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6 August, 2019

EPA South Australia
GPO Box 2607,
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Outer Harbor Channel Widening Project - Monthly Report for July 2019

Flinders Ports are currently undertaking dredging of the Outer Harbor Channel and Swing Basin. This work is being undertaken in accordance with the conditions of EPA licence 50556.

Flinders Ports has engaged dredge contractor Boskalis to undertake this work.

Dredging commenced on 7/6/19 utilising the trailing suction hopper dredge 'Gateway'. Backhoe dredge 'Magnor' commenced dredging on 3/7/19.

This monthly report consists of 3 components:

- Boskalis Monthly Environmental Report – July 2019
- BMT Monthly Water Quality Monitoring & Validation Report – July 2019
- Flinders Ports Monthly Stakeholder Engagement Update – July 2019

Next report for August will be issued at the start of September.

Monthly Environmental Report – July 2019

DOCUMENT NUMBER: 036-10315-01-006

PROJECT NAME: Port Adelaide Outer Harbor Channel Widening
PROJECT NUMBER: 036-101315

CLIENT NAME: Flinders Ports Pty Ltd
CLIENT REFERENCE: FP-10/18

DOCUMENT CONTROL

General document data	
Document Title:	Monthly Environmental Report – July 2019
Document Number:	036-10315-01-006
Project Name:	Port Adelaide Outer Harbor Channel Widening Project
Project Number:	036-10315
Client Name:	Flinders Ports Pty. Ltd.
Client Reference:	FP-10/18
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Boskalis Entity:	Boskalis Australia Pty. Ltd.

Revision status		
Revision Number:	Rev. 01	
Revision Date:	05-Aug-2019	
Approval Status:	Issued for Use	
Prepared By:	Michel Oosterwegel	Role: Environmental Engineer
Reviewed By:	Irena Doets	Role: Environmental Manager
Interdisciplinary Check:	Rob Evans	Role: SHE-Q Manager
Approved By:	Pieter Jan Stuiver	Role: Project Manager

Change log		
Revision	**Section**	**Change**
Rev A1	All	Issued for internal review
Rev B1	All	Issued for Client review
Rev 01	All	Issued for Use

Boskalis
Dredging & Marine Experts

TABLE OF CONTENTS

1. INTRODUCTION

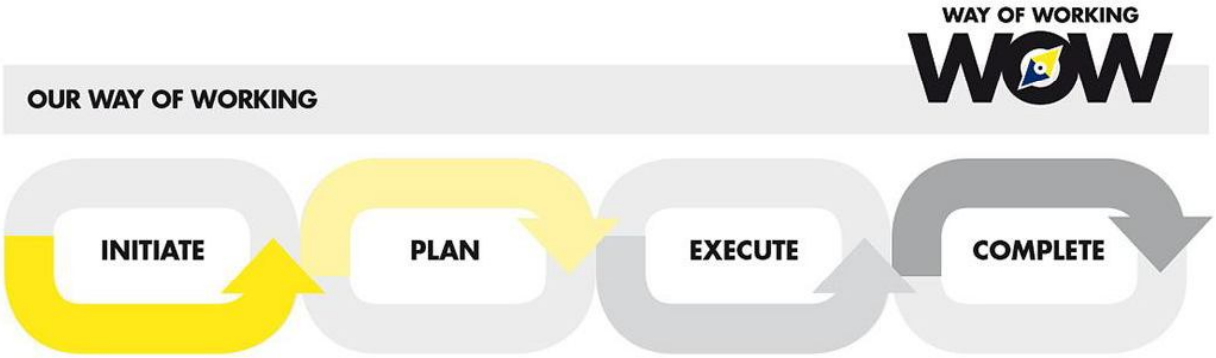
This Monthly Environmental Report presents the results of the second month of dredging. Hence the reporting period includes the 1st of July until the 31st of July The report presents action taken by the Contractor in line with the Licence conditions [1] and the Dredge Management Plan (DMP) [11]. It covers the following items:

- Any updates to the DMP (Chapter 3);
- Overview of dredge activities in this period including dredge and disposal volumes (Chapter 3).
- Actions taken to correct turbidity exceedances (Chapter 4);
- Summary of additional monitoring undertaken by the Contractor (Chapter 4);
- Marine mammal observations (Chapter 5);
- Summary of Weekly Site Inspections (Chapter 6);
- Register of non-conformances and actions taken (Chapter 7).

For results on Water Quality monitoring data and Zone Validation monitoring in this period, reference is made to Water Quality and Validation Report from July 2019 [10].

1.1. Boskalis Way of Working

This document forms part of the Boskalis Way of Working, the integrated quality management system applicable to all operations in Boskalis. The Boskalis Way of Working is structured around four Phases as pictured below. This Monthly Environmental Report is prepared in the EXECUTE Phase.



More detailed information about the Boskalis Way of Working can be found in the Group Manual and the User Guide. A dedicated website with all supporting materials is available at wow.boskalis.com

Where the Corporate Way of Working system does not meet the requirements of Australia Work Health and Safety legislation or Environmental legislation, additional or alternative procedures (BKA – Country Tools) have been prepared by Boskalis Australia as described in the Way of Working Booklet – Australia.

Management commitment is shown to SHE-Q through the various policy statements.
Reference is made to:

- GT-001 Way of Working Policy Statement
- BKA-016 Way of Working Booklet - Australia.
- BKA-001 Boskalis Fitness for Duty Policy
- BKA-002 Boskalis Rehabilitation Policy
- BKA-003 Boskalis Business Conduct and Workplace Behaviour Policy
- BKA-004 Boskalis Privacy Policy

1.2. Plan ownership, change management, approval and distribution

The Project Manager is the document owner and is responsible for the contents of the Monthly Environmental Report. He will ensure that the content is up to date and that only authorized and updated versions are in circulation.

Revision to the Report can be initiated by the following processes:

- Changes in legislation
- Changes in work methods
- Major scope and schedule changes
- Results from risk assessments
- Results from audits (external & internal)
- Results from management reviews
- Results from Client inspections/reviews
- Changes in the Boskalis Way of Working

Any resultant changes will be issued, and agreed upon, by all parties concerned.

2. PROJECT OUTLINE

The Port of Adelaide is the primary port in South Australia, located at Outer Harbor (approximately 14km north-west of the Adelaide CBD) in South Australia (Figure 2.1). The port is operated by Flinders Ports and handles a diverse array of inbound and outbound cargoes, contributing significantly to the State's economic activity. A significant amount of this trade is containerized, and Outer Harbor is the location of the Flinders Adelaide Container Terminal and the Port Adelaide Passenger Terminal which contribute significantly to South Australia's import and export of goods and visitors.

Flinders Ports Pty Ltd (FP) has identified the need to widen the existing shipping channel and swing basin at Outer Harbor in Port Adelaide. This is being driven by the emergence of Post Panamax class vessels which are wider than the 36m design vessel width of the existing channel and swing basin. Outer Harbor can only currently accommodate vessels up to a maximum width of 42.2m width with operational restrictions. The Port Adelaide Outer Harbor Channel Widening Project will enable the port to accommodate vessels with a maximum width of 49m without operational restrictions.

To meet this growth, the existing channel will be widened by 40m to a total width of 170m. The swing basin will be widened from 505m to 560m. The widening footprint of the channel and turning basin are illustrated by the red line in Figure 2.1.

The dredged material will be transported to a designated Dredge Material Placement Area (DMPA), located approximately 30km offshore in the Gulf of St Vincent (yellow box in Figure 2.1). This area is approximately 7km by 5km in size and located in deep water (>30m), thereby avoiding major shipping routes.

Figure 2.1: Overview Project area with outer shipping channel and turning basin

2.1. Project Identification

Project	
Details	**Description**
Project Name	Port Adelaide Outer Harbor Channel Widening Project
Project Scope	Widen and deepen the turning basin and approach channel to the port
Project Location	Outer Harbor, South Australia
Project Number	036-10315
Client Project Number	FP 10/18

Client	
Details	**Description**
Name Client	Flinders Ports Pty Ltd
Address Client	Level 1, 296 St Vincent Street, Port Adelaide South Australia, 5015
Other Client details	Carl Kavina Principal's Representative Lee Kolokas Principal's Representative's Delegate

Engineer / Consultant	
Details	**Description**
Name	ARUP via Flinders Ports
Address	N/A
Other details	Jasvinder Opkar (Principal's Site Representative)

Operating Company	
Details	**Description**
Name	Boskalis Australia Pty Ltd
Address	Level 1 - Suite 3 9 Havelock Street, West Perth, WA 6005 Australia
Other details	General Manager – Peter Boere

3. GENERAL

3.1. Updates to the DMP

After approval of the DMP [11] two Addenda have been made, covering the following elements:

- Addendum 1 to both the EMP and DMP [8] describing a methodology and framework for providing public access to the approved DMP and EMP and reports generated under the licence according to condition 2.7.3.
- Addendum 2 to the DMP [12] detailing revised contact details for:
  - HOLD trigger exceedance notifications;
  - Request for re-commencement after HOLD trigger exceedance;
  - Dolphin incidents;
  - Environmental incident reporting; and
  - Fuel spills.

3.2. Dredging Activities

Dredging in this period took place from the 1st of July until the 31st of July. Dredging was undertaken in all areas of the dredge channel (Figure 3.1) by the Trailing Suction Hopper Dredge (TSHD) *Gateway*. In total 80 trips were completed in this period. The Backhoe Dredger (BHD) Magnor has dredged in areas B, C, D, E and G. 126 barge trips to the dredged material placement area (DMPA) have been completed.

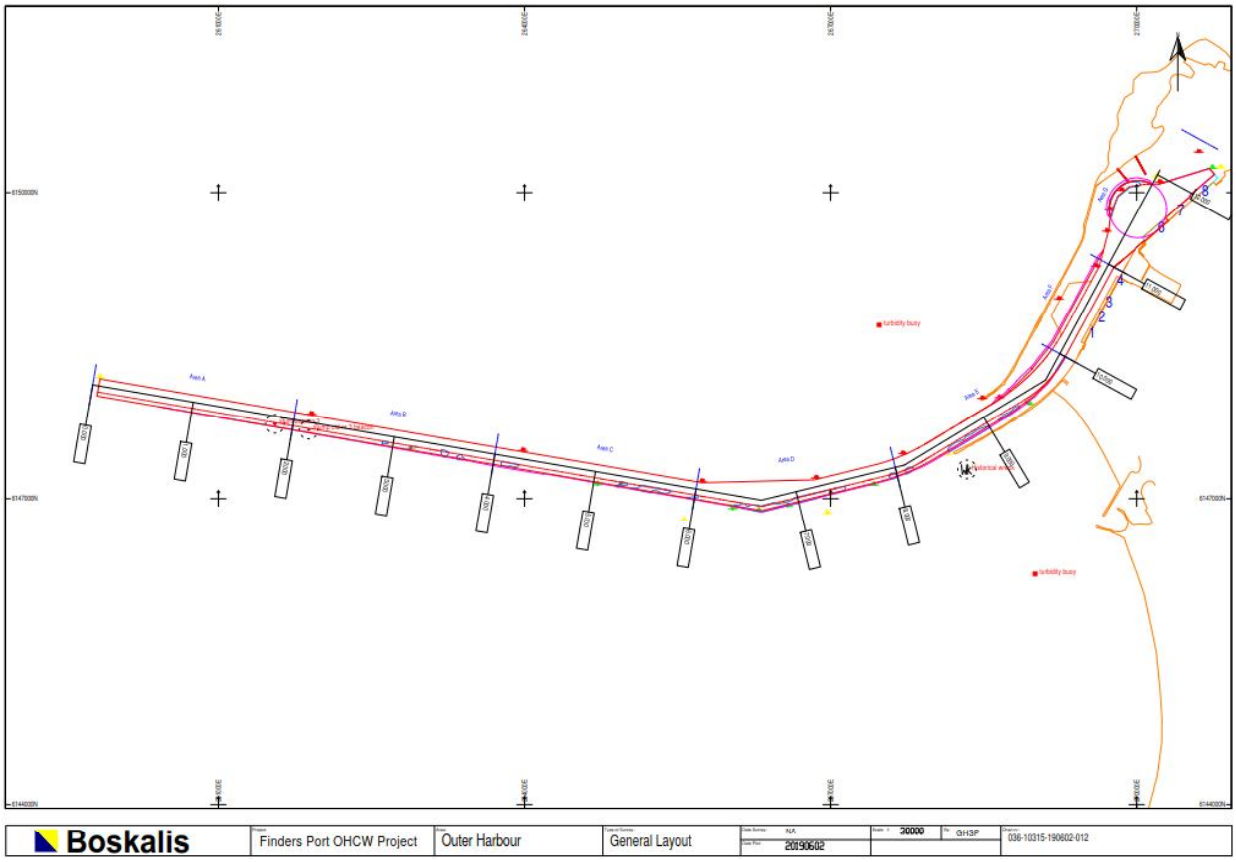


Figure 3.1: Overview dredge area including chainages and area numbering

A total volume of 1,146,823 m3 has been dredged and deposited at the Dredge Material Placement Area (DMPA). Volume dredged in July is 713,323 m3. Figure 3.2 gives an overview of the areas dredged based on survey on the 31st of July compared to the pre-survey, where red/pink indicates large dredge volumes and blue small volumes.

