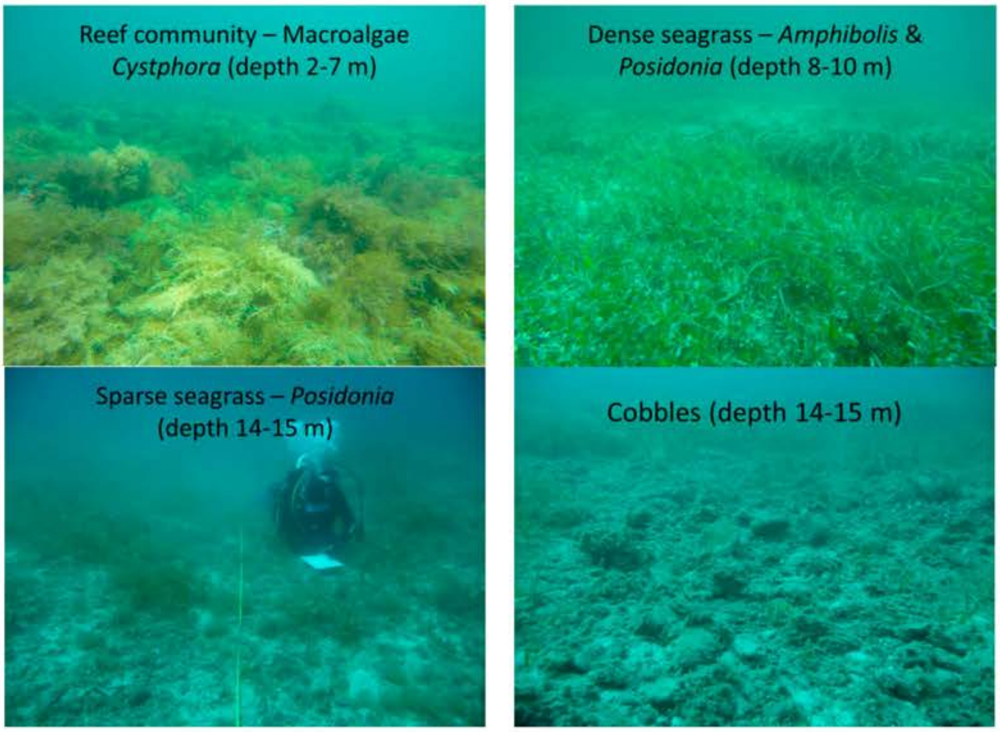

Figure 2-14 Smith Bay seabed characteristics.

3 Assessment of Potential Impacts

3.1 Overview

This section outlines the potential impacts the project may have on Smith Bay coastal processes. This section describes:

- Potential impacts on coastal processes from the constructed wharf facilities and associated dredging.
- Options for managing and mitigating identified impacts.

A risk-based approach has been used to assess coastal process impacts, and is based on the consideration of the following:

- Consequence of Impact – made up of assessment of the intensity and scale (geographic extent), of coastal process impacts. Table 3-1 is a summary of the categories used to define impact significance.
- Duration of impact - the duration of identified impacts is classified as per Table 3-2.
- Likelihood of Impact – which assesses the probability of the impact occurring. Table 3-3 is a summary of the categories used to define impact likelihood.

Risk rating – which assesses the level of risk for key impacting processes. The risk table (Table 3-4) adopted is generated from the Consequence and Likelihood scores, based on the overall matrix presented in Part A.

Table 3-1 Categories used to define consequence of impact (coastal processes)

Impact Consequence	Description for Water Quality (includes magnitude, duration, and sensitivity of receiving values)
Disastrous	Very major, permanent effects to coastal processes extending beyond the project area. This level of impact would be indicated by: • Very large changes to the natural physical processes in Smith Bay, such as major shoreline erosion or major changes to tidal currents and/or sediment transport patterns
Major	Long term permanent effects to coastal processes, potentially extending beyond the project area. This level of impact would be indicated by: • Large changes to the natural physical processes in Smith Bay and Inlet, such as shoreline erosion or large changes to tidal currents and sediment transport patterns
Moderate	Medium term effects to coastal processes within the project area. This would be indicated by: • Moderate changes to the natural physical processes in Smith Bay, such as significant shoreline realignment or moderate changes to tidal currents and/or sediment transport patterns
Minor	Impacts are recognisable/detectable but contained within the project area and are deemed acceptable. This would be indicated by:

Impact Consequence	Description for Water Quality (includes magnitude, duration, and sensitivity of receiving values)
	• Minor changes to the natural physical processes in Smith Bay, such as subtle shoreline realignment or minor changes to tidal currents and/or sediment transport patterns
Negligible	Minimal change to the existing situation. This could include, for example, impacts that are below levels of detection, impacts that are within the normal bounds of variation or impacts that are within the margin of forecasting error.
Beneficial	Existing coastal processes are modified by the project with corresponding ecological or social benefits in the project area and surrounds.

Table 3-2 Classifications of the duration of identified impacts

Relative duration of impacts	
Temporary	Days to months
Short Term	Up to one year
Medium Term	From one to five years
Long Term	From five to 50 years
Permanent / Irreversible	In excess of 50 years

Table 3-3 Categories used to define likelihood of impact (water quality)

Likelihood	Categories
Virtually impossible	Has almost never occurred elsewhere in similar situations, but is conceivable over the next 100 years.
Unlikely	Has occurred a few times elsewhere in similar situations. May occur within decades.
Possible	An occasional occurrence elsewhere in similar situations. May occur within the next few years.
Likely	A regular occurrence elsewhere in similar situations. Likely to occur within months.
Virtually certain	A very frequent occurrence elsewhere in similar situations. Expected to occur within days to weeks, or ongoing.

Table 3-4 Risk matrix for water quality

			Likelihood				
			1	2	3	4	5
			Virtually impossible	Unlikely	Possible	Likely	Virtually certain
Consequence	1	Negligible effect	1 (Low)	2 (Low)	3 (Low)	4 (Low)	5 (Medium)
	2	Minor effect	2 (Low)	4 (Low)	6 (Medium)	8 (Medium)	10 (High)
	3	Moderate effect	3 (Low)	6 (Medium)	9 (Medium)	12 (High)	15 (Extreme)
	4	Major effect	4 (Low)	8 (Medium)	12 (High)	16 (Extreme)	20 (Extreme)
	5	Disastrous effect	5 (Medium)	10 (High)	15 (Extreme)	20 (Extreme)	25 (Extreme)

Table 3-5 Risk rating legend

>=0	0 - Low	> Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.
>=5	5 - Medium	> Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level.
>=10	10 - High	> High risks demand attention at the most senior management level to ensure that they are mitigated and controlled as rapidly as possible. They are reported upon at the executive level.
>=17	17 - Extreme	> Extreme risks demand urgent attention at the most senior (including executive) level and must be immediately controlled. Operations must cease if the risk cannot be controlled.

3.2 Water Levels

The coastal infrastructure proposed for the KIPT wharf facility would be unlikely to result in any significant impacts to Smith Bay water levels, either in terms of tidal amplitudes or timing. Figure 3-1 compares water level timeseries at the Yumbah Intake West location and demonstrates that base case and developed case water levels are essentially the same. Figure 3-2 shows the water levels for the base and developed cases (and impacts) during a large storm surge event (11th July 2016). Changes in the water level at this time are minimal.

