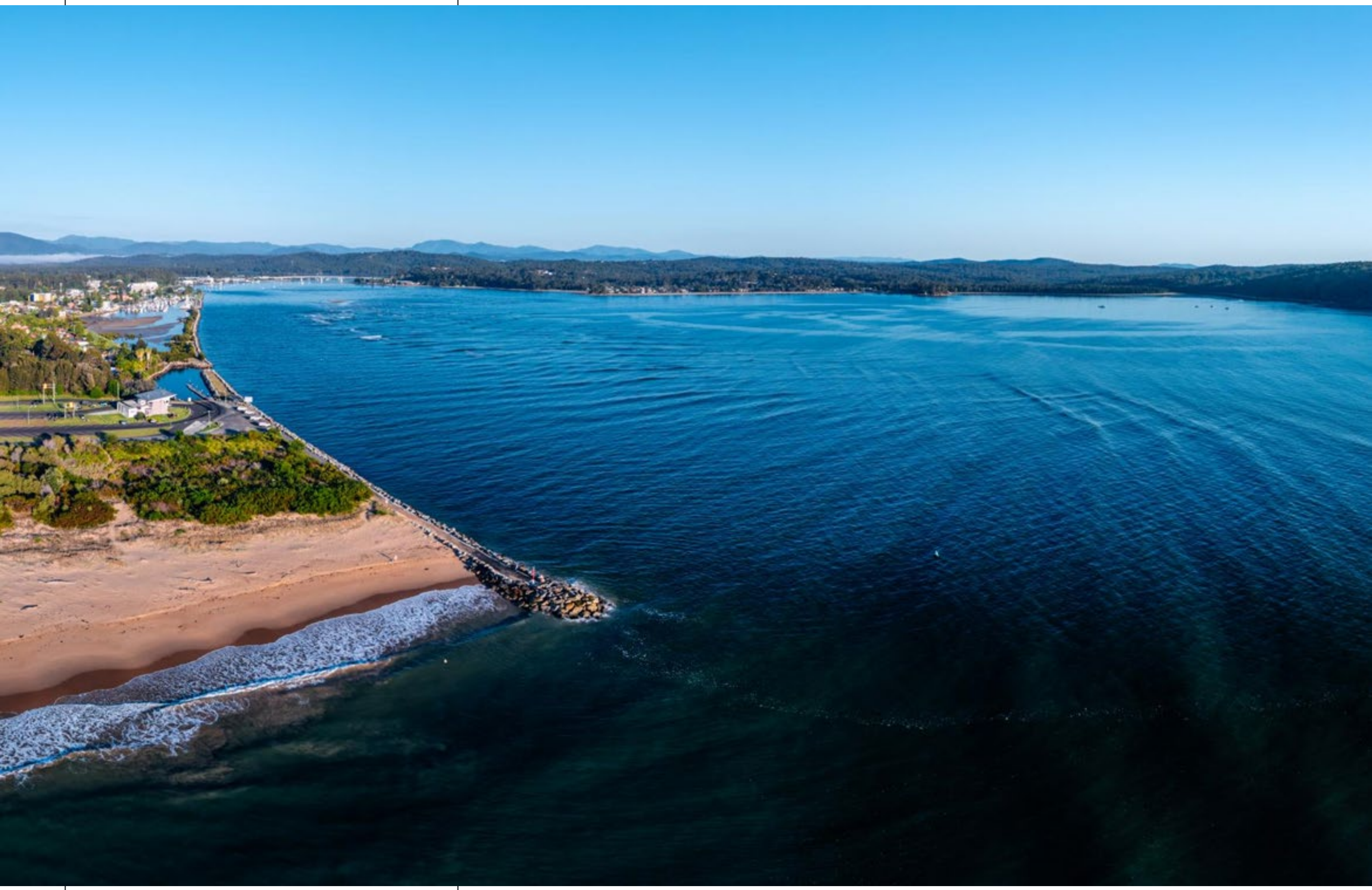
Transport for NSW

Clyde River Bar Dredging (2025 - 2035)

REF Submissions Report

August 2025



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Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which we work and live.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Prepared by Maritime and Civil Delivery Group Pty Ltd, Complete Planning and Environment Pty Ltd and Transport for NSW.

Executive summary

The proposal

Transport for NSW (Transport) proposes to undertake maintenance dredging, as required, over a 10-year period within the navigation channel at the entrance bar to the Clyde River at Batemans Bay (the Proposal). The key aspect of this Proposal involves dredging to maintain a safe navigable channel, with a width of at least 40 metres and a maximum channel bed elevation of -2.4 metres below the Lowest Astronomical Tide (LAT). The proposed dredging location is identified in Figure 1-1 of this report. It is not expected that any dredging campaign would exceed 30,000m^3 per year, with extraction volumes most likely to be up to 25,000m^3 per campaign.

For minor dredging campaigns (involving dredging of less than 500 millimetres in depth), small tug bed levelling, large tug bed levelling, small tug bed agitation and small cutter suction dredging is likely to be required. For larger scale dredging campaigns (involving dredging of greater than 500 millimetres in depth), the use of a trailing suction hopper dredge (TSHD) with off-shore placement is likely to be more suitable.

The dredged material would be strategically placed within the littoral transport system. This system redistributes the material as part of natural coastal processes. The placement locations and methodology associated with the Proposal have been informed through modelling of coastal process, with intent to optimise potential beach nourishment outcomes, particularly on Surfside Beach. Therefore, in addition to achieving maritime safety objectives, the Proposal would also seek to facilitate beach nourishment through optimised natural redistribution of the dredged material within Batemans Bay.

Implementation of the Proposal may start in 2025, subject to all required approvals being obtained. Each dredging campaign may take between 3 and 5 weeks, with some campaigns being longer in duration due to variables in environmental conditions. Individual campaigns are anticipated to be completed as required, approximately once every two years for a period of up to 10 years, subject to funding availability.

Display of the review of environmental factors (REF)

Transport prepared a REF for the Proposal. The REF was publicly exhibited between 12 May 2025 and 2 June 2025 in the following ways:

Internet

The REF was made available on the Transport website.

Printed copies

The documents were made available at the following locations:

- Batemans Bay Library, Hanging Rock Place, Batemans Bay.
- Eurobodalla Shire Council, Vulcan Street, Moruya.

Copies by request

Printed and electronic copies were made available through the Maritime Infrastructure Delivery Office (MIDO) Dredging Team.

Staffed displays – Information Session

Staffed information sessions were undertaken on Tuesday 13 May from 3pm to 6pm and Wednesday 14 May from 2pm to 5pm at Bay Pavilions, 12 Vesper Street, Batemans Bay NSW 2536.

Online displays – Information Session

An online information session was offered on Tuesday 27 May from 6pm to 7pm. The session was cancelled due to low numbers.

During the exhibition of the REF, Transport invited the public to provide written feedback on the Proposal.

Summary of issues and responses

A total of 52 submissions were received in response to the display of the REF. This included submissions from 3 government agencies, 3 other organisations and 46 submissions from individual members of the community.

The majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material and existing coastal erosion. This included a number of submissions from residents and property owners of the northern Batemans Bay beaches regarding beach erosion and coastal inundation, particularly on Surfside Beach.

Other submissions from individuals provided suggestions for marine infrastructure improvements, raised issues regarding the influence of existing infrastructure (such as the new Batemans Bay bridge and existing breakwall) on coastal processes, highlighted the importance of maintaining public access along the foreshore, and highlighted the cultural and environmental significance of Batemans Bay.

All 3 submissions received from organisations other than government agencies were provided by maritime industry stakeholders. These submissions generally outlined the urgent and critical need for dredging to maintain navigational safety and support local economic activity.

Two of the three government agency submissions received challenged the consistency of the Proposal with the Eurobodalla Open Coast Coastal Management Program (CMP), sought further clarification regarding the modelling used to support the preferred placement option for dredged material and questioned the potential effectiveness of beach nourishment resulting from the Proposal. The third government agency submission stated no objection to the Proposal, and further clarified requirements with regard to change management, notification, licencing, review of project documentation and threatened species classification.Each submission has been examined individually to understand the issues being raised. The issues raised in each submission have been extracted and collated, and corresponding responses to the submissions have been developed. Key matters raised within submissions are summarised under the headings below.

Dredge material placement

As outlined above, the majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material. This included a number of submissions from residents and property owners of the northern Batemans Bay beaches regarding beach erosion and coastal inundation, particularly on Surfside Beach. Specific concerns raised in relation to the placement of dredged material included:

- The potential ineffectiveness of the proposed dredged material placement locations, requesting that dredged material be placed closer to, or directly on, the northern Batemans Bay beaches.
- The unreliability of the sediment transport modelling, and uncertainty regarding expected beach nourishment outcomes.
- Lack of cost benefit analysis information within the REF to substantiate cost justification for the preferred material placement option, and the need for additional resourcing to undertake beach nourishment if required.
- Inconsistency between the preferred spoil placement option within the REF and with the proposed dredged material placement methodology outlined within the CMP.
- The need for monitoring, review and refinement of the dredged material placement approach if sediment transport modelling does not reflect anticipated beach nourishment outcomes.

In response to the above matters, it has been considered that a key objective of the Proposal in accordance with the NSW Maritime Infrastructure Plan (MIP) is to restore the Clyde River Bar to a suitable navigable depth and width to improve the safety and navigability of the channel over ten years. The Proposal also seeks to beneficially reuse the dredged material in the most time and cost-efficient manner.

The CMP has been comprehensively considered in the development of the preferred option for the Proposal. However, the preferred methodology for spoil placement has required further assessment of the cost and benefit of placement options in consideration of environmental, social and economic factors.

The preferred option for the placement of dredged sand, as identified within the REF, has been confirmed as it would significantly minimise impacts to the community and the environment when compared to other options considered, and would ensure the navigational objectives of the Proposal are both practically and economically viable.

In relation to the reliability of sediment transport modelling used to inform the REF, and in particular the potential effectiveness of the preferred dredging spoil placement locations, substantial further technical analysis has now been undertaken in order to inform the consideration of spoil placement options in relation to the Proposal. Compared with the preliminary modelling work outlined in the REF, which involved only three simplified scenarios including an isolated dredging case, the updated study presents a more comprehensive and operationally relevant suite of analyses. This additional monitoring is further described within Section 2.2, Section 4.1 and Appendix A of this report.

In addition to the above, in order to verify the accuracy of the above modelling and to facilitate consideration of any required changes to the works methodology, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport, and potential deposition hotspots. These insights will assist to inform dredging operations and adaptive management, and may also assist to inform future shoreline protection measures in Batemans Bay.

Coastal erosion, and other coastal management issues

The second most frequently raised matter was categorised as 'coastal erosion and other coastal management issues'. Specifically, these matters included:

- The need for coastal protection works such as sand bag placement, rock groynes and sea walls.
- Lack of Council intervention in relation to beach erosion, despite receipt of funding to address the issue.
- Potential exacerbation of erosion on Surfside Beach as a result of the new Batemans Bay bridge.
- Funding for coastal management which has not resulted in coastal protection works.
- Transport and Council responsibility regarding coastal protection.
- Insufficient funding to address ongoing erosion issues at Surfside beach.
- Suggested land use planning and property acquisition to manage erosion risk.
- Suggested amendments to the CMP.
- The impact of coastal erosion on public foreshore access.
- Impact of coastal erosion on property values.
- Potential for legal action in response inaction regarding coastal erosion.
- Opportunity for coastal monitoring with fixed coast snap stations.

Unlike feedback on dredge material placement options, much of the feedback categorised as 'coastal erosion and other coastal management issues' did not align specifically with the key objective of the Proposal, being to restore the Clyde River Bar to a suitable navigable depth and width over ten years.

It has been noted that the CMP (including potential options for beach nourishment) has been comprehensively assessed as part of the identification of the preferred option for the Proposal. However, current resource allocation is aligned with the objectives of the Proposal. As such, maintaining a safe navigational channel will be prioritised as part of this Proposal, with project benefits such as beach nourishment being pursued where practical to do so. The development of other coastal management works associated with foreshore protection (such as sandbags, rock groynes and sea walls) do not form part of the scope of this Proposal, and could be pursued through other programs and initiatives which more closely align with these activities, such as the NSW Governments Coastal and Estuary Planning and Implementation Program.

With regard to potential exacerbation of coastal erosion associated with the new Batemans Bay bridge, this matter is not included as part of the scope of this Proposal. However, it has been noted that this particular project completed modelling on the potential impacts of the bridge as part of the project REF in 2017, and that further modelling and assessments were then carried out in 2018. It has been noted that the 2018 modelling confirmed the findings of earlier assessments and identified that the new bridge will have less impact on erosion, wave, tides and currents in the Clyde River compared to the existing bridge. This is due to the reduced number of piers and the abutments being further away from the river.

Regarding the potential use of fixed coast snap stations, it is noted that 3 stations currently exist within this area at Surfside Beach, Cullendulla Beach, and Long Beach. These stations are not likely to be used directly as part of the Proposal, due to alternative ways of monitoring being proposed within the REF. However, these stations are likely to remain active and would continue to record changes in these locations over time.

In relation to coastal planning and development controls, it is acknowledged that existing controls are in place under legislation such as the *Environmental Planning and Assessment Act 1979* to manage coastal development, and that review of coastal planning and development controls does not form part of the scope of this Proposal. In a similar regard, it can also be noted that review of the CMP, existing coastal management strategies and property boundaries also does not form part of the scope of this Proposal.

It can be noted that this submissions report will be made available to Eurobodalla Shire Council (ESC), to ensure ESC is provided with the opportunity to review feedback received in relation to this Proposal, including coastal management on the northern Batemans Bay beaches.

With regard to review and monitoring, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport, and potential deposition hotspots. These insights will assist to inform dredging operations and adaptive management, and may also assist to inform future shoreline protection measures in Batemans Bay.

Navigation dredging

A number of submissions provided feedback regarding dredging, many of which reiterated the urgent and critical need to undertake the proposed work to ensure safe access for vessels through the Clyde River Bar. A number of submissions also suggested that ongoing dredging of the bar was required in order to ensure safe navigation can be maintained.

In response to the above, it has been acknowledged that the Clyde River Bar is a key navigational channel requiring ongoing dredging maintenance to allow safe passage for recreational and commercial vessels accessing the Clyde River. The Proposal would assist in achieving this by meeting the objectives of the *NSW Coastal Dredging Strategy 2019-2024* (CDS) and MIP with regard to maintaining a suitable navigational channel.

It is also noted that Transport proposes to undertake dredging as required over a 10 year period. In order to facilitate this while ensuring consideration of any environmental legislative changes, a Due Diligence Environmental Assessment (refer to Appendix B) is to be completed prior to each dredging campaign.

Marine infrastructure and navigation

Feedback received in relation to marine infrastructure and navigation included request for new infrastructure such as new wharf facilities, modification to existing piers, more length to be added to the southern breakwall and removal of length from the breakwall. It was noted as part of consideration of these submissions that many of these matters did not relate directly to the objectives of the Proposal, and could be pursued under alternative more fit for purpose maritime programs and initiatives.

One submission requested that pre and post dredging surveys should be forwarded to the Australian Hydrographic Office, and that the alignment of navigation leads with the navigation channel be reviewed to ensure safety for vessels navigating the Clyde River Bar. These matters have now been captured by new proposed management measures included within Section 5.2 of this report.

Biodiversity

One submission raised concern that the REF does not mention the environmental impact of proposed dredging, including impact to rays and other marine species. However, it has been noted that the potential environmental impacts of the Proposal are assessed within Section 6 of the REF. Potential impact to marine species is specifically assessed within Section 6.7 and Appendix D of the REF.

Other matters

Other matters raised within submissions included:

- Appreciation for community consultation and the community information session.
- An expression of feeling ignored with the Proposal.
- Request for more community information following determination of next steps.

Community and stakeholder sentiment regarding the Proposal and the consultation process is acknowledged. It has been noted that this submissions report is intended to summarise the issues raised and provide responses to each issue, detail investigations carried out since finalisation of the REF, describe and assesses the environmental impact of changes to the Proposal and identify new and revised environmental management measures in consideration of community and stakeholder feedback.

This submissions report will be made available for community and stakeholder review, and the community will be advised of the next steps associated with the Proposal following Determination (approval, modification or refusal) of the REF.

Changes to the proposal

The majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material or existing coastal erosion. In response to this, Transport has undertaken further assessment of the assumptions used in the development of the REF and has made refinements to the proposed sand placement methodology to optimise potential beach nourishment outcomes.

The refinements to the scope of the Proposal are discussed within Section 2 and associated additional safeguards and management measures are included within Section 5.2 of this report.

Assessment of the refined Proposal shows that dredged sediment released at off-shore sand placement sites can be effectively transported toward the shoreline with the potential for sediment retention along Surfside Beach under both wave-forced and calm conditions. When implemented with adaptive planning and evidence-based strategies as detailed within Section 5.2 of this report, the refined Proposal has been found to have the potential to deliver long-term benefits for both maritime infrastructure and shoreline resilience.

Additional assessment

As outlined previously within this report, the majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material or existing coastal erosion. Other submissions from individuals provided suggestions for marine infrastructure improvements, raised issues regarding the influence of existing infrastructure on coastal processes, highlighted the importance of maintaining public access along the foreshore, and highlighted the cultural and environmental significance of Batemans Bay.

As noted previously, the objectives of the Proposal include restoring the Clyde River Bar to a suitable navigable depth and width over ten years and to beneficially reuse the dredged material in the most time and cost-efficient manner. As such, the matters raised within the submissions that most closely relate to the scope of the Proposal include dredging, dredge material placement and navigation.

Adequate existing information is available to Transport in relation to navigation matters that have been raised to address these issues. Accordingly, an additional management measure has been proposed as detailed within Section 5.2 of this report.

Matters raised regarding dredging generally align with the Proposal and no further action is considered warranted in this regard.

In relation to the assessment of dredge material placement options as outlined within Section 2.2 of this report, Transport has undertaken further assessment of the assumptions used in the development of the REF. This assessment process and the associated outcomes are detailed within Section 4.1 of this report. Section 4.1 outlines that substantial further technical analysis has been undertaken in order to inform the consideration of spoil placement options associated with the Proposal. This analysis has been undertaken by the University of New South Wales (UNSW) on behalf of Transport and expands upon previous work commissioned to inform the REF.

This further assessment shows that dredged sediment released at off-shore sand placement sites can be effectively transported toward the shoreline with the potential for sediment retention along Surfside Beach under both wave-forced and calm conditions. Overall, the findings provide strong scientific support for the Proposal as a well-founded and timely coastal management initiative. When implemented with adaptive planning and evidence-based strategies, the Proposal has been found to have the potential to deliver long-term benefits for both maritime infrastructure and shoreline resilience. Several recommendations of this analysis have been captured within the safeguards and management measures included within Section 5.2 of this report.

In addition to the above, in order to verify the accuracy of the above modelling and to facilitate consideration of any required changes to the works methodology, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport, and potential deposition hotspots. These insights will assist to inform dredging operations and adaptive management, and may also assist to inform future shoreline protection measures in Batemans Bay.

Next steps

Transport as the determining (approval) authority will consider the information in the REF and this submissions report and make a decision whether or not to proceed with the Proposal.

Transport will inform the community and stakeholders of this decision, and where a decision is made to proceed, will continue to consult with the community and stakeholders prior to and during the implementation phase.

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1. Introduction and background

1.1 The proposal

Transport proposes to undertake maintenance dredging, as required, over a 10-year period within the navigation channel at the entrance bar to the Clyde River at Batemans Bay (the Proposal). The key aspect of this Proposal involves dredging to maintain a safe navigable channel, with a width of at least 40 metres and a maximum channel bed elevation of -2.4 metres below the LAT. The proposed dredging location is identified in Figure 1-1. It is not expected that any campaign would exceed 30,000m^3 per year, with extraction volumes most likely to be up to 25,000m^3 per campaign.

For minor dredging campaigns (involving dredging of less than 500 millimetres in depth), small tug bed levelling, large tug bed levelling, small tug bed agitation and small cutter suction dredging is likely to be required. For larger scale dredging campaigns (involving dredging of greater than 500 millimetres in depth), the use of a TSHD with off-shore placement is likely to be more suitable.

The dredged material would be strategically placed within the littoral transport system. This system redistributes the material as part of natural coastal processes. Therefore, in addition to achieving maritime safety objectives, the Proposal would also seek to facilitate natural redistribution of the dredged material within Batemans Bay.

Implementation of the Proposal may start in 2025, subject to all required approvals being obtained. Each dredging campaign may take between 3 and 5 weeks, with some campaigns being longer in duration due to variables in environmental conditions. Individual campaigns are anticipated to be completed as required, approximately once every two years for a period of up to 10 years, subject to funding availability.

A more detailed description of the Proposal is found within the Clyde River Bar Dredging 2025-2035 Review of Environmental Factors (REF) prepared by Transport in April 2025.

Figure 1-1 Proposed Dredging Location

1.2 REF display

Transport prepared the REF to assess the potential environmental impacts of the proposed works. The REF was publicly displayed for 22 days between 12 May 2025 and 2 June 2025 in the following ways:

Internet

The REF was made available on the Transport website.

Printed copies

The documents were made available at the following locations:

- Batemans Bay Library, Hanging Rock Place, Batemans Bay.
- Eurobodalla Shire Council, Vulcan Street, Moruya.

Copies by request

Printed and electronic copies were made available through the Maritime Infrastructure Delivery Office (MIDO) Dredging Team.

Staffed displays – Information Session

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Online displays – Information Session

An online information session was offered on Tuesday 27 May from 6pm to 7pm. The session was cancelled due to low numbers.

During the exhibition of the REF, Transport invited the public to provide written feedback on the Proposal.

1.3 Purpose of this report

This submissions report relates to the REF prepared for the Clyde River Bar Dredging (2025-2035) Proposal, and should be read in conjunction with that document.

The REF was placed on public display and submissions relating to the Proposal and the REF were received by Transport. This submissions report summarises the issues raised and provides responses to each issue (Section 2). It details investigations carried out since finalisation of the REF (Section 3), describes and assesses the environmental impact of changes to the Proposal (Section 4) and identifies new or revised environmental management measures (Section 5).

2. Response to issues

In total, Transport received 52 submissions in relation to the Proposal. Table 2-1 lists the respondents and each respondent's allocated submission number. The table also indicates where the issues from each submission have been addressed in Section 3 of this report.

Table 2-1: Respondents

Respondent	Submission No.	Section numbers where issues are addressed
Individual	1	2.4.1
Individual	2	2.4.1
Individual	3	2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 2.5.2, 2.5.3
Individual	4	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1
Individual	5	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3, 2.4.1
Individual	6	2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.3, 2.3.5, 2.4.1
Individual	7	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3, 2.6.1
Individual	8	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3
Individual	9	2.2.1, 2.2.2, 2.2.7, 2.3.1, 2.3.2, 2.3.3, 2.7
Individual	10	2.2.1, 2.3.1, 2.3.2, 2.3.3
Individual	11	2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.3
Individual	12	2.2.1, 2.3.1, 2.3.2, 2.3.4, 2.4.2
Individual	13	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3
Individual	14	2.2.1, 2.3.1, 2.3.2, 2.4.2
Individual	15	2.2.1, 2.2.2, 2.2.4, 2.2.7, 2.3.1, 2.3.2, 2.3.3, 2.3.5, 2.4.2, 2.7
Individual	16	2.2.1, 2.2.2, 2.2.4, 2.2.7, 2.3.1, 2.3.2, 2.3.3, 2.3.5, 2.4.2, 2.7
Individual	17	2.2.1, 2.2.2, 2.2.4, 2.2.7, 2.3.1, 2.3.2, 2.3.3, 2.3.5, 2.4.2, 2.7
Individual	18	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.4.1, 2.4.4, 2.5.3, 2.7
Individual	19	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3

Respondent	Submission No.	Section numbers where issues are addressed
Batemans Bay Boaters Association	20	2.2.1, 2.2.2, 2.2.3, 2.2.7, 2.3.1, 2.3.3, 2.4.1, 2.4.3, 2.6.2, 2.7
Individual	21	2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.2, 2.3.3, 2.4.1, 2.4.3, 2.4.4, 2.6.2
Individual	22	2.2.1, 2.2.2, 2.3.1, 2.3.2
Individual	23	2.2.1, 2.3.1, 2.3.2, 2.3.3
Individual	24	2.2.1, 2.3.1
Individual	25	2.2.1, 2.3.1
Individual	26	2.2.1, 2.2.2, 2.3.1, 2.3.3
Individual	27	2.2.1, 2.2.2, 2.3.1, 2.3.3
Individual	28	2.2.1, 2.2.2, 2.3.1, 2.3.2, 2.3.3, 2.3.5, 2.4.2
Individual	29	2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.3.3, 2.7
Individual	30	2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.7, 2.3.1, 2.3.3, 2.7
Individual	31	2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.7, 2.3.1, 2.3.2, 2.3.5, 2.7
Individual	32	2.2.1, 2.2.5, 2.3.1, 2.3.3, 2.4.1
Individual	33	2.2.1, 2.3.1, 2.3.2, 2.3.3, 2.3.4
Individual	34	2.2.1, 2.3.1, 2.3.3, 2.4.1, 2.7
Individual	35	2.2.1, 2.2.2, 2.3.1, 2.3.3
Individual	36	2.2.1, 2.3.1, 2.3.3
Individual	37	2.2.1, 2.2.5, 2.2.6, 2.3.1, 2.5.1, 2.5.3
Individual	38	2.2.1, 2.3.1
Individual	39	2.5.3
Individual	40	2.2.1, 2.2.3, 2.2.6, 2.3.1, 2.3.2, 2.4.2
Individual	41	2.2.1, 2.3.1, 2.3.2, 2.3.3, 2.3.4
Individual	42	2.4.1, 2.4.4
Individual	43	2.2.1, 2.3.1, 2.3.3, 2.4.1
Individual	44	2.2.1, 2.3.1, 2.3.2, 2.3.3, 2.3.4

Respondent	Submission No.	Section numbers where issues are addressed
Individual	45	2.2.1, 2.2.2, 2.2.5, 2.3.1, 2.3.3, 2.3.5
Individual	46	2.5.1
Individual	47	2.4.1
Batemans Bay Sailing Club	48	2.4.1, 2.7
D'Albora	49	2.4.1, 2.4.4
Department of Climate Change, Energy, the Environment and Water (DCCEEW)	50	2.2.1, 2.2.2, 2.3.1, 2.3.5
Eurobodalla Shire Council (ESC)	51	2.2.1, 2.2.2, 2.2.3, 2.3.1
Department of Primary Industries and Regional Development (DPIRD) - NSW Fisheries	52	2.7

2.1 Overview of issues raised

A total of 52 submissions were received in response to the display of the REF. This included submissions from 3 government agencies, 3 other organisations and 46 submissions from individual members of the community. The majority of submissions were received via email, with a further 8 submissions received by phone and 1 submission formally received during a Project community information session.

The majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material or existing coastal erosion. This included a number of submissions from residents and property owners of the northern Batemans Bay beaches regarding beach erosion and coastal inundation, particularly on Surfside Beach. A number of submissions from individuals were also critical of coastal protection efforts to date, including funding and implementation of coastal protection initiatives by Council and the NSW Government.

Other submissions from individuals provided suggestions for marine infrastructure improvements, raised issues regarding the influence of existing infrastructure (such as the new Batemans Bay bridge and existing breakwall) on coastal processes, highlighted the importance of maintaining public access along the foreshore, and highlighted the cultural and environmental significance of Batemans Bay.

All 3 submissions received from organisations other than government agencies were provided by industry stakeholders. These submissions generally outlined the urgent and critical need for dredging to maintain navigational safety and support local economic activity.

Two of the three government agency submissions received challenged the consistency of the Proposal with the CMP, sought further clarification regarding the modelling used to support the preferred placement option for dredged material and questioned the potential effectiveness of beach nourishment resulting from the Proposal. The third government agency submission stated no objection to the Proposal, and further clarified requierments with regard to change management, notification, licencing, review of project documentation and threatened species classification.

Each submission has been examined individually to understand the issues being raised. The issues raised in each submission have been extracted and collated, and corresponding responses to the submissions have been developed. Where similar issues have been raised in different submissions, only one response has been provided. The issues raised and Transport response to these issues forms the basis of this chapter.

A summary of matters raised within submissions is presented within Figure 2-1 below.