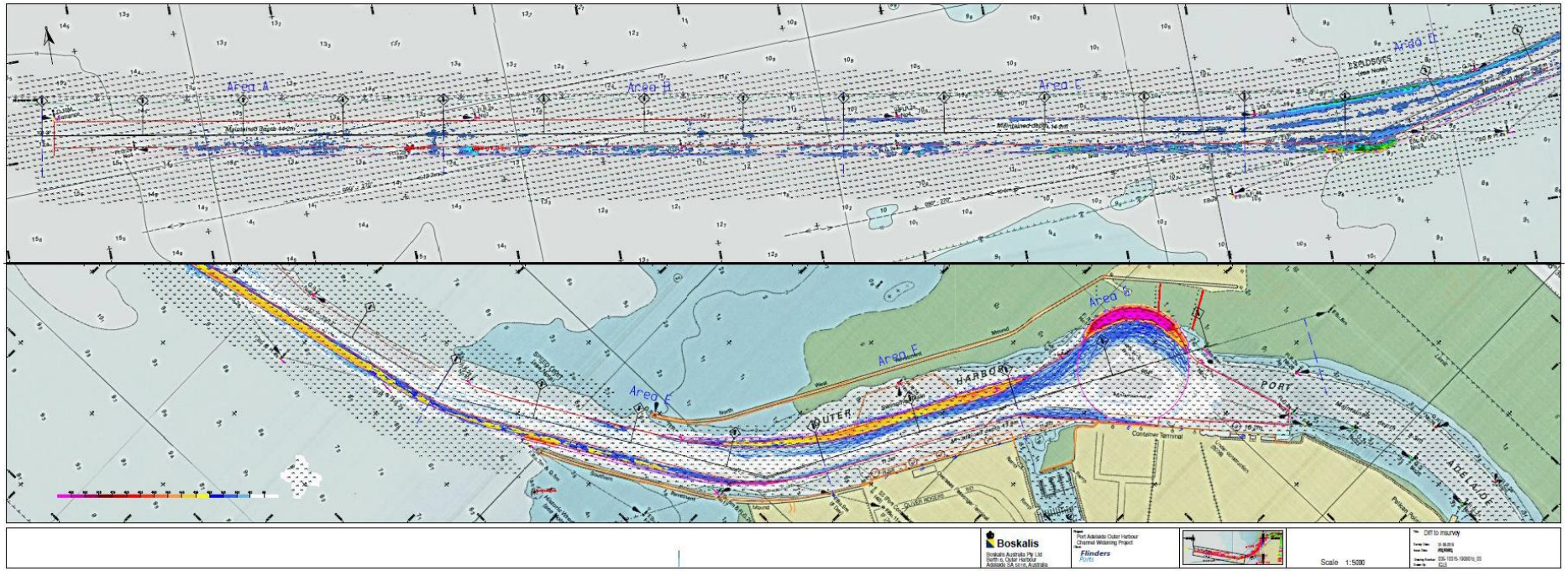


Figure 3.2: Difference in pre-survey compared to survey on the 31st of July

4. TURBIDITY

4.1. Turbidity Exceedances

Table 4.1 provides an overview of turbidity exceedances occurred during this reporting period and actions taken. For an overview of dredge areas, see Figure 3.1. For the turbidity data reference is made to [10].

Table 4.1: Turbidity exceedances in month of July 2019 and actions taken

Turbidity station with exceedance	Level of Exceedance	Start date and time exceedance	Stop date and time exceedance	Actions taken
D2	ALARM 15-day rolling median	01-07-2019 03:40:00	03-07-2019 17:40:00	▪ Dredging further outside of the Channel (areas B and C).
D2	ALARM 15-day rolling median	12-07-2019 10:40:00	02-08-2019 01:40:00	▪ Gateway dredging in areas F and G inside the breakwaters.
D1	ALARM 15-day rolling median	13-07-2019 06:40:00	Still exceeded	▪ Gateway dredging in areas F and G inside the breakwaters.
B1	ALARM 15-day rolling median	13-07-2019 04:40:00	02-08-2019 01:40:00	▪ N/A.
D2	HOLD 15-day rolling median	19-07-2019 01:40:00	28-07-2019 5:40:00	▪ Ceased dredging within 3 hours of HOLD exceedance ▪ Dredging while above HOLD continued under EPA conditions described in section 4.2.
D1	HOLD 15-day rolling median	21-07-2019 05:40:00	26-07-2019 05:40:00	▪ Same actions as described in section 4.2.
B1	HOLD 15-day rolling median	19-07-2019 08:40:00	29-07-2019 18:40:00	▪ N/A.
B1	ALARM 6-day rolling median	02-07-2019 16:40:00	05-07-2019 15:40:00	▪ N/A.
D2	ALARM 6-day rolling median	13-07-2019 05:40:00	25-07-2019 01:40:00	▪ Gateway relocated to areas F and G inside the breakwaters.
B1	ALARM 6-day rolling median	13-07-2019 11:40:00	2707-2019 17:40:00	▪ N/A.
D1	ALARM 6-day rolling median	13-07-2019 22:40:00	21-07-2019 12:40	▪ Gateway relocated to areas F and G inside the breakwaters.

The first 15-day rolling median ALARM exceedance at D2 in the month of July was a combination of dredge induced turbidity during the days before the ALARM was reached and a bad weather event on the 29th and 30th of June. Wind speeds up to 30 knots were measured which caused turbidity to increase at all monitoring stations (including background). After the ALARM level was reached, the Gateway was relocated to area B further away from the monitoring stations.

During a severe storm event with prolonged wet weather and strong winds (up to 40 knots) between the 10th and 15th of July, significant increases in turbidity at all monitoring stations were measured. On the 12th of July, the 15-day rolling median at D2 reached the ALARM level. On the 13th of July, the 15-day rolling median at D1 reached the ALARM level and subsequently the 15-day rolling median at B1 reached ALARM. The Gateway was relocated to areas F and G inside the breakwaters on the 10th of July, in response to the expected upcoming increased turbidity levels caused during the storm event. The 15-day rolling medians at D1, D2 and B1 continued to increase until HOLD levels were exceeded at all three monitoring stations. D2 and B1 on the 19th of July, and D1 on the 21st of July.

4.2. HOLD exceedance

The only HOLD exceedance occurred on Friday the 19th of July 01:40:00 AM. The suggested cause for this HOLD event is prolonged wet weather and strong winds between the 10th and 15th of July which caused significant increases in turbidity at all monitoring stations (including background).

Boskalis executed a number of turbidity management actions in anticipation of the upcoming severe storm event between the 10th and 15th of July. The following actions were taken in response to the expected upcoming increased turbidity levels caused during the storm event:

- Gateway: dredging in areas F and G inside the breakwaters, both with rising and falling tide.
- Gateway: bunkering was brought forward so no dredging took place for 24 hours.
- Magnor: dredging inside breakwaters (areas E, F and G).
- Magnor: no dredging undertaken for periods as bad weather prevented barges sailing to disposal area.
- Magnor: scheduled maintenance was brought forward so no dredging took place for 12 hours.

In addition, the following actions were undertaken directly after the storm event until HOLD level was reached:

- Gateway: as above, dredging in areas F and G inside the breakwaters.
- Gateway: dredging in area E with rising tide and monitoring impacts during falling tide.
- Magnor: as above, dredging inside the breakwaters (areas E, F and G).
- Where possible, maintenance onboard both Gateway and Magnor was brought forward to provide periods of no dredging.

Within 3 hours of HOLD exceedance on Friday the 19th of July at 1:40 AM, all dredging was ceased (both Gateway and Magnor). From the moment of HOLD exceedance, several teleconferences with Boskalis, Flinders Ports and EPA were held. The EPA assessed turbidity monitoring and provided written approvals for the undertaking of dredging forthwith, in accordance with condition 1.3.2 (b) of the dredge licence [1], as follows:

19th of July:

- Gateway (TSHD) to dredge with no overflow within all designated areas; and
- Magnor (BHD) to dredge in designated areas F and G only

22nd of July:

- Gateway (TSHD) to dredge in designated areas E, F and G ONLY, and ONLY during incoming tide events; and
- Gateway (TSHD) to dredge in all areas without overflow
- Magnor (BHD) to dredge in all designated areas

23rd of July:

- Gateway to dredge in all designated areas (with NO overflow)
- Gateway (TSHD) to dredge in designated areas E, F (with overflow) on incoming tide ONLY
- Gateway (TSHD) to dredge in designated area G (with overflow) on incoming tide AND on a single outgoing tide event commencing approximately 9:00, 25/7
- Magnor (BHD) to dredge in all designated areas

26th of July:

- Gateway (TSHD) to dredge in all designated areas (with NO overflow)
- Gateway (TSHD) to dredge in designated area E (with overflow) on incoming tide ONLY
- Gateway (TSHD) to dredge in designated area F (with overflow) on incoming tide AND on a single outgoing tide event commencing approximately 10:00 AM, 26/7
- Gateway (TSHD) to dredge in designated area G (with overflow) with no tidal restriction
- Magnor (BHD) to dredge in all designated areas

26th of July:

- Gateway (TSHD) to dredge in all designated areas (with NO overflow)
- Gateway (TSHD) to dredge in area E (with overflow) on incoming tide ONLY
- Gateway (TSHD) to dredge in designated area F (with overflow) with no tidal restriction
- Gateway (TSHD) to dredge in designated area G (with overflow) with no tidal restriction

After dropping below the HOLD limit on the 28th of July at 5:40am, ongoing turbidity management actions were taken. The TSHD Gateway continued dredging in F and G while the Magnor dredged in area D. On the 31st of July, the TSHD Gateway did one trial dredge cycle in area E, which is a critical area with respect to turbidity levels. This trial cycle did not cause significant increased turbidity levels however, the Gateway alternated between areas E, F and G in order to minimize increased turbidity at the monitoring stations.

4.3. Additional Handheld Monitoring

During this period seven additional hand-held measurements campaigns were undertaken around the Magnor while above HOLD. Hand-held measurements were taken in all compass directions at distances of 100m, 500m, 1000m and 2000m from the Magnor. Overall it was concluded that the Magnor did not contribute to increased turbidity levels at the monitoring stations. One hand-held measurement campaign has been undertaken to establish background values in area A and B. A summary of the hand-held measurement campaigns around the Magnor and in area A and B can be found in Table 2.

Table 2: Additional hand-held monitoring campaigns around Magnor

Campaign	Date	Location	Comment
1 – Magnor	18-07-2019 8:00	Area G	Falling tide
2 – Magnor	18-07-2019 15:00	Area G	Rising tide
3 – Background	19-07-2019 13:00	Area A and B	Rising tide
4 – Magnor	20-07-2019 8:00	Area G	Falling tide
5 – Magnor	20-07-2019 15:00	Area G	Rising tide, no Magnor dredging
6 – Magnor	21-07-2019 15:00	Area G	Rising tide
7 – Magnor	24-07-2019 8:00	Area D	Falling tide
8 – Magnor	24-07-2019 15:00	Area D	Rising tide

Furthermore, on the 18th of July and on the 20th of July readings were verified with a hand-held turbidity sensor, similar to the sensor installed on the monitoring stations. The handheld sensor was lowered to a depth of approximately 1m below the water surface, at similar level as the buoy sensors, for a period of approximately 1 minute. The results of this verification can be found in Table 3. Hand-held turbidity readings were slightly higher compared to the turbidity buoy readings. The differences on the 21st of July were still within the margin of the accuracy of the sensors. The differences on the 19th of July were probably not within the margin of the accuracy of the sensors.

Table 3: Turbidity buoy verification measurements

Monitoring station	Time measurement	Buoy reading [NTU]	Average value handheld reading [NTU]	Difference [NTU]
D1	19-07-2019 at 7:20	At 7:20: 8.52 NTU	6.41 NTU	2.11 NTU
D2	19-07-2019 at 7:09	At 7:10: 4.83 NTU	3.38 NTU	1.45 NTU
D1	19-07-2019 at 16:57	At 17:00: 4.28 NTU	2.63 NTU	1.65 NTU
D2	19-07-2019 at 17:08	At 17:10: 2.74 NTU	1.98 NTU	0.76 NTU
D1	21-07-2019 at 9:12	At 9:10: 2.90 NTU	2.52 NTU	0.38 NTU
D2	21-07-2019 at 9:23	At 9:20: 8.6 NTU	8.54 NTU	0.06 NTU

5. MARINE MAMMAL OBSERVATIONS

In this reporting period a total number of 100 marine mammals have been observed. Per dredge equipment the following count is made:

- Gateway: 17
- Magnor: 5
- Topaz: 55
- Onyx: 23

Most of the reported marine mammals were dolphins. Some sightings of seals were reported as well. No whales were reported during this reporting period.

As the Magnor is a stationary piece of dredge equipment and it does not change its location often, less dolphins are spotted on the Magnor. Especially the Gateway, Topaz and Onyx which are sailing to and from the DMPA on a daily basis have reported Marine Mammal sightings.

It should be noted that the Topaz spotted approximately 26 dolphins at the DMPA on the 28th of July. As there is lots of nutrition for fish during dump activities of the dredge barges, dolphins get attracted.

No incidents with marine mammals occurred.

For full details of the marine mammal sightings, reference is made to Attachment 9.2. Please note that the Magnor, Onyx and Topaz started with dredging operations on the 3rd of July, and therefore the 1st and 2nd of July are not included in the Marine Mammal Observation logsheets.

6. WEEKLY SITE INSPECTIONS

In this period four weekly site inspections were undertaken. For full details of the weekly site inspections reference is made to Attachment 9.3.

No corrective actions were required.

7. NON-CONFORMANCES

In this period an environmental audit was undertaken by Client's Environmental Representative (BMT) on the 31st of July. The EPA also visited the BHD Magnor on the 25th of July. Both inspections were positive and no non-conformances were observed.

