SWASH

ABMRI Dredge Trial - Report on Operational and Environmental Feasibility of Dredging

Adelaide Beach Management Review Implementation Project

21 March 2025

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

1 Executive Summary

In May 2024, the South Australian government committed to a dredging trial to deliver sand nearshore to West Beach as part of the Adelaide Beach Management Review Implementation (ABMRI) project.

To facilitate very short timeframes to complete a dredging trial in 2024, the Department for Environment and Water (DEW) selected to proceed with local SA dredging contractor – Maritime Constructions (MC) who already held an Environment Protection Authority (EPA) approved dredge licence. DEW also had an existing contract in place with MC with respect to dredging of boat harbours, and MC had locally available resources – people, plant and equipment to undertake and manage the dredging trial at short notice.

Two sand borrow areas (SBA) at North Haven (SBA1) and West Beach Boat Harbour sand trap (SBA3) were dredged with sand relocated nearshore at West Beach via split hopper barges and pipeline / diffuser barge arrangements respectively.

MC adopted cutter suction dredging (CSD) operations due to shallow depths of sand borrow areas. Other dredging methodologies such as trailing suction hopper dredging (TSHD) or backhoe dredging (BHD), may be more feasible subject to the characteristics (i.e. water depths, operating conditions) of alternative sand borrow areas.

Dredging operations occurred between 3 October and 30 November 2024.

This report:

- Provides a summary of the ABMRI dredge trial with respect to operability, production, contractual, environment and safety.
- Reviews the trial in line with ABMR Independent Advisory Panel (IAP) recommendations, DEW scoping studies, and the dredging contractor's Performance Evaluation Report.
- Provides discussion points and lessons learned.

Figure 1. Dredging at sand source area SBA1 with CSD Kingston (left), anchor barge (middle) and split hopper barge WH762 supported by Sea Pelican tug (right)

1.1 Production

A shortened extract of **Table 5. 2024 Dredging production rates** and key information is provided below.

Item	Phase 1 SBA1	Phase 2 SBA3	Total / Average
Dredging commenced	3 Oct 24	30 Oct 24	3 Oct 24
Dredging finished	21 Oct 24	30 Nov 24	30 Nov 24
Dredging duration	19 days (3 weeks)	32 days (4.5 weeks)	59 days (8.5 weeks)
Actual dredging days	11 days	22 days	33 days
Dredge area (m^2)	8,544 m^2	21,532 m^2	30,076 m^2
Dredge volume (m^3) est.	17,573 m^3	39,451 m^3	57,024 m^3
Survey volume (m^3) removed	16,781 m^3	41,791 m^3	58,572 m^3
Production rate (m^3/NOH)	168 m^3/NOH	181 m^3/NOH	176 m^3/NOH
Ave. Production rate (m^3/day)	925 m^3	1,233 m^3	966 m^3
Max. Production rate (m^3/day)	2,808 m^3	3,983 m^3	3,983 m^3
Sand source seabed depth (m) below CD	- 2.5 to - 1.0m CD	- 3.0 to - 0.5m CD	----
Target dredge depth (m) below CD	- 3.5 m CD	- 3.0 m CD	----
Dredge cut depth (m)	0.5 – 2.0 m	0.5 – 2.5 m	----

1.2 Discussion and Lessons learned

1.2.1 Operational

- A dredge volume of 58,572 m^3 was achieved in this 9-week trial, representing 65% of a desirable target of 90,000 m^3. (Note: the priority of trial was to test operational feasibility (dredging and placement methodologies) along with environmental feasibility).
- The use of a cutter suction dredge (CSD) was successful in dredging shallow nearshore sand borrow areas (-2.5m to -1.0m Chart Datum).
- A small trailing suction hopper dredge (TSHD) would have limited capacity to dredge in these shallow depths due to draft of vessel. However, would likely be more productive/feasible in water depths deeper than -3.0m CD. (Note: there is a limited market of very small TSHDs in Australasia).
- Productivity of SBA1 and SBA3 dredging was limited by seasonal weather conditions (wind and waves) and maximum operating parameters of the CSD. For a Damen build CSD350 'Kingston', the typical maximum operating parameters are H_s <0.35m and wave length < 9m. For standby on spuds or wires H_s <0.65m and wave length < 13.5m (source: Damen).
- Hopper barges and self-propelled TSHDs can typically operate in conditions of H_s < 1.0 – 1.5m and wind speeds up to 20 knots.

- Productivity of SBA1 dredging was further reduced during significant weather events due to the need for both SHBs to be towed into the Inner Harbour for refuge. Long standdown periods associated with only one tow vessel for SHBs, early berthing due to port shipping schedules and erring on the side of caution with weather forecasts. Note a self-propelled TSHD or SHB could return to Inner Harbour only when conditions deteriorated substantially and not based on forecast weather only.
- Standby and Standdown periods resulted in higher dredging unit cost rates, particularly for SBA1.
- If utilising a cutter suction dredge, then dredging at a more preferrable time of year such as autumn when winds are typically from the north and north-east would improve CSD productivity.
- The coupling / de-coupling time to switch from one SHB to another during SBA1 dredging was reduced from 2 hours to around 20 minutes throughout this trial.
- Mobilisation and demobilisation costs, as a percentage of total dredging contract costs would be reduced if greater volumes of sand were dredged.
- Dredging unit rates from this trial sets a baseline upper limit of costs for potential future programs, due to lessons learned and efficiencies from longer term planning and purposely procured dredge and equipment.
- A crew transfer vessel should be considered so that crew change onto tug/SHB, or TSHD, can occur during transit trips to reduce standby time, i.e. waiting for night shift to start before commencing SHB transit to West Beach.
- The size and number of SHBs to be further reviewed. Smaller, shallower hopper barges would facilitate closer nearshore placement though require more barges to keep up with dredging productivity. On high productivity days the SHBs were being filled and then the CS dredge was on standby waiting for empty hopper barge to return. Self-propelled barges should also be considered.
- A backhoe dredge could be considered for similar nearshore (SBA1) areas to mechanically load sand into hopper barges and reduce overflow associated with hydraulically filling hopper barge with CSD. A BHD could also operate in greater operating conditions (waves H_s < 1.2m, wave period < 8 seconds, winds up to 20 knots).
- A mobile, self-propelled TSHD would likely be more feasible for sand borrow areas with deeper water depths than trial SBA areas due to only requiring one vessel. TSHDs can also operate in greater operating conditions (waves H_s < 1.5m, winds up to 20 knots) and more readily mobilise into sheltered port waters during severe weather events.
- Nearshore placement of sand with 760 m^3 split hopper barges was successful and achievable.
- The Rehandling Area (RA) was used in the trial and could be used in the future to place further sand volumes via larger SHBs or TSHDs. This sand could then be rehandled (dredged) and placed nearshore/onshore at a more favourable time of year with a CSD.
- Alternatively, sand can also be pumped nearshore/onshore via a pipeline from TSHDs directly.

1.2.2 Environmental

- Water quality – there were no exceedances of the water quality trigger levels during the dredging period. The 6-day and 15-day rolling median turbidity data indicated that turbidity remained below the trigger values during dredging periods, even using the more stringent November trigger values.
- Seagrass – overall, the findings suggest that dredging activities - at the trial scale - did not have a significant negative impact on seagrass cover, biomass, or habitat structure, with observed changes in seagrass communities more likely attributed to natural variability and external environmental factors.
- Noise – several attended and unattended noise monitoring undertaken during the AMBRI dredge trial showed compliance with the relevant noise criteria was achieved. Noise at both locations

(SBA1 and SBA3/SPA1) was observed to be controlled by natural sounds or extraneous noise sources rather than dredging activity.

- Marine Fauna - An independent Marine Mammal Observer (MMO) was engaged to monitor cutter suction dredging and hopper barge loading activities at SBA1 (North Haven) between 03 to 21 October 2024. Only 1 sighting of two bottlenose dolphins was observed at 1438 hours on 13 October 2024. The Observer noted '*Dredging was in progress at the time. They (dolphins) were moving steadily and straight, so appeared to be simply travelling by and disinterested in the dredging operations.'*
- Odour and visual amenity – no odour complaints are known to have been made to DEW. No onshore placement of sand occurred which would be more likely to result in potential odour or visual amenity complaints. Visual amenity was likely more impacted by associated truck and quarry sand movements.

1.3 Summary

Overall, the ABMRI dredge trial was successful in proving the **operational and environmental feasibility of dredging,** including:

- availability of plant and equipment for adequate timeframes;
- ability of dredging infrastructure to recycle the volumes required;
- nearshore placement of sand via both bottom placement through split hopper barges and via pipeline and diffuser barge arrangement; and
- no environmental impacts associated with water quality, seagrass, noise, marine mammals.

There were limitations to the trial associated with:

- adoption of cutter suction dredge for trial with more restricted productivity associated with wind/waves operating conditions (i.e. Spring winds from south-west)
- suitable and sustainable sand borrow areas;
- no onshore sand placement was trialled; and
- no backhoe or trailing suction hopper dredging was trialled, though placement methodology would be the same as trial nearshore bottom placement. Both of these TSHD or BHD methodologies could operate in larger operating conditions (wind/waves) compared with a CSD, though a TSHD would require a minimum water depth of -3.0m chart datum to maintain sufficient vessel under keel clearance.

Acronyms

Table 1. Acronyms

Acronym	Explanation
ABMRI	Adelaide Beach Management Review Implementation
AHD	Australian Height Datum
BHD	Backhoe Dredge
CD	Chart Datum (approximate Lowest Astronomical Tide (LAT) is 1.45m below Australian Height Datum (AHD)
CSD	Cutter Suction Dredge
DEW	Department for Environment and Water (South Australia)
DMP	Dredge Management Plan (EPA approved)
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPA	Environment Protection Authority (South Australia)
LAT	Lowest Astronomical Tide
MC	Maritime Constructions
MMO	Marine Mammal Observer
NTU	Nephelometric Turbidity Units (measure of water clarity / turbidity)
pH	Quantitative measure of acidity or basicity of aqueous or other solutions
RA	Rehandling Area
SBA	Sand Borrow Area
SHB	Split Hopper Barge
SPA	Sand Placement Area
SLSC	Surf Life Saving Club
TSHD	Trailing Suction Hopper Dredge
WBBH	West Beach Boat Harbour

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2 Introduction

2.1 Background

In May 2024, the South Australian government committed to a dredging trial to deliver sand nearshore to West Beach as part of the Adelaide Beach Management Review Implementation (ABMRI) project.

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2.2 Preliminaries

A summary of the 2024 project preliminaries is provided in **Table 2** below.

Table 2. Summary of preliminaries

Project:	2024 ABMRI – Dredging Trial
Location:	Adelaide Beach Management Review Implementation – Dredging Trial
Contract Title:	Provision of (Trial) Dredging Services
Contract Number:	19422
Contract Type:	Goods & Services Agreement
Principal:	SA Department for Environment and Water (DEW)
Project Executive:	Nicole Pelton
Project Managers / Superintendent	Felicity Beswick Jason Quinn
Dredging Superintendent's Rep	Damian Snell (Swash)
Sand placement design and monitoring	Brad Smith (Hatch)
Dredging Contractor:	Maritime Constructions Dredging & Port Development Pty Ltd

Dredging Contractor's Representatives	Sikko Krol – Project Director Simon Spencer – Project Manager / Environmental Avi Patel – Project Engineer Huw Thomas - Hydro surveyor

2.3 Locations

The Sand Borrow Areas (SBAs) outlined in the EPA approved Dredge Management Plan (DMP) included:

- SBA1 - North Haven marina sand trap
- SBA2 - West Beach sand bank *(no dredging occurred here during trial)*
- SBA3 - West Beach boat harbour sand trap
- RA - Rehandling Area *(no dredging occurred here during trial)*

The Sand Placement Areas (SPAs)

- SPA1 - Nearshore at West Beach
- SPA2 - Onshore at West Beach *(no sand was placed directly onshore during trial)*
- RA - Rehandling Area

These SBAs and SPAs are shown in **Figure 2** below.