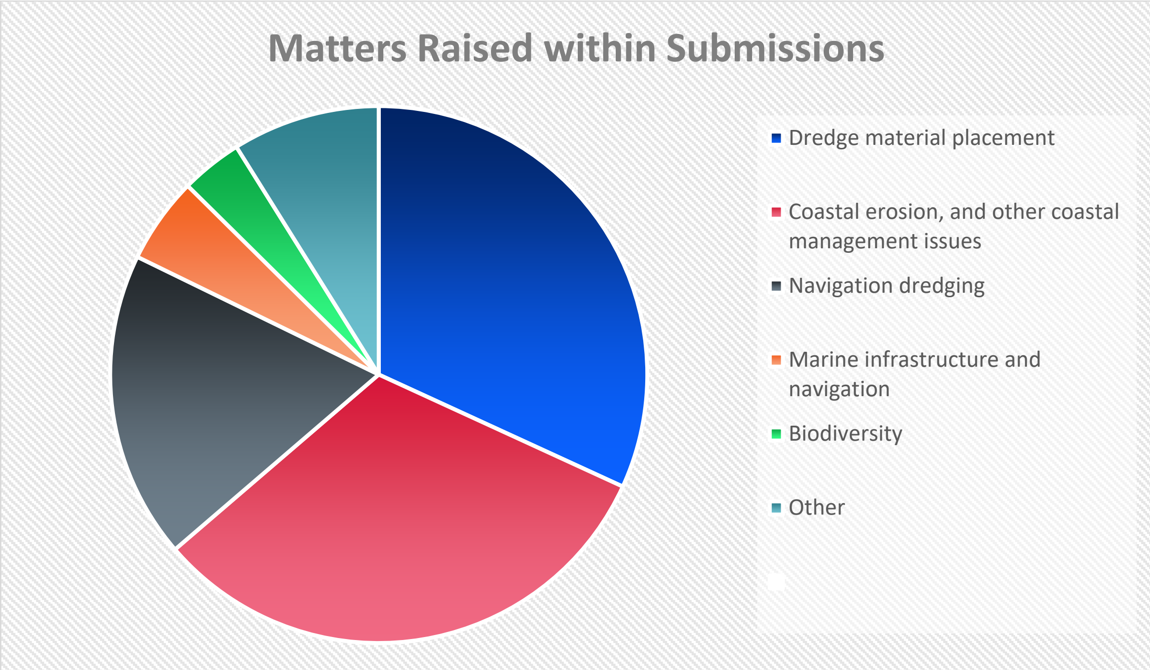

Figure 2-1 Matters Raised within Submissions

2.2 Dredge material placement

As outlined previously, the majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material. This included a number of submissions from residents and property owners of the northern Batemans Bay beaches regarding beach erosion and coastal inundation, particularly on Surfside Beach.

For ease of responding to the number of submissions received, we have broken this section into further sub categories related to the matters raised.

2.2.1 Dredged sand needs to be placed on or closer to Surfside Beach

Submission numbers

3-38, 40, 41, 43-45, 50 and 51

Description of Issue

- The placement of sand at Surfside Beach should be what happens every time dredging work is undertaken near Batemans Bay, and should occur until a permanent long term solution is put in place.
- The potential ineffectiveness of the proposed dredged material placement locations, requesting that dredged material be placed closer to or directly on the northern Batemans Bay beaches.
- Placing sand on Surfside Beach is a positive impact for the community due to saving properties. If not within the current budget, we need more money to do the job well [place sand directly on Surfside Beach.
- Issues at McClouds Beach and Surfside West are different and less worrying than Surfside Beach. The Council has received funding for a levee at McClouds Beach and the community has been told those works will start soon. The priority for the placement of sand from dredging should be along Surfside Beach, particularly toward the northern end.
- The REF is unclear about the expected beach nourishment outcomes based on identified placement locations, or how Transport will monitor and report on the effectiveness of the sand nourishment approach.

- The reasons for rejecting options 1 and 2 (such as increased safety risks, visibility, environmental risk, program risk, visual and noise and vibration impacts) are over stated and trivial in comparison to the potential outcome that would be achieved by a better mechanism to transport sand to Surfside Beach.

- It is noted that monitoring of sand placement outcomes is proposed. However, if unsuccessful this will be too late for properties as Surfside Beach is eroding at 0.5m per month.

Response

As outlined within Section 2.3.1 of the REF, the objectives of the Proposal include:

- Restore the Clyde River Bar to a suitable navigable depth and width to improve the safety and navigability of the channel.
- Beneficially reuse the dredged material in the most time and cost-efficient manner.
- Maintain dredging over ten years.

These objectives are intended to fulfil the relevant aspects of the MIP, which provides a strategic, evidence-based approach to delivering maritime infrastructure, prioritising safe access to waterways.

The option of beach nourishment using material dredged from the Clyde River at Batemans Bay is outlined within Management Option CH_1L of the CMP as follows:

'Subject to environmental planning approvals, undertake nourishment at Northern Batemans Bay beaches [Surfside /Surfside west/ Wharf Road/Long Beach] when dredging is undertaken in Batemans Bay / Clyde River as required for navigational purposes.'

The CMP provides design considerations for beach nourishment at each of the above locations which have been considered in the development of the REF. However, the preferred methodology for spoil placement has required further assessment of the cost and benefit of placement options in consideration of environmental, social and economic factors as outlined within Section 2.4.2 of the REF.

The preferred option for the placement of dredged sand as outlined within the REF has been identified as it would significantly minimise impacts to the community and the environment when compared to other options considered, and would ensure the navigational objectives of the Proposal are both practically and economically viable.

In relation to the financial cost of the placement options that have been considered, it can also be noted that the applicable MIDO dredging program is funded from the Boating Infrastructure and Dredging Scheme (BIDS) which has two sub-programs to address dredging issues and includes $16m funding for dredging projects until 2027. This program is intended to include the delivery of 12 projects with limited budget over the next four years. As such, implementation of the preferred option would ensure the economic viability of not only the Clyde River Bar dredging, but also other dredging projects throughout NSW.

2.2.2 Proposed off-shore sand placement is ineffective and not consistent with CMP

Submissions numbers

3-9, 11, 13, 14-18, 20-22, 26, 27-29, 30, 31, 35, 44, 45, 50, 51

Description of issues

- Inconsistency between the preferred spoil placement option within the REF and with the proposed dredged material placement methodology outlined within the CMP and MIP.

- Beach nourishment is not just a technical issue — it's affecting people's homes, safety, and long-term viability of the coastline. Reconsider land-based or nearshore placement options more thoroughly, including the allocation of appropriate funding to deliver on Transport's obligations for Surfside in the CMP.
- The littoral transport system won't work here, and so dumping sand 600 metres from shore will not do much, if anything at all, for Surfside Beach. Sand for beach nourishment needs to be physically brought to the beach and earthmoving machinery used to push it up to where it is needed.

- Concern that dredged material could be washed from the placement locations out to sea in the event of a flood.

- Concern regarding what happens when the offshore placement doesn't hold or deliver the results that are needed, and what the plan is if beach nourishment fails. Next steps or contingency measures if beach nourishment is not successful are not outlined within the REF. The residents of Surfside do not appear to have enough time to save their homes if the current plan does not work.

- It is understood that environmental and heritage factors are important [in relation to dredge material disposal options], but placing sand so far offshore doesn't seem to guarantee any real protection for properties or community assets.

- Placing sand in water will just infill the navigation channel faster.

Response

Background and justification for the proposed sand placement approach in relation to the scope of the Proposal is described in detail under the response heading of Section 2.2.1 of this submissions report

It can also be noted that the proposed sand placement locations have been identified through sediment transport modelling undertaken by UNSW. Since the completion of the REF in April 2025, substantial further technical analysis has been undertaken in order to inform the consideration of spoil placement options in relation to the Proposal. This further technical analysis is described in detail under the response heading of Section 2.2.3 below.

2.2.3 Sediment transport model

Submission numbers

3, 6, 11, 20, 21, 29, 30, 31, 40, 51

Description of issues

- The unreliability of the sediment transport modelling (including assumed hydrological conditions, coastal infrastructure and material volumes) used to inform the proposed dredged material placement locations, along with the associated potential effectiveness of beach nourishment as a result of this material placement and inconsistency with local observations.

- The concerns of Department of Climate Change, Energy, the Environment and Water regarding the preferred dredge material placement have not been addressed.

Response

It is acknowledged that a number of submissions received in relation to the public exhibition of the REF questioned the reliability of sediment transport modelling used to inform the environmental assessment, and in particular the potential effectiveness of the preferred dredging spoil placement locations. As such, since the completion of the REF in April 2025, and to address the comments raised by members of the community during the Batemans Bay Dredging Information Session in May 2025, substantial further technical analysis has been undertaken in order to inform the consideration of spoil placement options in relation to the Proposal.

Compared with the preliminary modelling work outlined in Section 6.2 of the REF, which involved only three simplified scenarios including an isolated dredging case, the updated study presents a more comprehensive and operationally relevant suite of analyses. The standalone dredging-only scenario has been removed, as dredging activities are proposed to always be accompanied by spoil placement, making that scenario of limited real-world applicability. In its place, fourteen scenarios have been developed to explore a range of conditions, including a no-placement control run (baseline), multiple placement cases under different hydrodynamic forcings (waves, flooding, and calm conditions), variations in placement location (Site 1 - southern location, Site 2 – central location, Site 3 - northern location, and a combination of Sites 1 and 2), and two different simulation durations (short-term 3-day and long-term 3-week runs).

In contrast to the earlier study, which only focused on a brief period from 11–12 April 2022, the new modelling work incorporates more meaningful and representative timeframes: 9–11 July 2022 to capture storm-driven processes, 7–9 April 2022 for flood-related dynamics, and a full 3-week simulation aligned with the proposed dredging schedule. These expanded periods allow a more realistic assessment of sediment dynamics under operational and environmental variability.

In addition to changes in temporal scope, the spatial analysis has also been significantly enhanced. Where the earlier study focused on suspended sediment concentration (SSC) evolution at a single location near Surfside Beach and primarily used horizontal residual fluxes, the updated work introduces a transect-based framework using five strategically placed cross-shore and alongshore transects near the shoreline and bay inlet. This approach allows for a more detailed quantification of residual sediment fluxes, providing deeper insight into alongshore and onshore sediment delivery, retention patterns, and the efficacy of nourishment strategies.

Furthermore, the updated model corrects the sediment placement volume, reducing it from the previously assumed 180,000 m^3 to 30,000 m^3 in alignment with current Proposal estimates. It also incorporates new placement site scenarios, including Site 1 - southern location, Site 2 – central location, Site 3 - northern location, and a combination of Sites 1 and 2, under various environmental conditions. These additions offer a more realistic and comprehensive basis for evaluating the performance and environmental impact of proposed dredging and sand placement operations.

The modelling used in this updated work is based on the high-resolution 3D current–wave–sediment coupled numerical model originally developed by Yang et al. (2022) to investigate hydrodynamics and sediment dynamics in Batemans Bay. This model has been validated against observational datasets and its methodology peer-reviewed in the scientific literature (e.g., Yang et al., 2022; Deng et al., 2025). For this study, the model has been enhanced with a suspended sediment placement function to allow simulation of dredged material discharge and subsequent transport.

More detailed results, methods, and interpretations can be found in the accompanying report titled *'Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study'*. This additional modelling work is provided within Appendix A of this report.

In addition to the above, in order to verify the accuracy of the above modelling and to facilitate consideration of any required changes to the works methodology, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport, and potential deposition hotspots. These insights will assist Transport to inform dredging operations and adaptive management, and may also assist to inform future shoreline protection measures in Batemans Bay.

An indicative illustration of the turbidity and current monitoring meters is provided within Figure 2-2. The three strategic sites where monitoring is proposed is illustrated within Figure 2-3.

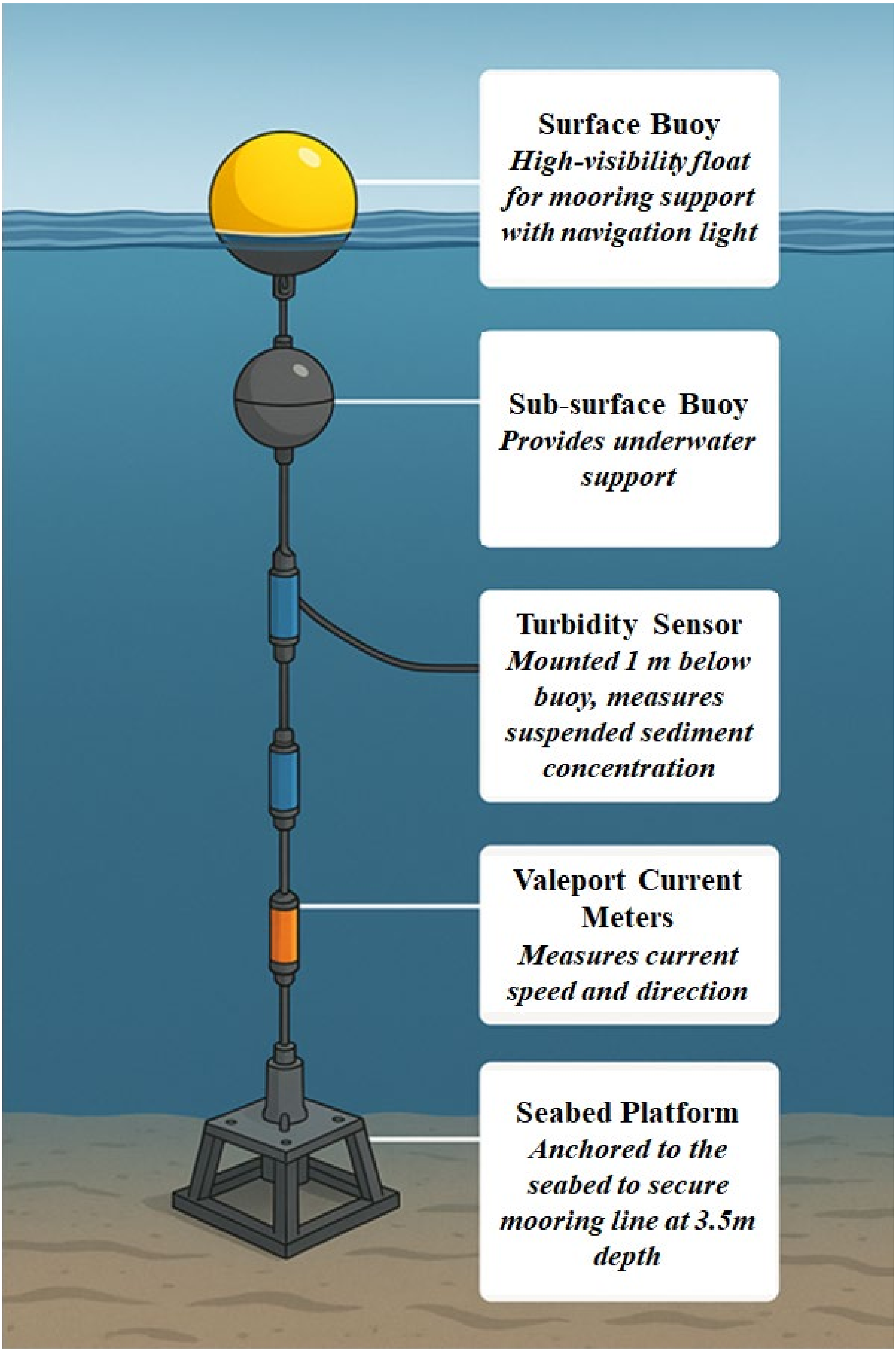

Figure 2-2 Indicative Batemans Bay Monitoring System (source: UNSW 2025)

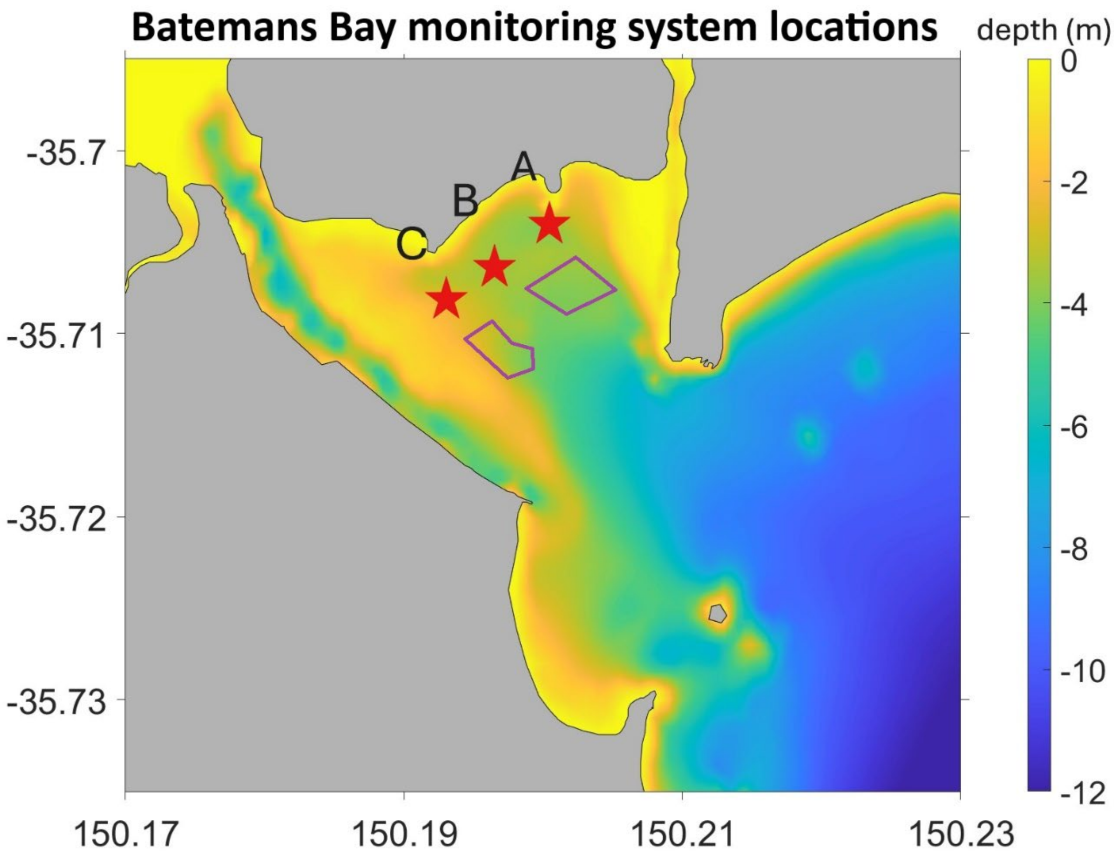

Figure 2-3 Proposed Batemans Bay Monitoring System Locations (source: UNSW 2025)

2.2.4 No cost benefit analysis was included in the REF to show why off-shore sand placement is the preferred option

Submission numbers

6, 15, 16, 17, 30, 31

Issues description

- Lack of cost benefit analysis information within the REF to substantiate cost justification for the preferred material placement option.
- The wider socio-economic benefits to the community of placement Options 1 and 2 [from the REF] have not been fully considered.

Response

The preferred methodology for spoil placement has been informed through assessment of the cost and benefit of placement options in consideration of environmental, social and economic factors as outlined within Section 2.4.2 of the REF. The three options that were explored were as follows:

- **Direct Land Placement –** This option would stockpile sand at Corrigans Beach and then truck sand material to Surfside beach. This was ruled out because it had a higher impact to the environment as well as impacts to the community associated with the need for trucks and machinery to transfer the material via road. This method also has a high cost associated as double handling of dredge material.
- **Direct Marine Based Placement** – This option would use dredge pipes and boosters to place the sand closer to Surfside beach. This option was also ruled out because of the significant cost increase to deliver this method. It was also ruled out as this method increases program and safety risk as this method is more susceptibile to impacts from weather conditions.
- **Littoral Transport System Placement –** This was selected as our preferred option for the placement of dredged sand as outlined within the REF has been identified as it would significantly minimise impacts to the community and the environment when compared to the other two options considered, and would ensure the navigational objectives of the Proposal are both practically and economically viable.

In relation to the financial cost of the placement options that have been considered, it can also be noted that the applicable MIDO dredging program is funded from the Boating Infrastructure and Dredging Scheme (BIDS) which has two sub-programs to address dredging issues and includes $16m funding for dredging projects until 2027. This program is intended to include the delivery of 12 projects with limited budget over the next four years. As such, implementation of the preferred option would ensure the economic viability of not only the Clyde River Bar dredging, but also other dredging projects throughout NSW.

2.2.5 Would like dredge sand to be placed near Long Beach and Cullendulla Beach

Submission numbers

32, 37, 45

Issues description

- Would like Long Beach and Cullendulla Beach areas also included in beach nourishment.

Response

Nourishment of northern Batemans Bay beaches, including Long Beach and Cullendulla Beach, was considered as part of the assessment of options for the placement of dredged sand as outlined within the REF.

The REF identified that Cullendulla Creek is a Sanctuary Zone under the DPIRD Batemans Marine Park Zoning Map. This zoning is offered the highest level of protection for biological diversity, habitat and ecological functions. Dredging and beach nourishment is not permitted within a Sanctuary Zone.

The results of investigation as part of the sediment transport model regarding potential off-shore sand placement adjacent to Long Beach is outlined within Section 6.2.3 and Figure 6-6 of the REF. Ultimately, the Long Beach location was not selected as the preferred sand placement site, as the model suggested that while placement in this location appears effective in supporting some nourishment of Surfside Beach, it showed limited impact on sediment transport toward Long Beach. In comparison, the REF identified that sand placement adjacent to Surfside Beach, which is closer to the dredging location, was likely to be more effective in achieving beach nourishment outcomes. As such, the preferred approach would seek to support the practical and economic viability of the navigation and beach nourishment objectives associated with the Proposal.

Further background and justification for the proposed sand placement approach in relation to the scope of the Proposal is described in detail under the response heading of Section 2.2.1.

2.2.6 The proposed near-shore sand placement area may impact navigation

Submission numbers

37, 40

Issues description

- When the bar experiences high swells, vessels use a passage which is located where the proposed sand placement area is. As such, the proposed placement location will disrupt this navigational area for smaller vessel using the bay.

Response

The Proposal seeks to improve navigability of the main channel to the Clyde River at Batemans Bay. The Proposal has also sought to achieve beach nourishment outcomes as detailed within Section 2.2.2 of this report, an issue that has been raised within the majority of submissions received in relation to the public exhibition of the REF.

As detailed within Section 2.2.2 - 2.2.4 of this report, the preferred option for the placement of dredged sand as outlined within the REF has been identified as it would significantly minimise impacts to the community and the environment when compared to other options considered, and would ensure the navigational objectives of the Proposal are both practically and economically viable.

As such, the proposed placement locations have been identified in order to best achieve navigation and beach nourishment outcomes, while also ensure the potential community and the environment impacts are effectively mitigated. If these placement locations were to be adjusted, it may reduce beach nourishment outcomes and/or increase community and environment impacts.

2.2.7 Lack of technical evidence and precedence to support the approach to beach nourishment

Submission numbers

9, 15, 16, 17, 20, 30, 31

Issues description

- Money proposed for this action is not supported with enough evidence to be successful, and should be used towards sand placement closer to or directly on to Surfside Beach, or a longer term more permanent solution.

- The REF does not appear to mention previous projects where littoral sand transport has achieved successful beach nourishment outcomes.

Response

As outlined within Section 2.4.2 of the REF, the proposed littoral sand transport approach would be similar in nature to a ‘sand motor’, being the placement of material on a coastline which is redistributed through natural processes and seeks to slow down or reverse the loss of beaches along at-risk coastlines *(Source: World Economic Forum 2024)*. This existing methodology has been implemented successfully on coastlines throughout the world, and has been comprehensively modelled by UNSW as detailed within Appendix A of this report. This approach will minimise impacts to the community and the environment when compared to other options considered within the REF, and ensure the navigational objectives of the Proposal are both practically and economically viable.

2.3 Coastal erosion, and other coastal management issues

2.3.1 The current coastal erosion issues at Surfside

Submission numbers

3-38, 40, 41, 43-45, 50 and 51

Description of Issues

- Need to address coastal erosion at Surfside.
- Risk of coastal erosion to the reputation of Batemans Bay as a tourist destination.
- This dredging project is a chance to do something [good] for Surfside.
- Cullendulla Nature Reserve is significant area for the Aboriginal Community, access via Surfside and preservation of Surfside should factor into that.

Response

Current coastal erosion issues at Surfside Beach were a key consideration in the development of the Proposal, and coastal protection (including potential options for beach nourishment) has been comprehensively assessed as part of the identification of the preferred option for dredge material placement for the Proposal. However, current resource allocation is aligned with the objectives of the Proposal as outlined in Section 2.3.1 of the REF and reiterated in Section 2.2.3 of this report. As such, maintaining a safe navigational channel will be prioritised as part of this Proposal, with project benefits such as beach nourishment being pursued where practical to do so.

2.3.2 The need for a longer term solution to coastal erosion at Surfside

Submission numbers

4, 5, 7-10, 12-18, 19, 21-23, 28, 31, 33, 40, 41, 44

Description of Issues

- A mid term fix of sandbags has been installed at Longbeach and plans for long term rock revetment planned for only 20% of the beach to protect the road.
- Each time the Bay is dredged, priority should be given to using the sand to nourish Surfside Beach.
- Need a lot more than 30,000m^3 [forecast maximum annual dredge volume] for effective beach nourishment.
- A seawall for Wharf Road and Surfside could be implemented to solve the area's long term erosion issue.

Response

As noted above, coastal protection (including potential options for beach nourishment) have been comprehensively assessed as part of the identification of the preferred option for dredge material placement for the Proposal. However, current resource allocation is aligned with the objectives of the Proposal as outlined in Section 2.3.1 of the REF and reiterated in Section 2.2.3 of this report. As such, maintaining a safe navigational channel will be prioritised as part of this Proposal, with project benefits such as beach nourishment being pursued where practical to do so.

The development of other coastal management works associated with foreshore protection (such as rock groynes and sea walls) do not form part of the scope of this Proposal and would be more appropriately pursued through other programs and initiatives which more closely align with these activities, such as the NSW Governments Coastal and Estuary Planning and Implementation Program.

2.3.3 The need for more Government funding, action and support

Submission numbers

5-11, 13, 15-21, 23, 26-29, 30, 32-36, 41, 43-45

Description of Issues

- Lack of Council intervention in relation to beach erosion, despite receipt of funding to address this issue. Council rates should pay for measures to address coastal erosion at Surfside.
- Council responsibility to do something about erosion. No assistance (including free or reduced tip fees to discard rubbish) has been provided by Council following inundation of properties at Surfside.
- Council recently moved sand from one section of Long Beach to another, which has not been a permanent fix and erosion has continued.
- The NSW Government should prohibit all new building in the area and, as people move out of existing residences along the foreshore, purchase all properties.
- In Queensland they do more regular dredging. Best option is to place sand on Surfside beach, like the Gold Coast.
- The development at 2A Myamba Parade was never finished, and today some built structures on this property are eroding into the ocean and the property boundary and structures cut off access to the rest of Cullendulla Reserve at mid to high tide. Whatever action is taken, safe public access to our reserves and beaches must be considered, ensured, and maintained.
- Government help has been promised for many years, but no action has happened in that time. The Government needs to find a [beach nourishment] solution that will work.
- Cullendulla Beach is currently not considered by the CMP. Consider recommending to Council that the CMP be amended to included Cullendulla Beach.
- The CMP notes Transport is responsible for sand nourishment.
- If this project does not have the funds to correctly and appropriately dispose of the dredge spoils, it should be delayed until more funds can be found.

Response

This submissions report will be made available to Eurobodalla Shire Council (ESC), to ensure Council is provided with the opportunity to review feedback received in relation to this Proposal, including coastal management on the northern Batemans Bay beaches.

The CMP (including potential options for beach nourishment) have been comprehensively assessed as part of the identification of the preferred option for dredge material placement for the Proposal. However, current resource allocation is aligned with the objectives of the Proposal as outlined in Section 2.3.1 of the REF and reiterated in Section 2.2.3 of this report. As such, maintaining a safe navigational channel will be prioritised as part of this Proposal, with project benefits such as beach nourishment being pursued where practical to do so.

In relation to coastal planning and development controls, it is acknowledged that existing mechanisms currently exist under legislation such as the *Environmental Planning and Assessment Act 1979* to manage coastal development, and that review of coastal planning and development controls does not form part of the scope of this Proposal. In a similar regard, it can also be noted that a review of the CMP, existing coastal management strategies and property boundaries also does not form part of the scope of this Proposal.

2.3.4 That the new bridge has caused erosion issues at Surfside

Submission numbers

8, 12, 33, 41

Issues Description

- Potential exacerbation of erosion on Surfside Beach as a result of the new Batemans Bay bridge.