8. REFERENCES, ABBREVIATIONS, DEFINITIONS

8.1. References

Controlled Legislation		
No.	**Document No.**	**Document Title**
[1]		Licence No. 50556 Flinders Ports Pty Limited issued 12 March 2019
[2]		Development Approval Outer Harbor Channel and Swing Basin Widening

Client Documents		
No.	**Document No.**	**Document Title**
[3]	R.B22346.010.02	Adelaide Outer Harbor Channel Widening Project: Environmental Monitoring Program
[4]	R.B22346.008.03	Adelaide Outer Harbor Channel Widening Project: Seagrass Monitoring Program
[5]		Outer Harbor Channel Widening Project Community Engagement Plan
[6]	R.B22346.009.00	Adelaide Outer Harbor Channel Widening Project: POMS Management Plan
[7]	253257-00	Closure Plan
[8]	ADD-01	Outer Harbor Channel Widening Project Addendum 1: DMP/EMP
[9]	R.B22346.012.01	Adelaide Outer Harbor Channel Widening Project: Baseline Seagrass Survey
[10]		Water Quality Monitoring and Validation Report July 2019 (BMT)

Contractor Documents		
No.	**Document No.**	**Document Title**
[11]	036-10315-02-003	Dredge Management Plan
[12]	50556_036-10315-02-013	Addendum to DMP 036-10315-02-003 No. 2
[13]	036-10315-02-001	Work, Health and Safety Management Plan
[14]	036-10315-14-004	TSS-NTU Method Statement
[15]	036-10315-01-003	TSS-NTU Report

Other Documents		
No.	**Document No.**	**Document Title**

8.2. Abbreviations

Abbreviation	Full meaning
ADS	Adelaide Dolphin Sanctuary
DMP	Dredge Management Plan
DMPA	Dredge Material Placement Area
EMP	Environmental Monitoring Program
EPA	Environment Protection Agency
FP	Flinders Ports Pty Ltd (Client)
MMO	Marine Mammal Observation
NTU	Nephelometric Turbidity Units
Rev	Revision
TSHD	Trailing Suction Hopper Dredge
TSS	Total Suspended Solids

8.3. Definitions

Definition	Full meaning
Client	Flinders Ports Pty Ltd
Client's Engineering Consultant	Arup
Client's Environmental Representative	BMT
Contractor	Boskalis Australia Pty. Ltd.
Project	Port Adelaide Outer Harbor Channel Widening
Project number	036-10315
Subcontractor	Companies contracted by Contractor to perform a specific portion of the work.

9. ATTACHMENTS

9.1. Specifications hand-held turbidity sensor

ProDSS Sensor Specifications

Sensor/Parameter	Range	Resolution	Accuracy
Temperature	-5 to 70 °C (temperature compensation range for DO mg/L measurement: -5 to 50 °C)	0.1 °C or 0.1 °F (user selectable)	±0.2 °C
pH	0 to 14 pH units	0.01 pH units	±0.2 pH units
ORP	-1999 to 1999 mV	0.1 mV	±20 mV
Dissolved Oxygen	0 to 500%, 0 to 50 mg/L	0.01 mg/L and 0.1%, or 0.1 mg/L and 1% (user selectable)	0 to 200%: ±1% of reading or 1% saturation, whichever is greater 200 to 500%: ±8% of reading 0 to 20 mg/L: ±0.1 mg/L or 1% of reading, whichever is greater 20 to 50 mg/L: ±8% of reading
Barometer	375 to 825 mmHg	0.1 mmHg	±1.5 mmHg from 0 to 50 °C
Conductivity	0 to 200 mS/cm	0.001, 0.01 or 0.1 µS/cm (range dependent)	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading
Specific Conductance*	0 to 200 mS/cm	0.001, 0.01, 0.1 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading. User selectable reference temperature (15 to 25 °C; default 25 °C) and compensation coefficient (0 to 4%/°C; default 1.91%)
Salinity*	0 to 70 ppt	0.01 ppt	±1.0% of reading or ±0.1 ppt, whichever is greater
Total Dissolved Solids (TDS)*	0 to 100 g/L	0.001, 0.01, 0.1 g/L	Calculated from specific conductance and a user-selectable TDS multiplier (0.30 to 1.00; default 0.65)
Resistivity*	0 to 2 Mohms	0.001, 0.01, 0.1 ohms	±0.1% Full Scale
Seawater Density*	0.0 to 50.0 sigma, sigma T	0.1 sigma or sigma T	-
Turbidity	0 to 4000 FNU	0.1 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, whichever is greater 1000 to 4000 FNU: ±5% of reading
TAL-Chlorophyll	0 to 100 RFU or 0 to 400 µg/L chl	0.01 RFU or 0.01 µg/L	Linearity: $r^2 \geq 0.999$ for Rhodamine WT across full range
TAL-Phycocyanin	0 to 100 RFU or 0 to 400 µg/L PC		
TAL-Phycoerythrin	0 to 100 RFU or 0 to 400 µg/L PE		
Ammonium**	0 to 200 mg/L NH_4-N	0.01 mg/L	±10% of reading or 2 mg/L, whichever is greater
Ammonia*	0 to 200 mg/L NH_3-N	0.01 mg/L	-
Chloride**	0 to 18000 mg/L Cl	0.01 mg/L	±15% of reading or 5 mg/L, whichever is greater
Nitrate**	0 to 200 mg/L NO_3-N	0.01 mg/L	±10% of reading or 2 mg/L, whichever is greater
Depth	0 to 328 feet (0 to 100 m)	0.001 m or 0.01 ft	±0.004 m for 1, 4, and 10 m cables ±0.04 m for cables 20 m and longer

*Derived/calculated parameter
**ISEs for freshwater only; 20-meter maximum depth

9.2. Marine Mammal Observation Logsheets

9.2.1. Gateway

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
01/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	None required
02/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	None required
03/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	None required
04/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	A. Tupou	None required
05/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	A. Tupou	None required
06/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	A. Tupou	Non required
07/07/2019	Outer Channel	Nil Sightings	N/A	N/A	0	A. Tupou	Non required
08/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	Non required
09/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	Non required
10/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	Non required
11/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	None required
12/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	None required
13/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	None required
14/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	None required
15/07/2019	Alongside #8 Adelaide Outer Harbour	NW	10m	SW	1 Bottlenose Dolphin	Wes & Rune	Vessel alongside
16/07/2019	Alongside #8 Adelaide Outer Harbour	NW	50m	N	1 Dolphin	A. Tupou	Vessel alongside
16/07/2019	34 48.6' S 138 12.1'E	W	50m	NE	1 Dolphin Undermined species	Rune	Vessel slowed down.
17/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	Non required
18/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A. Tupou	Non required

19/07/2019	Alongside #8 Adelaide Outer Harbour	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
20/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
21/07/2019	Alongside OH8 Adelaide	W	100m	SW then NE	1 Dolphin	Wes	Alongside.
22/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
23/07/2019	Beacon #18	S	70m	NE	2 Dolphins	Radi	Speed reduction
23/07/2019	Beacon #18	NW	100m	NE	1 Seal	Radi	Ship holding position
24/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
25/07/2019	Beacon #16	W	150m	Steady sleeping	7 Seals	Runno	Non required
26/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
27/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
28/07/2019	Outer Channel	S	150m	W	1 Dolphin	Runno	Reduce speed
29/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
30/07/2019	Outer Channel	Nil Sighting	N/A	N/A	0	A.Tupou	Non required
31/07/2019	Outer Channel	W	150m	NW	2 Dolphins	A.Tupou	non

9.2.2. Magnor

Boskalis | **MARINE MAMMAL OBSERVATION LOG SHEET** | **Flinders Ports**

ADELAIDE OUTER HARBOR CHANNEL WIDENING PROJECT

Vessel: Magnor

Environmental Supervisors: Irena Doets – irena.doets@boskalis.com +61 455 933 068; Michel Oosterwegel – michel.oosterwegel@boskalis.com +61 436 337 940

1. Monitoring by a MMO within the caution zone (150m of any dredging vessel) → Record any sightings on the MMO log sheet
2. Delay or pause dredging when marine mammals are observed within 50m of the Backhoe Dredge
3. Report number of sightings in daily progress report and submit log sheets weekly to Environmental Supervisor

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
3 July 2019	Swing Basin	N/C sighted				J.A. Hamstra	
4 July 2019	Swing Basin	N/C sighted				B.A. Hamstra	
5 July 2019	Swing Basin	Nil Sighted				J.A. Hamstra	
6 July 2019	Area C	Nil sighted					
7 July 19	Area C	No sighting				Liam Thomas	
8 July	...	No Sighting				Harris	
9 July	Area G	No sighting				Liam Thomas	
10 July	Swing basin	No sighting				Liam Thomas	
11 July	Swing basin	No sighting					
12 July	Turning bay	Nil sighting				J.A.	
13 July	Swing basin	No sighting				J.A. Hamstra	
14-07-19	G-area	No sighting				J.A. Hamstra	

1

MMO Log Sheet
22/5/2019

Boskalis

MARINE MAMMAL OBSERVATION LOG SHEET

ADELAIDE OUTER HARBOR CHANNEL WIDENING PROJECT

Flinders Ports

15-July-19	G-Area	No sighting				A. Heerschap	
16-07-19	G-Area	No sighting				T. Hamstra	
17-07-19	G-Area	No sighting				A. Heerschap	
18-07-19	G-Area	Towards downstream	200m	S	Dolphin	Jasvinder Opher.	
19-07-19	G-Area	No sighting				A. Heerschap	
20-07-19	G-Area	No sighting				[illegible]	
21-07-19	G-Area						
22-07-19	G-Area	No Sighting				A. Heerschap	
23-07-19	G-Area	No sighting				A. Heerschap	
24-07-19	AReq G	channel	approx 150m	N	Two Dolphins	T. Hamstra	
MS 25.07.19	Area D	No sighting				A. Heerschap	
26-07-19	AReq D	South channel	± 200 mtr	S	Dolphin	[illegible]	
27-07-19	AReq D	No sighting				[illegible]	
28-7-19	Area D	seal sighting	150m	W	seal 1	Liam Thomas	

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MARINE MAMMAL OBSERVATION LOG SHEET

ADELAIDE OUTER HARBOR CHANNEL WIDENING PROJECT

Flinders Ports

Vessel: Magnor	Environmental Supervisors	Irena Doets – irena.doets@boskalis.com +61 455 933 068 Michel Oosterwegel – michel.oosterwegel@boskalis.com +61 436 337 940

1. Monitoring by a MMO within the caution zone (150m of any dredging vessel) → Record any sightings on the MMO log sheet
2. Delay or pause dredging when marine mammals are observed within 50m of the Backhoe Dredge
3. Report number of sightings in daily progress report and submit log sheets weekly to Environmental Supervisor

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
29-07-19	AReq E	No sighting				MAlamsta	
30-07-19	Area D	No sighting				A.Scull	
31-07-19	AReq D	No sighting				MBlanch	

9.2.3. Union Onyx

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
03-07-2019	No Sightings						
04-07-2019 09:45	Area F	W	100 m	Up river	2x Dolphin	Michiel, Master	Reduced speed
04-07-2019 10:30	34°48'1 S 138°23'1 E	NW	400 m	NE	Whale	Michiel, Master	No
05-07-2019	No Sightings						
06-07-2019	No Sightings						
07-07-2019	No Sightings						
08-07-2019	34°50'2 S 138°10'9 E	S	100 m	NE	Dolphin	Michiel, Master	No
09-07-2019	No observations						
10-07-2019	No observations						
11-07-2019	No observations	Vessel alongside berth					
12/07/2019	No observations						
13/07/2019	No observations						
14/07/2019	No observations						
15/07/2019	No observations						
16/07/2019	No observations						
17/07/2019	No observations						
18/07/2019	No observations						
19/07/2019	34°47'9 S 138°22'9 E	NW	300 m	S	3 x Dolphin	M.G. Koers	N/A
20/07/2019	No observations						
21/07/2019	No observations						
22/07/2019	No observations						

23/07/2019	No observations						
24/07/2019	No observations						
25/07/2019	34°47'5 S 138°27'2 E	unknown	10 m	var	2 x Dolphin	J.Krasavins C/O	N/A
26/07/2019	34°48'13 S 138°23'00 E	S	300 m	N	01 x Dolphin	J. Krasavins C/O	N/A
27/07/2019	Off Berth No1 AOH	South	80 m	SSW	1 x Dolphin	R. Maxwell	N/A
	34 50.1S 138 11.0 E	West	5 m	West	2 x Dolphin	R. Maxwell	N/A
28/07/2019	34°50'13 S 138°10'00 E	N	20 m	W	3 x Dolphin	J. Krasavins C/O	Reduced speed
29/07/2019	34°50'2 S 138°09'7 E	NE	100 m	S	1 x Dolphin	J. Krasavins C/O	Reduced speed
30/07/2019	No observations						
31/07/2019	34° 47' 68 S 138° 26'40 E	Unknown	10 m	var	3 x Dolphin	R. Maxwell	N/A

9.2.4. Union Topaz

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
03/07/2019		No sightings				Captain Oleg Maslov	
04/07/2019 1445 hrs	34° 50.330' S 138° 09.310' E	S	20	E	4 dolphins	Captain Germans Medetbekovs	Slow down
05/07/2019		No sightings				Captain Oleg Maslov	
06/07/2019 1120 hrs	34° 50.090' S 138° 09.950' E	S	20-40	W	2 dolphins	Captain Oleg Maslov	Slow down
07/07/2019 1655 hrs	34° 50.063' S 138° 09'400 E	N	15	W	1 dolphin	Captain Germans Medetbekovs	Slow down
08/07/2019		No sightings				Captain Oleg Maslov	
09/07/2019	34° 49.700' S 138° 10'800 E	S	350	W	4 dolphins	Captain Germans Medetbekovs	Slow down
10/07/2019		No sightings				Captain Oleg Maslov	
11/07/2019		No sightings				Captain Oleg Maslov	
12/07/2019		No sightings				Captain Oleg Maslov	
13/07/2019		No sightings				Captain Oleg Maslov	
14/07/2019	34°47.55' S 138° 26.34 E	N	20	W	3 dolphins	Captain Germans Medetbekovs	Slow down
15/07/2019		No sightings				Captain Oleg Maslov	
16/07/2019		No sightings				Captain Oleg Maslov	
17/07/2019		No sightings				Captain Oleg Maslov	
18/07/2019		No sightings				Captain Oleg Maslov	
19/07/2019	34°50.02' S 138° 09.36' E	N	30	W	2 dolphins	Captain Oleg Maslov	Slow down
20/07/2019		No sightings				Captain Oleg Maslov	
21/07/2019		No sightings				Captain Oleg Maslov	
22/07/2019		No sightings				Captain Oleg Maslov	
23/07/2019		No sightings				Captain Oleg Maslov	

