

# KBMS Casuarina Boat Harbour Phase 1 DSDMP Water Quality Monitoring



24 September 2024

Monitoring Summary Report 3

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### Acronyms and Abbreviations

Abbreviation	Definition
BCH	Benthic Communities and Habitats
CBH	Casuarina Boat Harbour
CEMP	Construction Environmental Management Plan
CoC	Chain of Custody
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DDC	Dolphin Discovery Centre
DSDMP	Dredge Spoil Disposal Management Plan
EP Act	Environmental Protection Act 1986
GIS	Geographical Information System
KBMS	Koombana Bay Marine Structures
KBSC	Koombana Bay Sailing Club
LAT	Lowest Astronomical Tide
Nephelometer	Instrument for measuring turbidity
NTU	Nephelometric Turbidity Units
PAR	Photosynthetically Active Radiation
PSU	Practical salinity unit approximates g/l
QA/QC	Quality Assurance and Quality Control
SDP	Sea Dumping Permit
SI	Surface Irradiance
TSHD	Trailer Suction Hopper Dredge
TSS	Total Suspended Solids – sediment weight/volume in a subsample of water collected
WAL/IS JV	WA Limestone / Italia Stone Joint Venture
ZoI	Zone of Impact
ZoMI	Zone of Medium Impact
ZoHI	Zone of High Impact

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## EXECUTIVE SUMMARY

The Koombana Bay Marine Structures (KBMS) is a Strategic Proposal (Ministerial Statement 1226) approved under Part IV of the *Environmental Protection Act 1986* (EP Act) for the construction and operation of small craft marine infrastructure in Koombana Bay, located in Bunbury, Western Australia.

The Casuarina Boat Harbour (CBH) proposal was approved as a Derived Proposal under the Strategic Proposal. The CBH Proposal includes a dredging and dredge spoil disposal component. Construction is proposed to be completed in two phases.

Capital dredging for Phase 1 of the CBH Proposal is being implemented in accordance with an approved Dredge Spoil Disposal Management Plan (DSDMP). The DSDMP includes a water quality monitoring program at near-disposal, far-disposal and reference locations in the vicinity of the dredge spoil disposal site. Triggers for total suspended sediment (TSS) concentrations have been established in the DSDMP to monitor the accuracy of the disposal plume modelling predictions.

The trailer suction hopper dredge (TSHD), *Modi R*, suspended operations on 10 September 2024 for and estimated two to three weeks. Dredge operations for the CBH Proposal have continued via an excavator barge.

A survey was undertaken following the requirements of the DSDMP during a 180 m<sup>3</sup> spoil disposal event on 20 September 2024.

NTU data was transformed into estimated TSS values using the relationship:

$$\text{TSS} = 1.62 * \text{NTU}$$

The data collected showed no exceedance of either the Trigger 1 (TSS at a near disposal monitoring site >2 mg/L above the average of the reference site data) or Trigger 2 (TSS at a far disposal monitoring site >2 mg/L above the average of the reference site data) criterion at any site.

Other parameters (temperature, conductivity and dissolved oxygen) showed the water column was well mixed.

No impact to seagrass quality is predicted as a result of the present sampling data, as such, none of the management actions presented in the DSDMP require implementation.

# 1 INTRODUCTION

## 1.1 Project Background

The Koombana Bay Marine Structures (KBMS) is a Strategic Proposal (Ministerial Statement 1226) approved under Part IV of the *Environmental Protection Act 1986* (EP Act) for the construction and operation of small craft marine infrastructure in Koombana Bay, located in Bunbury, Western Australia.

The future proposals identified under the Strategic Proposal include the construction and operation of:

- Casuarina Boat Harbour (CBH);
- Koombana Bay Sailing Club (KBSC) marina; and
- Dolphin Discovery Centre (DDC) finger jetty.

The CBH Proposal was approved as a Derived Proposal under the Strategic Proposal. The CBH Proposal includes a dredging and dredge spoil disposal component, a piling component, land reclamation and construction of breakwater and revetment walls. The marine infrastructure includes the construction and operation of a wharf, jetties, boat ramps and boat pens. Construction is proposed to be completed in two phases. The CBH Phase 1 dredge and construction program includes the northern breakwater, associated reclamation area and internal jetties and boat pens.

Capital dredging for Phase 1 of the CBH Proposal will be implemented in accordance with an approved Dredge Spoil Disposal Management Plan (DSDMP) and associated Sea Dumping Permit (SDP) (SD2022/4034) issued under the Commonwealth *Environment Protection (Sea Dumping) Act 1981*, administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). Up to 177,000 m<sup>3</sup> of capital dredging material is proposed to be disposed offshore at the approved spoil ground during Phase 1.

The approved DSDMP outlines the management and monitoring actions required to minimise the environmental impact of dredge spoil disposal activities associated with construction of the proposals identified under the KBMS Strategic Proposal (Cardno 2023). This report covers the component of the DSDMP's water quality monitoring program at near-disposal, far-disposal and reference locations in the vicinity of the dredge spoil disposal site.

## 1.2 DSDMP Water Quality Monitoring Program

### 1.2.1 Intent

- Demonstrate measured total suspended solids (TSS) concentrations (inferred from turbidity [NTU] data using a TSS~NTU relationship) remain within the expected range predicted by sediment plume dispersion modelling (model validation);
- Measure NTU and additional physical water quality parameters within disposal plumes for comparison against background condition (reference sites);
- Inform ongoing spoil disposal activities and any requirement to manage these; and
- Assess potential impacts to benthic community habitats (BCH e.g. seagrass shading) should measurements be outside of the modelled range (trigger exceedance).