Response

With regard to potential exacerbation of erosion associated with the new Batemans Bay bridge, this matter is not included as part of the scope of this Proposal. However, it has been noted that this particular project completed modelling on the potential impacts of the bridge as part of the project REF in 2017, and that further modelling and assessments were then carried out in 2018. It has been noted that the 2018 modelling confirmed the findings of earlier assessments and identified that:

- The new bridge will have less impact on erosion, wave, tides and currents in the Clyde River compared to the existing bridge. This is due to the reduced number of piers and the abutments being further away from the river.
- The new bridge will not create additional impacts to the shoreline compared to the existing bridge.
- The new bridge will not adversely influence the distribution of waves inside the Bay.
- The new bridge will not influence sea level rise.

2.3.5 Improved monitoring or data

Submission numbers

6, 15-17, 28, 31, 45, 50

Issues Description

- There is an opportunity for sand nourishment to be monitored with fixed coast snap stations. This could be a collaborative initiative between the NSW Government, UNSW, Eurobodalla Shire Council and the community.
- It is great that this is a 10 year plan, but the project should be monitored, reviewed and adapted if required.
- Include further detail about how Transport will monitor and report on the effectiveness of the proposed off-shore placement in achieving sand nourishment for Surfside Beach and to inform future campaigns.

Response

It is noted that 3 coast snap stations currently exist within this area at Surfside Beach, Cullendulla beach, and Long Beach. These stations are not likely to be used directly as part of the Proposal, due to alternative ways of monitoring being proposed within the REF. However, these stations are likely to remain active and would continue to record changes in these locations over time.

With regard to review and monitoring of the dredging program and its campaigns, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport, and potential deposition hotspots. These insights will assist to inform future dredging operations and adaptive management, and may also assist to inform future shoreline protection measures in Batemans Bay.

2.4 Navigation dredging

2.4.1 Need for navigation dredging

Submission numbers

1-6, 18, 20, 21, 32, 34, 42, 43, 47-49

Issues Description

- Question the immediate priority of the Clyde River Bar project given low local maritime traffic compared to bars at Narooma and Bermagui.
- Agreement that the dredging proposal including the sand placement location makes sense.
- The dredging is a great idea and well overdue.
- The need for dredging is urgent and critical as highlighted by recent incidents and impacts to industry.
- Dredging of Batemans Bay is a waste of money and is not needed. Dredging this waterway just allows people who can afford to buy larger expensive sailing boats to get in and out. It is not going to add to the economy of the area via increased tourism. Spend the money elsewhere.
- It is important to dredge the bar entrance.
- Supportive of the dredging project, boaters in the area need reliability [of navigation] and safe access to mooring locations.
- Current restriction of boaters by tides, can't go out during low tide as the bar is too shallow.
- Regular dredging is required to ensure navigability.
- The proposal will address current navigational safety issues by offering safe access in times of emergencies, such as those encountered during the 2025 Sydney to Hobart Yacht Race.

Response

It is acknowledged that the Clyde River Bar is a key navigational channel requiring ongoing dredging maintenance to facilitate safe passage for recreational and commercial vessels accessing the Clyde River at Batemans Bay.

It is noted that the NSW Coastal Dredging Strategy 2019-2024 (CDS) recognises the Batemans Bay and Clyde River entrance and bar channel as a key investment location to improve navigation and accessibility for commercial, recreational and tourist enterprises, which have flow-on benefits for local economies. It is further noted that the NSW Maritime Infrastructure Plan 2019–2024 (MIP) has identified Batemans Bay as a popular recreational boating destination that supports significant tourism activity and provides access to the Batemans Bay Marine Park, including the Montague Island Nature Reserve. The MIP also notes the area supports a growing and regionally important aquaculture industry, particularly oyster farming, and a range of other commercial operations including marinas, fishing businesses, hire and drive businesses and commercial passenger vessels. The MIP identifies that accessible and clearly marked navigation channels are required for current and future usage to support the growth of tourism and recreational boating in the area, in addition to the local aquaculture industry.

The Proposal would aim to assist in achieving the objectives of both the CDS and the MIP with regard to maintaining a suitable navigational channel at the Clyde River Bar. The dredging and maintenance of other coastal bar crossings are prioritised by Transport based on considerations such as the cost and benefit of any particular potential dredging campaign against the objectives of the CDS and MIP and resourcing availability.

Transport acknowledges the current condition of the Clyde River Bar, and seeks to maintain a navigable channel of at least 40m width, with a bed elevation of -2.4m LAT as a minimum standard for the next 10 years (2025–2035), with commencement of the first dredging campaign anticipated for late 2025.

In order to facilitate efficient ongoing maintenance whilst ensuring required consultation and environmental approvals have been obtained, a Due Diligence Environmental Assessment (refer to Appendix B) would be prepared prior to each dredging campaign to identify and address any changes to the environment or statutory requirements from those listed in the approved REF and this Submissions Report.

The proposed design, consultation, environmental assessment, implementation, monitoring and refinement methodology for the Proposal is illustrated within Figure 2-4 below.

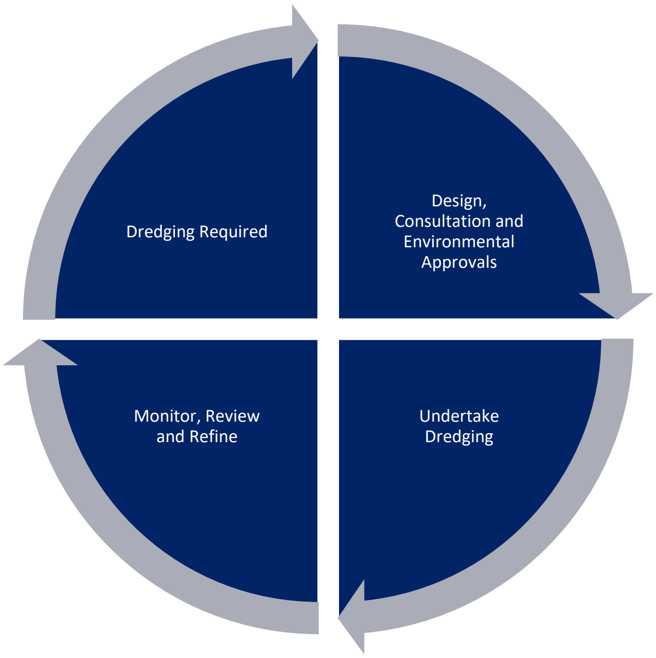

Figure 2-4 10 Year Dredging Implementation Strategy

2.4.2 Was pumping the sand via pipes investigated

Submission numbers

3, 12, 14-17, 21, 40

Issues Description

- Other projects have used pipes to pump sand to the beach and this should be explored or considered on this project.

Response

The option of sand transport through pumping and pipes has been investigated as detailed within Section 2.4.2 of the REF. However, this methodology was found to result in more significant environmental and safety risk and was also identified to be unviable in relation to project resource allocation. As such, this methodology would not meet the objectives of the Proposal as outlined within Section 2.3 of the REF.

2.4.3 The dreging footprint

Submission numbers

20, 21

Issues Description

- The size, shape and footprint of the dredging area appears simplistic and does not take into account historic data regarding the shape and movement of the bar over time.
- Recommend a revised dredging footprint that better aligns with historical and observed sediment movements.

Response

The Proposal seeks to maintain a safe navigation channel at the entrance bar to the Clyde River at Batemans Bay, with a width of at least 40 metres and a maximum channel bed elevation of -2.4 metres below LAT. It is noted that the proposed dredging approach as outlined within Section 3 of the REF will achive this objective, and is within the general location of the existing bar crossing.

2.4.4 Dredging schedule

Submission numbers

3, 18, 21, 42, 49

Issues Description

- Would like informtaion on the dredging schedule.
- Ensure this is not a one off project, dredgeing should be undertaken regularly.
- There should be a clear future schedule for the dredging program with relevant funding.

Response

Transport proposes to undertake maintenance dredging, as needed over a 10-year period within the navigation channel at the entrance bar to the Clyde River at Batemans Bay.

This will not be a one off project and we plan to improve reliability of the channel through regular maintenance dredging campaigns. It is expected that this may occur every 2-5 years, subject to available funding.

2.5 Marine infrastructure and navigation

2.5.1 The breakwall

Submission numbers

37, 46

Issues Description

- Need to add more length to the southern breakwall to make the sand push out into deeper water.
- Issues with the bar siltation and Surfside erosion are caused by the breakwall extension disrupting the flow from south to north. Remove the breakwall extension.

Response

Need and options considered and the scope of the Proposal are outlined within Sections 2 and 3 of the REF respectively. The scope of the propsal as outlined within Section 3 of the REF does not incorporate modification to existing maritime infrustucture (including the existing breakwall), as this has not been demonstrated to directly deliver against the project objectives outlined within Section 2.3 of the REF.

2.5.2 Pre and post dredging surveys to be published

Submission numbers

3

Issues Description

- Request that pre and post dredging surveys be forwarded to the Australian Hydrographic Office.

Response

Consideration will be given to provision of pre and post dredging surveys to the Australian Hydrographic Office. This matter is now adressed as Environmental Safeguard 82 within Table 5-1 of this report.

2.5.3 Accessibilty improvements for fishing and improvements to navigation and boating infrustucture

Submission numbers

3, 20, 37, 39

Issue description

- Need for fishing platforms and breakwall to have disabled access. Need for safety rails on piers and more safety for fishing infrastructure generally.
- Request for dredging and new wharf facilities that could accommodate ship anchorage and wharfage closer to the Batemans Bay township.
- The alignment of navigation leads needs to be taken into consideration and addressed.
- Growth of tourism and recreational boating is severely hampered by high berth prices, berth limit and the apparent hold by Maritime on new and existing swing moorings on both sides of the bar. Until these issues are addressed, water-based tourism and the growth of recreational boating within the area will remain stagnant.

Response

The development of new marine infrastructure such as wharf and mooring facilities, modification to the existing breakwall, and modification to fishing platforms and piers does not form part of the scope of this Proposal. However, relevant maritime initiatives may be pursued as part of other Transport infrastructure programs under the NSW Maritime Infrastructure Plan (MIP).

Notwithstanding the above, issues associated with the alignment of leads is acknowledged, and will be further considered by Transport as part of broader navigation improvements associated with the Clyde River Bar. This matter is now adressed as Environmental Safeguard 83 within Table 5-1 of this report.

2.6 Biodiversity

2.6.1 Enviornmental impacts

Submission numbers

7

Issue description

- Concern that the REF does not mention the environmental impact of proposed dredging, including impact to rays and other marine species.

Response

The potential environmental impacts of the Proposal are assessed within Section 6 of the REF. Potential impact to marine species is specifically assessed within Section 6.7 and Appendix D of the REF. This assessment found that the dredging and placement of sand at the identified areas will avoid areas of sensitive aquatic habitat, cultural value, and any associated impacts. The assessment also found that the Proposal is expected to have minor and temporary impacts on water quality and recreational and vessel usage near the dredge and placement areas, but that any impacts will be restricted to the period of dredging and placement and can be effectively managed with the measures identified in Section 6 of the REF.

2.6.2 Impacts to oyster farms

Submission number

20, 21

Issue description

- Emphasise the importance of tidal movements and the risk of sediment plumes impacting upstream oyster leases.

Response

In relation to the potential impact of dredging plumes during incoming tides, while the dredged material is anticipated to settle quickly given its sandy (non-dispersive) characteristics as detailed within Appendix E of the REF, as outlined within Section 6.3.3 of the REF, efforts will be made to minimise sediment plumes throughout the works, adhering to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

A comprehensive water quality management plan will be developed, incorporating monitoring protocols to assess and mitigate turbidity levels effectively. These measures will seek to ensure that sediment plumes are effectively managed during all tidal conditions, to minimise or avoid impact to the surrounding environment including upstream oyster leases.

2.7 Other

Submission numbers

9, 15-18, 20, 29-31, 34, 48, 52

Issue description

- Appreciation for community consultation.
- Appreciation for the community information session.
- Feel ignored with this proposal.
- The REF is commended for its quality.
- Request for more community information following determination of next steps.
- Potential for legal action in response inaction regarding coastal erosion.
- Clarification with regard to change management, notification, licencing, review of project documentation and threatened species classification.

Response

Community and stakeholder sentiment regarding the Proposal and the consultation process is acknowledged. This submissions report is intended to summarise the issues raised and provide responses to each issue, detail investigations carried out since finalisation of the REF, describe and assess the environmental impact of changes to the Proposal and identify new and revised environmental management measures in consideration of community and stakeholder feedback.

Clarification with regard to change management, notification, licencing, review of project documentation and threatened species classification has been noted, and subsequent additional environmental safeguards are now included within Table 5-1.

This submissions report will be made available for community and stakeholder review, and the community will be advised of the next steps associated with the Proposal following Determination (approval, modification or refusal) of the REF.

3. Changes to the proposal

The majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material or existing coastal erosion. In response to this, Transport has undertaken further assessment of the assumptions used in the development of the REF and has made refinements to the proposed sand placement methodology to optimise potential beach nourishment outcomes.

The refinements to the scope of the Proposal are discussed within Section 2 and associated additional safeguards and management measures are included within Section 5.2 of this report.

Assessment of the refined Proposal shows that dredged sediment released at off-shore sand placement sites can be effectively transported toward the shoreline with the potential for sediment retention along Surfside Beach under both wave-forced and calm conditions. When implemented with adaptive planning and evidence-based strategies as detailed within Section 5.2 of this report, the refined Proposal has been found to have the potential to deliver long-term benefits for both maritime infrastructure and shoreline resilience.

4. Environmental assessment

The purpose of this chapter is to document the outcomes of additional environmental assessment undertaken in response to submissions received following the public exhibition of the REF.

As outlined previously within this report, the majority of submissions received during the public exhibition of the REF raised concerns regarding the proposed methodology for placement of dredged material or existing coastal erosion. Other submissions from individuals provided suggestions for marine infrastructure improvements, raised issues regarding the influence of existing infrastructure on coastal processes, highlighted the importance of maintaining public access along the foreshore, and highlighted the cultural and environmental significance of Batemans Bay.

As also outlined previously within this report, the objectives of the Proposal include:

- Restore the Clyde River Bar to a suitable navigable depth and width to improve the safety and navigability of the channel.
- Beneficially reuse the dredged material in the most time and cost-efficient manner.
- Maintain dredging over ten years.

Given the above, the matters raised within the submissions that most closely relate to the scope of the Proposal include dredge material placement and navigation.

Adequate existing information is available to Transport in relation to navigational matters that have been raised to address these issues. Accordingly, an additional management measure has been proposed as detailed within Section 5.2 of this report.

In relation to the assessment of dredge material placement options as outlined within Section 2.2 of this report, Transport has undertaken further assessment of the assumptions used in the development of the REF. This assessment process and the associated outcomes are detailed within Section 4.1 below.

4.1 Dredged material placement

4.1.1 Methodology

Substantial further technical analysis has been undertaken in order to inform the consideration of spoil placement options associated with the Proposal. This analysis has been undertaken by UNSW on behalf of Transport and expands upon previous work undertaken to inform the REF.

Compared with the preliminary modelling work outlined in Section 6.2 of the REF, which involved only three simplified scenarios including an isolated dredging case, the updated study presents a more comprehensive and operationally relevant suite of analyses. The standalone dredging-only scenario has been removed, as dredging activities are proposed to always be accompanied by spoil placement, making that scenario of limited real-world applicability. In its place, fourteen scenarios have been developed to explore a range of conditions, including a no-placement control run (baseline), multiple dumping cases under different hydrodynamic forcings (waves, flooding, and calm conditions), variations in placement location (left, right, or both sites), and two different simulation durations (short-term 3-day and long-term 3-week runs).

In contrast to the earlier study, which only focused on a brief period from 11–12 April 2022, the new modelling work incorporates more meaningful and representative timeframes: 9–11 July 2022 to capture storm-driven processes, 7–9 April 2022 for flood-related dynamics, and a full 3-week simulation aligned with the proposed dredging schedule. These expanded periods allow a more realistic assessment of sediment movement under a variety of operational and environmental conditions.

In addition to changes in temporal scope, the spatial analysis has also been significantly enhanced. Where the earlier study focused on suspended sediment concentration (SSC) evolution at a single location near Surfside Beach and primarily used horizontal residual fluxes, the updated work introduces a transect-based framework using five strategically placed cross-shore and alongshore transects near the shoreline and bay inlet. This approach allows for a more detailed quantification of residual sediment fluxes, providing deeper insight into alongshore and onshore sediment delivery, retention patterns, and the efficacy of nourishment strategies.

Furthermore, the updated model corrects the sediment placement volume, reducing it from the previously assumed 180,000 m^3 to 30,000 m^3 in alignment with current Proposal estimates. It also incorporates new placement site scenarios, including Site 1 - southern location, Site 2 – central location, Site 3 - northern location, and a combination of Sites 1 and 2, under various environmental conditions. These additions offer a more realistic and comprehensive basis for evaluating the performance and environmental impact of proposed dredging and placement operations.

The modelling used in this updated work is based on the high-resolution 3D current–wave–sediment coupled numerical model originally developed by Yang et al. (2022) to investigate hydrodynamics and sediment dynamics in Batemans Bay. This model has been validated against observational datasets and its methodology peer-reviewed in the scientific literature (e.g., Yang et al., 2022; Deng et al., 2025). For this study, the model has been enhanced with a suspended sediment placement function to allow simulation of dredged material discharge and subsequent transport.

More detailed results, methods, and interpretations can be found in the accompanying report titled *Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study*. This additional modelling work is provided within Appendix A of this report.

4.1.2 Summary of additional assessment

The further technical analysis included as Appendix A to this report has demonstrated, through scenario-based numerical modelling, the effectiveness and strategic value of the Clyde River Bar Dredging 2025–2035 Proposal as a dual-purpose intervention for enhancing navigation safety and mitigating coastal erosion in Batemans Bay. By simulating a range of realistic environmental conditions and operational strategies, including wave-driven events, calm periods, and flooding scenarios, the model provides detailed insight into sediment transport pathways and their implications for shoreline nourishment, particularly at Surfside Beach.

The model confirms that dredged sediment released at offshore placement sites can be effectively transported toward the shoreline, with clear evidence of sediment retention along Surfside Beach under both wave-forced and calm conditions. Notably, long-term placement operations were found to significantly improve sediment delivery and retention compared to short-term events, highlighting the importance of sustained implementation. The modelling also reveals that site-specific strategies, such as using a single placement site, can optimise sediment transport by minimising hydrodynamic interference, offering practical opportunities for targeted nourishment.

In contrast, flooding scenarios led to substantial offshore sediment export and should be avoided to prevent sediment loss from the inner bay. The results underscore the importance of aligning placement activities with favorable environmental conditions and support the use of real-time forecasting to guide operational decisions.

Overall, the findings provide strong scientific support for the Clyde River Bar Dredging 2025–2035 Proposal as a well-founded and timely coastal management initiative. When implemented with adaptive planning and evidence-based strategies, the Proposal has the potential to deliver long-term benefits for both maritime infrastructure and shoreline resilience.

In addition to the above, in order to verify the accuracy of the above modelling and to facilitate consideration of any required changes to the works methodology, Transport now propose to implement a real time turbidity and current monitoring system for the full duration of dredge material placement operations. This additional monitoring will provide continuous data on sediment plumes, current-driven transport and potential deposition hotspots. These insights will assist to inform dredging operations and adaptive management and may also assist to inform future shoreline protection measures in Batemans Bay.

An indicative illustration of the turbidity and current monitoring meters is provided within Figure 2-2. The three strategic sites where monitoring is proposed is illustrated within Figure 2-3.

4.1.3 Revised dredged material placement safeguards and management measures

Additional and revised safeguards developed in response to the above environmental assessment are provided within Table 4-1 below.

Table 4-1: Additional and revised dredged material placement safeguards and management measures

Impact	Environmental safeguard	Responsibility	Timing	Reference
Dredged material placement	Dredged material placement planning should prioritise single-site placement to optimise beach nourishment outcomes.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
Dredged material placement	Where practical, undertake dredged material placement activities during calm weather conditions.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
Flood impact on sand placement	Dredged material placement is to be avoided during periods of riverine flooding.	Dredging Contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)

5. Environmental management

Section 7 of the REF identified the framework for environmental management, including safeguards and management measures that would be adopted to avoid or reduce environmental impacts. After consideration of the issues raised in the public submissions, these safeguard and management measures have been revised to include additional monitoring and review requirements.

Should the Proposal proceed, environmental management will be guided by the framework and measures outlined below.

5.1 Environmental management plans (or system)

A number of safeguards and management measures have been identified in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the Proposal. Should the Proposal proceed, these management measures would be incorporated into the detailed design and applied during the construction and operation of the Proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be reviewed prior to each dredging campaign and must be certified by Transport environment staff prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the Transport quality assurance framework applicable to each dredging campaign.

5.2 Summary of safeguards and management measures

The REF identified a range of environmental safeguards and management measures that would be required to avoid or reduce the environmental impacts of the Proposal.

After consideration of the issues raised in the public submissions, the environmental management measures for the Proposal (refer to Section 6 of the REF) have been revised. Should the Proposal proceed, the environmental management measures in Table 5-1 will guide the subsequent phases of the Proposal. Additional and/or modified environmental safeguards and management measures to those presented in the REF have been underlined and deleted measures, or parts of measures, have been struck out.

Table 5-1: Summary of environmental safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
1	Seagrass beds	Dredging and dredged material placement around seagrass beds will be avoided as much as possible in accordance with the *NSW Fisheries Management Act 1994.*	Dredging Contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
2	Impact to Ballast reef	Disposal of dredged material not to be undertaken within 50 metres of the known ballast reef.	Dredging Contractor	During each dredging campaign	Aquatic Ecology Assessment (Appendix D of REF)
3	Continued shoaling	Survey the channel annually to track and monitor changes to shoaling and buoyage placement.	Transport	Prior to each dredging campaign	*Marine NRMA and CCC consultations (see Sections 5.2 and 5.4* of REF*)*
4	Smothering of sensitive aquatic habitat	Placement of dredge material around sensitive aquatic habitat would be avoided though the establishment of project buffers. A buffer of 50m from the Ballast Reef and 500m from Cullendulla Creek.	Dredging contractor	During each dredging campaign	Aquatic Ecology Assessment (Appendix D of REF)
5	Slumping of dredge batters	To minimise the risk of slumping and impacting surrounding habitats and accelerate sedimentation within the navigation channel, all dredge-cut batters are to be no steeper than 1 in 4.	Dredging contractor	During each dredging campaign	
6	Sediment processes	Placement allocations will be designed such that the potential for the formation of new channels, bars or beach erosion is minimised.	Dredging contractor	Prior and during each dredging campaign	
7	Sediment processes	Numerical sensitivity tests will be undertaken prior to each dredging campaign. These tests will investigate the sediment impact of the proposed dredging and placement activities and determine the best approach for maximising sediment transport toward the target beaches to achieve optimised nourishment outcomes.	Transport for NSW	Prior to each dredging campaign	Hydrodynamic Modelling and Sediment Transport Analysis (Appendix F of REF)
8	Dredged material placement	Dredged material placement planning should prioritise single-site placement to optimise beach nourishment outcomes.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
9	Dredged material placement	Where practical, undertake dredged material placement activities during calm weather conditions.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
10	Flood impact on sand placement	~~In the event that a flood event is imminent, dredging and placement of dredged material will cease until the weather patterns return to those~~	~~Transport~~	~~Prior to and during each~~	~~Hydrodynamic Modelling and~~