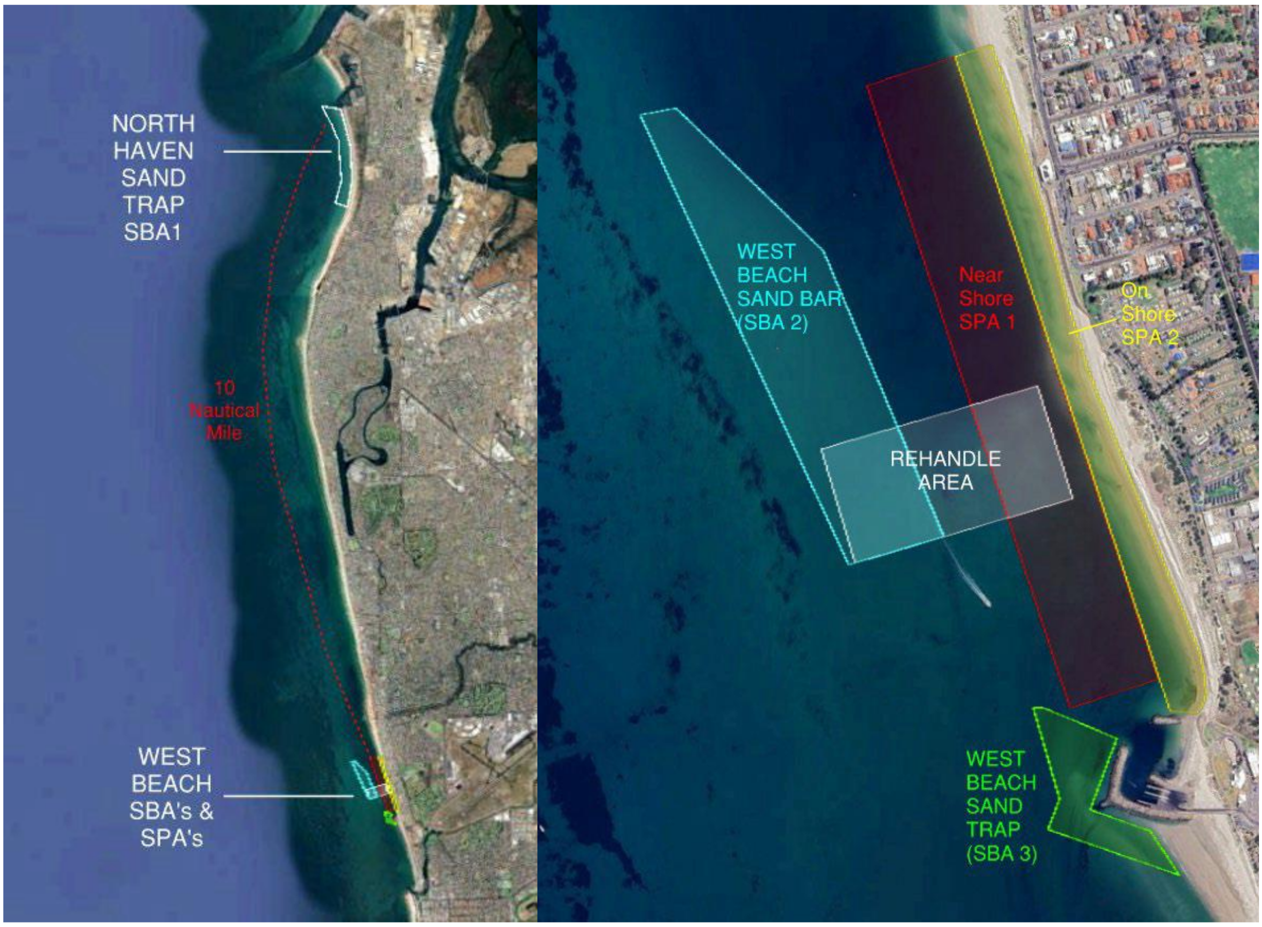


Figure 2. Locations of Sand Borrow and Sand Placement Areas (source: Figure 4-1 of EPA approved DMP)

3 Operational

Maritime Constructions utilised the following plant and equipment on site during this project (**Table 3**). Additional plant and equipment were brought on site as required for:

- Loading and unloading pipe
- Profiling beach (not used)
- Welding pipe strings
- Diffusing sand nearshore (diffuser barge)

Table 3. Key Marine Plant (source: Maritime Constructions)

Name	Vessel Type	Dimensions / Specifications	Weight (t)
KINGSTON	Damen CSD350	Length – 16.5m Beam – 6.0m	55
KENNY	Anchor Barge	Length – 9m Beam – 3.8m	12
LLOYD	Workboat	Length – 7.61m Beam – 2.3m	2
SEA PELICAN	Primary Tug	Length – 23.5m Beam – 7.5m 15T bollard pull	180
CHAPMAN	Assistance Tug	Length – 13.72 Beam – 4.31m 3T bollard pull	60
WH761	Split Hopper Barge	Length – 59.4m Beam – 11.04m Hopper Capacity – 760m^3	630
WH762	Split Hopper Barge	Length – 59.4m Beam 11.04m Hopper Capacity – 760m^3	630
RAPID	Survey vessel	Length – 6.5m	n/a

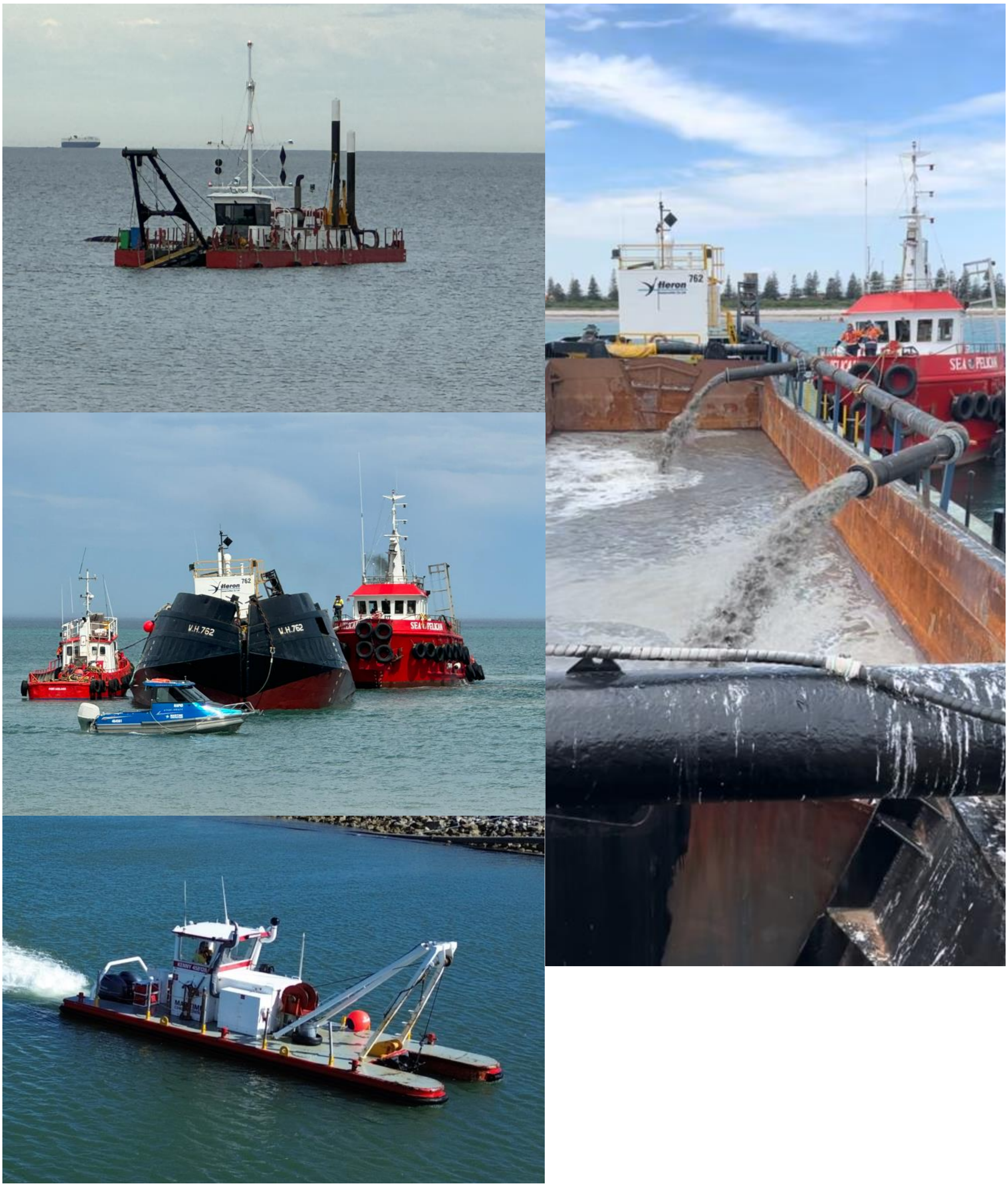


Figure 3. Key Marine Plant – CSD Kingston (top left); Chapman, Rapid, WH762 & Sea Pelican (middle), anchor barge Kenny (bottom left) and filling hopper barge WH762 (right)