### 1.2.2 Frequency

Monitoring is to be conducted fortnightly for the duration of dredge spoil disposal activities, including a monitoring campaign prior to the start of dredging and two weeks post- disposal activities.

During dredge spoil disposal activities, data will be collected immediately after an individual disposal action and then at three equally spaced periods as the turbid plume disperses, until just prior to the next disposal action (4 sampling repeats in total).

### 1.2.3 Monitoring locations

Profiling of the water column will occur at 12 monitoring sites (Figure 1-1):

- Eight sites within the modelled dredge plume extent;
  - Four near-disposal sites (DIS01, DIS02, DIS03 and DIS04).
  - Four far-disposal sites (DIS05, DIS06, DIS07 and DIS08).
- Four sites beyond the modelled dredge plume extent (background, REF01, REF02, REF03 and REF04).

### 1.2.4 Analysis

Parameters to be measured are those of Section 7.1.2 of the DSDMP. These include:

- Turbidity (NTU);
- Photosynthetically active radiation (PAR);
- Conductivity;
- Temperature;
- Dissolved Oxygen; and
- Depth

In addition, 48 water samples will be collected at a range of locations and water depths alongside a turbidity sensor **during the first monitoring campaign only** and analysed for TSS concentration. The results from this data will be used to establish a NTU~TSS relationship to infer TSS from future NTU profiling.

### 1.2.5 Test Narrative

Thresholds for elevated TSS concentrations were developed within the Strategic Proposal for the purpose of mapping spatial zones of influence and impact for the project's dredging and disposal action, with respect to BCH. The thresholds/zones were defined as follows:

- Zone of Influence (ZoI): Elevated TSS at least once (i.e. instantaneous duration threshold).
- Zone of Medium Impact (ZoMI): Elevated TSS continually for 18 days.
- Zone of High Impact (ZoHI): Elevated TSS continually for 90 days.

The modelling suggested that ZoMI or ZoHI would not be formed during the disposal actions. Triggers were established to monitor the accuracy of the modelling predictions. Investigations will be triggered should monitoring infer that a ZoMI may exist, in areas where seagrass has been mapped. Triggers and their responses are outlined in Table 1-1.