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		~~simulated within through Hydrodynamic Modelling and Sediment Transport Analysis used to inform this REF (refer to Appendix F).~~ Dredged material placement is to be avoided during periods of riverine flooding.	Dredging Contractor	~~dredging campaign~~ During each dredging campaign	~~Sediment Transport Analysis (Appendix F)~~ Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
11	Sediment plumes	All efforts will be made to minimise the occurrence and extent of the sediment plumes throughout the works.	Dredging contractor	During each dredging campaign	*Australian and New Zealand Guidelines for Fresh & Marine Water Quality*
12	Monitoring protocols	A water quality management plan is to be prepared, including monitoring protocols, water quality objectives, water pollution prevention strategies and an emergency plan.	Dredging contractor	Prior to each dredging campaign	*Australian and New Zealand Guidelines for Fresh & Marine Water Quality*
13	PASS or AASS	Potential or actual acid sulfate soils will be managed in accordance with the Roads and Maritime Services and Guidelines for the Management of Acid Sulfate Materials 2005. The ASSMP is to include procedures for testing, material classification, treatment and disposal.	Dredging contractor	Prior and during each dredging campaign	*Roads and Maritime Services Guidelines for Management of Acid Sulfate Materials 2005*
14	Tides and vessel-passage	Vessels (including barges) are only to be used at suitable tides when no less than 600mm clearance is available between the vessel's underside and the waterway's bed.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
15	Hazardous materials	Refuelling plant and equipment and storing hazardous materials on barges will occur within a double-bunded area. All fuels, chemicals and liquids are to be stored in an impervious bunded area.	Dredging contractor	Prior to and during each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R3)*
16	Spill kit and bins availability	An emergency spill kit and bins will always be kept on all vessels and at the site compound, maintained throughout the work and appropriately sized for the volume of substances on the vessel.	Dredging contractor	During each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*
17	Spill kit type	Spill kits for construction barges must be specific for working within the marine environment.	Dredging contractor	During each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
18	Spill kit training	All workers will be advised of the location of the spill kit and trained in its use.	Dredging contractor	Prior to each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*
19	Incident reporting	If an incident (e.g. spill) occurs, the Roads and Maritime Services Environmental Incident Classification and Reporting Procedure is to be followed, and the Roads and Maritime Services Contract Manager is to be notified as soon as possible.	Dredging contractor	During each dredging campaign	*Environmental Incident Classification and Management Procedure 2018. RMS 17.374. Version 5.1*
20	Maritime spill	In the event of a maritime spill, the incident emergency plan will be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies.	Dredging contractor	During each dredging campaign	*Environmental Incident Classification and Management Procedure 2018. RMS 17.374. Version 5.1*
21	Emergency contacts	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, and the plant and site office. All workers will be advised of these contact details and procedures.	Dredging contractor	Prior to and during each dredging campaign	
22	Maintenance and inspection	Vehicles, vessels, and plant must be properly maintained and regularly inspected for fluid leaks and excessive emissions. Prior to entry into the waterway, machinery should be appropriately cleaned, degreased and serviced. If defects are identified, works are to cease pending rectification.	Dredging contractor	Prior to and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
23	Wash-down and re-fuelling	No vehicle or vessel wash-down or re-fuelling will occur on-site.	Dredging contractor	Prior to, during and after each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
24	Construction and Personnel waste	All construction and personnel waste will be disposed of appropriately.	Dredging contractor	During and after each dredging campaign	
25	Waste management	A waste minimisation hierarchy will be implemented: • Avoidance of waste production. • Treated and reused onsite. • Recycled. Disposed of in appropriate bins and a licensed waste management facility.	Dredging contractor	During and after each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
26	Vessel wastewater	Vessel wastewater will not be discharged into the environment. Wastewater will be disposed of at a site approved to receive vessel wastewater.	Dredging contractor	During and after each dredging campaign	
27	Noise and vibration	A noise and vibration management plan (NVMP) is to be developed as part of the construction environmental management plan (CEMP) for the project. The NVMP is to be reviewed and updated prior to each dredging campaign to ensure affected receivers are identified and notified in accordance with this REF prior to the commencement of any dredging campaign.	Dredging contractor	Prior to each dredging campaign	
28	Unused plant	Plant would be turned off when not in use.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
29	Standard work hours	Works are to be undertaken within standard working hours where possible. If work within standard working hours is not possible due to tidal conditions, etc, noise impacts are to be minimised in accordance with the Transport Noise Estimator Tool, including additional measures as applicable. Any works outside of standard working hours would be subject to approval from the relevant Transport representative.	Dredging contractor	During each dredging campaign	Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (N1)
30	Standard work hours	Works taking place in the evening (OOHW Period 1) require additional measures including periodic notification, verification monitoring, specific notification, and a respite offer.	Dredging contractor	Prior and during each dredging campaign	
31	Outside standard work hours	The community must be notified of all work outside standard hours, which has the potential to impact noise-sensitive receivers. Notification requirements must comply with the *RMS Construction Noise and Vibration Guideline.*	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
32	Outside standard work hours	Works taking place at night (OOHW Period 2) require additional measures including: periodic notification, verification monitoring, specific notification, respite period, and duration reduction.	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
33	Loading/ unloading locations	Loading and unloading of materials/deliveries is to occur as far away as possible from sensitive receivers.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
34	Shielding of loading/ unloading	Dedicated loading/unloading areas are to be shielded if close to sensitive receivers.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
35	Laydown area location	The laydown area is to be located away from sensitive receivers where practical.	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
36	Cleanliness each day	Laydown area is to be kept clean, tidy, and rubbish-free at all times.	Dredging contractor	During each dredging campaign	
37	Cleanliness for each campaign	All site materials, plant, machinery and storage are to be removed from the laydown site and waterway at the end of each campaign.	Dredging contractor	Prior, during and after each dredging campaign	
38	BAP adherence	Adhere to the Benthic Assessment Procedure (BAP) developed for the project (Appendix D), which identifies the requirements and procedures for the 10-year approval, including the completion of a Marine Habitat Survey prior to each dredging campaign, reporting and further assessment requirements, consultation requirements, triggers for Species Impacts Statements and management plans and any permits and offsetting.	Dredging contractor	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
39	Marine Habitat Survey	A Marine Habitat Survey is to be conducted prior to each dredging campaign to identify the potential to impact on any threatened species under the FM Act and to update the distribution of ecologically significant habitats (e.g. seagrasses, macroalgae stands, soft coral communities). These distribution maps of ecologically sensitive habitats are to be prepared for incorporation into the project CEMP or equivalent that identify habitat boundaries and required buffers. *A Marine Habitat Survey will not be required within 12 months for areas considered as part of this initial assessment.*	Transport	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
40	Soft sediment communities	A monitoring program to measure ecological recovery of soft sediment communities within the subtidal Placement Areas is recommended and pre-dredging data obtained within three months of commencing dredging works. This data should include: • Measurement of infauna assemblages, diversity and abundance using replicated sampling to account for spatial variability (Min n = 4) at each site.	Dredging contractor	Prior to each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Measurement of key sediment characteristics TOC and PSD at each site. • Sampling of a minimum of two impact (within each Placement Area) and two appropriate control sites.			
41	*P. australis* occurrence	The CEMP or equivalent document should include information to assist in identifying the threatened *P. australis* communities. Locations where these species are located are to be avoided during dredging and placement activities.	Dredging contractor	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*
42	DPIRD - Fisheries permit	A section 199 notification must be issued prior to each dredging campaign. A section 205 permit should be applied for, and associated notification issued where identified within the Marine Habitat Survey or requested by NSW DPIRD Fisheries.	Dredging contractor	Prior to each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994*
43	DPIRD - Batemans Marine Park Permit	As the Proposal would be undertaken within the Batemans Marine Park, a permit will be required prior to the commencement of the activity.	Transport	Prior to each dredging campaign	*Marine Estate Management Act 2014* and Marine Estate Management (Management Rules) Regulation 1999
44	Reef Buffer	Sand placement must not occur within 50m of the ballast reef.	Dredging contractor	During each dredging campaign	
45	Sanctuary Zone (SZ)	Sand placement must not occur within 500m of the Cullendulla Creek SZ.	Dredging contractor	During each dredging campaign	
46	Works around seagrass beds	No works, including vessel launching, beaching, or any operation or laying of pipes, will occur within 50 m of any seagrass beds outside the navigational channels.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994*
47	Sand placement around seagrass beds	Sand placement via a hopper will not occur within 100 m of any seagrass beds.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
48	Discovery of threatened species	If any unexpected threatened species (e.g. White's Seahorse, Cauliflower Soft Coral) are seen within 10 m of any works, works must stop immediately, and a marine ecologist should be notified. The marine ecologist and project team must consult with DPIRD Fisheries to assess appropriate management actions, referring to the BAP.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
49	Mooring or beaching around marine vegetation	No mooring or beaching of vessels is to occur within any seagrass areas or any other marine vegetation.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat (2013)*
50	Fur seals	The NSW NPWS Guidelines for approach distance to fur seals (see Appendix D) must be adhered to at all times. Should this not be possible, the project ecologist and NPWS must be notified immediately.	Dredging contractor	During each dredging campaign	*NSW NPWS Guidelines for developments adjacent to national parks and other reserves 2020*
51	Dredge pipes	No dredge pipes are to be placed over seagrasses or rocky intertidal or subtidal areas.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994*.
52	Storing of hydrocarbon-based products	Avoid storing hydrocarbon-based products on any water sites within the Proposal area. Storage should be in a suitable bunded area within the site laydown area.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
53	Dredge plume monitoring	Visual and turbidity monitoring of dredge pluming should be undertaken as part of standard water quality monitoring during dredging works.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
54	Hydrocarbon boom placement	Where practical, floating containment booms should be in place around machinery operating on or over water to control any unplanned spills of hydrocarbons.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
55	Hydrocarbon storage	Hydrocarbons are to be stored in a bunded area with adequate spill kits available.	Dredging contractor	During each dredging campaign	*Safe work NSW Storage and Handling of Dangerous Goods Code of practice*
56	*C. taxifolia* introduction and the cleaning of equipment	All equipment to be brought to the proposal area must be thoroughly cleaned and free of substrate to avoid the introduction of species such as *C. taxifolia*. Given the potential for *C. taxifolia* in nearby areas, equipment should be thoroughly cleaned following the completion of the project to prevent the spread of the species to other areas.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
57	*C. taxifolia* discovery	If *C. taxifolia* is found within the proposal area, it should be avoided and not disturbed to minimise further spread to other areas of the Proposal area. If dredging vessels or equipment are found to have caught *C. taxifolia* during works, they should be thoroughly cleaned with fresh water, with all bota safely disposed of on land.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
58	Marine flora, fauna, infauna and habitats	All materials, machinery and rubbish must be removed from the site.	Dredging contractor	After each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
59	Marine flora, fauna, infauna and habitats	Regular inspections of the site are to be undertaken by the Transport Environment Officer or Project Manager.	Dredging contractor	After each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994*.
60	Marine flora, fauna, infauna and habitats	Any notification requirements of the section 199 or 205 permits must be filled and submitted.	Dredging contractor	After each dredging campaign	*FM Act 1994*
61	Updated mapping	For future dredging works scheduled to occur greater than 12 months following completion of the site surveys done as part of the 2024 AEA, the mapping of sensitive habitats (seagrass beds, macroalgae stand and soft coral communities) will need to be updated for inclusion into an updated version of the CEMP.	Dredging contractor	After each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
62	Public communication	Notification is to be given to affected community members before the work occurs. The notification is to include: • Details of the proposal. • Duration of work and working hours. • Changes to traffic or access. • Lodging a complaint or obtaining information. Contact information.	Transport	5days prior to commencement of works	
63	Recording complaints	All complaints are to be recorded on the complaints register and attended to promptly.	Dredging Contractor/ Transport	During each dredging campaign	
64	Ancillary facility footprint	The footprint of the ancillary facility will be minimised where possible.	Dredging contractor	Prior and during each dredging campaign	
65	Pedestrian access	Pedestrian access to the foreshore will be maintained.	Dredging contractor	Prior and during each dredging campaign	
66	Permit for ancillary facility	A permit will be sought from the Eurobodalla Shire Council to use the ancillary facility area as required.	Dredging contractor	Prior and during each dredging campaign	
67	Disturbance to existing vessel movements	Where possible, existing vessel movements (recreational) will be maintained during dredging works. Any disturbance to recreational users is to be minimised as much as practicable.	Dredging contractor	Prior and during each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
68	On-water Traffic	A Marine Traffic Management Plan (MTMP) is to be submitted to Transport Maritime (Maritime South) for review and comment a minimum of 6 weeks prior to any works commencing. This MTMP will include provision for one navigable channel to be open at all times unless otherwise approved by Transport Maritime (Maritime South).	Dredging contractor	Prior to each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
69	Navigation markers, warnings, lighting and signage	In accordance with the MTMP, appropriate navigation markers, warnings, lighting, and signage will be installed to restrict access to dredge and placement areas, locations of pipeline and dredge. These markers will include: • Navigation channel lateral marks. • Channel blocked/closed signals. • Navigation marks or signage required by NSW Maritime to ensure the safe and efficient operation of the navigation channel or channels through or around the works and temporary removal, relocation, or covering of any existing contradictory or superfluous signs, buoyage or navigation marks. The contractor must also ensure that these protocols are being followed: • Always maintaining a radio listening watch on VHF channel 16 by the dredge master. • Reporting any marine pollution resulting from a work vessel to the Senior Boating Safety and Transport by phoning 13 12 36. • Notifying NSW Maritime if the proposal duration is to be extended. • Removing all items, including vessel, plant, machinery and auxiliary equipment from NSW State Waters on completion of the works unless they otherwise hold an appropriate licence. All operators and vessels (including the dredge) used in this operation must comply with the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, including strict adherence to International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) System regarding day shapes and night lights. No agent shall be exempted from the provisions of the *Marine Safety Act 1998* or any other relevant legislation.	Dredging contractor	Prior to each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
70	Compliance of vessels	All work vessels will comply with the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, the *Marine Safety Act 1998*, and all relevant subordinate legislation.	Dredging contractor	Prior and during each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
71	Preventing collisions via COLREGS	All work vessels will exhibit lights and shapes in accordance with *International Regulations for Preventing Collisions at Sea 1972* (COLREGS).	Dredging contractor	During each dredging campaign	*International Regulations for Preventing Collisions at*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					Sea 1972 (COLREGS), Rules 20-30.
72	Marking equipment to reduce risk to vessels	All pipes and associated equipment that will restrict or vary existing navigation conditions will be clearly marked, including the use of lights at night, to reduce the risk to vessel navigation and safety. Appropriate markings shall be identified within the MTMP.	Dredging contractor	Prior and during each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
73	Discovering Aboriginal objects	If any potential Aboriginal objects (including skeletal remains) are discovered during the Proposal, all work near the find will cease. Steps in the TfNSW *Standard Management Procedure: Unexpected Heritage Items* must be followed.	Dredging contractor	During each dredging campaign	TfNSW (2021) *Unexpected Heritage Items*
74	Changes to proposal	If the proposal's scope changes, the relevant Transport for NSW Aboriginal Community and Heritage Officer (ACHO) will be contacted.	Dredging contractor	Prior to each dredging campaign	
75	Changes to proposal	If the proposed spoil placement area were to change, updated modelling information is to be provided to DPIRD to ensure that spoil will not move into Cullendulla Creek or harm sensitive habitats within Batemans Bay.	Dredging contractor	Prior to any change in spoil placement area	
76	Awareness of highly sensitive areas	Due to the type of Aboriginal sites within the vicinity of the Proposal area, this area is regarded as highly sensitive. Staff undertaking work will be made aware of all Aboriginal sites within the vicinity of the proposal area to ensure these sites are not impacted.	Dredging contractor	Prior to each dredging campaign	*NPW Act 1974, section 90*
77	Unexpected heritage items	If unexpected heritage items are uncovered during the works, all works will cease in the vicinity of the material/find and the steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* will be followed. Transport Senior Environment Specialist - Heritage will be contacted immediately of an unexpected find.	Dredging contractor	During each dredging campaign	*Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items*
78	Changes in the bathymetry of Clyde River Bay following significant weather events	Undertake hydrographic surveys after significant weather events to assess changes in bathymetry of the dredging footprint.	Transport	After significant weather events	*NSW Marine Estate Management Strategy 2018-2028*
79	Changes in the bathymetry of Batemans Bay	Undertake hydrographic surveys prior to dredging.	Transport	Prior to each dredging campaign	*NSW Marine Estate Management Strategy 2018-2028*
80	Traffic and parking	The Proposal project manager will liaise with Eurobodalla Shire Council and/or Transport Maritime to ensure that project schedules for upgrades to nearby public infrastructure are known.	Transport	Prior to each dredging campaign	*Cumulative Impact Assessment*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Works will be staged so that upgrades and dredging activities are, where practicable, not being undertaken concurrently.			*Guidelines for State Significant Projects*
81	Monitoring and review	A turbidity and current monitoring system is to be implemented to verify the accuracy of project sediment modelling and to facilitate consideration of any required changes to the works methodology.	Transport	Each dredging campaign	*Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)*
82	Monitoring and review	Consideration is to be given to providing pre and post dredging surveys to the Australian Hydrographic Office.	Transport	Following each dredging campaign	
83	Navigation	The alignment of navigation leads in relation to the intended navigation channel is to be assessed prior to each dredging campaign. Adjustment of leads or the dredge design should be made as required to ensure alignment of these navigational features.	Transport	Prior to each dredging campaign	
84	Environmental Assessment	A Due Diligence Environmental Assessment (refer to Appendix B) is to be prepared prior to each dredging campaign to identify and address any changes to the environment or statutory requirements from those listed in the Determined REF and this Submissions Report.	Transport	Prior to each dredging campaign	
85	Management Plan Referral	DPIRD is to be provided with copies of the Water Quality Management Plan and CEMP prior to each dredging campaign.	Dredging contractor	Prior to each dredging campaign	
86	Marine Vegetation Surveys and Offsets	DPIRD is to be provided with pre-works ecology surveys as they are completed to ensure no harm to marine vegetation is anticipated. If seagrass or any marine vegetation is likely to be negatively impacted to a degree that cannot be mitigated, environmental compensation at a rate of 2:1 habitat offset requirement and a permit to harm marine vegetation under section 205 of the Act would be required before works commence.	Dredging contractor	Prior to each dredging campaign	

5.3 Licensing and approvals

Required licences and approvals in relation to the Proposal are listed and described in Table 5-2 below. All licences and approvals listed below must be checked for validity prior to each dredging campaign (also refer to Appendix B of this report).

Where any particular licence or approval cannot be obtained for the 10 year period, new licences and/or approvals as required must be obtained prior to works. The duration of each licence and approval would be confirmed upon initial issue and the table below may be updated accordingly.

Table 5-2: Summary of licensing and approval required

Instrument	Requirement	Timing
Marine Safety Act 1998 (section 18)	The Proposal is an aquatic activity as it would be undertaken on navigable waters and would temporarily restrict the availability of those waters for normal use by the public. As such, the Proposal requires Transport (Maritime Operations) approval.	Prior to the start of the Proposal
Marine Estate Management (Management Rules) Regulation 1999 – Clauses 1.16 and 1.22	Marine Park Permit to interfere with habitat in the Habitat Protection Zone (Clause 1.16) and the Special Purpose Zone (Clause 1.22).	Prior to start of the activity
Crown Land Management Act 2016 (Division 3.4, 5.5 and 5.6)	Lease or licence to occupy areas of Crown land, including the proposed ancillary facility site. Note: Work on Crown land triggers the requirement for a 24KA notice under the *Native Title Act 1993*.	Prior to start of the activity

6. References

Deng, Y., Wang, X.H., Li, Z., Wang, Y. and Yang, G., High-Frequency Water-Level Oscillations in a Semi-Enclosed Embayment. Available at SSRN 5189590. Submitted to *Estuarine, Coastal and Shelf Science*.

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Wang, A., Wang, X.H. and Yang, G., 2021. The Effects of Wind-Driven Storm Events on Partly Sheltered Estuarine Beaches in Batemans Bay, New South Wales, Australia. Journal of Marine Science and Engineering, 9(3), p.314.

Yang, G., Wang, X.H., Zhong, Y. and Oliver, T.S., 2022. Modelling study on the sediment dynamics and the formation of the flood-tide delta near Cullendulla Beach in the Batemans Bay, Australia. *Marine Geology*, *452*, p.106910.

Appendix A: Impacts of Dredging on Sediment Dynamics in Batemans Bay NSW: A Modelling study

Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study

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Executive Summary

The Clyde River Bar Dredging 2025–2035 Project is a strategically important initiative that addresses two critical challenges in Batemans Bay: the need for safe maritime navigation through the Clyde River Bar and the ongoing coastal erosion at Surfside Beach. This long-term program integrates navigation safety with shoreline nourishment, aiming to deliver sustainable benefits over a ten-year period. In particular, Surfside Beach has experienced alarming shoreline retreat in recent years, with erosion threatening residential properties, public infrastructure, and environmental assets. The Clyde River project represents a timely and well-justified intervention that combines coastal engineering with adaptive sediment management.

This modelling study assesses the effectiveness of proposed dredging and offshore sediment dumping operations in delivering nourishment to Surfside Beach under varying hydrodynamic and environmental conditions, which are represented through fourteen carefully designed scenarios. Using a validated high-resolution 3D coupled wave–current–sediment model, these scenarios were simulated under a range of environmental and operational conditions, including storm events, flooding, and different dumping configurations.

The model results highlight the strong potential of the Clyde River Bar Dredging 2025–2035 Project to enhance onshore sediment transport. Whether under wave-forced or calm conditions, sediment is effectively delivered toward Surfside Beach. In particular, during both the 4-week and 8-week calm scenarios, sediment continues to move shoreward, with notable retention along the erosion-prone eastern section of the beach. In contrast, flooding events were shown to significantly increase offshore sediment export, making them unsuitable for active dumping operations. The modelling also indicates that scenarios using a single dumping site often result in more concentrated and effective sediment delivery, providing a viable strategy for targeted nourishment. Furthermore, long-term simulations demonstrate that extended dumping operations contribute substantially more to shoreline replenishment than short-term

events, underscoring the value of sustained implementation throughout the project duration.

Overall, this report provides strong evidence in support of the Clyde River Bar Dredging 2025–2035 Project's preferred placement of dredged material in the offshore zone. The modelling confirms that, with appropriate timing and site management, dredged sediment can be effectively retained within the inner bay and directed through natural littoral processes toward Surfside Beach to aid in the renourishment of this erosion-prone beach and dune system. The project stands as a well-founded and practical solution to the dual challenges of maintaining navigational access and protecting vulnerable coastal zones. Continued investment and adaptive planning will be key to maximising the environmental and social benefits of this initiative.

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1 Introduction

1.1 Background

Batemans Bay (Figure 1.1), located on the south coast of New South Wales, is a semi-enclosed, funnel-shaped estuary influenced by waves, tides, and freshwater input from the Clyde River. The region experiences significant seasonal variations in wave height and sediment transport, shaping its dynamic coastal environment.

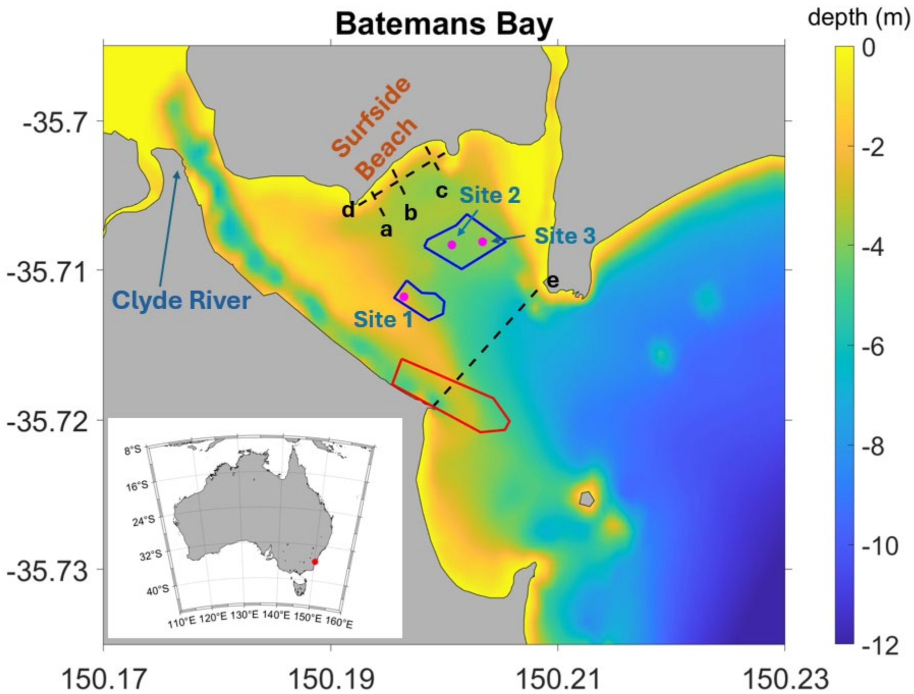

Figure 1.1 Map of Batemans Bay. The red polygon indicates the proposed dredging location; the blue polygons represent the proposed offshore dumping areas; the magenta points mark the specific dumping sites defined in the model — Site 1 (left), and Site 2 and Site 3 (right); and the black dashed lines, labelled a to e, denote the transects used for model results analysis. The scale on the right-hand side of the figure denotes water depth relative to the Australian Height Datum (AHD), which approximates mean sea level.

At the entrance to the Clyde River, the Clyde River Bar forms a shallow channel that restricts safe navigation for vessels. To address this, Transport for NSW has initiated the Clyde River Bar Dredging 2025–2035 Project, a long-term sediment redistribution program aimed at maintaining a navigable channel with adequate depth and width over ten years. Dredging will be carried out within the navigation channel (denoted by the red polygon in Figure 1.1), and the excavated material will be transported to designated offshore dumping sites (denoted by the blue polygons in Figure 1.1) to support shoreline nourishment. The dredging activities in 2025 are proposed to be conducted in August and last for about 3 to 8 weeks.

One of the key beneficiaries of this program is Surfside Beach, which has experienced severe coastal erosion in recent years. In some locations, the shoreline has retreated to within 30 metres of residential properties, with some yards visibly affected by wave action and erosion — including exposed tree roots and seawater-washed debris scattered across private land. This ongoing erosion poses a threat to infrastructure, public safety, and property values. Additionally, the erosion has exposed buried utilities and compromised the integrity of protective dune systems, raising growing concern among local residents, the council, and environmental authorities. These issues are particularly pronounced along the eastern section of Surfside Beach, where shoreline retreat is more severe, making it a focal point for community and management concerns. By combining navigation safety improvements with strategic dredge disposal placement, the Clyde River Bar Dredging 2025–2035 Project aims to deliver dual benefits: maintaining safe maritime access and aiding in the renourishment of the erosion-prone Surfside Beach.

This study supports the implementation of Action CH1_L from the Eurobodalla Open Coast Coastal Management Program (CMP), which recommends opportunistic beach nourishment at northern Batemans Bay beaches — including Surfside Beach and Long Beach — when dredging is undertaken in the Clyde River for navigational purposes. The CMP identifies beach erosion as a key coastal threat and proposes that navigational dredging operations be used as opportunities to deliver sediment nourishment to these vulnerable shorelines. This modelling study provides an essential foundation for evaluating and guiding such nourishment actions, by simulating sediment behaviour under realistic operational and hydrodynamic conditions. In doing so, it helps assess the feasibility and strategic alignment of opportunistic dredging-based nourishment as outlined in CMP, and provides a science-based framework to inform future environmental approvals and management planning.

Compared to the conceptual sediment models for Batemans Bay (WRL, 2017; Rhelm, 2021), which are descriptive and focus on broad patterns of sediment transport, the Batemans Bay sediment dynamics model (BB sediment model) represents a significant advancement in sediment transport modelling. It fully integrates wave, current, and sediment dynamics, capturing complex interactions critical for accurate simulations. While the conceptual model assumes hydrodynamic and sediment transport processes remain constant over time and in two dimensions, the BB sediment dynamics model is a three-dimensional model, realistically forced by all forcings including tides, river inflows, waves, atmospheric forcing (wind, heat fluxes, and air pressure) and open ocean processes such as the Eastern Australian Current. As such, this model dynamically accounts for changes due to extreme weather events or human activities.

Additionally, it has been rigorously validated with observational data and published in high-impact journals, ensuring its credibility. This advanced framework supports detailed scenario-based planning, making it an essential tool for effective sediment management and coastal resilience in dynamic estuarine environments.

1.2 Project Overview

This modelling study evaluates the impacts of dredging and offshore dumping activities associated with the Clyde River Bar Dredging 2025–2035 Project on sediment transport in Batemans Bay. A particular focus is placed on assessing how effectively the dredged sand, once dumped offshore, is transported toward Surfside Beach — a key target area for shoreline nourishment under the various scenarios investigated.

By simulating the coupled hydrodynamic and sediment transport processes, the study aims to inform the planning and timing of dredging operations, support adaptive coastal management, and guide future beach nourishment strategies. While focused on Batemans Bay, the modelling approach and insights gained have broader relevance to similar wave-dominated coastal environments.

Expected outcomes include a refined numerical modelling framework, improved understanding of sediment dynamics in response to dredging, and practical recommendations to enhance the long-term sustainability of dredging and shoreline protection efforts.

1.3 Hydrodynamics and Sediment Dynamics in Batemans Bay

Previous studies (e.g., Yang et al., 2022) developed a high-resolution, 3D coupled current–wave–sediment model for Batemans Bay, simulating hydrodynamics and sediment dynamics during both summer and winter 2018. These simulations revealed that wave action is the dominant force driving water circulation and sediment resuspension in the bay, with tidal forcing playing a secondary role (Wang and Yang, 2022).

Batemans Bay receives offshore swells primarily from the southeast. These swells propagate into the bay, generating nearshore currents that strongly influence sediment transport and erosion, particularly under high-energy wave conditions. In summer, the region experiences more frequent and intense storm-driven waves, which generate strong bottom stresses and wave-induced currents, enhancing sediment resuspension and transport toward the inner bay.

One of the key sediment transport pathways involves movement toward the wave shadow shoal (WSS) near Cullendulla Beach, where increased wave activity promotes onshore sediment flux from outer bay regions. This results in a clockwise sediment circulation around the tidal inlet and the formation of localized eddies in the inner bay. Sediment tends to accumulate in sheltered zones where wave energy diminishes, contributing to seasonal build-up within the WSS.

In contrast, winter conditions feature reduced wave heights, leading to lower bottom stress and weaker sediment transport. While the overall transport patterns remain similar to those in summer, their magnitudes are significantly diminished, resulting in less erosion and deposition across the bay.

1.4 Modelling Objectives and Scope

The primary objective of this modelling study is to assess how dredging and offshore dumping activities associated with the Clyde River Bar Dredging 2025–2035 Project influence sediment transport pathways in Batemans Bay, with a particular focus on the potential delivery of dredged sediment to Surfside Beach for shoreline nourishment.

To achieve this, a series of numerical scenarios were designed to isolate the effects of key factors, including wave forcing, river flooding, dumping site selection, and dumping duration. These scenarios simulate both short-term events (e.g., storms and floods) and long-term operations, reflecting realistic environmental conditions observed in 2022. The simulations provide insight into sediment behaviour under a range of physical forcings and operational strategies.

The modelling approach is designed to inform operational decisions, optimise dredging strategies, and minimise environmental risks, while also contributing to a transferable framework for sediment management in similar wave-dominated estuarine environments.

2 Numerical Modelling Setup

The Batemans Bay sediment dynamics model (BB sediment model) is a fully integrated system that couples wave, current, and sediment transport processes, enabling simulation of the complex interactions that govern estuarine dynamics. The model is capable of dynamically representing responses to extreme weather events and anthropogenic activities, providing a robust platform for scenario-based analysis.

This modelling framework has been rigorously validated against observational datasets and its methodology peer-reviewed in scientific literature (e.g., Yang et al., 2022, Deng et al., 2025), enhancing its reliability and scientific credibility. Its ability to simulate sediment behaviour under various environmental conditions makes it a valuable tool for informed sediment management, dredging planning, and improving coastal resilience in dynamic, wave-dominated estuarine systems.

2.1 Model Description

This study employs the Finite-Volume Community Ocean Model (FVCOM) to simulate the hydrodynamics and sediment dynamics of Batemans Bay. FVCOM is a three-dimensional, free-surface, primitive-equation ocean model developed by Chen et al. (2003), designed specifically for simulating coastal and estuarine systems with complex bathymetry and irregular coastlines. One of FVCOM's key strengths lies in its use of unstructured triangular grids, which allows flexible and high-resolution representation of intricate shoreline features, tidal inlets, and shallow water environments — conditions characteristic of Batemans Bay. Its finite-volume framework ensures strong conservation of mass, momentum, and tracers (e.g., salt and heat), while maintaining computational efficiency. The model applies a terrain-following sigma-coordinate system in the vertical direction, with five uniform layers used in this study to accommodate the relatively shallow depths in the bay. Vertical and horizontal mixing are parameterized using the Mellor and Yamada (1982) Level 2.5 turbulent closure scheme and the Smagorinsky (1963) formulation, respectively — standard approaches that provide robust turbulence representation in coastal models.

To incorporate wave-induced processes, FVCOM was fully coupled with the Simulating Waves Nearshore (SWAN) model, forming the FVCOM-SWAVE system. This integration enables the inclusion of wave radiation stress gradients in the hydrodynamic momentum equations, accounting for wave–current interactions that are especially critical in wave-dominated environments like Batemans Bay. For sediment transport, the model employs the FVCOM-SED module, which is based on the USGS Community Sediment Transport Model (CSTM). This module has been widely applied in various coastal studies and allows for dynamic simulation of erosion, deposition, and resuspension under varying hydrodynamic conditions.

2.2 Boundary Conditions and Forcings

The model domain covers Batemans Bay and adjacent shelf waters (Figure 2.1, from Yang et al., 2022), with grids constructed using the Surface-water Modelling System (SMS). Coastline data was extracted from Google Earth (2020), while bathymetry within the bay (5 × 5 m resolution) was sourced from the NSW Government's 2018 marine LiDAR dataset. Outside the bay, bathymetry was derived from the ETOPO1 Global Relief Model (1 arc-minute resolution). The unstructured mesh resolution ranges from 20 m nearshore to 3300 m at the open boundary, and a uniform sigma-stretched vertical coordinate with five layers was applied.

