Tweed Sand Bypassing

Environmental Monitoring Report

May 2022 to April 2023

Project: Tweed River Entrance Sand Bypassing Project

Report No. CA – 24

August 2023

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Term/Acronym/Department	Definition
AC	TRESBP Advisory Committee
ACC	TRESBP Advisory Committee & Community (no longer active)
AHD	Australian Height Datum
AMG	Australian Mapping Grid
CoGC	City of Gold Coast
CA	Concession Agreement for the operation of the TRESBP
DA	Development of Agreement for the construction of the TRESBP
DPIE	New South Wales Department of Planning, Industry and Environment (including Environment, Energy and Assessment, Planning and Assessment and Housing and Property)
DSITIA	Queensland Department of Science, Information, Technology, Innovation and Arts
DES	Queensland Department of Environment and Science
DUAP	New South Wales Department of Urban Affairs and Planning (now DPIE – Environment, Energy and Science)
EIS/IAS	Environmental Impact Statement / Impact Assessment Study
EMP	Environmental Management Plan
EMS	Environmental Management System
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
CoGC	City of Gold Coast
Governments	News South Wales Minister for Transport and Roads & Minster for Regional Transport and Roads and the Queensland Minister for the Environment and the Great Barrier Reef, Minister for Science and Minister for Multicultural Affairs
ISG	Integrated Survey Grid
Joint Proponents	News South Wales Minister for Transport and Roads & Minster for Regional Transport and Roads and the Queensland Minister for the Environment and the Great Barrier Reef, Minister for Science and Minister for Multicultural Affairs
MUAP	New South Wales Minister for Urban Affairs and Planning (now the Minister for Planning and Public Spaces)
NSW	New South Wales
NSW EPA	New South Wales Environmental Protection Authority
NSW NPWS	New South Wales National Parks & Wildlife Service

Qld	Queensland
Qld DPI	Queensland Department of Primary Industries
TBLALC	Tweed Byron Local Aboriginal Land Council
TfNSW	Transport for NSW
TRESBCo	Tweed River Entrance Sand Bypassing Company
TRESBP	Tweed River Entrance Sand Bypassing Project
TSB	Tweed Sand Bypassing
TSC	Tweed Shire Council
WG	TRESBP Working Group

ENVIRONMENTAL MONITORING REPORT
May 2022 to April 2023

Table 1 – Annual Review of Environmental Management System Operations

Name of operation	Tweed River Entrance Sand Bypass Project
Name of operator	TRESBCo
Development consent / project approval #	D94/00236
Name of holder of development consent / project approval	Tweed River Entrance Sand Bypassing
Mining lease #	N/A. TRESBP is not a mining operation.
Name of holder of mining lease	N/A
Water licence #	N/A
Name of holder of water licence	N/A
MOP/RMP start date	*Rehabilitation works were completed in the vicinity of the Jetty previously by TRESBCo soon after operations started in 2001. Due to operations being carried out in the natural environment affected by storm activities, rehabilitation works will be ongoing and on needs for basis.*
MOP/RMP end date	See above
Annual Review start date	1 May 2022
Annual Review end date	30 April 2023

I, Matthew Harry, certify that this audit report is a true andaccurate record of the compliance status of TRESBP for the period May 2022 to April 2023 and that I am authorised to make this statement on behalf of TRESBP.

Note.

a) *The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false ormisleading information (or provide information for inclusion) in an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).*

Name of authorised reporting officer	Matthew Harry
Title of authorised reporting officer	A/Project Manager for NSW and Qld Governments - Tweed Sand Bypassing
Signature of authorised reporting officer	
Date	25 August 2023

1 Statement of compliance

Development Consent (DC) was granted for the project by the relevant authorities at the start of the contract in 1999. The development was completed and was ready for the start of operations in May 2001. Both the Governments (currently Transport for New South Wales – TfNSW and Queensland Department of Environment and Science – DES) and the operator (Tweed River Entrance Sand Bypassing Company – TRESBCo) have carried out environmental monitoring to comply with the relevant approval conditions and results are presented in the report below.

The Tweed River Entrance Sand bypassing Project (TRESBP) now referred to as the Tweed Sand Bypassing (TSB) is not a mining operation. Sand is transported by mechanical means from the active beach zone and then placed back along the beach in the active beach zone to mimic natural sediment transport. No sand is mined.

Table 2 Statement of compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent	No A non-compliance were identified against EMP sub-plans. Refer section 5.2 Evaluation of Compliance for further details.
Mining License	N/A

2 Introduction

2.1 Project Background

The Tweed River Entrance Sand Bypassing Project (TRESBP) is a joint initiative of the State Governments of New South Wales and Queensland ('the Governments'), to improve and maintain navigation conditions at the Tweed River entrance and to replenish and maintain a natural sand supply to the southern Gold Coast Beaches.

The project has been carried out in two stages:

- Stage 1 Initial Dredging and Nourishment Works (April 1995 to May 1998).
- Stage 2 Sand Bypassing System (May 2001 to present).

In December 1999, the Governments awarded contracts *(the 'Concession Agreement')* to a consortium led by the McConnell Dowell Corporation Limited for the construction and operation and maintenance (CA expiring September 2024) of the Stage 2 Sand Bypassing System. The system was commissioned during March and April 2001. The Tweed River Entrance Sand Bypassing Company (TRESBCo, a subsidiary company of the McConnell Dowell Corporation) commenced full-scale operation of the sand bypassing system on 4 May 2001.

The project is managed by Transport for NSW (TfNSW) and the Queensland Department of Environment and Science (DES) on behalf of the Governments, with the financial support of the City of Gold Coast (CoGC) and in conjunction with Tweed Shire Council (TSC).

This document reports on the project's environmental monitoring and management requirements for the period May 2022 to April 2023, as required under Condition 15 of the EP&A Act (NSW) Approval (application no. G94/00236).

An Environmental Impact Statement / Impact Assessment Study (EIS/IAS) for the project was prepared and publicly exhibited in accordance with the planning requirements of both States in 1997 (Hyder et al 1997). The former NSW Department of Land & Water Conservation (responsibilities for TSB since transferred to TfNSW) obtained environmental assessment concurrence in accordance with *the Queensland State Development and Public Works Organisation Act (1971-81)* and planning approval for the project pursuant to the *NSW Environmental Planning and Assessment Act, 1979* on behalf of the Governments in March and July 1998 respectively. Planning approval for the project was subject to a number of approval conditions which focused on the appropriate management of environmental issues through the development and implementation of project-specific Environmental Management Plans (EMPs).

Two Environmental Management Systems (EMSs) were developed for the project comprising an EMS-Delivery applicable to the construction and commissioning phase of the system and the EMS-Operations which is currently in place and applies to the operational phase.

. The EMS-Delivery was implemented from February 2000 to May 2001. Monitoring outcomes for the EMS-Delivery are presented in the project's environmental monitoring reports for the Delivery Period (Report No. DA-01 to DA-05).

The EMS-Operations were developed by TRESBCo and the Governments to satisfy the environmental management requirements for Stage 2 of the project arising out of the EIS/ IAS for the project:

- Conditions of the EP&A Act approval;
- Recommendations of the Queensland Impact Assessment Review Report.

The EMS-Operations consists of an overarching EMP-Operations and associated sub-plans that deal with significant environmental aspects.

2.2 Description of the Sand Bypassing System

The sand bypassing system comprises **of**:

- A sand collection jetty, pumps and control building at the northern end of Letitia Spit, about 250 m south of the southern Tweed River breakwater (refer to Figure 1).
- A clean water low pressure pump station mounted on a short jetty (intake Jetty) on the southern river training wall at the northern end of Letitia Spit (refer to Figure 1).
- A compound area at the landward end of the sand collection jetty for the housing of a control building and workshop, and sand slurry collection pit (refer to Figures 1 & 3).
- A sand delivery pipeline that crosses under the Tweed River about 250 m downstream of Jack Evans Boat harbour (refer to Figure 3 & 4).
- Sand delivery outlets at Snapper Rocks East, Snapper Rocks West, Duranbah, Greenmount and Kirra Point (refer Figure 4).

Figure 1. Aerial Photographs of Project Site, TSB system and locality (photo: October 2022)

Figure 2. Aerial Photographs of Project Site, southern Gold Coast beaches (photo: October 2022)

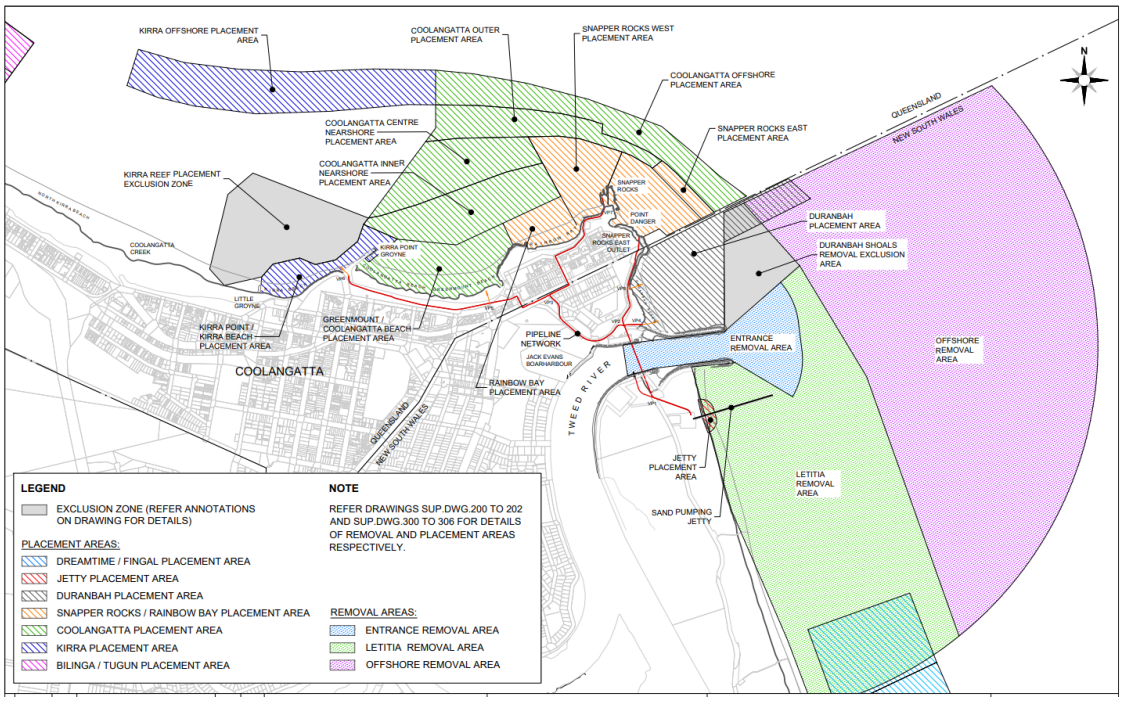


Figure 3 Project Locality Plan *(TRESBP)*

Figure 4 Location of TSB pumping outlets *(TRESBP)*

The jetty is approximately 450 m long and extends into ocean to a water depth of about -5 m AHD. Ten submerged jet pumps sit in a trough in the seabed that acts as a sand trap beneath the jetty. Waves and currents feed sand from the continuous coastal sand drift into the trap, where it is collected by the pumps. From the pumps, the sand is discharged as a slurry through a 400 mm diameter buried pipeline to feed beaches north of the Tweed River entrance.

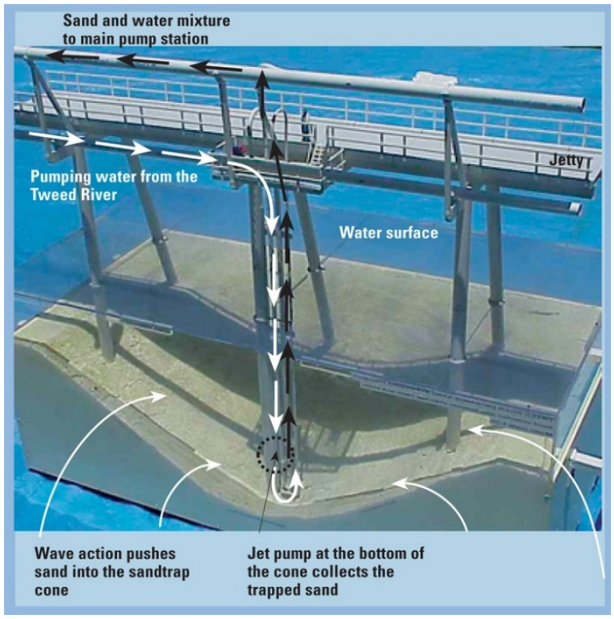


Figure 5 Sand collection jetty diagram (left),

The jetty collects as much as possible of the northerly moving coastal sand drift before it reaches and accumulates in the Tweed River entrance, thereby helping to maintain a clear navigational channel at the entrance.

The system is designed to collect and deliver an average of about 500,000 m³ of sand each year under normal operation. It also has the reserve capacity to deliver at higher rates when sand drift rates are elevated, such as during storms.

The majority of sand collected by the jetty system is delivered to the primary outlet point of Snapper Rocks East. To provide flexibility, intermittent discharge outlets have also been established at Duranbah Beach, Greenmount Beach, Snapper Rocks West and Kirra Point (Figure 3). Additionally, the pipeline layout has the capability to deliver sand to the Tweed River lower estuary shoals, and Letitia Spit if required via temporary pipe from valve pits (refer Figure 4 VP1) or directly from Jetty system.

The bypassing system is not able to intercept 100% of the coastal sand drift making its way to the Tweed River Entrance, and it may not be possible to maintain a clear navigation channel all of the time using the bypassing system alone. Outflanking of and leakage through the jetty during severe storms and flooding of the Tweed River may deposit sand in the entrance area and compromise navigation conditions at times. Therefore, the project contract agreements allow for supplementary dredging and nourishment works to be carried out to clear the Tweed River entrance when required. Nearshore placement zones from Dreamtime to Bilinga Beach have been established for the deposition of dredged sand (refer Figure 6). Typically, a volume of up to 200,000m^3 per dredge campaign is placed within these zones.

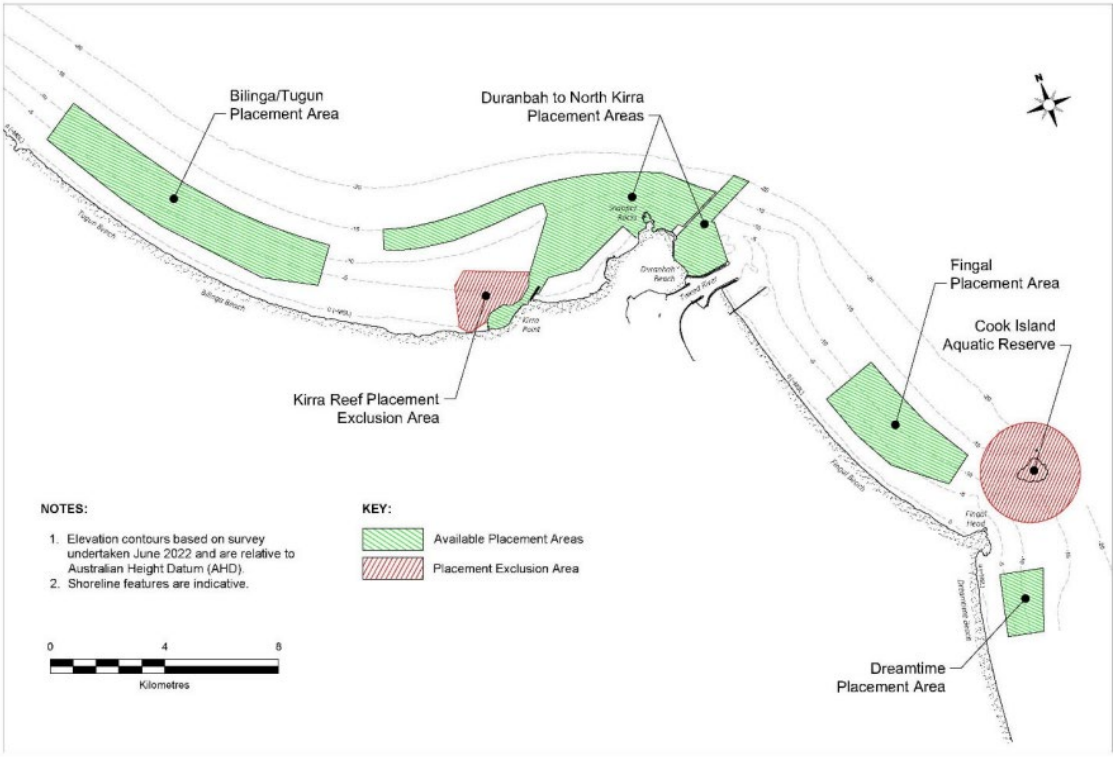


Figure 6 Dredge Placement Boxes *(TRESBP)*

2.3 Acknowledgements

This report has been prepared jointly by the following parties on behalf of the Tweed River Entrance Sand Bypassing Project's joint proponents being, the NSW Minister for Transport and Roads and Minister for Regional Transport and Roads and the Queensland Minister for the Environment and the Great Barrier Reef, Minister for Science and Minister for Multicultural Affairs:

- Transport for NSW
- Queensland Department of Environment and Science
- Tweed River Entrance Sand Bypassing Company

For further information regarding the Tweed River Entrance Sand Bypassing Project, please refer to the following websites:

www.tweedsandbypass.nsw.gov.au

https://www.qld.gov.au/environment/coasts-waterways/beach/restoration/tweed-river

http://ci.wrl.unsw.edu.au/current-projects/tweed-river-sand-bypassing-project/

Queries concerning this report or monitoring outcomes may be directed to the Governments' Project Manager:

TRESBP Project Manager
Transport for NSW
14 Eden Street
Tweed Heads NSW 2485

Phone: 0437 273 874
Email: matthew.harry@transport.nsw.gov.au

3 Statutory and other obligations

3.1 TSB Governing legislation

Tweed Sand Bypassing operates under overarching legislation in both NSW and Qld, the enabling Acts known as the *Tweed River Entrance Sand Bypassing Act 1995* (NSW) and *Tweed River Entrance Sand Bypassing Agreement Act 1998 (*Qld).

The TSB Project Legislation provides the framework for the implementation of a unique joint agreement between the NSW and Qld governments (the Governments) in perpetuity and gives effect to the Heads of Agreement and a Deed of Agreement (both included as a schedule to the legislation).

The objectives of the Qld Act and the NSW Act are set out under the enabling Acts, and more generally are to improve and continually maintain:

- the navigability of the Tweed River entrance; and
- the amenity of southern Queensland beaches.

The intentions for the project and a high-level framework for the project are set out in the Heads of Agreement, and a more detailed framework provided under the Deed of Agreement.

3.2 Concession agreement

The sand bypass jetty system was commissioned on 4 May 2001 and is operated under the Concession Agreement between the Governments, Tweed River Entrance Sand Bypassing Company Pty Limited and the Guarantor. The Concession Agreement expires on 30 September 2024 (unless it is extended in accordance with its terms or by agreement between the parties).

The Governments' Project Team is currently undertaking a TSB Transition Project to identify and evaluate options for the governance of the TSB Project post 30 September 2024. While the Concession Agreement is set to expire in 2024, the TSB Project Legislation which underpins the Concession Agreement, contemplates that the system will operate in perpetuity.

3.3 EP&A Act (NSW) approval and management framework

The TSB project operates under an environmental management system (EMS-Operations) which was developed based on the environmental management framework set out in the original environmental impact statement/integrated assessment study (EIS/IAS) and overarching approval (application no. G94/00236) issued under the EP&A Act (NSW).

The framework for the EMS-Operations is outlined in Figure 7 below. The EMS-Operations document and sub-plans managed by TRESBCo are certified under the ISO14001 framework.

The EMS-Operations were approved by the former NSW Department of Urban Affairs and Planning (now DPIE) on 23 February 2001, and incorporates environmental management sub-plans (16 thereof) that address significant environmental aspects of the project. The EMPs specify the assignment of resources and responsibilities for achieving the environmental requirements and include detailed monitoring programs.

ENVIRONMENTAL MANAGEMENT SYSTEM – OPERATIONS *** managed by TRESBCo under ISO14001 certification*	
Environmental Management Plan – Operations Sub-plans	
Governments Sub-plans **managed and implemented by Governments	**TRESBCo Sub-plans** **managed and implemented by TRESBCo under ISO14001 certification.
B1 Consultation Strategy Plan	B2 Community Information Plan
B9 Letitia Spit Avifauna Habitat Management Plan	B3 Sand Retrieval and Placement Strategy
B13 Beach Management and Nourishment Strategy	B4 Noise and Vibration Management Plan
B14 Kirra Reef Management Plan	B5 Traffic and Air Quality Management Plan
B15 Duranbah Surf Quality & Beach Amenity Management Plan	B6 Sand and Water Quality Management Plan
B16 Tweed River Entrance & Lower Estuary Management Plan	B7 Infrastructure and Public Access Management Plan
	B8 Waste Management Plan
	B10 Landscaping Management Plan
	B11 Historic Shipwreck Management Plan
	B12 Accident and Emergency Response Plan

Figure 7 Structure TSB EMS-Operations

The Governments arm of the TSB predominantly uses ChangePoint a database managed system led by TfNSW to manage their responsible documents and records under the EMS-Operations.

3.4 Review of Environmental Factors (REF)

The TSB operates in accordance with several Review of Environmental Factors (REF) assessments completed at various stages during project operations to date (post EIS/ IAS approval), as required under the EP&A Act. The following REFs are application:

- **Duranbah Beach valve pit construction** - completed for the construction of a new valve pit at Duranbah Beach for the connection of temporary sand pipe. Relevant agencies including the local Aboriginal Land Council were consulted in preparing the REF, and the community consulted via the TSB Advisory Committee forum.
- **Back-passing by Dredge** - back-passing of sand dredged from the Tweed River entrance. A maximum of 50,000m^3 of material per annum has been approved, with 30,000m^3 and 20,000m^3 allocated to Fingal and Dreamtime beaches respectively. The purpose is to enhance and maintain the attributes of

the Gold Coast – Tweed Heads region and more specifically the Tweed River estuary and the southern Gold Coast beaches and to achieve the objectives of each State. A Project Environmental Management Plan (PEMP) is required to be developed and implemented by the principal works contractor, Tweed River Entrance Sand Bypassing Company Pty Ltd, that complies with the conditions of the REF.

3.5 Environmental Protection License

Tweed River Entrance Sand Bypassing Company Pty Ltd holds the Environmental Protection License (EPL no. 10432) for Extractive Activities (Activity Type: Water-based extractive activity). This license was amended to include the back-passing by dredge in 2019.

3.6 Environmental reporting obligations

Condition 15 of the Part 4 approval (application no. G94/00236) under the EP&A Act for the TRESBP states:

> The proponent shall submit three (3) monthly reports to the Director-General and the EPA on the results of monitoring commencing after the date of actual commencement of construction works at the site until the completion of construction and six (6) monthly during bypass operation for the first two years and annually after that or at any other period as determined by the Director-General. The reports shall include, but not be limited to, information on the following:
>
> i) Any applications for consents, licences and approvals, and responses from relevant authorities during the reporting period;
>
> ii) Implementation and effectiveness of environmental controls and conditions relating to work undertaken;
>
> iii) Identification of impact predictions made in the EIS and other supplementary studies and details of the extent to which the actual impacts reflect the predictions;
>
> iv) Details and analysis of environmental monitoring;
>
> v) Assessment of compliance with Environmental management Plan(s) for both construction and operation activities;
>
> vi) Number and details of any complaints, including a summary of the main areas
>
> vii) Number and details of any complaints, including a summary of the main areas
>
> Copies of these reports shall be submitted at the same time to the Director-General EPA, NSW Fisheries, NPWS and the Advisory Committee and be made available to the public on request.

This report documents the project's environmental management and monitoring outcomes for the period from May 2022 to April 2023.

3.7 Applications for approvals during the monitoring period

There were no new applications for approvals made during this monitoring period.

4 Operations summary

Tweed Sand Bypassing - Operations (nsw.gov.au)

4.1 Mining operations

N/A

4.2 Operation of the permanent sand bypassing system

4.2.1 Sand bypassed by the system

The TSB was operated successfully without significant interruption during the reporting period. The following provides a summary of operations, with sand pumping volumes presented in Table 3:

- Days operated during year = 264 days.
- Average days operated per month = 20.3 days.
- Average hours operated per day = 6.7 hours.
- Maximum volume pumped per day = 10,179 m^3 (03/12/2022).
- Average pumping rate per day = 2,305.4 m^3/day.
- Total volume for monitoring period = 590,630 m^3

Sand was delivered by TRESBCo, in accordance with the sand delivery program developed by the project Working Group (which includes representatives of the Governments, City of Gold Coast and Tweed Shire Council), in consultation with the project's community-based Advisory Committee.

Sand was predominantly pumped to Snapper Rocks east discharge point consistent with previous years. Two (2) nourishment campaigns were completed at Duranbah beach during the reporting period July 2022 and September 2022. A total volume of 12,126m^3 was placed strategically in upper beach locations.

Table 3 Monthly TRESBP Sand Delivery May 2022 to April 2023

Month	Duranbah	SR-E	Kirra	Greenmount	SR-W	TOTAL
May	0	73,797	0	0	0	**73,797**
June	0	20,317	0	0	0	**20,317**
July	11,445	29,130	0	0	0	**40,575**
August	0	22,517	0	0	0	**22,517**
September	681	42,505	0	0	0	**43,186**
October	0	77,432	0	0	0	**77,432**
November	0	12,241	0	0	0	**12,241**
December	0	88,971	0	0	0	**88,971**
January	0	48,339	0	0	0	**48,339**
February	0	41,601	0	0	0	**41,601**
March	0	22,898	0	0	0	**22,898**
April	0	98,756	0	0	0	**98,756**
TOTAL	12,126	578,504	0	0	0	**590,630**

4.2.2 Sand delivered by dredge

Dredging was undertaken from August to November of 2022. A total of 72,399 cubic metres of sand was dredged from the entrance and delivered by dredge to approved placement areas (Figure 8) as follows:

- 33,174m^3 to Snapper Rocks East
- 30,599m^3 to Duranbah
- 8,626m^3 to Dreamtime

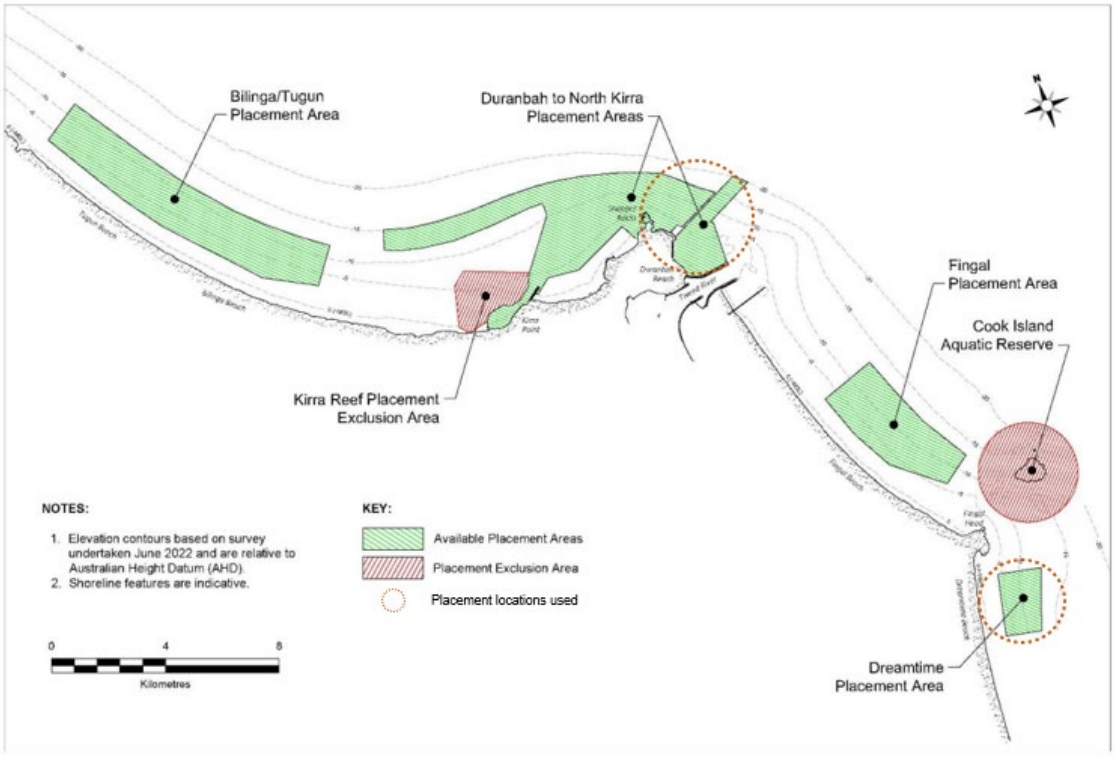


Figure 8 Approved placement locations used during August to November 2022 dredging campaign.

4.2.3 Sand delivered by the project to date

The project's Stage 1 and Stage 2 works have collected approximately 17.14 Million m³ of sand from the Tweed River bar/ entrance area and area connecting the Jetty system from April 1995 to April 2023.

- Stage 1 works (1995 to 1998) = 3.04 Million m^3 of sand
- Stage 2 works (to end April 2023) = 14.10 Million m^3 of sand

The volume of sand on the southern Gold Coast beaches (i.e. Snapper Rocks East to North Kirra) has increased as a result of sand nourishment by the project.

This sand initially accreted within the southern Gold Coast area and is now dispersing northwards along the coastline. A summary of sand quantities delivered to the various placement areas since April 2000 is presented in Tables 4 and 5.

Table 4 Stage 2 Sand Pumping Summary to 30 April 2023, values represent volume in cubic metres (m^3).

Quantity of sand delivered by TRESBP Stage 2 pumping (m^3)						
Period	**Duranbah**	**Snapper Rocks East**	**Snapper Rocks West**	**Greenmount Coolangatta**	**Kirra Point**	**Totals**
Pre-Commissioning Phase						
1 April 2000 to 3 May 2001	19,783	164,853	0	0	0	184,636
Operation Phase						
All monitoring (4 May 2001 to 30 April 2022)	924,725	9,492,819	12,264	31,931	264,112	10,725,851
This monitoring period (1 May 2022 to 30 April 2023)	12,126	578,504	0	0	0	590,630
Total Stage 2 Pumping (Operations Phase)	**936,851**	**10,071,323**	**12,264**	**31,931**	**264,112**	**11,316,481**
Previous Monitoring Periods						
Monitoring period (1 May 2020 to 30 April 2021)	60,364	340,197	0	0	0	400,561
Monitoring period (1 May 2021 to 30 April 2022)	59,974	503,925	0	0	0	563,899

NOTE: Refer to for location of sand pumping outlets.

Table 5 Stage 2 Sand Dredging Summary from April 2000 to 30 April 2023, values represent volume in cubic metres (m^3).

	Pre-Commissioning	Operations Phase		
Placement locations	1 April 2000 to 3 May 2001	Previous Monitoring Periods (4 May 2001 to 30 April 2022)	This Monitoring Period (1 May 2022 to 30 April 2023)	**Total Stage 2 Dredging (Operations Phase)**
Duranbah	0	504,778	30,599	535,377
SRE	246,987	1,188,928	33,174	1,222,102
SRW	15,509	164,615	0	164,615
Inner nearshore	30,279	94,199	0	94,199
Centre nearshore	106,531	188,403	0	188,403
Outer nearshore	133,212	410,487	0	410,487
Palm Beach	0	22,870	0	22,870
Northern 2A	0	11,859	0	11,859
Southern 2A	0	65,769	0	65,769
Fingal	0	63,461	0	63,461
Dreamtime Beach	0	0	8,626	8,626
TOTAL	**532,517**	**2,715,369**	**72,399**	**2,787,768**

Note: Dredging for this reporting period occurred from August to November 2022

4.2.4 Sand delivery forecast for next reporting period

The forecast for the operation that an average of 500,000m^3 of sand will be assisted by mechanical means to designated areas of the active beach zone for the May 2023 to April 2024 monitoring period.

5 Environmental performance

The results of environmental and project performance are predominately distributed through the Tweed Sand Bypass website. This website enables clear tracking and transparency of information to stakeholders and the community and promotes accountability amongst the team to undertake consistent and proactive analysis of data. The appendices and provision of supporting information for this report have been mindfully reduced and linked to the website where both appropriate and applicable.

Tweed Sand Bypassing - Website - Tweed Sand Bypass (nsw.gov.au)

Tweed Sand Bypassing - Environment Monitoring (nsw.gov.au)

5.1 Environmental monitoring

The following table provides a summary of environmental monitoring undertaken during the reporting period.

Table 6 Summary environmental monitoring May 2022 to April 2023

Monitoring	Frequency	Timing
Wave conditions & Sediment transport	Monthly	May 2022 to April 2023
Tidal analysis	Annual	May 2023

• Survey
  ○ Pre-dredge
  ○ Tweed river entrance
  ○ Full coastal (including entrance)
  ○ Tweed River (EPA)
	Quarterly – entrance
	As required – additional entrance
	Annual – full coastal
	.
		Pre-dredge – August 2022 & March 2023
		
		Quarterly Entrance - July & November 2022, January 2023
		
		Additional Entrance – May & September 2022, November 2022, March 2023
		
		Full Coastal – June & November 2022
		
		Tweed River - August 2022

Beach conditions
  ○ Argus coastal imagery
  ○ Aerial photography
  ○ Survey
	Monthly - beach width analysis
	Quarterly – aerial (vertical and obliques)
	As above i.e. quarterly, annual.
		Beach width - May 2022 to April 2023
		
		Aerial – July & October 2022, January & April 2023.