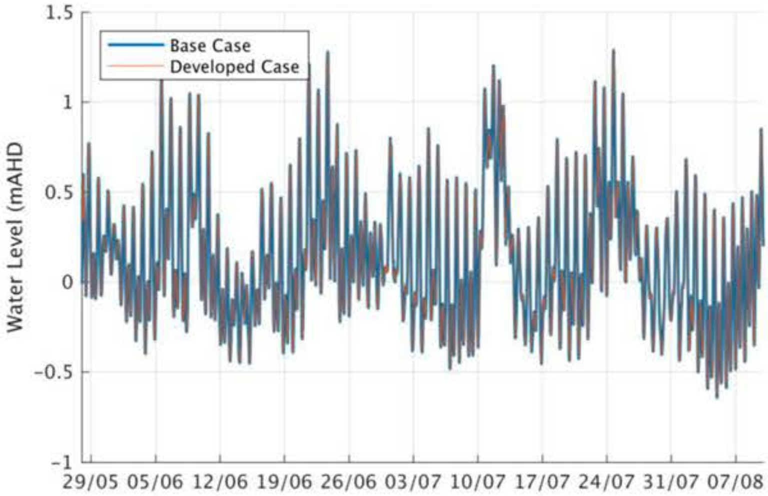

Figure 3-1 Water level comparison at Yumbah Intake West (Winter 2016)

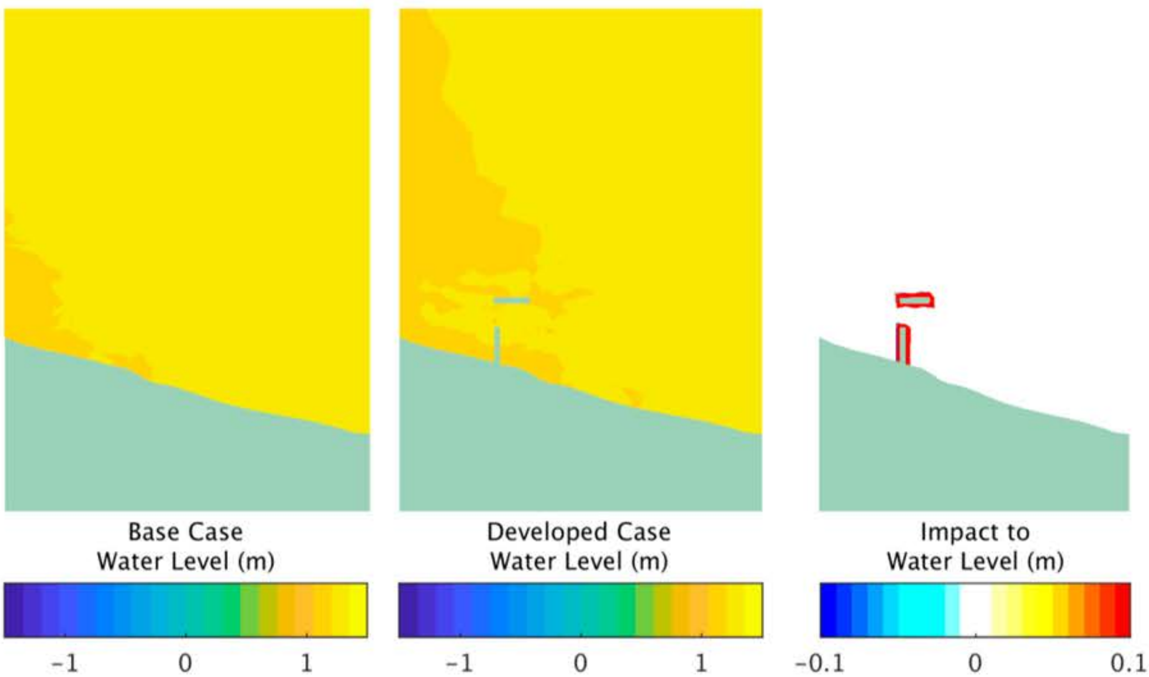

Figure 3-2 Water level impacts

3.3 Waves

The causeway and floating wharf structures will generate a localised zone of reduced wave height near the shoreline due to blockage of incoming wave energy.

The impact to the significant wave height during an event in June 2016 is shown in Figure 3-3. This shows that the most significant impacts occur in the immediate lee of the causeway and floating wharf structure. The blockage from the structures serves to reduce the wave heights in these regions. Some small directional changes are also observed for the residual wave energy. The zone of reduced wave height conditions extends approximately 2 to 3 times the causeway/wharf structure length, that is around 500 to 750 m.

Figure 3-4 shows a timeseries comparison of base and developed case significant wave height at a point located inshore of the proposed floating wharf structure. The timeseries shows that wave height is typically reduced by around 30-50% at this particular location in close proximity to the proposed wharf. Further to the east at the nearest active Yumbah intake (Intake 1), the wave height timeseries comparison (Figure 3-5) shows only a very slight (<5%) reduction in wave height.

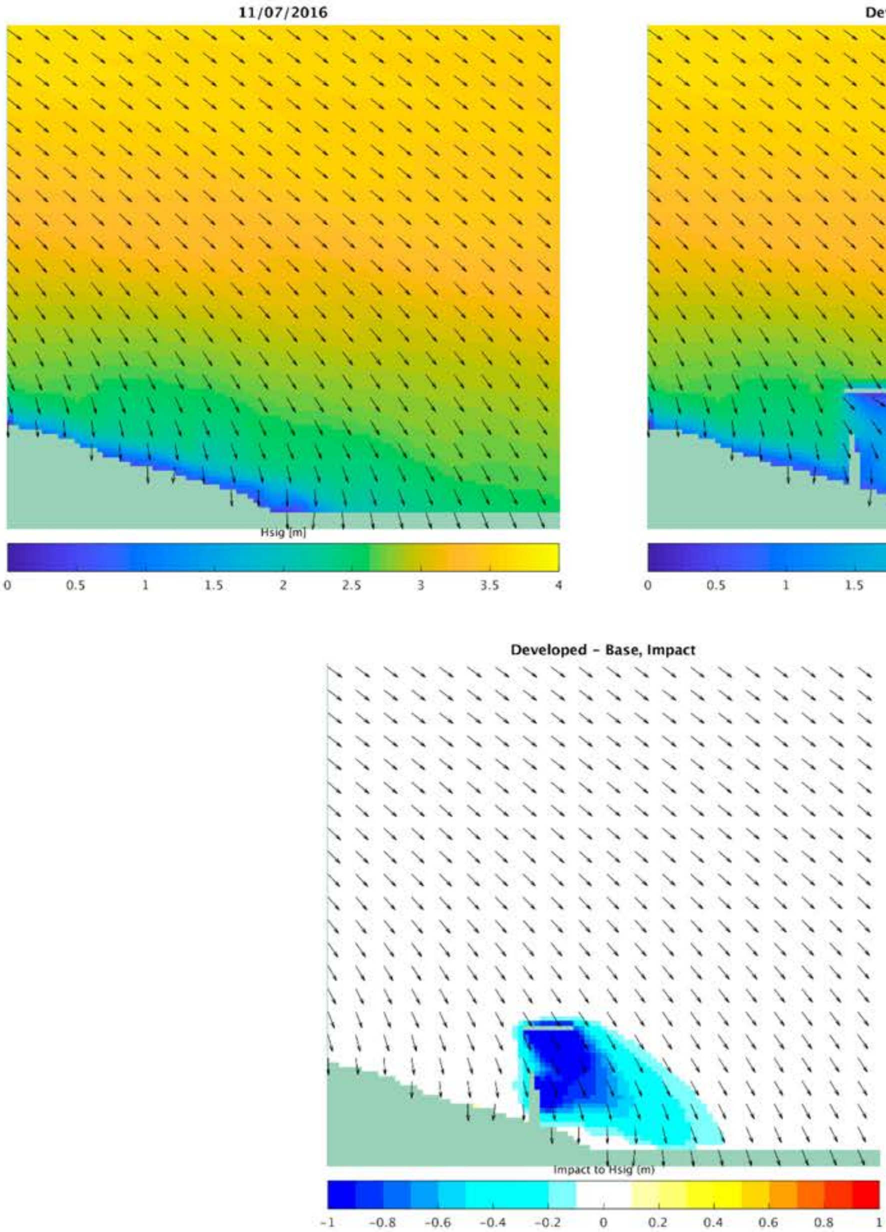

Figure 3-3 Base (Top-Left), Developed (Top-Right) and Impact (Bottom) to Significant Wave Height