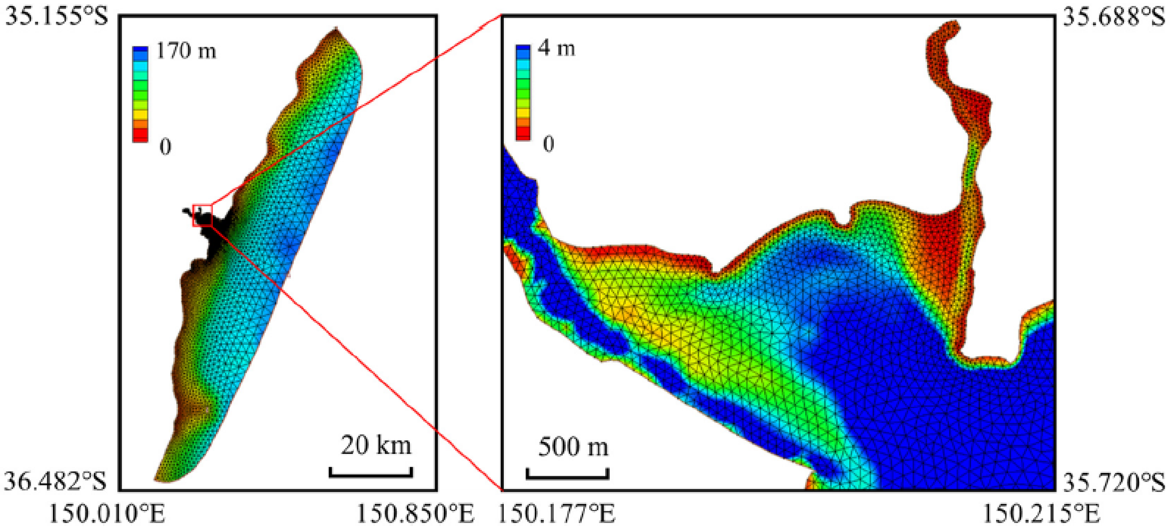

Figure 2.1 Grids of the model domain for Batemans Bay, from Yang et al. (2022)

The model was forced by a combination of tides, waves, atmospheric fluxes, river discharge, and open boundary conditions, as detailed below:

- Tidal forcing at the open boundary were obtained from TPXO 9.3 (0.25° resolution), including 13 constituents:
    - Diurnal: K_1, O_1, P_1, Q_1
    - Semidiurnal: M_2, S_2, N_2, K_2
    - Shallow-water: M_4, MS_4, MN_4
    - Long-period: Mf, Mm
- Open boundary conditions, including sea surface height, salinity, and currents, were derived from the HYbrid Coordinate Ocean Model (HYCOM), representing large-scale oceanic influences such as the East Australian Current.
- Wave forcing at the boundary was provided by the global NOAA Wave Watch III (WWIII) model, and wave processes were handled through coupling with the SWAN module within the FVCOM-SWAVE system. Relevant wave model settings follow the SWAN manual and prior studies (e.g., van der Westhuysen et al., 2012; Jiang et al., 2022).
- Atmospheric forcing (wind, heat fluxes, and air pressure) was sourced from the Climate Forecast System Reanalysis (CFSR v2) dataset.
- Freshwater input from the Clyde River was included using daily discharge data from WaterNSW (https://realtimedata.waternsw.com.au/).

The model assumes no sediment input across the open boundary. At the sea surface, net heat flux is set to zero, and adiabatic conditions are applied for heat and salt fluxes at the seabed. More detailed information about the model configuration can be found in Yang et al. (2022).

To isolate the effects of dumped sediment, bottom sediment resuspension was disabled in the model. Two representative dumping sites (Site 1 and Site 2, marked by magenta points in Figure 1.1) were selected within the proposed offshore disposal areas, where continuous suspended sediment input was applied at the surface to simulate the release of dredged sand into the water column. An additional dumping site (Site 3), located within the same proposed disposal zone as Site 2, was included in selected scenarios to explore sensitivity to alternate placement configurations. All scenarios have run for 10 days to warm up.

2.3 Scenario Design

A series of fourteen model scenarios were developed to evaluate the influence of dredging and offshore dumping activities on sediment transport in Batemans Bay under a range of environmental and operational conditions. Scenario 1 serves as the baseline, representing conditions without any dumping activity. These include short-term sensitivity tests around storm (9-11 July 2022) and flooding (7-9 April 2022) events, and long-term operational scenarios (4 to 8 weeks, 1 Aug-25 Sep 2022) aligned with proposed dredging timelines. All scenarios were based on observed 2022 conditions, used as a representative proxy. In all model runs, the Clyde River was configured as a continuous source of freshwater and suspended sediment, simulating natural riverine contributions to the bay in addition to any dredged material inputs. Dumping was primarily configured at Site 1 and Site 2, consistent with the proposed offshore placement strategy, while Site 3 — located farther offshore within the northern (right-hand) proposed dumping area — was included for sensitivity testing of alternate configurations within the same area.

Short-Term (3-Day) sensitivity scenarios focus on storm-driven and flood-driven responses, isolating the effects of wave forcing and dumping locations, whereas long-Term (4 – 8-Week) operational scenarios reflect the proposed dredging and dumping schedule, listed in Table 2.1.

Table 2.1 Model Scenario Descriptions

Scenario	Description
A. Short-Term (3-Day) Sensitivity Scenarios	
1	9 –11 July 2022 storm event, without dumping activities (baseline)
2	9 –11 July 2022 storm event, with dumping at Sites 1 and 2 under realistic wave conditions
3	Same as Scenario 2, but without wave forcing

4	7 – 9 April 2022 flooding period, with dumping at Sites 1 and 2 under realistic wave conditions
5	Same as Scenario 2, but dumping only at Site 1
6	Same as Scenario 2, but dumping only at Site 2
7	Same as Scenario 2, but dumping only at Site 3
8	Same as Scenario 3, but dumping only at Site 1
9	Same as Scenario 3, but dumping only at Site 2
10	Same as Scenario 3, but dumping only at Site 3
B. Long-Term Operational Scenarios	
11	1 – 28 August 2022 (4-week period), with dumping at Sites 1 and 2 under realistic wave conditions
12	Same as Scenario 11, but without wave forcing (calm conditions)
13	1 August – 25 September 2022 (8-week period), with dumping at Sites 1 and 2 under realistic wave conditions
14	Same as Scenario 13, but without wave forcing (calm conditions)

By comparing the results across these scenarios, the modelling framework enables a systematic assessment of individual factors — such as wave forcing, flooding events, dumping site selection, and dumping duration — on the spatial and temporal distribution of suspended sediments.

The impacts isolated through controlled scenario comparisons are presented, allowing for targeted analysis of:

- Wave-induced residual currents and sediment transport
- Sediment responses during river flooding events
- The relative effectiveness of different dumping site locations
- Differences between short-term storm-driven dumping and long-term operational disposal

2.4 Transect design

To quantitatively evaluate sediment transport and deposition patterns, five transects (labelled a to e, shown in Figure 2.2) were defined within the model domain.

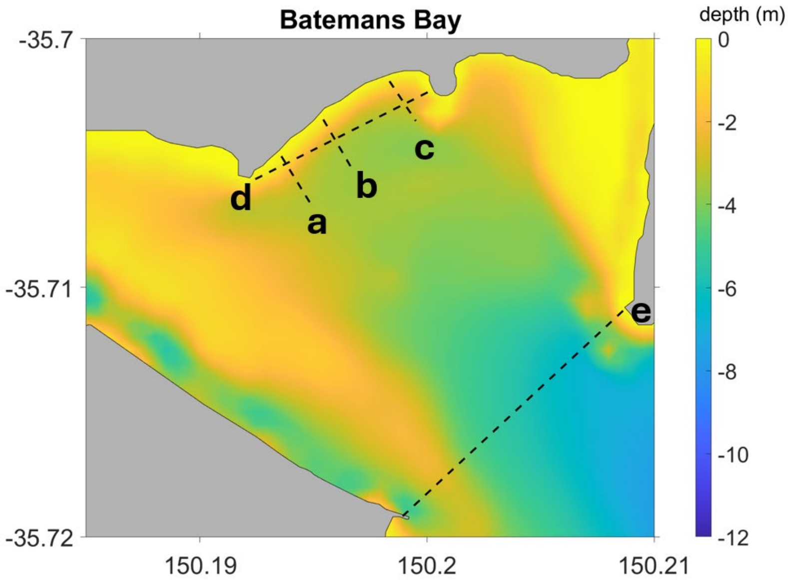

Figure 2.2 Positions of **Transect a** to **e** in Batemans Bay

- **Transects a** to **c** are positioned perpendicular to the shoreline, extending from the beach into the nearshore zone. These cross-shore transects are distributed from west to east, capturing spatial variation in alongshore sediment movement and accumulation.
- **Transect d** runs along the shoreline of Surfside Beach and is used to assess sediment flux towards the beach. While portions of the transect extend up to 150 m offshore, the nearshore region within 100 m is most relevant to Action CH1_L of the CMP, which recommends sediment placement within this distance for effective nourishment.
- **Transect e**, located at the tidal inlet connecting the inner and outer bay, is designed to estimate the proportion of dumped sediment that remains within the inner bay.

This transect-based approach enables detailed analysis of sediment fluxes and depositional trends, supporting the evaluation of how effectively dredged material is transported toward and retained within the intended nourishment area.

2.5 Sediment calculations

To assess sediment transport across the defined transects, net sediment flux is calculated, which reflects the net movement of sediment over time after filtering out tidal fluctuations.

Instantaneous sediment flux

The instantaneous sediment flux F represents the mass of suspended sediment transported through a vertical section per unit area per unit time. It is defined as:

$$F = u \times c \qquad \text{(Eq. 2.1)}$$

where *u* is the velocity component normal to the transect, *c* is the suspended sediment concentration (SSC)

Net sediment flux

To isolate long-term trends and eliminate the effects of tidal oscillations, net sediment flux NF is calculated by averaging the instantaneous flux over complete tidal cycles spanning the dumping period (e.g., 3 days or 8 weeks):

$$NF = \frac{1}{T}\int_0^T F(t)dt \qquad \text{(Eq. 2.2)}$$

where *T* is the duration of the full tidal cycles used.

Sediment volume

The overall volume of sediment transported across a transect, V, is then estimated by integrating the net flux over the transect area and converting mass to volume:

$$V = \frac{1}{\rho_s}\int NF(A)dA \qquad \text{(Eq. 2.3)}$$

where ρ_s is the density of dredged sediment, *A* is the transect area.

While net fluxes are valuable for identifying the net direction and intensity of sediment movement, the integrated sediment volume across a transect may exceed the actual amount of sediment dumped. This occurs because the flux method accounts for all sediment passing through the transect, including instances where the same sediment crosses multiple times, such as during tidal reversals or within recirculating flows. As a result, the computed volume reflects overall transport activity, rather than a one-way delivery of sediment. Nevertheless, net fluxes remain meaningful for comparing different scenarios under similar hydrodynamic conditions, offering insight into relative sediment mobility and system response.

3 Wave and Flooding Event Impacts on Residual Currents

Residual currents refer to the time-averaged water motion over a given period after filtering out oscillatory components such as tides and waves. These currents are crucial in estuarine and coastal systems, as they govern the net transport of water masses and suspended sediments over time. Unlike tidal currents, which typically reverse direction every few hours, residual currents provide insight into the dominant pathways of long-term material transport, including the movement of dredged sediments toward or away from target areas like Surfside Beach.

Figure 3.1 compares the 3-day residual current fields at the surface (top row) and bottom (bottom row) for scenarios 2-4 in Table 2.1. In the wave-influenced scenario (Scenario 2, Figures 3.1a and 3.1e), residual currents are significantly stronger and more spatially organized, particularly near the tidal inlet that connects the inner and outer sections of Batemans Bay. A distinct clockwise residual eddy is evident within the inner bay at both the surface and bottom layers, highlighting the strong influence of wave-induced processes. Along Surfside Beach, residual currents are predominantly eastward, supporting the net transport of sediment toward the nourishment area. It is important to note that instantaneous surface currents fluctuate between eastward and westward directions over time. However, the dominance of stronger and more frequent eastward flows results in a clear eastward residual current pattern. The similarity between surface and bottom current structures indicates that wave forcing impacts the full water column, enhancing both surface and near-bed transport.

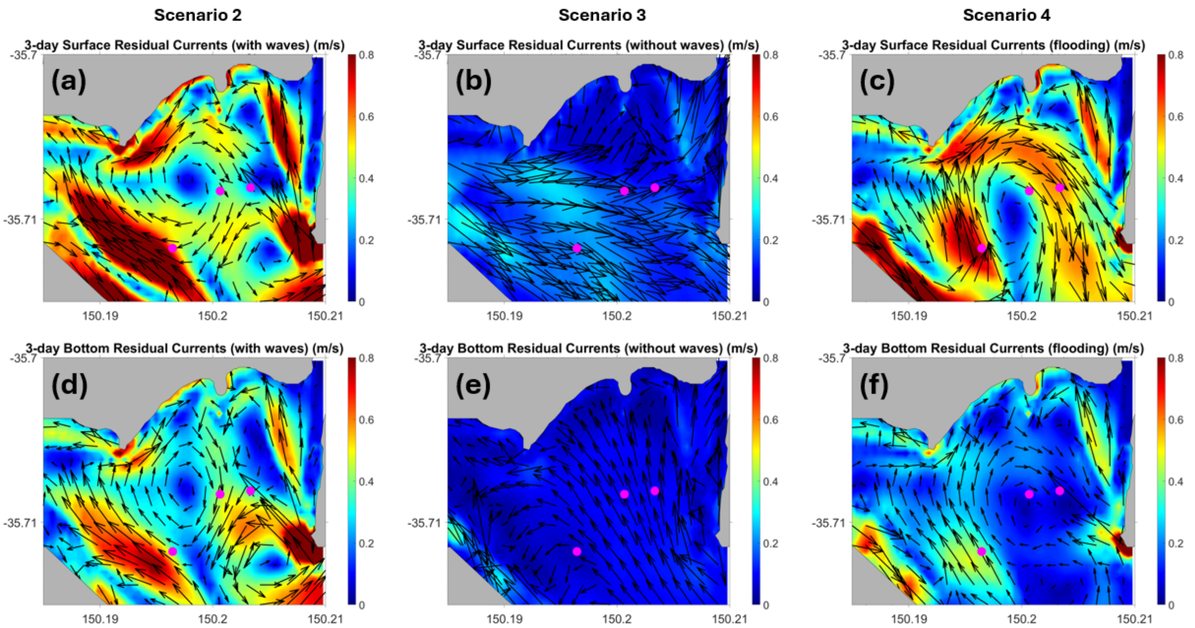

Figure 3.1 Residual currents at the surface (top row: a, b, c) and bottom (bottom row: d, e, f) under different wave forcing conditions. Left column (a, d) corresponds to Scenario 2: dumping under

realistic wave conditions during a storm event; middle column (b, e) shows Scenario 3: dumping without wave forcing during a storm event; right column (c, f) represents Scenario 4: dumping under realistic wave conditions during a flooding event. Magenta points indicate the dumping sites defined in the model.

In contrast, the no-wave scenario (Scenario 3, Figures 3.1b and 3.1e) shows much weaker residual flows at both the surface and bottom layers. Without wave radiation stress gradients, the current structure is primarily driven by tidal and riverine forces, resulting in lower overall transport potential. Under the no-wave scenario, the clockwise residual eddy observed in the wave-forced case is entirely absent. Instead, the residual circulation is characterized by general offshore flow at the surface and onshore flow at the bottom. Notably, the bottom residual currents are directed toward the head of the bay, which enhances connectivity between the offshore dumping areas and the nearshore zone, particularly Surfside Beach. This suggests that even in the absence of wave forcing, bottom currents may still play a role in facilitating sediment delivery to the shoreline, though less efficiently than under wave-driven conditions.

In the wave-forced flooding scenario (Scenario 4, Figures 3.1c and 3.1f), residual currents are also enhanced, though their magnitudes are generally weaker than those observed during the storm scenario. The spatial structure remains relatively organized, with both surface and bottom currents in the inner bay showing circulation patterns similar to those in Scenario 2. Along Surfside Beach, residual currents continue to flow eastward at both the surface and bottom, with larger magnitude at the surface but lower magnitude at the bottom. These results suggest that while flooding events contribute to residual transport, their role in enhancing sediment mobility is more modest compared to storm-driven wave forcing.

4 Sediment Transport Responses to Varying Environmental and Operational Conditions

Net sediment flux distributions for each transect under different scenarios are presented in Figures 4.1–4.14, with panels a to e corresponding to **Transects a** to **e**, respectively, as identified in Figures 1.1 and 2.2. A consistent colour scale is applied across all 3-day scenarios (Figures 4.2–4.10) to enable direct comparison between transects and scenarios, and a separate but internally consistent scale is used for the 4-week and 8-week scenarios (Figures 4.11–4.14). For Scenario 1 (Figure 4.1), which represents the baseline condition without any dumping activity, a different colour scale is applied to reflect the lower magnitude of sediment movement driven solely by natural river input.

For **Transects a** to **c** (oriented cross-shore), the perspective is from the west side of each transect, with north (land) on the left and south (sea) on the right. For **Transects d** and **e** (aligned alongshore and across the tidal inlet connecting the inner and outer bay, respectively), the view is from the offshore side, facing onshore, with southwest on the left and northeast on the right.

In Figures 4.1 to 4.14, positive net sediment flux values indicate transport toward the transect — eastward for **Transects a**–**c**, and onshore for **Transects d** and **e** — while negative values indicate transport away from the transect, corresponding to westward and offshore directions, respectively. For each transect, the overall net sediment volume is calculated to summarize the net direction and magnitude of sediment movement over the simulation period. For **Transects d** and **e**, the total positive and negative volumes are also shown, providing insight into the bidirectional exchange of sediment. This allows for deeper interpretation: for example, two scenarios may have similar net flux values but very different underlying dynamics — one dominated by strong one-way transport and the other by frequent two-way exchange.

It is important to note that the overall volume does not represent the exact quantity of sediment transported across the transect in a single direction. In many cases, sediment may cross a transect multiple times (e.g., due to tidal reversals or eddy circulations), which can lead to higher overall values than the actual one-way transport. Nonetheless, the overall net sediment volume remains a valuable indicator of prevailing sediment movement trends and spatial connectivity, particularly for assessing the effectiveness of dredging and nourishment strategies.

Scenario 1 (Figure 4.1) represents the baseline condition, simulating a storm event (9–11 July 2022) under realistic wave forcing, but without any dumping activities. This scenario isolates the natural sediment dynamics in Batemans Bay and along Surfside Beach in the absence of dredging intervention. **Transect d**, which runs parallel to the shoreline at Surfside Beach, captures cross-shore sediment transport, both toward and away from the beach. In this case, positive sediment fluxes dominate the western half, while negative fluxes dominate the eastern half, indicating onshore transport in the west and offshore transport in the east. This suggests an inherent imbalance in sediment delivery along the beach. When examined **Transects a** to **c**, which are oriented perpendicular to the shoreline and reflect alongshore sediment transport, a clearer pattern emerges. Sediment moves eastward from the western side of the beach, with positive overall fluxes at **Transects a** and **b** (Figures 4.1a–b), consistent with prevailing wave-driven residual currents. At **Transect c** (Figure 4.1c), near the eastern end of the beach, sediment continues to move eastward nearshore but shifts westward offshore, resulting in a slightly negative net flux. This reversal is likely due to the weakening influence of the residual eddy in that area, suggesting that sediment is unlikely to accumulate at the eastern end of the beach.

Under natural, undisturbed conditions, sediment introduced from the Clyde River generally travels eastward alongshore, but is ultimately diverted offshore before it can settle at the easternmost section. Although the flux magnitudes are relatively small — reflecting background transport over a 3-day period — the cumulative effect over time could contribute to the gradual erosion of the eastern beach, while the western section receives more consistent deposition. This pattern aligns with field observations showing more severe erosion along the eastern part of Surfside Beach, reinforcing the value and necessity of the Clyde River Bar Dredging 2025–2035 Project. It also highlights the importance of strategically targeting the eastern part of Surfside Beach during future sediment placement efforts to effectively counteract long-term erosional trends and enhance shoreline stability.

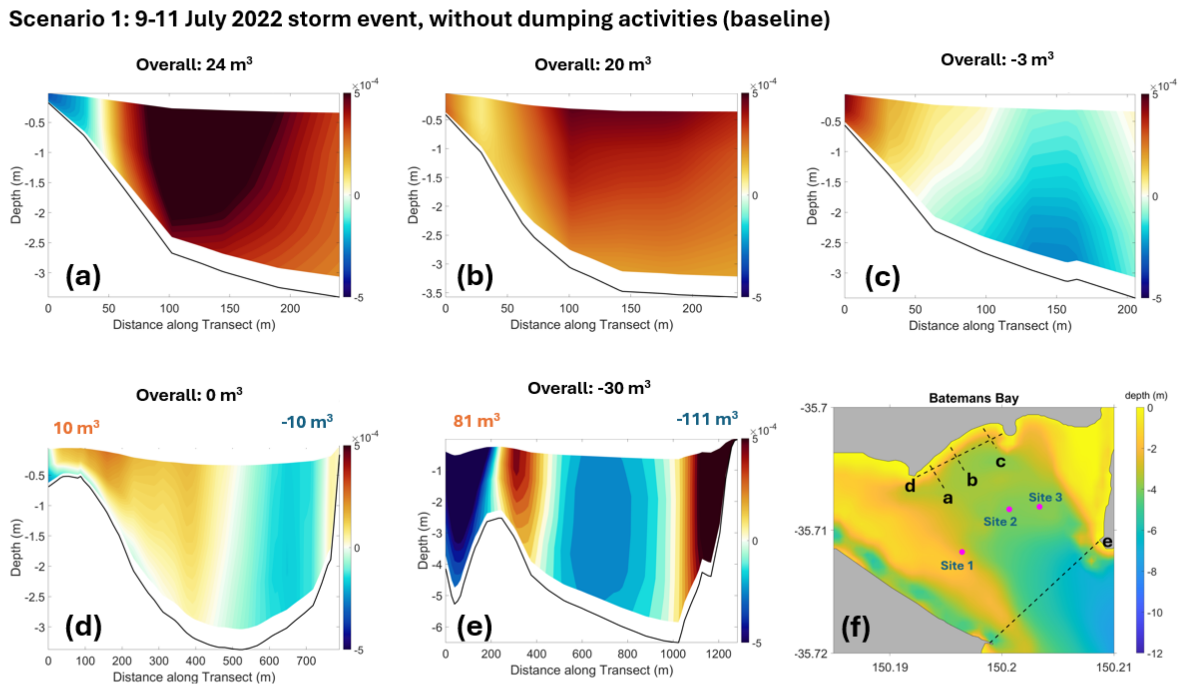

Figure 4.1 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 1: storm event (9–11 July 2022) with wave forcing, but without dumping. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

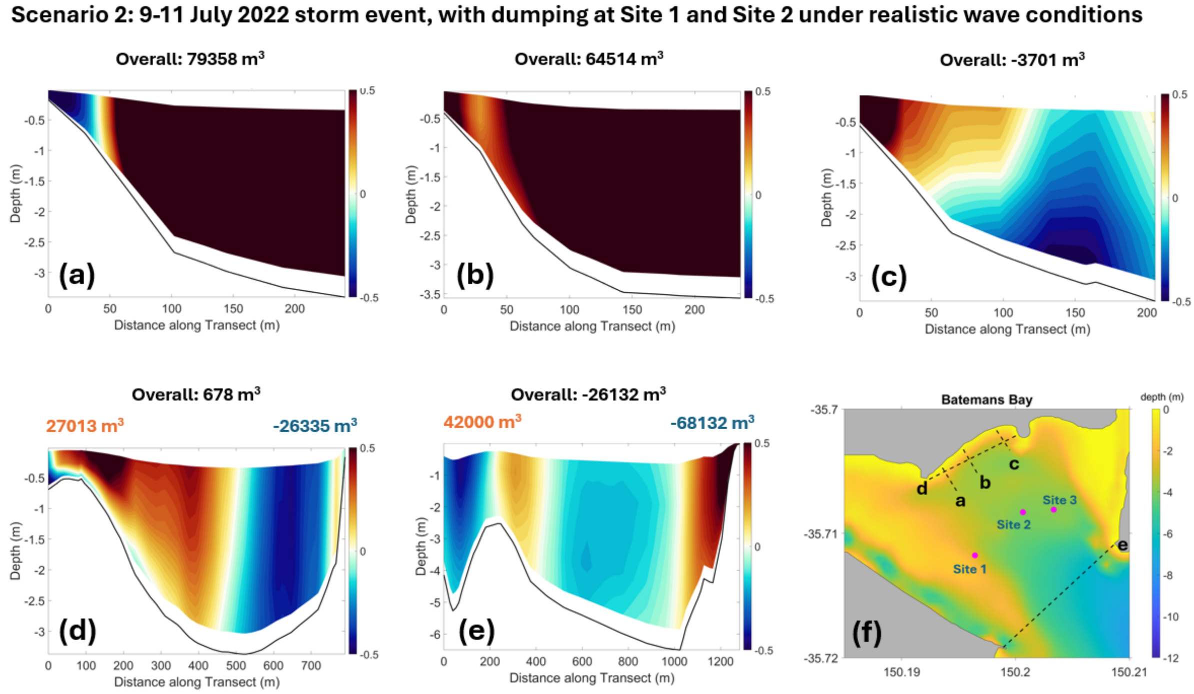

Figure 4.2 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 2: at Site 1 and Site 2 dumping during a storm event (9–11 July 2022) with wave forcing. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

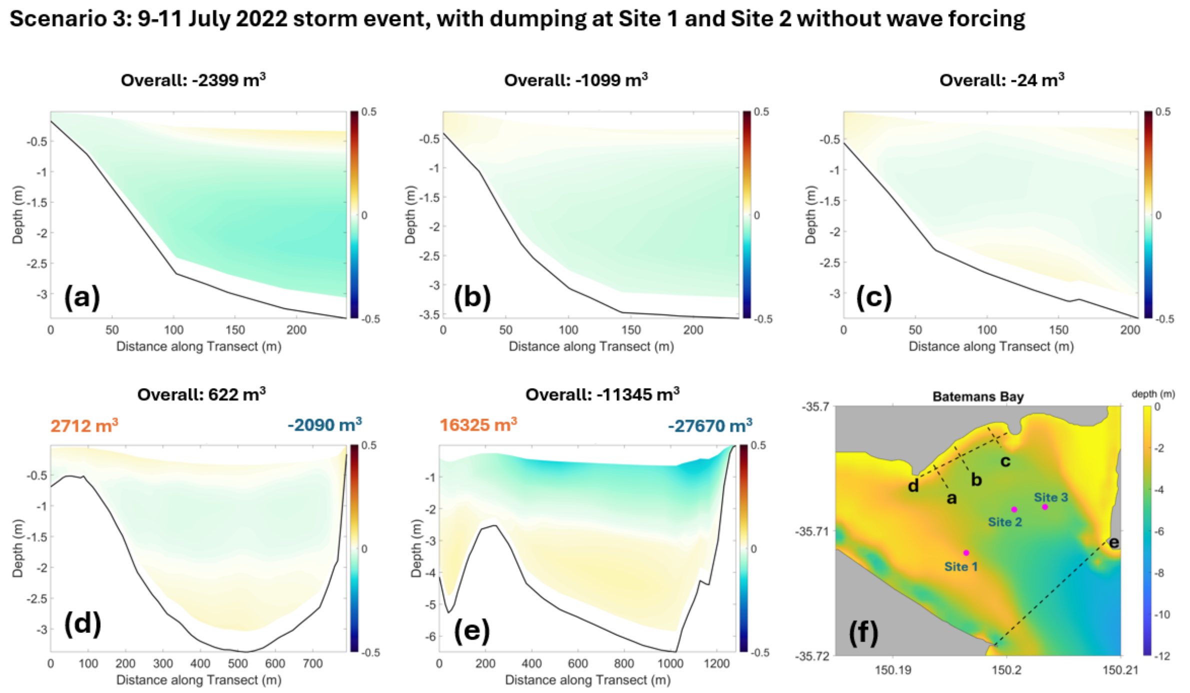

Figure 4.3 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 3: dumping at Site 1 and Site 2 during a storm event (9–11 July 2022) without wave forcing. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