• Reef monitoring
  ○ Kirra (Qld)
  ○ Cook Island (NSW)
	Annual	May 2023 – field survey.

Tweed River Lower Estuary Shoals and Wetlands Extents	As required	March 2023

5.1.1 Sediment transport and wave conditions

5.1.1.1 Wave Conditions

Wave climate summary report is provided in Appendix A (item 1).

Queensland Government (Department of Environment and Science - DES) maintain a network of wave monitoring sites to measure the height and direction of waves along the Queensland coast which extends into NSW waters.

DES operates two wave buoys jointly with the TSB:

- 'Tweed Heads' nearshore buoy (installed Jan 1995) located in approximately 22m water depth off Letitia/ Fingal beaches; and
- 'Tweed offshore' buoy (installed Jan 2020) in approximately 60m water depth to the east and adjacent to Kingscliff and Dreamtime beaches.

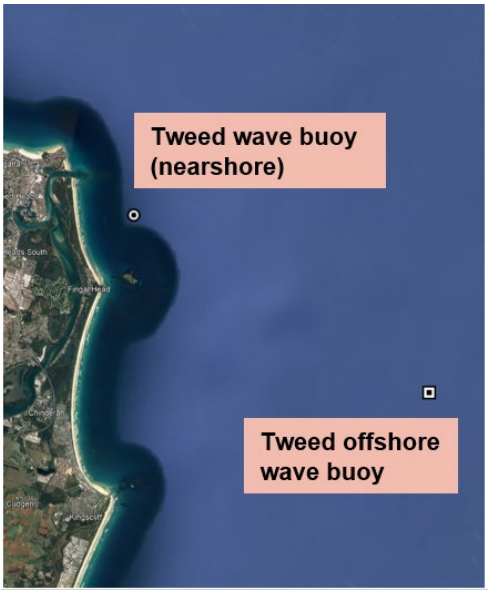


Figure 9 TSB Wave buoy locations

This section provides a summary of the wave data collected from these two wave buoys for the reporting period.

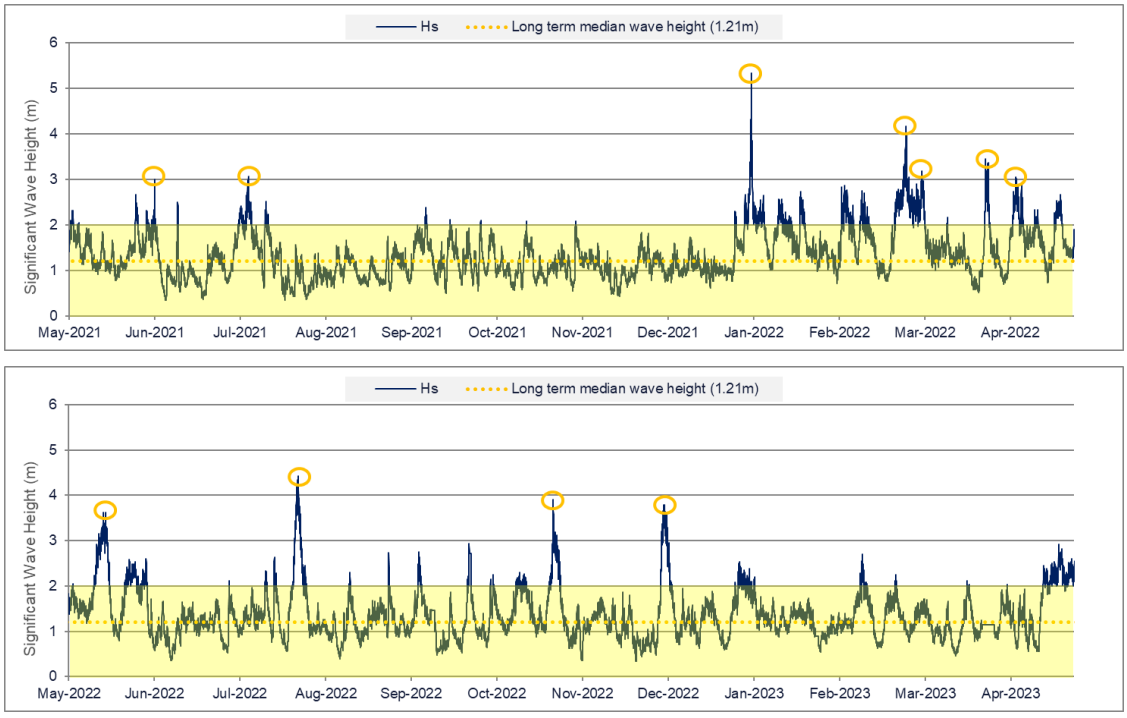


Figure 10 Tweed Heads buoy significant wave heights, previous reporting period (top), current reporting period (bottom)

Significant wave heights (Hsig) ranged from 0.34-4.42m during the reporting period, with wave directions generally from ESE. This reporting year saw the number of days where Hsig was >2m at some point, with 78 days. This is compared with previous reporting periods of 82 days *(May 2021 – April 2022)*, 32 days *(May 2020 – April 2021)*

and 7 days *(May 2019 – April 2020).* This increase corresponds to an increase in the number of swell and storm events which occurred during this period.

A low from the Coral Sea moved down the coast in the 3rd week of July. This produced a significant swell event over 4 days with wave directions from the ENE and east, producing the peak Hsig for this period of 4.42m. The peak Hsig for the previous reporting period was 5.33m in January 2022.

Low pressure systems influenced wave conditions in October and December, generating wave peaks at just under 4m for both events. Another low-pressure system brought increased wave heights at the end of December and into January. A persistent swell event during April had significant influence on longshore transport rates, refer Figure 12.

Predominant wave conditions overall are consistent with the previous reporting period where overall we saw an increase in the number of large swell events.

Table 7 Comparison of wave parameters May 2022 to April 2023 with previous reporting periods

Monitoring Period	Hsig Max (m)	Hsig Min (m)	Days Hsig (>2m)	**Days Hsig (<1m)**
May 2019 – April 2020	2.5	-	7	296
May 2020 – April 2021	6.41	0.25	32	267
May 2021 – April 2022	5.33	0.34	82	173
May 2022 – April 2023	**4.42**	**0.34**	**78**	**161**

5.1.1.2 Sediment Transport

Summaries of indicative sediment transport rates are included in the monthly environmental reporting, Appendix A (item 4).

Sand flows northwards along the northern NSW coast at a rate estimated to be in the order of 500,000 m^3 per year under waves predominantly from the SE. This is due tonatural coastal processes, the net effect of these processes is referred to as Longshore Sediment Transport (LST). The amount of LST is estimated to vary from 250,000 m^3 to 1,000,000 m^3 each year depending on the wave conditions.

TSB uses a one-dimensional sediment transport program (Litpack model) to calculate sediment transport rates under defined hydrodynamic conditions. Monthly wave data is a key input enabling 'natural' transport rates for sand that travels north along Letitia Beach to be estimated.

Understanding sediment transport rates is important to achieving the legislative project objective (set out under enabling Acts) of continuing supply of sand to the southern Gold Coast beaches at a rate consistent with LST rates of these beaches.

Figure 11 below shows the Letitia indicative longshore transport assessment, which compares pumping volumes with estimated transport volumes (Litpack) for the monitoring period. The data shows correlation between the pumping and modelled data. Monthly comparisons, as shown in Figure 12, highlight how wave conditions significantly influence transport rates, which result in the annual variability in LST.

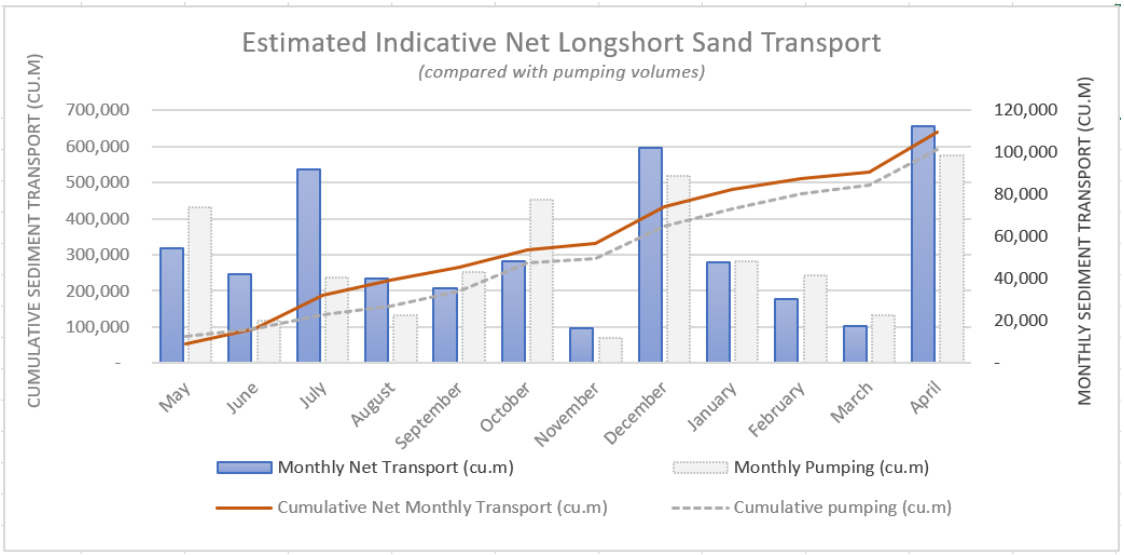


Figure 11 Estimated Indicative Net Longshore Sand Transport, May 2022 – April 2023

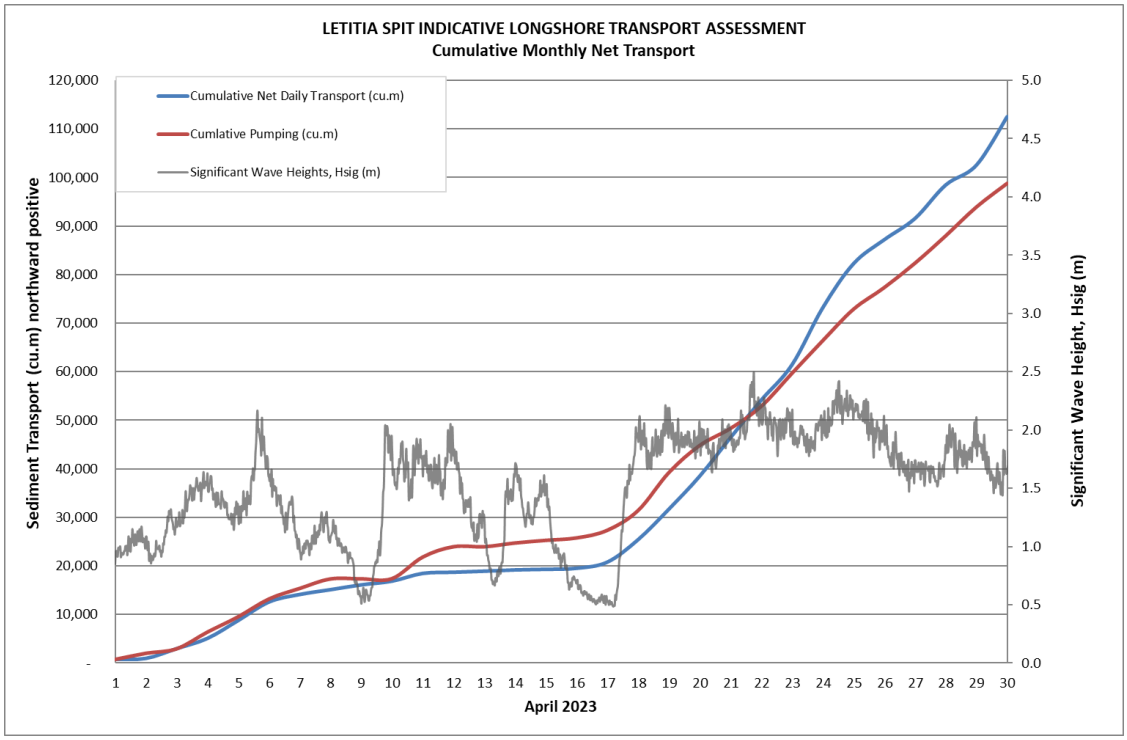


Figure 12 Pumping volumes compared against estimated transport rates, April 2023

5.1.2 Tidal analysis

A copy of the Tidal analysis report for this reporting period is provided in Appendix A (item 2).

A tidal harmonic analysis was performed by NSW Manly Hydraulics Laboratory (MHL) on three tidal measurement datasets: Letitia 2A at the Tweed River entrance, Coffs Harbour Jetty, and Mooloolaba at the Sunshine Coast. The analysis uses data collected from continuous recording stations at the three locations. Data is available on MHL website https://www.mhl.nsw.gov.au/Station-201429.

Mean water levels behaved consistently between all three sites, similarly to previous years.

The spring tidal range was steady across this 12-month period and consistent with the previous year's analysis, and the ratio of spring tide range between sites also remains consistent with last year's analysis.

Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) across all three sites show similar trends to the previous years and remained consistent over this reporting period.

The report summarises that any significant tidal anomalies recorded at Letitia 2A were due to elevated water levels which were caused by precipitation in the Tweed catchment or synoptic meteorological events.

Overall, the Tweed River entrance is unlikely to have experienced any significant morphological changes over the study period resulting in changes to the astronomical tidal response.

5.1.3 Reef monitoring

Reef monitoring was undertaken in May 2023, with a supplementary survey undertaken in June 2023, to assess potential ecological changes at Kirra Reef (Qld), and for reefs around Cook Island (NSW). Refer to Appendix A (item 3) for full monitoring report including any recommendations, the following provides a summary of findings.

Six reef locations were surveyed (refer Figure 13): Kirra Reef (previously impacted reef, as assessed under the EIS/ IAS); Cook Island West and South Reefs (potential impact reefs, as assessed under an REF for Back-passing by dredge); and Cook Island North Reef, Palm Beach Bait Reef, and Palm Beach Reef (comparative reefs).

Figure 13 Reef monitoring locations (Appendix A (item 3) Ecological Service Professionals Pty Ltd)

Bathymetric survey data as well as aerial and satellite imagery was used to determine reef extent, and data from previous monitoring reports used to assess changes in areal extent of Kirra reef overtime. Field surveys were undertaken to assess differences in benthic communities (algae, sessile and mobile invertebrates) and fish assemblages among reefs.

5.1.3.1 Kirra Reef

The EIS/ IAS predicted a reduction in extent of the Kirra Reef because of the project, and conditions of approval imposed an exclusion zone to manage and reduce potential impacts to the reef.

Three distinct reef areas were identified in 1995 *(maximum extent recorded in 1995),* a shallow southern reef, a shallow eastern reef near the current groyne, and a northern section of reef section in deeper water. In recent years, only the northern section located in deeper waters has been uncovered. Reef areas in shallow waters (southern and eastern sections) have a low profile (or relief) and are likely to be more prone to natural disturbance from sand coverage and/ or wave turbulence in comparison to reef areas in deeper waters. The higher frequency of physical disturbance in these shallower sections of the reef is likely to limit the development of a diverse community of reef dwelling organisms on these reef sections.

Monitoring reports from the earlier stages of the project show there were substantial changes in the aerial extent of Kirra Reef through time, with the maximum extent measured in 1995 (approx. 5900m^2 in northern section), declining to its lowest extent in 2008, then increasing again from 2010 and remaining relatively stable since 2012.

This recovery and stabilisation has been substantiated through annual monitoring under the TSB monitoring program. The recovery of Kirra reef communities has included an increase in coverage, to 83% of the maximum extent recorded, more diverse fish assemblages and improved diversity of algal and sessile assemblages.

In April 2023, the areal extent of Kirra Reef increased over the past year from 3,014 m^2 in May 2022 to 3,492 m^2 . The change in reef area is not substantially different to the relatively stable reef extent that has been observed consistently since 2012 (Ecological Service Professionals (ESP), 2023).

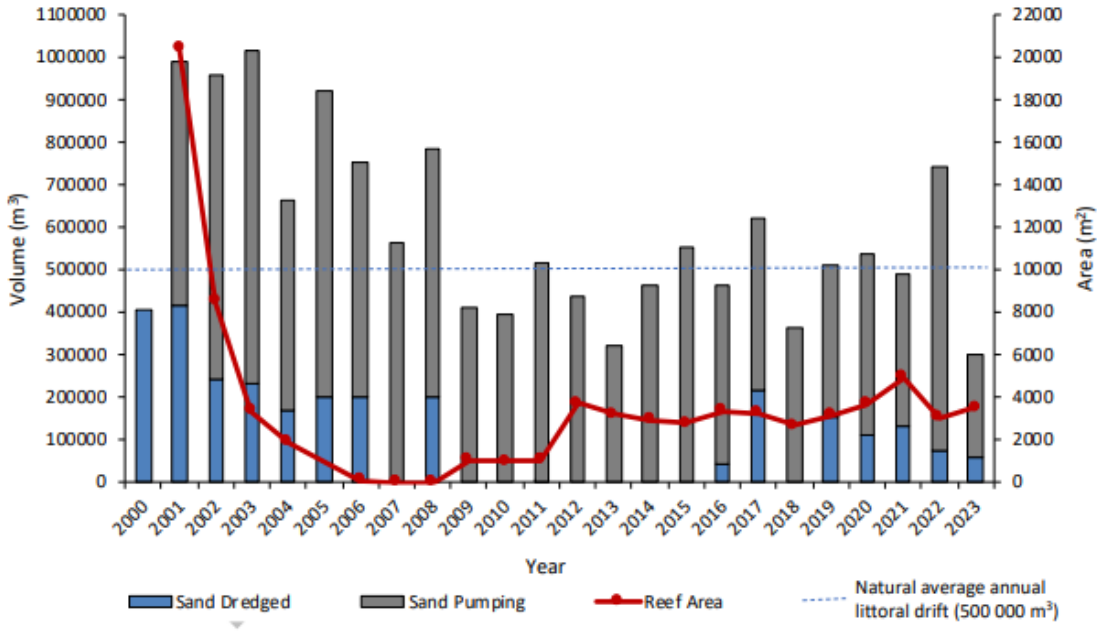


Figure 14 Estimated surface area (m^2) at Kirra Reef and total annual dredging and pumping volumes (m^3) between 2000 and 2023 (data for 2023 includes sand volumes up to end of May) (Source: Reef Biota Monitoring 2023, ESP).

5.1.3.2 Cook Island

Cook Island North and Cook Island South had good coverage of long-lived hard corals, large ascidian and sponge colonies which is typical of reef communities found in South-East Queensland. Fish communities at Cook Island North were more diverse than recorded at all other reef locations.

Seagrass was recorded between 2020 and 2022 at Cook Island West and was observed again in 2023, however the coverage had declined. Likely cause noted was prolonged recovery following flood impacts. A quantitative assessment of the distribution and density of seagrass habitat has not been completed (ESP, 2023).

The REF for back-passing noted that, *"the habitat in the proposal area and adjacent habitats is a high energy coastal area of open beach that is not suitable for the establishment of seagrasses."* The Reef Biota Monitoring Report (Ecological Service Professionals (ESP), 2023), indicated that monitoring of seagrass should occur following sand disposal at adequate spatial and temporal scales. TSB intend to seek further advice on the appropriate response to monitoring seagrass meadows off Cook Island West when planning placement at either Dreamtime or Fingal placement areas.

5.1.4 Beach and entrance conditions

In addition to tidal (section 5.1.2) and wave monitoring (section 5.1.1), monitoring of beach/ surf conditions and the condition of the Tweed River entrance and lower estuary is summarised below, with monthly summaries provided in Appendix A (item 4) and beach width and compartment volume analysis in Appendix A (item 7).

5.1.4.1 Coastal Imaging Network

A network of 16 ARGUS coastal imaging cameras is used to monitor the beaches of the stretch of coast extending from North Kirra in Queensland to Duranbah in New South Wales, as well as the Tweed River entrance. Cameras are mounted at four different locations, providing a 180º view of the coast at each site.

Images from the cameras are collected every daylight hour and processed to produce the equivalent of an aerial photo of the beaches every low, mid, and high tide. The width of the beach is also mapped weekly, providing data for the evolving condition of the beaches and the impacts of severe weather events. Images and data from the coastal imaging stations has been collected by WRL for over a decade.

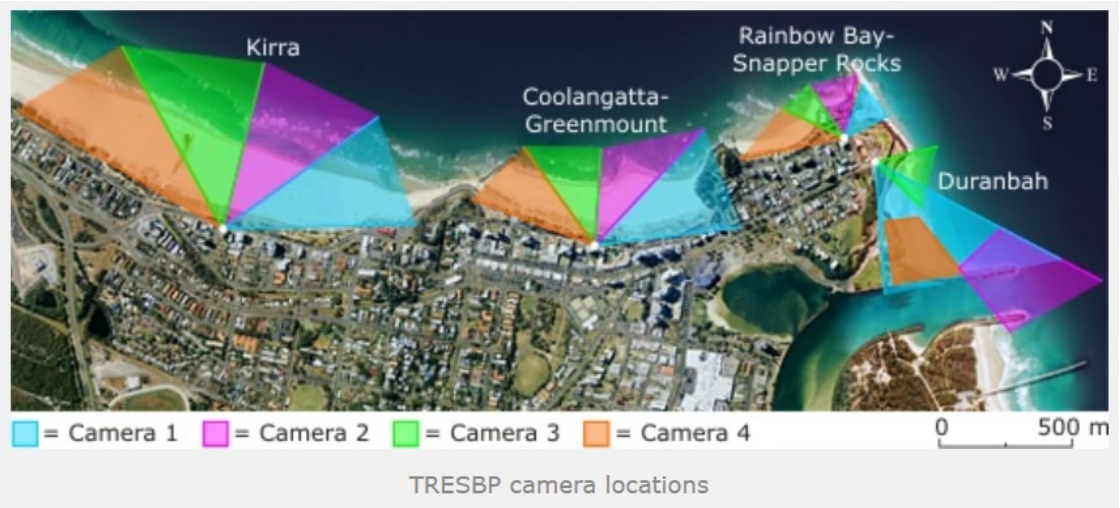


Figure 15 Argus camera locations (Water Research Laboratory - UNSW)

5.1.4.2 Survey

Michel's Group Services Pty Ltd was engaged during the reporting period to undertake regular sand monitoring surveys of the Tweed River entrance and beach profiles from Dreamtime Beach in NSW to Currumbin Beach in Qld. The surveys comprise of a land-based component (beach profiles) and/ or a hydrographic surveying component.

The monitoring includes, but is not limited to, **quarterly** surveys of the Tweed River entrance, required to be undertaken by the operator under the Concession Agreement, to ensure the legislative objective that is to maintain a clear navigation channel is achieved.

The extent of survey works covers the following areas at different times during the reporting period -

Full coastal

The coastal area from Dreamtime Beach in NSW to Currumbin Beach in Qld, Kirra Reef and the Tweed River entrance. This area includes the upper beach and the seabed in the nearshore area i.e. from RL +4 mAHD to -20 mAHD.

Tweed River Hydrographic Survey

Tweed River between the Tweed River Entrance, Boyds Bay Bridge and Barney's Point Bridge. The survey area includes all accessible waterways within the survey extent up to the riverbank.

Aerial photography and beach / surf condition photos are also taken during the reporting period to supplement hydrographic survey.

Refer Appendix A (item 8) for further survey information and Appendix C for the survey register.

5.1.4.3 Tweed River Entrance

The Tweed River Entrance is actively monitored through hydrographic survey (described above), as the depth of the entrance is a key parameter when assessing against the legislative objectives. During this monitoring period, survey indicated the depth of was not within the required parameters, which triggered intervention through dredging.

A total of 72,399 m^3 of sand was dredged from the entrance between August and November 2022, however vessel constraints meant the design volume for removal could not be achieved. Further dredging campaigns were subsequently planned for May 2023 and September 2023, falling outside of this monitoring period.

Aerial imagery, Appendix A (item 5) captured during the period covers the Tweed River entrance and sections of the lower estuary. Tidal analysis, Appendix A (item 2), using data measured at Letitia 2A gauge shows no significant changes in the water levels at the Tweed River entrance during this period, consistent with results of the previous reporting period.

5.1.4.4 Duranbah (NSW)

Sand was pumped to north Duranbah beach between the 21st and 25th July 2022 coinciding with the Coral Sea well event, 11,445m^3 of sand was delivered. Duranbah held up well throughout August following the placement of sand in July during a significant swell event. The shoreline along north facing beaches were drawn back over the month due to easterly and ENE swell conditions. A further 681m^3 of sand was delivered to Duranbah in September 2022.

Figure 16 Oblique imagery Duranbah, October 2022 to April 2023

5.1.4.5 Letitia (NSW)

Aerial imagery shows the beach width at Letitia remained relatively stable during the reporting period. Back-passing by dredge was implemented during this period (in August 2022) with 8,626m^3 of sand placed in the Dreamtime placement area.

Calm conditions in June and again in November 2022, saw a gradual rebuilding of Fingal and Letitia. However, erosion of the upper beach at Fingal through late April 2023 was observed, primarily due to sustained easterly wave energy in the last two weeks of the month.

Figure 17 Oblique imagery Letitia, October 2022 to April 2023

5.1.4.6 Rainbow Bay/ Snapper Rocks (Qld)

Mild conditions during November resulted in a gradual building of the beaches. Easterly swell in December affected those stretches of coastline not protected with storm bar formation was evident. The banks off Snapper Rocks were affected but they slowly recovered.

Short term changes were observed at Rainbow Bay and Coolangatta Greenmount because of the sustained easterly wave energy in late April.

Beach width analysis and compartment volume changes show a relatively stable formation during the reporting period.

Figure 18 Oblique imagery Snapper Rocks and Rainbow Bay, October 2022 to April 2023

5.1.5 Lower estuary conditions and Wetlands

5.1.5.1 Lower Estuary Shoals

A review was undertaken of the Lower Estuary Shoals to assess their condition, vulnerability to flood events post the 2022 major floods in northern NSW and the scope of monitoring and management intended by EIS to inform future monitoring requirements. The following is a summary of the outcomes of the review detailed in section 5.1.5.1.2.

Considerations

- Environmental Impact Statement (EIS) and the purpose of monitoring the lower estuary shoals in relation to shoal formation post major flood events.
- EIS expectations for reviewing monitoring frequencies with the intent to reduce monitoring activities based on data and experience.
- EIS expectations for the impacts extractive works within the Tweed River have on hydrodynamics and flood events.
- Sub-plan B16, which refers to:
  - remedial works to restore lower estuary shoals (in the event that the shoals are eroded in a major flood event and are slow in recovering as a result of the operation of the sand bypassing system).
  - Actions required in response to tidal analysis showing a specified drop for three consecutive months.
- The Tweed Shire Council Coastal Management Program 2022-2032 and the extent of estuary management being undertaken by Tweed Shire Council and the NSW Government to restore estuarine health and maintain navigation.

Outcome

- TSB operations have not triggered any environmental responses that would result in changes to tidal regimes within the estuary.
- Annual hydrographic survey of the lower Tweed River has no clear merit in managing project impacts.

Evidence

- 10+ years of monitoring data showing distributional trends have not significantly departed from broader trends since initiation of the Tweed Sand Bypass project.

- Mapping of the Tweed River was undertaken by the EPA in August 2022 and compared with survey undertaken in 2019, showing no clear impact to shoal distribution.
- Annual tidal analysis (completed since 2000) showing no changes to tidal regimes - the operation of the system has not had a significant impact on the river tides.
- Major flood events have not triggered any long-term tidal responses within the Tweed River. February/March major floods recorded tidal anomalies for a period of 2 weeks.

5.1.5.1.1 Review

The review looked at the following key aspects:

- EIS context and obligations
- approval conditions
- environmental management plan and sub-plans
- available monitoring data
- Tweed Shire Council's Tweed River Estuary Coastal Management Program

EIS Context and Obligations

The EIS (Hyder Consulting Pty Ltd, Patterson Britton Partners Pty Ltd and WBM Oceanics Australia, 1997) includes the following key statements related to the Lower Estuary Shoals:

- "growth of the lower Tweed estuary shoals would restrict the tidal range resulting in poorer estuarine water quality and damage to ecology including seagrass and mangroves. Permanent sand bypassing will reduce the rate of formation of lower estuary shoals".
- "impacts on wetland ecosystems will only be experienced if the lower Tweed estuary sand shoals were to become eroded as the result of flood events"
- "the scouring potential associated with a 5% AEP flood (low tailwater case) was greatest in the channel narrowing, opposite the tip of Ukerebah Island. The magnitude of the scour potential was estimated to be about 30,000m3 and this represents an average scouring over the full area of the channel of approximately 0.4m. An average scouring potential of this order is not great and is consistent with the known flood behaviour in this area".
- "major floods with an AEP of 1-2% can scour in excess of 200,000m^3 from the lower estuary marine shoals. As these shoals are a major control on the propagation of tides (section 4.4.1.2), a substantial reduction in shoal volume would lead to significant changes in tidal levels and flows throughout the estuary".
- summarised the results of extensive case modelling to say that a "major flood which scours the lower estuary marine shoals can be expected to have a substantial impact on the propagation of tides into the estuary. As a consequence, tidal ranges would increase by 18cm in the vicinity of Letitia 2A".
- This triggered an estimation that the "tidal hydrodynamic impact of major flood scour could be expected to be felt substantially for 2-3 years".
- "without the shoals in place, there is the potential for slightly greater tidal ranges to be experienced within the estuary. Modelling studies indicate that with the shoals removed by flood and all approved river dredging completed, Mean Spring High Tides would increase by up to 0.07m, whilst Mean Spring Low Tide Levels would decrease to a greater extent by 0.11m".
- "there is an undeniable need, merely in respect of the existing environment, for the lower estuary marine shoals to be managed. The objective would be to

restrain future shoal build-up to acceptable limits, to avoid long-term water quality problems and contain the build-up sand in sensitive areas".

- "the Strategy is needed to maintain the lower estuary shoals in an optimum configuration which would:
    - Avoid water quality problems associated with excessive infilling of the shoals; and
    - Carry out post major flood restorative works to avoid a major shift in the tidal planes of the estuary".
- "post flood sand placement is likely to be required irrespective of whether the permanent bypass is constructed or not".
- "it is considered therefore that the Tweed Estuary Management Plan needs to be extended to include detailed Lower Estuary Marine Shoals Management Strategy. The Strategy would anticipate and allow for the largely beneficial incremental impacts of a permanent bypass system".

Approval

Condition 17 of the approval requires a monitoring program to be developed as part of the EMP, and is to include monitoring of the condition of the Lower Estuary Marine Shoals and compliance with the Lower Estuary Marine Shoals Management Plan.

Condition 37 of the approval requires consultation with Tweed Shire Council and other relevant parties to develop a Lower Estuary Shoals Management Plan prior to commencement of the operation of the bypass system. The plan, which must form part of the Tweed River Management Plan, shall include procedures and responsibilities for maintaining and protecting the Lower Estuary Shoals. TSB's specific responsibilities in the Plan shall include the maintenance of the shoals following major flood events.

Environmental Management Plan

Sub Plan B16 Tweed River Entrance and Lower Estuary Management Plan includes the following key monitoring tasks:

- On-going monitoring of the lower estuary water levels by the use of automated tide recorder at Letitia 2A
- Regular hydro-surveys of the lower reaches of the Tweed River

Monitoring summary

Tidal analysis has been undertaken annually by Manly Hydraulics Laboratory since the commencement of operations (2000). The assessment has shown that there have been no sustained reportable increases or decreases in tidal range over that period (monitoring commencing in 2000). Analyses and comparisons presented in the tidal analysis reports have consistently concluded that "*the Tweed River entrance is unlikely to have experienced any significant morphological changes over study period resulting in changes to the astronomical tidal response*" (Manly Hydraulics Laboratory, NSW Government, 2023).

Where tidal anomalies have been reported they are notably due to flooding and are short in duration. Such as the major flood event in February/March 2022, which elevated levels on the Tweed River at Letitia 2A, however this was only for a period of 2 weeks (Manly Hydraulics Laboratory, NSW Government, 2023).

In March 2022, the NSW Government commissioned an independent report into the 2022 flood event, the full report was delivered in July 2022 (2022 Flood Inquiry (nsw.gov.au)) (NSW Government, 2022). This report assessed the AEP for the Tweed River and showed that the storm envelope sat well outside design rainfall, and less

than 1% (NSW Government, 2022). Based on this, the 2022 flood event was considerably larger than any of the events analysed for the EIS. Also noting the increases to design rainfalls in Australian Rainfall and Runoff (runoff) in 2016 and again in 2019.