3.1 Project timeline and key dates

Table 4. Project timeline and key dates

Date	October 2024	November 2024
1	DMP approved 25/9. Set up SHBs (arrived 15/9) coupling pontoon. Final positioning (Trimble) checks. Tow & install pipeline at SBA1. MC induction (22 people).	Dredging (16.17 hrs, 2,765 m³);
2	Relocated moorings. Trial towing empty SHB WH762.	Standby weather (24.00 hrs)
3	**Dredging commenced** (2.5 hrs, Load 1) **Commissioning run (6m³)**. No night shift.	Standby weather (24.00 hrs)
4	Standby weather (24.00 hrs)	Dredging (1.75 hrs, 144 m³); Mobilised dozer for onshore placement trial.
5	Standby weather (24.00 hrs)	Dredging (2.08 hrs, 112 m³);
6	Standby weather (24.00 hrs)	Standby weather (24.00 hrs)
7	Dredging (6.33 hrs); Standby weather (6.08 hrs)	Standby weather (24.00 hrs)
8	Dredging (8.58 hrs); Loads 2, 3 & 4 placed	Standby weather (24.00 hrs)
9	Standby weather (24.00hrs); Load 5 placed @ 1330 hrs	Dredging (12.58 hrs, 1,430 m³);
10	Standby weather (24.00 hrs)	Dredging (17.58 hrs, 2,400 m³);
11	Standby weather (24.00 hrs)	Dredging (14.33 hrs, 2,059 m³); Additional 240m pipeline added (total 1,390m)
12	Dredging (9.08 hrs); Load 6 placed	Dredging (3.75 hrs, 684 m³);
13	Dredging (13.42 hrs); Loads 7, 8 & 9 placed	Dredging (1.00 hrs, n/a m³);
14	Dredging (15.92 hrs); Loads 10, 11, 12, 13 placed	Dredging (6.83 hrs, 2,120 m³);
15	Dredging (16.00 hrs); Loads 14, 15, 16, 17 placed	Dredging (20.50 hrs, 3,822 m³);
16	Dredging (15.75 hrs); Loads 18, 19, 20, 21 placed	Standby weather (24.00 hrs)
17	Dredging (2.00 hrs); Loads 22 & 23 placed	Standby weather (24.00 hrs)
18	Standby weather (24.00 hrs)	Dredging (2.17 hrs, 600 m³);
19	Standby weather (24.00 hrs)	Dredging (4.17 hrs, 1,012 m³);
20	Dredging (13.92 hrs); Loads 24 & 25 placed	Dredging (19.09 hrs, 3,983 m³);
21	Dredging (1.33 hrs); Loads 26 & 27 placed	Dredging (17.00 hrs, 3,445 m³);
22	Standby weather (24.00 hrs)	Dredging (15.92 hrs, 3,856 m³);
23	Standby weather (24.00 hrs); DEW decision to cease SBA1 dredging and SHB demobilisation.	Dredging (11.17 hrs, 2,099 m³);
24	Standby weather (24.00 hrs); Build add.pipe strings.	Dredging (8.75 hrs, 1,685 m³);
25	Standby weather (24.00 hrs); Towed CSD& pipe to WBBH	Dredging (19.83 hrs, 3,530 m³);
26	Standby weather (24.00 hrs);	Dredging (9.67 hrs, 1,697 m³);
27	Standby weather (24.00 hrs);	Standby weather (24.00 hrs)
28	Standby weather (24.00 hrs);	Standby weather (24.00 hrs)
29	Standby weather (24.00 hrs); additional pipeline from Berth 8 towed. Delayed last 4 days due to weather.	Dredging (3.58 hrs, 913 m³);
30	Standby weather. Diffuser & pipeline connected. **Dredging SBA3 commenced 2200 hrs (6.83 hrs, 410m³)**	**End Dredge Trial** – CSD and 2 anchor barges inside WBBH by 1130 hrs.
31	Dredging (3.58 hrs, 410 m³);	

4 Production

Key dredging production rates, volumes and dates are included in **Table 5**.

Further details are provided within figures and tables within this **Section 4.**

Table 5. 2024 Dredging production rates

Item	Phase 1 SBA1	Phase 2 SBA3	Total / Average
DMP approved	25 Sep 24	---	---
Contract fully executed	26 Sep 24	---	---
SHB arrival from Sydney to Adelaide	15 Sep 24	---	---
Dredging commenced	3 Oct 24	30 Oct 24	3 Oct 24
Dredging finished	21 Oct 24	30 Nov 24	30 Nov 24
Dredging duration	19 days (3 weeks)	32 days (4.5 weeks)	59 days (8.5 weeks) (inc. 8 days in between due to bad weather and mob to SBA3)
Actual dredging days	11 days	22 days	33 days
Dredging Net Operational Hours (NOH)	105 hrs	218 hrs	323 hrs
Total available hours	456 hrs	768 hrs	1,416 hrs
Percentage NOH	23 %	28 %	23 %
Average dredging hours per day (total)	5.5 hrs	6.8 hrs	5.5 hrs
Average dredging hours per day (exc. non-production days)	9.5 hrs	9.9 hrs	9.8 hrs
Range of dredging hours per day	1.3 – 16.0 hrs	1.0 – 20.5 hrs	1.0 – 20.5 hrs
Operating shifts [1]	18	32	50
Standby shifts	9	21	30
Standdown shifts	16	14	30

[1] Operating, Standby and Standdown shifts up to 27/10 for SBA1 and from 28/10 for SBA3. Some weeks have less than 14 chargeable shifts at commencement and end of project as well as transition week from SBA1 to SBA3. Shifts are 12-hour operations either 0600 – 1800 hrs day shift or 1800 to 0600 hrs night shift.

Item	Phase 1 SBA1	Phase 2 SBA3	Total / Average
Dredge area (m^2)	8,544 m^2	21,532 m^2	30,076 m^2
Dredge volume (m^3) est.	17,573 m^3	39,451 m^3	57,024 m^3
Survey volume (m^3) removed	16,781 m^3	41,791 m^3	58,572 m^3
Dredge / Survey volume ratio	1.05	0.94	0.97
Production rate (m^2/NOH)	82 m^2/NOH	99 m^2/NOH	93 m^2/NOH
Production rate (m^3/NOH)	168 m^3/NOH	181 m^3/NOH	176 m^3/NOH
Ave. Production rate (m^3/day)	925 m^3	1,233 m^3	966 m^3
Max. Production rate (m^3/day) [2]	2,808 m^3	3,983 m^3	3,983 m^3
Sand source seabed depth (m) below CD	- 2.5 to - 1.0m CD	- 3.0 to - 0.5m CD	----
Target dredge depth (m) below CD[3]	- 3.5 m CD	- 3.0 m CD	----
Dredge cut depth (m)	0.5 – 2.0 m	0.5 – 2.5 m	----

[2] Maximum dredge log estimate was 2,808 m^3 and maximum hopper load estimate 2,659 m^3.

[3] Chart Datum (approximate Lowest Astronomical Tide (LAT) is 1.45m below Australian Height Datum (AHD).

4.1 Phase 1 – SBA1 sand source with barge placement to SPA1 north

In total, 27 split hopper barge loads of sand from SBA1 was transported south for nearshore placement at West Beach. Refer **Table 6, Figure 4** to **Figure 7**.

Twenty (20) barge loads were placed in 6 cells (A01 to B03) at northern end of SPA1, just to the north of West Beach SLSC.

Seven (7) barge loads were placed in the Rehandling Area due to the following reasons:

- Loads 1 and 2 – first dry and wet commissioning placement runs for crew to be comfortable with process and handling of tug and hopper barge.
- Loads 6, 13 and 14 – full loads placed due to combination of weather events and Trimble navigation system issues at time of placement.
- Loads 25 & 27 – final two loads with barge WH761 due to stolen Trimble navigational system (refer incident 1144 in **Table 9**).

Table 6. Phase 1 SBA1 production volumes and barge trips

Date	No. of barge trips	Estimated Tonnages (t)	Estimated volume (m^3)
03-Oct-24	1	11	6
04-Oct-24	---	0	0
05-Oct-24	---	0	0
06-Oct-24	---	0	0
07-Oct-24	---	0	0
08-Oct-24	3	2,954	1,738
09-Oct-24	1	1,105	650
10-Oct-24	---	0	0
11-Oct-24	---	0	0
12-Oct-24	1	1,105	650
13-Oct-24	3	2,940	1,729
14-Oct-24	4	3,956	2,327
15-Oct-24	4	4,424	2,602
16-Oct-24	4	4,520	2,659
17-Oct-24	2	2,402	1,413
18-Oct-24	---	0	0
19-Oct-24	---	0	0
20-Oct-24	2	2,306	1,356
21-Oct-24	2	2,306	1,356
22-Oct-24	---	0	0
23-Oct-24	---	0	0
24-Oct-24	---	0	0
Total	**27**	**28,029 t**	**16,488 m^3**

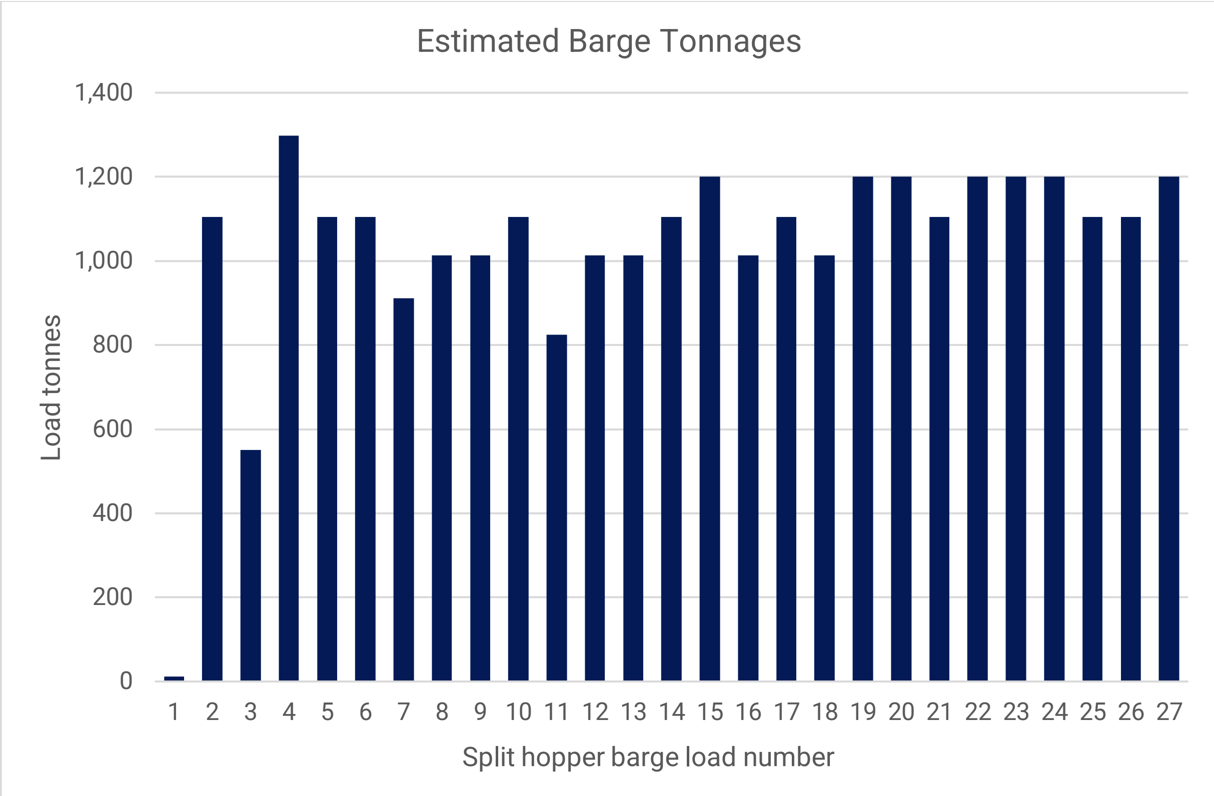
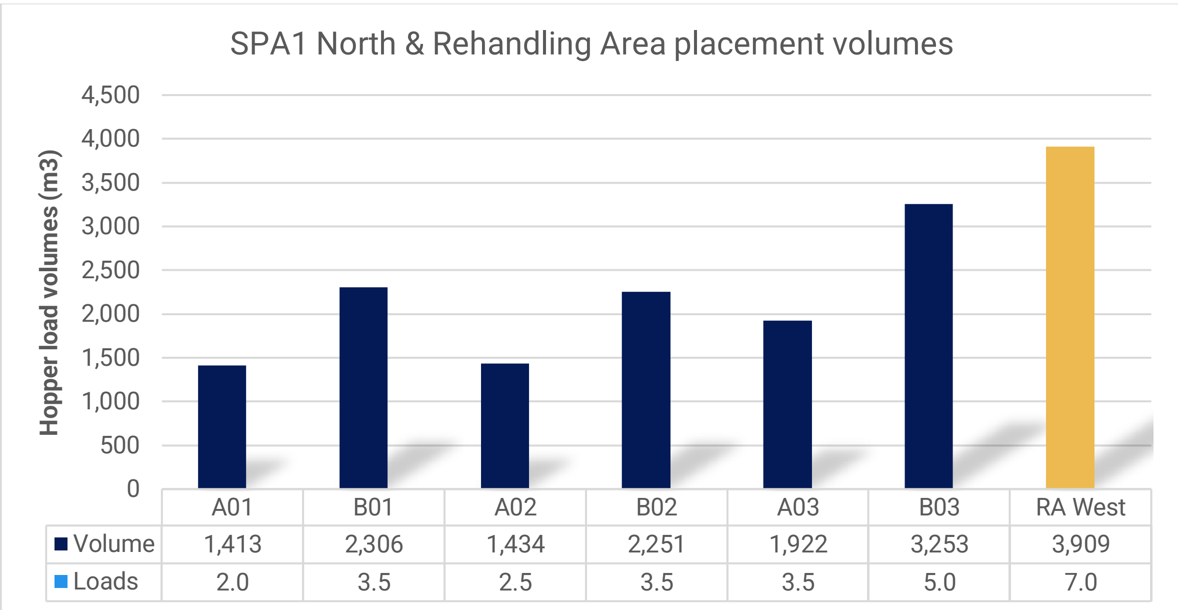