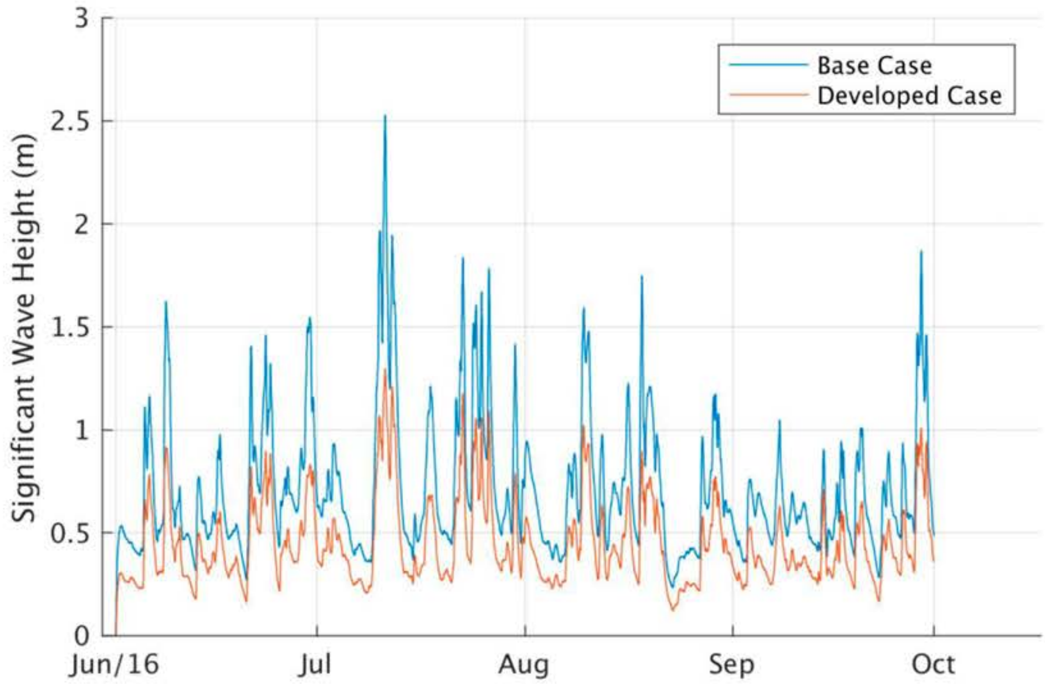

Figure 3-4 Significant wave height comparison behind floating wharf (MSI Buoy Location)

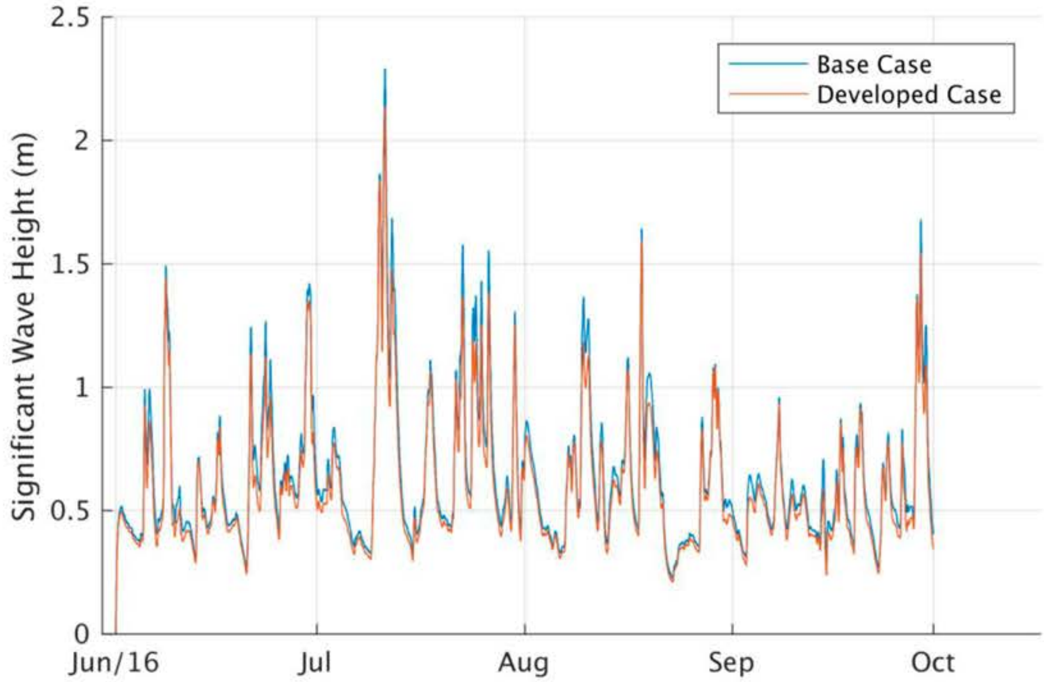

Figure 3-5 Significant wave height comparison at Yumbah Intake West

3.4 Currents

Currents in Smith Bay are generally driven shore parallel by a combination of water level gradients (tidal and storm surge) and wind stress. Refer to Figure 2-7 for an illustration of the prevailing current speeds and directions. The proposed shore-normal causeway structure has the potential to interrupt the alongshore current flow. The localised deepening associated with the dredging and the blockage associated with the roughly shore-parallel floating wharf structure also have some limited potential to modify the flow fields.

Figure 3-6 and Figure 3-7 show the current fields during typical spring- flooding and ebbing tides respectively. The causeway and floating wharf block the flow of currents near to the coastline and reduce the peak current magnitudes by ~0.1 m/s, predominantly in the lee of the structure. The timeseries comparison at the Yumbah Intake West location (Figure 3-8) shows that current speed reductions represent around 30% of the base case under typical tidally dominated conditions.

3.5 Water Temperature

The current circulation impacts show a slight reduction in current speeds flowing through Smith Bay nearshore waters as a result of the proposed development. The potential risk of elevated water temperatures as a result of these minor flow circulation changes was therefore modelled. A timeseries comparison of modelled water temperature at Yumbah Intake West is shown in Figure 3-9 and indicates that base and developed case predictions are almost indistinguishable. This comparison is further assessed using a base versus developed scatter plot in Figure 3-10. Again, this shows that the base and developed case are very close to identical, with the developed case result sometimes slightly higher and at other times slightly lower than the base case results, with no persistent warming bias predicted as a result of the causeway.

The maximum water temperature over the entire summer simulation period was also derived and is spatially mapped for both the base and developed case in Figure 3-11. Maximum temperatures are predicted to increase slightly in nearshore waters to the east of the proposed causeway, with a corresponding slight decrease predicted to the west. The predicted temperature increases are typically less than 0.2 degrees in shallow nearshore waters and even less significant further offshore where the aquaculture intakes are located.

3.6 Smith Creek Plumes

Smith Creek discharges immediately to the west of the proposed wharf and therefore the causeway might be expected to affect how the creek plume disperses into nearshore waters. A 1-in-10 Annual Exceedance Probability flood discharge hydrograph for Smith Creek was derived and the plume dispersion with Smith Bay was modelled for both the base case and developed case scenarios.

The impact assessment results () shows that the constructed causeway causes the flood plume to be constrained near the creek mouth and then directed further offshore. This results in an increased TSS to the west of the causeway and further offshore in the Bay, but a decreased TSS in the nearshore zone to the east of the causeway, including at the locations of the Yumbah intakes.