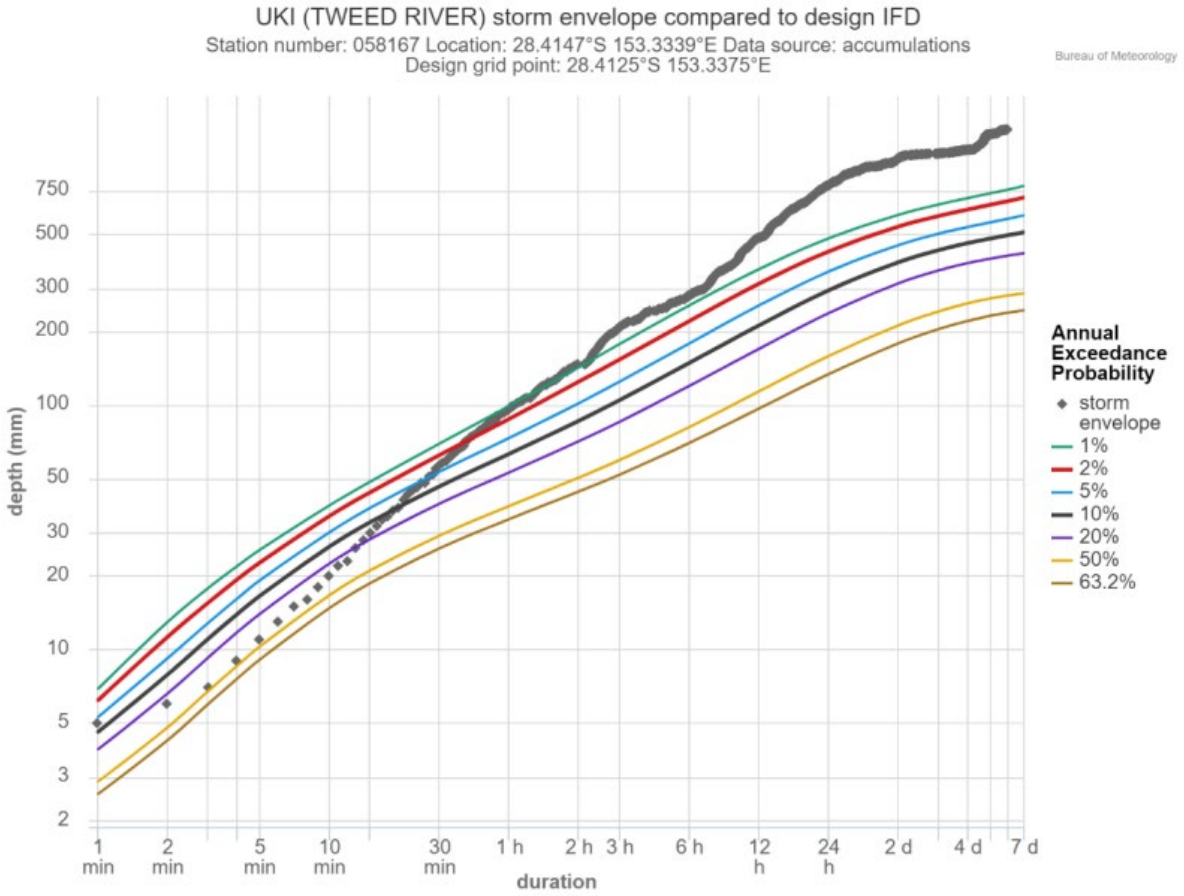
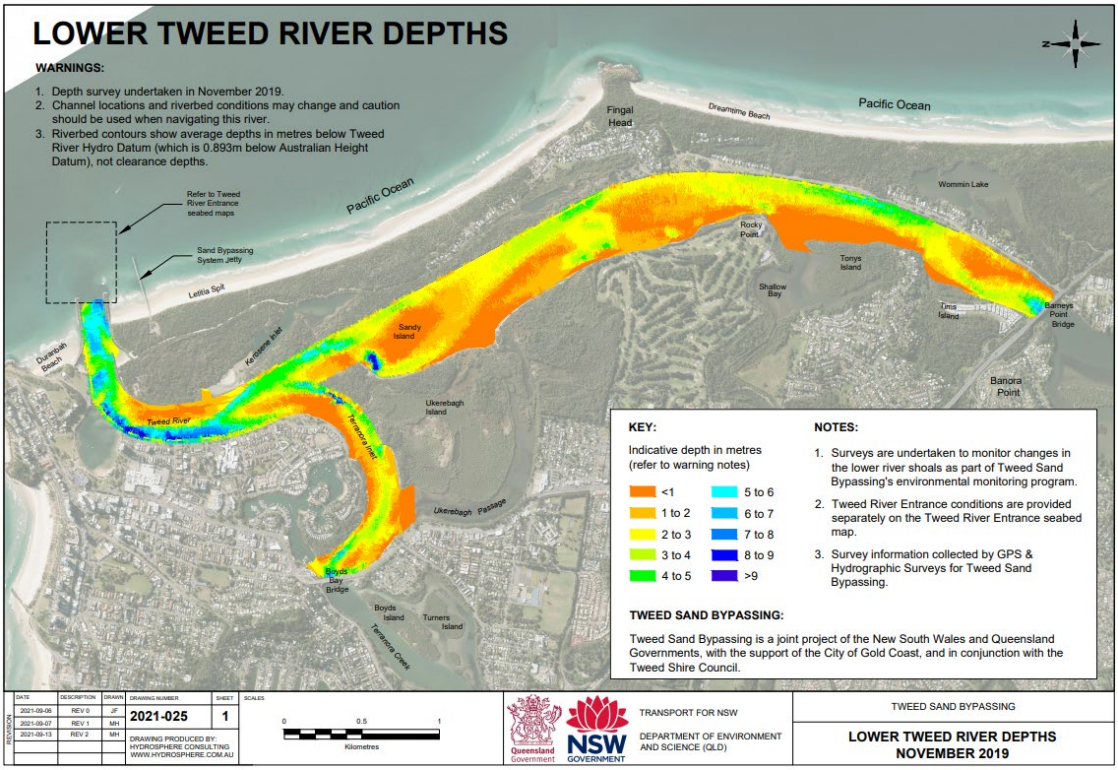


Figure 19 IFD Analysis of rainfall in Lismore's upper catchment at Uki for the week ending 28 February 2022. Source: 2022 Flood Inquiry, Volume Two: Full Report.

Survey of the Tweed River Lower Estuary was commissioned by the EPA and completed in July 2022 (Appendix A). The results of the survey continue to show consistent establishment of the shoals within the lower estuary when compared to the November 2019 survey (River Depths (nsw.gov.au).



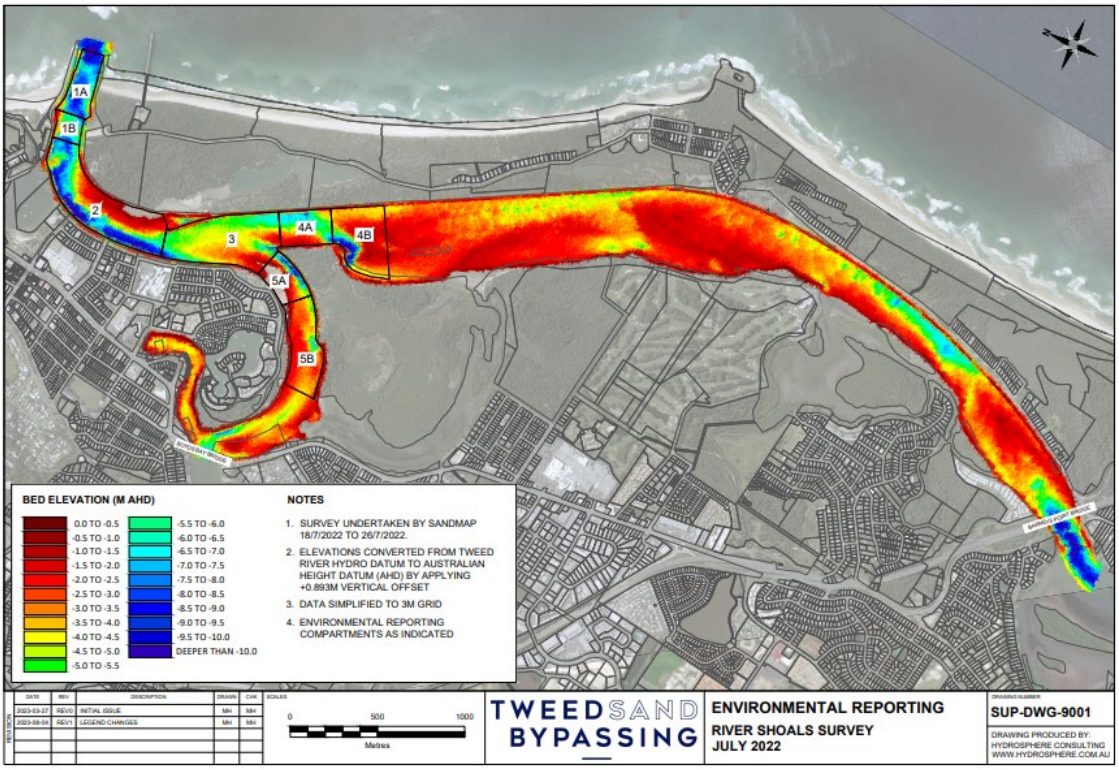


Figure 20 Tweed River Estuary Survey Comparison, 2019 (top) and 2022 (bottom)

The shoals upstream of Kerosene Inlet appear to be more extensive in formation in the 2022 survey when compared to 2019. A volume analysis comparison was undertaken between the 2019 and 2022 surveys for each of the compartments shown in Figure 20 and the results tabulated in Table 8. Volume changes are largely attributed to the northern NSW floods in early 2022.

Table 8 Summary volume analysis between 2019 and 2022 Tweed River surveys

River Compartment	Change in Volume m^3 (2019-2022)
Area 1A	-62,710
Area 1B	-10,263
Area 2	-142,268
Area 3	-37,649
Area 4A	-60,692
Area 4B	-355
Area 5A	-3,258
Area 5B	6,764

To isolate the impact of these volume changes, an isopach was developed. This highlights where within the estuary significant volume changes have occurred to determine the extent of impact to the lower estuary shoals.

Based on the isopach in Figure 21, scour appears to have been largely confined to the channels where velocities would be the highest, this is evident in compartment Area 2, denoted by the dark blue holes along the bank of the last meander before the entrance. Overall, the survey shows that the shoals remain relatively stable.

It is to be noted that dredging campaigns to maintain navigation channels within the Tweed River (i.e. external to TRESBP operations) also contributes to compartment volume changes, and could remove some of this sediment from the system.

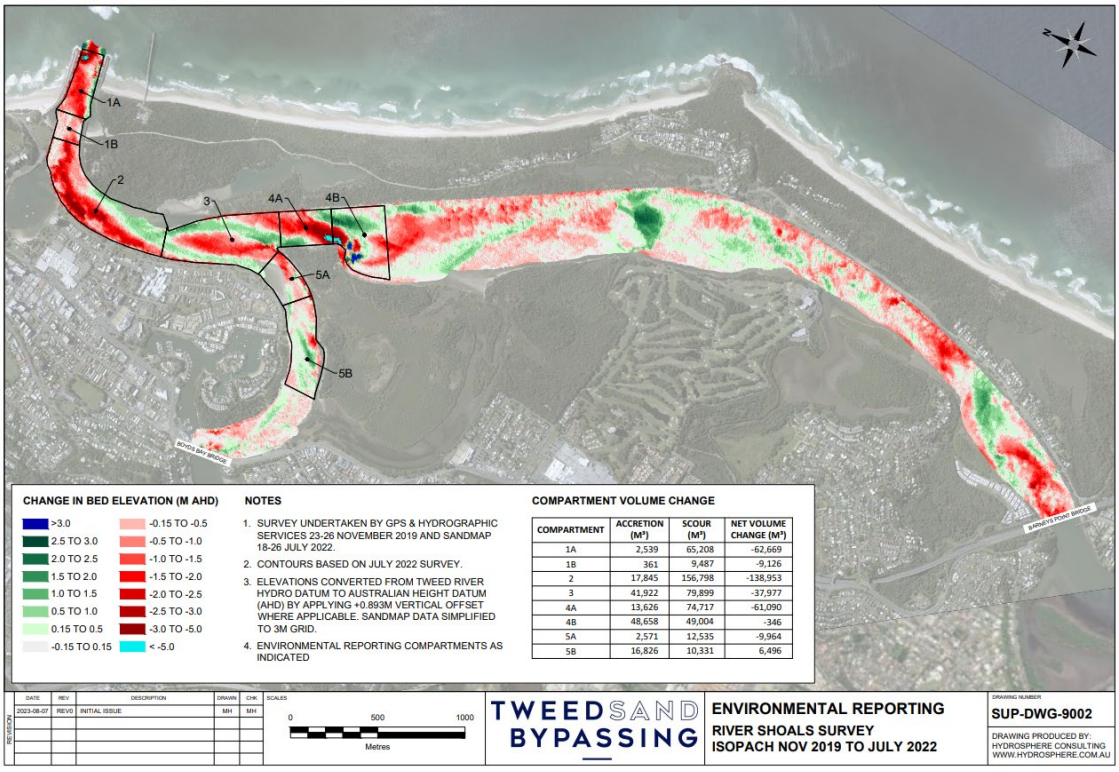


Figure 21 Isopach volume comparison between 2019 and 2022 survey (see also Appendix C).

5.1.5.1.2 Conclusions

- The intent of monitoring the shoals was to determine the extent of restorative work required post major flood events due to scouring of the shoals and altering tidal ranges.
- Monitoring has showed that TSB operations have not had an impact on the tidal ranges within the lower estuary.
- Shoal formation post flood events have not had an impact on tidal ranges within the lower estuary.
- Continued dredging for navigation within the Tweed River has ongoing impacts to hydrodynamics and therefore extent and formation of the shoals.

Given the EIS predictions, impacts to be mitigated, results of the 2019 and 2022 survey comparisons, tidal analysis data, conclusions drawn from the wetland and vegetation distribution mapping and external pressures outside of the projects control (such as dredging for navigation), the annual hydrographic survey of the lower Tweed River for the purposes of shoal monitoring has no clear merit in managing potential project impacts under current operations.

5.1.5.2 Wetland distribution

A review was undertaken in accordance with action item *"determine whether further assessment of extent of wetland is required"* outlined in the 2021 to 2022 monitoring period annual report. The following is a summary of the outcomes of the review detailed in section 5.1.5.2.2.

Considerations

- Environmental Impact Statement (EIS) and the purpose of monitoring wetland extents in relation to project construction and operational impacts.
- EIS expectations for reviewing monitoring frequencies with the intent to reduce monitoring activities based on data and experience.
- Action plan in sub-plan B16, which nominated the monitoring frequency to be reviewed after 5 years.
- Newly developed Estuarine Habitat Dashboard developed by New South Wales DPI (Fisheries) - NSW Estuarine Mapping (shinyapps.io).

Outcome

- TSB operations have not triggered any environmental responses that would result in changes to estuarine habitat and wetland distribution during its operations, including that of the last 2 monitoring periods.
- Monitoring and mapping of estuarine habitat has been undertaken by NSW DPI (Fisheries) in 2022.
- Estuarine health is being monitored and actively managed by Tweed Shire Council, as part of their CMP and their responsibilities under the CM Act.
- Ongoing annual monitoring of wetland extents within the lower estuary has no clear merit in managing potential project impacts under the current operational arrangement.

Evidence

- 10+ years of monitoring data showing distributional trends of wetlands and vegetation have not significantly departed from broader trends since initiation of the Tweed Sand Bypass project.
- Annual tidal analysis showing no changes to tidal regimes - the operation of the system has not had a significant impact on the river tides.
- 2005 and 2008 flood events reported through the monitoring program to have had minimal impact on vegetation extents.

- The extent of non-project specific pressure indicators identified in the State of the Catchment report i.e. only 1 out of 8 pressures are related to the project, specifically the training walls.
- The Tweed Shire Council Coastal Management Program 2022-2032 and the estuary health and monitoring reporting program.
- Department of Primary Industries, Estuarine Habitat Dashboard that shows a change in area from 1983, 2003 and 2022, with data indicating an overall increase in distribution since 1983.

5.1.5.2.1 Review

The review looked at the following key aspects:

- EIS context and obligations
- approval conditions
- environmental management plan and sub-plans
- available monitoring data
- Estuary Habitat Dashboard [NSW DPI (Fisheries)]
- Tweed Shire Council's Tweed River Estuary Coastal Management Program

EIS Context and Obligations

The EIS highlighted through sections 8.3.10 and 8.5.1.5 that expected changes to wetland extents could be caused by a loss of the lower entrance shoals from flood events. Subsequently, monitoring of the shoals and wetland extents were included in the recommended monitoring program (Table 8.5.1 in the EIS), with the expectation that the monitoring program be scaled down after 10 years due to experience obtained from operation of the system.

Approval

Condition 17 of the approval requires that the Environmental Management Plan contain a monitoring program that includes wetland distribution and health determined using aerial photography and periodic quadrant sampling, if required.

Environmental Management Plan

Sub Plan B16 Tweed River Entrance and Lower Estuary Management Plan includes the mapping of wetland extents for a frequency of annually for the first five (5) years of operation, with the frequency to be reviewed thereafter.

Monitoring summary

Extensive vegetation monitoring was undertaken in 2003, 2006, 2008, 2011 and 2012. Generally, across all assessments the following statements were consistent:

- There was a consistent per annum increase in mangrove extent likely due to estuarine sedimentation.
- There was a consistent decrease in saltmarsh extents per annum, with the decrease being consistent with other estuaries in the same geographical area.
- There was a consistent increase in seagrass extents, indicating stable climatic, hydrological and geomorphic conditions. Flood events have not caused any significant decline in seagrass extents. Infrastructure such as boat ramps, appeared to be the cause of minor losses of some seagrass extents.
- Mangrove and saltmarsh distributional and structural trends have not departed significantly from broader trends following the initiation of the sand bypassing project.

- Unless monitoring identifies that the operation of the system has had a significant impact on the river tides, there does not appear to be a need to sustain the current mapping frequency to manage the potential impacts on the mangrove, saltmarsh and seagrass communities.

In 2017, an ecological assessment (Hydrosphere Consulting, 2017) of the Tweed River was undertaken for Tweed Shire Council to inform the Tweed River Estuary Coastal Management Plan. The lower estuary of the Tweed River was characterised as having fair to very good condition ratings across several key ecological parameters. With water quality rating 'very good' and seagrass health and extent as 'good'.

In 2010, the State of Catchment Report (NSW Government, 2010) provided a 'high' pressure rating for the Tweed River based on several individual pressure indicators, including:

- Cleared land
- Population
- Sediment (TSS) input
- Nutrient (TN) input
- Freshwater flow
- Disturbed habitat (e.g. % foreshore vegetation, presence of foreshore structures, aquaculture leases and invasive seaweed)
- Tidal flow (presence of training walls)
- Fishing (annual commercial fish catch)

Following on from this, the State of the Environment report (NSW Environment Protection Authority (EPA), 2021) assigned a moderate condition rating to the Tweed River, consistent with the state-wide average. This rating is determined in accordance with the river condition index which measures ecosystem health across five components:

- Riparian vegetation cover
- Hydrological stress
- Biodiversity condition
- Geomorphic condition
- Catchment disturbance.

Estuarine Habitat Dashboard, NSW DPI (Fisheries)

NSW Estuarine Mapping (shinyapps.io).

The NSW DPI (Fisheries) has developed an interactive mapping tool that consolidates historic and current estuarine habitat data sets into a single point of reference. The estuarine habitat includes seagrass, mangrove and saltmarsh across a variety of species. The Tweed River has been mapped with 1983, 2003 and 2022 data sets.

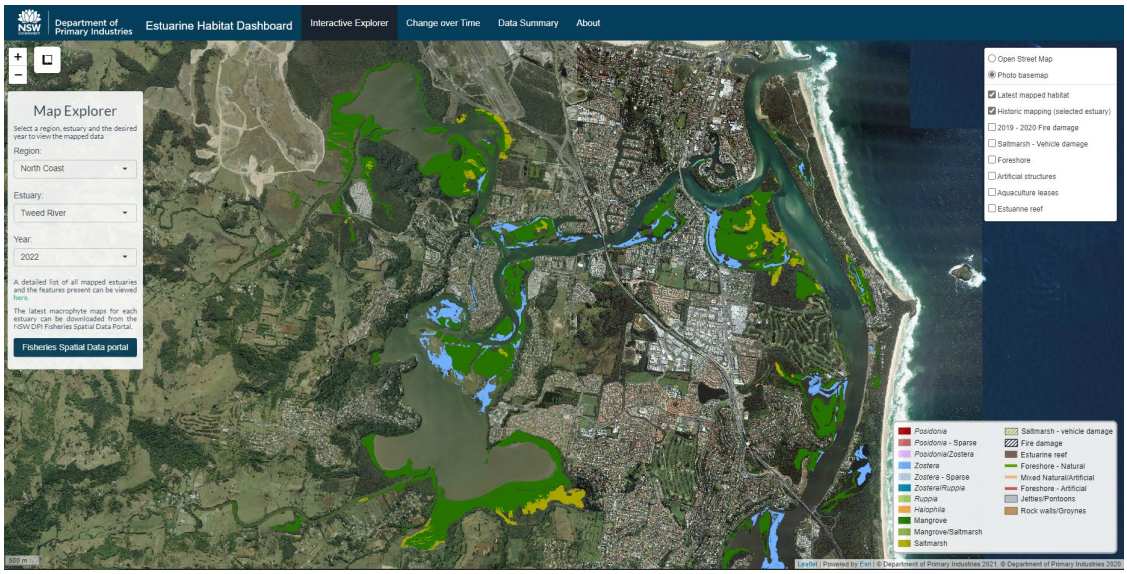


Figure 22 Tweed River Estuarine Habitat Distribution 2022 (Department of Primary Industries, 2023)

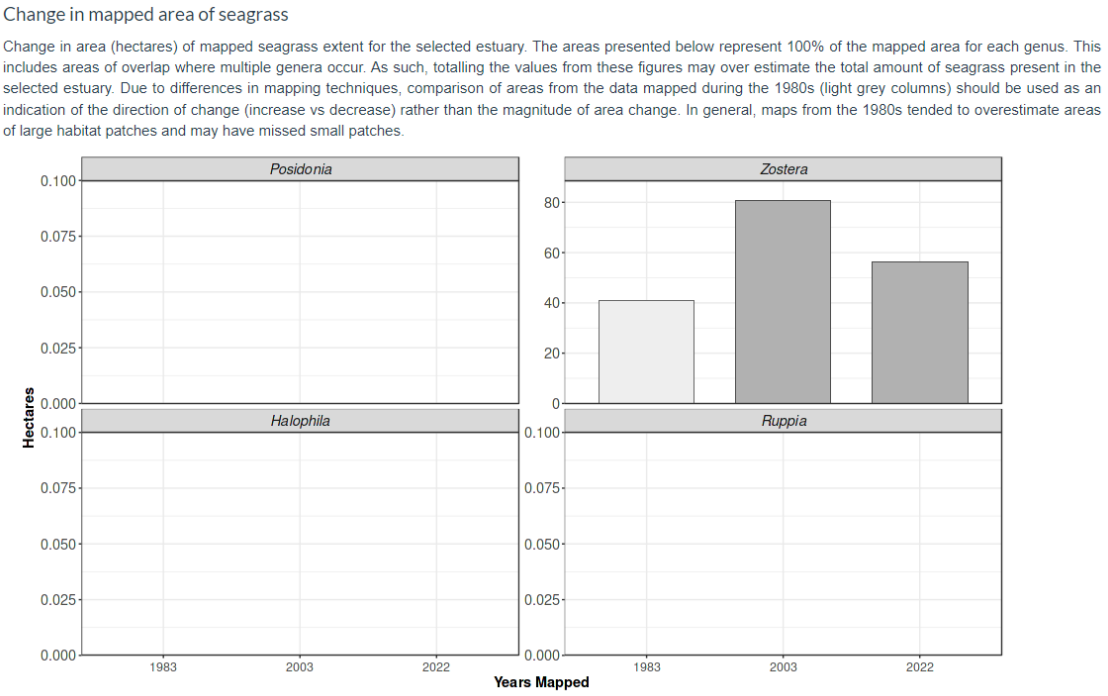


Figure 23 Tweed River Changes in mapped area of Seagrass (Department of Primary Industries, 2023)

Change in mapped area of mangrove and saltmarsh

Change in area (hectares) of mapped mangrove and saltmarsh for the selected estuary. Areas in the figures below represent the total mapped area for each habitat for each time. Due to differences in mapping techniques, comparison of areas from the data mapped during the 1980s (light grey columns) should be used as an indication of the direction of change (increase vs decrease) rather than the magnitude of change area change.

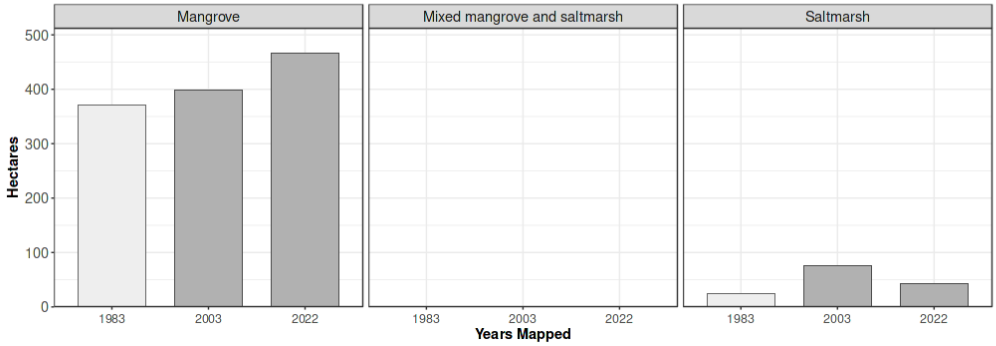


Figure 24 Tweed River Changes in mapped area of Mangrove and Saltmarsh (Department of Primary Industries, 2023)

Tweed River Estuary Coastal Management Program 2022 – 2032, Tweed Shire Council

The Coastal Management Program (CMP) recognises the achievements of past management plans and programs, primarily the Lower Tweed River Management Plan (PWD, 1991) and the Upper Tweed Estuary Management Plan (TRMPAC, 1996), however addresses the requirements of the State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) and supports the implementation of the management objectives of the Coastal Management Act, 2016 (CM Act) (Hydrosphere Consulting, 2022).

The CMP includes a suite of coastal planning and management actions that aim to protect and conserve estuarine and terrestrial ecosystems for the enjoyment of all stakeholders whilst optimising the value of the floodplain and waterways for existing agricultural, commercial, recreational and cultural users, to protect and enhance natural coastal processes and to improve the resilience of coastal assets (Hydrosphere Consulting, 2022).

A key component of the CMP is an estuary health monitoring and reporting program. It was noted that estuary health is currently monitored through a series of disconnected monitoring programs at a variety of timescales and is rarely reported in a holistic and comprehensible manner. The aim of the estuary health monitoring and reporting program is to consolidate monitoring activities into a structure program that is consistent (Hydrosphere Consulting, 2022). This program is an initiative of Tweed Shire Council.

Tweed River Estuary: Coastal Management Program 2022 - 2032 (nsw.gov.au)

5.1.5.2.2 Conclusions

- Monitoring has showed that TSB operations have not had an impact of the distribution and health of wetlands within the Lower Tweed Estuary and are not expected to do so unless operations trigger a response to tidal regimes.
- Estuarine habitat mapping completed in 2022, (Department of Primary Industries, 2023) has shown the same distributional and structural trends in mangrove and saltmarsh that were reported in the 2003, 2006, 2008, 2011 and 2012 vegetation monitoring reports.
- Estuarine health is being monitored and actively managed by Tweed Shire Council, as part of their CMP.

- Aerial photogrammetric mapping has no clear objective or relevance to monitoring the impacts of the project due to external pressures (including dredging of the tweed river, population growth, land use etc)
- the requirement for CMP's under the CM Act, which are implemented to achieve the acts objectives including rehabilitation and restoration of degraded coastal wetlands and littoral rainforests.

5.2 Evaluation of compliance

5.2.1 NSW EP&A Act Approval

Appendix D provides a table of compliance status against conditions of approval for the monitoring period.

Conditions of approval were mostly satisfied during the reporting period, with the exception of:

- Condition 1 and 3, due to the latest version of the EMS-Operations (developed in accordance with TRESBCo certified environmental management system) having not been formally approved by DPIE. The document has been submitted through the major planning portal but is awaiting further resolution on other planning matters before being resolved.

5.2.2 Environmental Management System - Operations

Implementation of and compliance with each sub-plan (Figure 7) has been assessed for this monitoring period (refer Appendix E Governments sub-plans and Appendix F TRESBCo sub-plans).

A summary of compliance against sub-plans managed by Governments is provided in Table 9.

Table 9 Summary of compliance against Governments sub-plans

Sub-Plan	Compliant	Comments
B1 Consultation Strategy Plan	**N**	The current version of the EMS-Operations has not been approved.
B9 Letitia Spit Avifauna Habitat Management Plan	**Y**	
B13 Beach Management and Nourishment Strategy	**Y**	
B14 Kirra Reef Management Plan	**Y**	
B15 Duranbah Surf Quality & Beach Amenity Management Plan	**Y**	
B16 Tweed River Entrance & Lower Estuary Management Plan	**N**	Zwarts Pole decommissioned. Training walls inspected annually by Transport for NSW (Maritime – MIDO), not the responsibility of TSB.

5.3 Evaluation of EIS/IAS impact predictions

An evaluation of the extent to which the actual impacts reflect the predictions made in the EIS/ IAS and other supplementary studies is provided in section 5 of TRESBCo Annual Environmental Monitoring Report (Appendix F).

Predictions were consistent with those reported last reporting period. Ongoing monitoring and study of the longer-term recession behaviour at Letitia and effect of options to refine pumping strategy's to further promote beach rebuilding will continue, noting that the back-passing by dredge option was implemented during this period with 8,626m^3 of sand placed in the Dreamtime placement area.

Aerial imagery showed no significant changes in beach width at Letitia during the reporting period.

The EIS/ IAS predicted in the case of the current TSB system a maximum shoreline retreat of approximately 90m at the extraction location at Letitia Spit and in relation to dredging at the entrance a retreat of 30-40m immediately adjacent to the training wall.

Consistent with previous annual reports, long-term trends (refer Appendix B Letitia compartment volume change graph) show an overall reduction in sand volumes along Letitia Spit since the baseline survey in 1993, followed by periods of recovery and stabilisation between 2009-2023, with volumes in Letitia Centre compartment showing a slight accretionary trend in recent years.

Volume trends within Letitia south compartment are likely to be influenced by sand supply past Fingal more than the behaviour of up-drift compartments along Letitia Spit, when comparing against changes in the Letitia centre/ north compartments.

These conclusions and trends have been supported by recent independent studies, such as the 'Letitia Beach Behaviour Report' commissioned in February 2022. Letitia Beach Behaviour Report (nsw.gov.au).

5.4 Community engagement and complaints

The TSB utilises various platforms to engage and communicate key project activities and information within the local community. Communication channels include:

- Instagram @tweedsandbypassing and TSB App
- Website https://www.tweedsandbypass.nsw.gov.au/
- Facebook via TfNSW
- Community events (i.e. World Surf League)
- Advisory committee- AC (comprising elected members of community and representatives from Governments)

Note: The Advisory Community Committee - ACC (open to any community members wishing to attend) is no longer active, action endorsed by the TSB Working Group and current Advisory Committee.

Figure 25 Key communications and engagement activities during the monitoring period

5.4.1 Instagram and TSB App

Communications were released on Instagram and the TSB App throughout the reporting period, covering the following project information and updates:

Table 10 Summary of Instagram and App communications

Date	Project Information
July 2022	Duranbah nourishment ahead of large swell forecasts
August 2022	Pre-dredge notification
August 2022	Dredge commencement notification
November 2022	Dredging completion notification
April 2023	Pre-dredge notification

The app also provides live footage of the Tweed River Entrance, Tweed River, Rainbow Bay and Kirra.

5.4.2 Website

The TSB website was updated throughout the reporting period, with environmental monitoring including sand delivery volumes and reef monitoring, community information such as Advisory Committee meetings, Schools Package and Dredging campaign information.

Additional information available on the website includes project background and publications and studies.

5.4.3 Focus Group Sessions

The following focus group sessions were held through the reporting period.

Table 11 Summary of focus group sessions

Date	Audience
April 2023	Friends of Rainbow Bay

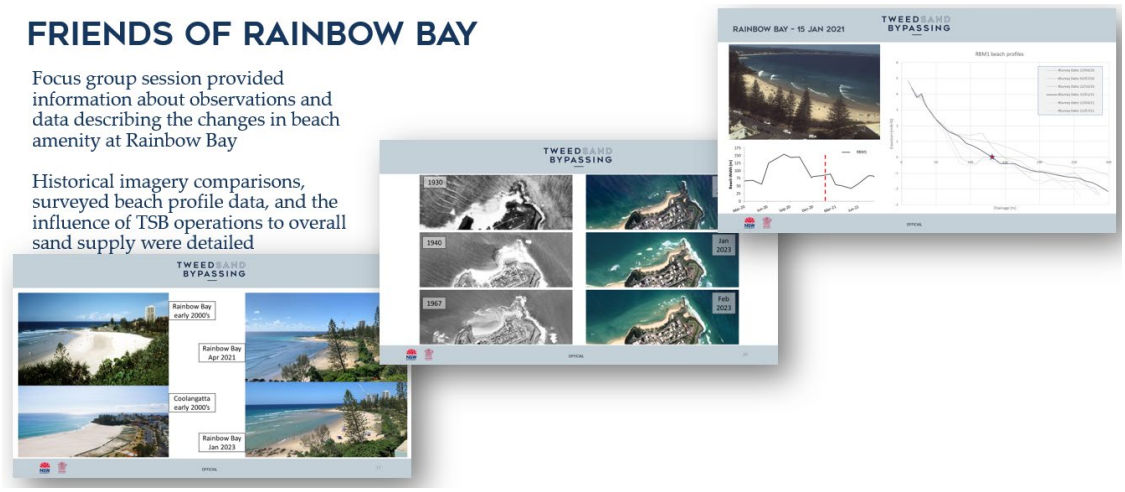


Figure 26 Focus group session summary

5.4.4 AC

During the reporting period, AC meetings were held in:

- May 2022,
- August 2022,
- November 2022, and
- February 2023.