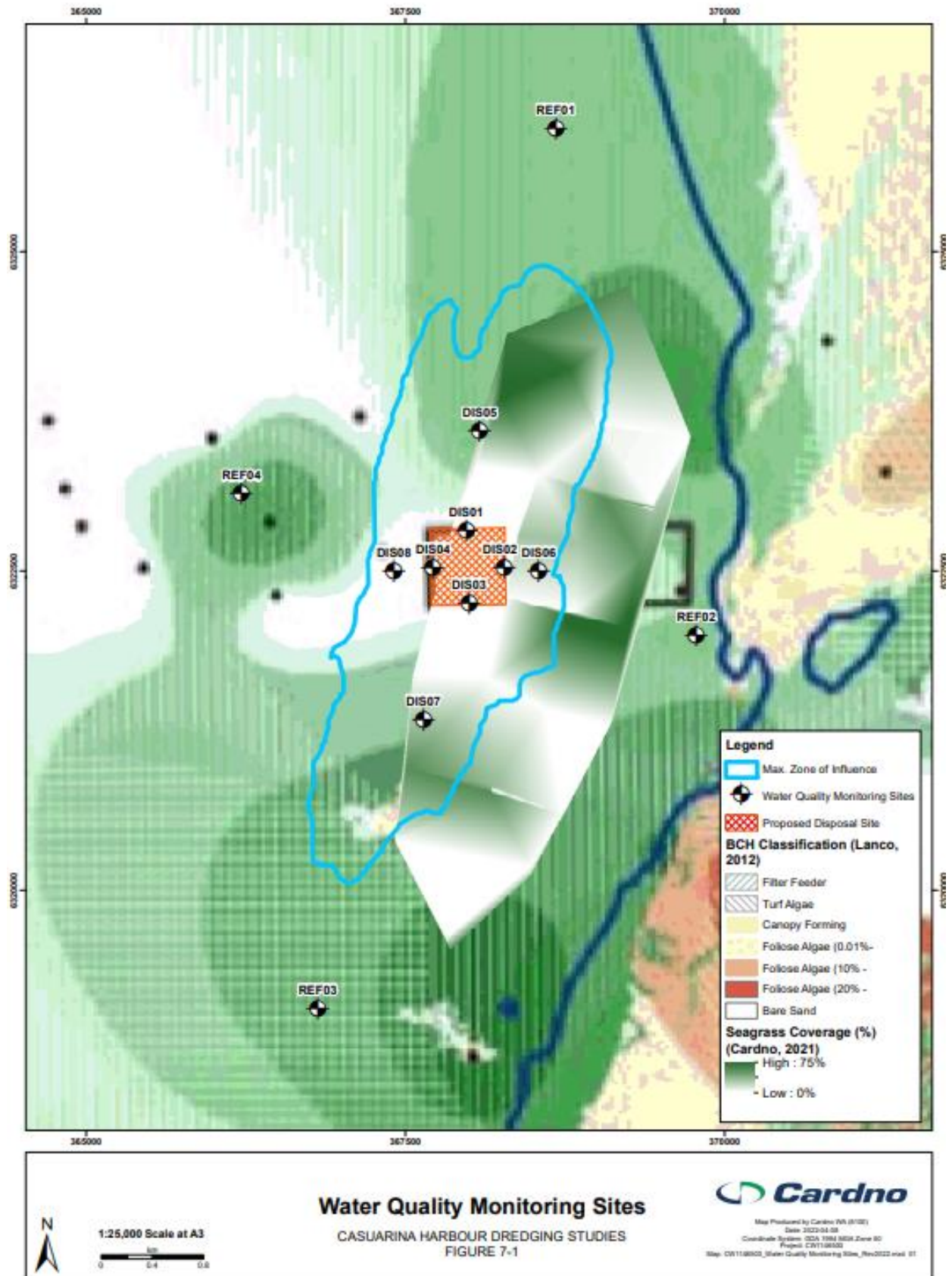


Figure 1-1. DSDMP water quality monitoring locations

Table 1-1. DSDMP triggers, tests and responses

Trigger Level	Test/Threshold	Response
Trigger 1	Depth- and time-averaged (across individual monitoring campaign) TSS concentration (inferred from NTU data) at any of the near disposal monitoring sites (DIS01 to DIS04) is greater than 2 mg/L above average background levels (average of sites REF01-REF04) for a measurement campaign.	Investigate if Trigger 2 has been exceeded for any sites
Trigger 2	Depth- and time-averaged (across individual monitoring campaign) TSS concentration (inferred from NTU data) at any of the far disposal monitoring sites (DIS05 to DIS08) is greater than 2 mg/L above average background levels (average of sites REF01-REF04) for a measurement campaign.	<ul style="list-style-type: none"> <li>• Assess metocean condition data available from BoM and DoT to determine if the exceedance at the site(s) in question is likely to exist for a continuous period of greater than 18 days (e.g. continuous prevailing winds in one direction);</li> <li>• Investigate how the disposal rate during the monitoring campaign compares with historical and planned disposal rates (typical, higher than average, lower than average);</li> <li>• Further investigate light attenuation (PAR profile data) associated with site(s) of elevated TSS to determine if stress may be placed on seagrass, with respect to the light attenuation stress thresholds presented in RPS (2023) for <i>Posidonia</i> and <i>Amphibolis</i> species and PAR at reference sites. This should include temporal assessment of shading across the monitoring campaign, as the plume dissipates (i.e. is the average exceedance prolonged, or due to a short, very high elevation);</li> <li>• Provide a statement as to whether, based on the above, seagrass quality in the vicinity of the disposal site is likely to suffer permanent reduction in quality as a result of the ongoing and proposed disposal schedule. If impact to seagrass quality is predicted, the following actions should be undertaken: <ul style="list-style-type: none"> <li>○ Dispose in different portion of disposal site;</li> <li>○ Dispose in certain portions of the site for certain metocean conditions (i.e. 'upstream side'); and</li> <li>○ Consider additional monitoring campaign to confirm effectiveness of varied placement; and</li> <li>○ Consider reduction in disposal rate during daylight hours.</li> </ul> </li> </ul>

### 1.3 Previous Survey

A summary of the previous disposal monitoring campaign is provided in Table 1-2.

Table 1-2. Previous monitoring campaign summary

Campaign #	Date	Summary
2	02 September 2024	<ul style="list-style-type: none"> <li>No exceedance of TSS triggers.</li> </ul>

### 1.4 Document Purpose

This report provides:

- A summary of the third disposal action monitoring campaign data.

In accordance with DSDMP instructions, summary data includes:

- Summary of disposal rates associated with the monitoring campaign;
- Plots and statistical summary of vertical profiling data for all parameters and profiles;
- Identification of any trigger exceedances;
- Assessment of trigger exceedance with respect to potential impacts to seagrass; and
- Recommendation for management should impacts be predicted.

#### 1.4.1 Structure of this Document

The document lists:

- The background to the Project;
- A summary of the DSDMP;
- The monitoring methodology;
- Summary data for the third disposal monitoring campaign; and
- Identification of trigger exceedances, assessment of impacts and management recommendations.

The document is current as at the date on the cover page and is referenced as Version 1 (Documents with a lower version number are superseded by this document).

## 2 METHODOLOGY

### 2.1 Monitoring Design

The monitoring design implemented was consistent with the prescriptions in Section 7 of the DSDMP (Cardno 2023).

#### 2.1.1 Monitoring locations

During the monitoring campaigns, data was collected from locations as close as possible to the proposed monitoring site coordinates listed in the DSDMP (Cardno 2023), as shown in Figure 1-1.

### 2.2 Field Procedures

#### 2.2.1 Physical Water Quality

Water quality records (NTU, PAR, conductivity, temperature, dissolved oxygen and depth) were obtained with a calibrated YSI ProDSS multiparameter sonde and Licor-192 Underwater Quantum PAR sensor (see Appendix A for YSI calibration sheet).

The water quality monitoring campaign was carried out on 20 September 2024. All parameters were recorded at a surface (0.5 m), mid-water column (depth/2) and bottom (1-2 m off the seabed) depth profile at each monitoring site (Figure 1-1). Data collection occurred first at the near-disposal monitoring sites, then the far-disposal sites and finally the reference sites. Data was collected immediately after an individual disposal event at 0856, for four complete sampling rounds at all sites.