24/07/2019		No sightings				Captain Oleg Maslov	
25/07/2019	34°49.40' S 138° 12.30' E	W	360	N	3 dolphins	Captain Germans Medetbekovs	Watching their movements
26/07/2019	34°46.95' S 138° 28.56' E	ENE	40	NNW Crossing ship's heading	1 dolphin	Captain Oleg Maslov	Slow down. Course change.
27/07/2019	34°50.03' S 138° 08.57' E	W	10	S	4 or 5 dolphins	I.R. Rodney Boyes	During dumping. Ship stopped.
28/07/2019	34°47.97' S 138° 22.34' E	S	20	E	2 dolphins	Captain Oleg Maslov	Slow down
28/07/2019 14:38 hrs	34°47.90' S 138° 25.10' E	S	250	E	3 dolphins	Captain Germans Medetbekovs	Watching
28/07/2019 16:00-16:08	34°49.66' S 138° 10.42' E	W	50-400	N	26 dolphins	Captain Germans Medetbekovs	Slow down and watching
29/07/2019		No sightings				Captain Oleg Maslov	
30/07/2019 09:30	34°47.89' S 138° 25.47' E	NE	120	SE	2 dolphins	Captain Oleg Maslov	Slow down
31/07/2019		No sightings				Captain Oleg Maslov	

9.3. Weekly Site Inspections

Boskalis

LOCATION: Adelaide Site office.
DATE: 06 / 07 / 2019 Time:

ENVIRONMENTAL INSPECTION

☑ = Complies ☒ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED			COMMENTS
		☑	☒	N/A	
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	✓			29-30/06 Dredging area A-B.
2	MMO observation carried out on dredge vessels	✓			
3	MMO sightings recorded on logsheets daily	✓			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	✓			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	✓			
6	Record and resolve any complaints received			X	
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	✓			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	✓			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	✓			
10	Segregation of solid waste for recycling	✓			
11	Waste bins are labelled to designate their waste stream	✓			
12	Refuelling occurs in designated areas and spill prevention measures are in place	✓			
13	No spill incidents	✓			
14	Maintenance or changes to management measures required?			✓	

Required Action by Who and by When:

Inspection Team:

Name:	Signature:	Name:	Signature:
Name:	Signature:	Name:	Signature:

Boskalis

LOCATION:
DATE: 13 / 07 /2019 Time:

ENVIRONMENTAL INSPECTION

✓ = Complies ✗ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED			COMMENTS
		✓	✗	N/A	
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	✓			Mixed GW inside area F) with strong weather *
2	MMO observation carried out on dredge vessels	✓			
3	MMO sightings recorded on logsheets daily	✓			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	✓			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	✓			
6	Record and resolve any complaints received			✓	
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	✓			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	✓			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored				
10	Segregation of solid waste for recycling	✓			
11	Waste bins are labelled to designate their waste stream	✓			
12	Refuelling occurs in designated areas and spill prevention measures are in place	✓			
13	No spill incidents	✓			
14	Maintenance or changes to management measures required?			✓	

Required Action by Who and by When:

* discussion with the EPA ongoing on continuation of dredge when reached HOLD level caused by extra-ordinary weather event 10-14 July.

Inspection Team:

Name:	Sara Doch	Signature:		Name:	Signature:
Name:	ROB EVANS	Signature:		Name:	Signature:

Boskalis

LOCATION:
DATE: 20 / 07 / 2019 Time:

ENVIRONMENTAL INSPECTION

✓ = Complies ✗ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED ✓	✗	N/A	COMMENTS
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	X			HOLD extended 19th July 1:40 AM: cleared dredging within 3 hours
2	MMO observation carried out on dredge vessels	X			
3	MMO sightings recorded on logsheets daily	X			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	X			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	X			
6	Record and resolve any complaints received			X	
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	X			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	X			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	X			
10	Segregation of solid waste for recycling	X			
11	Waste bins are labelled to designate their waste stream	X			
12	Refuelling occurs in designated areas and spill prevention measures are in place	X			
13	No spill incidents	X			
14	Maintenance or changes to management measures required?			X	

Required Action by Who and by When:

- Daily teleconferences with EPA to discuss continuation of TSHD and BHD while above HOLD

Inspection Team:			
Name: Michel Ontiveros	Signature:	Name: RCVAN	Signature:
Name:	Signature:	Name:	Signature:

Boskalis

LOCATION:
DATE: 27 / 07 / 2019 Time:

ENVIRONMENTAL INSPECTION

✓ = Complies ✗ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED ✓	✗	N/A	COMMENTS
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	X			Actions in compliance with daily EPA the conference
2	MMO observation carried out on dredge vessels	X			
3	MMO sightings recorded on logsheets daily	X			Increase in MMO sightings compared to last week.
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	X			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	X			
6	Record and resolve any complaints received			X	
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	X			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	✓			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	✓			
10	Segregation of solid waste for recycling	✓			
11	Waste bins are labelled to designate their waste stream	✓			
12	Refuelling occurs in designated areas and spill prevention measures are in place	✓			BUNKER EVENTS. CHECKED.
13	No spill incidents	✓			
14	Maintenance or changes to management measures required?			X	

Required Action by Who and by When:

- No actions required

Inspection Team:			
Name: R. EVANS.	Signature:	Name: Mitchell O.	Signature:
Name:	Signature:	Name:	Signature:

Adelaide Outer Harbor Channel Widening Project: July Water Quality Monitoring and Validation Report

Reference: R.B23698.015.01.WQMPV Report_july
Date: August 2019
Confidential

Document Control Sheet

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Author:	Lisa McKinnon, BMT
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Client Contact:	Lee Kolokas
Client Reference:	
Synopsis:	

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Flinders Ports		PDF									
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1 Introduction

Flinders Ports Pty Ltd (Flinders Ports) is currently conducting dredging to widen the Adelaide Outer Harbor Channel (Outer Harbour Channel Widening Project – OHCW). A detailed Development Application (DA) Report was submitted in July 2017 in accordance with the *Development Act 1993*, as a Section 49 application given this project is defined as *public infrastructure*. Sponsorship for this application was received from the Minister for Transport and Infrastructure prior to lodgement in May 2017. Flinders Ports DA 010/V048/17 received approval on 28th May 2018.

Subsequently, a dredge licence was issued by the Environmental Protection Authority (EPA) in 2019, and an Environmental Monitoring Program (EMP) prepared which outlined water quality monitoring to be undertaken for the duration of the dredge campaign.

Condition 3.4.2 (f) requires a water quality monitoring report to be provided to the EPA on the 7th of each month, that includes Schedule 1 parameters, and all calculations, assessments and calibration required under this condition. Condition 3.5.2 (a) also requires that a monthly zone validation report is provided.

This document reports on compliance with the Water Quality Monitoring Plan and the Zone Validation Plan for the month of July (1st July to 31st July), the second month of reporting. A total of 1,146,823m^3 of in-situ material has now been dredged since commencement. Both the Trailer Suction Hopper Dredge (TSHD) Gateway and the Backhoe Dredge (BHD) Magnor were active during July (BHD Magnor commenced operation on the 3rd July). .

1.1 Project Location

Figure 1-1 below provides an overview of the area to be dredged within the Port and the approved Dredge Material Placement Area (DMPA).

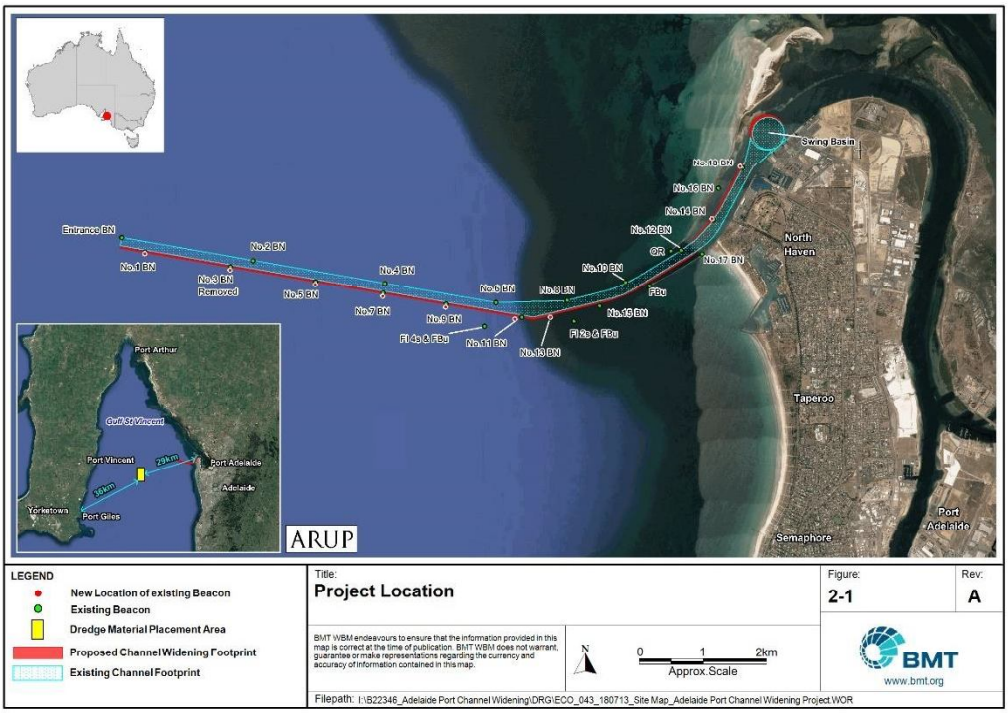


Figure 1-1 OHCW Project Location

2 Purpose, Scope and Objectives

The purpose of this report is to demonstrate compliance with the water quality criteria set for the project and validate plume impact predictions made in water quality modelling.

The objectives of this report are:

- To report on water quality parameters outlined in Schedule 1 of the dredge licence;
- To report any exceedance of either ALARM or HOLD turbidity triggers;
- To outline any actions taken to reduce turbidity in response to trigger exceedances; and
- To provide data validating modelling predictions.

3 Background

This section provides a summary of how the zones of impact and water quality triggers used for the project were derived, to enable comparison and validation of the modelling performed.

3.1 Water Quality Risk Assessment

3.1.1 Methodology

A water quality risk assessment methodology was applied to the project, using the outputs from the predictive dredge plume numerical model. The zones adopted for the water quality risk assessment, include the following:

- Zone of High Impact = water quality impacts resulting in predicted mortality of ecological receptors with recovery time greater than 24 months.
- Zone of Low to Moderate Impact = water quality impacts resulting in predicted sub-lethal impacts to ecological receptors and/or mortality with recovery between 6 months (lower end of range) to 24 months (upper end of range).
- Zone of Influence = extent of detectable[1] plume, but no predicted ecological impacts.

The adopted turbidity thresholds for this project are provided in Table 3-1.

Table 3-1 Impact thresholds for above ambient turbidity

Impact Zone	Turbidity (NTU) thresholds above background[2]			
	20%ile	50%ile	80%ile	95%ile
Zone of High Impact	3	5	15	-
Zone of Low to Moderate Impact	1	2	5	-
Zone of Influence	-	0.5	2	5

The turbidity impact map for the selected case winter scenario is shown in Figure 3-1; the impact map includes the seagrass extent as surveyed in May 2019.

[1] 'Detectable' plume in terms of detectable above background conditions by instrumentation deployed in the water column
[2] Background is defined as turbidity measures in real-time during dredging at the background buoy (B1). Background measurements will be collected and report to provide an indication of whether turbidity is a result of dredging, or reflective of naturally occurring weather events.