Meeting minutes are available on the TSB website, see Appendix A (item 9).

5.4.5 Media

TSB were mentioned in the media on several occasions throughout the monitoring period:

- March 29, 2023, 7NEWS Gold Coast - more than one hundred locals are calling for a review into the 'Tweed Sand Bypassing Project', with a petition lodged to council. (Note – council committee recommendation TI23.0808.005 Minutes of Meeting of the Transport and Infrastructure Committee - Tuesday, 8 August 2023 (goldcoast.qld.gov.au)).
- May 25, 2023, Tweed Valley Weekly – Sand pumping concerns
- June 16, 2023, ABC NEWS, ABC Sport - How sand pumping helped shape Gold Coast's Superbank, one of Australia's most famous surf breaks (msn.com)

5.4.6 Complaints

Validated and written complaints received by the Governments arm of the TSB are currently recorded in a database known as ChangePoint.

Table 12 Summary of complaints May 2022-April 2023

Date	Issue	Response	Action Taken	Status as at April 2023
6/07/2022	Received complaint from a community member via TRESBP inbox, concerning the small volume of sand being placed at Dreamtime and the extent of erosion at Dreamtime.	Provided the REF approval conditions for back-passing and noted that the volume allocated was the maximum allowable under the conditions.	No further action taken.	Closed.

Date	Issue	Response	Action Taken	Status as at April 2023
October to December 2022	Multiple email community complaints relating to changes to the provision of live streaming cameras on the app used for beach and surf monitoring at Rainbow Bay, Kirra, Tweed River and Tweed River Entrance.	Based on community feedback, live streams were reinstated on the app (January 2023) and community members were notified via email.	No further action taken.	Closed.
28/01/2023	Received complaint from a community member via TRESBP inbox regarding the effectiveness of the August to November dredging campaign and the safety of the bar from a commercial vessel user.	Face to face meeting with the community member to explain the constraints of the August to November campaign and the resolution through further dredging in commencing May 2023.	No further action taken.	Closed.
2/02/2023	Received complaint from a community member via TRESBP inbox, regarding the beach breaks north of Kirra to Palm Beach and enquiry regarding the pumping of sand during south moving currents and swells.	Email response explain the TSB transfers sand when sand is available irrespective of the conditions.	No further action taken	Closed.
14/03/2023	Complaint from a community group regarding the level of consultation with specific members of the community.	A presentation and meeting was prepared for the interested parties.	The community group is actively included focus sessions initiated by TSB.	Closed.

5.5 Independent Audit

The project's last independent environmental audit was undertaken for the monitoring period (May 2014 to April 2018) in early 2020 and the next scheduled audit is for

completion in 2023/2024. Procurement activities and consultation with DPIE have commenced for appointment of an independent auditor in late 2023.

5.6 Incidents (at Jetty) and non-compliances during the reporting period

Refer to 5.2 Evaluation of Compliance, and Appendix F TRESBCo Annual Environmental Monitoring Report.

There were no incidents reported to the Governments arm of the TSB regarding TSB operations. Although there have been instances of unauthorised access to the Jetty, police have been notified and a new security has been installed to restrict access.

5.7 Actions required from previous annual review (May 2021 to April 2022)

- Continue with Environmental Monitoring and consult with Project partners and local communities to deal with any arising issues.
- Continue to monitor long-term recession behaviour at Letitia, and refine pumping strategy where opportunities are identified, in accordance with the recommendations provided in the Letitia Beach Behaviour Report 2022, (Bluecoast Consulting Engineers, 2022) (Letitia Beach Behaviour Report (nsw.gov.au)).
- Monitor entrance post-dredging to determine if a clear navigation channel has been achieved.
- Assess any changes to lower estuary shoals which have occurred overtime. Liaise with Tweed Shire Council to have any such future monitoring catered for through their respective Tweed River Estuary/ Coastal Management Plan.
- Determine whether further assessment of extent of wetland is required. Monitor extent/ distribution of lower Tweed River estuary wetland using satellite imagery. Liaise with Tweed Shire Council to have any such future monitoring catered for through their respective Tweed River Estuary/ Coastal Management Plan. Obtain supplementary data from other agencies where available.
- Periodically review EMP sub-plans, at least annually, to ensure actions remain relevant and up to date. Obtain approval from administering authority revisions to the EMP-Operations and associated sub-plans.

5.8 Activities to be completed in next reporting period

- Continue with Environmental Monitoring and consult with Project partners and Local communities to deal with any arising issues.
- Continue to monitor long-term recession behaviour at Letitia, and refine pumping strategy where opportunities are identified.
- Complete the Independent Audit for monitoring period May 2018 to April 2023.
- Finalise forward planning pathway to address the revision of the EMS-Operations and subplans and undertake stakeholder engagement, including amending the frequency of monitoring activities to align with EIS expectations after 10 years of operations and SME recommendations.
- Seek further advice on the appropriate response to monitoring seagrass meadows off Cook Island West when planning placement at either Dreamtime or Fingal placement areas.

5.9 Rehabilitation

Rehabilitation works were completed in the vicinity of the Jetty previously by TRESBCo, soon after operations started in 2001. Due to the operation being carried out in the natural environment and affected by storm activity, rehabilitation works will be ongoing and on needs for basis.

5.10 Water

N/A

6 References

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Ecological Service Professionals (ESP). (2023). *Reef Biota Monitoring 2023 Tweed Sand Bypass.*

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NSW Government. (2010). *State of the Catchments 2010, Overview Northern Rivers Region.* Department of Environment, Climate Change and Water.

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Queensland Government. (2023). *Tweed Heads / Brisbane Wave Climate Annual Summary 2022-2023.*

Tweed Sand Bypassing, TfNSW. (2023, August 25). Retrieved from Tweed Sand Bypassing: https://www.tweedsandbypass.nsw.gov.au/

Appendix A

Supporting Information - website

https://www.tweedsandbypass.nsw.gov.au

Tweed Sand Bypass proactively manage a project website to ensure the latest available data and information is provided to stakeholders and the community on a easily accessible public platform.

Below is a summarised list of the key analytics found on the website that support this annual report, with website links provided.

Table A Summary of supporting information

Item No.	Analytic	Summary	Website Link
1	Wave Climate	The Queensland Government carries out wave monitoring on behalf of the TRESBP. Annual wave climate summary reports from the wave recording of Tweed Heads and Brisbane Waverider buoy sites are published by Queensland Government.	Tweed Sand Bypassing - Coastal conditions (nsw.gov.au)
2	Tidal Analysis	The NSW Department of Planning, Industry and Environment (DPIE) through the Manly Hydraulics Laboratory (MHL) undertakes tidal data analysis for the TRESBP. This work has been undertaken since 2000 to determine if there are any major changes in tidal behaviour of the estuary due to the sand bypassing operations. The study consists of a tidal harmonics analysis for three locations on the Eastern Australia coastline	Tweed Sand Bypassing - Coastal conditions (nsw.gov.au)
3	Reef Monitoring	Ecological monitoring of Kirra Reef has been conducted for the project intermittently since operations began in 2001. Cook Island has also been monitored as a control for each study and more recently as an independent site. A report has been produced annually since 2014.	Tweed Sand Bypassing - Kirra Reef monitoring (nsw.gov.au)
4	Monthly Environmental Monitoring	Monthly environmental monitoring reports are developed every month and published online, outlining: ✓ Sand delivered by pumping and dredging ✓ Wave conditions including min and max Hsig for the month and directional wave roses ✓ Modelled v actual (pumping) sediment transport ✓ Beach and surf amenity observations ✓ Tweed River Entrance usage data	Tweed Sand Bypassing - Monthly monitoring summaries (nsw.gov.au)
5	Aerial Photography	Vertical aerial photography of the project coastline area is captured twice per year, on the same dates (subject to weather and ocean conditions) in autumn and spring. The photography provides excellent information on beach changes. Oblique aerial photography is captured every three months to cover the project area extending from Kingscliff in NSW to Currumbin in Queensland.	Tweed Sand Bypassing - Aerial Photography (nsw.gov.au) Tweed Sand Bypassing - Aerial Photography - archive (nsw.gov.au)

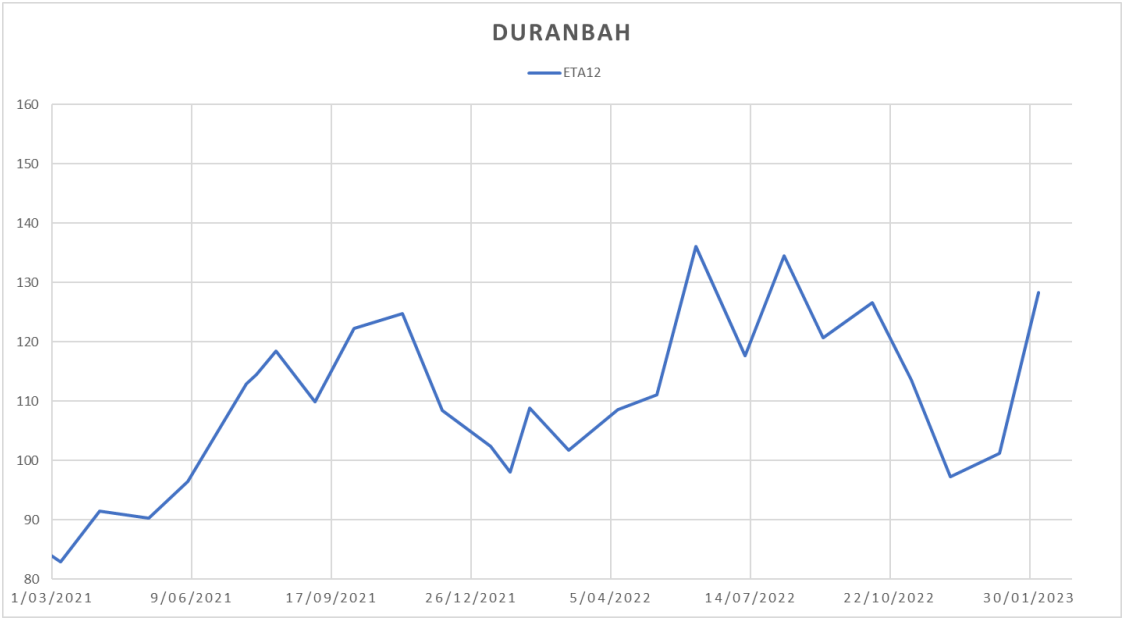
6	Beach Photos	Photographs of five beaches within the Tweed Sand Bypassing project area have been taken every couple of months since the project was commissioned in 2001. They are an excellent indication of the degree of beach width fluctuation.	Tweed Sand Bypassing - Beach Photographs (nsw.gov.au)
7	Beach Width and Compartment Volume	The University of New South Wales Water Research Laboratory maintains a coastal imaging system on behalf of TSB (ARGUS). Sixteen fixed land-based cameras at four different locations collect and analyse images to provide quantitative data about shoreline movement. Detailed shoreline position information is also available, with the data showing the relative change in shoreline position over time, given as meters from a common reference point. Further data can also be found in Appendix B.	Tweed Sand Bypassing - Beach width monitoring (nsw.gov.au)
8	Survey	Tweed Sand Bypassing relies on detailed marine and beach survey information to analyse how the beaches are changing in response to sand delivery and natural seasonal fluctuations. The latest entrance, full coastal and Tweed River surveys are available online. For the register of all surveys undertaken during the monitoring period, refer to the survey register in Appendix C.	Tweed Sand Bypassing - Surveys (nsw.gov.au)
9	Meetings and presentations	The States of New South Wales and Queensland have acknowledged the importance of community input to the Tweed River Entrance Sand Bypass Project [TRESBP] through its various stages of development and continuing operation. To ensure that such consultation is incorporated within the management framework the States initiated a range of measures including the formation of a TRESBP Advisory Committee. The committee is the primary mechanism for communications between the TRESBP and the local community and stakeholders and provides advice on matters of relevance to the local community associated with ongoing operations and the consideration of feasibility studies into potential operational enhancements.	Tweed Sand Bypassing - Community Advisory Committee (nsw.gov.au)

Appendix B

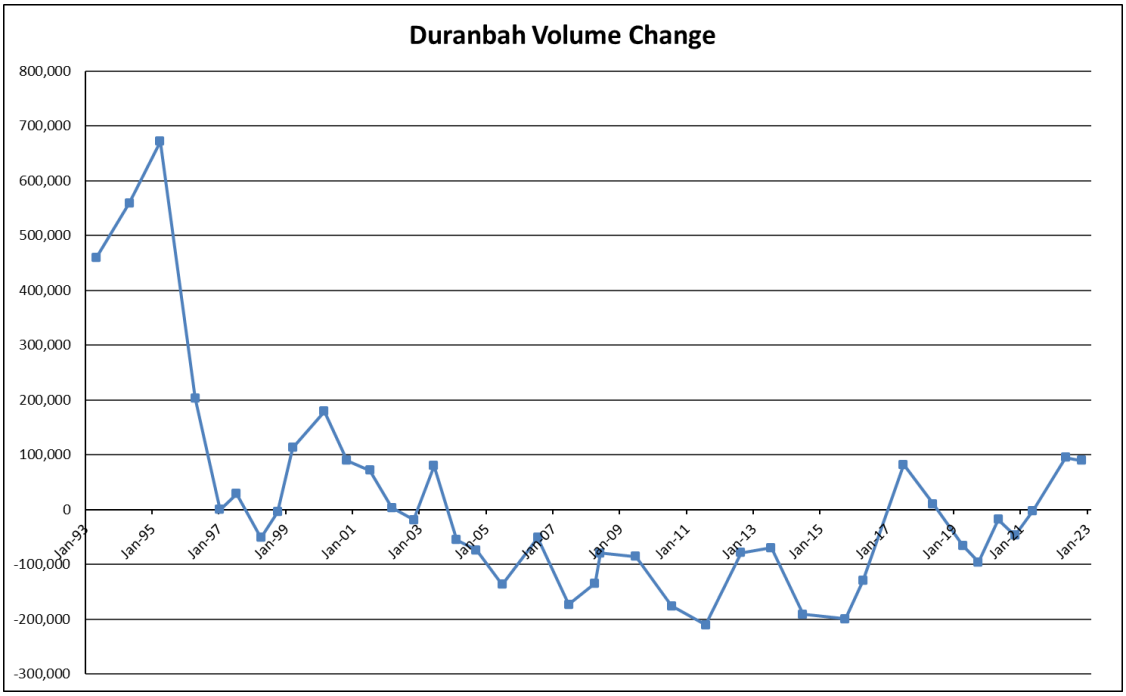
Beach Width and Compartment Volume Analysis

DURANBAH

Beach width (in metres)

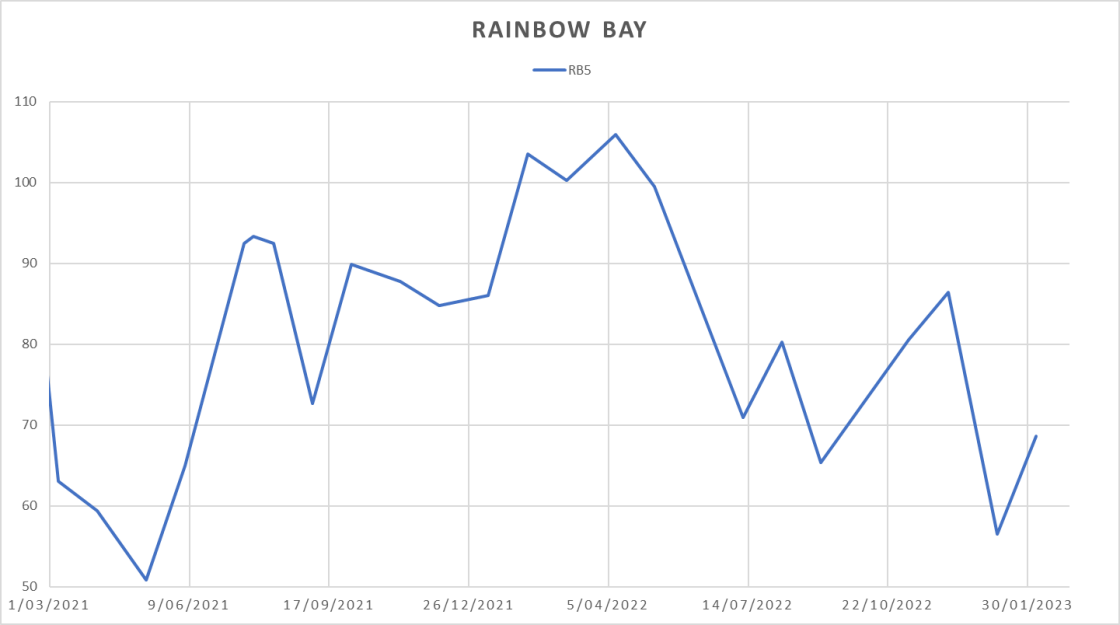


Compartment Volume (in cubic metres)

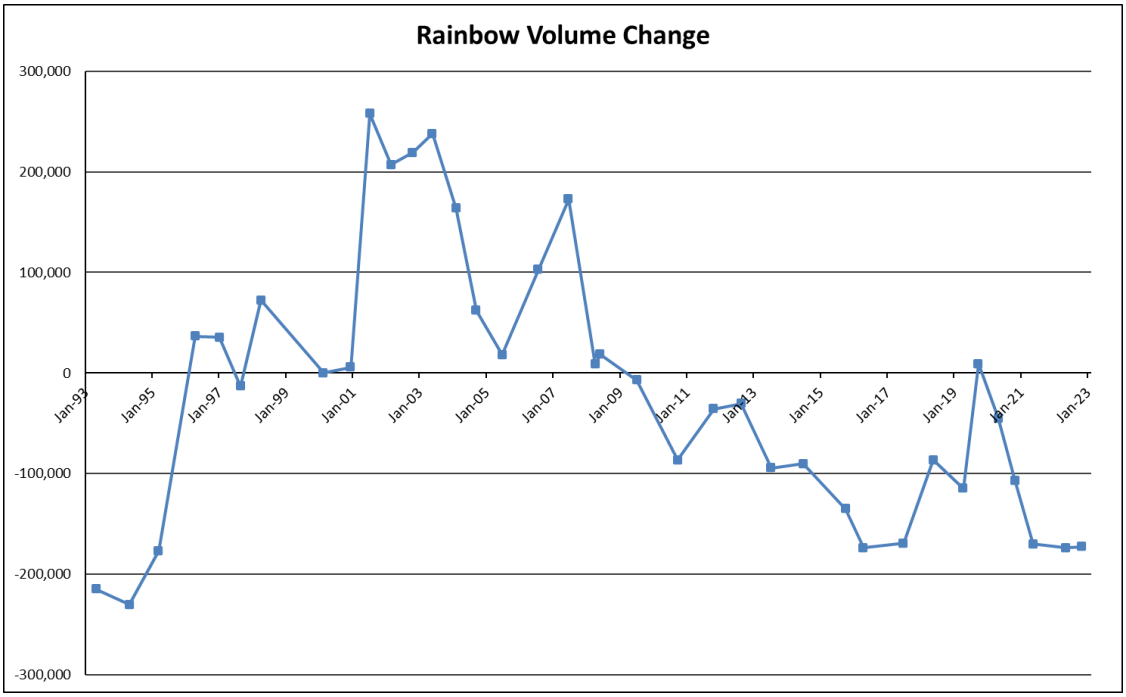


RAINBOW BAY

Beach width (in metres)

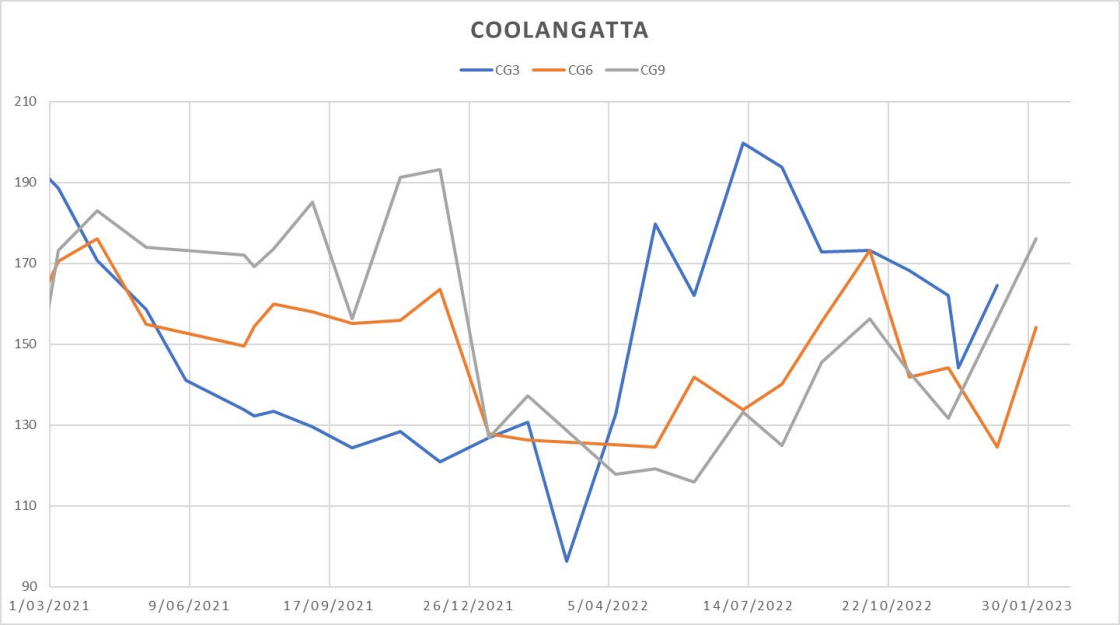


Compartment Volume (in cubic metres)

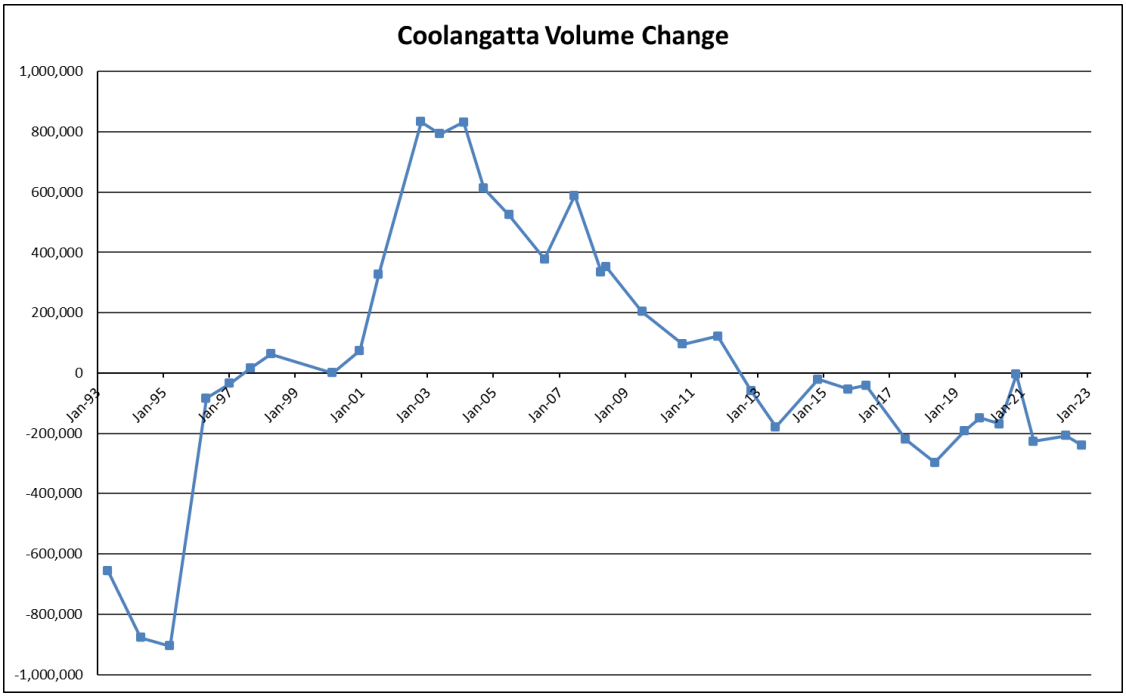


COOLANGATTA

Beach width (in metres)

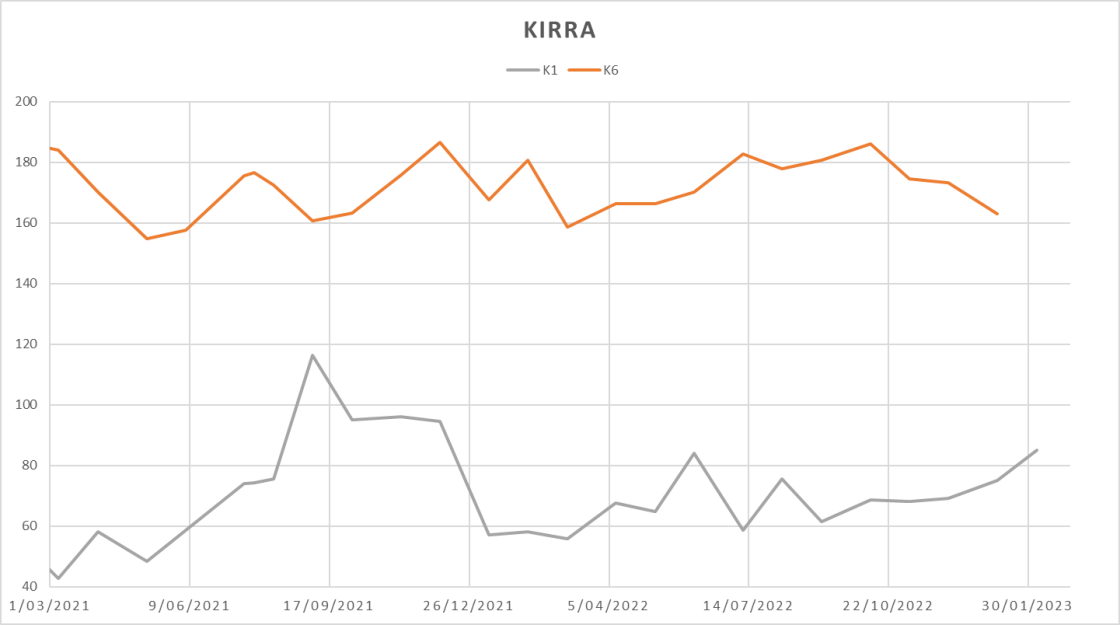


Compartment Volume (in cubic metres)

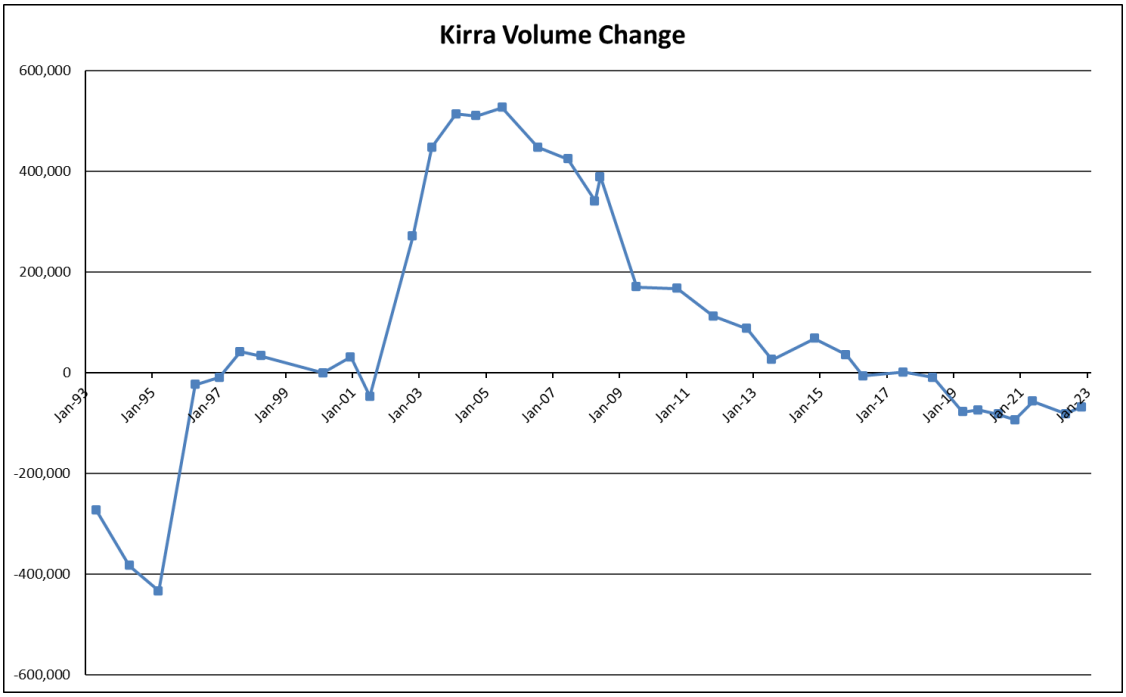


KIRRA

Beach width (in metres)

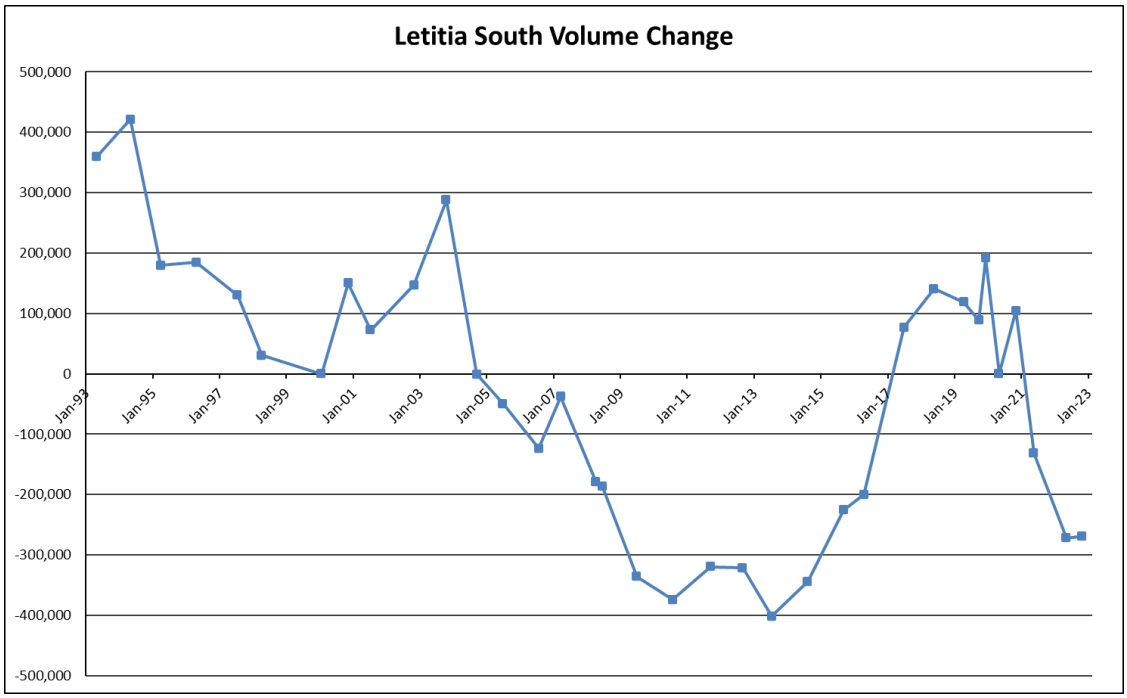


Compartment Volume (in cubic metres)

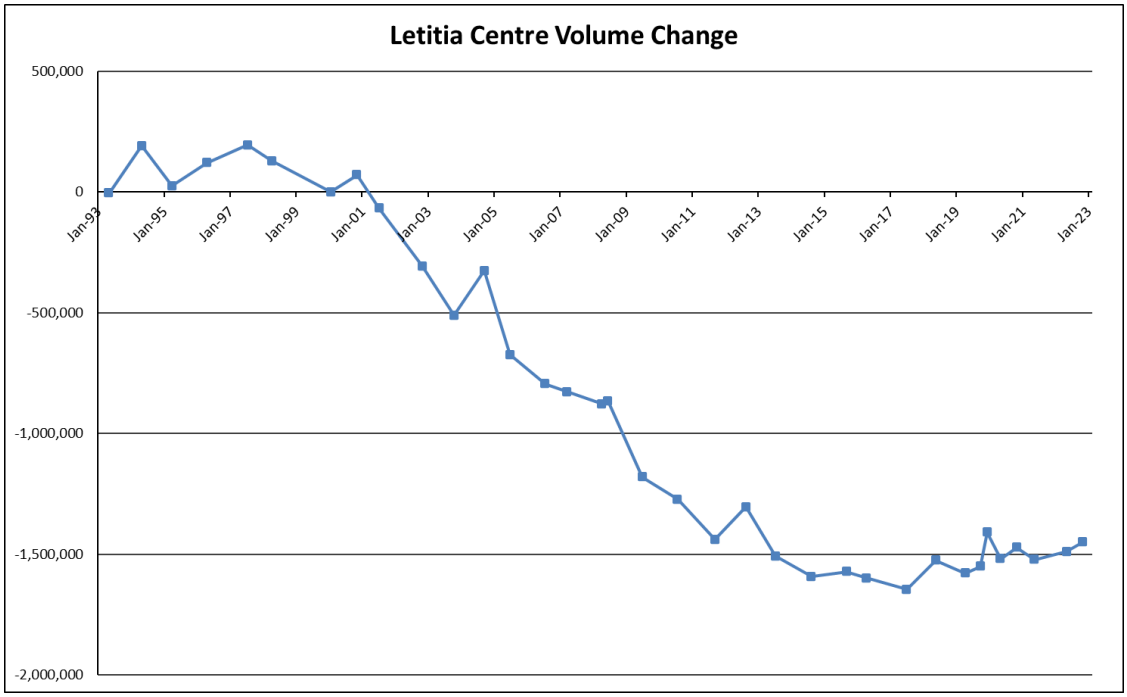


LETITIA

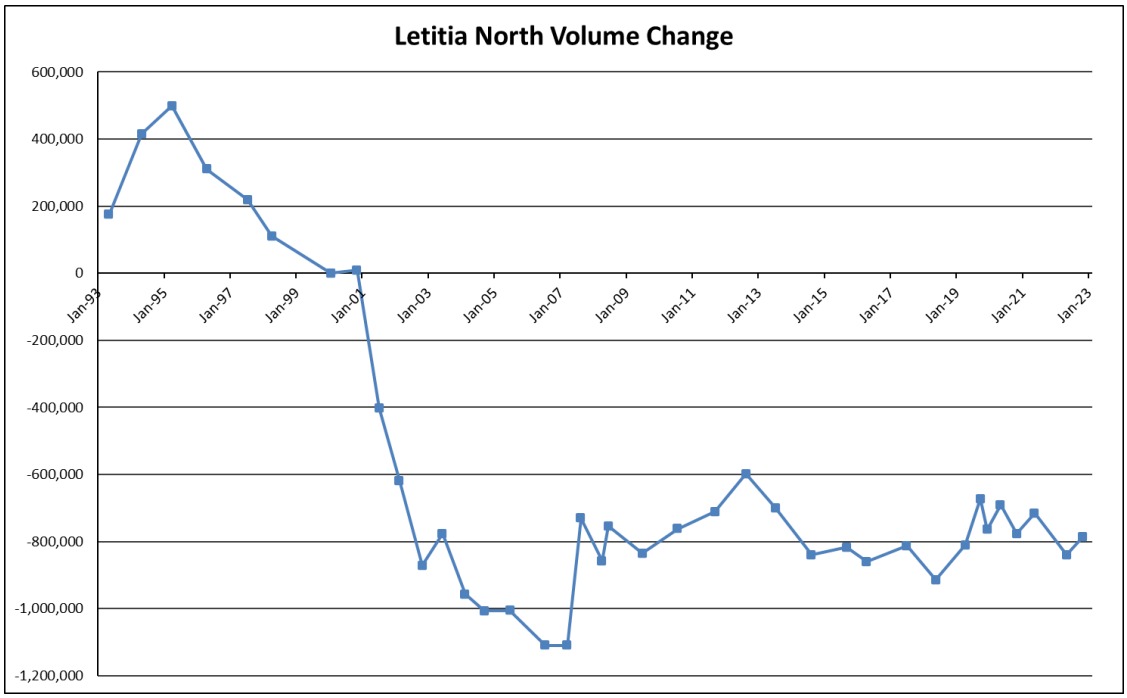
Compartment volume (South) (in cubic metres)



Compartment Volume (Centre) (in cubic metres)



Compartment Volume (North) (in cubic metres)



ADDITIONAL INFORMATION

Further information on beach width monitoring can be found on the website.