Figure 4. Estimate barge tonnages from SPA1



	A01	B01	A02	B02	A03	B03	RA West
Volume	1,413	2,306	1,434	2,251	1,922	3,253	3,909
Loads	2.0	3.5	2.5	3.5	3.5	5.0	7.0

Figure 5. SPA1 North & Rehandling Area hopper estimate placement volumes

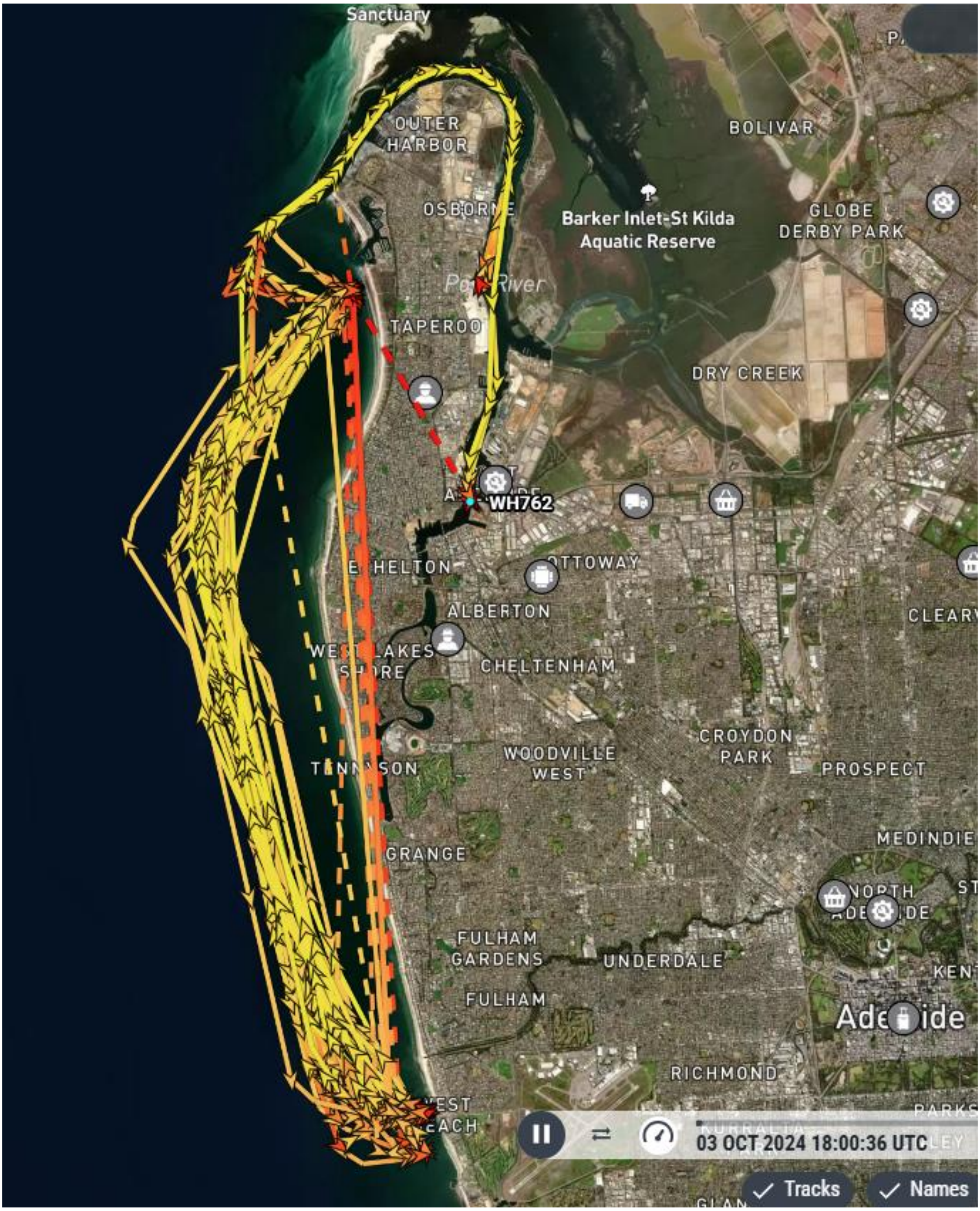


Figure 6. SHB transit route between SBA1 and SPA1 North (3 – 21 October)

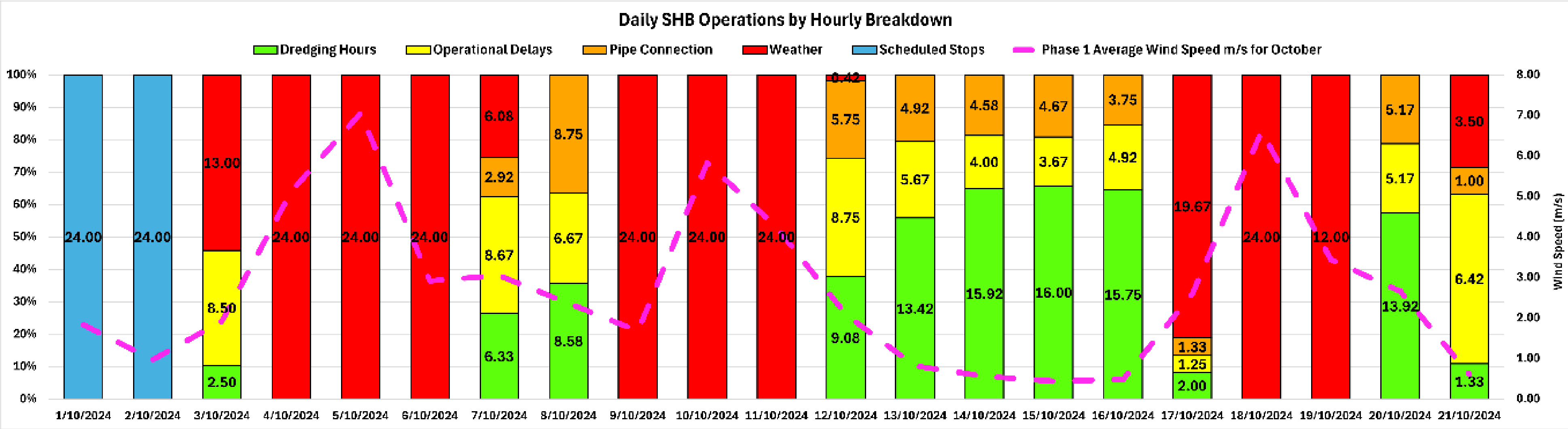
Figure 7. SHB nearshore sand placement at West Beach SPA1 North and Rehandling Area (3 – 21 October)

4.2 Phase 2 – SBA3 sand source with nearshore diffuser to SPA1 South

Dredging at the WBBH sand trap (SBA3) **(Figure 2)** commenced on 30 October 2024 with sand relocated north via a 1,400-metre-long pipeline and diffuser barge outlet.

Sand was placed in SPA1 south and predominantly targeting cells A14 to B18.

Additional charts on operational/standby hours and production rates for both SBA1 and SBA3 are included in **Figure 8, Figure 9** and **Figure 10** on the following pages.



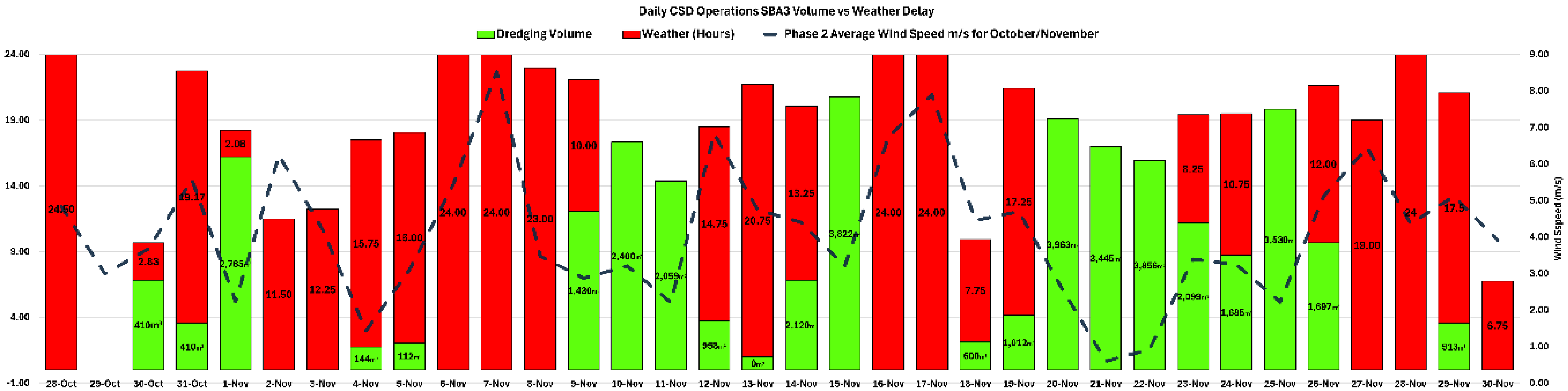


Figure 8. 2024 Dredging and barge production and standby hours (source: Maritime Constructions)