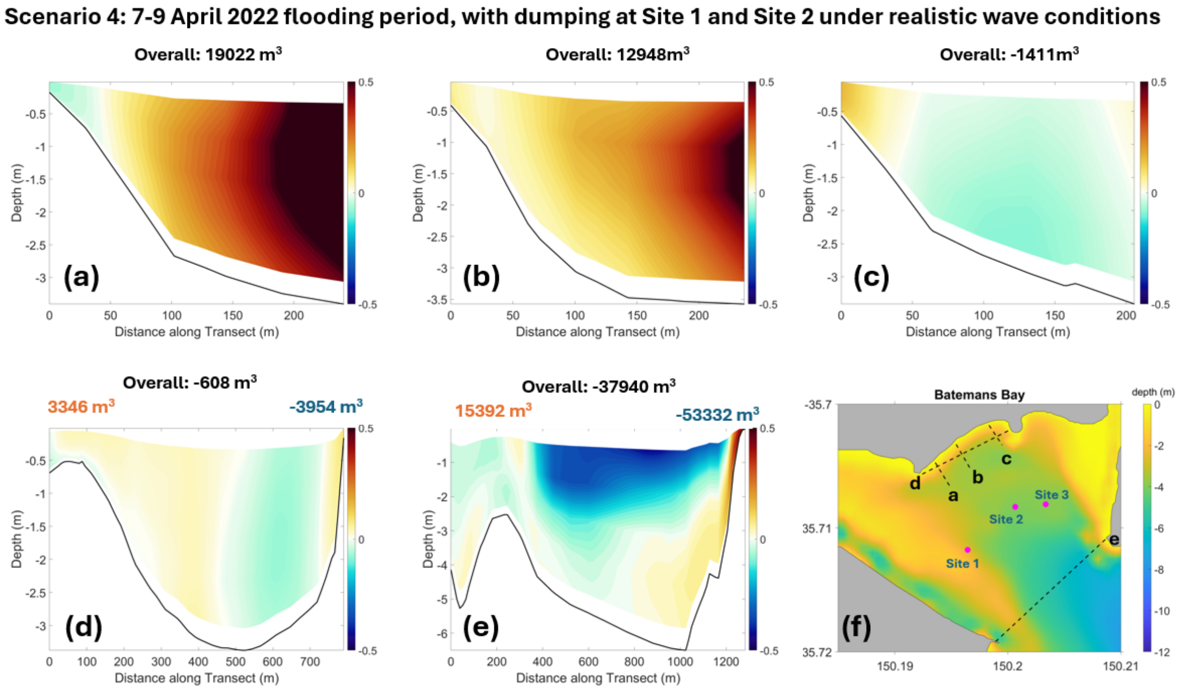

Figure 4.4 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 4: dumping at Site 1 and Site 2 during a flooding event (7–9 April 2022) with wave forcing. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

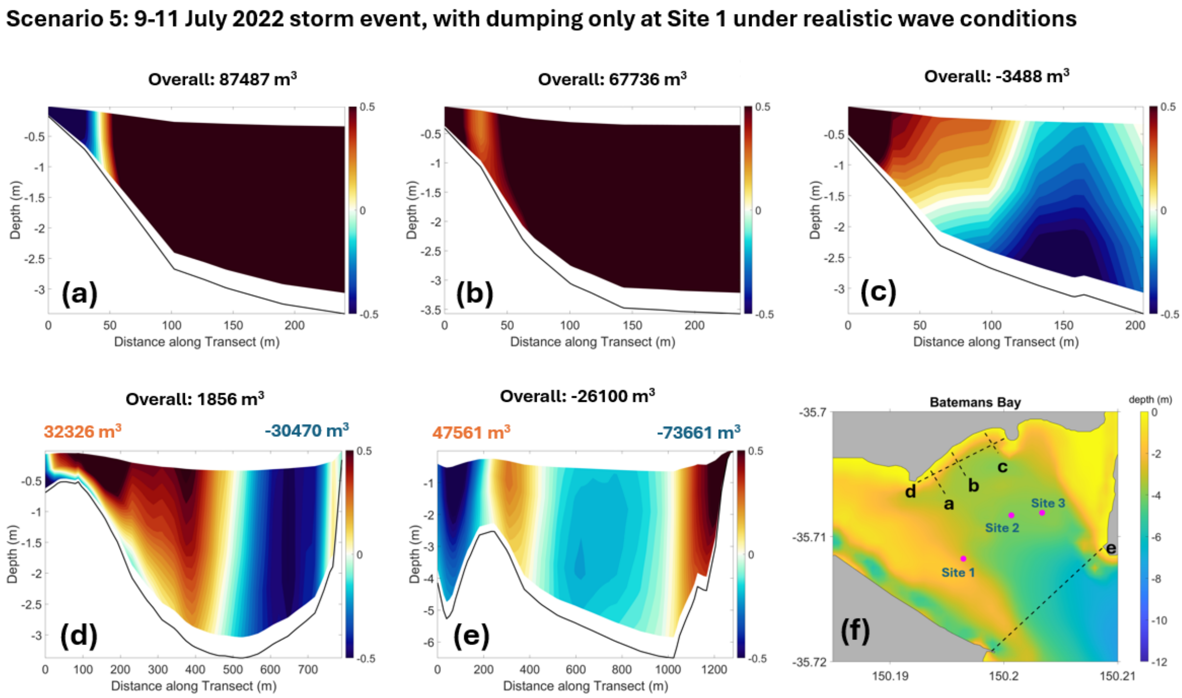

Figure 4.5 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 5: dumping during a storm event (9–11 July 2022) with wave forcing, but only at Site 1. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

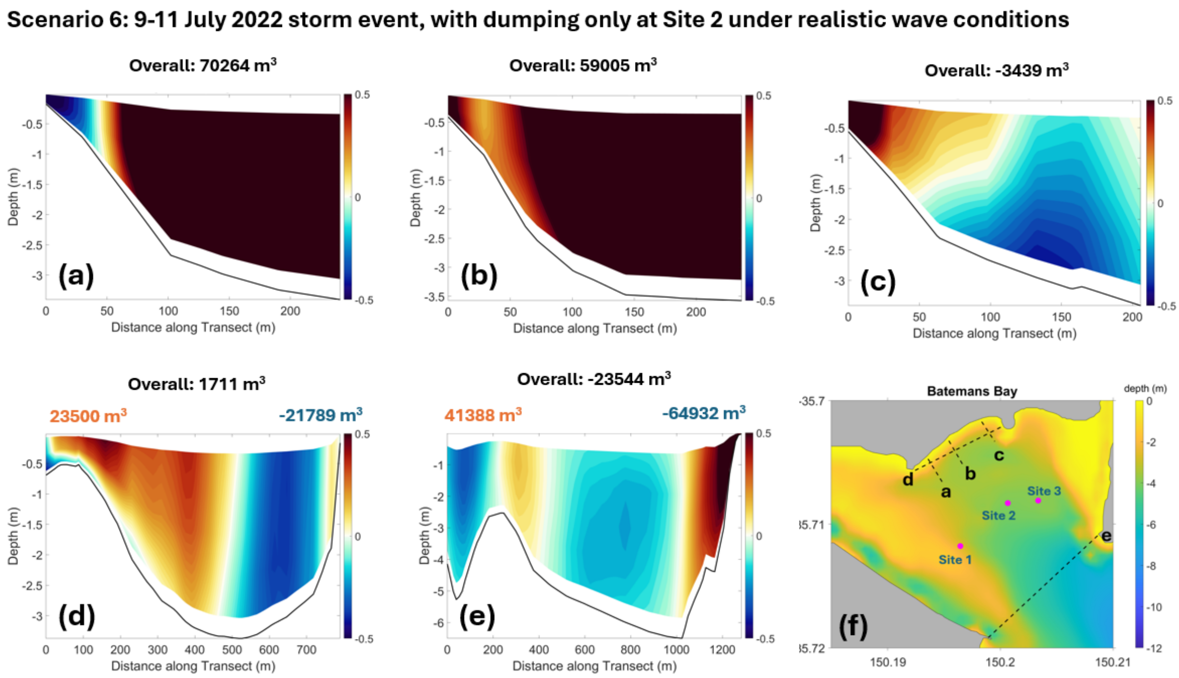

Figure 4.6 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 6: dumping during a storm event (9–11 July 2022) with wave forcing, but only at Site 2. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

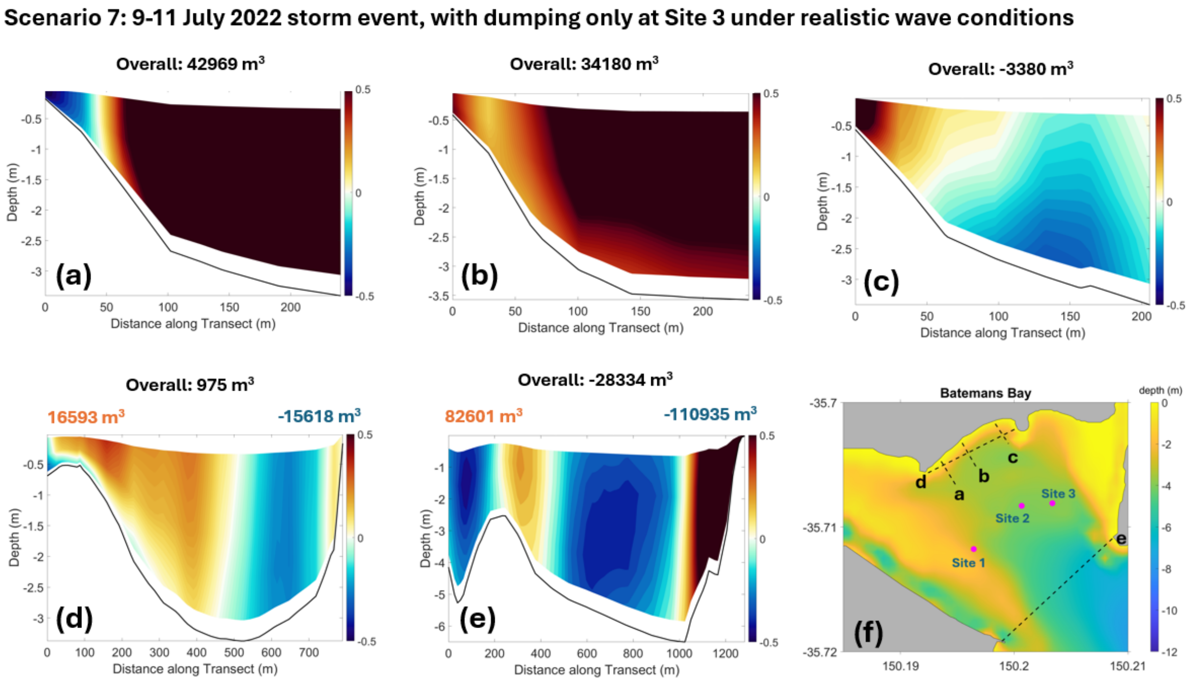

Figure 4.7 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 7: dumping during a storm event (9–11 July 2022) with wave forcing, but only at Site 3. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

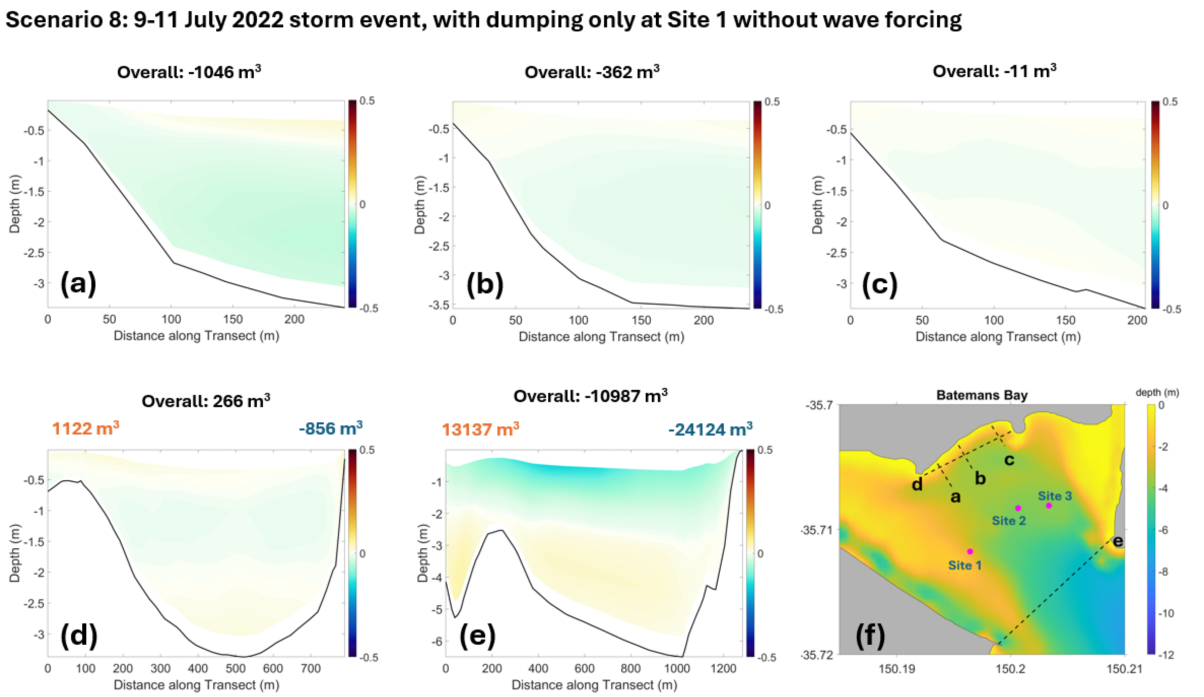

Figure 4.8 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 8: dumping during a storm event (9–11 July 2022) without wave forcing, but only at Site 1. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

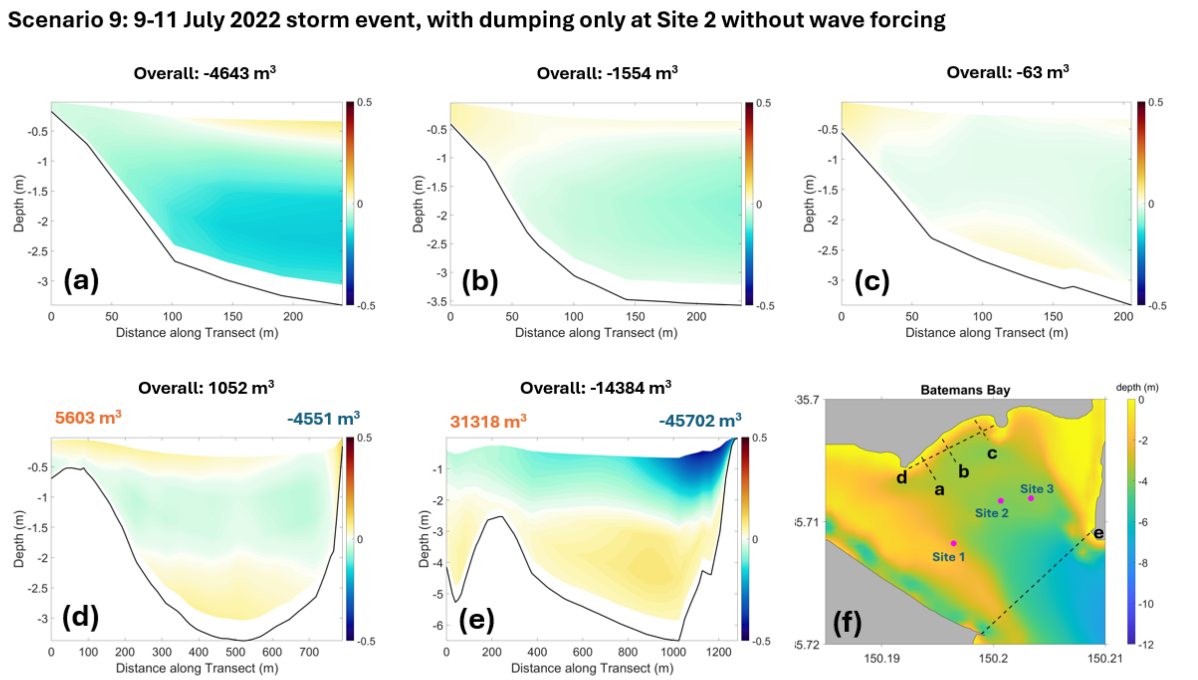

Figure 4.9 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 9: dumping during a storm event (9–11 July 2022) without wave forcing, but only at Site 2. Positive values

indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

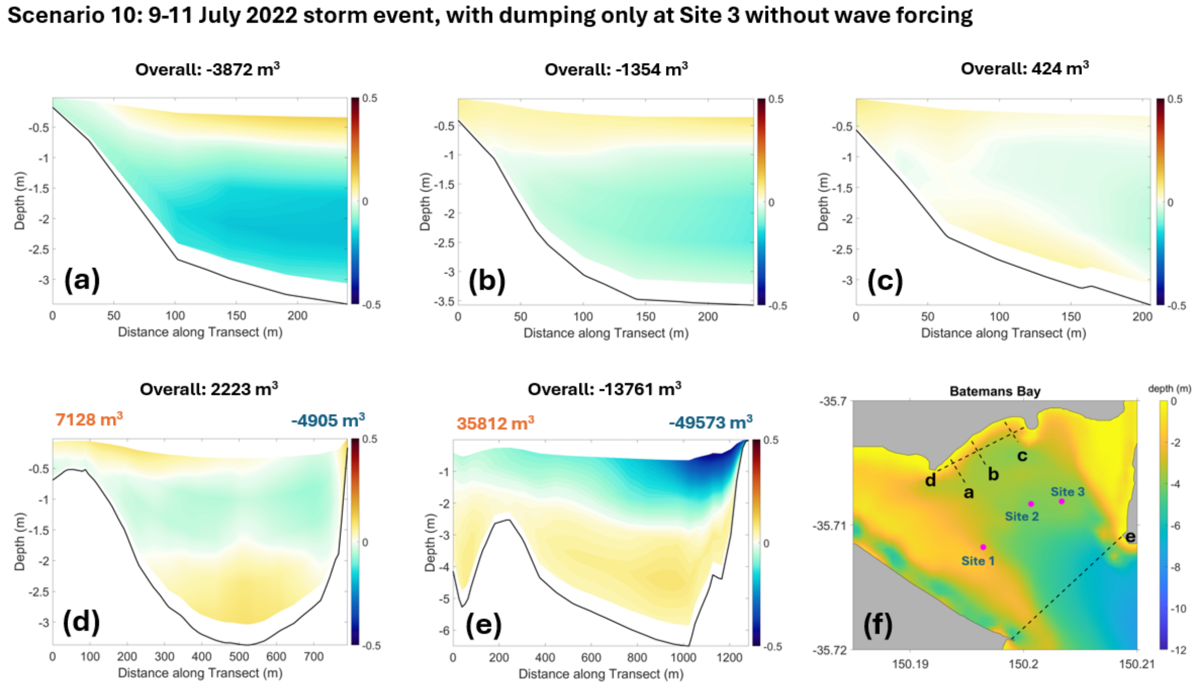

Figure 4.10 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 10: dumping during a storm event (9–11 July 2022) without wave forcing, but only at Site 3. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

Scenario 11: 1 - 28 August 2022 (4-week period), with dumping at Site 1 and Site 2 under realistic wave conditions

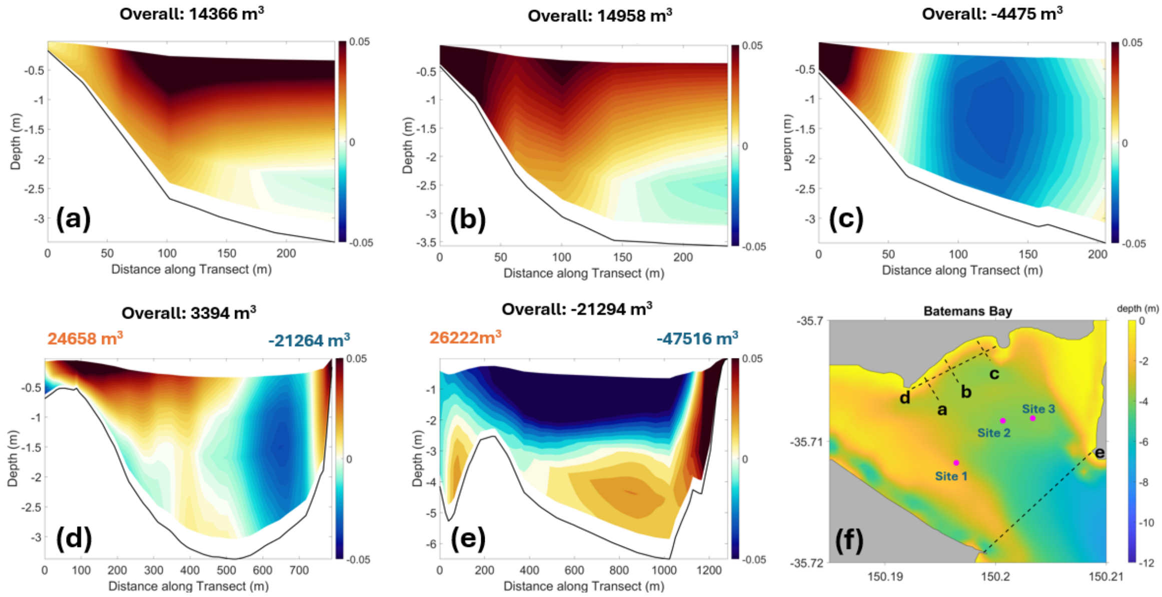

Figure 4.11 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 11: dumping at Site 1 and Site 2 over an 4-week period (1 – 28 August 2022) with realistic wave conditions. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

Scenario 12: 1 - 28 August 2022 (4-week period), with dumping at Site 1 and Site 2 without wave forcing

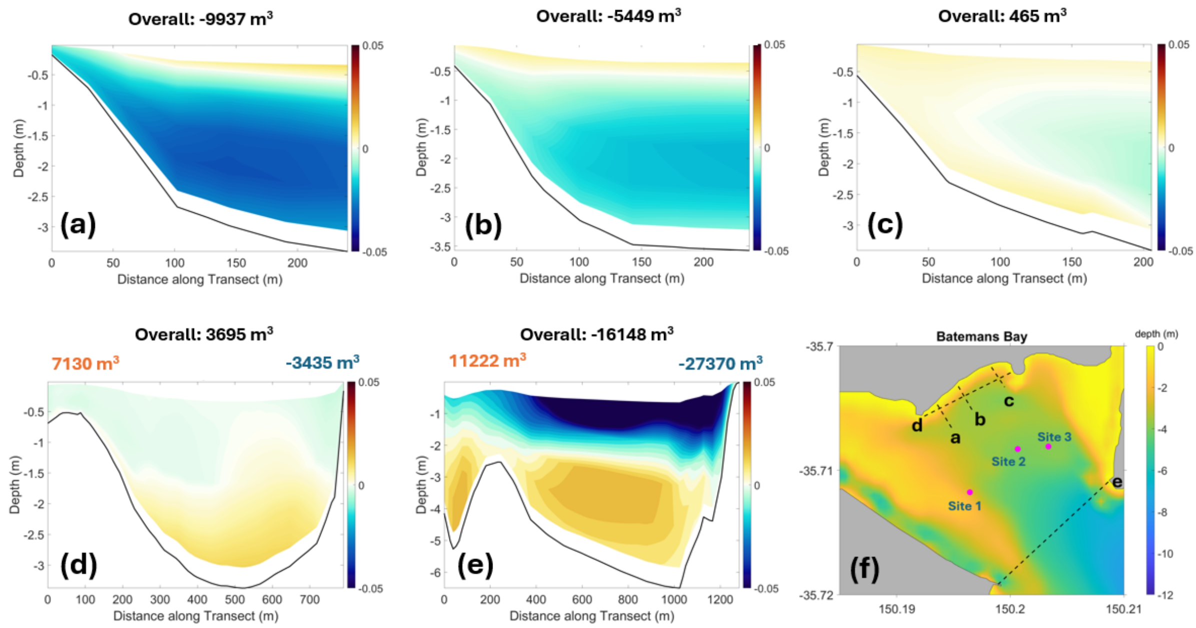

Figure 4.12 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 12: same as Scenario 11, but without wave forcing (calm conditions). Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

Scenario 13: 1 August - 25 September 2022 (8-week period), with dumping at Site 1 and Site 2 under realistic wave conditions

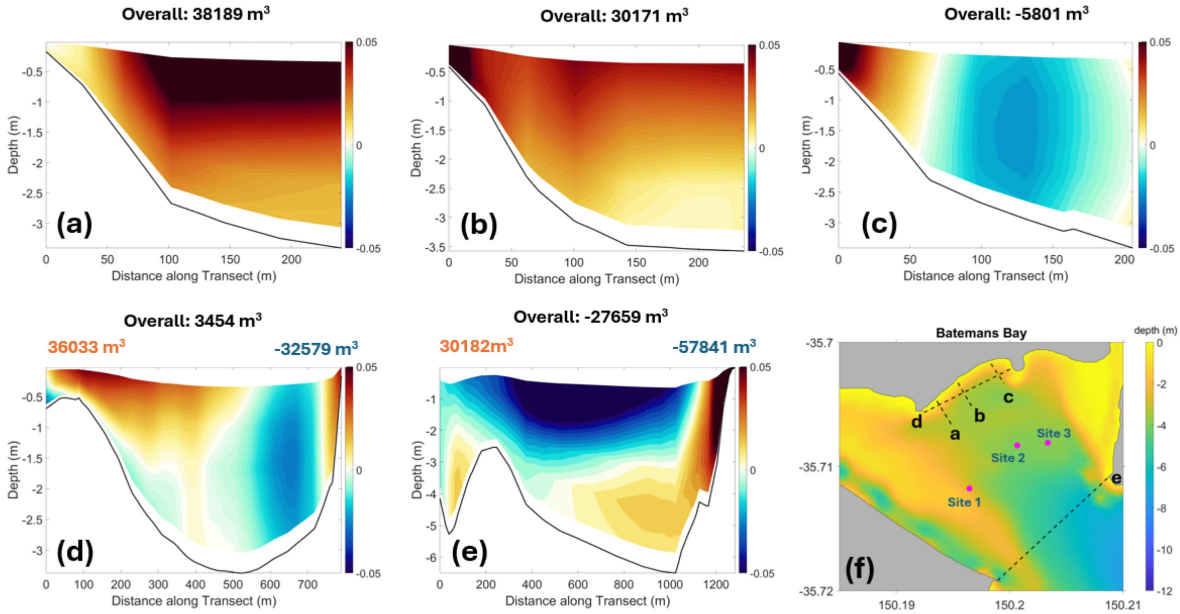

Figure 4.13 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 13: dumping at Site 1 and Site 2 over an 8-week period (1 August – 25 September 2022) with realistic wave conditions. Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

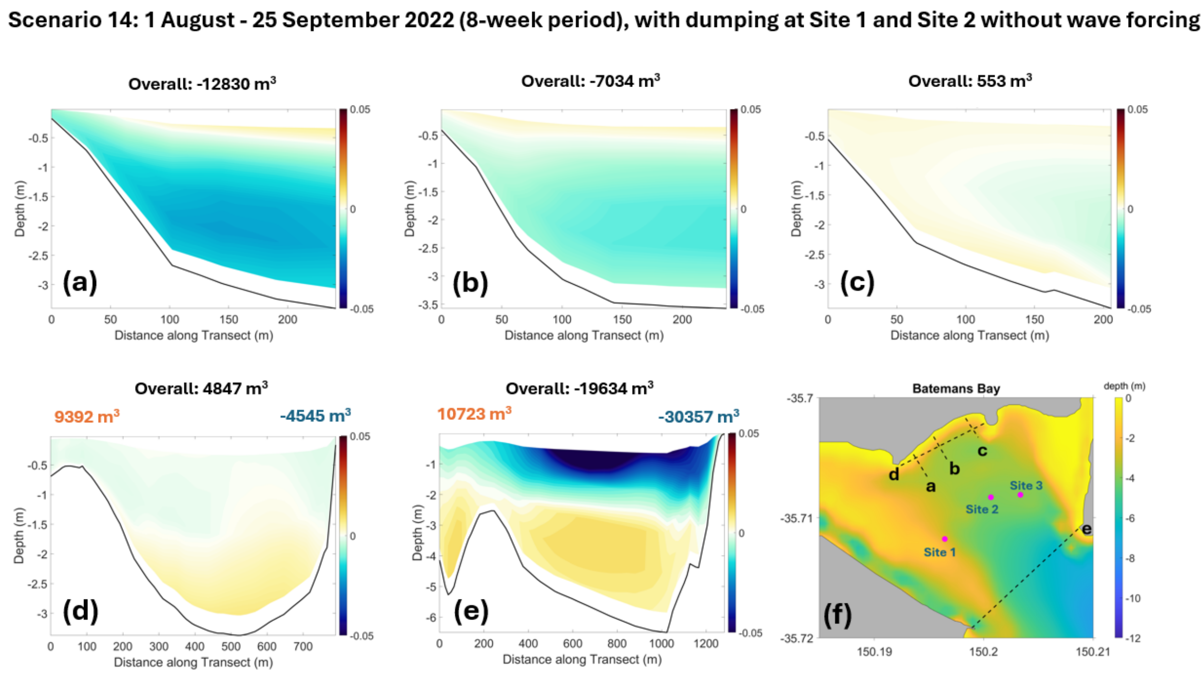

Figure 4.14 Net sediment flux (unit: kg/m^2/s) across **Transects a–e** under Scenario 14: same as Scenario 13, but without wave forcing (calm conditions). Positive values indicate eastward transport for **Transects a–c**, and onshore transport for **Transects d** and **e**; negative values indicate westward and offshore transport, respectively. Overall sediment volumes are shown above each panel, with positive and negative components also labelled for **Transects d** and **e** to reflect the degree of bidirectional exchange. The positions of the transects and dumping sites are shown in panel (f).