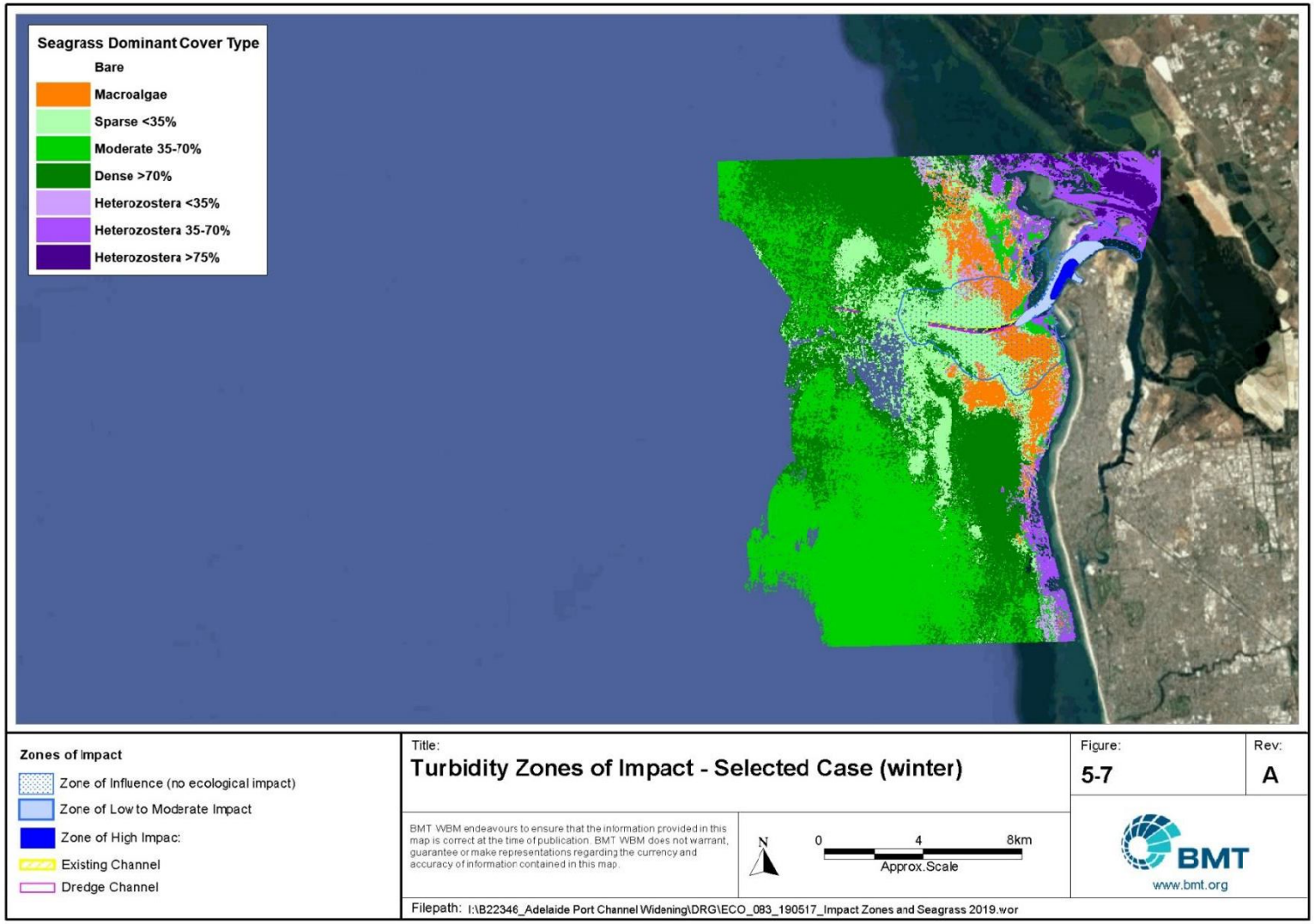


Figure 3-1 Turbidity Zones of Impact

3.2 Water Quality Limits

3.2.1 Data Collection

Water quality monitoring is being undertaken at three (3) sites to collect water quality data as follows:

- Two 'dredge plume monitoring' sites – one site located to the north of the channel (D1) and one site to the south of the channel (D2). These sites are located near to seagrass meadows and within the predicted zone of influence as indicated by dredge plume modelling.
- One 'background' site - located approximately 5.5 km from the channel dredging area and representing background conditions.

The monitoring sites are shown in Figure 3-2. All three sites are located in a water depth of approximately -8 m LAT.

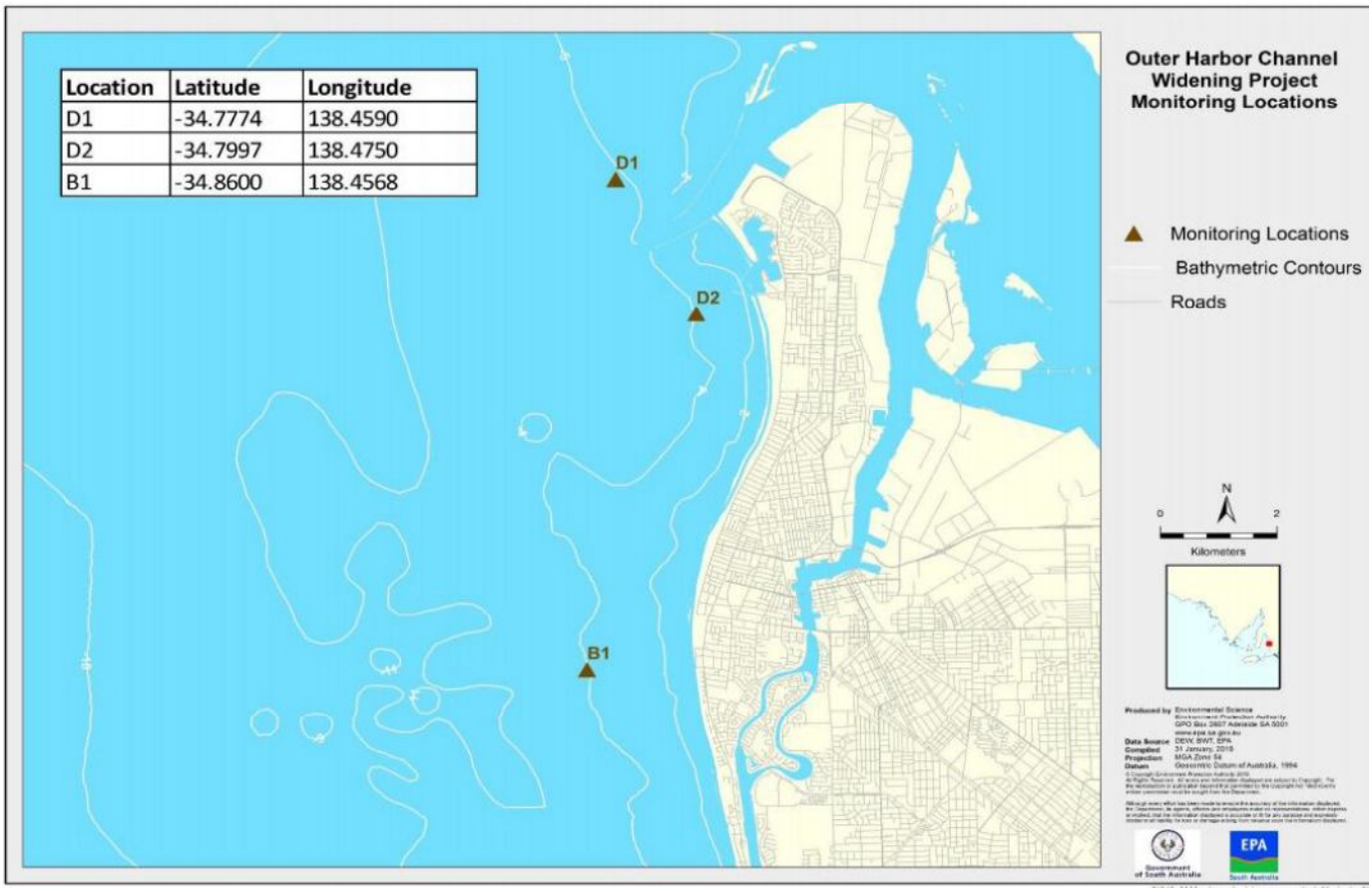


Figure 3-2 Water quality monitoring locations

The following parameters are being continuously measured (i.e. data logged every 10 minutes) during baseline and dredging phases:

- Turbidity - as measured by optical scatter via a nephelometer giving readings in Nephelometric Turbidity Units (NTU). Turbidity provides a proxy for suspended sediments within the water column.

- Photosynthetically Active Radiation (PAR) – benthic PAR measured on the seafloor to represent that part of the light spectrum that is available to benthic photosynthetic organisms (e.g. seagrass) to utilise.
- Dissolved oxygen, pH, salinity and temperature – water quality instruments at each site are fitted with sensors to measure these additional parameters.

To supplement the continuously logged data, and to give independent measures of turbidity, water samples were collected at the three monitoring sites during a servicing trip on the 25th and 26th July for the following parameters:

- Total suspended solids;
- Turbidity; and
- Chlorophyll-a.

Water samples were sent to a NATA accredited laboratory to be analysed; they are not yet available but will be forwarded separately when received.

Data for the month of June (collected on 26th June during 1st reporting period) are provided in Table 3-2. It should be noted that these are one off samples, and should not be used to establish any correlation between TSS and NTU.

Table 3-2 June Water Quality Samples

Parameter	Units	B1	D1	D2
Total Suspended Solids	Mg/L	<1	3	6
Turbidity	NTU	0.8	0.7	0.6
Chlorophyll a	Mg/m^2	0.8	0.7	1

3.2.2 Turbidity Limits

Table 3-3 documents the turbidity limits that were set in Schedule 2 of the dredge licence; these were derived from the impact thresholds (Refer to Table 3-1) plus an additional allowance for average background turbidity of 0.8 NTU (determined from water quality monitoring in place for 11 months prior to dredging commencement).

Table 3-3 Turbidity Limits for the project set by the Dredge Licence

Level	Criteria
ALARM	2.8 NTU on a 15 day rolling median; or 5.8 NTU on a 6 day rolling median
HOLD	5.8 NTU on a 15 day rolling median; or 15.8 NTU based on a 6 day rolling median

4 Water Quality Results

4.1 Turbidity

Adverse weather conditions were experienced in the month of July, with winds regularly above 20km/hr experienced (Refer to Table 4-1). There was a general correlation between rising turbidity and wind events at all monitoring locations, particularly when wind was from a westerly direction.

Figure 4-1 provides raw turbidity readings (NTU) at each of the three monitoring locations (B1, D1 and D2). Turbidity rose rapidly from the 10th July, which coincided with high winds, with gusts of up to 78km/hr being experienced. During this storm period, turbidity reached a peak of 22.9 NTU at B1 and 32.6 NTU at D2 From the 14th July, winds subsided and turbidity slowly reduced, however a further period of high wind from the 17th -18th July and between 21st – 24th saw further (smaller) rises in turbidity.

Table 4-1 Wind Speeds (July 2019) (Bureau of Meteorology, Port Station)

Date	Wind Direction	Max Speed (km/hr)	Wind Direction	9am Av Speed (km/hr)	Wind Direction	3pm Av. Speed (km/hr)
1/07/2019	N	44	N	31	N	26
2/07/2019	NNW	22	NE	17	SSW	9
3/07/2019	ESE	26	ENE	11	ENE	13
4/07/2019	ESE	35	ESE	15	E	19
5/07/2019	ENE	35	ENE	22	NNE	15
6/07/2019	NNE	44	NE	22	NNE	24
7/07/2019	W	31	WNW	7	W	15
8/07/2019	W	26	W	19	W	17
9/07/2019	N	39	NNE	15	N	24
10/07/2019	WNW	74	NW	37	NW	39
11/07/2019	WNW	50	WNW	33	W	20
12/07/2019	SW	70	WNW	33	WSW	33
13/07/2019	SW	78	SW	24	SW	19

14/07/2019	SW	57	W	24	WSW	31
15/07/2019	SSW	43	S	17	SSW	19
16/07/2019	NNW	30	ENE	7	NW	9
17/07/2019	W	41	W	28	W	22
18/07/2019	NW	33	WNW	22	N	15
19/07/2019	NNE	37	NE	13	NNE	26
20/07/2019	N	63	N	44	N	44
21/07/2019	W	41	NW	22	N	15
22/07/2019	WSW	63	N	35	NW	28
23/07/2019	WNW	56	NW	28	WNW	31
24/07/2019	W	31	WNW	17	WSW	17
25/07/2019	N	33	NE	11	NNE	28
26/07/2019	SW	30	SSW	17	SW	22
27/07/2019	SSE	20	ENE	11	WNW	7
28/07/2019	N	50	NE	15	NNE	9
29/07/2019	SSW	35	SSE	19	SW	24
30/07/2019			E	15	SW	15
31/07/2019	SE	28	ESE	6	SW	15

Average wind speed over 20km/hr Average wind speed over 30km/hr

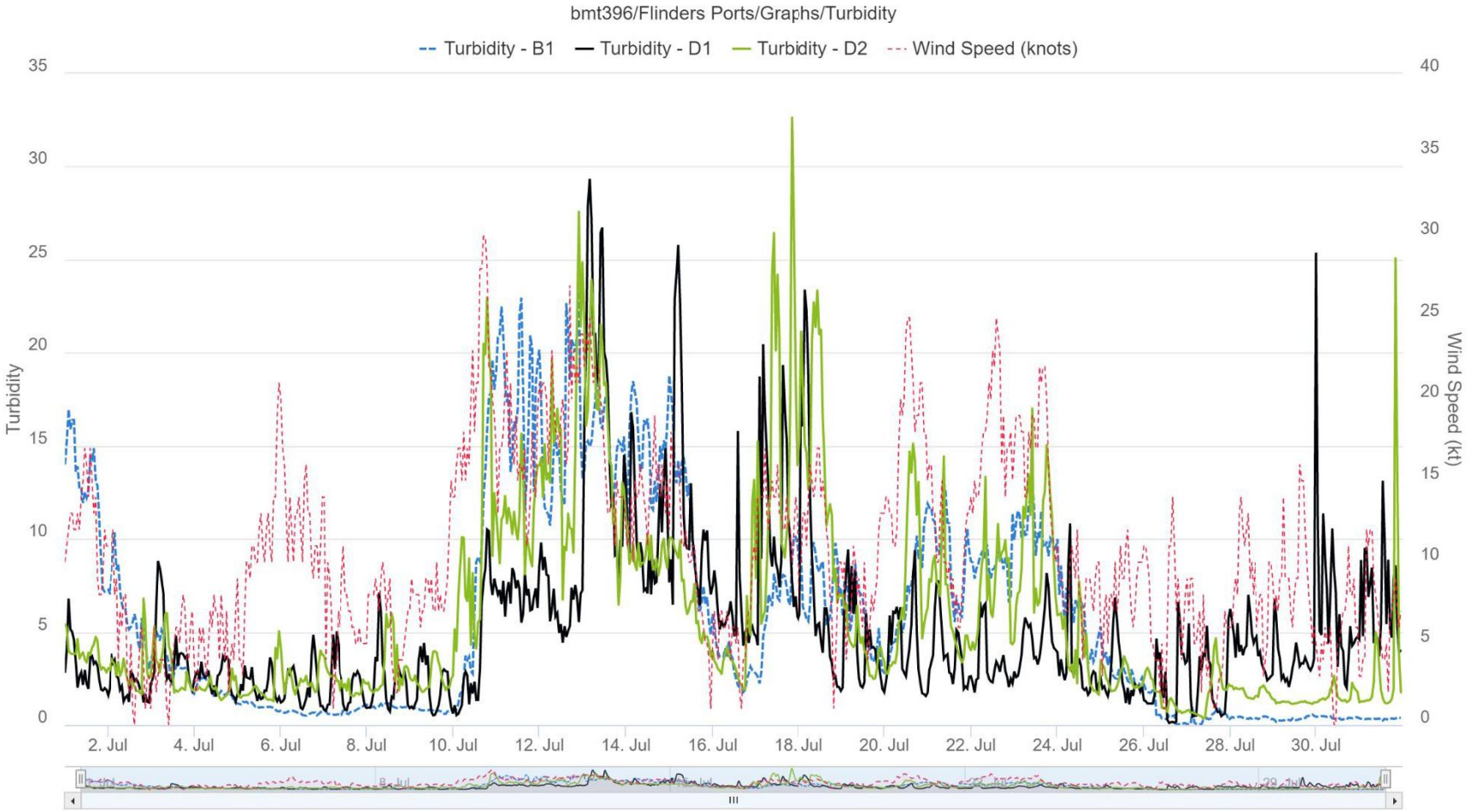


Figure 4-1 Raw turbidity data (NTU) for B1, D1 & D2 (1st July 31st July)