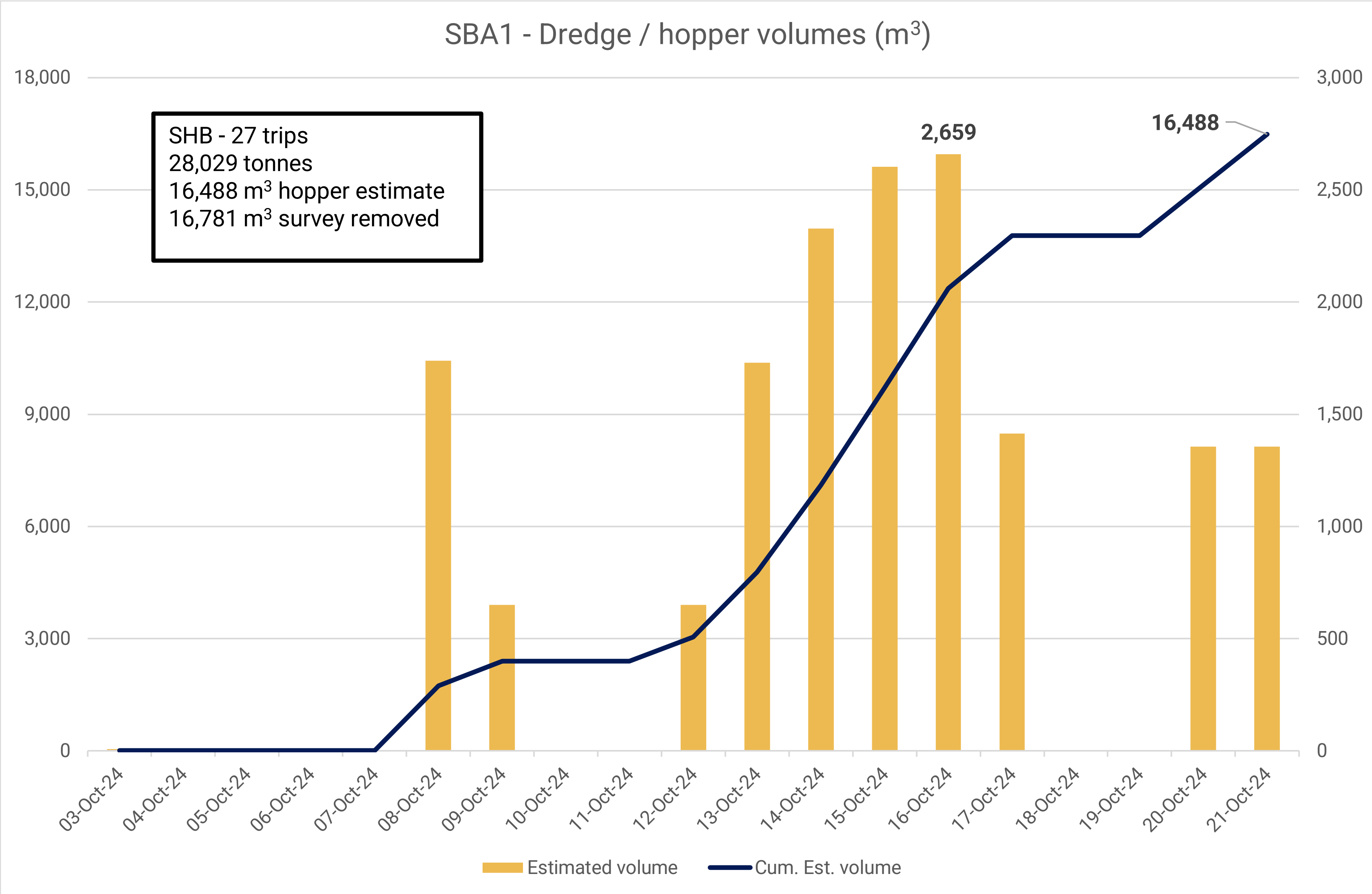


Figure 9. SBA1 estimated dredge (hopper) and surveyed volumes

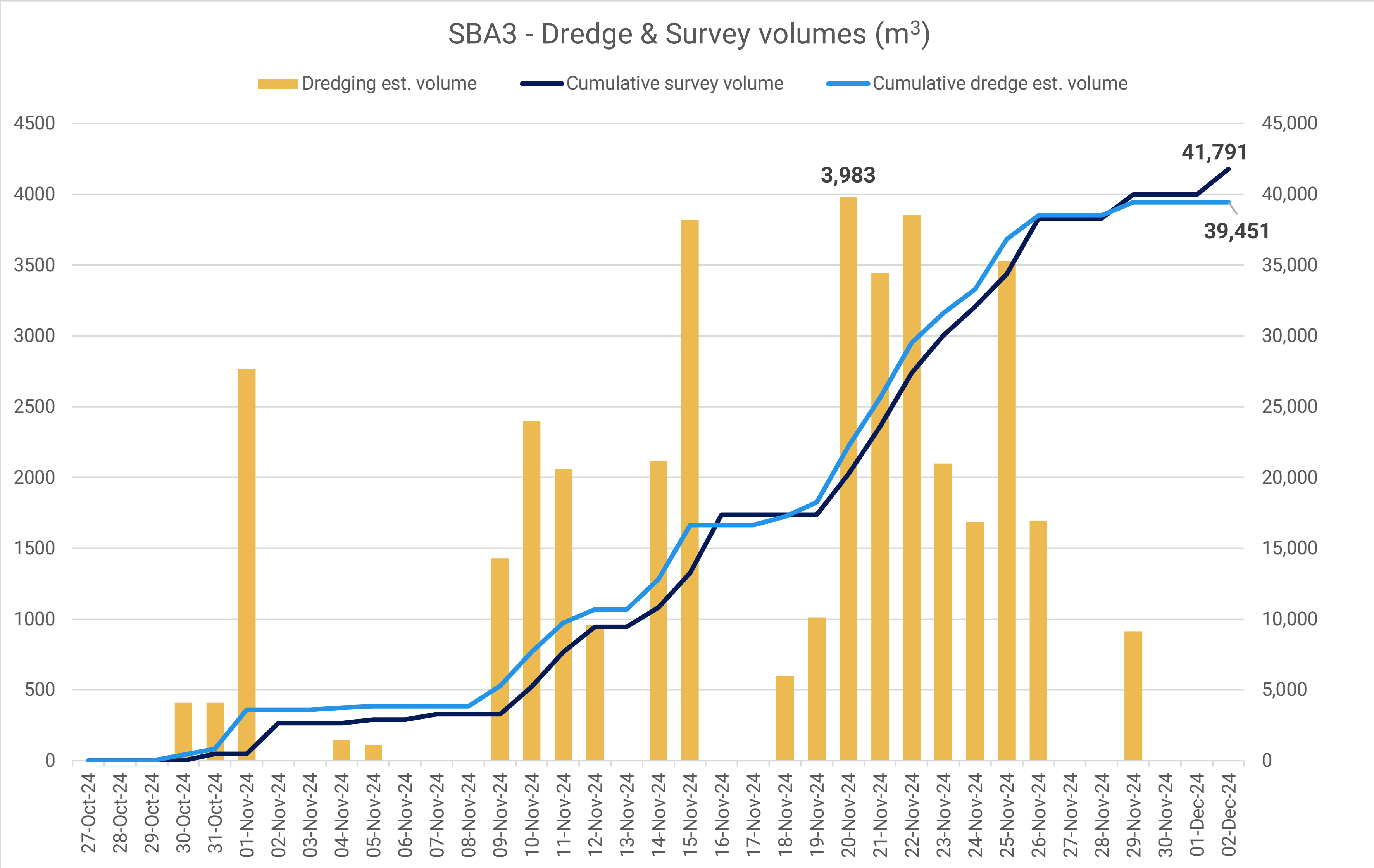


Figure 10. SBA3 estimated dredge and surveyed volumes

5 Survey

This section provides a high-level summary of volumes and tonnages (refer **Table 7** and **Table 8**). Detailed analysis and surveys as provided separately by Hatch.

In-situ volumes removed are calculated from pre-dredging and post-dredging surveys. Likewise, placement volumes are calculated between pre- and post-placement surveys.

The volume of sand relocated to West Beach (12,024 m^3) from SBA1 (16,781 m^3) represents retention of 71.6% of sand. Allowing for surveyed overflow losses of 3,118 m^3 at the SHB mooring location, 88.0% of 13,663 m^3 was retained at West Beach placement areas.

The volume of sand placed at SPA1 South (36,357 m^3) from SBA3 (41,791 m^3) represents retention of 87.0% of sand (refer **Figure 10**).

5.1 Sand source area volumes

Table 7. Sand source area volumes

Sand source area	Pre-dredge survey	Post-dredge survey	Insitu volume removed [4]	Dredge / Hopper estimate [5]
SBA1	30 Sep	26 Oct	16,781 m^3	17,573 m^3 (dredge) 16,488 m^3 (hopper)
SBA2	---	---	---	---
SBA3	30/31 Oct	2-Dec	41,791 m^3	39,451 m^3
Total			**58,572 m^3**	

5.2 Sand placement area volumes

Table 8. Sand placement area volumes

Sand placement area	Cells	Pre-dredge survey	Post-dredge survey	Volume placed
SPA1 North	A01 – B03	23 – 28 Sep	20 – 25 Oct	9,459 m^3
SPA1 South	A14 – B18 [6]	23 – 28 Sep	2 Dec	36,357 m^3
Rehandling Area	----	23 – 28 Sep	20 – 25 Oct	2,565 m^3
Total				**48,381 m^3**

[4] A volume of 3,118 m^3 (26/10) was retained at the SHB mooring area due to overflow process.

[5] The hopper volume estimate for SBA1 was based on estimated hopper tonnage for each load from forward and aft draft mark lines and dividing by 1.7 (t/m^3).

The estimated dredge volume for SBA3 was calculated each shift based on cut width, forward length and average depth of cut.

[6] SPA1 south initial target cells was A14 to B16, however due to increased volumes was extended to B18.

6 Environmental

6.1 Incidents

There were no notifiable environmental incidents associated with the ABMRI dredge trial. This trial was implemented in accordance with the EPA approved Dredge Management Plan.

6.2 EPA inspections

EPA undertook a site inspection at North Haven (SBA1) dredge area on 14 October 2024. The purpose of the inspection was to assess compliance with MC's environmental authorisation licence 42842 and obligations under the *Environment Protection Act, 1993.* The EPA was 'generally happy' with the outcomes of the inspection; however a letter of observations/alleged contraventions was issued to MC on 23 October 2024. MC addressed these items immediately and issued a formal response to EPA on 4 November 2024. No further responses or actions have been advised.

6.3 Weather

Weather and metocean data were monitored throughout the trial and are reported in detail by others elsewhere.

It is important to note that weather (wind and waves) did impact on productivity of the dredge trial.

Winds during the trial (Spring season) were typically from the south-west (offshore) resulting in typically harsher operating conditions, particular for adopted cutter suction dredge operations. Productivity in terms of operational hours versus wind speeds is summarised in **Figure 8.** Noting that south-west winds also produced increased wave heights and swell conditions which also impact on productivity.

Standby / Standdown time was further exacerbated for SBA1 works with the need to transfer barges within the safety of Port River early during significant weather events and in coordination with existing port shipping movements.