4.1 Wave Impacts

To evaluate the influence of wave forcing on sediment transport with dumping activities, net sediment fluxes across five transects were compared between two scenarios: with waves (Figure 4.2) and without waves (Figure 4.3) during a storm event (9–11 July 2022). Compared to the wave-forced conditions, sediment transport is significantly reduced under no-wave conditions across all transects, with some transects also exhibiting changes in transport direction.

In the wave-forced scenario (Scenario 2), sediment transport patterns resemble those in the baseline case (Scenario 1), but with substantially greater magnitude due to the added dumping activities. Under Scenario 2, **Transect d** (Figure 4.2d), which runs along Surfside Beach, shows sediment movement toward the beach in the western half and away from the beach in the eastern half. The overall onshore transport across **Transect d** is 678 m^3, with a highly dynamic exchange: 27,013 m^3 moving onshore and –26,335 m^3 offshore. Compared to the no-wave scenario, this indicates a more intense bidirectional exchange driven by wave action, which enhances both landward sediment delivery and partial offshore return flow.

Alongshore transport patterns are captured by **Transects a** to **c**, which are oriented perpendicular to the shoreline. **Transects a** and **b** (Figures 4.2a–b) show strong eastward sediment movement, with overall volumes of 79,358 m^3 and 64,514 m^3, respectively. At **Transect c** (Figure 4.2c), located near the eastern end of the beach, sediment continues to move eastward in the nearshore zone but westward offshore, resulting in a weaker overall westward transport of –3,701 m^3. **Transect e** (Figure 4.2e), located across the tidal inlet between the inner and outer bay, shows an overall offshore transport of –26,132 m^3, indicating that more sediment exits the inner bay than enters. This is consistent with and confirms the placement of dumping sites within the inner bay.

It is worth noting that the overall flux values for **Transects a** and **b** exceed the total dumped volume of 30,000 m^3, and that the westward flux at **Transect c** is larger than in the baseline condition (Scenario 1). This does not imply that dumping causes increased erosion in the western part of the beach. Rather, it reflects the repeated movement of sediment across transects — sediments may cross a transect multiple times, entering and leaving through complex flow pathways not fully captured by a single transect. This results in inflated flux values due to multiple crossings of the same sediment mass. Nevertheless, net sediment volume remains a valuable indicator of net transport direction, intensity, and connectivity between dumping areas and shoreline zones, particularly for assessing the effectiveness of dredging and nourishment strategies.

Under no-wave conditions (Scenario 3), sediment transport is significantly weaker across all transects and exhibits notable shifts in direction and vertical distribution. At **Transect d** (Figure 4.3d), sediment moves toward the beach at the surface and bottom, but away from the beach in the mid-water column. The net transport remains onshore (622 m^3), but with considerably reduced total volumes (2,712 m^3 onshore and –2,090 m^3 offshore) compared to the wave scenario. **Transects a** and **b** (Figures 4.3 a–b) show westward sediment movement, with overall volumes of –2,399 m^3 and –1,099 m^3, respectively — reversing direction from the wave-forced case. At **Transect c**, sediment transport is minimal (–24 m^3) and shows no significant directional change compared to the wave scenario. **Transect e** shows continued offshore sediment movement (–11,345 m^3) under no-wave conditions, but at a lower magnitude than in the wave-forced scenario, again reflecting weaker residual circulation.

In the absence of wave radiation stress gradients, the residual current energy is insufficient to maintain eastward movement along Surfside Beach, resulting in a reversal of alongshore transport. This suggests that under calm conditions, sediment from dumping activities still reaches Surfside Beach, but with reduced mobility and intensity. Notably, the eastern section of the beach, which is more erosion-prone, experiences less dynamic flow, meaning sediment delivered there is more likely to be retained. **Therefore, if the goal is to enhance nourishment specifically in the eastern**

zone, scheduling dumping during calm conditions may be more effective in minimising sediment loss due to offshore transport. Under such conditions, the reduced hydrodynamic energy appears to promote sediment retention and improve net sediment gain along this more erosion-prone portion of the beach.

Importantly, these results suggest that the Clyde River Bar Dredging Project is effective in delivering sediment toward Surfside Beach regardless of wave conditions. Whether under energetic (storm-driven) or calm scenarios, overall onshore sediment transport is achieved, particularly across **Transect d**, which lies directly offshore of Surfside Beach. This stands in comparison with the no-dumping scenario (Figure 4.1d), where the overall transport across **Transect d** is essentially zero, demonstrating that without dredging input, meaningful shoreline replenishment does not occur.

4.2 Flooding Impacts

Figure 4.4 a–e presents net sediment fluxes across **Transects a** to **e** for the flooding event scenario (7–9 April 2022). Overall, sediment transport under flooding conditions shares broad similarities with the storm scenario under wave forcing, but with a notable difference at **Transect d**, which lies directly offshore of Surfside Beach.

Transects a and **b** (Figures 4.4 a–b) show continued eastward sediment transport, with overall volumes of 19,022 m^3 and 12,948 m^3, respectively. While these volumes are lower than those observed under storm-driven wave conditions, the persistent eastward movement is likely maintained by a combination of moderate wave activity and increased river discharge during the flood. **Transect c** (Figure 4.4c) shows weaker westward transport, with a net volume of –1,411 m^3.

Transect d (Figure 4.4d) continues to exhibit onshore transport on the western side and offshore transport on the eastern side, but with a net offshore flux of –608 m^3. The total offshore volume (–3,954 m^3) slightly exceeds the onshore component (3,346 m^3), reversing the onshore-dominant transport pattern observed during storm scenarios. **This indicates that flood-dominated conditions, even when accompanied by moderate wave activity, may impede effective sediment delivery to Surfside Beach.**

Transect e (Figure 4.4e), located across the tidal inlet between the inner and outer bay, shows a substantial net offshore flux of –37,940 m^3, with strong offshore-directed transport (–53,332 m^3) significantly exceeding the onshore return (15,392 m^3). This suggests that a large portion of the dumped sediment — along with elevated sediment input from flood-driven river discharge — may be exported from the inner bay under high-flow conditions. The magnitude of offshore flux exceeding the dumped volume of 30,000 m^3 is largely attributed to this additional sediment contribution from the flooding river.

These results suggest that flooding events are not optimal for conducting dumping activities, particularly when the objective is to retain sediment within the inner bay or enhance nourishment at Surfside Beach. The offshore transport observed at **Transect d** highlights the increased risk of sediment loss from the system, which could diminish the effectiveness of dredging and placement efforts. To maximize sediment retention and shoreline stabilisation, dumping operations should be avoided during major flooding periods.

4.3 Dumping Site Impacts

To assess the influence of dumping location on sediment transport, Scenarios 5 – 10 (Figures 4.5 – 4.10) were simulated, in which sediment was released only at a single dumping site — Site 1, Site 2, or Site 3 — under both wave-forced and no-wave storm conditions.

Overall, the spatial patterns of sediment transport in the single-site dumping scenarios are broadly consistent with those observed when both sites are active. Under wave conditions (Scenarios 5, 6, and 7), the alongshore and cross-shore transport directions closely resemble those in Scenario 2 (dumping at both Sites 1 and 2 with wave forcing). Similarly, under calm conditions (Scenarios 8, 9, and 10), the patterns generally align with those in Scenario 3 (dumping at both sites without wave forcing), except for a reversed flux at Transect c in the Site 3-only scenario. These comparisons suggest that while the dumping location does not substantially alter transport direction, it does affect the magnitude of sediment delivery across transects.

Compared to dumping at both Site 1 and Site 2, higher onshore sediment transport toward Surfside Beach is observed across **Transect d** in all three single-site dumping scenarios under wave conditions. Specifically, Scenario 5 (Site 1 only) yields 1,856 m^3, Scenario 6 (Site 2 only) yields 1,711 m^3, and Scenario 7 (Site 3 only) yields 975 m^3, all exceeding the 678 m^3 observed in Scenario 2 (both sites). This counterintuitive outcome is likely due to higher suspended sediment concentrations at a single site, which enhances bottom-layer transport where onshore flux is more effective (as shown in Figure 5.1). Concentrated sediment input at one location also allows the plume to follow a more coherent and stable transport path, particularly when aligned with residual circulation, improving delivery to the nearshore zone.

However, Scenario 7 (Site 3 only) shows reduced transport across **Transects a to d** and increased sediment export at **Transect e**. This may be because Site 3 lies near the outer edge of the residual eddy (Figures 3.1a and d), favouring offshore dispersion rather than onshore delivery to Surfside Beach. Thus, while Site 3 is less effective than Site 1 or Site 2 under wave-forced conditions, it still outperforms the double-site scenario in terms of focused sediment delivery.

Under no-wave conditions, sediment transport in Scenarios 8, 9, and 10 generally resembles that of Scenario 3. However, when dumping occurs only at Site 1 (Scenario 8), the overall onshore transport across **Transect d** is relatively low at 266 m^3, compared to 1,052 m^3 for Site 2 (Scenario 9) and 2,223 m^3 for Site 3 (Scenario 10). Additionally, Scenario 10 shows a notable reversed flux of 424 m^3 at **Transect c**, which is absent in the other scenarios. This difference may be attributed to bottom residual currents directed shoreward under calm conditions (as shown in Figure 3.1e), which likely enhance onshore transport from Sites 2 and 3 — especially Site 3, where both surface and bottom flows appear to favour movement toward the coast.

These results suggest that dumping at Site 1 under calm conditions results in weaker onshore transport, whereas Sites 2 and 3 yield stronger sediment delivery toward Surfside Beach. Furthermore, the strong net onshore flux from Site 3 may indicate its advantage in delivering sediment to the eastern end of Surfside Beach, where erosion is most severe. Therefore, under calm conditions, Site 3 may be the most effective single-site dumping location for shoreline nourishment. When considering both wave and calm conditions, however, Site 2 generally appears to be the more consistently productive option.

In summary, the results suggest that using a single dumping site at a time may deliver more sand to Surfside Beach than using multiple sites together. Under wave conditions, Site 1 and Site 2 both perform effectively, while Site 3 shows lower overall transport. Under calm conditions, Site 3 delivers the most onshore sediment, particularly toward the erosion-prone eastern end of the beach. Site 2 also performs well under both wave and calm conditions, making it a generally reliable option. Site 1 may still contribute to local sediment retention but is less effective overall under calm conditions.

4.4 Impacts of Long-term and Short-term Dumping Period

The 3-day scenarios were designed as sensitivity tests to explore sediment transport responses under various forcing conditions, such as wave presence, flooding, and dumping location. In contrast, the Clyde River Bar Dredging 2025–2035 Project is intended to span an extended 3–8-week operational period, making long-term simulations more relevant for practical implementation. To evaluate long-term performance, four operational scenarios were simulated: two 4-week and two 8-week runs. Each duration includes one scenario with wave forcing and one without (calm conditions), all involving dumping at both Site 1 and Site 2. Specifically, Scenarios 11 and 12 represent the 4-week period with and without wave forcing (Figures 4.11 and 4.12), while Scenarios 13 and 14 represent the 8-week period under the same respective conditions (Figures 4.13 and 4.14). The resulting sediment transport patterns are broadly consistent with those observed in the 3-day storm scenarios (Scenarios 2 and 3), though with notable differences in overall transport magnitude and spatial distribution.

Under wave-forced conditions, sediment delivery to Surfside Beach increases notably over longer durations. For example, across **Transect d**, the onshore sediment volume rises from 678 m^3 in the 3-day case (Scenario 2) to 3,454 m^3 in the 8-week case (Scenario 13; Figure 4.13d). A similar improvement is observed over the 4-week period in Scenario 11 (Figure 4.11d), with 3,394 m^3 transported onshore. This enhanced delivery is likely due to cumulative effects of sustained dumping and consistent wave-induced currents. However, increased bidirectional exchange is also seen — particularly at **Transects c and e** — indicating more dynamic redistribution over time.

Under calm conditions, sediment delivery also improves significantly over longer durations. The onshore volume across **Transect d** increases from 622 m^3 in the short-term calm scenario (Scenario 3) to 4,847 m^3 in the 8-week calm case (Scenario 14; Figure 4.14d). Similarly, in the 4-week calm scenario (Scenario 12; Figure 4.12d), the onshore transport is 3,695 m^3. Additionally, **Transect c**, which showed weak or reversed transport in the short-term calm case, now exhibits consistent eastward flux under both long-term scenarios, suggesting improved alongshore sediment movement.

These findings demonstrate that long-term dumping operations — whether under wave-forced or calm conditions — are more effective in delivering sediment toward Surfside Beach. Importantly, even in the absence of wave forcing, bottom residual currents continue to facilitate onshore sediment transport, particularly toward the eastern section of the beach where erosion is most pronounced. This supports the strategic value of sustained dumping schedules under a range of hydrodynamic conditions when long-term shoreline nourishment is the operational priority.

5 Temporal Evolution of Suspended Sediment Transport During Dumping Activities

The surface and bottom distributions of Suspended Sediment Concentrations (SSC) under Scenario 13 (8-week simulation with wave forcing and active dumping at Site 1 and Site 2) are shown in Figure 5.1 to illustrate the short-term evolution of sediment movement. Given the long simulation period (1 August to 25 September 2022), only a representative sequence of snapshots from 2 August 2022 is displayed here at hourly intervals: 07:00, 08:00, 09:00, and 10:00 — during a flood tide phase to illustrate the short-term evolution of sediment movement.

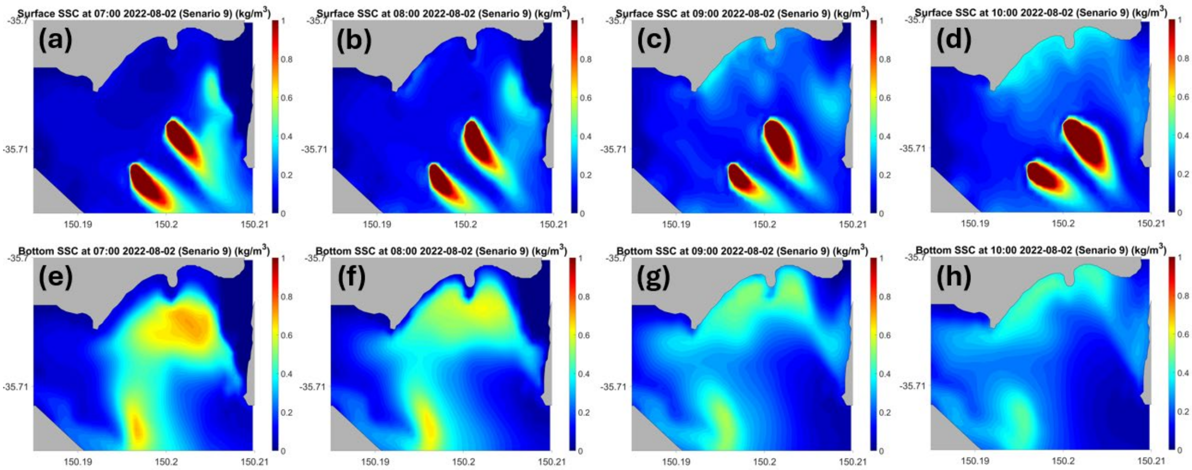

Figure 5.1 Surface (top row: a–d) and bottom (bottom row: e–h) Suspended Sediment Concentrations (SSC) in units of kg/m^3 under Scenario 13 at four time stamps during a flood tide phase on 2 August 2022: 7:00 am (a, e), 8:00 am (b, f), 9:00 am (c, g), and 10:00 am (d, h).

At the surface (Figure 5.1 a–d), the dumping sites are clearly visible as localised areas of elevated SSC, where dredged sediment is released into the water column. Following the onset of dumping, surface sediment tends to be dispersed seaward, forming offshore-directed plumes that vary with local hydrodynamic conditions. At the bottom (Figure 5.1 e–h), sediment patterns reflect a return flow mechanism, where part of the suspended sediment is transported landward toward the shoreline, particularly toward Surfside Beach. This dynamic reflects the combined influence of tidal and wave-induced circulation, promoting both offshore and onshore sediment exchange over time. Such processes support the findings in Section 4, which showed that net sediment fluxes tend to favour net onshore transport, particularly across **Transect d**.

Additionally, the Clyde River Bar, the site of ongoing dredging operations, appears to receive some of the redistributed sediment at the bottom. While this may result in partial re-deposition of dumped material within the dredging area, it can be managed through routine dredging cycles and does not diminish the broader effectiveness of sediment transport toward the target nourishment zone.

Overall, the temporal evolution of SSC under Scenario 13 demonstrates the dynamic but spatially coherent movement of sediment from the dumping sites toward the inner bay and nearshore region. These findings further support the conclusion that the Clyde River Bar Dredging 2025–2035 Project has strong potential to enhance shoreline nourishment at Surfside Beach, particularly when aligned with favourable hydrodynamic conditions.

6 Recommendations and Mitigation Strategies

The results of this modelling study provide strong evidence supporting the Clyde River Bar Dredging 2025–2035 Project as an effective intervention to address the dual objectives of improving navigation safety and enhancing shoreline stability at northern beach locations such as Surfside Beach. The simulations consistently demonstrate that, with appropriate environmental and operational planning, dredged sediment can be successfully delivered toward Surfside Beach, in some cases, even towards the eastern section of Surfside Beach where erosion is more prone. Both short-term and long-term scenarios indicate that sediment transport pathways can be managed to promote onshore and alongshore movement, helping retain sediment near the shoreline and offset long-term erosional trends. The project is therefore well-justified in terms of delivering tangible environmental and community benefits, especially when guided by evidence-based operational strategies.

6.1 Operational Recommendations

Based on the results of the scenario-based modelling assessment, several key operational recommendations can be drawn to improve the effectiveness of dredging and dumping activities for shoreline nourishment at Surfside Beach:

- **Avoid Dumping During Flooding Events:** Sediment transport during flooding scenarios (Section 4.2) indicates strong offshore export across **Transects d** and **e**, resulting in a net loss of dredged material from the inner bay. To minimise sediment loss and maximise retention near Surfside Beach, dumping activities should be avoided during periods of high river discharge or major flooding.

- **Consider Dumping Site Optimisation:** Model results indicate that using a single dumping site (Scenarios 5, 6, or 7) may result in more effective sediment delivery to Surfside Beach than splitting the load between two sites (Scenario 2). This is likely due to higher suspended sediment concentrations when dumping is concentrated at a single location, which enhances vertical settling and onshore bottom transport — especially under wave-forced conditions. Among the single-site options, Site 2 performs reliably well under both calm and wave conditions, while Site 3 shows the greatest sediment delivery during calm conditions and may be particularly effective for nourishing the more erosion-prone eastern part of the beach. Therefore, if weather forecasts indicate sustained calm conditions, Site 3 may be preferred; otherwise, Site 2 offers a more consistent and reliable option. Operational planning should consider alternating or prioritising single-site dumping to optimise sediment transport and reduce dispersion.

- **Align Dumping Timing with Strategic Nourishment Goals:** Wave-forced scenarios (Sections 4.1 and 4.3) demonstrate stronger sediment transport both onshore and alongshore, particularly enhancing delivery toward Surfside Beach. Under calm conditions without wave forcing, onshore transport remains active, especially when dumping at Site 3, and may support greater sediment retention near the erosion-prone eastern section of the beach. This pattern is further reinforced in long-term calm scenarios (Scenarios 12 and 14), which show improved sediment delivery and retention over time at the eastern end. Therefore, calm weather conditions may be preferable when the operational objective is to prioritise nourishment at the eastern section, while wave-forced conditions may be more suitable for promoting wider shoreline coverage.

- **Implement Monitoring to Support Adaptive Management:** To enhance the effectiveness of dredging operations and shoreline nourishment, sediment transport monitoring should be integrated into operational planning. This will provide evidence-based support for decision-making and allow for adaptive responses that improve sediment retention and overall project outcomes. Additional detail on the proposed monitoring framework is provided in Section 6.2.

These recommendations aim to optimise the dual objectives of the Clyde River Bar Dredging 2025–2035 Project: maintaining safe maritime access and enhancing long-term shoreline stability at Surfside Beach. Careful consideration of environmental forcing, site selection, and timing can significantly improve sediment utilisation efficiency and reduce re-dredging requirements over the project duration.

6.2 Long-Term Monitoring Proposals

To support ongoing and future dredging and dumping operations in Batemans Bay, the implementation of a long-term monitoring program is recommended. This system would provide real-time observations of turbidity and current conditions at key locations, enabling adaptive management of sediment redistribution activities. A proposed monitoring system includes the deployment of turbidity sensors and current meters (e.g., Valeport instruments) at strategic stations to continuously record data on suspended sediment concentrations and current velocities throughout the dredging period.

Collected data will help quantify sediment plume dispersion, assess the environmental impact of dumping, and validate sediment transport model outputs. In the longer term, these insights will support improved decision-making for the timing and location of dumping activities, ensuring that dredged material contributes effectively to shoreline nourishment while minimizing potential ecological disturbances. The monitoring program will also enhance the scientific foundation for future modelling studies and provide regulatory agencies with the evidence needed to evaluate the effectiveness of sediment management strategies in Batemans Bay.

6.3 Future Work and Model Enhancements

To further support evidence-based planning and adaptive coastal management, several enhancements to the current modelling framework are recommended.

First, although the hydrodynamic and sediment transport model applied in this study has been rigorously validated in previous publications, future work should focus on expanding validation efforts through the integration of new observational data. Real-time data on turbidity and current velocity collected during dredging operations via the monitoring system (Section 5.2) will provide a valuable observational dataset to validate and refine the sediment transport model used in this study. Direct comparison between observed and modelled sediment fluxes will improve confidence in simulation results and enhance the predictive capacity of the model.

Additionally, expanding the scope of model scenarios to encompass a wider range of climatic and hydrodynamic conditions is critical. Incorporating interannual variability such as different phases of the El Niño–Southern Oscillation (ENSO), as well as extreme events like high river discharge or storm surges, would improve understanding of the resilience and robustness of proposed dredging and nourishment strategies under dynamic environmental settings. Future work should also extend the model domain to evaluate dredging impacts on other erosion-prone northern beaches in Batemans Bay, such as Long Beach, to support broader regional coastal management efforts.

7 Conclusions

This study has demonstrated, through scenario-based numerical modelling, the effectiveness and strategic value of the Clyde River Bar Dredging 2025–2035 Project as a dual-purpose intervention for enhancing navigation safety and aiding in shoreline nourishment in Batemans Bay. By simulating a range of realistic environmental conditions and operational strategies — including wave-driven events, calm periods, and flooding scenarios — the model provides detailed insight into sediment transport pathways and their implications for shoreline nourishment, particularly at Surfside Beach.

The results show that dredged sediment released at offshore dumping sites can be effectively transported toward the shoreline, with clear evidence of sediment retention along Surfside Beach under both wave-forced and calm conditions. Notably, long-term dumping operations were found to significantly improve sediment delivery and retention compared to short-term events, highlighting the importance of sustained implementation. The modelling also reveals that site-specific strategies — such as using a single dumping site — can optimise sediment transport by minimising hydrodynamic interference, offering practical opportunities for targeted nourishment.

In contrast, flooding scenarios led to substantial offshore sediment export and should be avoided to prevent sediment loss from the inner bay. The results underscore the importance of aligning dumping activities with favourable environmental conditions and support the use of real-time forecasting to guide operational decisions.

Overall, the findings provide strong scientific support for the Clyde River Bar Dredging 2025–2035 Project as a well-founded and timely coastal management initiative. When implemented with adaptive planning and evidence-based strategies, the project has the potential to deliver long-term benefits for both maritime infrastructure and shoreline resilience, addressing pressing community and environmental concerns in a sustainable and proactive manner.

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Appendix B: Due Diligence Environmental Assessment – Clyde River Bar Dredging Checklist

Clyde River Bar Dredging Project 2025 - 2035

Review of environmental factors - Due diligence assessment

Document controls

Approval and authorisation

Title	Clyde River Dredging review of environmental factors due diligence assessment campaign MM/YYYY
Accepted on behalf of Transport for NSW by:	Dave Hopper Principal Manager, Dredging
Signed:	
Dated:	

Document status

Document status	Date	Prepared by	Reviewed by

Disclaimers

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Appendices

1 Introduction

1.1 The determined project

Transport for NSW completed a review of environmental factors (REF) of the Clyde River Bar Dredging Project 2025 - 2035 in August, 2025. The REF described the project, assessed the potential environmental and social impacts associated with the construction and operation of the project and identified safeguards and management measures to avoid, mitigate or manage those potential impacts.

The REF was placed on public display between 12th May and 2nd June, 2025. Following public display submissions received were considered and responded to by Transport for NSW in theClyde River Bar Dredign 2025 – 2035 REF Submissions Report.

After consideration of the REF and submissions report, Transport for NSW made a decision to proceed with the project on the 18th August, 2025.

1.2 Purpose

This due diligence assessment is to be prepared prior to each dredging campaign. The assessment is to ensure that any changes to the baseline existing environment or statutory requirements since the REF was determined has been considered. It helps to ensure that the REF and project is delivered in accordance with the statutory requirements of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of this due diligence assessment is to:

- Review the potential environmental impacts of the project against the environmental impacts of the determined project
- Decide whether or not the project is generally consistent with the determined project in accordance with the EP&A Act and the EPBC Act requirements
- Based on the decision of whether or not the project is consistent with the determined project, identify any further environmental impact assessment or environmental management requirements applicable required.