### 2.3 Data Analysis and QA/QC

Data analysis was completed as set out within Sections 7.1.3 and 8.1.3 of the DSDMP. Plots and statistical summary (including mean, median, minimum, maximum, 20<sup>th</sup> percentile, 80<sup>th</sup> percentile and standard deviation) of profiling data were calculated as recommended by the DSDMP and derived using either Microsoft Excel 365™ or Statistica 11 (StatSoft Inc 2011).

NTU data was transformed into estimated TSS values using the relationship:

$$\text{TSS} = 1.62 * \text{NTU}$$

QA/QC of physical water quality profile data included manual checks to remove any erroneous entries. For the current monitoring report, no data was removed.

### 3 DISPOSAL MONITORING CAMPAIGN DATA SUMMARY

#### 3.1 Dredge Disposal Summary

The trailer suction hopper dredge (TSHD), *Modi R*, suspended operations for the CBH Proposal on 10 September 2024. MScience was advised the TSHD would not be recommencing operations for an estimated two to three weeks. Dredge operations have continued at the Proposal site via an excavator barge operated by Polaris Marine Group (Polaris).

A summary of the Polaris dredge spoil disposal activities on 20 September 2024 has been provided in Table 3-1. The monitoring campaign commenced immediately after disposal of Load#1, at 0856hrs.

Table 3-1. Dredge disposal summary for 20 September 2024

Load# for Project	27	28	29	-
Load# for Day	1	2	3	-
Load start time	0:00	10:45	18:35	
Load stop time	07:45	14:50	21:20	-
Discharge start time	08:56	15:54	22:26	
Discharge stop time	09:12	16:10	22:37	-
Discharge Location	N 33° 13 .579s	33° 13 .705s	33° 13 .806s	-
	E 115° 35. 023e	115° 35. 14.5e	115° 35. 136e	-
Load Discharge Total (m <sup>3</sup> )	180	180	180	-
Daily Discharge Total (m <sup>3</sup> )	540			
Project Discharge Total (m <sup>3</sup> )	Not Provided			

#### 3.2 Metocean Conditions

Weather conditions on 20 September 2024 were overcast in the morning and became clear with some cloud around midday. Winds were southerly at 5 - 10 knots in the morning, increasing to 10 – 15 knots in the afternoon. Seas were 1 – 1.5 m. The tidal range for the day was 0.41 m, with low tides of 0.43 m in the early morning and 0.52 m in the late afternoon. There was a 2215hrs high tide of 0.84 m.

#### 3.3 Physical Water Quality

A statistical summary of the disposal campaign vertical profiling data for each monitoring site is provided in Appendix B. Plots of the vertical profiling data are shown in Appendix C where relevant.

##### 3.3.1 Total Suspended Sediments

The depth- and time-averaged estimates of TSS for each monitoring site, and the average of the reference site data, during the monitoring campaign are shown in Table 3-2.

No site reported TSS concentrations >2 mg/L above the average of the reference site data.

Table 3-2. Depth- and time-averaged estimates of TSS (mg/L) for all sites

Near Disposal Sites		Far Disposal Sites		Reference Sites		
Site	TSS (mg/L)	Site	TSS (mg/L)	Site	TSS (mg/L)	Average TSS (mg/L)
DIS-01	0.84	DIS-05	0.76	REF-01	0.68	0.68
DIS-02	0.87	DIS-06	1.02	REF-02	0.75	
DIS-03	0.79	DIS-07	0.70	REF-03	0.62	
DIS-04	0.79	DIS-08	0.71	REF-04	0.70	

**Green Cell** = TSS threshold concentration (average of REF site data) for the individual monitoring campaign.

**Orange Cells** indicate TSS at a near disposal site is > 2mg/L above the trigger threshold value (Trigger 1)

**Red Cells** indicate TSS at a far disposal site is > 2mg/L above the trigger threshold value (Tigger 2).

### 3.3.2 Turbidity

Mean turbidity was <0.7 NTU at all monitoring sites (Figure 3-1). Site DIS-06 reported the highest mean turbidity and site REF-03 reported the lowest mean turbidity. Most sites showed little variability in NTU through the water column (Appendix C), although turbidity was sometimes slightly higher in bottom samples (generally 0.5 NTU difference between surface and bottom readings).

### 3.3.3 PAR

While light was recorded as PAR, it is best represented as the percentage of surface irradiance (SI(%)) to reflect the strength of the ambient light at the time of measurement. Mean percent surface irradiance (Figure 3-2) was generally consistent across sites with most sites showing a depth-time averaged mean of between 10 to 15%. The highest percent surface irradiance (~15 %) was recorded the near disposal site DIS-03 and the reference sites REF-01, REF-02 and REF-03.