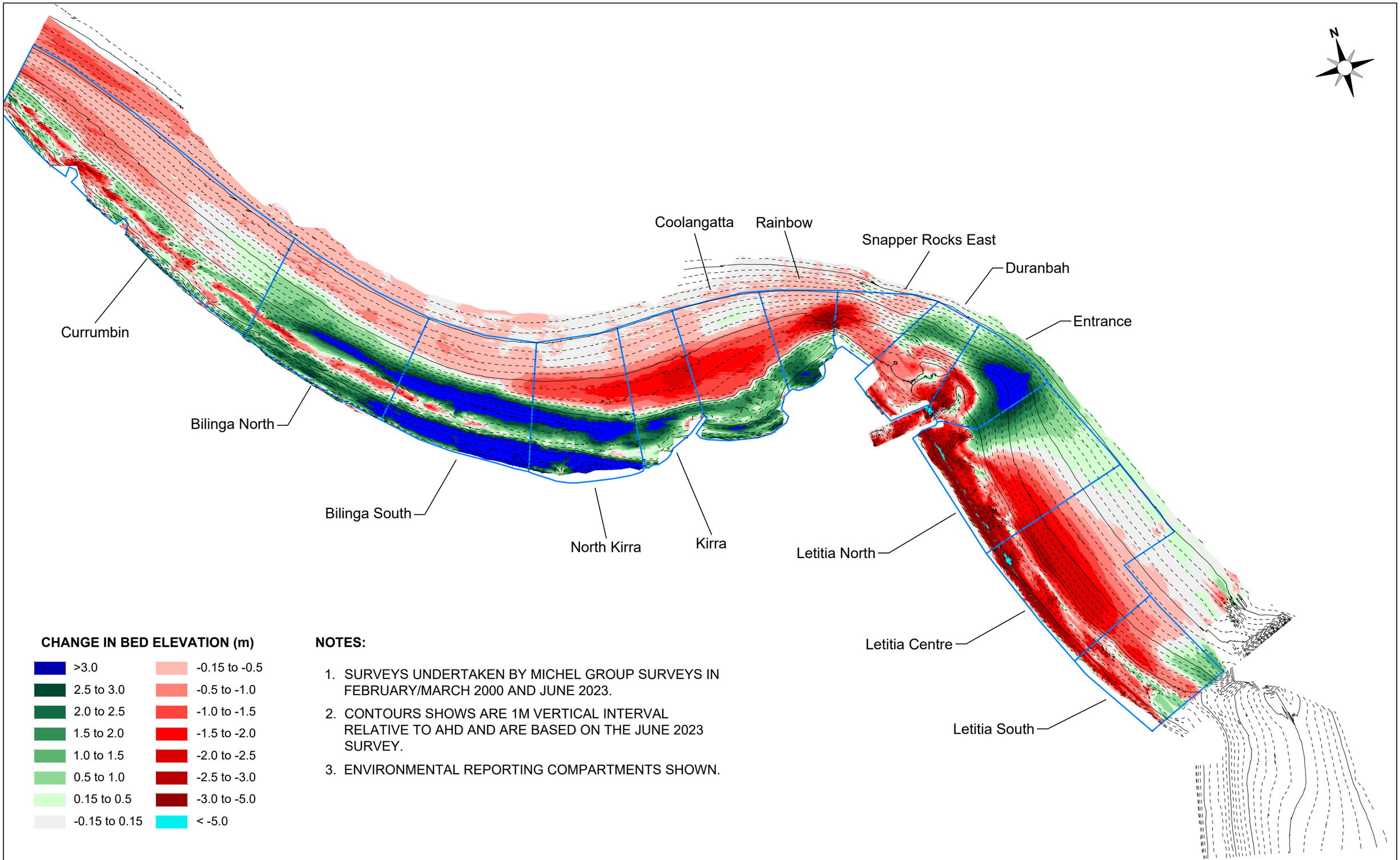
Tweed Sand Bypassing - Beach width monitoring (nsw.gov.au)

Appendix C

Survey

Hydrographic Survey Register

Survey Name	Survey Type	Start Date	No of Days	End Date	Delivery Date	Days to Delivery
Additional Entrance Survey	AES	18-May-22	0	18-May-22	25-May-22	7
Full Coastal Survey	full coastal	01-Jun-22	7	08-Jun-22	22-Jun-22	14
Kirra Reef Survey	Kirra reef (grid)	01-Jun-22	7	08-Jun-22	22-Jun-22	14
Tweed Quarterly (TRESBCo)	Quarterly	18-Jul-22	0	18-Jul-22	15-Aug-22	28
Tweed River - Sandmap via EPA	Tweed River	18-Jul-22	8	26-Jul-22	20-Sep-22	56
Control Volume, CVS & DVS	Control Volume	03-Aug-22	0	03-Aug-22	15-Aug-22	12
Pre-dredge survey (Ent, Fin, 2A, SRE, DBH)	Pre-dredge	09-Aug-22	8	17-Aug-22	18-Aug-22	1
Additional Entrance Survey	AES	19-Sep-22	0	19-Sep-22	27-Sep-22	8
Additional Entrance Survey	AES	02-Nov-22	0	02-Nov-22	09-Nov-22	7
Tweed Quarterly (TRESBCo)	Quarterly	15-Nov-22	1	16-Nov-22	21-Nov-22	5
Control Volume, CVS & DVS	Control Volume	15-Nov-22	1	16-Nov-22	21-Nov-22	5
Post-dredge survey (Ent, Fin, 2A, SRE, DBH)	Post-dredge	16-Nov-22	0	16-Nov-22	07-Dec-22	21
Full Coastal Survey	full coastal	22-Nov-22	7	29-Nov-22	14-Dec-22	15
Tweed Quarterly (TRESBCo)	Quarterly	13-Jan-23	14	27-Jan-23	08-Feb-23	12
Control Volume, CVS & DVS	Control Volume	13-Jan-23	14	27-Jan-23	08-Feb-23	12
Additional Entrance Survey	AES	28-Feb-23	0	28-Feb-23	06-Mar-23	6
Pre-dredge survey (Ent, Fin, 2A, SRE, DBH)	Pre-dredge	17-Mar-23	0	17-Mar-23	29-Mar-23	12



CHANGE IN BED ELEVATION (m)

>3.0	-0.15 to -0.5
2.5 to 3.0	-0.5 to -1.0
2.0 to 2.5	-1.0 to -1.5
1.5 to 2.0	-1.5 to -2.0
1.0 to 1.5	-2.0 to -2.5
0.5 to 1.0	-2.5 to -3.0
0.15 to 0.5	-3.0 to -5.0
-0.15 to 0.15	< -5.0

NOTES:

1. SURVEYS UNDERTAKEN BY MICHEL GROUP SURVEYS IN FEBRUARY/MARCH 2000 AND JUNE 2023.
2. CONTOURS SHOWS ARE 1M VERTICAL INTERVAL RELATIVE TO AHD AND ARE BASED ON THE JUNE 2023 SURVEY.
3. ENVIRONMENTAL REPORTING COMPARTMENTS SHOWN.

REVISION

DATE	REV	DESCRIPTION	DRAWN	CHK
2023-08-07	REV0	INITIAL ISSUE	MH	MH

SCALES

0 1 2

Kilometres

TWEEDSAND BYPASSING

FULL COASTAL SURVEY

ISOPACH
MARCH 2000 TO JUNE 2023

DRAWING NUMBER

SUP-DWG-7002

DRAWING PRODUCED BY:
HYDROSPHERE CONSULTING
WWW.HYDROSPHERE.COM.AU

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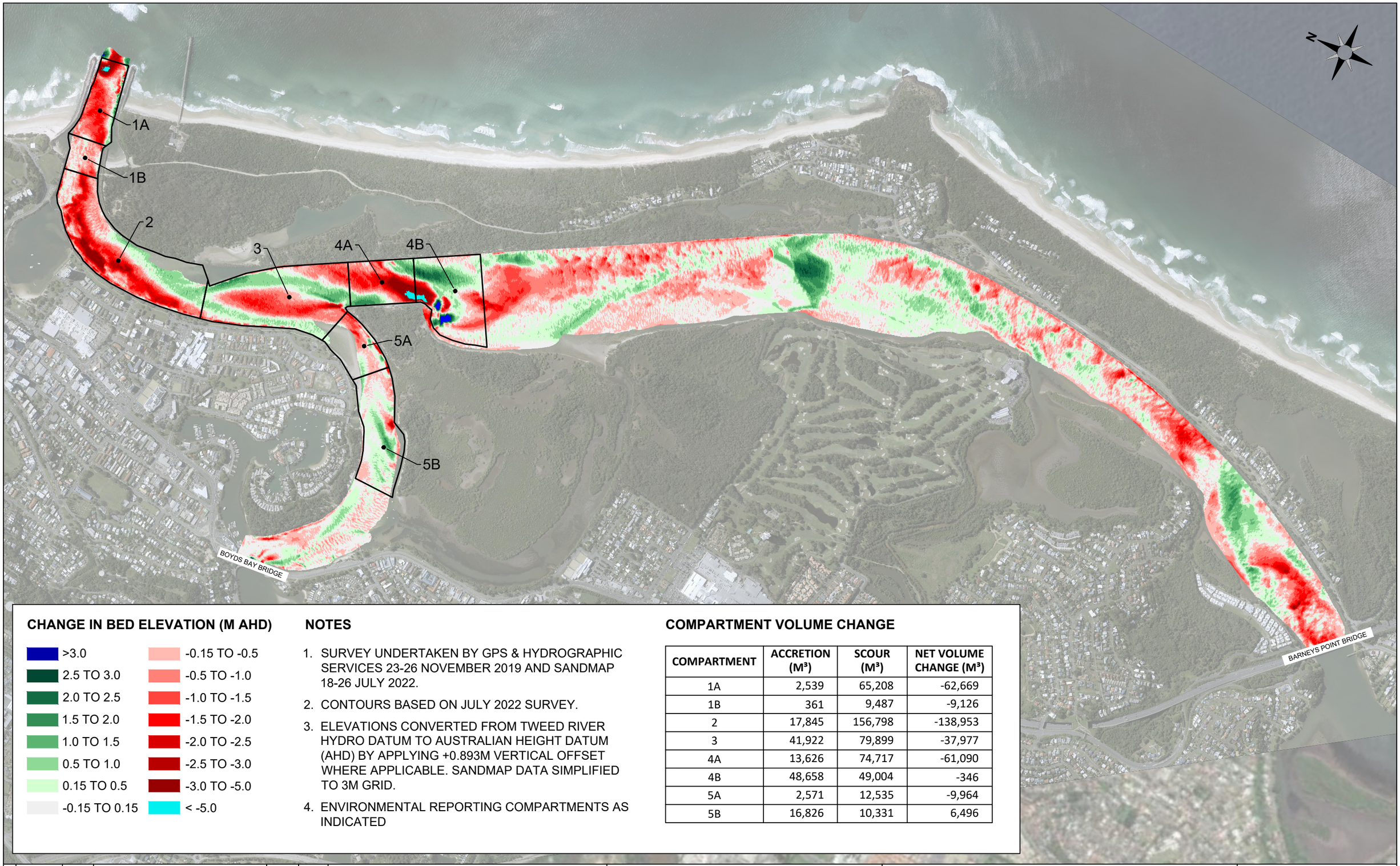

CHANGE IN BED ELEVATION (M AHD)

>3.0	-0.15 TO -0.5
2.5 TO 3.0	-0.5 TO -1.0
2.0 TO 2.5	-1.0 TO -1.5
1.5 TO 2.0	-1.5 TO -2.0
1.0 TO 1.5	-2.0 TO -2.5
0.5 TO 1.0	-2.5 TO -3.0
0.15 TO 0.5	-3.0 TO -5.0
-0.15 TO 0.15	< -5.0

NOTES

1. SURVEY UNDERTAKEN BY GPS & HYDROGRAPHIC SERVICES 23-26 NOVEMBER 2019 AND SANDMAP 18-26 JULY 2022.
2. CONTOURS BASED ON JULY 2022 SURVEY.
3. ELEVATIONS CONVERTED FROM TWEED RIVER HYDRO DATUM TO AUSTRALIAN HEIGHT DATUM (AHD) BY APPLYING +0.893M VERTICAL OFFSET WHERE APPLICABLE. SANDMAP DATA SIMPLIFIED TO 3M GRID.
4. ENVIRONMENTAL REPORTING COMPARTMENTS AS INDICATED

COMPARTMENT VOLUME CHANGE

COMPARTMENT	ACCRETION (M^3)	SCOUR (M^3)	NET VOLUME CHANGE (M^3)
1A	2,539	65,208	-62,669
1B	361	9,487	-9,126
2	17,845	156,798	-138,953
3	41,922	79,899	-37,977
4A	13,626	74,717	-61,090
4B	48,658	49,004	-346
5A	2,571	12,535	-9,964
5B	16,826	10,331	6,496

REVISION

DATE	REV	DESCRIPTION	DRAWN	CHK
2023-08-07	REV0	INITIAL ISSUE	MH	MH

SCALES

0 500 1000

Metres

TWEEDSAND BYPASSING

ENVIRONMENTAL REPORTING

RIVER SHOALS SURVEY
ISOPACH NOV 2019 TO JULY 2022

DRAWING NUMBER

SUP-DWG-9002

DRAWING PRODUCED BY:
HYDROSPHERE CONSULTING
WWW.HYDROSPHERE.COM.AU

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Appendix D

EP&A Act Approval (NSW) Compliance

	Issues with satisfying condition; or compliance with condition dependent on other assessment contained in this report.
	Condition satisfied.
	Not applicable *i.e. condition may be relevant to earlier stages of project* or *not triggered during this period.*

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
1	General The proposal shall be carried out in accordance with: • the proposal contained in the TRESBP Permanent System EIS subject to any modifications to the proposal as described in the TRESBP System Representations Report. • all identified procedures, safeguards and mitigation measures identified in the EIS and Representations Report subject to the conditions of approval granted by the Minister.	Refer to findings of this annual report for overall compliance status in relation to project.
2	General For the purposes of this approval, the date of commencement shall be from the date that the proponent determines to proceed with the proposal. The proponent shall provide the Director-General with the date of commencement within 14 days of the proponent determining to proceed with the proposal.	**Not applicable.** Condition relates to earlier stages of project.
3	Compliance It shall be the ultimate responsibility of the proponent to ensure compliance with all conditions of approval granted by the Minister.	Refer to findings of this annual report for overall compliance status in relation to project.
4	Compliance The proponent shall comply or ensure compliance with all requirements of the Director-General in respect of the implementation of any measures arising from the conditions of this approval. The proponent shall bring to the attention of the Director-General any matter that may require further investigation and issuing of instructions from the Director-General. The proponent shall ensure that these instructions are implemented to the satisfaction of the Director-General within such time that the Director-General may specify.	This annual report is provided to the Department of Planning, Industry and Environment. Any feedback from the Department will be responded to and/ or actioned appropriately.
5	Compliance	**Not applicable.**

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
	The proponent must submit for the approval of the Director-General a compliance report concerning the implementation of all conditions of this approval. The compliance report must be submitted within three months of completion of construction, or as otherwise agreed by the Director-General.	Condition relates to earlier stages of project.
6	Dispute Resolution The proponent shall endeavour as far as possible to resolve any dispute with relevant public authorities arising out of the implementation of these conditions of approval. Should this not be possible, the matter shall be referred to the Minister for resolution. The Minister's determination of the disagreement shall be final and binding on all parties.	**Not applicable.** There were no known disputes with relevant public authorities requiring resolution during this reporting period.
7	Consultation Requirements Following the selection of a preferred option, the proponent shall develop a Consultation Strategy to the satisfaction of the Director-General. This Strategy shall be submitted to the Director-General two months before the commencement of construction.	**Not applicable.** Condition relates to earlier stages of project.
8	Community Information The proponent shall ensure that the local community is kept informed of progress of the project by way of local newsletters, leaflets, newspaper advertisements and community notice boards as appropriate.	Refer section 6.4 Community engagement and complaints.
9	Complaints The proponent shall record details of all complaints received in an up to date log book and ensure that an initial acknowledgement is provided to the complainant within 24 hours and a detailed response within 10 days. Information on complaints received shall be made available on request of the Advisory Committee, all relevant government agencies, Tweed Shire Council, Gold Coast City Council and a summary included in Environmental Monitoring Reports. The proponent shall nominate an appropriately qualified person with the responsibility to receive, log, track and respond to complaints within the specified timeframe.	Refer section 6.4 Community engagement and complaints.
10	Environmental Management System The proponent shall ensure the appointment of contractors that have: • A demonstrated capability and experience in the implementation of an EMS prepared in accordance with the AS/NZS ISO 14000 series or BS 7750-1994 and certified by an accredited certifier; and/or • A proven track record in environmental management of projects of a similar nature.	Any actions in relation to construction not applicable for this reporting period, as construction was completed in earlier stages of project. In relation to operational activities, Governments have engaged Operator under a Concession Agreement with specific environmental requirements.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
		Currently the Operator has a Project Environmental Manager responsible for the EMS (EMP-Operations and TRESBCo sub-plans) under the ISO14001 certification.
11	Environmental Management Representative A suitably qualified Environmental Management Representative shall be available during construction activity at the site and be present on site during any critical construction activities as defined in the EMP for the construction stage works.	**Not applicable.** Condition relates to earlier stages of project.
12	Environmental Management Plans The proponent shall ensure the preparation and implementation of project specific Environmental Management Plans for the construction and operation stages of the work. The EMPs shall: • For all construction activities, be prepared and submitted to the Director-General for approval at least one month period to the commencement of construction work on site in accordance with the conditions of this approval, the EIS and Representations Report, all relevant Acts and Regulations and accepted best practice management plans. • For operational activities be prepared and submitted to the Director-General for approval at least one month prior to the commencement of operation of the system in accordance with the conditions of this approval, the EIS and Representations Report, all relevant Acts and Regulations and accepted best practice management plans. • Be updated as required and when requested by the Director-General. Any significant changes to the EMPs shall be referred to the Director-General for approval. • Be made publicly available and copies of the current version supplied to the Department of Planning, Tweed Shire Council, Gold Coast City Council and the Advisory Committee annually during the operation of the bypass system, or upon request.	EMPs prepared and submitted during earlier stages of project. Refer to section 3.3 – Figure 6 for list of current EMPs. There were no significant changes made to EMPs during this monitoring period. Available to the public through Tweed Shire Council and Gold Coast City Council.
13	Framework for EMPs The EMPs shall be prepared following consultation with relevant government agencies including EPA, NPWS, NSW Fisheries, the Advisory Committee, Tweed Shire Council and Gold Coast City Council.	**Not applicable.** Completed during earlier stages of project. Refer section 3.3 for list of management plans prepared for project.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
14	Framework for EMPs The EMPs shall include strategies for key environmental elements. The strategies shall be relevant to both the construction and operation stages of the project.	Completed during earlier stages of project. Refer section 3.3 for list of management plans prepared for project.
15	Environmental Monitoring Reports The proponent shall submit three (3) monthly reports to the Director-General and the EPA on the results of monitoring commencing after the date of actual commencement of construction works at the site until the completion of construction and six (6) monthly during bypass operation for the first two years and annually after that or at any other period as determined by the Director-General. Reports shall include, but not be limited to, information on the following: • any applications for consents, licences and approvals, and responses from relevant authorities during the reporting period; • implementation and effectiveness of environmental controls and conditions relating to work undertaken; • identification of impact predictions made in the EIS and other supplementary studies and details of the extent to which actual impacts reflect the predictions; • details and analysis of environmental monitoring; • assessment of compliance with Environmental Management Plans for both construction and operation activities; • number and details of any complaints, including a summary of the main areas of complaint, action taken, response given and intended strategies to reduce complaints of a similar nature; and • any other matter relating to the compliance by the proponent with the conditions of this approval, or as requested by the Director-General of DUAP. Copies of these reports shall be submitted at the same time to the Director-General, EPA, NSW Fisheries, NPWS and the Advisory Committee and be made available to the public on request.	Submission of this annual report is intended to satisfy this condition. Copies of the report will be supplied to all relevant parties as per condition.
16	Environmental Audits Environmental audit reports shall be submitted to the Director-General, the EPA and any other relevant authority: • at the completion of construction • annually for the first two years of operation	The project's independent audit was undertaken for the monitoring period (May 2014 to April 2018) in early 2020 and the next schedule 5 yearly audit will be due in 2023/2024. Audit is currently schedule for completion by the end of 2023.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
	• at five year periods thereafter during operation • at any other period required by the Director The audits shall be carried out by an independent person agreed to by the Director-General at the proponent's expense and shall assess the impacts relating to the proposal and the adequacy of safeguards and mitigation measures. The audits shall review all impact predictions made in the EIS and supplementary studies and detail the extent to which the actual impacts reflect the predictions. The compliance of the proponent with these conditions of approval including the implementation of the Environmental Management Plan shall also be assessed. Results of the consultation with the community and other relevant stakeholders shall also be included. The proponent shall comply with all reasonable requirements of the Director-General, the EPA or any other relevant authority with respect to the measures arising from, or recommendations by, the audits.	
17	<u>Environmental Monitoring Requirements</u> As part of the Environmental Management Plan referred to in Conditions 12 and 14, a detailed environmental monitoring program for the construction and operation stages of the works shall be developed. The monitoring program shall be based on the commitments contained in Table 8.5.1 of the EIS and shall include, but not be limited, monitoring of the following parameters: • Duranbah surf quality and beach amenity; • Tweed River Entrance bathymetric conditions; • Wetland distribution and health determined through the use of aerial photography and periodic quadrat sampling if required; • Beach morphology and encroachment into currently stabilised dunal areas at Letitia Spit; • Training wall stability; and, • Condition of Lower Estuary Marine Shoals and compliance with Lower Estuary Marine Shoals Management Plan.	Monitoring program developed during early stages of project, and is reviewed annually as part of budget planning/ review. Sub-plans as per section 3.3 include monitoring requirements where applicable. Refer section 5.1 for monitoring undertaken during this period.
18	<u>Conditions of Contract</u> All conditions of Contract imposed by the proponent shall also form part of this condition of approval. Where there is an inconsistency between the conditions of contract and these conditions of approval, the conditions of approval will apply.	Contractor compliance with contract monitored ongoing.
19	<u>Notification of Selected Bypass System</u>	**Not applicable.** Condition relates to earlier stages of

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
	Following selection of a bypass system and prior to commencement of construction, the proponent shall notify the Director-General of the bypass system and shall demonstrate to the satisfaction of the Director-General that the selected system is within the parameters of these conditions of approval. This notification shall be provided within one month of selection of the preferred system.	project.
20	Notification of Change of Bypass System Six months prior to decommissioning of an existing bypassing system, the proponent shall notify the Director-General of the new system to be implemented and demonstrate to the satisfaction of the Director-General that it is within the parameters of these conditions of approval.	**Not applicable.** Not required during this monitoring period.
21	Traffic & Access As part of the EMPs referred to in Conditions 12 and 14, the proponent shall ensure that a Traffic Management Strategy is prepared for the construction and operation stages of the works. The Strategy shall be prepared in consultation with Tweed Shire Council.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B5 Traffic and Air Quality Management Plan managed by TRESBCo relates specifically to this condition.
22	Landscaping & Visual The proponent shall ensure that all on-site lighting is screened or directed away from residences.	Completed in earlier stages of project. Sub-plan B10 Landscaping Management Plan managed by TRESBCo relates specifically to this condition.
23	Landscaping & Visual The proponent shall ensure that all structures are of material and colours which are sympathetic to the surrounding environment.	
24	Landscaping & Visual Permanent pipelines shall be buried where possible and shall be painted an appropriate colour to minimise visual intrusion where burial is not possible.	
25	Landscaping & Visual The proponent shall prepare a landscaping plan for disturbed areas which shall incorporate the use of native species. The plan shall be prepared in consultation with Tweed Shire Council.	
26	Noise & Vibration Management As part of the EMPs referred to in Conditions 12 and 14, the proponent shall prepare in consultation with the EPA, a detailed Noise and Vibration Management Strategy. The Strategy shall provide details of noise and vibration	Refer to section 3.3 for list of management plans developed to meet conditions of this approval.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
	control measures to be undertaken during construction and operation and shall reference environmental issues and goals set out in the relevant EPA guidelines.	Sub-plan B4 Noise and Vibration Management Plan managed by TRESBCo relates specifically to this condition.
27	Noise & Vibration Management All construction activities (with the following exception) including entry and departure of heavy vehicles shall be restricted to the hours 7am to 6pm Mondays to Fridays, and 8am to 1pm Saturdays and Sundays with no work to be undertaken on Sundays and Public Holidays. Works outside these hours which may be permitted include: • Any works which do not cause noise emissions to be audible at any nearby residential property; • The delivery of materials which is required outside these hours requested by NSW Police or other authorities for safety reasons; • Emergency work to avoid the loss of lives/property or damage to the environment; and, • Any other works as approved by the EPA.	**Not applicable.** Construction works not undertaken during the reporting period, other than the construction of a new pit at Duranbah beach which was managed in accordance with requirements of the Review of Environmental Factors report inclusive of Noise management controls.
28	Historic Shipwreck Management Strategy As part of the EMPs referred to in Conditions 12 and 14, the proponent shall ensure a Historic Shipwreck Management Strategy is prepared by a suitably qualified specialist in consultation with the NSW Heritage Office.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B11 Historic Shipwreck Management Plan managed by TRESBCo relates specifically to this condition.
29	Air Quality The proponent shall: • Undertake dust suppression measures, including use of water trucks, water spraying of activity areas and roads, covering or protecting stockpile sites, ensuring all trucks leaving the site are covered and undertaking revegetation of disturbed areas.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B5 Traffic and Air Quality Management Plan (current version managed by TRESBCo is relevant to this condition, and is implemented accordingly.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
30	Soil & Water Management Prior to commencement of construction, an assessment of the potential for disturbance of acid sulphate soils or potential acid sulphate soils shall be undertaken along the pipeline routes and other relevant areas in accordance with 'Acid Sulphate Soils – Assessment and Management Guidelines (Draft)' (ASSMAC, 1997). If required a management plan shall be prepared to the satisfaction of the EPA.	**Not applicable.** Condition relates to earlier stages of project.
31	Soil & Water Management As part of the EMPs referred to in Conditions 12 and 14, the proponent shall prepare a Water Quality Management Strategy which outlines the proposed mitigation measures to be implemented during construction and operation stages of the works. The strategy shall contain procedures to be implemented in case of accidental spillage.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B6 Sand and Water Quality Management Plan (current version managed by TRESBCo is relevant to this condition.
32	Waste Management As part of the EMPs referred to in Conditions 12 and 14, the proponent shall prepare a Waste Management Strategy that details how waste material will be managed to ensure reuse, reprocessing or recycling is maximised and how any remaining waste will be disposed of. This condition applies to all stages of the project, including decommissioning of the bypass system.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B8 Waste Management Plan managed by TRESBCo is relevant to this condition.
33	Utilities & Services The proponent shall ensure the diversion, protection or support of services and utilities affected by the construction activities, in consultation with the relevant service authorities. Any alterations to utilities and services shall be carried out to the satisfaction of the relevant authority(s) and, unless otherwise agreed to, at no cost to the service authority.	**Not applicable.** Condition relates to earlier stages of project.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
34	Utilities & Services The proponent shall be responsible for minimising any disruption to services resulting from such work and shall be responsible for advising affected people prior to disruption to services.	**Not applicable.** Condition relates to earlier stages of project.
35	Indigenous Heritage All construction activities shall be undertaken in a manner which avoids disturbance to the following areas as identified in Figures 3 and 5 in 'A Cultural Heritage Assessment of the Terrain to be Impacted by the Proposed Tweed River Entrance Sand Bypassing Project' (Davies, 1997): • Soak on Letitia Spit; • Unquarried portion of rock at Point Danger; and, • Rocky knoll behind Duranbah Beach.	**Not applicable.** Condition relates to earlier stages of project.
36	Indigenous Heritage If any potential archaeological remains are identified during construction or operation activities, the proponent shall immediately contact NPWS, Tweed-Byron Local Aboriginal Corporation and the appropriate action shall be taken under the *National Parks and Wildlife Act, 1974*.	**Not applicable.** There were no known archaeological remains identified during this reporting period.
37	Lower Estuary Shoals Management Plan The proponent shall consult with Tweed Shire Council and other relevant parties to develop a Lower Estuary Shoals Management Plan prior to the commencement of operation of the bypass system. The Plan, which must form part of the Tweed River Management Plan, shall include procedures and responsibilities for maintaining and protecting the Lower Estuary Shoals. The proponent's specific responsibilities in the Plan shall include maintenance of the shoals following major flood events.	Tweed Shire Council has implemented the *Tweed River Estuary Coastal Management Program 2022-2032* under the *Coastal Management Act 2016*. Tweed River Estuary: Coastal Management Program 2022 - 2032 (nsw.gov.au) It follows the five (5) stage process for preparing a CMP in accordance with the Coastal Management Manual and was done in consultation with DPE. As part of

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
		this program a review of the environmental monitoring data collected thus far through the *TRESBP Environmental Monitoring Program* has been programmed in consultation with Tweed Shire Council, TfNSW Maritime and TRESBP to determine future response to dredging and sand extraction activities. Sub-plan B16 Tweed River Entrance & Lower Estuary Management Plan (refer section 6.2.2) includes actions for the management of Lower estuary shoals.
38	Sand Retrieval & Discharge Strategy Following selection of a preferred bypass system, the proponent shall prepare a Sand Retrieval and Placement Strategy.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plan B3 Sand Retrieval and Placement Strategy managed by TRESBCo is relevant to this condition.
39	Flora & Fauna Management Prior to the commencement of construction works, the proponent shall prepare, to the satisfaction of the Director-General and in consultation with NPWS, a Flora and Fauna Management Strategy for the proposed works. The Strategy shall take into account, as advised by NPWS, any draft or final recovery plan for the Little Tern. When any such draft recovery plan is finalised, the proponent shall review and if necessary update the Flora and Fauna Management Strategy to implement any relevant recommendations of the recovery plan.	Refer to section 3.3 for list of management plans developed to meet conditions of this approval. Sub-plans B9 Letitia Spit Avifauna Habitat Management Plan (managed by Governments) and B10 Landscaping Management Plan (managed by TRESBCo) are relevant to this condition.