Further discussion on weather and impact on operability is discussed in **Section 11.**

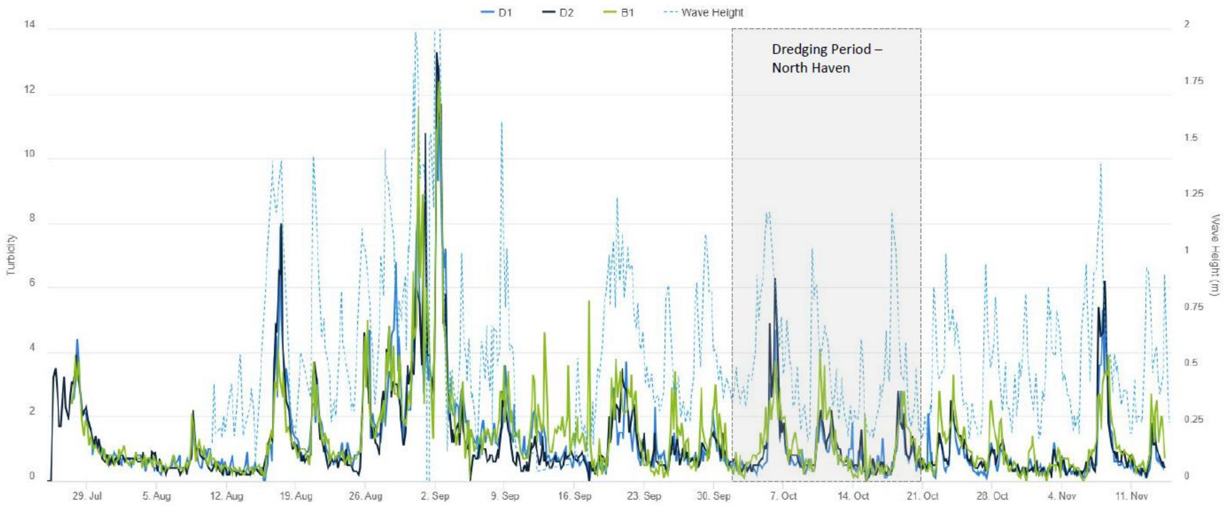
6.4 Water quality

Detailed analysis of the water quality monitoring program is provided in a separate report (Epic, Feb 2025).

An extract from the summary of this report is provided below for monitoring which occurred between 25 July to 11 December 2024 (4.5 months).

> *Monitoring comprised a combination of surface monitoring using monitoring buoys and benthic loggers deployed on benthic frames. Key findings from the turbidity data includes the following:*
>
> - *Turbidity fluctuated from around 0.3 NTU during calm conditions and up to 15–20 NTU during windier periods. The highest turbidity was recorded in late August (prior to dredging) during a period of sustained strong winds from the south-west. These stronger wind periods resulted in increased wave action causing natural resuspension of sediments and increased turbidity.*
> - *Turbidity appeared to be strongly corelated with wave height, with increases in turbidity coincident with increased wave height. There was no discernible signal of dredge plumes in the turbidity data.*
> - *The 6-day and 15-day rolling median turbidity data indicated that turbidity remained below the trigger values during dredging periods, even using the more stringent November trigger values.*
> - *There were no exceedances of the water quality trigger levels during the dredging period. Therefore, there was no requirement for implementation of adaptive management measures in accordance with the dredge management plan.*

- *As expected in a marine environment, Electrical Conductivity (EC), pH and Dissolved Oxygen (DO) were relatively consistent at all sites throughout the monitoring period, and were consistent with values typically recorded in the marine environment.*
- *Water temperature was around 12°C during equipment deployment in late July, with temperature increasing gradually throughout the monitoring period up to a temperature of approximately 23°C in December.*



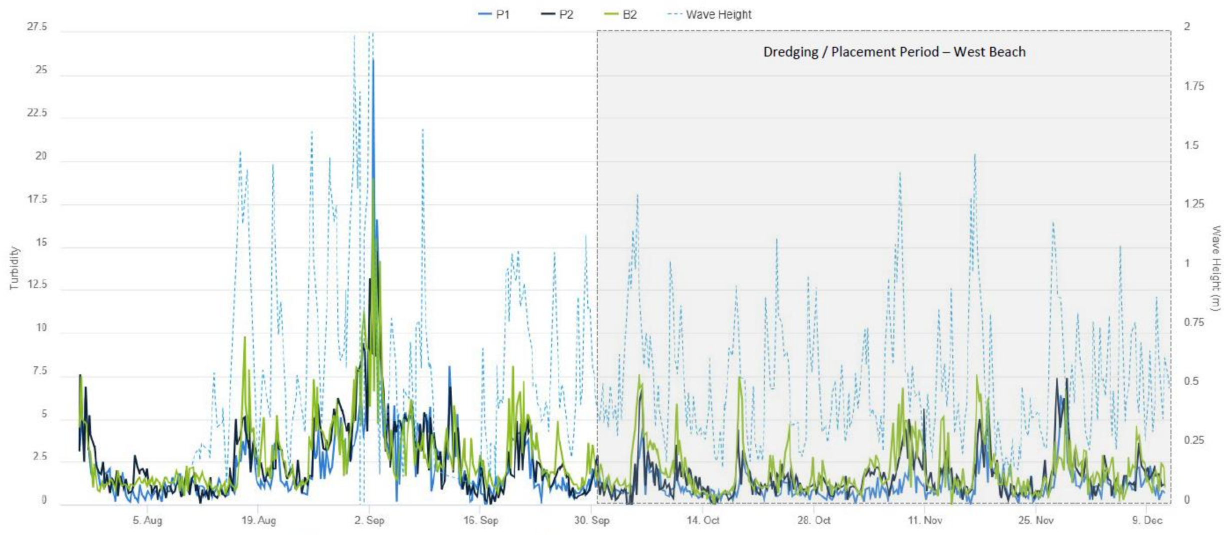


Figure 11. Turbidity data (15-minute intervals) for SBA1 (North Haven) sites (top) and SBA3/SPA1 (West Beach) sites (bottom image)

6.5 Seagrass

Detailed analysis of pre- and post-seagrass surveys and mapping are ongoing and provided separate to this report. Analysis occurred at North Haven, West Beach and Tennyson (control site).

The Seagrass Assessment report (Hydrobiology, March 2025) following pre-dredging and post-dredging seagrass mapping only, concluded:

> *The study identified that Posidonia spp. the dominant seagrass species (83%), followed by Zostera/ Heterozostera spp. (8%), Amphibolis spp. (5%), and Halophila spp. (4%). The benthic habitat varied significantly between Areas of Interest (AOIs), with West Beach having the most continuous Posidonia spp. cover within each seagrass meadow, while Tennyson exhibited greater meadow patchiness and a higher proportion of disturbance-tolerant species.*

No significant declines in total seagrass cover, habitat structure, or biomass were observed at North Haven or West Beach, indicating no detectable impact from dredging activities. In contrast, a significant decrease in seagrass cover and biomass at Tennyson suggests that external factors, unrelated to dredging, were likely responsible.

Post-dredge surveys showed an overall increase in Posidonia spp. cover, particularly at West Beach, likely due to seasonal growth patterns. Differences in seagrass recovery between AOIs were attributed to variations in meadow structure, with West Beach supporting a more stable seagrass community compared to the fragmented and disturbance-tolerant meadows at North Haven and Tennyson. Within the North Haven and West Beach AOIs, there was no significant difference in seagrass cover between pre- and post-dredging surveys in transects directly next to or intersecting sand borrow and placement areas despite there being an overall decrease in seagrass cover.

Epiphytic biomass increased significantly across all AOIs, but this change was consistent across sites, suggesting it was driven by seasonal temperature increases rather than dredging. Similarly, while benthic communities and seagrass assemblages differed significantly between AOIs, no significant changes were detected between pre- and post-dredge surveys that would indicate dredging-related impacts.

Overall, the findings suggest that dredging activities - at the trial scale - did not have a significant negative impact on seagrass cover, biomass, or habitat structure, with observed changes in seagrass communities more likely attributed to natural variability and external environmental factors.

6.6 Noise

6.6.1 Airborne

Attended and unattended noise monitoring was undertaken prior to, and during various dredging and placement methodologies of the dredge trial, with noise monitoring consultant (Sonus) concluding:

Noise monitoring was undertaken as part of the Adelaide Beach Management Review beach dredging trial.

Attended noise measurements (8, 15, 16 October and 1 November 2024) were taken at locations representative of the closest noise-sensitive receivers to near-shore noise-generating activity associated with the Project. Attended measurements showed compliance with the relevant noise criteria was achieved on all attended measurement occasions.

Unattended noise monitoring was also undertaken between 11-17 October 2024 at locations at West Beach and North Haven which were likely to be most affected by noise from Dredging. Noise at both locations was observed to be controlled by natural sounds or extraneous noise sources rather than dredging activity. Dredging activity at both locations was not shown to have significantly affected measured noise levels over the unattended noise monitoring period.

6.6.2 Underwater

An assessment of underwater noise impacts (Sonus, 2024) associated with the dredge trial concluded:

Underwater noise levels have been predicted and assessed against criteria determined in accordance with the DIT Underwater Piling and Dredging Noise Guidelines. Safety Zones and Potential Effects Zones have been determined from predicted underwater noise threshold distances, assuming potential prevalence of all relevant species during the dredging activity. The Standard Operating Procedures defined by the DIT Underwater Piling and Dredging Noise Guidelines are recommended to be implemented by the dredging contractor. The need for additional mitigation and management measures will need to be considered, based upon the Project's risk assessment of the potential impacts on EPBC Act Matters of National Environmental Significance.

Furthermore,

a) *An EPBC Act self-assessment (JBS&G, 2024) based on findings from a desktop review, field-based ecological assessment, and our understanding of potential project impacts. It was JBS&G's determination that the Project is **unlikely** to have a significant impact on MNES.*

b) *Dredging of the West Beach Boat Harbour, and to an extent North Haven marina, with similar sized dredge plant and pipelines has occurred for over a decade.*

c) *A Marine Mammal Observer was present during SBA1 dredging to determine if mitigation measures were required at any time.*

6.7 Marine Fauna

An independent Marine Mammal Observer (MMO) was engaged to monitor cutter suction dredging and hopper barge loading activities at SBA1 (North Haven) between 03 to 21 October 2024.

Only 1 sighting of two bottlenose dolphins was observed at 1438 hours on 13 October 2024. The Observer noted '*Dredging was in progress at the time. They (dolphins) were moving steadily and straight, so appeared to be simply travelling by and disinterested in the dredging operations.*'

7 Safety

7.1 Incidents and near misses

Four (4) project incidents were reported by Maritime Constructions (**Table 9**).

Table 9. Project safety and environment incidents

MC Incident No.	Date	Incident Description	Rectification
1134	07/10/24	**Personal injury** (medium) – crew transfer from tender vessel to Sea Pelican. Wave hit tender vessel at same time, causing crew member to fall on deck.	Superficial injury.
1138	14/10/24	**Environmental impact** (low) Vessel Starsky had been borrowed to facilitate an EPA inspection, the vessel had different fuel fittings to the one site. Crew member began to decant fuel into another tank and had a minor unleaded petrol spill on deck.	Decanting process stopped and very minor spill cleaned up on deck. No release to waterways.
1139	15/10/24	**Property damage** (medium) - Chapman was in push pull position during deployment of sand at West beach. As the barge opened, her forward most Fender protruding from the bow got hooked on the hull of the SHB. The bow lifted and when she dropped the push pull line snatched on the upper plate causing it to fail. The Fender was lost and sank immediately in Cell A02	Supervisor notified and DPA notified. Incident report submitted. Tyres put in place as temporary fix; however we will conduct a risk assessment before continuing works. Fender later recovered.
1144	19/10/24	**Property damage** (low) - Crews jumped on board split hopper barge 761 this afternoon moored at Penrice, to find that overnight the wheelhouse containing the GPS computer had been forcefully entered by breaking the lock off with a Stanchion post. As a result we had the Trimble positioning computer stolen with the internet dongle and cables attached	Notified supervisor and collected photos. Rehandling areas used for remaining couple of hopper placements with barge 761.

8 Contract and financials

8.1 Contractual matters

There were no Contractual matters throughout the ABMRI dredge trial.

8.2 Variations

There were two contract variations as summarised in **Table 10.** Both of these variations were included in the contract scope of works, have been separately itemised in the schedule of rates (items B4.3, B4.4 and C1.5).