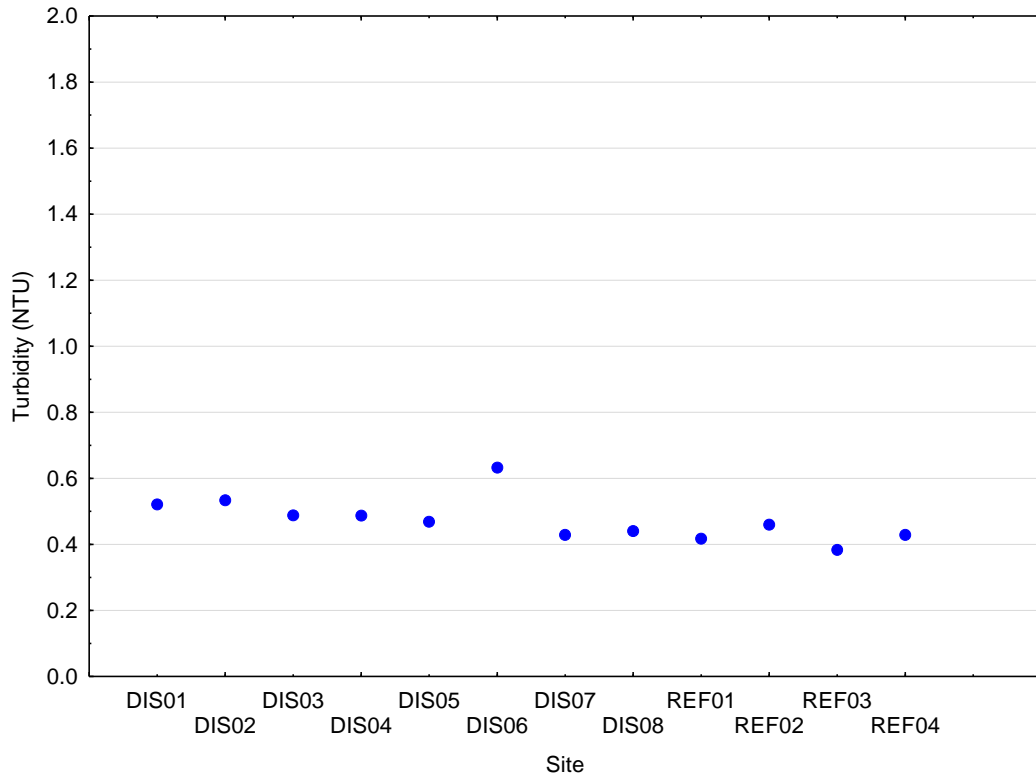


Figure 3-1. Turbidity means (time and depth averaged) at sites in the disposal monitoring campaign.

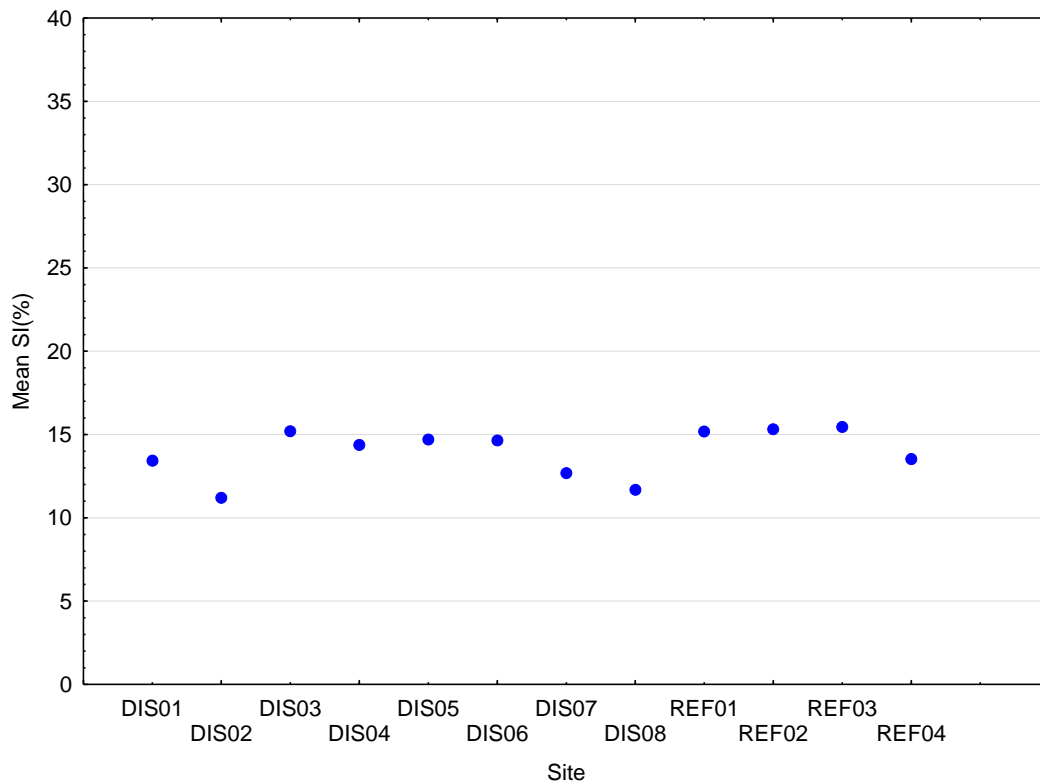


Figure 3-2. Mean percent surface irradiance at sites in the disposal monitoring campaign

### **3.3.4 Temperature, Conductivity, Dissolved Oxygen**

Temperature varied by less than 0.5°C across all sites (Appendix B). Most monitoring sites showed little (0.6°C difference) stratification through the water column (Appendix C). Variation between readings at the same profile was as large as that between profiles.

Conductivity showed little variation and little stratification at all sites.

Dissolved oxygen levels suggest waters are generally well oxygenated and quite uniform (including across depth profiles, Appendix C) with a 5% difference in dissolved oxygen levels between surface and bottom readings at all sites. Dissolved oxygen saturation was close to over 90% in all readings.