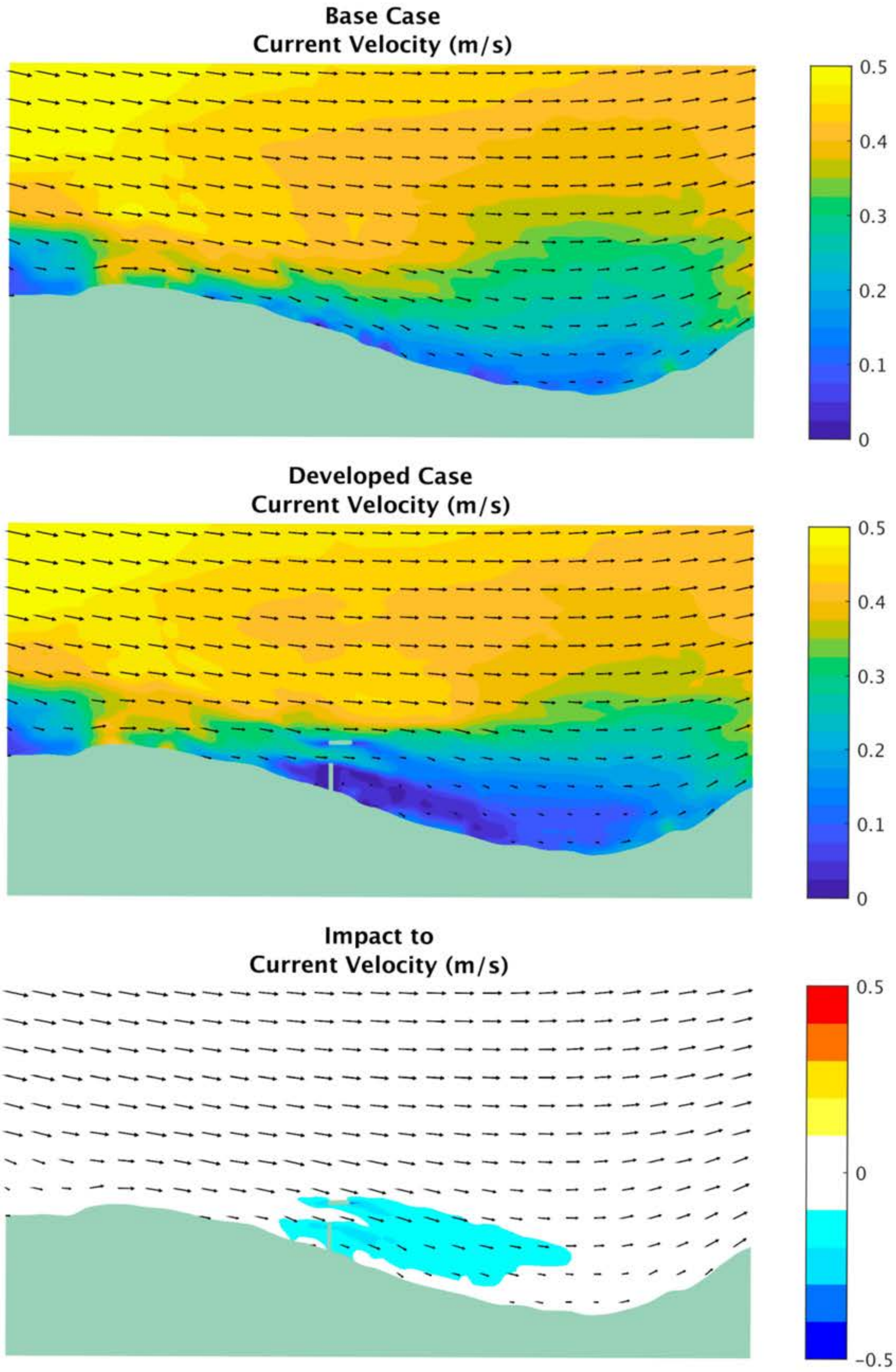

Figure 3-6 Flood-tide currents impacts

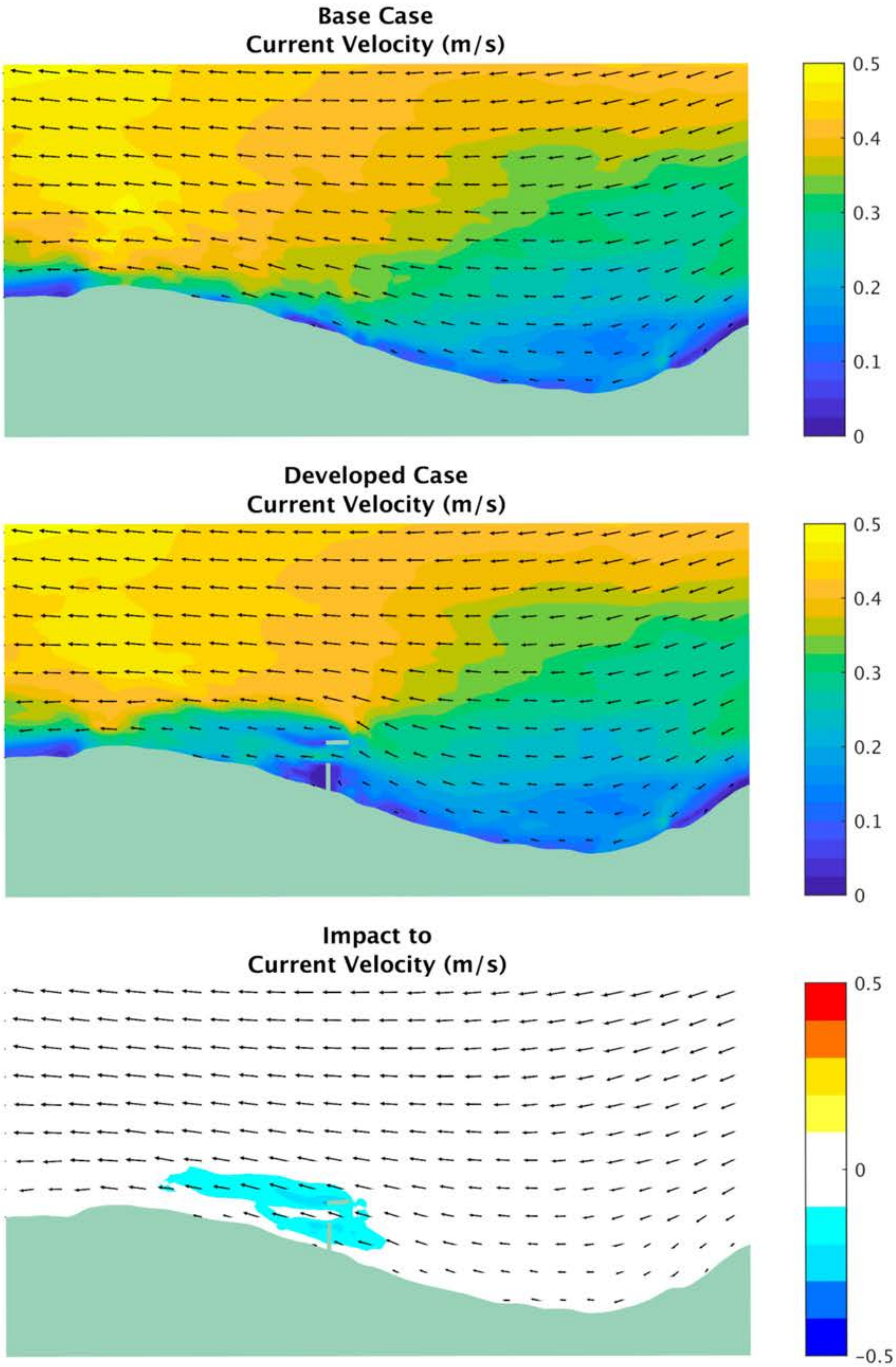

Figure 3-7 Ebb-tide currents impacts

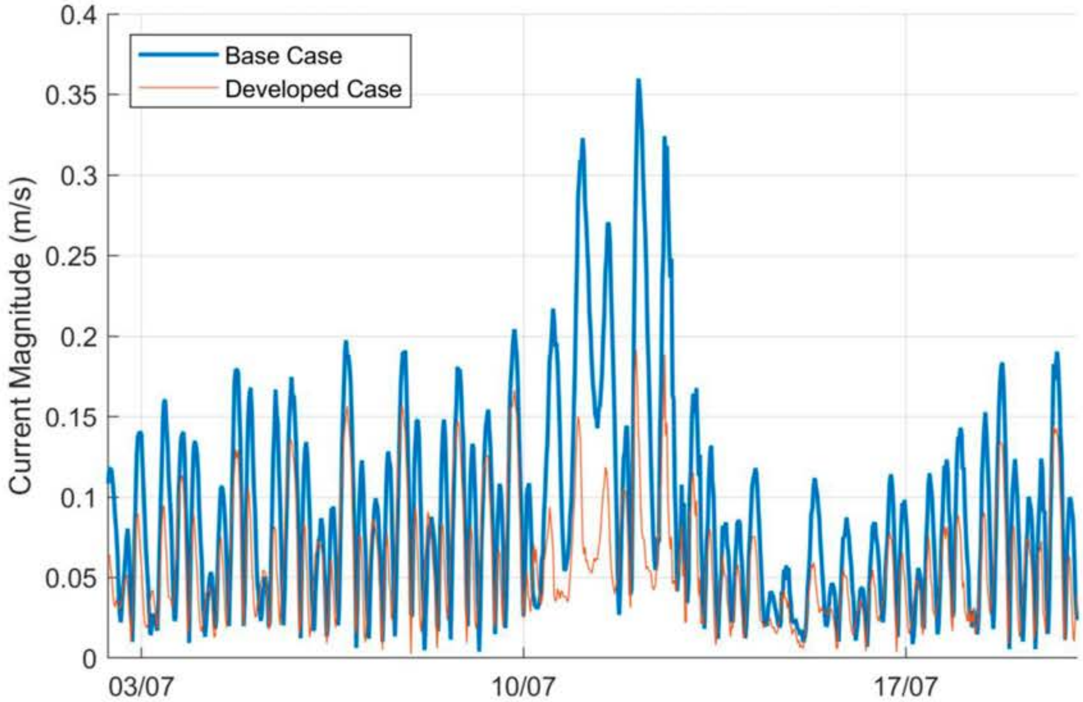

Figure 3-8 Depth-averaged current timeseries comparison at Yumbah Intake West