Table 10. Contract variations

Variation Request No.	Date		Variation amount	Claimed amount
0210_01	11/11/24	Survey monitoring of sand placement (10 months)	$ 558,400	Ongoing
0210_02	6/12/24	Mobilisation & demobilisation of Bulldozer CAT D6 for onshore placement works	$ 7,600	$ 7,600

8.3 Financials

The total dredging services contract spend to the end of the trial was $2.50 million (up to 8 December 2024).

This equates to 62% of the approved contract amount of $4.0 million.

This does not include ongoing survey works associated with monthly and quarterly sand monitoring.

An itemised breakdown of dredging contractor costs is summarised in **Table 11** and **Appendix A**.

Table 11. Dredging contract cost summary

Item	Contract claimed amount	Percentage of total Contract spend	Difference claimed versus Contract amount
Mobilisation	$ 307,579	12%	-$ 18,946
Dredge - Operational	$ 475,300	19%	-$ 532,336
Dredge - Standby	$ 175,410	7%	$ 134,481
Dredge - Standdown	$ 125,160	5%	$ 100,128
SHB - Operational	$ 376,466	15%	-$ 1,208,654
SHB - Standby	$ 127,400	5%	$ 25,480
SHB - Standdown	$ 85,730	3%	$ 34,292
Management & Site supervision	$ 382,144	15%	-$ 27,296
Hydrosurvey	$ 268,800	11%	-$ 28,000
Demobilisation	$ 168,832	7%	$ 14,181
Variations	---	0%	---
Total	**$ 2,492,821**	100%	-$ 1,506,669

8.4 Area & unit rates

A breakdown of total and unit rate costs by area and activity is provided in **Table 12** and **Table 13** below. The dredging trial total unit rate was $42.56/m^3 for dredging of 58,572 m^3. Furthermore:

- Dredging only unit rates are in line with market rates. Reduced unit rates at SBA3 due to no standby associated with SHB operation; and good sand cut depths within WBBH sand trap.
- The rapid and evolving nature of trial required more intensive management and supervision resourcing and associated costs.
- The trial required intensive surveying of dredging and placement activities, not typically required in similar scale dredging projects.
- All SHB mobilisation and demobilisation costs have been assigned to SBA1. The CSD and pipeline mobilisation and demobilisation costs have been apportioned 50% to each SBA1 and SBA3.
- Mobilisation and demobilisation often make up a significant proportion of total dredging project costs. Savings are made where these costs are shared with other nearby projects.

Table 12. Dredging trial total costs by activity and sand source area

Costs	SBA1 16,781 m^3	SBA3 41,791 m^3	Total 58,572 m^3
Dredging	$ 290,483	$ 485,387	$ 775,870
SHB	$ 589,596	$ 0	$ 589,596
Dredging + SHB	**$ 880,079**	**$ 485,387**	**$ 1,365,466**
Management, Supervision & Surveying	$ 250,928	$ 400,016	$ 650,944
Mobilisation & Demobilisation	$ 411,206	$ 65,206	$ 476,411
Total costs	**$ 1,542,213**	**$ 950,609**	**$ 2,492,821**

Table 13. Dredging trial unit rates by activity and sand source area

Costs	SBA1 16,781 m^3	SBA3 41,791 m^3	Total 58,572 m^3
Dredging	$ 17.31	$ 11.61	$ 13.25
SHB	$ 35.13	$0.00	$ 10.07
Dredging + SHB	**$ 52.44**	**$ 11.61**	**$ 23.31**
Management, Supervision & Surveying	$ 14.95	$ 9.57	$ 11.11
Mobilisation & Demobilisation	$ 24.50	$ 1.56	$ 8.13
Total costs	**$ 91.90**	**$ 22.75**	**$ 42.56**

9 Review of dredging contractor's Project Evaluation Report

Overall Maritime Constructions' (MC) Project Evaluation Report (DP0210.PER revision B) provides an accurate representation of the ABMRI dredging trial.

Table 14 below provides a number of topics from MC's Project Evaluation Report which will be discussed further in **Section 11** of this report.

Table 14. Dredging Contractor Project Evaluation Report Review – topics for discussion

Section	Page	Topic	MC statement
1 – Executive Summary	4	Overflow	Sand-loss due to 'overflow' on the barges remained localised as the barges were stationary during filling (compare with Trailer Suction Hopper Dredgers which are filled over large areas)
1 – Executive Summary	4	Barge size	The limiting factor for rates of production were the barge sizing (too large), type (non-propelled) and draft (too deep). With purpose build barges, significant operational gains can be made, resulting in higher rates of production and accuracy of placement.
3 – Outline of Project	8	Backhoe dredge	Dredging of the sands and filling of the barges was to be done using a cutter suction dredge (CSD) and/or backhoe dredge (BHD).
3 – Outline of Project 8.6 SHB Placement areas	12 31	Barge draft & nearshore placement	MC raised concerns about the SHBs' laden draft (-3.5 m) and the potential risks of placement nearshore during lower tides. …in the event of potential risk of placement nearshore, due to weather or tide, an additional Rehandling Area (RA) could be utilised Actual exhaustion of placement areas by means of volume was not really a factor.
	13	Dredging commencement	Final review and timely approval of the DMP became a project commencement risk. However, the delayed operations schedule was compensated by the delayed arrival of the SHB's from Sydney due to weather.
4 – Plant and Equipment	14	CSD Kingston (Damen build)	For the dredge trial MC allocated CSD Kingston.
6 – Works Executed	19	Program summary	Summary of executed program….
7.2 – Public interaction & community consultation	24	Stakeholder engagement	As required by the EPA and DEW, there were a range of stakeholder engagements, interactions and community consultation

Section	Page	Topic	MC statement
			matters prior and during the works. Predominantly managed by DEW, a number of operational aspects were handled by MC directly, including providing subject matter advice and explanations in consultation forums and into public notifications,
7.5 Weather standby risk 8.2 Weather exposure	27 - 30	Dredging downtime	Weather exposure on the Adelaide metro coastline is seasonally poor during spring months, frequently generating SW winds and associated sea state. SHB operations could only use the major port (for refuge) and given the only berthing option was Inner Harbour, barge transport took a considerable period of time and weather standby responses were extenuated by this.
8.3 CSD pipeline to SHB connection	30	Crew change & hopper cycle timing	Because of the day/night shift cycles and transport distances, there were inherent delays in shift handover position and that this could not be done mid-trip. So overall there were stressors in getting connected, filling, switch fill points and completing a tow that had to consider shift change overlap.
8.4 SHB asset sub-optimal	30	Hopper size	These SHB's were larger than desired and basic in design, suited for bulk backhoe type excavation and ocean dumping work.
8.7.5 Large scale rehandling area	32	Rehandling area	A large-scale rehandling area will increase the capacity and flexibility of sand transfer by enabling a large storage bank of sand to be retained nearby for eventual nearshore or onshore placement.

10 Review of scoping study

Following the ABMR Scientific Review and Independent Advisory Panel recommendations, DEW undertook further scoping studies in early 2024 such as sediment sampling, surveys and dredge market sounding.

10.1 Dredge operational feasibility

10.1.1 Bluecoast Scientific Review – shortlist

Bluecoast (2023) undertook a **review of dredging equipment** to inform shortlisted management options involving dredging as part of the Adelaide Beach Management scientific review (Appendix D, Bluecoast 2023).

This review discussed varying dredge vessel suitability – trailing suction hopper, cutter suction and backhoe. An overview of potentially suitable trailing suction hopper dredges for sand placement at Adelaide metropolitan northern beaches was provided in Table 43 of this report. This table included **6 potential TSHDs from 4 dredging contractors / operators.**

10.1.2 Independent Advisory Panel recommendations

In December 2023, the Independent Advisory Panel (IAP) made recommendations to the State Government via the Attorney-General. Recommendation 2.1 was to:

> ***Investigate the feasibility of dredging nearshore*** *or nearby sand deposits as a long-term, sustainable method to deliver sand recycling. This should include verifying the availability of suitable sand in the littoral and/or in-shore zone, as well as the* ***operational viability*** *and constraints for environmental approvals.*
>
> - *If viable, assess against sand recycling pipeline option to determine the best long-term, sustainable sand recycling option.*
> - *If not viable, seek relevant approvals to implement the sand recycling pipeline.*

This was further reiterated by the IAP, who recommended further investigations include:

> ***Operational feasibility such as availability of plant and equipment for adequate timeframes, ability of dredging infrastructure*** *to recycle the volumes required, impacts of weather on operations, and any other limitations*;

10.1.3 Dredging market sounding

In March 2024, market sounding and information request was undertaken of relevant dredging contractors **(Table 15).** These included trailing suction hopper dredge operators as well as cutter suction and backhoe dredge operators for the purpose of determining several potential suitable methodologies. Responses were sought on the following items:

a) Proposed dredge vessel(s)

b) Minimum and maximum dredge depths

c) Bottom placement methodology (i.e. split hopper, hopper doors, hopper valves)

d) Rainbowing capacity

e) Pipeline – pump onshore capability

f) Pipeline – nearshore diffuser placement capability

g) Program capacity and preference (i.e. 90,000 m^3 every 1 year, 180,000 m^3 every 2 years)

h) Program length

i) Program timing and availability

j) Mobilisation and demobilisation

k) Trial program capacity

Table 15. Summary of Dredging Contractors / Organisations market sounding responses

No.	Dredging owner/operator	Location	State or Country	Responded	Interested
1	Rohde Nielsen (RN)	Fremantle	WA	Yes	Yes
2	McQuade Marine (MQM)	Gold Coast	Qld	Yes	Yes
3	Maritime Constructions (MC)	Adelaide	SA	Yes	Yes
4	Port of Brisbane (PB)	Brisbane	Qld	Yes	Yes
5	Heron Constructions (HC)	Newcastle / Auckland	NSW / NZ	Yes	Yes
6	Gippsland Ports (GP)	Lakes Entrance	Vic	Yes	Not presently
7	McKay Maritime (MKM)	Gold Coast	Qld	No	n/a
8	Port of Newcastle (PN)	Newcastle	NSW	No	n/a
9	Dutch Dredging (DD)	n/a	NZ	No	n/a

10.1.4 Scoping Study Dredge Operational Feasibility recommendations

Recommendations (**Table 16**) from various scoping studies were undertaken to prepare and plan for a potential one-off trial sand backpass program of 90,000 m^3 in situ over a duration of 20 – 75 days subject to contractor and final dredging methodologies.

Table 16. Recommendations

No.	Recommendation	Actioned
1	Early contractor involvement with one (or more) dredging RFI respondents to discuss trial volumes, durations, timeframes, dredging and placement methodologies, and mitigation of potential environmental impacts.	Yes
2	Procurement of dredging contractor	Yes
3	Progress physical data collection (surveys, sediment analysis and sub-bottom profiling)	Yes
4	Progress environmental management and monitoring requirements.	Yes
5	Progress discussions with EPA regarding proposed monitoring program(s).	Yes
6	Design and prepare construction plans for trial dredge and placement areas (i.e. gridded system).	Yes

10.1.5 Procurement

To facilitate very short timeframes to complete a dredging trial in 2024, DEW selected to proceed with local SA dredging contractor – Maritime Constructions who already held an EPA approved dredge licence. The DEW also had an existing contract in place with respect to dredging of boat harbours, and MC had locally available resources – people, plant and equipment to undertake and manage the dredging trial at short notice. At the end of May the government committed to the dredging trial to occur in late 2024.