## 4 ASSESSMENT OF TRIGGER EXCEEDANCE AND RECOMMENDATIONS

### 4.1 Exceedance Investigation

Results presented in Section 3.3.1 (Table 3-2) indicate there was no exceedance of the DSDMP Trigger 1 (>2mg/L above reference) at the near disposal monitoring or Trigger 2 (>2mg/L above reference) at the far disposal monitoring sites. As such, no exceedance investigation was required.

### 4.2 Response Recommendation

Following the prescriptions of the DSDMP, if impact to seagrass quality is predicted, the following actions should be undertaken:

- Dispose in different portion of disposal site;
- Dispose in certain portions of the site for certain metocean conditions (i.e. 'upstream side');
- Consider additional monitoring campaign to confirm effectiveness of varied placement; and
- Consider reduction in disposal rate during daylight hours.

No impact to seagrass quality is predicted as a result of the present sampling data, as such, none of the above actions require implementation.

## 5 REFERENCES

Cardno (2023) Dredge Spoil Disposal Management Plan. Casuarina Harbour Dredging Studies. Report: CW1146500, Prepared for Department of Transport, West Perth, WA

RPS (2023) Benthic Communities and Habitat Study. Koombana Bay Marine Structures, Bunbury. Report: AU213001693.004, Prepared for South West Development Commission, Subiaco, Western Australia

StatSoft Inc (2011) STATISTICA (data analysis software system), Version 10.

## 6 APPENDIX A – YSI CALIBRATION SHEET

# ProDSS pH / CON / SAL / ORP / DO / Turbidity



Form EV-SR20-50

Customer: <u>M Science</u>	Customer Order No. <u>TBA</u>	Date: <u>10 SEP 24</u>
Meter: <u>YSI</u>	Equipment ID: <u>ProDSSPSE2</u>	Serial Number: <u>21K100422</u>

## METER

INITIAL INSPECTION / CONDITION: COMMENT	
Case	<u>OK</u>
Keypad	<u>OK</u>
LCD	<u>OK</u>
Connector	<u>OK</u>
Battery(s)	<u>OK</u>
Cable	<u>OK - 21E103882</u>

## pH ELECTRODE

Condition of Electrode	S/N: <u>21F103484 - OK</u>		
Asymmetry Potential	<u>-22.0</u> mV		
Response in pH4 / <del>pH10</del>	<u>149.0</u> mV	Acceptable ( $\pm$ )177.5mV $\pm$ 20mV $\pm$ Asy. Pot.	Pass <input checked="" type="checkbox"/> Fail <input type="checkbox"/>
Slope	<u>57.8</u> mV/pH		Pass <input checked="" type="checkbox"/> Fail <input type="checkbox"/>
Response Time	<u>8</u> secs	Excellent - < 15 secs <input checked="" type="checkbox"/> Acceptable 30 - 45 secs <input type="checkbox"/> Poor >60 secs <input type="checkbox"/>	
Calibration	1 Pt <input type="checkbox"/> 2 Pt <input checked="" type="checkbox"/> 3 Pt <input type="checkbox"/> 5 Pt <input type="checkbox"/>	Buffer 1.65 <input type="checkbox"/> 4.01 <input checked="" type="checkbox"/> 6.86 <input type="checkbox"/> 7.00 <input checked="" type="checkbox"/> 9.18 <input type="checkbox"/> 10.01 <input type="checkbox"/> 12.43 <input type="checkbox"/>	
Batch # pH7 <u>427975</u> <u>11/25</u>			
Batch # pH4 <u>429847</u> <u>12/25</u>			
<del>Batch # pH10</del>			
Confirmation	pH4.01 = <u>4.01</u> pH6.86 =	pH7.00 = <u>7.00</u> pH 9.18 =	pH10.01 =
Meter and Electrode is Calibrated and Conforms to Manufacturer's Specifications			YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

## CONDUCTIVITY / SALINITY ELECTRODE

Condition of Electrode	S/N: <u>21F101915 - OK</u>			
Temperature	Is Correct Temperature Displayed and Responds Accordingly YES <input type="checkbox"/> NO <input type="checkbox"/> If NO, Probe Requires Replacement. If YES, continue with Calibration			
Calibration	Single Pt <input checked="" type="checkbox"/> Multiple Pt <input type="checkbox"/>	Cond. ( $\mu$ S/cm) 84 <input type="checkbox"/> 1,413 <input type="checkbox"/> 2,764 <input type="checkbox"/> 12,880 <input checked="" type="checkbox"/> 54,400 <input type="checkbox"/> 111,900 <input type="checkbox"/> Salinity (ppt) 2.0 <input type="checkbox"/> 35.0 <input type="checkbox"/> 36.0 <input type="checkbox"/> Other <input type="checkbox"/> Salinity (mS/cm) 54.4 <input type="checkbox"/> 56.0 <input type="checkbox"/> 58.0 <input type="checkbox"/> Other <input type="checkbox"/>		
Linearity Checked	1,413	12,880 <u>12882</u>	54,400 111,900 180,000 $\mu$ S/cm	
Does Electrode Calibrate Correctly according to above parameter specification?	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
New Cell K (if Displayed)	<u>5.35</u>			
Meter and Electrode is Calibrated and Conforms to Manufacturer's Specifications			YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	