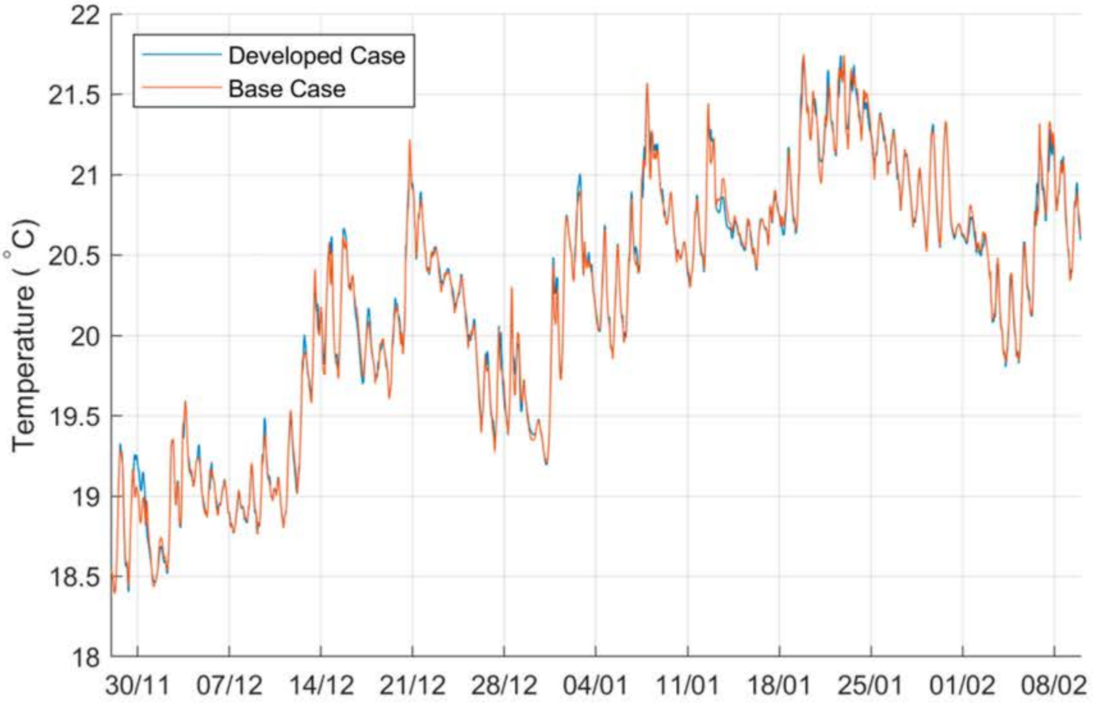

Figure 3-9 Timeseries comparison of depth-averaged temperature at Yumbah Intake West

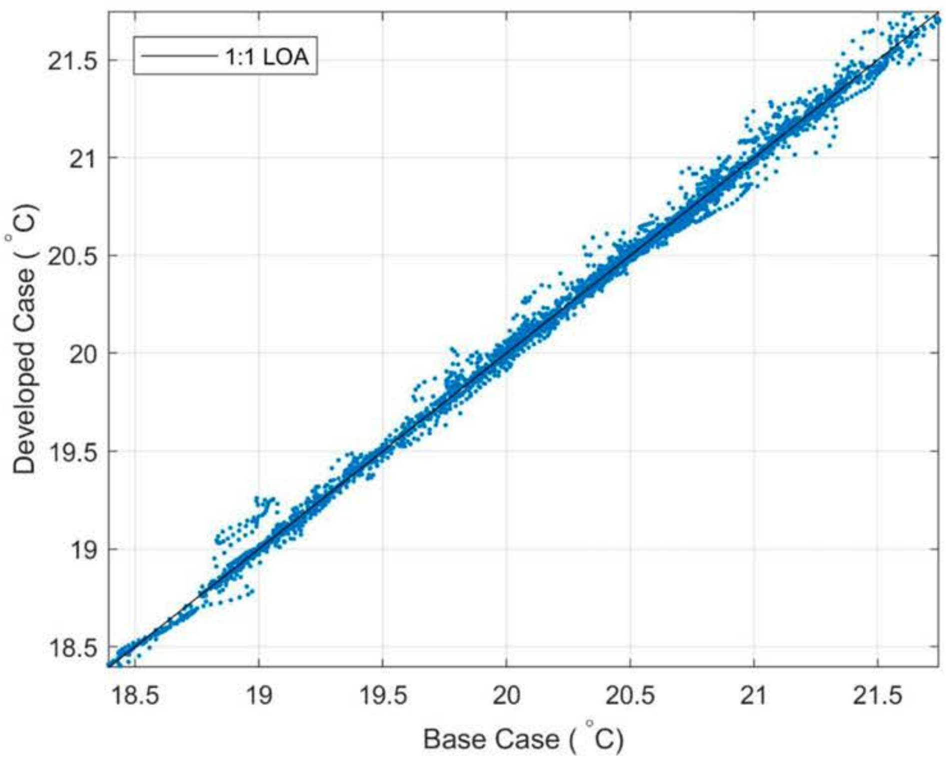

Figure 3-10 Scatter plot comparison of depth-averaged temperature at Yumbah Intake West