These adverse conditions resulted in HOLD exceedances of the 15-day rolling median turbidity on the 19th July and 21st July at D2/B1 and D1 respectively. In the lead-up to the exceedance, Flinders Ports and the contractor undertook a series of measures to reduce sediment plumes generated from the TSHD (refer to the Boskalis July monthly report for further detail) including:

- Moving the TSHD to either Areas B, C F and G where sediment generated does not generate as large a plumes comparison to Areas D and E (due to the nature/volume of material to be disturbed as well as probable additional flushing).
- Gateway: bunkering was brought forward so no dredging took place for 24 hours.
- Magnor: dredging inside breakwaters (areas E, F and G).
- Magnor: no dredging undertaken for periods as bad weather prevented barges sailing to disposal area.
- Magnor: scheduled maintenance was brought forward so no dredging took place for 12 hours.

Upon reaching the HOLD criteria, dredging ceased within 3 hours, as per the dredge licence conditions. During the HOLD period, the EPA undertook further assessment and approved recommencement of dredging with specific operational restrictions. This included restricting TSHD to operation without overflow in all designated areas, and restricting dredging to Areas F and G for the BHD Magnor. The specific operational restrictions during HOLD were gradually eased in consultation with the EPA, and as per written advice. Refer to the Boskalis July monthly report for further detail.

D1 fell below the HOLD criteria on the 26th July, and D2 on the 28th. As turbidity was still above the ALARM criteria for the 15-day rolling average, measures to reduce turbidity were continued, such as selection of areas to dredge with TSHD and timing dredging with tidal movements.

The 15-day rolling median turbidity (chronic condition) for July is shown in Figure 4-2, with the range of medians provided in Table 4-2. Figure 4-3 shows the 6-day rolling median turbidity (acute condition) for the month of July.

Background turbidity (B1) was higher towards the end of the month; this is believed to be due to high westerly wind conditions, rather than as a result of dredging. Background turbidity has since returned to baseline conditions.

Table 4-2 Rolling Medians – July 2019

Location	Lowest Value	Highest Value
15 Day Rolling Median		
B1	1.34	9.43
D1	2.21	6.08
D2	2.37	8.54
6 Day Rolling Median		
B1	0.66	14.88
D1	1.99	9.19
D2	1.41	9.97

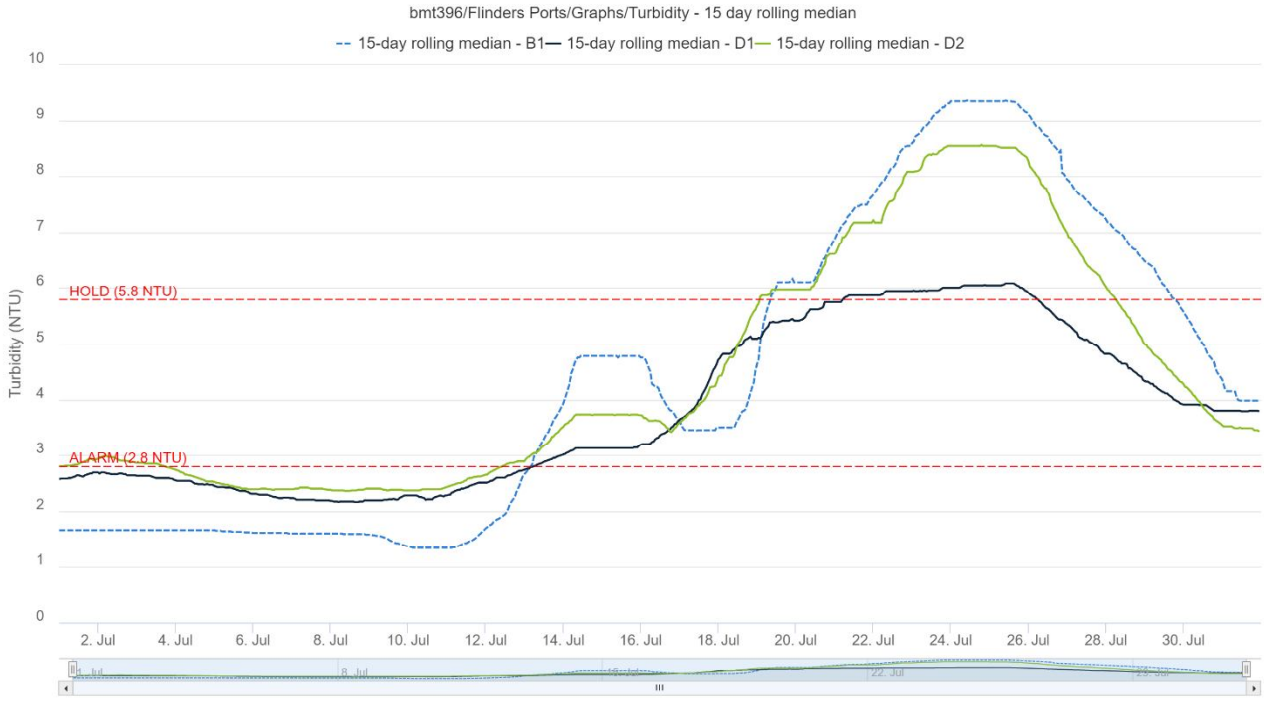


Figure 4-2 15 day rolling median QA' ed turbidity data (NTU) for B1, D1 and D2 – July 2019

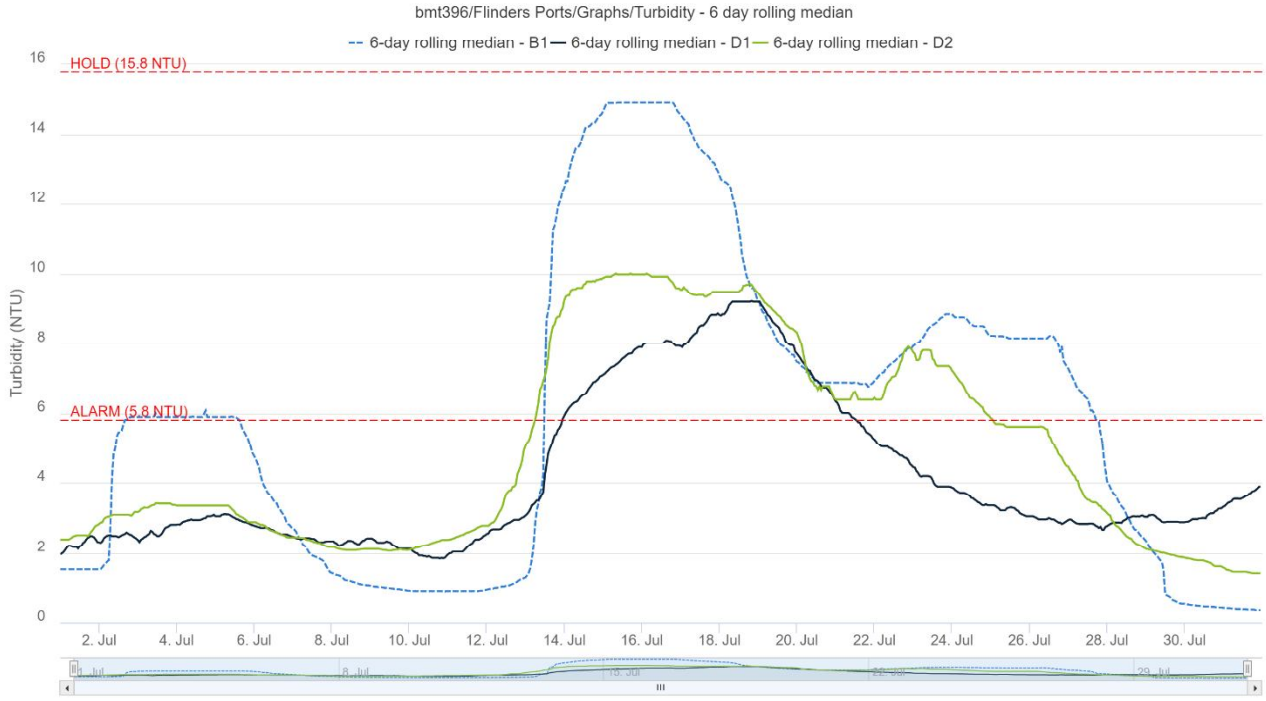


Figure 4-3 6 day rolling median QA'ed turbidity data (NTU) for B1, D1 and D2 – July 2019

4.2 Dissolved Oxygen

Dissolved Oxygen was steady throughout the month of July, ranging between 90 and 107% saturation as shown in

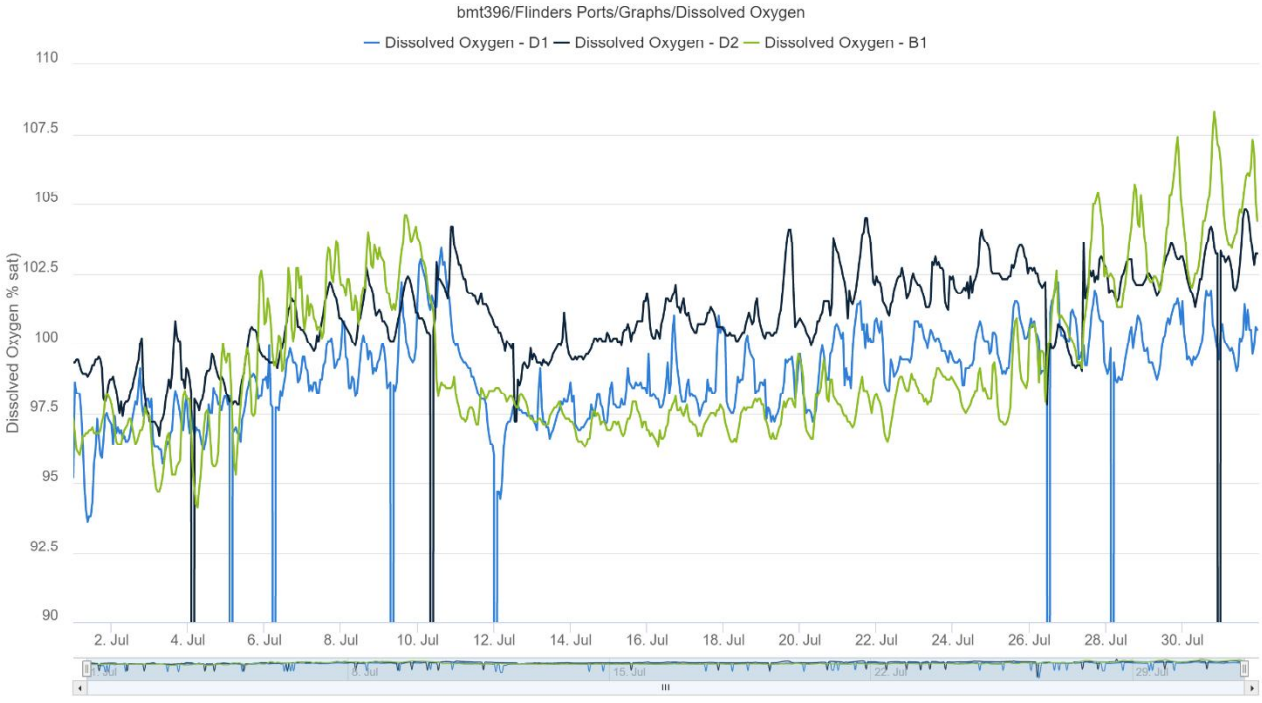


Figure 4-4, which is within the default trigger value range for marine waters (ANZECC, 2000). There

was no significant difference in DO between monitoring locations. Note that there were some signal failures in the data set below.