Service Technician: HOWARD Signed: H Jones Date: 10 SEP 24

# ProDSS pH / CON / SAL / ORP / DO / Turbidity



Form EV-SR20-50

## ORP ELECTRODE

Condition of Electrode	S/N: 21F103484 - OK		
		RESULT	
<b>Response Check.</b> Use one or more of the Test Solutions to Confirm Response. Cost dependant Item Batch # Zobell A 24/1807 Batch # Zobell B 24/1807	Quinhydrone +86mV (New H <sub>2</sub> Reference +296mV)	<input type="checkbox"/>	Pass <input type="checkbox"/> Fail <input type="checkbox"/>
	Quinhydrone +263mV (New H <sub>2</sub> Reference +473mV)	<input type="checkbox"/>	Pass <input type="checkbox"/> Fail <input type="checkbox"/>
	Zobell's +229mV	<input checked="" type="checkbox"/> 229mV	Pass <input checked="" type="checkbox"/> Fail <input type="checkbox"/>
	Light's +475mV	<input type="checkbox"/>	Pass <input type="checkbox"/> Fail <input type="checkbox"/>
Response Time 8 secs	Excellent - < 15 secs <input checked="" type="checkbox"/> Acceptable 30 - 45 secs <input type="checkbox"/> Poor >60 secs <input type="checkbox"/>		
Meter and Electrode is Calibrated and Conforms to Manufacturer's Specifications			YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

## DO ELECTRODE

Condition of Electrode	S/N: 21G101444 - OK		
Calibration Batch # Sodium Sulfite N/A	Zero <input checked="" type="checkbox"/> 100% <input checked="" type="checkbox"/> Salinity Correction: 0.00 Value: 100.0% Slope Value (if Displayed): 1.06		
Does Electrode Calibrate Correctly according to above parameter specification? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
Meter and Electrode is Calibrated and Conforms to Manufacturer's Specifications			YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

## TURBIDITY SENSOR

Condition of Electrode	S/N: 21F101802 - OK		
Pre-calibration checks	Readings of any Specific Standards prior to recalibration 0.0 FNU Reads 0.08 FNU 124.0 FNU Reads 123.4 FNU		
Calibration. Check with customer for operational range Batch # 124NTU 24B24009015 02/25	Zero <input checked="" type="checkbox"/> Mandatory to check. Turbidity Value(s) of Calibration: 0.00 FNU 124.00 FNU _____ FNU _____		
	Read Value(s) AFTER Calibration: 0.00 FNU 124.00 FNU _____ FNU _____		
	Specify Turbidity Value of Validation: _____ FNU Reads _____ FNU Specify Turbidity Value of Validation: _____ FNU Reads _____ FNU		
Does Sensor Calibrate Correctly according to above parameter specification? YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>			
Meter and Sensor is Calibrated and Conforms to Manufacturer's Specifications			YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>

Service Technician: HOWARD Signed: Hones Date: 10 SEP 24

# ProDSS pH / CON / SAL / ORP / DO / Turbidity



Form EV-SR20-50

Accessories	Shipped	Returned
Case	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Handheld meter	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Cable (70 m)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Sensors	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Manual (on USB drive)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
USB 2.0 cable (2m) black	<input checked="" type="checkbox"/>	<input type="checkbox"/>
USB 2.0 OTG cable (15cm) <del>white</del> <b>BLACK</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Report sheet (client copy)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Terms and Conditions	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Quick Guide	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Charger and Battery Pack	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Service Technician: Howard Signed: H Jones Date: 10 Sep 24

## 7 APPENDIX B – DETAILED WATER QUALITY STATISTICS BY SITE

Site		Turbidity (NTU)	PAR ( $\mu\text{Mol}/\text{m}^2/\text{s}$ )	Conductivity ( $\mu\text{S}$ )	Temperature ( $^{\circ}\text{C}$ )	Dissolved Oxygen (%)
DIS-01	N	12	12	12	12	12
	Mean	0.5	179.1	79537	16.5	96.4
	Median	0.5	70.6	45506	16.4	96.7
	Minimum	0.2	10.3	45287	16.3	91.3
	Maximum	1.0	635.0	454111	16.7	99.8
	20th %ile	0.3	18.0	45317	16.4	94.9
	80th %ile	0.7	371.0	45717	16.5	98.2
	Std. Dev	0.2	221.6	117960.4	0.1	2.2
DIS-02	N	12	12	12	12	12
	Mean	0.5	164.7	45764	16.5	95.9
	Median	0.4	65.0	45508	16.4	96.6
	Minimum	0.2	8.9	45313	16.3	92.0
	Maximum	1.5	620.0	48719	16.7	98.7
	20th %ile	0.3	15.9	45331	16.4	93.1
	80th %ile	0.9	305.0	45712	16.5	97.8
	Std. Dev	0.3944	201.3887	945.7563	0.1087	2.3558
DIS-03	N	12	12	12	12	12
	Mean	0.5	178.1	45509	16.5	96.4
	Median	0.4	67.9	45542	16.5	96.9
	Minimum	0.2	8.9	45311	16.4	92.9
	Maximum	0.9	690.0	45750	16.7	99.2
	20th %ile	0.3	14.3	45320	16.4	94.7
	80th %ile	0.8	330.4	45720	16.6	98.5
	Std. Dev	0.2599	232.7749	181.9842	0.1030	2.1066
DIS-04	N	12	12	12	12	12
	Mean	0.5	203.5	45487	16.5	96.4
	Median	0.5	67.1	45430	16.4	96.9