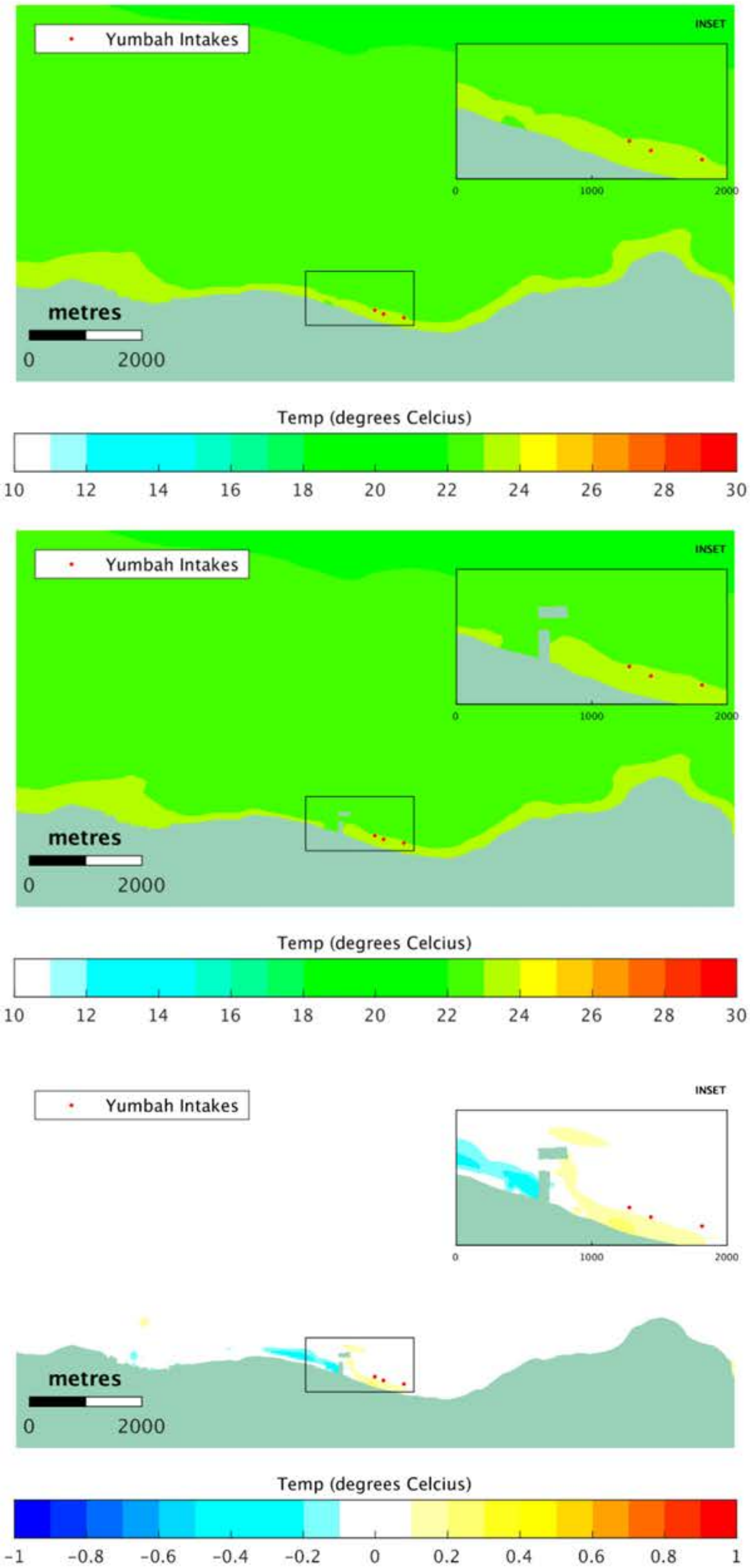

Figure 3-11 Maximum depth-averaged temperature, Base Case (Top); Developed Case (Mid) and Impact (Bottom)

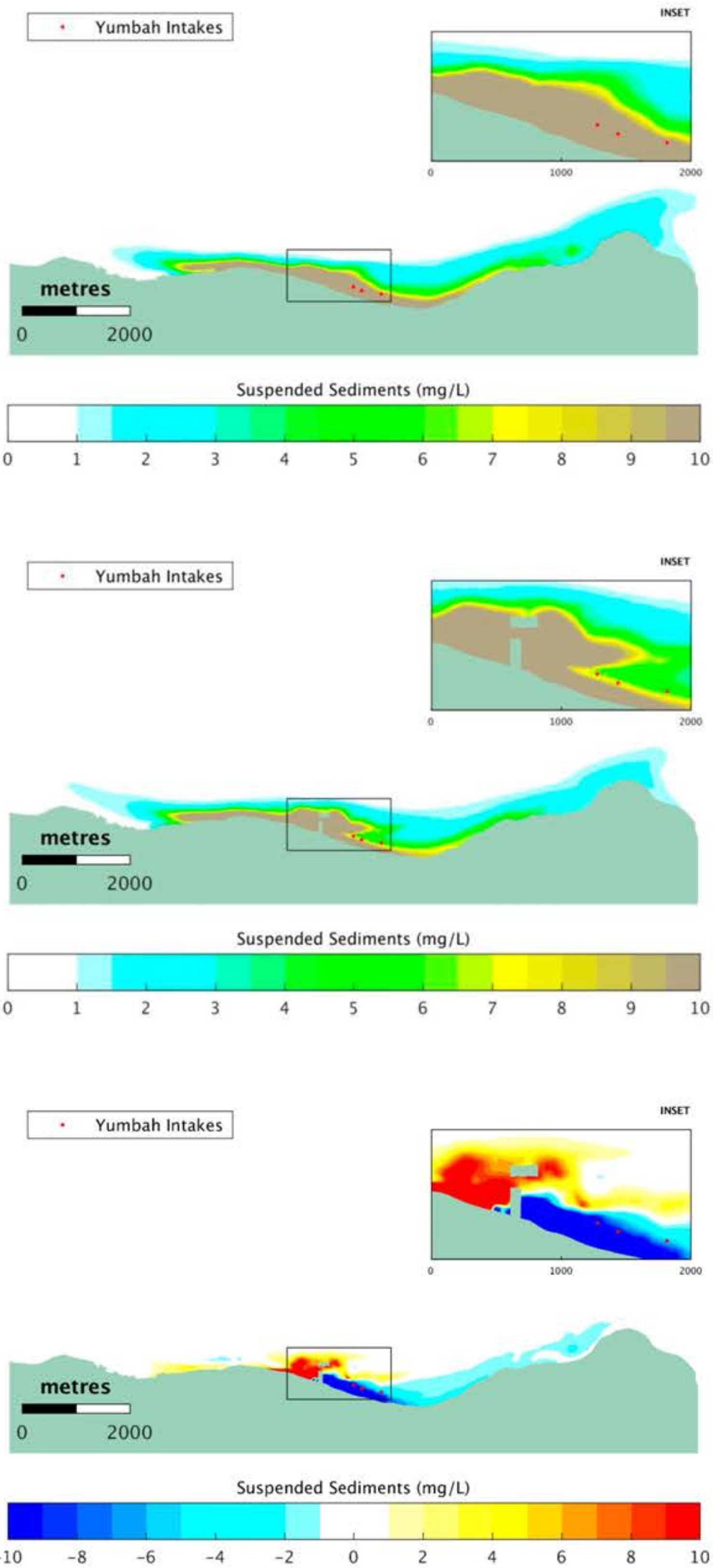

Figure 3-12 Depth-averaged flood plume TSS (95th percentile) for base case (Top), Developed Case (Middle), and Impact (Bottom)

3.7 Sediment Transport

3.7.1 Bed Shear Stress

The potential for coastal sediment transport impacts and associated changes to seabed sediment characteristics was assessed based on modelling of combined wave and current bed shear stresses. The modelled bed shear stress (95th percentile) was summarised from the base and developed case and is shown in Figure 3-14 along with the predicted impact to this quantity.