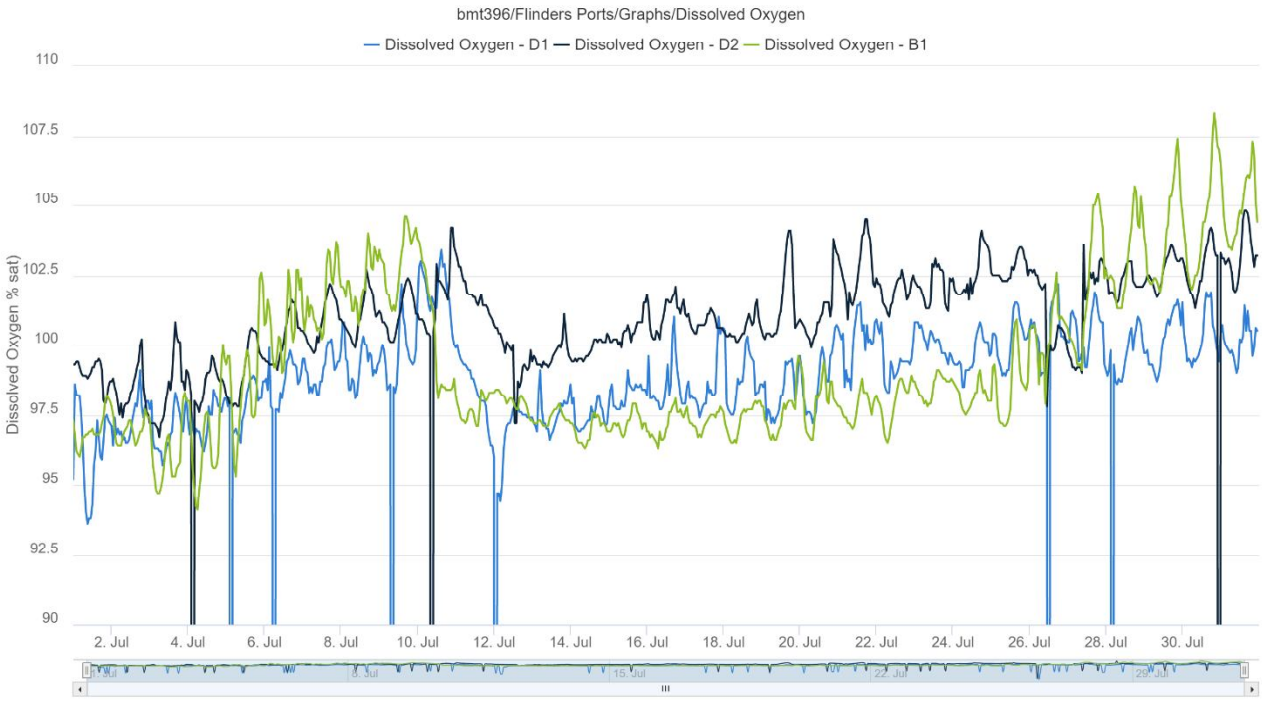


Figure 4-4 Dissolved Oxygen (% saturation) at B1, D1 and D2 – July2019

4.3 pH

pH was quite uniform throughout the month of July, ranging between 8.0 and 8.4 as shown in Figure 4-5 which is within the default trigger value range for marine waters (ANZECC, 2000).

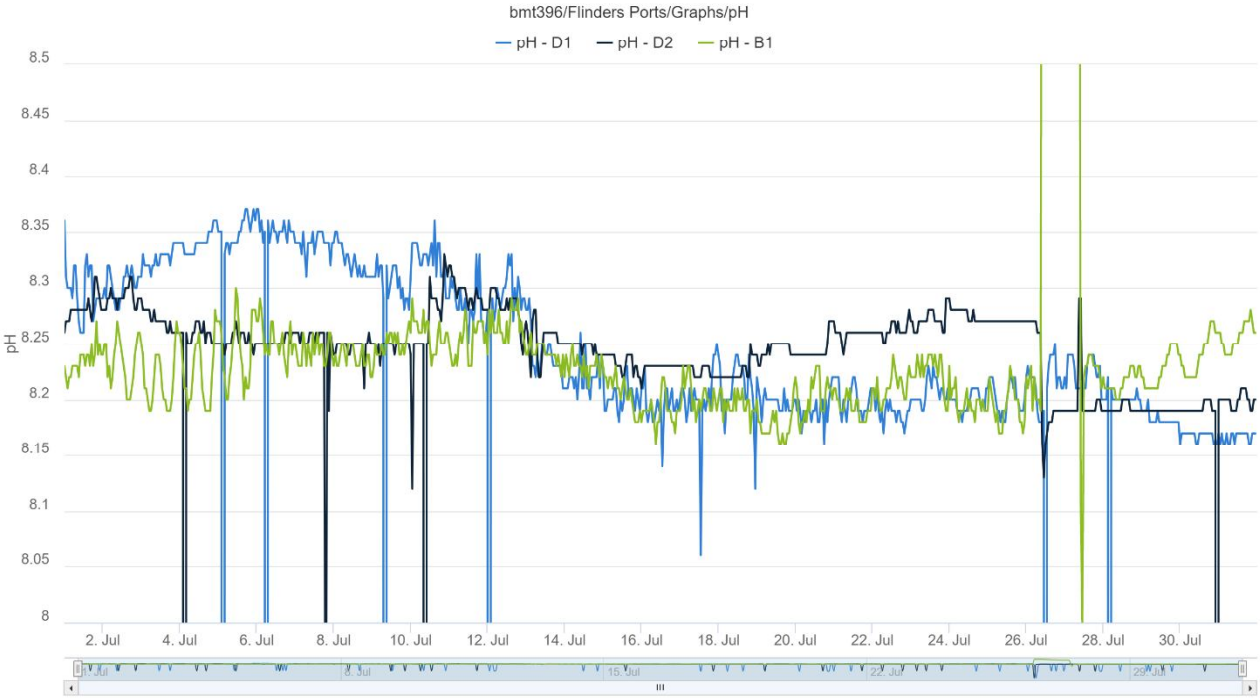


Figure 4-5 pH at B1, D1 and D2 – July 2019

4.4 Electrical Conductivity

Electrical Conductivity (EC) ranged between 56,000 and 57,500µS/cm, as shown in Figure 4-6.

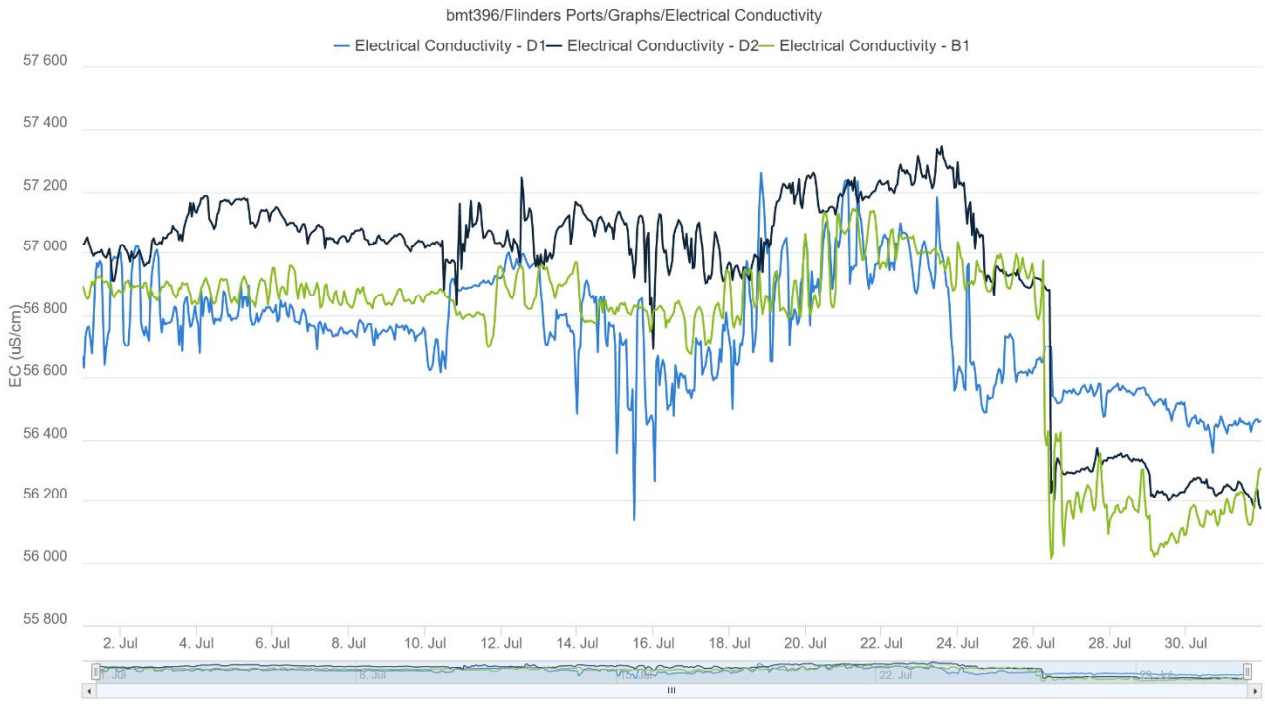


Figure 4-6 Electrical Conductivity (µs/cm) for B1, D1 and D2 – July 2019

4.5 Water Temperature

Water temperature has been steady, ranging from between 11.5C at the beginning of June, to 13.5ºC at the end of the month, as shown in Figure 4-7.

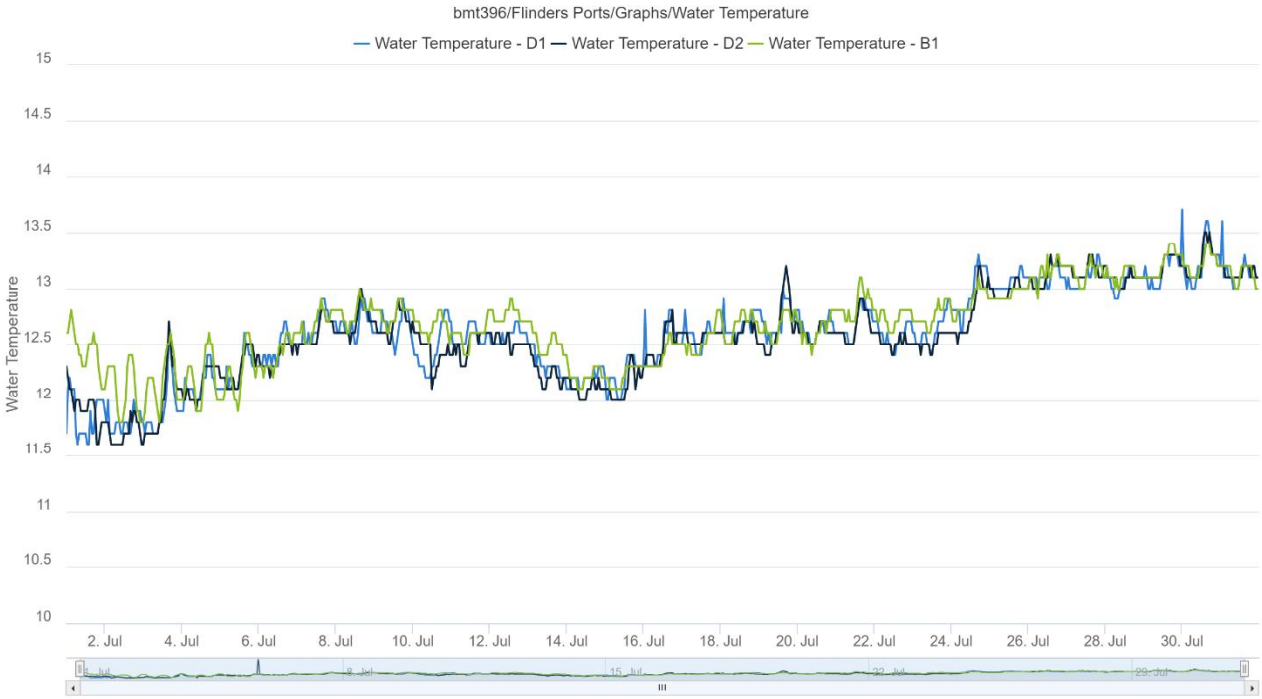


Figure 4-7 Temperature (ºC) for B1, D1 and D2 – July 2019

4.6 PAR

As one of the primary drivers of seagrass condition and resilience to disturbance, understanding the light available, and any loss of light for a prolonged period of time is important. Photosynthetically Available Radiation (PAR) is a way of measuring light available to seagrass. PAR is naturally lower in winter months when daylight hours are reduced. For seagrass loss to occur, light must be limited for a significant period, although the exact duration after which seagrass loss occurs is not well studied in South Australia. South Australian seagrasses would be naturally adapted to low light levels during the winter months.

Although a PAR target has not been set, BMT have been recording PAR data at the three monitoring stations. These have been processed as % of surface irradiance to enable a comparison of light availability. This data will be utilised when examining post-dredging seagrass survey results.

As expected, with turbidity being high this month, available light has been low, particularly from the 10th July at B1 and D2, but does appear to be picking up again towards the end of the month as turbidity reduces.