The findings of the due diligence assessment are to confirm the findings of the determined REF:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval to be sought from the Minister for Planning and Public Spaces under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten

long-term survival of these matters, and whether offsets are required and able to be secured

2 Due diligence assessment

2.1 Potential environmental impacts

Table 2-1: Comparison of environmental impacts

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
Geology and soils	Not applicable	
Land surface	Not applicable	
Hydrology/Hydrological issues	• Survey the channel annually (or prior to each campaign) to track and monitor changes to shoaling and buoyage placement. • Placement allocations will be designed such that the potential for the formation of new channels, bars or beach erosion is minimised. • Numerical sensitivity tests will be undertaken prior to each dredging campaign. These tests will investigate the sediment impact of the proposed dredging and placement activities and determine the best approach for maximising sediment transport toward the target beaches to achieve optimised nourishment outcomes. • Undertake hydrographic surveys prior to dredging.	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
	• A turbidity and current monitoring system is to be implemented to verify the accuracy of project sediment modelling and to facilitate consideration of any required changes to the works methodology.	
Biodiversity	• Complete a Marine Habitat Survey. Update the distribution maps of ecologically significant habitats (seagrasses, macroalgae stands, soft coral communities) identifying boundaries and required buffers. • Where shoreline placement areas are used, a pre-works inspection of the shoreline must be undertaken, particularly for fauna habitat (e.g., threatened shorebirds). • The Section 199 permit must be current and associated notification issued. A Section 20 permit should be applied for, and associated notification issued where identified within the Marine Habitat Survey or requested by NSW DPI Fisheries. • Adhere to the Benthic Assessment Procedure (BAP) developed for the project (Appendix D), which identifies the requirements and procedures for the 10-year approval, including the completion of a Marine Habitat Survey prior to each dredging campaign, reporting and further assessment requirements, consultation requirements, triggers for Species Impacts Statements and management plans and any permits and offsetting. • A Marine Habitat Survey is to be conducted prior to each dredging campaign to identify the potential to impact on any threatened species under the FM Act and to update the	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
	distribution of ecologically significant habitats (e.g. seagrasses, macroalgae stands, soft coral communities). These distribution maps of ecologically sensitive habitats are to be prepared for incorporation into the project CEMP or equivalent that identify habitat boundaries and required buffers. *A Marine Habitat Survey will not be required within 12 months for areas considered as part of this initial assessment.* • A monitoring program to measure ecological recovery of soft sediment communities within the subtidal Placement Areas is recommended and pre-dredging data obtained within three months of commencing dredging works. This data should include: • Measurement of infauna assemblages, diversity and abundance using replicated sampling to account for spatial variability (Min n = 4) at each site. • Measurement of key sediment characteristics TOC and PSD at each site. • Sampling of a minimum of two impact (within each Placement Area) and two appropriate control sites.	
Traffic, transportation and access	• The Proposal project manager will liaise with Eurobodalla Shire Council and/or Transport Maritime to ensure that project schedules for upgrades to nearby public infrastructure are known.	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
	Works will be staged so that upgrades and dredging activities are, where practicable, not being undertaken concurrently.	
Water transport	• A Marine Traffic Management Plan (MTMP) is to be submitted to Transport Maritime (Maritime South) for review and comment a minimum of 6 weeks prior to any works commencing. This MTMP will include provision for one navigable channel to be open at all times unless otherwise approved by Transport Maritime (Maritime South). • In accordance with the MTMP, appropriate navigation markers, warnings, lighting, and signage will be installed to restrict access to dredge and placement areas, locations of pipeline and dredge. •	
Land use and property	• Obtain Crown Lands Licence and/or ensure the current licence is still valid and all relevant conditions have been met.	
Noise and vibration	• A noise and vibration management plan (NVMP) is to be developed as part of the construction environmental management plan (CEMP) for the project. The NVMP is to be reviewed and updated prior to each dredging campaign to ensure affected receivers are identified and notified in accordance with this REF prior to the commencement of any dredging campaign.	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
Aboriginal cultural heritage	• Undertake a basic AHIMS search to determine if there are any new Aboriginal Heritage considerations. • Undertake 24ka notification under the *Native Title Act 1993*. The notice is to be prepared by the legal team and sent to NTSCORP prior to each campaign. • If the proposal's scope changes, the relevant Transport for NSW Aboriginal Community and Heritage Officer (ACHO) will be contacted.	
Non-Aboriginal heritage	• Undertake a desktop review of any new heritage listings in proximity to the proposal area.	
Landscape character and visual impacts	Not applicable	
Water quality	• A water quality management plan is to be prepared, including monitoring protocols, water quality objectives, water pollution prevention strategies and an emergency plan. • Potential or actual acid sulfate soils will be managed in accordance with the Roads and Maritime Services and Guidelines for the Management of Acid Sulfate Materials 2005. The ASSMP is to include procedures for testing, material classification, treatment and disposal.	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
	• DPIRD is to be provided with copies of the Water Quality Management Plan and CEMP prior to each dredging campaign.	
Air quality	Not applicable	
Socio-economic issues	• Works taking place in the evening (OOHW Period 1) require additional measures including periodic notification, verification monitoring, specific notification, and a respite offer. • The community must be notified of all work outside standard hours, which has the potential to impact noise-sensitive receivers. Notification requirements must comply with the *RMS Construction Noise and Vibration Guideline.* • Works taking place at night (OOHW Period 2) require additional measures including: periodic notification, verification monitoring, specific notification, respite period, and duration reduction. • The alignment of navigation leads in relation to the intended navigation channel is to be assessed prior to each dredging campaign. Adjustment of leads or the dredge design should be made as required to ensure alignment of these navigational features.	
Climate change	Not applicable	

Environmental issue	Requirements to be completed prior to each campaign (where applicable)	Consideration of the relative environmental impacts of the project compared to the determined project
Waste and resource management	Not applicable	
Hazard and risk	• Emergency contacts will be kept in an easily accessible location on vehicles, vessels, and the plant and site office. All workers will be advised of these contact details and procedures. • Vehicles, vessels, and plant must be properly maintained and regularly inspected for fluid leaks and excessive emissions. Prior to entry into the waterway, machinery should be appropriately cleaned, degreased and serviced. If defects are identified, works are to cease pending rectification. • No vehicle or vessel wash-down or re-fuelling will occur on-site.	
Cumulative impacts	Not applicable	

2.2 EPBC Act factors

Under the environmental assessment provisions of the *Environment Protection and Biodiversity Conservation Act 1999*, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered for the project.

Table 2-2: Comparison of EPBC Act factors

Factor	Consideration of the relative impact of the project compared to the determined project and if applicable any change to the EPBC strategic assessment or other EPBC approval
Any impact on a World Heritage property?	
Any impact on a National Heritage place?	
Any impact on a wetland of international importance?	
Any impact on a listed threatened species or communities?	
Any impacts on listed migratory species?	
Any impact on a Commonwealth marine area?	
Does the proposal involve a nuclear action (including uranium mining)?	
Additionally, any impact (direct or indirect) on Commonwealth land?	

2.3 Licences, permits and approvals

Table 2-3: Comparison of licence, permit and approval requirements

Existing requirement for the determined project	Identification of additional requirements or any change to the existing requirements
Batemans Marine Park Permit	
Crown Land Licence	
Transport (Maritime Operations) Approval	

3 Environmental management

3.1 Environmental management plans

A number of safeguards and management measures have been identified to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the project. Should the project proceed, these management measures would be addressed if required during detailed design and incorporated into the Contractors Environmental Management Plan (CEMP) and applied during the construction and operation of the project.

3.2 Summary of safeguards and management measures

Environmental safeguards and management measures for the Clyde River Bar Dredging 2025 – 2035 Project are summarised in Table 5-1. Additional safeguards and management measures identified in this due diligence assessment are included in bold and italicised font. The safeguards and management measures will be incorporated into the detailed design phase of the project, and the CEMP and implemented during construction and operation of the project, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment.

Table 5-1: Summary of site specific safeguards

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
1	Seagrass beds	Dredging and dredged material placement around seagrass beds will be avoided as much as possible in accordance with the *NSW Fisheries Management Act 1994*.	Dredging Contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
2	Impact to Ballast reef	Disposal of dredged material not to be undertaken within 50 metres of the known ballast reef.	Dredging Contractor	During each dredging campaign	Aquatic Ecology Assessment (Appendix D of REF)
3	Continued shoaling	Survey the channel annually to track and monitor changes to shoaling and buoyage placement.	Transport	Prior to each dredging campaign	*Marine NRMA and CCC consultations (see Sections 5.2 and 5.4 of REF)*
4	Smothering of sensitive aquatic habitat	Placement of dredge material around sensitive aquatic habitat would be avoided though the establishment of project buffers. A buffer of 50m from the Ballast Reef and 500m from Cullendulla Creek.	Dredging contractor	During each dredging campaign	Aquatic Ecology Assessment (Appendix D of REF)

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
5	Slumping of dredge batters	To minimise the risk of slumping and impacting surrounding habitats and accelerate sedimentation within the navigation channel, all dredge-cut batters are to be no steeper than 1 in 4.	Dredging contractor	During each dredging campaign	
6	Sediment processes	Placement allocations will be designed such that the potential for the formation of new channels, bars or beach erosion is minimised.	Dredging contractor	Prior and during each dredging campaign	
7	Sediment processes	Numerical sensitivity tests will be undertaken prior to each dredging campaign. These tests will investigate the sediment impact of the proposed dredging and placement activities and determine the best approach for maximising sediment transport toward the target beaches to achieve optimised nourishment outcomes.	Transport for NSW	Prior to each dredging campaign	Hydrodynamic Modelling and Sediment Transport Analysis (Appendix F of REF)
8	Dredged material placement	Dredged material placement planning should prioritise single-site placement to optimise beach nourishment outcomes.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
9	Dredged material placement	Where practical, undertake dredged material placement activities during calm weather conditions.	Dredging contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in Batemans Bay, NSW: A Modelling Study (UNSW)
10	Flood impact on sand placement	Dredged material placement is to be avoided during periods of riverine flooding.	Dredging Contractor	During each dredging campaign	Impacts of Dredging on Sediment Dynamics in

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					Batemans Bay, NSW: A Modelling Study (UNSW)
11	Sediment plumes	All efforts will be made to minimise the occurrence and extent of the sediment plumes throughout the works.	Dredging contractor	During each dredging campaign	*Australian and New Zealand Guidelines for Fresh & Marine Water Quality*
12	Monitoring protocols	A water quality management plan is to be prepared, including monitoring protocols, water quality objectives, water pollution prevention strategies and an emergency plan.	Dredging contractor	Prior to each dredging campaign	*Australian and New Zealand Guidelines for Fresh & Marine Water Quality*
13	PASS or AASS	Potential or actual acid sulfate soils will be managed in accordance with the Roads and Maritime Services and Guidelines for the Management of Acid Sulfate Materials 2005. The ASSMP is to include procedures for testing, material classification, treatment and disposal.	Dredging contractor	Prior and during each dredging campaign	*Roads and Maritime Services Guidelines for Management of Acid Sulfate Materials 2005*
14	Tides and vessel-passage	Vessels (including barges) are only to be used at suitable tides when no less than 600mm clearance is available between the vessel's underside and the waterway's bed.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
15	Hazardous materials	Refuelling plant and equipment and storing hazardous materials on barges will occur within a double-bunded area. All fuels, chemicals and liquids are to be stored in an impervious bunded area.	Dredging contractor	Prior to and during each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R3)*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
16	Spill kit and bins availability	An emergency spill kit and bins will always be kept on all vessels and at the site compound, maintained throughout the work and appropriately sized for the volume of substances on the vessel.	Dredging contractor	During each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*
17	Spill kit type	Spill kits for construction barges must be specific for working within the marine environment.	Dredging contractor	During each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*
18	Spill kit training	All workers will be advised of the location of the spill kit and trained in its use.	Dredging contractor	Prior to each dredging campaign	*Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (R6)*
19	Incident reporting	If an incident (e.g. spill) occurs, the Roads and Maritime Services Environmental Incident Classification and Reporting Procedure is to be followed, and the Roads and Maritime Services Contract Manager is to be notified as soon as possible.	Dredging contractor	During each dredging campaign	*Environmental Incident Classification and Management Procedure 2018. RMS 17.374. Version 5.1*
20	Maritime spill	In the event of a maritime spill, the incident emergency plan will be implemented in accordance with Sydney Ports Corporation's response to shipping incidents and emergencies.	Dredging contractor	During each dredging campaign	*Environmental Incident Classification and Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					Procedure 2018. RMS 17.374. Version 5.1
21	Emergency contacts	Emergency contacts will be kept in an easily accessible location on vehicles, vessels, and the plant and site office. All workers will be advised of these contact details and procedures.	Dredging contractor	Prior to and during each dredging campaign	
22	Maintenance and inspection	Vehicles, vessels, and plant must be properly maintained and regularly inspected for fluid leaks and excessive emissions. Prior to entry into the waterway, machinery should be appropriately cleaned, degreased and serviced. If defects are identified, works are to cease pending rectification.	Dredging contractor	Prior to and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
23	Wash-down and re-fuelling	No vehicle or vessel wash-down or re-fuelling will occur on-site.	Dredging contractor	Prior to, during and after each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
24	Construction and Personnel waste	All construction and personnel waste will be disposed of appropriately.	Dredging contractor	During and after each dredging campaign	
25	Waste management	A waste minimisation hierarchy will be implemented: • Avoidance of waste production. • Treated and reused onsite. • Recycled. Disposed of in appropriate bins and a licensed waste management facility.	Dredging contractor	During and after each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
26	Vessel wastewater	Vessel wastewater will not be discharged into the environment. Wastewater will be disposed of at a site approved to receive vessel wastewater.	Dredging contractor	During and after each dredging campaign	
27	Noise and vibration	A noise and vibration management plan (NVMP) is to be developed as part of the construction environmental management plan (CEMP) for the project. The NVMP is to be reviewed and updated prior to each dredging campaign to ensure affected receivers are identified and notified in accordance with this REF prior to the commencement of any dredging campaign.	Dredging contractor	Prior to each dredging campaign	
28	Unused plant	Plant would be turned off when not in use.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
29	Standard work hours	Works are to be undertaken within standard working hours where possible. If work within standard working hours is not possible due to tidal conditions, etc, noise impacts are to be minimised in accordance with the Transport Noise Estimator Tool, including additional measures as applicable. Any works outside of standard working hours would be subject to approval from the relevant Transport representative.	Dredging contractor	During each dredging campaign	Environmental Assessment Procedure for Routine and Minor Work: Standard Safeguard List (N1)
30	Standard work hours	Works taking place in the evening (OOHW Period 1) require additional measures including periodic notification, verification monitoring, specific notification, and a respite offer.	Dredging contractor	Prior and during each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
31	Outside standard work hours	The community must be notified of all work outside standard hours, which has the potential to impact noise-sensitive receivers. Notification requirements must comply with the *RMS Construction Noise and Vibration Guideline.*	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
32	Outside standard work hours	Works taking place at night (OOHW Period 2) require additional measures including: periodic notification, verification monitoring, specific notification, respite period, and duration reduction.	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
33	Loading/ unloading locations	Loading and unloading of materials/deliveries is to occur as far away as possible from sensitive receivers.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
34	Shielding of loading/ unloading	Dedicated loading/unloading areas are to be shielded if close to sensitive receivers.	Dredging contractor	During each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
35	Laydown area location	The laydown area is to be located away from sensitive receivers where practical.	Dredging contractor	Prior and during each dredging campaign	*NSW Construction Noise and Vibration Strategy 2018*, ST-157/4.1
36	Cleanliness each day	Laydown area is to be kept clean, tidy, and rubbish-free at all times.	Dredging contractor	During each dredging campaign	
37	Cleanliness for each campaign	All site materials, plant, machinery and storage are to be removed from the laydown site and waterway at the end of each campaign.	Dredging contractor	Prior, during and after each dredging campaign	
38	BAP adherence	Adhere to the Benthic Assessment Procedure (BAP) developed for the project (Appendix D), which identifies the requirements and procedures for the 10-year approval,	Dredging contractor	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		including the completion of a Marine Habitat Survey prior to each dredging campaign, reporting and further assessment requirements, consultation requirements, triggers for Species Impacts Statements and management plans and any permits and offsetting.			*habitats and riparian zones)*
39	Marine Habitat Survey	A Marine Habitat Survey is to be conducted prior to each dredging campaign to identify the potential to impact on any threatened species under the FM Act and to update the distribution of ecologically significant habitats (e.g. seagrasses, macroalgae stands, soft coral communities). These distribution maps of ecologically sensitive habitats are to be prepared for incorporation into the project CEMP or equivalent that identify habitat boundaries and required buffers. *A Marine Habitat Survey will not be required within 12 months for areas considered as part of this initial assessment.*	Transport	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
40	Soft sediment communities	A monitoring program to measure ecological recovery of soft sediment communities within the subtidal Placement Areas is recommended and pre-dredging data obtained within three months of commencing dredging works. This data should include: • Measurement of infauna assemblages, diversity and abundance using replicated sampling to account for spatial variability (Min n = 4) at each site. • Measurement of key sediment characteristics TOC and PSD at each site. • Sampling of a minimum of two impact (within each Placement Area) and two appropriate control sites.	Dredging contractor	Prior to each dredging campaign	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
41	*P. australis* occurrence	The CEMP or equivalent document should include information to assist in identifying the threatened *P. australis* communities. Locations where these species are located are to be avoided during dredging and placement activities.	Dredging contractor	Prior to each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1 (Pre-clearing process)*
42	DPIRD - Fisheries permit	A section 199 notification must be issued prior to each dredging campaign. A section 205 permit should be applied for, and associated notification issued where identified within the Marine Habitat Survey or requested by NSW DPIRD Fisheries.	Dredging contractor	Prior to each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994*
43	DPIRD - Batemans Marine Park Permit	As the Proposal would be undertaken within the Batemans Marine Park, a permit will be required prior to the commencement of the activity.	Transport	Prior to each dredging campaign	*Marine Estate Management Act 2014* and Marine Estate Management (Management Rules) Regulation 1999
44	Reef Buffer	Sand placement must not occur within 50m of the ballast reef.	Dredging contractor	During each dredging campaign	
45	Sanctuary Zone (SZ)	Sand placement must not occur within 500m of the Cullendulla Creek SZ.	Dredging contractor	During each dredging campaign	
46	Works around seagrass beds	No works, including vessel launching, beaching, or any operation or laying of pipes, will occur within 50 m of any seagrass beds outside the navigational channels.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					conservation and management (2013) and *FM Act 1994*
47	Sand placement around seagrass beds	Sand placement via a hopper will not occur within 100 m of any seagrass beds.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 10 (Aquatic habitats and riparian zones)*
48	Discovery of threatened species	If any unexpected threatened species (e.g. White's Seahorse, Cauliflower Soft Coral) are seen within 10 m of any works, works must stop immediately, and a marine ecologist should be notified. The marine ecologist and project team must consult with DPIRD Fisheries to assess appropriate management actions, referring to the BAP.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
49	Mooring or beaching around marine vegetation	No mooring or beaching of vessels is to occur within any seagrass areas or any other marine vegetation.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat (2013)*
50	Fur seals	The NSW NPWS Guidelines for approach distance to fur seals (see Appendix D) must be adhered to at all times. Should this not be possible, the project ecologist and NPWS must be notified immediately.	Dredging contractor	During each dredging campaign	*NSW NPWS Guidelines for developments adjacent to national parks and other reserves 2020*
51	Dredge pipes	No dredge pipes are to be placed over seagrasses or rocky intertidal or subtidal areas.	Dredging contractor	During each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					management (2013) and *FM Act 1994.*
52	Storing of hydrocarbon-based products	Avoid storing hydrocarbon-based products on any water sites within the Proposal area. Storage should be in a suitable bunded area within the site laydown area.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
53	Dredge plume monitoring	Visual and turbidity monitoring of dredge pluming should be undertaken as part of standard water quality monitoring during dredging works.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
54	Hydrocarbon boom placement	Where practical, floating containment booms should be in place around machinery operating on or over water to control any unplanned spills of hydrocarbons.	Dredging contractor	During each dredging campaign	*Protection of the Environment Operations (General) Regulation 2022*
55	Hydrocarbon storage	Hydrocarbons are to be stored in a bunded area with adequate spill kits available.	Dredging contractor	During each dredging campaign	*Safe work NSW Storage and Handling of Dangerous Goods Code of practice*
56	*Caulerpa taxifolia (C. taxifolia)* introduction and the cleaning of equipment	All equipment to be brought to the proposal area must be thoroughly cleaned and free of substrate to avoid the introduction of species such as *C. taxifolia*. Given the potential for *C. taxifolia* in nearby areas, equipment should be thoroughly cleaned following the completion of the project to prevent the spread of the species to other areas.	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
57	*C. taxifolia* discovery	If *C. taxifolia* is found within the proposal area, it should be avoided and not disturbed to minimise further spread to other areas of the Proposal area. If dredging vessels or equipment are found to have caught *C. taxifolia* during works, they	Dredging contractor	During each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		should be thoroughly cleaned with fresh water, with all bota safely disposed of on land.			
58	Marine flora, fauna, infauna and habitats	All materials, machinery and rubbish must be removed from the site.	Dredging contractor	After each dredging campaign	
59	Marine flora, fauna, infauna and habitats	Regular inspections of the site are to be undertaken by the Transport Environment Officer or Project Manager.	Dredging contractor	After each dredging campaign	*NSW DPIRD Policy and guidelines for fish habitat conservation and management (2013)* and *FM Act 1994.*
60	Marine flora, fauna, infauna and habitats	Any notification requirements of the section 199 or 205 permits must be filled and submitted.	Dredging contractor	After each dredging campaign	*FM Act 1994*
61	Updated mapping	For future dredging works scheduled to occur greater than 12 months following completion of the site surveys done as part of the 2024 AEA, the mapping of sensitive habitats (seagrass beds, macroalgae stand and soft coral communities) will need to be updated for inclusion into an updated version of the CEMP.	Dredging contractor	After each dredging campaign	*Biodiversity Guidelines 2011 – Guide 1*
62	Public communication	Notification is to be given to affected community members before the work occurs. The notification is to include: • Details of the proposal. • Duration of work and working hours. • Changes to traffic or access. • Lodging a complaint or obtaining information.	Transport	5days prior to commencement of works	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		Contact information.			
63	Recording complaints	All complaints are to be recorded on the complaints register and attended to promptly.	Dredging Contractor/ Transport	During each dredging campaign	
64	Ancillary facility footprint	The footprint of the ancillary facility will be minimised where possible.	Dredging contractor	Prior and during each dredging campaign	
65	Pedestrian access	Pedestrian access to the foreshore will be maintained.	Dredging contractor	Prior and during each dredging campaign	
66	Permit for ancillary facility	A permit will be sought from the Eurobodalla Shire Council to use the ancillary facility area as required.	Dredging contractor	Prior and during each dredging campaign	
67	Disturbance to existing vessel movements	Where possible, existing vessel movements (recreational) will be maintained during dredging works. Any disturbance to recreational users is to be minimised as much as practicable.	Dredging contractor	Prior and during each dredging campaign	
68	On-water Traffic	A Marine Traffic Management Plan (MTMP) is to be submitted to Transport Maritime (Maritime South) for review and comment a minimum of 6 weeks prior to any works commencing. This MTMP will include provision for one navigable channel to be open at all times unless otherwise approved by Transport Maritime (Maritime South).	Dredging contractor	Prior to each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
69	Navigation markers, warnings, lighting and signage	In accordance with the MTMP, appropriate navigation markers, warnings, lighting, and signage will be installed to restrict access to dredge and placement areas, locations of pipeline and dredge. These markers will include: • Navigation channel lateral marks.	Dredging contractor	Prior to each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• Channel blocked/closed signals. • Navigation marks or signage required by NSW Maritime to ensure the safe and efficient operation of the navigation channel or channels through or around the works and temporary removal, relocation, or covering of any existing contradictory or superfluous signs, buoyage or navigation marks. The contractor must also ensure that these protocols are being followed: • Always maintaining a radio listening watch on VHF channel 16 by the dredge master. • Reporting any marine pollution resulting from a work vessel to the Senior Boating Safety and Transport by phoning 13 12 36. • Notifying NSW Maritime if the proposal duration is to be extended. • Removing all items, including vessel, plant, machinery and auxiliary equipment from NSW State Waters on completion of the works unless they otherwise hold an appropriate licence. All operators and vessels (including the dredge) used in this operation must comply with the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, including strict adherence to International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) System regarding day shapes and night lights. No agent shall be exempted from the provisions of the *Marine Safety Act 1998* or any other relevant legislation.			
70	Compliance of vessels	All work vessels will comply with the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, the *Marine Safety Act 1998*, and all relevant subordinate legislation.	Dredging contractor	Prior and during each	*Marine Safety (Domestic Commercial*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
				dredging campaign	*Vessel) National Law Act 2012*
71	Preventing collisions via COLREGS	All work vessels will exhibit lights and shapes in accordance with *International Regulations for Preventing Collisions at Sea 1972* (COLREGS).	Dredging contractor	During each dredging campaign	*International Regulations for Preventing Collisions at Sea 1972 (COLREGS), Rules 20-30.*
72	Marking equipment to reduce risk to vessels	All pipes and associated equipment that will restrict or vary existing navigation conditions will be clearly marked, including the use of lights at night, to reduce the risk to vessel navigation and safety. Appropriate markings shall be identified within the MTMP.	Dredging contractor	Prior and during each dredging campaign	*Marine Safety (Domestic Commercial Vessel) National Law Act 2012*
73	Discovering Aboriginal objects	If any potential Aboriginal objects (including skeletal remains) are discovered during the Proposal, all work near the find will cease. Steps in the TfNSW *Standard Management Procedure: Unexpected Heritage Items* must be followed.	Dredging contractor	During each dredging campaign	TfNSW (2021) *Unexpected Heritage Items*
74	Changes to proposal	If the proposal's scope changes, the relevant Transport for NSW Aboriginal Community and Heritage Officer (ACHO) will be contacted.	Dredging contractor	Prior to each dredging campaign	
75	Changes to proposal	If the proposed spoil placement area were to change, updated modelling information is to be provided to DPIRD to ensure that spoil will not move into Cullendulla Creek or harm sensitive habitats within Batemans Bay.	Dredging contractor	Prior to any change in spoil placement area	
76	Awareness of highly sensitive areas	Due to the type of Aboriginal sites within the vicinity of the Proposal area, this area is regarded as highly sensitive. Staff undertaking work will be made aware of all Aboriginal sites	Dredging contractor	Prior to each dredging campaign	*NPW Act 1974, section 90*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		within the vicinity of the proposal area to ensure these sites are not impacted.			
77	Unexpected heritage items	If unexpected heritage items are uncovered during the works, all works will cease in the vicinity of the material/find and the steps in the *Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items* will be followed. Transport Senior Environment Specialist - Heritage will be contacted immediately of an unexpected find.	Dredging contractor	During each dredging campaign	*Roads and Maritime Services Standard Management Procedure: Unexpected Heritage Items*
78	Changes in the bathymetry of Clyde River Bay following significant weather events	Undertake hydrographic surveys after significant weather events to assess changes in bathymetry of the dredging footprint.	Transport	After significant weather events	*NSW Marine Estate Management Strategy 2018-2028*
79	Changes in the bathymetry of Batemans Bay	Undertake hydrographic surveys prior to dredging.	Transport	Prior to each dredging campaign	*NSW Marine Estate Management Strategy 2018-2028*
80	Traffic and parking	The Proposal project manager will liaise with Eurobodalla Shire Council and/or Transport Maritime to ensure that project schedules for upgrades to nearby public infrastructure are known. Works will be staged so that upgrades and dredging activities are, where practicable, not being undertaken concurrently.	Transport	Prior to each dredging campaign	*Cumulative Impact Assessment Guidelines for State Significant Projects*
81	Monitoring and review	A turbidity and current monitoring system is to be implemented to verify the accuracy of project sediment modelling and to facilitate consideration of any required changes to the works methodology.	Transport	Each dredging campaign	*Impacts of Dredging on Sediment Dynamics in*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					Batemans Bay, NSW: A Modelling Study (UNSW)
82	Monitoring and review	Consideration is to be given to providing pre and post dredging surveys to the Australian Hydrographic Office.	Transport	Following each dredging campaign	
83	Navigation	The alignment of navigation leads in relation to the intended navigation channel is to be assessed prior to each dredging campaign. Adjustment of leads or the dredge design should be made as required to ensure alignment of these navigational features.	Transport	Prior to each dredging campaign	
84	Environmental Assessment	A Due Diligence Environmental Assessment (refer to Appendix B) is to be prepared prior to each dredging campaign to identify and address any changes to the environment or statutory requirements from those listed in the Determined REF and this Submissions Report.	Transport	Prior to each dredging campaign	
85	Management Plan Referral	DPIRD is to be provided with copies of the Water Quality Management Plan and CEMP prior to each dredging campaign.	Dredging contractor	Prior to each dredging campaign	
86	Marine Vegetation Surveys and Offsets	DPIRD is to be provided with pre-works ecology surveys as they are completed to ensure no harm to marine vegetation is anticipated. If seagrass or any marine vegetation is likely to be negatively impacted to a degree that cannot be mitigated, environmental compensation at a rate of 2:1 habitat offset requirement and a permit to harm marine vegetation under section 205 of the Act would be required before works commence.	Dredging contractor	Prior to each dredging campaign	

4 Conclusion

The project is considered to be [*generally consistent with the determined project*] / [*not consistent with the determined project*].

In addition, the project [*would/would not result in any change to the potential impacts identified and assessed in accordance with the existing EPBC Act strategic assessment / EPBC Act approval / SIS / BDAR for the project*] Or [*would/would not result in additional impacts that would likely trigger EPBC Act strategic assessment / EPBC Act approval / SIS / BDAR*].

5 Certification and endorsement

5.1 Certification – due diligence assessment preparer

This document provides a true and fair review of the scope and potential impacts of the project compared with the scope and environmental impacts of the determined project.

Signed		Signed	
Name		Name	
Position		Position	
Date		Date	

5.2 Transport for NSW certification and endorsement

[*I have reviewed the scope and potential environmental impacts of the project against the determined project. A separate or addendum environmental impact assessment is required*].

[Or]

[*I have reviewed the scope and potential environmental impacts of the project against the determined project. The due diligence assessment has identified that since the REF was determined, the project would be generally consistent with the determined project and is exempt from further environmental impact assessment.*

The project would not trigger the EPBC Act strategic assessment/other EPBC Act approval and/or a SIS or BDAR.

The CEMP and sub plans will be updated to incorporate updated information or additional safeguards required.]

Signed		Signed	
Name		Name	
Position	Transport for NSW Environment officer	Position	Transport for NSW Environment officer
Date		Date	

5.2.1 Endorsement

I have examined the outcomes of the due diligence assessment with the determined Clyde River Bar Dredging Project 2025 - 2035

[*I endorse the findings of this assessment subject to adoption of my requirements in the table below*] or [*I have reviewed and do not endorse the findings of this due diligence assessment*].

Requirements	•

Signed	
Name	
Position	Transport for NSW Environment Manager
Date	