COND NO.	APPROVAL CONDITION	COMPLIANCE STATUS MAY 2022 TO APRIL 2023
40	Flora and Fauna Management Construction and operation of any works associated with the bypass system that may affect South Head Beach area are not to be undertaken in conjunction with any works to be carried out at Tony's Bar including dredging works proposed in that location by Tweed Shire Council.	**Not applicable.** Not triggered during the reporting period.
41	Flora & Fauna Management For those bypass systems defined as Category 3 systems in the 'Tweed Entrance Bypass Threatened Avifauna Assessment' (WBM Oceanics, 1997), namely those systems involving a fixed infrastructure with sand intakes located across the nearshore zone, with pump stations/headquarters located landward of the foredune, all infrastructure and any significant disturbance must be contained within 1000 m of the southern breakwater of the entrance of the Tweed River.	Construction related aspects of this condition completed in earlier stages of project. There was no significant disturbance noted in this area during this reporting period that may be attributed to the TSB operation – however beach width at Letitia did reduce following a major storm event in December 2020.
42	Flora & Fauna Management For those bypass systems defined as Category 2 or Category 4 systems in the 'Tweed Entrance Bypass Threatened Avifauna Assessment' (WBM Oceanics, 1997), namely those systems involving mobile land based systems which extract sand from the beach, berm and immediate nearshore areas and which may include delivery pipes across or buried under the beach and dune, all infrastructure and any significant disturbance must be contained within 500m of the southern breakwater of the entrance of the Tweed River.	**Not applicable.** Category 2 or Category 4 system not selected as preferred option.

Appendix E

Evaluation EMP and Sub-Plans

	Non-compliance.
	Issues with satisfying condition; or compliance with condition dependent on other assessment contained in this report.
	Condition satisfied.
	Not applicable *i.e. condition may be relevant to earlier stages of project* or *not triggered during this period.*

Sub-plan B1: Consultation Strategy *(5 April 2007 Rev: 1)*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1	Approval of the EMS–Operations.	EMS-Operations and sub-plans were approved in 2007. EMS-Operations were revised in 2021 in accordance with TRESBC certified environmental management system. Awaiting endorsement from administering authority – see below. Endorsement of EMS-Operations and revised sub-plans (as indicated last reporting period) is currently on-hold as TSB liaise with the department regarding an administrative modification to modernise the approval and monitoring program to ensure relevancy to monitoring data collected from project inception.
1.2	Registration of the consultation process.	Action to be revised as it appears to be relevant to earlier stages of the project.
1.3	Make the EMS-Operations publicly available.	**Compliant.** EMS-Operations is available to the public upon request, and copies were circulated to relevant authorities for distribution to the public in early stages of the project.
1.4	Appointment of an Environmental Management Auditor for independent environmental audit.	**Not triggered.** Audit not required during this monitoring period. Last independent audit completed for the 2013-2018 period. Next audit due in 2023.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		Audit has been scheduled for completion by the end of 2023.
1.5	Independent Environmental Audits.	**Not triggered.** Audit not required during this monitoring period. Last independent audit completed for the 2013-2018 period. Next audit due in 2023. Audit has been scheduled for completion by the end of 2023.
1.6	Consult with the surfing community in relation to Beach Management and Nourishment Strategies.	**Compliant.** See section 5.4 Community engagement and complaints.
1.7	Satisfy the NSW and QLD statutory planning and development requirements, and to obtain licences, approvals and permits where required.	Refer to contents of this report for compliance status in relation to project planning approval. No new project works were undertaken requiring approvals or licences during this reporting period.
1.8a	Be aware of the possible existence of sites that may have Aboriginal Cultural and Heritage Values and avoid any possible disturbance to the sites.	**Not triggered.** No known or reported impacts to Aboriginal and Heritage values were identified during the reporting period.
1.8b	Consult with NSW NPWS if any potential archaeological remains are identified in NSW during Operations and carry out the appropriate action under the NPWS Act 1974, Qld. EPA (now Department of Environment and Heritage Protection) if remains are found in Qld.	**Not triggered.** No known archaeological remains reported or identified during the reporting period.
1.9	Ensure that the relevant parties are consulted regarding Native Title issues.	**Not triggered.** No known or reported Native Title issues identified during the reporting period.
1.10	Consult with the relevant agencies on potential disruptions and public safety during dredging.	**Compliant.** Refer section 5.4 Community engagement and complaints. Maritime NSW notified of proposed dredging works during reporting period. Marine notice published by

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		NSW Maritime on Transport for NSW Maritime website. Point Danger Volunteer Marine Rescue, local Surf Life Saving Clubs and Maritime Safety QLD were notified via email of dredging campaign; and the community via TSB community meetings and social/ website platforms.
1.11	Inform the tourism industry of the possible disruption in accessing the beach areas during repairs and maintenance period.	**Compliant.** Refer section 5.4 Community engagement and complaints.
1.12	Minimise any impact on the fisheries, especially whiting and mullet.	**Compliant.** TSB operations undertaken in accordance with environmental management plans and project approvals to minimise any impacts to the environment including fisheries, for example community and key stakeholders informed of project activities, defined placement locations and sand quantity limits for pumping and dredging, environmental monitoring etc.
1.13	Regularly inform the local community and registered stakeholder groups of the progress of the project.	**Compliant.** Refer section 5.4 Community engagement and complaints.
1.14	Review the consultation requirement due to changes in legislation.	**Compliant.** Refer section 5.4 Community engagement and complaints.

Sub-plan B9: Letitia Spit Avifauna Management Strategy *(5 April 2007 Rev: 5)*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1	Review and update the monitoring program carried out during the construction and commissioning phase of the Stage 2 permanent sand bypassing system.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Letitia Spit Avifauna Management Plan approved by Department of Planning (previously Department of Urban Affairs and Planning) on 23 February 2001."
2.1	Before the start of operations of the sand bypassing system, undertake low level aerial photography along Letitia Spit to be used as a baseline to establish the pre-commissioning location of the shoreline.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Baseline aerial photographs were captured on 11 May 2000."
2.2	Carry out capture of aerial photography of the shoreline along Letitia Spit at regular intervals to detect any changes in the shoreline.	**Compliant.** See section 5.1 and Appendix F. Aerial imagery captured periodically throughout the monitoring period.
2.3	Undertake tidal monitoring within the Lower Tweed River.	**Compliant.** Water level and tidal data is continuously recorded at station Letitia 2A by Manly Hydraulic Laboratory (NSW). See section 5.1 and Appendix B Tidal Analysis Report.
2.4	Review and analyse the tidal behaviour at Letitia 2A tide gauge and assess changes in tidal levels at Tony's Bar.	**Compliant.** Water level and tidal data reviewed and analysed by Manly Hydraulic Laboratory (NSW). See section 5.1 and Appendix B Tidal Analysis Report. No significant changes in water levels identified during this monitoring period.
2.5	Prepare tidal analysis report.	**Compliant.** Tidal analysis report prepared by MHL on behalf of the TSB. See Appendix B.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
2.6	Develop and implement management measures in partnership with Tweed Shire Council (TSC) if the sand bypassing system causes impacts on the Little Tern due to significant tidal changes in the lower Tweed River estuary.	**Not triggered.** No significant tidal changes detected in tidal analysis.
2.7	Consult with NSW NPWS and Tweed Shire Council in the preparation of public education campaign informing users of South Head Beach areas of the importance as habitat for bird species.	**Compliant.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Pamphlets have been distributed to NSW NPWS, QEPA, TSC, TBLALC, Fingal residents, TRESBC, other interested residents and tourism companies, bait shops, kiosk and caravan parks."
2.8	Preparation of public education campaign and placement and maintenance of the signage.	**Compliant.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "3 signs have been erected at: Southern side of the southern entrance breakwater, Entry to TRESBC jetty compound and Entry to Fingal"
2.9	Liaise with TSC regarding the banning of dogs and 4WD on South Head Beach, particularly within the northernmost 500m of the beach.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "TSC has banned 4wd at South Head Beach except those belonging to licensed Mullet Fishermen (march 2001)."

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
2.10	Liaise with TSC and TBLALC to ensure that the Little Tern is considered in their proposed habitat enhancement work, if any.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Have consulted TSC. TSC has carried out little tern survey at six monthly interval for some years."
2.11	Engage an Ornithologist to observe if any nesting occurs and prepare a proposal for habitat enhancement works if appropriate.	**Compliant.** Ornithologist engaged during earlier stages of project (2009/2010 and 2013/2014 breeding seasons). No evidence of Little Tern nesting was found and there is no evidence from previous studies to prove Little Terns nested historically on South Head Beach. The 2009/2010 report notes that Little Terns use South Head Beach sporadically and that the beach provides some value as a migration stop over, however it was highly unlikely that Little Terns would attempt to nest on South Head beach due to the quality of habitat, lack of good shingle cover and impacts from recreational disturbance and construction of break wall. The 2013/2014 survey did not record/ observe any Little Terns, although two threatened species listed on the NSW Threatened Species Conservation Act 1995, and four migratory species listed on the Federal Environment Protection and Biodiversity Conservation Act 1999 were recorded. The report notes that habitat seemed to have stabilised since the 2009/2010 survey. The area of exposed sand north of the sand pumping jetty, noted also in 2009/10 survey, coupled with the sparsely vegetated fore dune, had some suitable breeding habitat attributes for little tern. However, the Ornithologist concluded that the area is highly disturbed and lacks the openness of most current little tern

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		breeding sites; and that use of the area as a breeding site by little tern is unlikely. There were no recommendations for habitat enhancement works in the 2009/2010 or 2013/2014 reports. A search of NSW Bionet (as of 5 August 2022) did not show any records of Little Terns at or near Letitia Spit.
2.12	Liaise with DECC and DoP regarding the result of the observation and the recommendation of the Ornithologist.	**Not triggered.** Not required during this period.
2.13	Liaise with DECC (formerly NSW NPWS) to determine the status of the Draft Little Tern Recovery Plan.	**Not applicable.** Confirmed during earlier stages of project, Little Tern Recovery Plan approved October 2003 and available on the NSW NPWS website.
2.14	Implement the recommendations of the Ornithologist taking into account the outcome of consultation with DECC, TSC, TBLALC and DoP.	**Not triggered.** Not required during this period.
2.15	Monitor the effectiveness of the habitat enhancement works if required.	**Not triggered.** No habitat enhancement works completed during period.
2.16	Should it not be viable to carry out habitat enhancement work at South Head Beach, after further assessing the beach's suitability and consulting with DECC, seek the Minister for Planning's Approval to modify Condition No. 39ii.	**Compliant.** Commenced consultation with administering authority in relation to modifying condition.
2.17	Document the process of all consultations.	**Compliant.** Formal consultations with administering authorities saved in TfNSW database, for example Review of Environmental Factors consultation, approval modification request etc

Sub-plan B13: Beach Management & Nourishment Strategy *(5 April 2007 Rev: 1)*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1	Notification of Target Quantity for First Contract Year, including estimate for dredging quantity.	**Not applicable.** Action completed during early stages of project. Reference to historic note as recorded in EMP sub-plan: "Refer Operations Manager's notice of 17 Jan. 2001".
1.2	Proportioning of Target Quantity for the First Contract Year to be delivered to each placement location.	**Not applicable.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Draft delivery program reviewed at Advisory Committee meeting on 11 Jan. 2001 and approved by Working Group at meeting of Jan. 2001. Note: Delivery program also presented at the combined Advisory Committee / Beach Nourishment Group meeting on 31 Jan. 2001." "Review for the First Contract Year was carried out in Dec. 2001 and Apr. 2002." "Refer Brown and Root's notice to Operator of 30 Jan 2001."
1.3	Measurement of sand quantities delivered to the nominated outlets and placement areas by the sand bypassing system.	**Compliant.** See Section 4.2.
1.4	Notification of the proposed Target Quantity of sand to be delivered in the following Contract Year, if it is in excess of 700,000m³.	**Not triggered.** Not required during this monitoring period.
1.5	Specification of the Target Quantity (TQ) and proportions to be delivered to each placement location in the following Contract Year (except for the First Contract Year).	**Compliant.** Letter issued to operator on 26 August 2022 (CA-TFN-CY21) specifying Target Quantity and proportions to be

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		delivered.
1.6	Notification of the estimated total quantities of sand to be delivered in the current Contract Year and proposed quantity of sand to be delivered by dredge in the following Contract Year.	**Compliant.** Letter issued to operator on 26 August 2022 (CA-TFN-CY21) specifying Target Quantity and proportions to be delivered.
1.7	Monitor Operator compliance.	Complete.
2.1 to 2.6	Baseline environmental monitoring programs and community consultation undertaken during the construction and commissioning of the permanent sand bypassing system (February 2000 to 3 May 2001).	**Not applicable.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: -in relation to beach and offshore survey from Fingal to Currumbin (Task 2.1): "Baseline surveys carried out in Feb./Mar. 2000 and in Dec. 2000/Feb. 2001". -in relation to beach and surf quality observations (Task 2.2): a) Rainbow/ Snapper Rocks video "Continuous video capture recorded from Sept. 1995 to commissioning of system. b) Beach and surf observations by Messrs. Mason and Ford, Tweed River entrance to North Kirra. "Ongoing during the construction and commissioning of the jetty-based sand bypassing system". Commenced Feb. 1997. c) Survey of upper beach profiles from Letitia Spit to Kirra Beach and Snapper Rocks nearshore profiles "Baseline surveys were carried out in April, July, and Sept. 2000 and Jan. 2001". d) Survey of upper beach COPE profile at Rainbow Bay "Baseline COPE surveys carried out in August and November 2000 (in addition to survey of the upper

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		beach profile at Rainbow Bay listed in Item 2.2 c)". -in relation to aerial photography of the southern Gold Coast beaches (Task 2.3): "Baseline photography captured in May and Sept. 2000". -in relation to Nearshore directional wave measurements (Task 2.4): "Continuous wave record has been measured at the Tweed Entrance buoy since Jan. 1995." -in relation to Assessment of longshore sand transport supply (Task 2.5): Marked as complete with Target date January/ February 2001. -in relation to Community Feedback (Task 2.6): "Advisory Committee meetings held in Jan., Mar., May, Aug. Oct., Nov. and Dec. 2000, and on 11 and 31 Jan. 2001".
3.1	Preparation of a schedule for ongoing monitoring activities for approval by the TRESBP Working Group.	**Compliant.** Initial schedule reviewed at Working Group meeting on 12 Jan 2001 as per historic notes recorded in EMP sub-plan. Ongoing - annual monitoring schedule is prepared as part of yearly budget and approved by Working Group. Monitoring is periodically reviewed as part of monthly finance/ budget updates.
3.2	Comprehensive survey of the upper beach and nearshore area from Fingal to Currumbin.	**Compliant.** See section 5.1 and Appendix E Surveys.
3.3	Beach and surf quality observations, Letitia Spit to North Kirra Beach.	**Compliant.** See section 5.1 for monitoring and Appendix D Beach and Entrance Conditions including photos.
3.4	Aerial photography of the southern Gold Coast beaches.	**Compliant.** See section 5.1 and Appendix F for aerial imagery.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
3.5	Nearshore Directional Wave Measurements.	**Compliant.** See section 5.1 and Appendix A for wave monitoring outputs.
3.6	Assessment of Longshore Sediment Transport.	**Compliant.** See section 5.1 and Appendix D for sediment transport assessment.
3.7	Condition of beach stormwater outlets in the project area when pumping to Kirra upper beach.	**Not triggered.** No sand pumped to Kirra outlet during period.
3.8	Prepare procedures and criteria for analysing monitoring data, including assessment of local coastal processes.	**Compliant.** See section 5.1 for analysis. Procedures/ methodology for analyses are largely defined in proposals from consultants e.g. reef monitoring, tidal analysis, hydrographic survey.
3.9	Analyse and report on the results of the monitoring program.	**Compliant.** See section 5.1 for monitoring outputs.
3.10	Develop and implement procedures for corrective action if any significant impacts are detected that are a consequence of the delivery by the sand bypassing system of sand quantities ordered in accordance with this sub-plan.2	**Compliant.** Corrective action process included in sub-plans, and any issues reported at Working Group.
4.1	Consultation with the surfing community, beach users, the local community and other stakeholders with regard to beach management and surf quality issues along the southern Gold Coast beaches.	**Compliant.** Refer section 5.4 relating to community engagement.
4.2	Organise stakeholder and public meetings to discuss issues relating to beach management (prior to the commencement of Operations)	**Not applicable.** Relates to earlier stages of project. Kirra Surfrider meeting held on 16 Oct. 2000. Public meetings held on 4 Nov. and 16 Nov. 2000.
4.3	Develop a mechanism for wider community feedback.	**Compliant.** Refer section 5.4, the TSB can be contacted via our website, TSB email, social medial (Instagram) Advisory Committee community representatives (meetings held quarterly).

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
4.4	Identify the community's primary concerns for each beach / placement area along the southern Gold Coast.	**Compliant.** Refer section 5.4 relating to community engagement.
4.5	Document outcomes from Beach Nourishment Group meetings and record in the Consultation Register.	**Compliant.** BNG previously disbanded. Refer section 5.4 relating to community engagement.
4.6	Review the effectiveness of the community feedback mechanism.	**Compliant.** The community meetings as per section 5.4 continue to operate.

Sub-plan B14: Kirra Reef Management *(5 April 2007 Rev: 1)*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1 & 1.2	Establish a Sand Placement Exclusion Zone in the TRESBP Contract Agreements to provide a buffer zone of approximately 100 m surrounding Kirra Reef, and Ensure C.A. specification of the Kirra Reef Exclusion Zone is covered by current Queensland sand placement approvals.	**Not applicable.** Completed in early stages of project, the TRESBP CA was signed on 22 December 1999.
1.3	Develop and implement operational procedures to prevent direct placement of sand in the Kirra Reef Sand Placement Exclusion Zone.	**Compliant.** Procedures in sub-plan B3 Sand Retrieval and Placement Strategy. Refer to TRESBCo Annual Environmental Monitoring Report (Appendix I) for evaluation of compliance against this sub-plan.
1.4	Monitor Operator compliance.	**Compliant.** Surveys undertaken throughout year to monitor Operator compliance including pre and post dredging surveys and additional entrance surveys. Operator provides, equipment calibration records to Governments and recorded quantities of sand delivered via the system.
2.1	Investigate the natural extent of Kirra Reef prior to the extension of the Tweed River breakwaters.	**Not applicable.** Completed in early stages of project.
2.2 (a)	Baseline hydrographic survey of the seabed levels in the vicinity of the reef.	**Not applicable.** Completed in early stages of project. Survey carried out during Feb. 2001.
2.2 (b)	Baseline monitoring of the existing reef marine biota.	**Not applicable.** Completed in early stages of project. Marine flora and fauna baseline survey carried out during Jan. 2001.
2.2 (c)	Baseline photogrammetric mapping of Kirra Reef using vertical aerial photography captured prior to the commencement of operations.	**Not applicable.** Completed in early stages of project.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
2.3 (a)	Preparation of a monitoring schedule for Kirra Reef, for approval by the TRESBP Working Group.	**Compliant.** Initial schedule reviewed at Working Group meeting on 12 Jan 2001 as per historic notes recorded in EMP sub-plan. Ongoing - annual monitoring schedule is prepared as part of yearly budget and approved by Working Group. Monitoring is periodically reviewed as part of monthly finance/ budget updates.
2.3 (b)	Hydrographic survey of the seabed elevations in the vicinity of the reef.	**Compliant.** See section 5.1 surveys and reef monitoring sections. Full coastal surveys undertaken in June 2022 and November 2022.
2.3 (c)	Aerial photography of the reef as part of the TRESBP coastline aerial photography program.	**Compliant.** See section 5.1 Reef monitoring outputs.
2.3 (d)	Photogrammetric mapping of Kirra Reef using vertical aerial photography.	**Compliant.** See section 5.1 Reef monitoring outputs.
2.3 (e)	Survey of upper beach profile at Kirra Beach.	**Compliant.** See section 5.1 surveys and reef monitoring sections. Full coastal surveys undertaken in June 2022 and November 2022.
2.3 (f)	Monitoring of turbidity if sediment plumes are observed to extend into the Placement Exclusion Zone due to nearby sand placement activities.	**Not triggered.** Operator reported that no turbidity plumes were reported or observed greater than 50m from point of discharge during the monitoring period. No sand was pumped to the Kirra outlet during the period and sand was delivered/ placed at locations away from Kirra Reef i.e. snapper rocks east, southern 2A placement area.
2.3 (g)	Monitoring of the reef marine biota if ongoing monitoring identifies unexpected impacts due to sand	**Compliant.** See section 5.1, reef monitoring carried out during reporting period despite reef extent remaining relatively stable since

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
	placement activities by the sand bypassing system.	2012.
2.4	Prepare a procedure and criteria for analysing monitoring information.	**Compliant.** Criteria required for monitoring detailed in request for quote when engaging suitably qualified and experienced consultant to undertake works. Consultant proposes procedure and method for analysis as part of quote. See section 5.1 for monitoring details.
2.5	Analyse and report on the results of the monitoring program.	**Compliant.** See section 5.1. See Appendix C.
2.6	Develop and implement procedures for corrective action if any significant unexpected impacts resulting from sand placement activities by the sand bypassing system are detected.	**Compliant.** Corrective action process included in sub-plans, and any issues reported at Working Group.

Sub-plan B15: Duranbah Surf Quality & Beach Amenity Management *(5 April 2007 Rev: 1).*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1	Notification of Target Quantity for First Contract Year, including estimate for dredging quantity.	**Compliant.** Action completed during early stages of project. Reference to historic note as recorded in EMP sub-plan: "Refer Operations Manager's notice of 17 Jan. 2001".
1.2	Specification of the portion of the Target Quantity for delivery to Duranbah Beach in the First Contract Year.	**Compliant.** Action completed during early stages of project. Reference to historic note as recorded in EMP sub-plan: "Draft delivery program reviewed at Advisory Committee meeting on 11 Jan. 2001 and approved by Working Group at meeting of 12 Jan. 2001. Note: Delivery program also presented at the combined Advisory Committee / Beach Nourishment Group meeting on 31 Jan. 2001."
1.3	Measurement of sand quantities delivered to the nominated locations by the sand bypassing system.	**Compliant.** See Section 4.2.
1.4	Notification of the proposed Target Quantity of sand to be delivered in the following Contract Year, if it is in excess of 700,000m³.	**Not triggered.** Not required during this monitoring period.
1.5	Specification of the Target Quantity and proportions to be delivered to each placement location in the Duranbah Placement Areas in the following Contract Year (except for the first Contract Year).	**Compliant.** Letter issued to operator on 26 August 2022 (CA-TFN-CY21) specifying Target Quantity and proportions to be delivered.
1.6	Notification of estimated total quantities of sand to be delivered in the current Contract Year and proposed quantity to be delivered by dredge in the following Contract Year.	**Compliant.** Letter issued to operator on 26 August 2022 (CA-TFN-CY21) specifying Target Quantity and proportions to be delivered.
1.7	Monitor Operator compliance. Procedures for monitoring sand delivery and auditing performance to	**Not Applicable.** Not required during this monitoring period.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
	be developed prior to commencement of operation.	
2.1 to 2.7	Baseline environmental monitoring programs and community consultation undertaken during the construction and commissioning of the permanent sand bypassing system (February 2000 to 3 May 2001).	**Not applicable.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: -in relation Beach and surf observations by Messrs. Mason and Ford, Tweed River entrance and Duranbah Beach (Task 2.1): "Ongoing during the construction and commissioning of the jetty-based sand bypassing system". Commenced Feb. 1997. -in relation to survey of Duranbah upper beach profiles (Task 2.2): "Baseline surveys carried out in April, July, & Sept. 2000 and Jan. 2001". -in relation to aerial photography of the Tweed River entrance and Duranbah beach (Task 2.3): "Baseline photography captured in May and Sept. 2000." -in relation to Tweed River entrance surveys (Task 2.4): "Baseline surveys carried out in April, July, and Sept. 2000 and Jan. 2001". -in relation to Nearshore directional wave measurements (Task 2.5): "Continuous wave record has been measured at the Tweed Entrance buoy since Jan. 1995." -in relation to Assessment of longshore sand transport supply (Task 2.6): Marked as complete with Target date January/ February 2001. -in relation to Community feedback (Task 2.7): "Advisory Committee meetings held in Jan., Mar., May, Aug. Oct., Nov. and Dec. 2000, and on 11 and

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		31 Jan. 2001".
3.1	Preparation of a schedule for ongoing monitoring activities for approval by the TRESBP Working Group.	**Compliant.** Initial schedule reviewed at Working Group meeting on 12 Jan 2001 as per historic notes recorded in EMP sub-plan. Ongoing - annual monitoring schedule is prepared as part of yearly budget and approved by Working Group. Monitoring is periodically reviewed as part of monthly finance/ budget updates.
3.2	Regular beach and offshore survey.	**Compliant.** See section 5.1 and Appendix G Surveys. Comprehensive surveys completed in June 2022 and November 2022.
3.3	Regular beach and surf quality observations.	**Compliant.** See section 5.1 for monitoring outputs and Appendix D Beach and Entrance Conditions including photos.
3.4	Regular aerial photography of the Tweed River entrance and Duranbah Beach	**Compliant.** See section 5.1 and Appendix F for aerial imagery.
3.5	Ongoing nearshore directional wave measurements.	**Compliant.** See section 5.1 and Appendix A for wave monitoring outputs.
3.6	Ongoing assessment of longshore sand transport supply.	**Compliant.** See section 5.1 and Appendix D for sediment transport assessment.
3.7	Regular Tweed River entrance surveys.	**Compliant.** See section 5.1 and Appendix G Surveys. Surveys of entrance undertaken at least quarterly during monitoring period.
3.8	Preparation of procedures and criteria for analysing monitoring data, including assessment of local coastal processes.	**Compliant.** See section 5.1 for analysis.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
3.9	Analyse and report on the results of the monitoring program.	**Compliant.** See section 5.1 for analysis.
3.10	Develop and implement procedures for corrective action if any significant unexpected impacts are detected that are a consequence of the operation of the sand bypassing system.	**Compliant.** Corrective action process included in sub-plans, and any issues reported at Working Group.
4.1	Consultation with the surfing community, beach users, the local community and other stakeholders with regard to surf quality and beach amenity issues at Duranbah Beach.	**Compliant.** Refer section 5.4.
4.2	Organise public meetings to discuss issues relating to surf quality and beach amenity (prior to the commencement of operations).	**Not applicable.** Relates to earlier stages of project. Public meetings held on 4 Nov. and 16 Nov. 2000.
4.3	Develop a mechanism for wider community feedback.	**Compliant.** Refer section 5.4.
4.4	Identify the community's primary concerns in regard to Duranbah Beach.	**Compliant.** Refer section 5.4.
4.5	Document the outcomes from the Beach Nourishment Group meetings and record in the Consultation Register.	**Compliant.** BNG previously disbanded. Stakeholder consultation occurs in its place as per section 5.4.
4.6	Review the effectiveness of the community feedback mechanism.	**Compliant.** The community meetings as per section 5.4 continue to operate.

Sub-plan B16: Tweed River Entrance & Lower Estuary Management *(4 April 2007 Rev: 3)*

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
1.1 to 1.3, 1.5 to 1.8	Baseline environmental monitoring programs undertaken during the construction and commissioning of the permanent sand bypassing system (February 2000 to 3 May 2001).	**Compliant.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: -in relation to lower estuary tidal levels (Task 1.1): "Ongoing program that commenced prior to the TRESBP Stage 1 entrance dredging works." -in relation to survey of lower Tweed River (Task 1.2): "Baseline surveys carried out in Feb. and Aug. 2000." -in relation to aerial photography of the lower Tweed River Estuary (Task 1.3): "Baseline photography captured in May 2000, Sep 2000 and Feb 2001." -in relation to Nearshore directional wave measurements (Task 1.5): "Continuous wave record has been measured at the Tweed Entrance buoy since Jan. 1995." -in relation to assessment of wave propagation into the Tweed River entrance (Task 1.6): "Continuous wave record has been measured at the Zwarts Pole since Jan. 1995." -in relation to Low level aerial photography of the Tweed River breakwaters (Task 1.7): "Baseline photography captured in May 2000." -in relation to Tweed River Entrance surveys (Task 1.8): "Baseline surveys carried out in April, July, & Sept. 2000 and Jan. 2001."
1.4	Baseline mapping of wetland extent.	**Compliant.** Action(s) completed during early stages of project. Reference to historic notes

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		as recorded in EMP sub-plan: "Baseline mapping was carried out by Pacific Wetlands using aerial photography captured on 13 May 2000."
2.1	Preparation of a schedule for ongoing monitoring activities for approval by the TRESBP Working Group.	**Compliant.** Initial schedule reviewed at Working Group meeting on 12 Jan 2001 as per historic notes recorded in EMP sub-plan. Ongoing - annual monitoring schedule is prepared as part of yearly budget and approved by Working Group. Monitoring is periodically reviewed as part of monthly finance/ budget updates.
2.2	Measurement of lower estuary tidal levels.	**Compliant.** Water level and tidal data is continuously recorded at station Letitia 2A by Manly Hydraulic Laboratory (NSW). See section 5.1 and Appendix B Tidal Analysis Report.
2.3	Survey of the lower Tweed River.	**Compliant.** See section 5.1 and Appendix G. Survey of the Lower Tweed River completed in August 2022 by EPA.
2.4	Aerial photography of the lower Tweed River estuary.	**Compliant.** See section 5.1 and Appendix F for aerial imagery.
2.5	Mapping of wetland extent.	**Compliant.** See section 5.1. Mapping of wetland extent carried out by NSW DPI (Fisheries) in 2022. Tidal analysis shows minimal changes to tidal levels. See section 6.1 for tidal monitoring results.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
2.6	Nearshore directional wave measurements.	**Compliant.** See section 5.1 and Appendix A for wave monitoring outputs.
2.7	Assessment of wave propagation into the Tweed River entrance.	Zwarts Pole decommissioned. Training walls inspected annually by Transport for NSW (Maritime – MIDO).
2.8	Low level aerial photography of the Tweed River breakwaters.	**Compliant.** Training walls inspected annually by Transport for NSW (Maritime – MIDO) report includes low level aerial imagery of breakwaters.
2.9	Tweed River Entrance Surveys	**Compliant.** See section 5.1 for list of surveys undertaken throughout the period. Full coastal surveys undertaken in June 2022 and November 2022. Surveys undertaken of entrance at least Quarterly during period.
2.10	Prepare procedures and criteria for analysing monitoring data, including assessment of local coastal processes.	**Compliant.** Criteria required for monitoring detailed in request for quote when engaging suitably qualified and experienced consultant to undertake works. Consultant proposes procedure and method for analysis as part of quote. See section 5.1 for monitoring outputs.
2.11	Analyse and report on the results of the monitoring program.	**Compliant.** See section 5.1 for outputs of monitoring.
2.12	Develop and implement procedures for corrective action if any significant or unexpected impacts are detected that are a consequence of the operation of the permanent sand bypassing system.	**Compliant.** Corrective action process included in sub-plans, and any issues reported at Working Group.
3.1	Consultation with Tweed Shire Council at Working Group level during the preparation of the Tweed River Entrance and Lower Estuary Management sub-plan.	**Compliant.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Draft EMS submitted to Working group during Sept.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
		2000 and on 6 Dec. 2000"
3.2	Consultation with TSC with regard to: (a) the preparation and implementation of the project's shoal remedial nourishment strategy, and (b) development by Council of a broader scoped Lower Estuary Shoals Management Plan under its Tweed River Management Plan.	**Compliant.** Action(s) completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Project Director of the Co-ordinating State attended the River Management Plan Action Committee meeting of 30 Aug. 2000 to discuss the Project's shoal nourishment strategy."
4.1	Ongoing analysis of lower estuary tidal levels.	**Compliant.** See section 5.1 and Appendix B.
4.2	Ongoing analysis of lower estuary hydrographic surveys to assess changes in the riverbed and condition of the lower estuary shoals.	**Compliant.** See section 5.1 for monitoring results. Volume analysis change between surveys completed by consultant.
4.3	Undertake a lower estuary shoal remedial nourishment design and environmental review study.	**Not triggered.** Not required during this monitoring period.
4.4	Monitor the Mean Low Water Spring tidal level at the Letitia 2A tidal recorder.	**Compliant.** Water level and tidal data is continuously recorded at station Letitia 2A by Manly Hydraulic Laboratory (NSW). See section 5.1 and Appendix B Tidal Analysis Report. There were no significant changes in water levels during this reporting period.
4.5	If the Letitia 2A MLWS tidal level falls below RL –0.55m AHD on two consecutive months then follow steps outlined in the Lower Estuary Shoals Remedial Nourishment Strategy.	**Not triggered.** Not required during this monitoring period.
4.6 &	Measurement of sand quantities delivered by the fixed jetty-based system to the lower estuary shoal outlet location; and Monitor Operator compliance.	**Not triggered.** Not required during this monitoring period.