The assessment shows that bed shear stress offshore of Smith Bay is fairly broadly in excess of 0.5 Pa, which is consistent with the predominantly coarse sand and cobble size of the surface sediments. In shallower offshore reef areas and in the immediate nearshore zone (depths <5 m) the 95th percentile bed shear stress values are typically in excess of 1 Pa as would be expected in regions of depth-limited (breaking) waves.

The proposed development results in a region of reduced bed shear stress in the lee of the floating wharf and causeway structures (Figure 3-14). However, under the developed case the bed shear stresses remain in excess of 0.5 Pa in the lee of the structure. This result indicates that it would be unlikely for this region to become an area of silt deposition in the developed case, as the shear stress remains too high for fine sediment fractions to form stable deposits.

3.7.2 Littoral Sediment Transport

The sub-aerial beach and dune system at the Project site is formed by predominantly cobble-sized sediments (Figure 2-11). Offshore of the inter-tidal beach the seabed is generally covered by dense macro-algae and seagrass assemblages. These characteristic features of the Smith Bay littoral zone will tend to strongly limit the active littoral sediment transport within this coastal compartment.

The proposed solid causeway structure extending approximately 250 m offshore will act to block any active littoral zone sediment transport. In the event that there was significant net littoral sediment transport, this would result in updrift accretion and downdrift erosion of the shoreline. However, given the reasons stated above Smith Bay is likely to be a very low net transport coastal compartment and shoreline impacts are therefore expected to be minor.

This conclusion is supported by an aerial imagery of the coastline approximately 1.5 km east of the Project site (Figure 3-13). At this location groyne structures have been constructed by shifting beach cobbles to provide a sheltered vessel launching area. There does not appear to have been substantial sand accumulation in response to these man-made changes to the littoral zone.

In the event that shoreline accretion was observed to occur against the causeway structure, this impact could be managed by mechanical bypassing of material to the other side of the causeway using an excavator and dump truck.

Figure 3-13 Rock groynes constructed by shifting local material

3.7.3 Maintenance Dredging Requirements

Only very minimal changes to bed shear stress are apparent within the dredge footprint area and for this reason it is also unlikely that this area would experience net fine sediment deposition necessitating regular or substantial maintenance dredging operations. The persistent presence of a distinct paleo channel feature in the nearshore bathymetry at Smith Bay (Figure 2-2) further supports an assessment that maintenance dredging would not be required for the proposed wharf facility.

3.8 Seagrass Wrack

Under certain natural conditions seagrass and macroalgae biomass may be shed from the seabed and subsequently accumulate along adjacent shorelines. The proposed causeway structure may potentially result in localised trapping of seagrass 'wrack' which may become an issue requiring management by the site operators. Potential management measures would include removal, relocation and or disposal of accumulated wrack material.

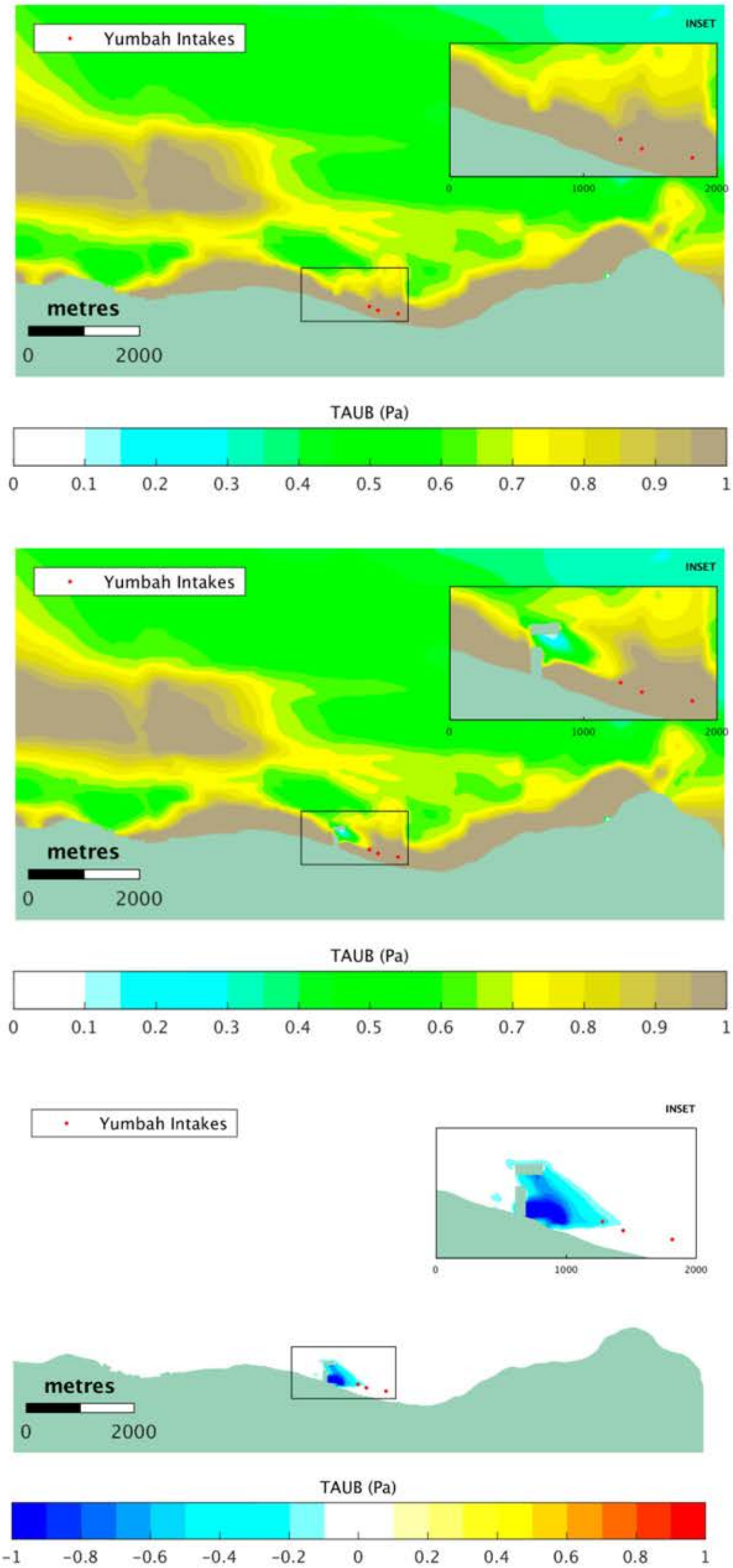

Figure 3-14 Bed Shear Stress (95th Percentile), Base Case (Top); Developed Case (Mid) and Impact (Bottom)

4 Residual Impacts and Assessment Summary

In accordance with the methodology described in Section 3.1, Table 4-1 summarises the coastal process impacts identified by the assessment in the previous sections. This assessment table also includes the significance of each of the identified impacting processes, the likelihood of the impact occurring, and the resulting risk rating.

Any associated standard and/or additional mitigation measures are also summarised in Table 4-1, with a risk rating indicated for the residual impacts after mitigation. As indicated in this assessment table, residual impacts are generally rated as low risk. Modifications to currents and waves have been rated as a medium risk due to their likelihood of occurrence, however it should be noted that the consequence rating for both these impacts is low as these changes are mostly restricted to the immediate Project area.