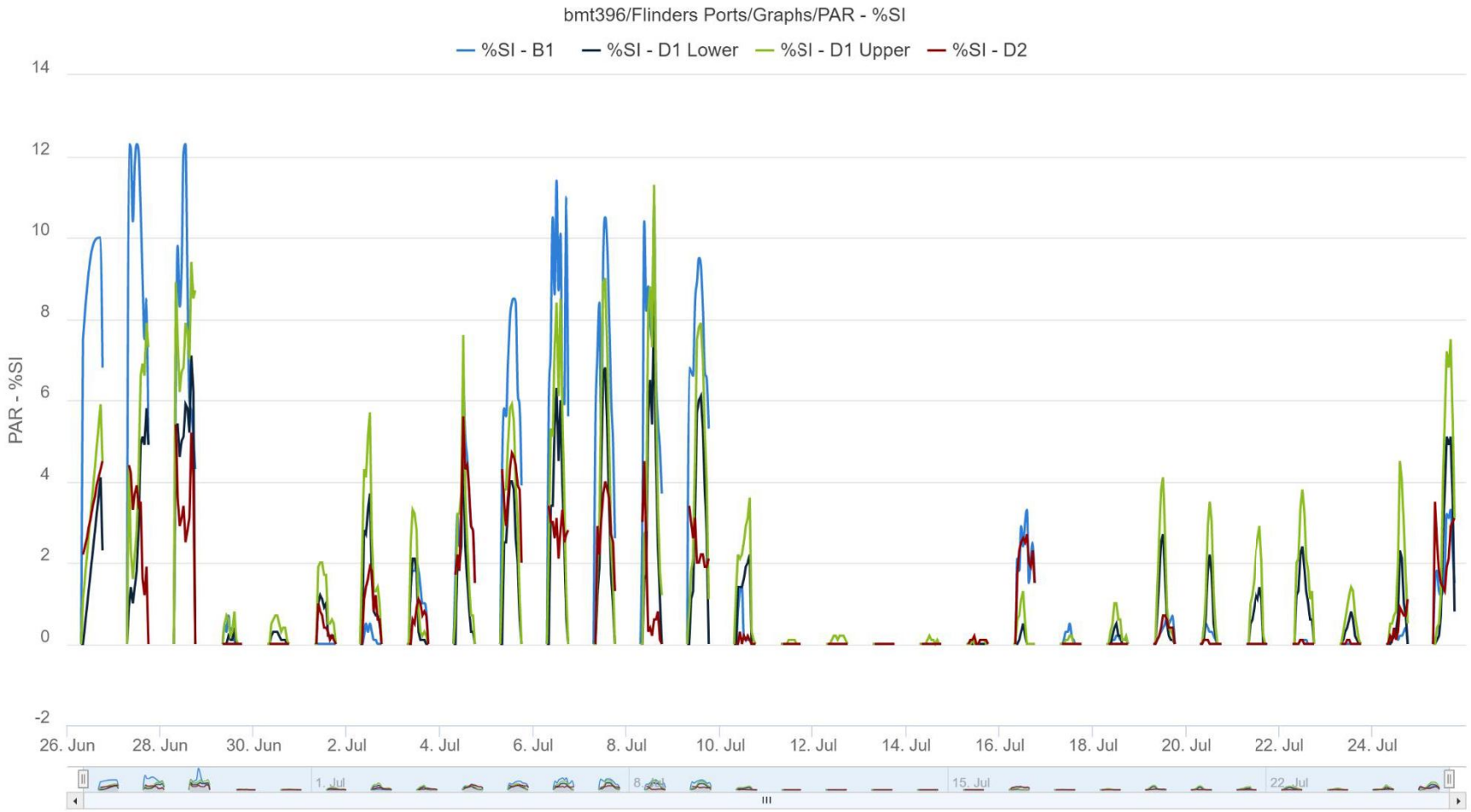
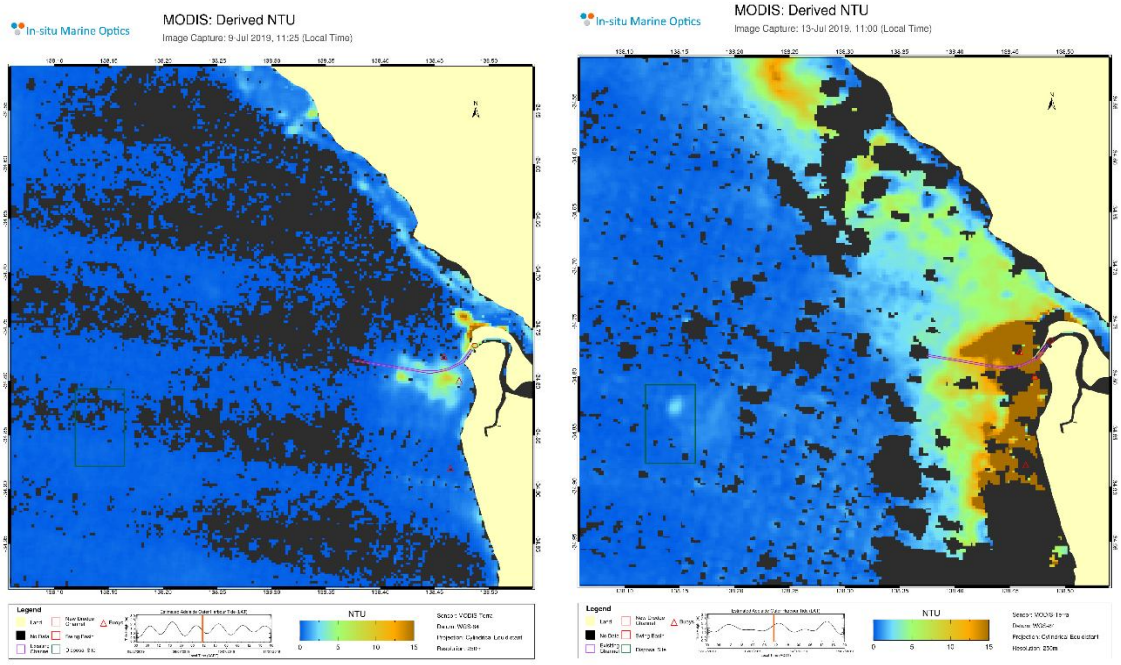


Figure 4-8 % surface light irradiance at B1, D1 and D2 – July 2019

5 Plume Zone Validation

A dredge plume model validation review was undertaken using the satellite imagery collected as part of the dredge plume monitoring program. The review has considered satellite images collected during July utilising those images that contained the clearest imagery – for much of the month, cloud cover was high, and the available satellite imagery is subsequently poor. As expected, plumes during the middle of the month were high along the inner coastline both north and south of the project area during high wind/storm conditions but confined to a smaller extent during the beginning and end of the month under better conditions.



Plume Zone Validation

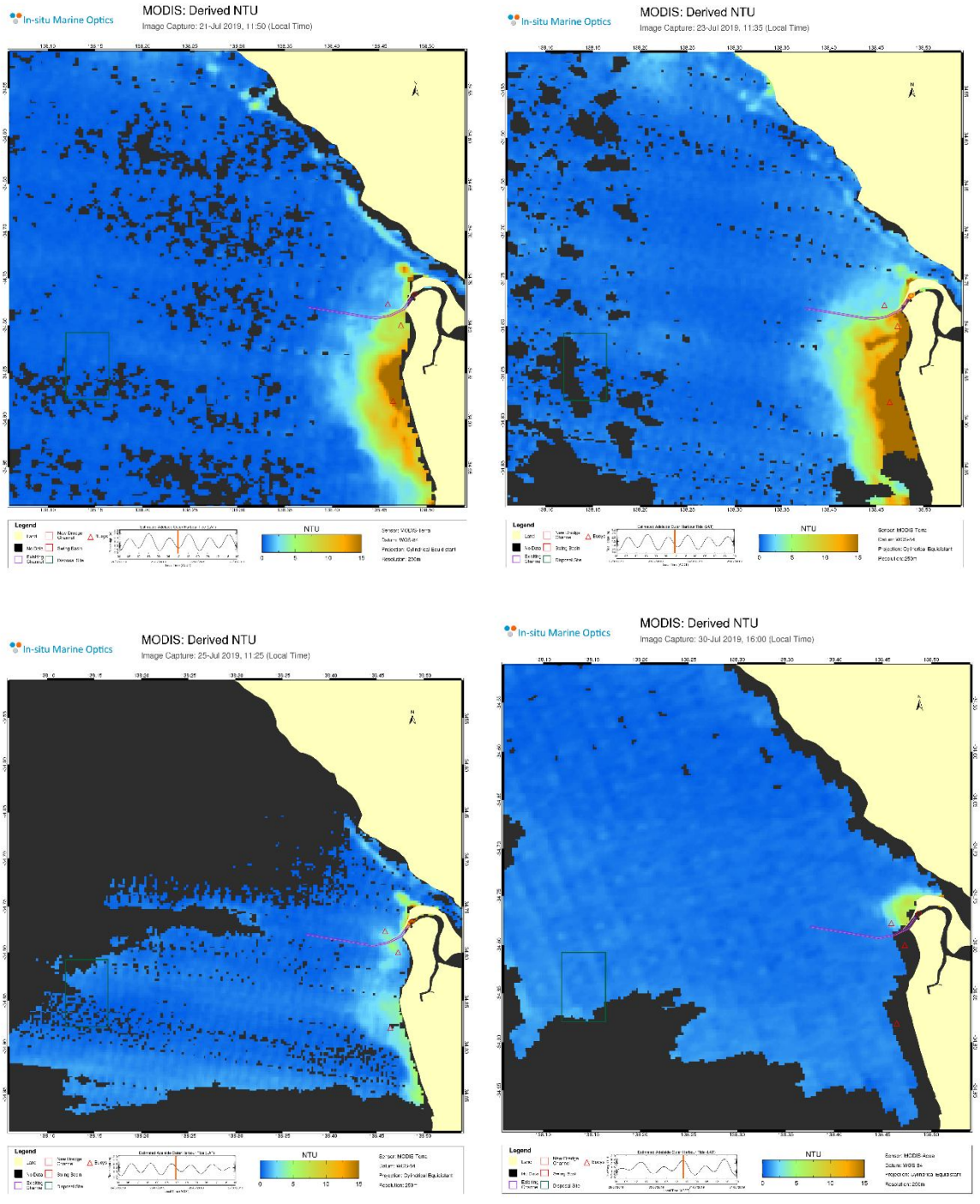


Figure 5-1 Satellite images during July

6 Conclusion and Summary

July saw adverse weather conditions through much of the month, particularly from the 10th July, which did result in some higher than expected turbidity plumes, causing the 15-day median HOLD criteria to be exceeded. There was also a significant reduction in PAR % surface light radiance during the middle period of July for a number of days. A combination of improved weather conditions and mitigation measures saw turbidity reduce significantly towards the end of the month.

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Flinders Ports
Outer Harbor Channel Widening Project

Monthly Stakeholder Engagement Update - EPA reporting

July 2019

Web page visits
928
(3,462 accumulative total)

Number of enquiries via website
0
(2 accumulative total)

Number of enquiries via hotline
20
(132 accumulative total)

Number of enquiries via email
3
(46 accumulative total)

Stakeholder meetings/briefings
1
(34 accumulative total)

Stakeholder database growth
3
(193 accumulative total)

EDM - Community Information Session (18 July 2019)

Number of people who received it
161

Open rate
47.2%

EDM - Turbidity levels reach HOLD (19 July 2019)

Number of people who received it
161

Open rate
51.6%

Milestone	Activities completed
Dredging progress engagement activities	Community information session held 25 July. Dredging update newsletter available at the session and on the microsite. Various other material available at the session. Promoted via an EDM, Flinders Ports Facebook and third party social media pages
	EDM sent to database regarding turbidity levels reaching HOLD
	Upcoming activities
Further dredging progress updates	Noticeboard poster with project update at various community locations
	EDM on dredging progress
	Continue to respond to enquiries

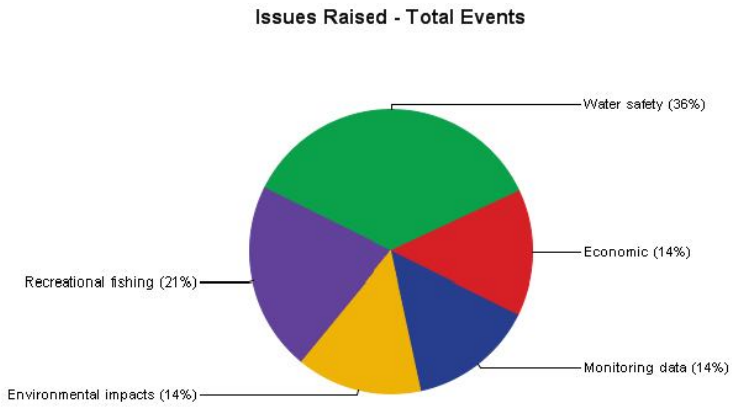
Complaints and engagement register summary

Outer Harbor Channel Widening Project

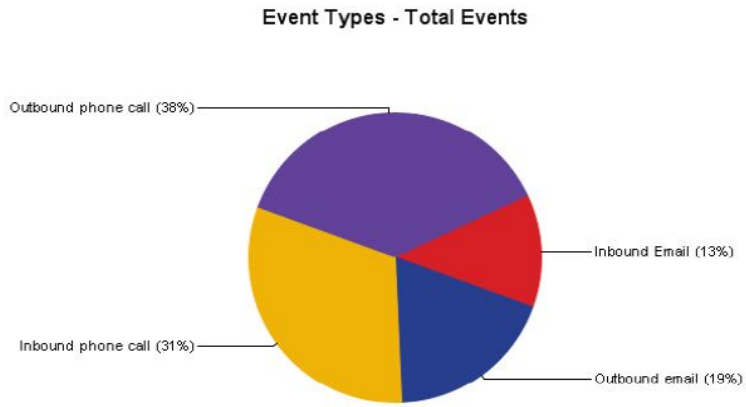
Engagement actions summary: July 2019

*When the word 'Events' is used in the graphs this is referring to 'engagement actions'

Issues	No. of interactions	Stakeholders	
		Individual	Total
Water safety	5	2	5
Recreational fishing	3	1	3
Environmental impacts	2	1	2
Monitoring data	2	1	2
Economic	2	1	2
[No Issues]	5	4	5
Total Event search	**16**	**7**	**16**



Action types	No. of interactions	Stakeholders	
		Individual	Total
Outbound phone call	6	3	6
Inbound phone call	5	5	5
Outbound email	3	3	3
Inbound Email	2	2	2
Total Event search	**16**	**7**	**16**



Complaints and engagement register summary

Outer Harbor Channel Widening Project

Stakeholder Groups	No. of interactions	Stakeholders	
		Individual	Total
Individual / Resident	10	3	10
Recreational Fishing	3	1	3
Local business	2	1	2
Environmental Group	1	1	1
Local Government	1	1	1
Elected members - local government	1	1	1
[No Stakeholder Groups]	1	1	2
Total Event search	**16**	**7**	**16**