Site		Turbidity (NTU)	PAR ( $\mu\text{Mol}/\text{m}^2/\text{s}$ )	Conductivity ( $\mu\text{S}$ )	Temperature ( $^{\circ}\text{C}$ )	Dissolved Oxygen (%)
	Minimum	0.3	13.1	45287	16.3	92.5
	Maximum	0.9	705.0	45739	16.7	98.6
	20th %ile	0.3	16.1	45312	16.4	95.1
	80th %ile	0.6	345.0	45720	16.6	97.6
	Std. Dev	0.1991	260.0036	184.4256	0.1240	1.7738
DIS-05	N	12	12	12	12	12
	Mean	0.5	214.0	45497	16.4	96.2
	Median	0.4	89.1	45556	16.4	96.7
	Minimum	0.3	10.1	45277	16.3	92.8
	Maximum	0.8	750.0	45710	16.6	98.3
	20th %ile	0.3	19.0	45301	16.3	94.3
	80th %ile	0.8	490.0	45666	16.5	97.9
	Std. Dev	0.2169	256.9491	176.6699	0.1030	1.8947
DIS-06	N	12	12	12	12	12
	Mean	0.6	240.5	45491	16.4	96.0
	Median	0.5	67.8	45357	16.4	96.8
	Minimum	0.3	7.1	45320	16.1	92.6
	Maximum	1.5	762.0	45733	16.7	99.1
	20th %ile	0.4	19.0	45330	16.4	93.6
	80th %ile	0.8	556.0	45709	16.5	97.6
	Std. Dev	0.3487	289.8143	191.8325	0.1557	2.1950
DIS-07	N	12	12	12	12	12
	Mean	0.4	206.7	45527	16.5	96.8
	Median	0.4	82.5	45522	16.5	97.1
	Minimum	0.2	14.2	45288	16.3	93.4
	Maximum	0.8	700.0	45795	16.7	99.7
	20th %ile	0.3	24.0	45307	16.4	94.5
	80th %ile	0.7	439.0	45765	16.5	98.6
	Std. Dev	0.1944	251.7814	210.6153	0.1055	2.0893



Site		Turbidity (NTU)	PAR ( $\mu\text{Mol}/\text{m}^2/\text{s}$ )	Conductivity ( $\mu\text{S}$ )	Temperature ( $^{\circ}\text{C}$ )	Dissolved Oxygen (%)
DIS-08	N	12	12	12	12	12
	Mean	0.4	151.0	45495	16.5	96.8
	Median	0.4	89.3	45441	16.5	97.1
	Minimum	0.2	14.0	45288	16.3	94.7
	Maximum	0.8	460.0	45747	16.7	98.7
	20th %ile	0.3	15.6	45327	16.4	95.7
	80th %ile	0.8	315.0	45728	16.6	97.7
	Std. Dev	0.2250	154.3137	181.8313	0.1115	1.2819
REF-01	N	12	12	12	12	12
	Mean	0.4	217.7	45528	16.5	97.1
	Median	0.4	92.1	45510	16.4	98.0
	Minimum	0.2	11.8	45329	16.3	93.2
	Maximum	0.7	750.0	45783	16.7	100.3
	20th %ile	0.3	25.6	45360	16.4	95.0
	80th %ile	0.5	476.0	45779	16.6	98.6
	Std. Dev	0.1436	258.1093	180.2601	0.1155	2.1989
REF-02	N	12	12	12	12	12
	Mean	0.5	213.9	45565	16.5	96.5
	Median	0.4	67.0	45635	16.5	97.1
	Minimum	0.1	10.4	45374	16.4	91.7
	Maximum	0.9	701.0	45736	16.8	100.2
	20th %ile	0.2	12.3	45383	16.4	94.6
	80th %ile	0.7	564.0	45716	16.7	98.3
	Std. Dev	0.2613	266.0528	162.2627	0.1443	2.5722
REF-03	N	12	12	12	12	12
	Mean	0.4	219.0	45596	16.5	96.5
	Median	0.4	90.3	45587	16.5	96.6
	Minimum	0.2	13.7	45310	16.2	92.6
	Maximum	0.6	830.0	45895	16.7	99.9

Site		Turbidity (NTU)	PAR ( $\mu\text{Mol}/\text{m}^2/\text{s}$ )	Conductivity ( $\mu\text{S}$ )	Temperature ( $^{\circ}\text{C}$ )	Dissolved Oxygen (%)
	20th %ile	0.3	22.0	45357	16.4	93.6
	80th %ile	0.5	525.0	45859	16.5	98.3
	Std. Dev	0.1387	278.9499	228.6805	0.1314	2.4149
REF-04	N	12	12	12	12	12
	Mean	0.4	199.1	45542	16.5	96.9
	Median	0.3	80.0	45558	16.5	97.0
	Minimum	0.2	12.0	45326	16.4	93.9
	Maximum	0.9	910.0	45747	16.7	99.9
	20th %ile	0.3	16.9	45377	16.4	95.6
	80th %ile	0.8	342.0	45739	16.6	98.4
	Std. Dev	0.2566	270.6516	168.7717	0.1165	1.8390

## 8 APPENDIX C – VERTICAL PROFILES