10.2 Environmental considerations

10.2.1 EPA consultation

Early consultation with EPA highlighted their concerns particularly around seagrass and water quality. EPA stated:

> *We would consider the risk of environmental harm as extreme and as such we would expect comprehensive monitoring and assessment, increased regulatory attention and best practice equipment and operation. (This is) based on the EPA's experience in the regulation of dredging and impact assessment from dredging in the region over the last 30 years.*

EPA outlined several potential environmental impacts / risks that would need to be monitored and managed during the dredging trial. These included:

- Seagrass
- Water quality
- OzFish program
- Odour and visual amenity
- Noise
- Lighting
- Marine mammals
- Screening
- Sand volumes

10.2.2 SARDI turbidity monitoring (2021/22)

The South Australian Research and Development Institute (SARDI) collected and analysed turbidity data at control (background) and impact (dredging) sites between December 2021 and November 2022. Harbour dredging and associated placement areas were monitored at North Haven marina, West Beach boat harbour and Glenelg marina.

SARDI's results and discussion points noted:

- Light limitation due to nutrient-driven epiphytic growth is the main limiting factor for seagrass growth in nearshore regions.
- Analysis of DEW turbidity data, however, did not demonstrate a consistent or meaningful influence of harbor dredging on recorded turbidity.
- Dredging activity and volume were not consistently associated with increased turbidity at impact sites.
- Even if differences in turbidity are due directly to dredging, any negative effect on surrounding benthic habitats or on the likelihood of seagrass recruitment to the nearshore zone is unlikely given maximum predicted increases were ~ 1 - 2 FNU, and there was no evidence of very high turbidity (i.e., daily median > 5 FNU or 95th percentile turbidity > 10 FNU) associated with dredging.

10.2.3 Dredge Management Plan

DEW procured MC to develop the Dredge Management Plan (DMP) to mitigate and manage project environmental risks.

The purpose of the DMP was to detail the management actions to be taken during the dredging and placement phases of the Dredge Trial to ensure they are carried out in a controlled and auditable manner in line with MC's EPA dredging licence no. 42842.

The DMP included the following:

- Scope of Work, including intended work methodologies, sand borrow and placement sites, and equipment to be used
- Environmental conditions
- Environmental requirements
- Environmental risk assessment
- Reporting

As required under EPA licence (no. 42842), the DMP also included environmental management sub-plans which aimed to identify, as far as reasonably practicable, environmental risks associated with the dredging and placement processes and outline procedures to prevent, minimise and manage such risks:

- Water Quality Monitoring Plan
- Seagrass Monitoring Plan
- Noise Monitoring Plan

The DMP and environmental management plans seek to:

- Identify potential environmental risks associated with the Dredge Trial
- Minimise environmental impacts that may be caused by dredging and placement activities; and
- Ensure potential impacts on the community and the marine environment near the borrow and placement areas are local and temporary.

10.2.4 Environmental monitoring results

The ABMR scoping study environmental recommendations were undertaken and the outcomes of the ABMRI dredging trial environmental monitoring and investigations is summarised in **Section 6.**

11 Discussion and lessons learned

11.1 Planning & approvals

Final EPA approval was received on 29 September 2024. Key learnings include:

- A new EPA dredge licence was not required through utilisation of local dredging contractor, Maritime Constructions, who had an existing EPA licence (42842) to dredge at various locations within South Australia.
- A project specific ABMRI Dredge Trial Dredge Management Plan was required to be developed for EPA approval as a condition of existing EPA licence.
- Requirement for rapid engagement of sub-consultants and internal parties to prepare DMP sub-plans including:
  - Water quality monitoring plan
  - Seagrass monitoring plan
  - Noise management plan
  - Engagement plan
  - EPBC Act self-assessment
- Rapid, pre-dredging trial field work was also required with respect to surveys, sub-bottom profiling, sediment sampling & analysis, water quality, seagrass and noise monitoring.
- Preparation, and EPA approval, of the Dredge Management Plan was the critical timeline factor for when works could commence. Noting SHBs arrived on 15/9 for setup and EPA approval received on 29/9.
- The above ensured a trial could be completed in 2024 by 30 November.

11.2 Dredge contractors

- Five (5) suitable dredging contractors responded favourably to a ‘Request for Information’ process in March 2024. Four (4) of these respondents stated they could, or possibly could, perform a 2–4 week trial between May to October 2024. The four respondents provided different dredging methodologies (TSHD x 2, CSD x 1, BHD x 1).
- Maritime Constructions was engaged by DEW to undertake the trial for several reasons including existing EPA dredge licence, local resources, existing contract with DEW, local knowledge and working relationship with DEW and EPA.

11.3 Availability of equipment

- MC provided the necessary plant and equipment to perform the dredging trial methodologies. *(Note: this trial used a cutter suction dredge for shallow water dredging at final selected sand borrow areas. Other dredging plant (TSHDs, BHDs) were available and potentially suited to these, or any future, deeper, sand borrow areas).*
- Initially intended split hopper barges (500 m^3) were not able to be obtained, however 2 x 760m^3 were able to be sourced from a dredging sub-contractor who had another project in Adelaide. *(Note: these split hopper barges are also representative of bottom placement via TSHD or BHD/SHB operation)*
- The CSD *Kingston* was utilised for all dredging works. The initially mentioned CSD *Ironheart* was not available.

- The second dredge CSD *Marcon* was located nearby but was not readily, or practically, available to dredge in tandem with the CSD *Kingston*. This was due mainly to ability to bring both dredges (and pipelines) into harbour during bad weather. Nonetheless parallel dredging operations was not required with dredging of sand from SBA2 not proceeding.
- A Backhoe Dredge was potentially to be trialled for a 1-2 week period, however, MC's Backhoe Dredge was interstate and not available for this trial.

11.4 Operational

- A dredge volume of 58,572 m^3 was achieved in this 9-week trial, representing 65% of a desirable target of 90,000 m^3. *(Note: the priority of trial was to test operational feasibility (dredging and placement methodologies) along with environmental feasibility).*
- The use of a cutter suction dredge (CSD) was successful in dredging shallow nearshore sand borrow areas (-2.5m to -1.0m Chart Datum).
- A small trailing suction hopper dredge (TSHD) would have limited capacity to dredge in these shallow depths due to draft of vessel. However, would likely be more productive/feasible in water depths deeper than -3.0m CD. *(Note: there is a limited market of very small TSHDs in Australasia).*
- Productivity of SBA1 and SBA3 dredging was limited by seasonal weather conditions (wind and waves) and maximum operating parameters of the CSD. For a Damen build CSD350 'Kingston', the typical maximum operating parameters are H_s <0.35m and wave length < 9m. For standby on spuds or wires H_s <0.65m and wave length < 13.5m (source: Damen).
- Hopper barges and self-propelled TSHDs can typically operate in conditions of H_s < 1.0 – 1.5m and wind speeds up to 20 knots.
- Productivity of SBA1 dredging was further reduced during significant weather events due to the need for both SHBs to be towed into the Inner Harbour for refuge. Long standdown periods associated with only one tow vessel for SHBs, early berthing due to port shipping schedules and erring on the side of caution with weather forecasts. Note a self-propelled TSHD or SHB could return to Inner Harbour only when conditions deteriorated substantially and not based on forecast weather only.
- Standby and Standdown periods resulted in higher dredging unit cost rates, particularly for SBA1.
- If utilising a cutter suction dredge, then dredging at a more preferrable time of year such as autumn when winds are typically from the north and north-east would improve CSD productivity.
- The coupling / de-coupling time to switch from one SHB to another during SBA1 dredging was reduced from 2 hours to around 20 minutes throughout this trial.
- Mobilisation and demobilisation costs, as a percentage of total dredging contract costs would be reduced if greater volumes of sand were dredged.
- Dredging unit rates from this trial sets a baseline upper limit of costs for potential future programs, due to lessons learned and efficiencies from longer term planning and purposely procured dredge and equipment.
- A crew transfer vessel should be considered so that crew change onto tug/SHB, or TSHD, can occur during transit trips to reduce standby time, i.e. waiting for night shift to start before commencing SHB transit to West Beach.
- The size and number of SHBs to be further reviewed. Smaller, shallower hopper barges would facilitate closer nearshore placement though require more barges to keep up with dredging productivity. On high productivity days the SHBs were being filled and then the CS dredge was on standby waiting for empty hopper barge to return. Self-propelled barges should also be considered.
- A backhoe dredge could be considered for similar nearshore (SBA1) areas to mechanically load sand into hopper barges and reduce overflow associated with hydraulically filling hopper barge with

CSD. A BHD could also operate in greater operating conditions (waves H_s < 1.2m, wave period < 8 seconds, winds up to 20 knots).

- A mobile, self-propelled TSHD would likely be more feasible for sand borrow areas with deeper water depths than trial SBA areas due to only requiring one vessel. TSHDs can also operate in greater operating conditions (waves H_s < 1.5m, winds up to 20 knots) and more readily mobilise into sheltered port waters during severe weather events.
- Nearshore placement of sand with 760 m^3 split hopper barges was successful and achievable.
- The Rehandling Area (RA) was used in the trial and could be used in the future to place further sand volumes via larger SHBs or TSHDs. This sand could then be rehandled (dredged) and placed nearshore/onshore at a more favourable time of year with a CSD.
- Alternatively, sand can also be pumped nearshore/onshore via a pipeline from TSHDs directly.

11.5 Environmental

- Water quality – there were no exceedances of the water quality trigger levels during the dredging period. The 6-day and 15-day rolling median turbidity data indicated that turbidity remained below the trigger values during dredging periods, even using the more stringent November trigger values.
- Seagrass – overall, the findings suggest that dredging activities - at the trial scale - did not have a significant negative impact on seagrass cover, biomass, or habitat structure, with observed changes in seagrass communities more likely attributed to natural variability and external environmental factors.
- Noise – several attended and unattended noise monitoring undertaken during the AMBRI dredge trial showed compliance with the relevant noise criteria was achieved. Noise at both locations (SBA1 and SBA3/SPA1) was observed to be controlled by natural sounds or extraneous noise sources rather than dredging activity.
- Marine Fauna - An independent Marine Mammal Observer (MMO) was engaged to monitor cutter suction dredging and hopper barge loading activities at SBA1 (North Haven) between 03 to 21 October 2024. Only 1 sighting of two bottlenose dolphins was observed at 1438 hours on 13 October 2024. The Observer noted '*Dredging was in progress at the time. They (dolphins) were moving steadily and straight, so appeared to be simply travelling by and disinterested in the dredging operations.*'
- Odour and visual amenity – no odour complaints are known to have been made to DEW. No onshore placement of sand occurred which would be more likely to result in potential odour or visual amenity complaints. Visual amenity was likely more impacted by associated truck and quarry sand movements.

11.6 Health & safety

- There were no major safety incidents during this trial.
- There were no loss time injuries.
- Minor safety and plant incidents are detailed in **Table 9**.
- All parties worked together to create a safe working place.
- Ongoing consultation occurred throughout the dredging trial with yacht and surf lifesaving clubs. Spotters and signage were utilised on the beach to minimise interaction between beach and waterway users with dredging and placement vessels.

Appendix A Financials

Appendix B Daily Dredge Reports

Appendix C Weekly Production Reports

Appendix D Weekly Site Reports

Appendix E Photos