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
4.7		
4.8	Review the Lower Estuary Shoals Remedial Nourishment Strategy on a regular basis to ensure consistency with Tweed Shire Council's River Management Plan.	**Compliant.** Tweed River Estuary Coastal Management Program implanted in accordance with the CM Act 2016 is now in place. TSB in consultation with Tweed Shire Council through Working Group and Advisory Committee.
5.1	Establish dredging restriction zones at the head of the breakwaters and in the river channel, within the TRESBP Contract Agreements.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Specification of breakwater clearance zones in the TRESBP Concession Agreement (refer Dwg. No. 9700998- CA-EX11-02). The TRESBP CA was signed on 22 December 1999."
5.2	Establish dredging depth limits in the Entrance Channel area, in the TRESBP contract agreements.	**Not applicable.** Action completed during early stages of project. Reference to historic notes as recorded in EMP sub-plan: "Specification of maximum permissible dredge levels in Removal Area Compartments A and B, in the TRESBP CA (refer Dwg. No. 9700998-CAEX11-02). The TRESBP CA was signed on 22 December 1999."
5.3	Monitor Operator compliance with CA restriction on sand removal.	**Compliant.** Surveys undertaken throughout year to monitor Operator compliance including pre and post dredging surveys.
6.1	Review the condition of the breakwaters/training walls and entrance bathymetry and wave	**Compliant.** Training walls inspected annually by Transport for NSW (Maritime – MIDO)

TASK NO.	REQUIREMENT	COMPLIANCE STATUS MAY 2022 - APRIL 2023
	transmission conditions on a regular basis.	report includes low level aerial imagery of breakwaters. Refer to 5.1 for monitoring of entrance bathymetry and wave conditions.

Appendix F

TRESBCo Environmental Monitoring Report

Tweed River Entrance Sand Bypassing Company

Transport for NSW

Queensland Department of Environment and Science

TWEED RIVER ENTRANCE SAND BYPASSING PROJECT STAGE 2 PERMANENT SAND BYPASSING SYSTEM

ANNUAL ENVIRONMENTAL MONITORING REPORT

MAY 2022 - APRIL 2023

Rev	Date	Details	Author	Reviewer
20/21-1	May 2021	Internal review, submission	G. Smith	M. Ross
21/22-1	May 2022	Internal review, submission	G Smith	M Ross
22/23-1	May 2023	Internal review, submission	G Smith	M Ross

CONTENTS

ACRONYMS

ASS	Acid Sulphate Soils
CA	Concession Agreement between McConnell Dowell and the Governments
DA	Development Agreement between McConnell Dowell and the Governments
DGPS	Differential Global Positioning System
EIS/IAS	Environmental Impact Statement/Impact Assessment Study
EMP	environ mental Management Plan
EMR	Environmental Management Representative
EMS	Environmental Management System
GCCC	Gold Coast City Council
Governments	Transport for NSW and Qld Department of Environment and Science on behalf of the Governments
LPPS	Low Pressure Pump Station
MSDS	Material Safety Data Sheet
MP	Monitoring Period May 2022 - April 2023
PASS	Potential Acid Sulphate Soils
PPE	Personal Protective Equipment
TBLALC	Tweed Byron Local Aboriginal Land Council
TRESBP	Tweed River Entrance Sand Bypassing Project
TSC	Tweed Shire Council

COMPLIANCE STATEMENT

I Gavin Smith, on behalf of the operator - Tweed River Entrance Sand Bypassing Company P/L (TRESBC), certify that this Environmental Monitoring Report has been prepared based on available and known information to provide a true and accurate record of compliance with the relevant environmental requirements and conditions imposed on the operator of the Tweed Sand Bypass system. Further, I am authorised to make this statement on behalf of TRESBC.
Note: This statement is made under the provisions of the Environmental Planning and Assessment Act 1979 Section 122E and the relevant sections of the Crimes Act 1900 relating to penalties for providing misleading or false information.

Authorised Reporting Officer

Name:	Gavin Smith		
Title:	Operations and Maintenance Manager - TRESBC		
Signature:		Date	30 April 2023

Operations and Maintenance Manager

ANNEXURE ONE – CHANGE OF ENTITIES

This document will refer to the government agencies and departments as they were when the original Environmental Monitoring Report was issued in April 2002. For the current agency names, please see the table below.

ACRONYM	FORMER AGENCY	CURRENT AGENCY
NEW SOUTH WALES		
DUAP	Department of Urban Affairs and Planning	Department of Planning and Infrastructure
EPA	Environmental Protection Agency	Environmental Protection Authority (Office of Environment and Heritage)
TfNSW	Transport for NSW	Transport for NSW
DOI	Department of Primary Industries - Lands	Department of Planning, Industry and Environment
NPWS	National Parks and Wildlife Service	Office of Environment and Heritage
Fisheries	NSW Fisheries	Department of Primary Industries
NSW Heritage Council	NSW Heritage Council	Office of Environment and Heritage
Work Cover	Work Cover	Work Cover Authority of NSW
NSW Maritime	NSW Maritime	Roads and Maritime Services
QUEENSLAND		

DES	Department of Science, Information Technology and Innovation	Department of Environment and Science, QLD Government
QEPA1	Queensland Environmental Protection Agency	Department of Environment and Science, QLD Government
QEPA2	Queensland Environmental Protection Agency	Department of Environment and Science, QLD Government
NRW	Department of Natural Resources and Water	Department of Natural Resources
DPI&F	Department of Primary Industries and Fisheries	Department of Agriculture and Fisheries

1. INTRODUCTION

This report has been prepared to partially fulfill the environmental reporting requirements of the ***Tweed River Entrance Sand Bypassing Project (TRESBP) Environmental Management System - Operations***. It contains the results of the Tweed River Entrance Sand Bypassing Company (TRESBC) environmental monitoring program undertaken between May 2022 and April 2023. It also reports on the following:

- Applications for consents, licenses and approvals, and responses from relevant authorities during the MP.
- Implementation and effectiveness of environmental controls and conditions relating to work undertaken.
- Identification of impact predictions made in the EIS/IAS and other supplementary studies that are the responsibility of the operator and details of the extent to which the actual impacts reflect the predictions.
- Details and analysis of the environmental monitoring program.
- Assessment of compliance with the EMS-Operations sub-plans.
- Number and details of any complaints, including a summary of the main area of complaint, action taken, response given and intended strategies to reduce complaints of a similar nature; and
- Any other matter relating to the compliance with the conditions of approval, or as requested by the Approving Authorities.

2. ENVIRONMENTAL MANAGEMENT SYSTEM

The Environmental Management Plan - Operations (EMP-Operations) has been prepared to as part of the environmental approval process for Stage 2 of TRESBP. It is based upon the requirements arising from the NSW conditions of environmental planning approval, the recommendations of the Queensland Impact Assessment Review Report, the EIS/IAS and Representations Report, all relevant Acts and Regulations and accepted best practice management plans.

This EMP covers the environmental management for the operation of the project including any supplementary dredging and nourishment activities. It provides a framework for the controls, mitigating measures, monitoring and auditing procedures necessary to prevent or ameliorate potentially adverse environmental effects resulting from the operation of the fixed bypassing system.

This EMP has been prepared for the Tweed Sand Bypassing Project, following consultation with relevant government agencies including:

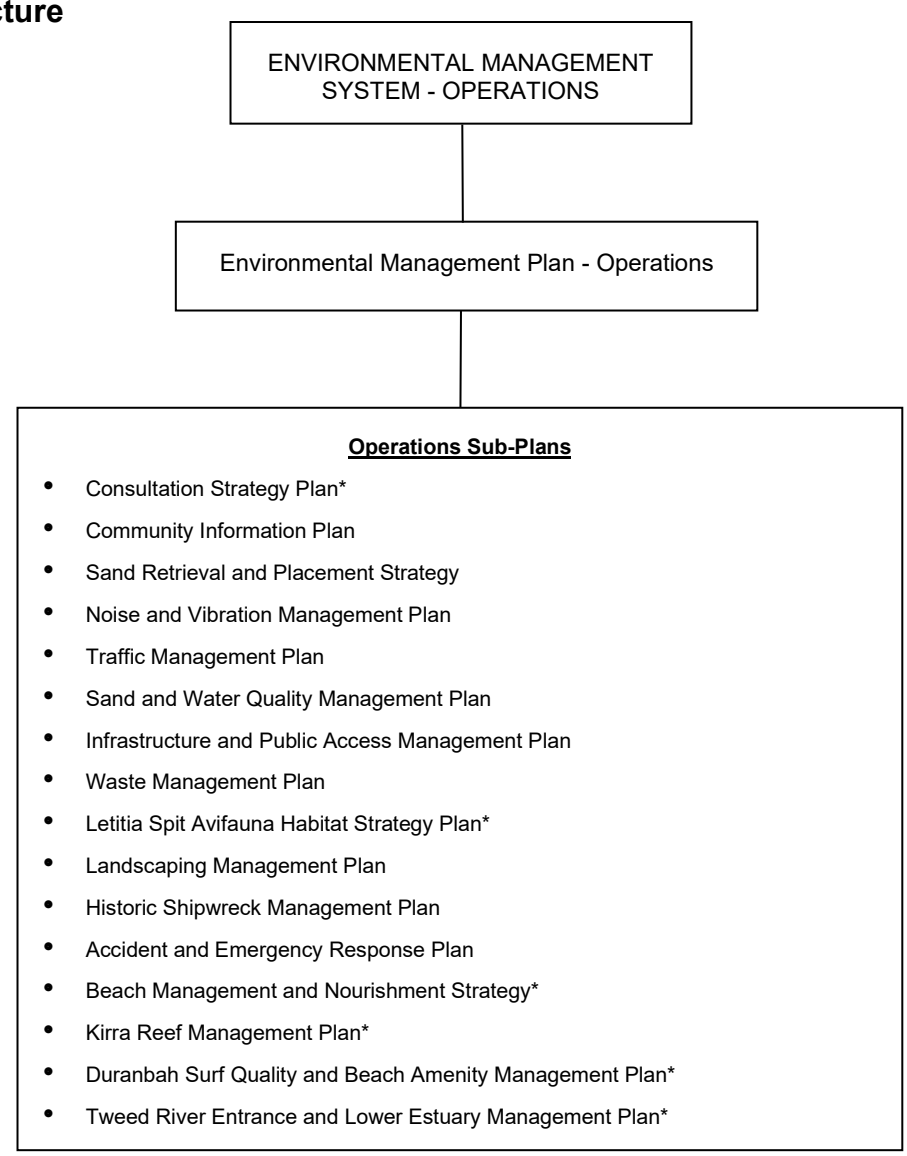
- Department of Environment and Science, Queensland Government
- NSW National Parks and Wildlife Service
- NSW Fisheries
- TRESBP Working Group and Advisory Committee
- Tweed Shire Council
- Gold Coast City Council
- Other local community groups

3. ENVIRONMENTAL MANAGEMENT PLANS AND SUB-PLANS

To manage key environmental performance requirements, an Environmental Management Plan (EMP) for the operations, supplementary dredging and nourishment works of the project have been developed. Each EMP contains separate sub-plans to manage key environmental and performance issues. These sub-plans also specify the assignment of resources and responsibilities for achieving the environmental requirements.

The structure of the EMP and its sub-plans are listed below.

EMP Structure



NB – The Operator is responsible for the implementation of the above sub-plans except for those marked * for which the Governments are responsible.

4. APPLICATIONS FOR APPROVALS, LICENCES AND CONSENTS

An Environmental Impact Statement (EIS) and an Impact Assessment Study (IAS) for the permanent bypassing system (Stage 2) was prepared by the Hyder Joint Venture and released in July 1997. Following a public exhibition and submission phase, additional environmental

assessment was undertaken to consider the impact of the project on threatened species. The EIS/IAS provides a summary of the benefits and impacts associated with the different options associated with the permanent sand-bypassing project in Section 7 - 92. These significant impacts have been addressed by establishing, implementing and maintaining the EMP Sub-Plans for the project.

Details of applications for approvals, licenses and consents from various authorities as well as details of their status are outlined in the table below.

Table 2.4.1 – Status of Approvals, Licenses and Consents – April 2016

Legislation	Department	Permit/Licence/ Approval/ Obligations	Status
New South Wales			
Environmental Planning and Assessment Act, Part V,	DUAP	• Approval of Environmental Management Plan (Approval Conditions 12, 13 & 14).	• Approval gained on 18th February 2000.
		• Approval of Environmental Representative for construction (Approval Condition 11).	• Approval gained on 18th February 2000.
		• Approval of Acid Sulphate Soils Management Plan (Approval Condition 30).	• Approval gained on 17th May 2000.
Heritage Act 1977, Division 2 of Part 4		Approval required for any development (including excavation) of land in which a heritage item is located.	Not required. No heritage items were found in the vicinity of the construction area.
Protection of Environmental Operations Act 1997	EPA	Obtain license for any scheduled development works under Chapter 3.	Original EPA License issued on 18th April 2000. Renewal License effective as of 13 April 2023.
Coastal Protection Act 1979	DOI	Concurrence from Minister for development in Coastal Zone.	Obtained.
Commonwealth Historic Shipwrecks Act 1976	NSW Heritage Council	Permit to disturb protected historic shipwrecks.	No protected shipwrecks disturbed.
		Consultation with NSW Heritage Council in preparation of Historic Shipwreck Management Strategy.	Undertaken.

Legislation	Department	Permit/Licence/ Approval/ Obligations	Status
Dangerous Goods Act 1975, Parts III and IV	Work Cover	License for: • Premises storing Dangerous Goods. • Vehicles conveying Dangerous Goods. • Use, handling and other activities involving Dangerous Goods.	No licensing required for the quantities of Dangerous Goods stored on site.
Threatened Species Conservation Act 1995, s91	NPWS	Inclusion of monitoring and contingency particularly wading birds and shorebirds.	Not required.
Water Act 1912, part 2	Water Ministerial Corporation	License for works involving dewatering and drainage.	No license required as Act only applies to fresh water supplies or irrigation or flood control works.
	DOI	• Concurrence to: • Approval of Environmental Representative for system operation. • Approval of Environmental Auditor.	Obtained.
	NSW Waterways Authority	Adequate Navigation Aids.	Advice received from Waterways Authority on 18 May 2000, on the provision of adequate navigation aids.
Local Government Act 1993	Tweed Shire Council	• Installation of temporary structures • Water supply, sewerage and drainage • Regular local government approvals.	Continually consulting with TSC throughout operations.
Queensland			
Environmental Protection Act 1994	QEPA1	License of Environmentally Relevant Activities under Section 39b. Duty to notify Serious and Material environmental harm.	Not required if a specific Development Approval is in force. Not applicable.
Environmental and Other Legislation Amendment Act 1997	QEPA1	Approval for removal of contaminated soil or remediation of contaminated site.	Not applicable.

Legislation	Department	Permit/Licence/ Approval/ Obligations	Status
Coastal Protection & Management Act 1995 *(Previous Harbours Act 1955, Section 86)*	QEPA2	Permit required for construction in tidal waters (includes discharge outlets and placement of sand by dredge).	Section 86 for the installation of fixed and flexible pipe outlets on southern Gold Coast beaches issued on 30-Aug-2000. Section 86 for refined dredging nourishment design issued on 16 May 2001.
Coastal Protection and Management Act 1995 (previously Beach Protection Act 1968)	Beach Protection Authority	Permit required for works in coastal management control district.	Not required. Outlets are covered within the Coastal Management Plan for the Gold Coast pursuant to the Act.
Fisheries Act 1994	DPI&F	Permit for disturbance to marine flora.	Not required.
Gold Coast City Council local laws	Gold Coast City Council	Regular local government approvals.	Consultation has been undertaken with GCCC on a number of matters including detailed design drawings, Traffic Management Plan, Landscaping Management Plan and Section 86 *Harbours Act* application.
Integrated Planning Act 1997	GCCC	Development Permit for Operational Works.	Development Permit for Operational Works received on 10 August 2000.
Land Act	NRW	Land Lease required.	Land Lease commenced on 01 December 2001.

5. EVALUATION OF OPERATIONS IMPACT PREDICTIONS MADE ON THE EIS/IAS

A list of operation predictions made in the EIS/IAS and other supplementary studies with an evaluation of the extent to which the actual impacts reflect the predictions is given in the table below.

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
Surface Topography and Drainage	Positive	• No changes to surface topography in upper reaches of estuary. • Existing drainage patterns unaltered. • Tidal levels and influence unaltered. • Protection and enhancement of beach and dune systems in the nourishment areas. • No impact from Acid Sulphate Soils.	• No impact evident within estuary • During the MP, for protection and enhancement of Duranbah beach – 11,445m3 of pumped sand was distributed along Duranbah Beach.
	Negative	• Recession of coastline at Letitia Spit.	• Recession has occurred along northern and central Letitia Beach. • Back passing by dredge to Fingal was carried out during this MP. • Aerial imagery and volume calculations on Letitia are carried out to monitor the recession.
Wave Propagation	Positive	• Wave steepening and shoaling will be reduced in entrance bar channel.	• Generally, channel bathymetry was maintained in the entrance channel area during the MP • Observed breaking waves during large swell events.
	Negative	• Altered wave refraction may affect surfing quality at Duranbah Beach. • Increased exposure of training walls to storm waves. • Increase of wave penetration into estuary but no significant impacts.	Positive feedback on surf quality at Duranbah has been observed during MP.
Turbidity	Positive	• Turbidity plumes will be contained within an approx. distance of 50m from the point of discharge. • However, plume will be short lived and last some 2-3 minutes after cessation of sand pumping activities.	No observed or reported turbidity plumes greater than 50 m from point of discharge observed during MP.
	Negative	No system specific impacts.	No impact evident.
Water Quality	Positive	No system specific impacts.	No impact evident.
	Negative	No system specific impacts.	No impact evident.
Sediment Quality	Positive	Sand on the bar is part of the longshore continuum between Letitia Spit and Gold	No impact evident.

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
		Coast beaches hence no adverse impact on sediment quality.	
	Negative	No system specific impacts.	No impact evident.
Beach Systems	Positive	• Improved coastal protection and beach amenity of southern Gold Coast. Allows nourishment of offshore profile i.e. re-establishment of long-term bathymetry.	• Beach widths continue to naturally fluctuate and are primarily dependant on seasonal wave activity and the occurrence of storm events.
	Negative	• Localised retreat of beach south of Tweed River entrance. • Modification of dune system at Letitia Spit however present beach and dune system are largely artificial due to construction of training walls.	• The observed recession near the jetty is up to 90m and the foreshore recession is relatively uniform along the northern part of the beach, recession southward from the jetty towards central Letitia Spit • Pumping strategy to promote beach rebuilding. • Back passing by dredge to Fingal was carried out during MP. • Aerial imagery and volume calculations on Letitia are carried out to monitor the recession.
Tweed River Entrance	Positive	• Entrance bar channel depth maintained.	Clear Navigation Channel depth was not maintained between 18 June 2022 - 9 November 2022 and 26 January 2023 – 13 April 2023.
	Negative	• Depending on the bar depth the height of waves during severe storms may be increased leading to possible damage or failure of training walls. • Bar configuration will have impact on height of waves breaking against walls. Depending on bar depth,	• No significant impact evident on the training walls during the MP.
Tweed River Estuary	Positive	• Change in tidal levels will not be significant. • In conjunction with the Tweed Estuary Management Plan, improvement of tidal mixing and flushing (improved water quality) of main arm. • Substantial reduction of net in-feed of marine sand into estuary. • No impact on flood flows. • No threat to existing internal training wall or parkland behind from wave penetration. • No significant impact on storm surge into the estuary.	• No impact evident within the estuary

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
	Negative	Lower estuary marine shoals will be slower to recover from flood events.	• No impact evident within the estuary
Marine Ecology	Positive	• The jetty mounted system may create new reef type habitat. • Re-establishment of new reef habitats on any trestle structure.	• Not specifically monitored. • Observations during daily activities indicate significant fish numbers around the jetty infrastructure
	Negative	• The jetty mounted system may cause alteration of species composition • The jetty mounted system may create zones devoid of benthic invertebrates. • Potential alteration of the path of migrating fin fish • Potential sand migration onto Kirra Reef. However, such movement would replicate historical natural sand transport patterns	• Aquatic habitats in the vicinity of the jetty not specifically monitored. • The sand trap zone beneath the jetty from where sand is pumped is a very small plan area within the greater Letitia embayment. Note: • No impact observed at Kirra during the MP - refer to publications on https://www.tweedsandbypass.nsw.gov.au/environmental-monitoring/kirra-reef-monitoring.html and Appendix A9 of the Concession Agreement.
Estuarine Ecology	Positive	• Negligible impact in tidal ranges. • Insignificant direct ecological impacts. • Permanent system will result in stabilisation of intertidal wetlands. • Mitigating measures available to maintain the tidal range at pre-flood conditions such as installation of temporary sand pumping pipeline from the permanent bypassing system. • Improved tidal flushing will improve water quality.	• No significant impact evident within the estuary • No requirement for mitigating measures.
	Negative	Potential to inhibit migratory fish species from entering Tweed River estuary.	Not specifically monitored but no significant tidal flow impact evident
Shorebirds	Positive	No system specific impacts.	• Not specifically monitored. • Ospreys continue to nest on extended pole tower on the jetty structure and produced two chicks in 2022.
	Negative	• Operation of the fixed jetty mounted system will disturb waterbird roosts at South Head beach and kerosene Inlet. • Clear water intake may disturb major roosts in Tweed River estuary.	• No impact evident. Note: Not specifically monitored this period but operation of fixed jetty system has small footprint on Letitia Spit beach and is remote from Kerosene Inlet. Operation of clean water intake involves very little disturbance activity and is located along a rock revetment river training wall away from major roosts in estuary.

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
Land use, Zoning and Tenure	Positive	• No significant impact on private land holdings or zoning. • No changes to private property boundaries. • No need to formally acquire lands.	• No impact evident.
	Negative	• No system specific impacts.	• No impact evident.
Aboriginal and Post Contact Heritage	Positive	• No system specific impacts.	• No impact evident.
	Negative	• No system specific impacts.	• No impact evident.
Socio-economic Profile	Positive	• Substantial recreational and economic impacts.	• Beach widths will continue to naturally fluctuate primarily due to seasonal wave conditions and the occurrence of large storm events. • Clear channel was not maintained throughout the MP.
	Negative	• No system specific impacts.	• No impact evident.
Business, recreation and Tourism	Positive	• Recreational fishing may be improved due to creation of reef-like habitat and provision of public access to a jetty structure. • Improved viability of the Tweed fishing industry. • Increased boating (including ocean going vessels) within Tweed estuary. • Establish consistent, good surfing and beach amenity in all seasons. • Revenue from tourism likely to increase. • Benefit to local commercial and retail businesses. • Oyster fisheries will benefit from improved tidal flushing of estuary. • Possibility of local employment benefits.	• No negative impact observed by operator.
	Negative	• No system specific impacts.	• No impacts evident.
Visual Amenity	Positive	• No system specific impacts.	• No impacts evident.
	Negative	• Highly visible from major vista points. • Permanent, therefore long-term visual impact.	• Jetty structure and LPPS are long-term highly visible impacts. No significant adverse reactions, due to public consultation undertaken during construction. • No complaints regarding the appearance of structures have been received

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
		• High existing visual sensitivity of Letitia Spit. • Large size and industrial appearance. • Exposed outlets are permanent and partially visible from major vista points	
Navigation	Positive	• Increased safety of navigation of entrance particularly during incoming tide. • Infilling of navigation channels within the estuary reduced. • Potential infilling of the secondary channel of main arm reduced. • Larger vessels will be able to navigate the entrance more safely.	• Safety improved. • Deeper wider channel allows for larger vessels to safely navigate the channel. • No significant impact evident on other indicators
	Negative	• Due to natural bypass of longshore transport occasional bar dredging will be required.	• Clear Navigation Channel depth was not maintained between 18 June 2022 - 9 November 2022 and 26 January 2023 – 13 April 2023.
Noise	Positive	Potential to ameliorate noise generated.	• Noise amelioration measures in place. No complaints received
	Negative	• Increased noise resulting from plant at the restaurant and Clubhouse at Jack Evans Boat Harbour. • Increased noise at Eden and Bay Streets. • Noise impacts on ecology. • Tweed River foreshore between Jack Evans Boat Harbour and Terranora Inlet areas has high noise sensitivity.	• Noise study undertaken in 2001. No significant noise increases evident. • Clean water pump station and jetty sand pumping facility located remote from residential and other noise sensitive areas
Air Quality	Positive	System electrically powered therefore no emissions in local area.	• No impact evident.
	Negative	No system specific impacts.	• No impact evident.
Traffic	Positive		
	Negative	• Traffic volumes remain high • Dust • Hazardous conditions	• Road remains unsealed and requires ongoing Tweed Shire Council maintenance. Maintenance occurred during the MP. • Excessive dust generated.
Hazard	Positive	• Reduction in hazard by improved navigation.	• Clear Navigation Channel depth was not maintained between 18 June 2022 - 9 November 2022 and 26 January 2023 – 13 April 2023.
	Negative	• Use of entrance by increased number of vessels and inexperienced sailors.	• No impact evident. • No impact evident.

Environmental Criteria	Impacts	Sand Retrieval, Transport and Placement Predictions	Evaluation
		• Potential navigational hazard during operation.	

6. SUB PLANS - RESULTS OF ENVIRONMENTAL MONITORING

Summary Table

Sub Plan Summary				
Sub Plan	Description	Custodian	Compliant	Comments
B2	Community Information Plan	TRESBC	Y	Calls to the operation by the public were regarding site visits by schools for educational purposes and by other interested community groups. All relevant notifications for dredging were issued.
B3	Sand Retrieval and Placement Strategy	TRESBC	Y	399,088m3 pumped and placed during the MP. Observed localised retreat and accretion. Letitia relatively stable through the MP. Sand placed by dredge to Fingal
B4	Noise and Vibration Management Plan	TRESBC	Y	All mitigation measures in place. No impact for the MP
B5	Traffic Management Plan	TRESBC	Y	All mitigation measures in place. No impact for the MP

B6	Sand and Water Quality Management Plan	TRESBC	Y	All mitigation measures in place. Water testing carried out for pumping and dredging as per EPA Guild lines. No impact for the MP.
B7	Infrastructure and Public Access Management Plan	TRESBC	Y	Unauthorised access to jetty occurred during the MP. Tweed water police completing patrols. New security gates installed and Letitia road closure have reduced the incidence of unauthorised access.
B8	Waste Management Plan	TRESBC	Y	All mitigation measures in place. No Impact for the MP
B10	Landscaping Management Plan	TRESBC	Y	No significant impact for the MP. Weed control carried out, Dune structure stable with minor recession during high tide and large swell events.
B11	Historic Shipwreck Management Plan	TRESBC	Y	All mitigation measures in place. No impact for the MP
B12	Accident and Emergency Response Plan	TRESBC	Y	All mitigation measures in place. No impact for the MP

Sub Plan Monitoring Detail

Task No.	Requirement	Status	Action By Whom
SUBPLAN B2: COMMUNITY INFORMATION PLAN			
2.1	For any significant construction activity likely to affect residents, provide community with adequate information regarding operation activities.	• The Advisory Committee was kept informed.	Operator / Governments

Task No.	Requirement	Status	Action By Whom
2.2	Display information signage in close vicinity of each sand outlet.	• Installed signs monitored weekly. • Vandalised/damaged signs and boards replaced as required.	Operator
2.3	Regularly update Community Information Noticeboards.	• Ongoing procedure. • Notice boards updated with information posters prepared and supplied by TfNSW and DES	Operator / Governments
2.4	Liaise with Volunteer Marine Rescue Pt. Danger regarding any restrictions to navigation in the Tweed River entrance during operations including supplementary dredging and nourishment activities.	• The appropriate agencies were notified prior and during to the 2022 dredging campaign.	Governments Operator Dredging Operator
2.5	Advise Coordinating State of times regarding any interruptions or restrictions to navigation in the Tweed River entrance so that a Notice to Mariners may be issued by the Operator	• The appropriate agencies were notified prior and during to the 2022 dredging campaign.	Governments Operator Dredging Operator
2.6	Investigate and respond to complaints.	• No complaints received	Operator
2.7	Record and report complaints.	• No complaints received.	Operator

Evaluation against performance indicators:

No complaints received in relation to lack of information. Complaints were received by the Governments regarding the beach amenity and surf quality in some locations.

Calls to the operation by the public were regarding site visits by schools for educational purposes and by other interested community groups.

All relevant notifications for dredging were issued.

SUBPLAN B3 – SAND RETRIEVAL AND PLACEMENT STRATEGY

3.1	Brief staff in the requirements of the plan.	• All employees working on site have been inducted in the provisions of this plan.	EMR/Operator
3.2	Minimise nuisance to beach users and any adverse impact on beach and surf amenity.	• Operation has occurred mainly between the hours of 20:00 and 06:30. When pumping to temporary outlets, a security guard has been in place at outlets	Operator
3.3	Consult QLD DPI if temporary relocation of shark control program equipment is required.	• No relocation required.	Operator Dredging Operator

Task No.	Requirement	Status	Action By Whom
3.4	Apply for approval under section 86 of the Harbours act 1955 (QLD) for works in, over, through or across any foreshore or any land lying under the sea within QLD waters.	• Approvals received 31-08-00 & 16-05-01 for the nourishment area design for dredging.	Operator
3.5	Sand Removal – Remove sand from within the Tweed River entrance as defined in CA Schedule 11	• No variance during the MP	Operator/ Dredge Operator
3.6	Removal areas	• No reporting required - Reference only	Operator
3.7	Sand Delivery locations	• No reporting required - Reference only	Operator
3.8	Sand Placement - Place sand removed by the system in accordance with CA Exhibit 10 and Schedule 10.	• No variance during the MP	Operator
3.9	Sand Placement - Addressing Short Term Receiving Capacity and the primary placement area of Snapper Rocks East except under certain circumstances.	• 11,445m3 of sand was pumped onto Duranbah Beach during the MP. This sand placement was staged across 4 locations to encourage formation of inshore banks. • Refer to Appendix C for the monthly quantities delivered and locations.	Operator
3.10	Sand Placement - Addressing Short Term Receiving Capacity for SRE and SRW	• No variance during the MP.	Operator
3.11	The quantity of sand removed and delivered via pumping from the System will be measured in accordance with Part A of CA Schedule 12 - Measurement of Sand Material Removed and Delivered.	• No variance during the MP.	Operator
3.12	Notify the Governments specifying the total amount of sand estimated to be removed by dredging.	• Communicated through the DMS	Operator
3.13	Governments to notify the distribution and total amount to placement areas	• Communicated through the DMS	Government

Task No.	Requirement	Status	Action By Whom
3.14	Select and use dredging plant and equipment suitable for bottom dumping in water depths expected to occur on achievement of the max. Crest levels specified in the current approvals at the placement areas.	• Communicated through the DMS	Operator Dredging Operator
3.15	Dredge Operator to prepare daily log sheets which detail at least the following information (as outlined in CA Schedule 12), and submit to the Manager daily	• Completed for dredging works during the MP	Operator Dredging Operator
3.16	Forward daily log sheet summary to Governments.	• Completed for dredging works during the MP	Operator Dredging Operator
3.17	Measure quantity of sand removed and delivered via dredging.	• Completed for dredging works during the MP	Operator Dredging Operator
3.18	Carry out post dredge and post deposition surveys at the completion of dredging.	• Completed for dredging works during the MP	Operator and Governments
3.19	Develop and implement operational controls to avoid placement of sand in the stage 2 Kirra Reef Placement Exclusion Zone.	• All sand dredged from the entrance was placed in approved locations – Duranbah, Snapper Rocks, Bilinga and Fingal	Operator Dredging Operator Governments
3.20	In respect of each Contract Year, remove from the Removal Areas and place in the Placement Areas, the Target Quantity as notified by Governments.	• Target quantity maintained and notification within the requirements.	Operator
3.21	Notify the Governments in writing of the estimated total quantities of sand delivered, the quantities delivered to each Placement Area at the end of the current Contract Year and the quantity of sand proposed to be removed by dredging in the following Contract Year.	• Completed for MP.	Operator
3.22	Maintain a Clear Navigation Channel.	• Clear Navigation Channel depth was not maintained between 18 June 2022 - 9 November 2022 and 26 January 2023 – 13 April 2023.	Operator
3.23	Monitor sand and water quality in accordance with Sub-Plan B6.	• Completed for MP.	Operator

Task No.	Requirement	Status	Action By Whom
3.24	Promptly inform Governments if dredge hopper is found to contain dredged material that is not Sand Material.	• No material other than Sand Material was dredged	Dredging Operator
3.25	If Governments determine that certain material placed or to be placed in the Placement Areas is not acceptable for beach nourishment purposes, carry out the requirements of Governments as specified by notice in writing.	• No material other than Sand Material was dredged	Governments
3.26	In case of a storm event that could adversely impact on entrance navigation the system may be operated on a 24-hour basis as required subject to restrictions related to the recession of Letitia Spit	• The system was operated for up to 23 hrs per day to suit the sand transport conditions.	Operator
3.27	Operate the System so that general foreshore alignment retreat due to long-term beach recession along Letitia Spit is limited to a maximum of 90 metres in the vicinity of the Works	• System operated to avoid foreshore alignment retreat. The general foreshore alignment retreat was limited to approx. 90m in the vicinity of the jetty over this MP. The “control volume survey” will provide a greater level of confidence to the decision-making process and improvement in the management of sand volumes	Operator
3.28	Undertake Dune Management measures as outlined in Sub-plan B10 – Landscaping Management Plan to manage the gradual recession along Letitia Spit.	• Not required for the MP. Dunes are generally vegetated with Spinifex and other native vegetation. Refer to Appendix D for photographic records	Operator
3.29	Operate the system so that significant disturbance to the upper beach and back beach areas along Letitia Spit is contained within 1000m of the southern training wall.	• Daily visual monitoring of shoreline ongoing. Shoreline recession also monitored through monthly cope pole measurements & quarterly beach profile surveys. •	Operator
3.30	Conduct Regular Channel Surveys of the Entrance Channel Area for certification of establishment of Clear Navigation Channel.	• Surveys conducted Monthly throughout the MP.	Operator / Surveyor
3.31	Conduct Regular Channel Surveys of SRE and SRW monitoring profiles.	• Surveys conducted monthly	Operator / Surveyor
3.32	Conduct Regular Surveys of upper beach monitoring profiles.	• Surveys conducted quarterly.	Operator / Surveyor

Task No.	Requirement	Status	Action By Whom
3.33	Conduct Post Dredge and Post Deposition Surveys.	• Surveys completed as required	Operator / Governments
3.34	Conduct other surveys as directed by Governments.	• Surveys as required completed for the MP	Operator / Governments
3.35	Prepare Survey reports.	• Survey reports prepared and forwarded to relevant stakeholders	Operator / Governments

Evaluation against Performance Indicators:

Clear Navigation Channel

Available	13 April 2022 – 17 June 2022
Unavailable	18 June 2022 – 9 November 2022
Available	10 November 2022 – 25 January 2023
Unavailable	26 January 2023 – 12 – April 2023

Sand delivery during the last 12 months was in general accordance with the sand delivery program provided by Governments.