The coastal processes assessments have shown that impacts of the Project will not be of significance with respect to the adjacent shoreline areas outside the immediate Project footprint. As such, long term adverse impacts to coastal processes are highly unlikely.

Specially, the modelling assessment results show that:

- Generally, impacts on coastal circulation are highly localised and in the immediate vicinity of the Project infrastructure where some local realignment and modification of current speeds will occur.
- Coastal circulation impacts are not expected to result in reduced flushing of Smith Bay waters nor to increased potential for elevated water temperatures.
- There will be minor modification to wave propagation in the immediate vicinity of Project infrastructure but no detectable impact to wave conditions elsewhere within Smith Bay.
- There will be no significant impact to sediment transport pathways and seabed sediment characteristics outside the immediate Project area.
- The Project dredged footprint and areas immediately adjacent to the causeway structure are unlikely to experience persistent fine sediment deposition which would require ongoing management.

The coastal processes impact assessments are summarised in Table 4-1 together with the anticipated risk and potential mitigation measures (where relevant). Based on the assessments, all risks to coastal processes that have been identified can be reduced to a low or medium residual risk through the application of controls inherent of the Project design.

Table 4-1 Risk assessment summary – coastal processes

Ref	Activity	Hazard (Environmental Aspect)	Potential Impact	Consequence	Likelihood	Inherent risk level	Management / mitigation measures	Consequence	Likelihood	Residual risk level
	Construction Phase									
-	Capital dredging and causeway construction	Generation of turbid plumes	Construction phase impacts have been assessed in the Marine Water Quality technical report (BMT 2018c)							
Operational Phase										
1	Coastal zone infrastructure: • Causeway • Piled jetty • Dredged berth and approach apron	Modification to coastal water levels	• No detectable increase to water levels	Negligible	Unlikely	Low	• Nil	Negligible	Unlikely	Low
2		Modification to coastal circulation - currents	• Minor reductions in current speed within area immediately adjacent to project infrastructure	Minor	Possible	Medium	• Nil	Minor	Likely	Medium
3		Modification to coastal circulation – water temperature	• Unlikely to result in detectable increases to water temperature within Smith Bay	Minor	Unlikely	Low	• Nil	Negligible	Possible	Low

Ref	Activity	Hazard (Environmental Aspect)	Potential Impact	Consequence	Likelihood	Inherent risk level	Management / mitigation measures	Consequence	Likelihood	Residual risk level
4		Modification to coastal circulation – Smith Creek plumes	• Modification to Smith Creek plume mixing, with enhanced mixing into deeper water • Shielding of Smith Creek plumes to the east of the causeway with potential benefits to water quality at Yumbah seawater intakes • Minor increase in creek plume exposure to west of causeway	Minor / Beneficial	Unlikely	Low	• Nil	Minor / Beneficial	Unlikely	Low
5		Modification to coastal waves	• Localised shielding of wave energy in lee of project infrastructure • Negligible modification of coastal wave climate outside project area	Minor	Possible	Medium	• Nil	Minor	Possible	Medium
6		Change to sediment transport pathways and beach processes	• Minor accumulation of sediment against causeway structure	Minor	Possible	Medium	• Mechanical bypassing of accumulated sediment to downdrift side of causeway	Negligible	Possible	Low
7		Requirement for future maintenance dredging	• Project infrastructure is unlikely to require maintenance dredging	Minor	Unlikely	Low	• Nil	Minor	Unlikely	Low

Ref	Activity	Hazard (Environmental Aspect)	Potential Impact	Consequence	Likelihood	Inherent risk level	Management / mitigation measures	Consequence	Likelihood	Residual risk level
8		Modification to seagrass wrack accumulation	• Localised trapping of seagrass wrack by Project infrastructure	Minor	Possible	Medium	• Removal, relocation and or disposal of accumulated wrack material.	Negligible	Possible	Low

5 References

BMT (2018a). *Smith Bay Design Wave and Water Level Assessment*, prepared for KIPT, February 2018. Ref: R.B22454.001.01.Design_Waves_Assessment.

BMT (2018b). *Smith Bay EIS - Hydrodynamic Modelling Report*. Prepared for Environmental Projects, December 2018. Ref: R.B22454.002.03.Modelling_Report.

BMT (2018c). *Marine Water Quality – Baseline and Impact Assessment*. Report prepared for Environmental Projects, December 2018. Ref: R.B22454.004.02.Marine Water Quality.

COOE (2017). *Kangaroo Island Plantation Timbers, Deep Water Export Facility. Assessment of Marine Sediments*. Report prepared for SEA Pty Ltd.

MSI (2017). Draft Data Report Prepared for Maritime Constructions by Metocean Services International. 29 November 2017.

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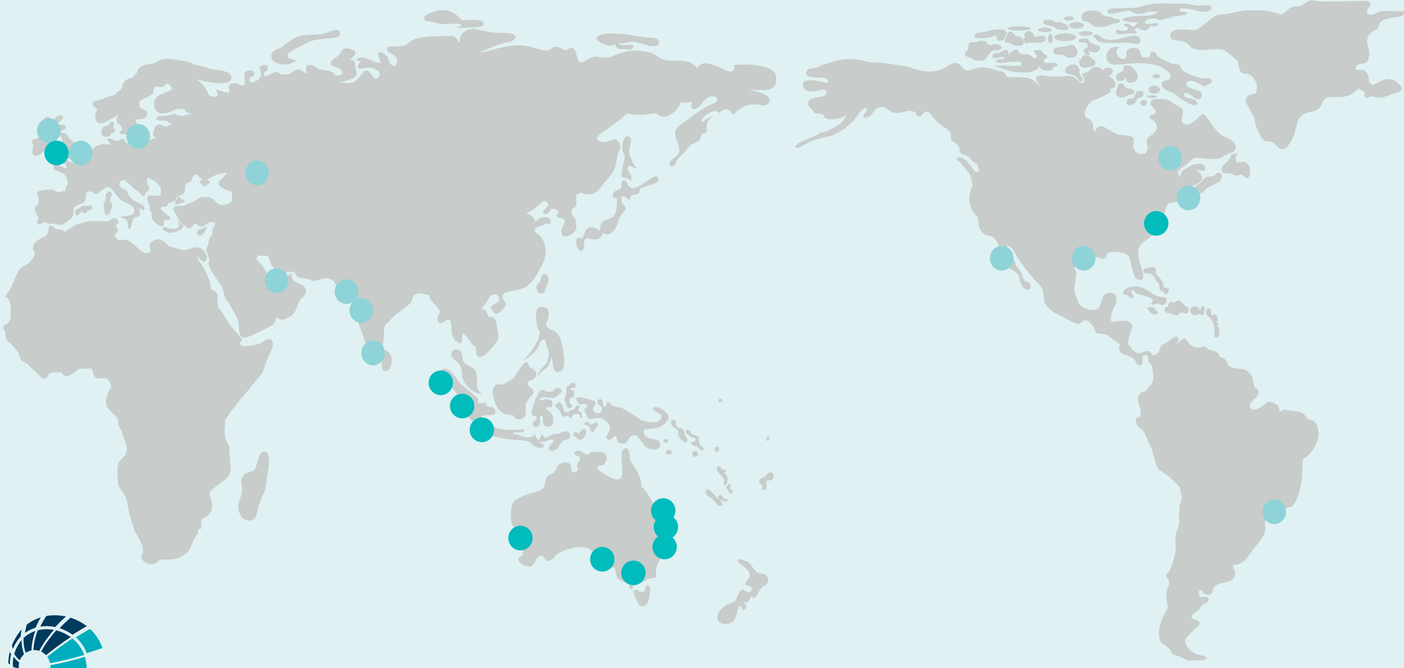

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