Outlet	Quantity – m3
Snapper Rocks East	390,236m3
Duranbah	11,445m3

In addition, the survey of upper beach monitoring profiles along Letitia Spit shows:

- Beach recession has occurred along central and northern Letitia Spit. The recession is greatest near the jetty. While the extent of foreshore recession is relatively uniform along the northern part of the beach, the observed recession generally reduces southward away from the jetty along central Letitia Spit.
- Localised beach recession of up to 90 metres has occurred within the immediate proximity of the jetty.
- General foreshore alignment has been relatively stable, lower beach rebuilding had been observed extending south of the jetty over most of this MP.
- Back passing by dredge was carried out in September 2021 to manage the volumes delivered to Queensland and enhance the rebuilding of Letitia Beach.

Location	Quantity – m3
Fingal	0
Dreamtime	8,626

Task No.	Requirement	Status	Action By Whom
No justifiable complaints were received directly by the operator in relation to sand removal and placement.			
SUBPLAN B4: NOISE AND VIBRATION MANAGEMENT PLAN			
4.1	Document all consultation and the outcome of such consultation carried out during the preparation and implementation of the EMP sub-plan in the Consultation Register.	• Documentation completed	Operator
4.2	Brief operations and maintenance staff in the requirements of the plan.	• All employees working on site have been inducted in the provisions of this plan. New staff briefed as required.	Operator
4.3	Task Completed	•	
4.4	Anticipated Operations Noise and Vibration for all Major Noise and Vibration Generating Activities	• Complete – Refer Appendix A of Subplan B	Operator
4.5	Ensure night-time operations in QLD does not exceed background noise plus 5dB(A) between 6pm and 10pm, and background plus 3 dB(A) between 10pm and 6am.	• Noise Study performed. • Refer to the Noise Assessment Report. - Environmental Monitoring Report March to April 2001.	Operator
4.6	Ensure night-time operations in NSW do not exceed background noise plus 3 dB(A).	• Noise Study performed. • Refer to the Noise Assessment Report. • Environmental Monitoring Report March to April 2001.	Operator
4.7	Notify affected residences by way of letter drop if significant construction or maintenance work is required.	• No significant construction or maintenance activities during this period.	Operator
4.8	Restrict significant construction and maintenance work that is likely to be audible at nearby residences to normal working hours.	• No significant construction or maintenance activities during this period. All minor construction activities were restricted to the normal working hours.	Operator
4.9	Contact the local NSW EPA for approval to work outside standard hours.	• All maintenance and construction work undertaken during normal working hours. • Procedure implemented.	Operator
4.10	Seek appropriate permission if audible noise is required before 6:30am, after 6:30pm or on a Sunday or public holiday.	• All work activities (maintenance or construction) confined to normal working days and hours.	Operator

Task No.	Requirement	Status	Action By Whom
4.11	Control deliveries to normal working hours.	• All deliveries limited to normal work hours. Deliveries sometimes restricted by poor condition of Letitia Road.	Operator
4.12	Monitor operation noise as required to comply with Environment Protection Licence	• Noise Study performed 12 April 2001.- Refer to the Noise Assessment Report. Environmental Monitoring Report March to April 2001.- Noise measured at monitoring locations within limits.	Operator
4.13	Investigate noise complaints.	• No complaints received.	Operator
4.14	Record and report complaints.	• No complaints received.	Operator
4.15	Check all plant and equipment is suitably acoustically treated and maintained.	• All plant and equipment checked and maintained on a daily / weekly basis. • Major inspections carried out every 6 months. • Ongoing procedure. • Checklists implemented.	Operator

Evaluation against Performance Indicators:

No Impact for the MP

Best practice noise minimisation measures such as installation of mufflers on plant and equipment, installation of sound rated ventilation filters, ensuring all sound rated doors are closed during operation, installation of quiet exciters on vibrating screen etc. have all been implemented and are effective.

Noise levels assessed under *AS1055.1-1997 Acoustics-Description and Measurement of Environmental Noise* and relevant legislation and guidelines.

No complaints received in relation to noise issues.

Noise levels monitored during the noise study were well within the NSW EPA License acceptable sound levels.

SUBPLAN B5: TRAFFIC AND AIR QUALITY MANAGEMENT PLAN

5.1	Employ traffic controller(s) in instances where activities may cause undue congestion.	• Not required during this MP.	Operator
5.2	Traffic Route	• Reference Only - Only one traffic route is available for access to site at Letitia Spit.	Operator
5.3	Dust suppression measures	• No specific dust suppression required on site. • Access to the site via unsealed Letitia Road, Driving behaviours of site staff and subcontractors are monitored to avoid excessive dust generation. • Unable to limit public use of road generating large levels of dust.	
5.4	Maintain / Upgrade Letitia Road	• The condition of Letitia Road is an ongoing problem. TRESBC depends on the maintenance of the road for staff and suppliers to safely access the site and has been actively involved in seeking solutions for the improvement of the road.	Operator / TSC / Governments

Task No.	Requirement	Status	Action By Whom
4.5	Provide the community with adequate pre-warning of street disruptions.	• No street disruptions over this MP.	Operator
5.6	Procedures to be implemented should any damage to access roads occur as a result of system operation traffic	• No damage occurred as a result of operations	Operator
5.7	Record all consultation and outcomes of such consultation carried out during the preparation and implementation of the EMP in the Consultation Register.	• All records maintained on site.	Operator
5.8	Ensure vehicles are fitted with adequate exhaust control measures.	• Vehicles inspected and maintained daily / weekly. • Major inspections every 12 months.	Operator / Subcontractor
5.9	Cover temporary spoil heaps and stockpiles where necessary.	• Not required for MP	Operator
5.10	Enforce the covering of trucks transporting earth and fill materials as required.	• Not required for MP	Operator
5.11	Undertake revegetation of disturbed areas.	• Revegetation of disturbed areas in the general area of the sand bypass facility compound, access ways, and pipeline corridors, undertaken. Refer also to sub plan B10, task Item 4.2 & 5.1 (xii)	Operator

Evaluation against Performance Indicators:

All MCD site vehicles are regularly serviced to ensure compliance with relevant QLD and NSW statutory requirements.

No dust generated on site for the MP.

TSC maintained Letitia Road in poor state with large amounts of dust generated creating hazardous conditions.

No complaints received with regards to site based traffic and/or air quality issues.

SUBPLAN B6: SAND AND WATER QUALITY MANAGEMENT PLAN

6.1	Prepare and submit to QEPA the monitoring, sampling, and reporting methods for the monitoring of sand and water quality for approval.	• Approval was provided by the QEPA on 15 March 2001.	Operator Governments

Task No.	Requirement	Status	Action By Whom
6.2	Brief staff in the requirements of implementing this plan.	• All employees working on site have been inducted in the provisions of this plan. New staff briefed as required.	Operator
6.3	Install and maintain a vibrating screen above the slurry pit for the removal of debris.	• Vibrating screen operated and maintained in accordance with the procedures contained within the Operation and Maintenance Manual. Currently screen aperture of 30mm x 60mm in use. A new vibrating screen was installed in December 2012.	Operator
6.4	Dispose of debris removed by the vibrating screen.	• Debris removed and recycled or disposed off-site by waste removalists.	Operator / Subcontractor
6.5	Establish communication link with Tweed Shire Council to be notified of a high pollution incident in the Tweed River likely to affect water at the Low-Pressure Pump Station.	• Communication link during this period through Mr. Rodney Keevers and Ms Jane Lofthouse of the Tweed Shire Council • No pollution notices for MP	Operator/ TSC
6.6	Accidental spillage management	• No incident to report.	Operator
6.7	Following a flood event in the Tweed River or in the event of becoming aware of a pollution incident or high turbidity in the Tweed River, notify Governments of the situation and arrange alternative sand delivery if required.	• Not required during the MP	Operator / Governments
6.8	Conduct a Sand and Water Quality Monitoring Program during the first three months of operations.	• Completed.	Operator
6.9	After the first three months of operations, conduct a Sand and Water Quality Monitoring Program for the duration of the operation period.	• Sand and Water Quality Monitoring Program ongoing. All reports during the past 12-month MP indicate compliance with sand and water criteria. Refer Appendix A.	Operator
6.10	If results of sand or water quality monitoring results indicate that the dredged material is not Sand Material or poor water quality, inform and carry out directions of Governments.	• No incident to report.	Operator Dredge Operator
6.11	If turbidity plume is negatively affecting beach users, re-direct discharge to Snapper Rocks East in accordance with Sub-Plan B3.	• Compliant	Operator
6.12	Supplementary Dredging - Brief staff in the requirements of implementing this plan.	• All employees working on site have been inducted in the provisions of this plan.	Operator

Task No.	Requirement	Status	Action By Whom
6.13	Undertake fulltime visual inspection of dredge loads to check the visual characteristics of dredged and placed material.	• Turbidity and Plume monitoring carried out during dredging works.	Operator / Dredge Operator
6.14	Conduct a Sand and Water Quality Monitoring Program during each dredging campaign.	• Testing carried out in accordance with the EPL	Dredge Operator
6.15	Conduct a Sand and Water Quality Monitoring Program during each dredging campaign.	• Testing carried out in accordance with the EPL	Dredge Operator
6.16	Immediately inform Governments if the results of visual inspection or weekly sediment monitoring results indicate that the dredged material is not Sand Material.	• No incident to report.	Dredge Operator
6.17	Verify sediment and water quality monitoring results to register compliance.	• Testing carried out in accordance with the EPL	Dredge Operator Operator
6.18	Following a flood event in the Tweed River, notify Governments of the situation and arrange to discharge to East Snapper Rocks if required.	• No requirement to redirect discharge to East Snapper Rocks following any flood event during this period.	Operator

Evaluation against Performance Indicators:

Sand and water quality testing results indicate compliance with the performance criteria set out in this sub plan. Refer - APPENDIX A - PUMPED SAND AND WATER QUALITY MONITORING

Water quality testing from settling pit overflow discharge point indicates compliance with NSW EPA license conditions.

Water quality testing from sand delivery line shows no detectable grease/oils.

No complaints received concerning sand and water quality issues.

SUBPLAN B7: INFRASTRUCTURE AND PUBLIC ACCESS MANAGEMENT PLAN

7.1	Provide suitable safety signage at the discharge outlets.	• Signage installed at outlets during construction. • Outlet and jetty signage inspected daily. • Any vandalised signs repaired or replaced.	Operator
7.2	Monitor and maintain all equipment such as fencing, signage, lighting etc for the safety of persons in the vicinity of the works.	• Monitoring and maintenance ongoing. • Main jetty gates have been modified to minimise unauthorized access. • No vandalism to report for MP	Operator

Task No.	Requirement	Status	Action By Whom
7.3	Inform the public of any disruptions to public services.	• No disruptions or planned disruptions during this period.	Operator/Government
7.4	Direct on-site lighting away from residences.	• Undertaken prior to operations.	Operator
7.5	Maintain structures using materials and colours as determined as a result of consultation during the construction period.	• Maintenance works are all in accordance with the Operation and Maintenance Manual.	Operator
7.8	Refuse public entry to site unless under consent from Governments and Operations Manager.	• All staff informed.	Operator
7.9	All visitors to site to report to the site office.	• All visitors inducted upon entering site and induction records maintained.	Operator
7.10	Maintain hazard warning lights and sirens at each discharge outlet to warn beach users that the system is in operation.	• Warning system maintained, monitored and tested regularly by TRESBC staff in accordance with O & M Manual. Siren has been removed due to noise issues at night. Security staff in place when pumping to temporary outlets	Operator
7.12	Manage sand discharge at the Kirra outlet to minimise potential blockage of the stormwater outlet in the immediate vicinity.	• No pumping to Kirra required during this period.	Operator / GCCC
7.13	Store temporary pipe and construction plant at the Letitia Spit compound when not assembled at either of the temporary outlets.	• Temporary pipe stored at Letitia Spit compound.	Operator
Evaluation against Performance Indicators: No complaints received concerning safety signage adequacy. No injury caused to public as a result of the works. Pumping to upper beach areas requires supervision/security to ensure public stay clear of outlet. Some unauthorised access has been detected on the main jetty.			
SUB PLAN B8: WASTE MANAGEMENT PLAN			
8.1	In the event of waste spillage refer to procedures in EMP Operations Sub-Plan B12 Accident and Emergency Response.	• No incident to report.	Operator
8.2	Waste oil to be collected in drums and transported off site for recycling where possible.	• Small quantity of waste oil collected and stored on-site following servicing of plant. The Operator disposes of the waste oil at Stotts Creek waste disposal site.	Operator / Subcontractor

Task No.	Requirement	Status	Action By Whom
8.3	Petroleum products to be stored, handled, separated and signed as required by the AS1940 Storage and Handling of Flammable and Combustible Liquids.	• All dangerous goods stored correctly on site. • SDS maintained for a chemicals and products used on site.	Operator
8.4	Chemicals should be stored in a secure, well-ventilated room with adequate signage warning of hazardous substances.	• Compliant	Operator
8.5	Metals will be segregated and recycled.	• Compliant	Operator / Subcontractor
8.6	Glass and aluminium will be segregated and recycled.	• Compliant	Operator / Subcontractor
8.7	Cardboard/paper will be segregated, re-used and recycled.	• Compliant	Operator / Subcontractor
8.8	Green waste will be mulched and stored on-site and re-used for landscaping purposes.	• Green waste re-used on site when possible and practical.	Operator / Subcontractor
8.9	Minimal regulated wastes (e.g. oil) are generated from the operation of the system.	• Compliant	Operator / Subcontractor
8.10	Recycling bins and containers will be provided as needed.	• Compliant	Subcontractor
8.11	Soil contaminated through oil leakage to be bioremediated and disposed of by qualified contractor.	• No contamination incident to report.	Operator
8.12	Disposal of domestic non-recyclable and debris removed by the vibrating screen waste to Council approved waste disposal facility.	• Compliant	Subcontractor
8.13	All personnel, sub-contractors or suppliers working on site to be advised of the Operator's policy to minimise waste and the associated procedures to be followed.	• Compliant	Operator / Subcontractor
8.14	Debris removed by the vibrating screen is to be disposed of at a waste disposal facility.	• Compliant See 8.12	Operator / Subcontractor

Task No.	Requirement	Status	Action By Whom
8.15	Wastewater and Greywater managed and used for irrigation where possible	• Compliant	Operator / Subcontractor

Evaluation against Performance Indicators:

All chemicals and paints have been stored and handled in accordance with NSW Dangerous Goods Regulations 1975, relevant Australian Standards and Work Cover requirements.

Unnecessary generation of waste has been prevented through measures including proper planning and purchasing methods and plant modifications.

All wastes have been recycled where practical.

All wastes are collected and disposed of by subcontracted waste disposalists.

Correct waste management practices have ensured no adverse impacts on land and water resources.

SUBPLAN B10: LANDSCAPE MANAGEMENT PLAN

10.1	Prepare plan in consultation with Tweed Shire Council and Gold Coast City Council. (CoGC)	• This Plan, which includes the Dune Management Strategy and species listing for the revegetation plan, has been prepared in consultation with CoGC, TSC, Fingal Dune Care, and two regional DLWC offices.	Governments Operator
10.2	Use plant species from the list contained in Sub plan B10 Appendix A for revegetation.	• Revegetation of cleared construction areas in the general area of the sand bypassing compound complete. All revegetation in accordance with Sub plan B10 Appendix A.	Operator
10.3	Source plants from local seed stock where possible	• Compliant	Operator
10.4	Use herbicides as necessary to control weed growth in disturbed areas.	• Compliant	Operator
10.5	Maintain all areas on-site that were revegetated during construction works.	• Compliant	Operator
10.6	Consult Coastal Dune Management (1990) by the Soil Conservation Service of NSW for dune stabilisation measures.	• Referenced as required	Operator
10.7	Maintain mulched walkway alongside jetty for internal access only.	• Compliant	Operator
10.8	Maintain security perimeter fencing.	• Compliant	Operator

<table>
<tr><th>Task No.</th><th>Requirement</th><th>Status</th><th>Action By Whom</th></tr>
<tr><td>10.9</td><td>Discourage introduced fauna to site through the correct disposal of waste.</td><td>• Compliant</td><td>Operator</td></tr>
<tr><td>10.10</td><td>Use standard soil and erosion control measures (including temporary mulching) to prevent impacts upon exposed areas.</td><td>• Measures implemented to stabilise exposed dunes after re-shaping works.</td><td>Operator</td></tr>
<tr><td colspan="4">10.3.1 Management of Shoreline Recession (Dune Management)</td></tr>
<tr><td colspan="4">The EIS/IAS Section 8.3.2.8 predicts that as a result of operation of the system, long term beach recession will occur along the northern section of Letitia Spit in the general vicinity of a jetty based bypassing system. A maximum long-term shoreline retreat of the order of 90 metres plus the normal fluctuations in high water mark of up to 50 – 80 metres due to storm erosion and accretion is anticipated. This retreat is expected to progressively occur over a period of 2-5 years.</td></tr>
<tr><td>10.3.1 (i)</td><td>Limit general foreshore alignment retreat due to long-term beach recession along Letitia Spit to a maximum of 90 m in the vicinity of the works.</td><td>• Revised
• Daily visual monitoring of shoreline ongoing.
• Plant operation to promote the growth of the beach local to the jetty.
• Foreshore alignment retreat was limited to about 90m in the vicinity of the jetty over this MP.
• Surveys during this MP show stable sand volumes along Letitia Spit.
• Refer also Sub plan B10, task item 5.1 (iii).</td><td>Operator</td></tr>
<tr><td>10.3.1 (ii)</td><td>Comply with maximum depth of sand removal for Compartment B.</td><td>• No longer monitoring the area defined as Western Boundary Compartment B.
• Revised Letitia monitoring program as recommended in “Letitia Beach Behaviour Report” (Feb 2022), and “Technical Note” (July2022)</td><td>Operator</td></tr>
<tr><td>10.3.1 (iii)</td><td>Limit significant disturbance to Letitia Spit upper and back beach areas to within 1000m of the southern training wall.</td><td>• Daily visual monitoring of shoreline ongoing.
• Plant operation to promote the growth of the beach local to the jetty.
• Surveys during this MP show stable sand volumes along Letitia Spit.
• Back passing by dredge undertaken to better manage volumes delivered to Queensland and to assist in the progradation of Letitia Beach.
<table>
<tr><th>Location</th><th>Quantity – m3</th></tr>
<tr><td>Fingal</td><td>0</td></tr>
<tr><td>Dreamtime</td><td>8,626</td></tr>
</table>
• Refer also Sub plan B10, task item 5.1 (i).</td><td>Operator</td></tr>
</table>

Task No.	Requirement	Status	Action By Whom
10.3.1 (iv)	Undertake removal of trees and shrubs within the predicted recession area (Compartment B) as necessary to prevent woody debris from entering and potentially blocking the system.	• Undertaken as required by front end Loader. • Visual monitoring performed daily. • No longer monitoring the area defined as Western Boundary Compartment B. • Revised Letitia monitoring program as recommended in "Letitia Beach Behaviour Report" (Feb 2022), and "Technical Note" (July2022)	Operator
10.3.1 (v)	In conjunction with the above task progressively undertake works as required to establish an appropriately vegetated dune at the landward edge of Compartment B and to minimise the potential for wind erosion of the upper beach. This work may include the mechanical handling of sand material into the Jetty sand trap where appropriate.	• All dunes are sufficiently covered by native vegetation	Operator
10.3.1 (vi)	Progressively reshape the new fore-dune area to match the dimensions of surrounding dunes.	• No reconstruction required during this period	Operator / Subcontractor
10.3.1 (vii)	Mulch all vegetation removed as a result of the above action items and store on site to be spread over re-worked areas.	• Cleared vegetation re-used for stabilisation of new dunes where practical and possible.	Operator
10.3.1 (viii)	Maintain a sufficient berm area to permit normal coastal processes, i.e. the toe of the dune should not encroach onto the beach berm.	• No reconstruction required during this period	Operator
10.3.1 (ix)	The reconstructed dune should have an aerodynamically stable shape with a seaward slope of 1V: 5H or flatter. The flatness of the slope helps moisture retention and therefore vegetation.	• No reconstruction required during this period	Operator
10.3.1 (x)	The seaward face of the reconstructed fore-dune should be flat to slightly convex in shape.	• No reconstruction required during this period.	Operator / Subcontractor
10.3.1 (xi)	Revegetate new fore and hind dune areas as required using primary and secondary species.	• No revegetation required during the MP.	Operator

Task No.	Requirement	Status	Action By Whom
10.3.1 (xii)	Install temporary wind screening fences to prevent wind erosion and traffic damage to dunes during revegetation works until plants are well established and dunes are stabilised.	• Will be used when required.	Operator
10.3.1 (xiii)	Control weed growth from all disturbed re-worked areas as per Task 4.4 and 4.5.	• Weed growth controlled as per 4.4 & 4.5.	Operator
10.3.1 (xiv)	Use selected plant species for revegetation works.	• Revegetation occurred in accordance with Sub plan B10 Appendix A.	Operator
10.3.1 (xv)	Undertake quarterly beach profile survey to monitor extent of localised long-term beach recession.	• Ongoing procedure with quarterly Surveys. Regular Surveys are supplemented by the Control Volume Surveys	Operator / Subcontractor
10.3.1 (xvi)	Undertake visual observation of beach changes relative to the fixed survey sight poles.	• Daily visual observations made and measured. Monthly results forwarded to Governments.	Operator
3.1.2	**Management of Localised Recession that extends beyond Compartment B in the immediate vicinity of the Jetty.**		
• The Concession Agreement allows the System to remove sand from below the 1960 seabed removal limit and exceed the side slopes specified for Compartment B in the vicinity of the Jetty. Localised long-term beach recession in the immediate proximity of the fixed bypassing system jetty may extend landward of the western boundary of Compartment B in this location, subject to the following management measures additional to those above. Note: No longer monitoring the area defined as Western Boundary Compartment B. Revised Letitia monitoring program as recommended in “Letitia Beach Behaviour Report” (Feb 2022), and “Technical Note” (July2022)			
10.3.1.2 (i)	Maintain a dune system in the immediate vicinity of the Jetty with appropriate dimensions to accommodate severe storm erosion and to ensure that the retreat of the upper beach does not reach the western boundary of the Tweed Bar and Entrance Area.	• Maintaining and monitoring dune system.	Operator

Task No.	Requirement	Status	Action By Whom
Evaluation against Performance Indicators: Weed infestation controlled on site. Plant growth satisfactory for this period. Revegetation providing a visual barrier to the compound. A continuous dune system was maintained throughout the MP. Refer Appendix D for photographic records. The observed recession generally reduces in extent further south of the jetty along central Letitia Spit beach. Localised beach retreat is up to about 90m and has been relatively stable over this MP. Note: No longer monitoring the area defined as Western Boundary Compartment B - Revised Letitia monitoring program as recommended in "Letitia Beach Behaviour Report" (Feb 2022), and "Technical Note" (July2022)			
SUB PLAN B11: HISTORIC SHIPWRECK MANAGEMENT PLAN			
11.1	Brief staff and contractors on known/ potential locations of shipwreck/relic sites. Reporting process and procedures	• Staff induction carried out	Operator/ Dredge Operator / Subcontractor
11.2	In the event of the discovery - Work is to stop immediately in this area, as continued work would constitute an excavation.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.3	In the event of the discovery - Notification should be made immediately to the NSW Heritage Office	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.4	Complete the Shipwreck Notification form	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor

Task No.	Requirement	Status	Action By Whom
11.5	Do not touch the relics unless it is considered they are under threat. If material has been recovered inadvertently then this should be placed in a secure and wet environment subject to advice from the NSW Heritage Office.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.6	The site should be adequately protected from any unwarranted interference.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.7	Restrict entry through the use of barriers or taping off of the area or through any other effective means.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.8	No further work should be carried out in this area until further advice from the NSW Heritage Office.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.9	Engage services of a qualified Maritime Archaeologist to assess the site of the relic.	• No relics discovered this period.	Operator/ Dredge Operator / Subcontractor
11.10	Report the discovery of a shipwreck to the receiver of Wreck.	• No relics discovered this period.	Operator
Evaluation against Performance Indicators: All staff inducted in procedures to follow in the case of discovering potential shipwreck on site.			
SUB PLAN B12: ACCIDENT AND EMERGENCY RESPONSE PLAN			
12.1	Train staff, including subcontractors, in the requirements of this plan and response procedures.	• Compliant. • Emergency Response and Occupational Health and Safety Plans are covered during the induction training program for new staff and subcontractors.	Operator

Task No.	Requirement	Status	Action By Whom
12.2	Collect and maintain MSDS's for all hazardous materials used.	• Compliant. • Safety Data Sheets (SDS) kept electronically at site office and hard copies where the chemicals are stored. • All suppliers informed that SDS must be supplied upon delivery / introduction of new materials on site.	Operator
12.3	Supply correct personal protective equipment to any employees handling Dangerous Goods.	• Compliant	Operator
12.4	Maintain spill response kit, and other emergency equipment.	• Spill response kits maintained on site. Maintenance and daily checks performed by Subcontractors and Operations staff. • All emergency exit lights tested and maintained by Electrical subcontractor and personnel on site. • All fire extinguishers tested and certified by Wormald Fire Systems.	Operator
12.5	In the event of an environmental emergency, follow the Emergency Response Plan kept as part of the Project Occupational Health Safety and Rehabilitation Plan.	• No incidents to report.	Operator
12.6	Notify and report NSW and QEPA of spill causing environmental harm.	• No incidents to report.	Operator
12.7	Monitor the affected area to ensure that all contaminated material has been removed and properly disposed of.	• Spill response kits maintained on site. Maintenance and daily checks performed by Subcontractors and Operations staff. • No incidents to report.	Operator
12.8	Contaminated clean up materials, included any contaminated soil will be collected and disposed of by a suitably qualified contractor.	• Spill response kits maintained on site. Maintenance and daily checks performed by Subcontractors and Operations staff. •	Operator
12.9	Fill out NCR form and record corrective action taken	• No incidents to report	Operator
12.10	All personnel on-site, including contractors and subcontractors must receive Induction Training, outlining the requirements of the: Emergency Response Plan, containing the Shipboard Oil Pollution Emergency Plan, Occupational Health, Safety and Rehabilitation Plan and procedures to be followed.	• Compliant	Operator

Task No.	Requirement	Status	Action By Whom
12.11	Collect and maintain SDS for all hazardous materials used or stored on site	• Compliant.	Operator
12.12	Have Spill Response Kit, fire extinguishers and other emergency response equipment fully maintained and readily available.	• Spill response kits maintained on site. Maintenance and daily checks performed by Subcontractors and Operations staff. • All emergency exit lights tested and maintained by Electrical subcontractor and personnel on site. • All fire extinguishers tested and certified by Wormald Fire Systems.	Operator
12.13	Supply correct personal protective equipment to any employees that may handle Dangerous Goods.	• PPE Supplied and staff trained in use	Operator
12.14	Notify the Manager and appropriate authorities in the event of a major spill or where environmental harm has occurred.	• No incidents to report	Operator
12.15	In the event of an environmental emergency, follow the Emergency Response Plan kept as part of the OHS&R Plan	• No incidents to report	Operator
12.16	Check safety procedures are implemented correctly and correct PPE worn. Monitor the affected area to ensure that all contaminated clean-up materials have been removed and properly disposed of.	• No incidents to report	Operator

Evaluation against Performance Indicators:

Dangerous Goods correctly stored and handled on site according to NSW Dangerous Goods Act and regulations and relevant Australian Standards.

A register of hazardous materials and their Material Safety Data Sheets is kept on site in a central location for all hazardous materials used or stored on site.

7. SUPPLEMENTARY DREDGING

- Dredging operations were undertaken during the current MP.
- Dredging was carried out under the guidance of the Dredge Management Plan (DMP) The DMP details the removal design and the placement locations and volumes.
- Dredging occurred from 21 August to 25 September.
- TRESBC holds the EML for these activities and carries out the required testing and record keeping complying with the EPA guidelines.

Placement Locations and Totals

Date	Fingal	Duranbah	Snapper East	2A South
27/08/2022	3261	0	0	0
28/08/2022	5365	0	0	0
30/08/2022	0	2443	0	0
31/08/2022	0	5105	0	0
1/09/2022	0	4886	0	0
2/09/2022	0	0	1548	0
8/09/2022	0	877	0	0
9/09/2022	0	0	2692	0
10/09/2022	0	0	2909	0
11/09/2022	0	0	5259	0
12/09/2022	0	0	6861	0
13/09/2022	0	0	2630	0
15/09/2022	0	0	1433	0
17/09/2022	0	0	2305	0
18/09/2022	0	0	720	0
26/09/2022	0	2854	0	0
27/09/2022	0	715	0	0
28/09/2022	0	671	0	0
5/10/2022	0	447	0	0
6/10/2022	0	2017	0	0
7/10/2022	0	626	0	0
17/10/2022	0	0	1471	0
20/10/2022	0	476	597	0
29/10/2022	0	3830	0	0
30/10/2022	0	2228	709	0
31/10/2022	0	632	0	0
3/11/2022	0	2461	0	0
4/11/2022	0	1125	0	0

5/11/2022	0	2353	0	0
6/11/2022	0	893	0	0
Location Totals	8626	34639	29134	0
Total	72,399			

8. ENVIRONMENTAL AUDIT

The following Audits were performed during this MP.

Environmental Audit covering the EMS performed by the EMR, Martin Ross in January 2023.
Internal WHS&E audit performed by WHS&E Manager in January 2023.

9. APPENDIX A - WATER QUALITY MONITORING

Discharge & Monitoring Point 1

Discharge and Monitoring, Discharge from concentrator to beach at Letitia Spit as shown on drawing fiqure 1 TRESBP EMP subplan B5 " Water Quality Sampling Locations Plan" sample location number 6 dated 14 April 2000.

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Oil and Grease	Visible	12	12	0	0	0
pH	pH	12	12	7.2	8.1	8.4
TSS (Wet)	milligrams per litre	12	12	2	24	142

Monitoring Point 3

Monitoring, Five hundred metres (500m) up current (away from the direction of the sediment plume) of the active dredge

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Turbidity	nephelometric turbidity units	28	28	0.35	0.72	2.45

Monitoring Point 4

Monitoring, Two hundred metres (200m) down current from the active dredge

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Turbidity	nephelometric turbidity units	28	28	0.35	0.75	3.15

Monitoring Point 5

Monitoring, Fifty metres (50m) down current from the dredge depositing sand at the Fingal Beach sand deposition area.

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Turbidity	nephelometric turbidity units	1	1	0.4	0.4	0.4

Monitoring Point 6

Monitoring, Fifty metres (50m) down current from the dredge depositing sand at the Dreamtime Beach sand deposition area.

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Turbidity	nephelometric turbidity units	3	3	0.4	0.53	0.7

Monitoring Point 7

Monitoring, Cook Island Aquatic Reserve

Pollutant	Unit of measure	No. of samples required	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Total suspended solids	milligrams per litre	0	0	0	0	0
Turbidity	nephelometric turbidity units	0	0	0	0	0

Discharge & Monitoring Point 1

Discharge and Monitoring, Discharge from concentrator to beach at Letitia Spit as shown on drawing fiqure 1 TRESBP EMP subplan B5 " Water Quality Sampling Locations Plan" sample location number 6 dated 14 April 2000.

Unit of measure	Frequency	No. of measurements made	Lowest result	Mean result	Highest result
kilolitres per day	Daily	264	0.1	1561	64308

Discharge Point 2

Discharge, Discharge from the Trailing Suction Hopper Dredger at keel level

Unit of measure	Frequency	No. of measurements made	Lowest result	Mean result	Highest result
megalitres per year	Daily	28	41166	15106.71	41166

10. APPENDIX C - MONTHLY VOLUMES OF SAND DELIVERED DURING THE MP – 13 April 2022 – 12 April 2023

Month	Volume	
	Snapper Rocks East	Duranbah
*Apr-22	45,349	
May-22	73,797	
Jun-22	20,307	
Jul-22	29,130	11,445
Aug-22	22,516	
Sep-22	42,505	
Oct-22	77,432	
Nov-22	12,240	
Dec-22	88,970	
Jan-23	48,339	
Feb-23	41,601	
Mar-23	22,897	
*Apr-23	24,001	

11. APPENDIX D - PHOTOGRAPHS

PHOTOGRAPHIC RECORDS OF LETITIA DURING THE MONITORING PERIOD


South - May 22


North – May 22


South – August 22


North – August 22


South – October 22


North – October 22

South – December 22

North December 22

South – February 23

North – February 23

South – April 23

North –April 23