



**TRANSNET SOC LTD**

**DCT BERTHS 203 TO 205 - RECONSTRUCTION, DEEPENING AND  
LENGTHENING**

**PORT OF DURBAN**

**SPECIFICATION – MONITORING OF TURBIDITY DURING DREDGING AND  
RECLAMATION**

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## SPECIFICATION - MONITORING OF TURBIDITY DURING DREDGING AND RECLAMATION

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## CONTENTS

<b>1.0</b>	<b>SCOPE.....</b>	<b>1</b>
1.1	Project.....	1
1.2	Scope.....	1
	1.2.1 Dredging.....	1
	1.2.2 Reclamation.....	1
1.3	Monitoring.....	1
	1.3.1 Baseline Monitoring.....	1
	1.3.2 Surveillance Monitoring.....	1
<b>2.0</b>	<b>NORMATIVE REFERENCES.....</b>	<b>3</b>
2.1	Reference Documents.....	3
2.2	Standard Specifications.....	3
2.3	<i>Employer's</i> Project Specific Specifications and Standards.....	3
<b>3.0</b>	<b>DEFINITIONS.....</b>	<b>4</b>
3.1	Chart Datum Port.....	4
3.2	Co-ordinate System.....	4
3.3	Tidal levels.....	4
3.4	Method Statements.....	4
3.5	Approved Disposal Site.....	4
3.6	Approved Offshore Borrow Site.....	4
3.7	Berth Dredging.....	4
3.8	Dredging.....	4
3.9	Reclamation.....	4
<b>4.0</b>	<b>REQUIREMENTS.....</b>	<b>5</b>
4.1	Method statements.....	5
4.2	Equipment.....	5
4.3	Calibration.....	5
4.4	Duration.....	5
4.5	Locations.....	6
4.6	Data Recording, presentation and reporting.....	6
<b>5.0</b>	<b>COMPLIANCE WITH REQUIREMENTS.....</b>	<b>7</b>
5.1	Trigger Limits.....	7
5.2	Monitoring requirements at dredge and reclamation sites.....	7
5.3	Monitoring requirements at offshore disposal site.....	7
5.4	Monitoring of Dissolved Oxygen and Chlorophyll.....	7

## 1.0 SCOPE

### 1.1 Project

This specification is a project specific technical specification for the DCT Berths 203 to 205 Reconstruction, Deepening and Lengthening Project in the Port of Durban.

### 1.2 Scope

The scope of this specification covers the *Employer's* requirements for measures to be adopted by the *Contractor* for monitoring of turbidity during dredging, backfill and reclamation. Sampling and testing of dredged material for reclamation and extension of the sandbank is covered under specification 1785-CO-000-C-SPC-0004 covering the dredging portion of the *works*.

A Total Suspended Solids (TSS) standard has been developed for the *Contractor* at the Port of Durban to ensure that the environmental impact of dredging and reclamation is limited. The *Contractor* is responsible for ensuring that the TSS standard is adhered to. This specification is associated with turbidity monitoring for the following *works*:

#### 1.2.1 Dredging

- a) The deepening and extension of the basin including the turning circle.
- b) Berth dredging for the new Berths 203 to 205 to provide caisson founding trench and scour protection trench.
- c) Dredging of launching dock to allow for launching and towing of caissons.

#### 1.2.2 Reclamation

- a) Reclamation of areas between new caisson wall and existing quay wall.
- b) Extension and reclamation of south bank of sandbank.
- c) Filling the caissons with dredged material.

## 1.3 Monitoring

### 1.3.1 Baseline Monitoring

Collection of data prior to dredging *works* has been undertaken by Others and will be made available to the *Contractor*.

The Baseline water quality measurements have been collected from a set of 20 stations distributed in the navigation channels surrounding the main intertidal and shallow subtidal sand bank areas in the Port of Durban and include turbidity taken at high and low tide over a five day period each season (autumn, winter, spring, summer), giving a total of 1600 profiles over 24 months.

Turbidity data has been collected using a Seabird SBEv19 (units = NTU) at all stations with profiles through the water column, as well as a single water sample from 2 m below the surface at each station which allows for conversion of the NTU data to TSS (mg/l).

Figure 1-1 indicates the location of the Water Quality Monitoring Stations.

### 1.3.2 Surveillance Monitoring

Surveillance monitoring, to be undertaken by the *Contractor*, is required to compare environmental measurements during dredging and against a threshold value to ensure increased levels of turbidity associated with the dredging *works* are not detrimental to the environment.

Independent turbidity surveillance monitoring may also be undertaken by the Environmental Control Officer for the Project.



Figure 1-1: Location of Water Quality Monitoring Stations



## 2.0 NORMATIVE REFERENCES

### 2.1 Reference Documents

The *works* shall be carried out as specified in the following documents:

- a) This Specification.
- b) Industry Codes, Standards and Specifications as listed in Section 2.2.
- c) *Employer's* Project Specific Technical Specifications as listed in Section 2.3.
- d) Project Drawings:
  - 1785-CO-020 Series of drawings – Dredging and reclamation.
- e) Method statement prepared by the *Contractor*, as described in Section 4.1.
- f) Project Geotechnical Reports, included in Part 4 - Site Information.
- g) Central Dredging Association (CEDA) - Information Paper - Environmental Monitoring Procedures – Rotterdam - April 2015.

### 2.2 Standard Specifications

The *Contractor* shall provide and maintain current copies of all the standard specifications referred to herein below on the site for reference by both parties.

The monitoring of turbidity during dredging, backfill and reclamation *works* shall comply with the following standard specifications:

- a) International Standard ISO 7027:2010-1:2016 –Water quality—Determination of turbidity.
- b) BS 6349-5:1991 – Maritime Structures – Code of practice for dredging and land reclamation.
- c) PIANC Report No 100 – 2009 – Dredging Management Practices for the Environment.

### 2.3 *Employer's* Project Specific Specifications and Standards

The monitoring of turbidity during dredging, backfill and reclamation *works* shall also comply with the following Project Specific Specifications and Standards:

- a) 1785-CO-000-C-SPC-0004 – Dredging and Reclamation (Including Vibro Compaction).
- b) 1785-CO-000-C-SPC-0016 – Sandbank Extension.
- c) Project Environmental Specifications (PES) as contained in the Works Information and annexures.

### 3.0 DEFINITIONS

All definitions of responsibilities shall be in accordance with the NEC Engineering and Construction Contract (ECC) for the construction of the *works*.

Where the standard specifications referenced in this specification refer the “Engineer”, replace this term with the term “Supervisor”.

For the purpose of this specification, the following definitions shall apply:

#### 3.1 Chart Datum Port

Chart Datum Port refers to the reference level used in the Port of Durban, which is 0,900 m below Mean Sea Level. All levels referred to in this document are relative to Chart Datum Port (CDP).

#### 3.2 Co-ordinate System

The co-ordinate system to be used for all setting out and survey shall be World Geodetic System 1984 (WGS84), LO31, referred to as WG31.

#### 3.3 Tidal levels

The Astronomical Tide Predictions as defined by the SA Navy Hydrographer and Chart SAN 2006 are as follows:

**Table 3.1 – Tide data**

Tide	Abbreviation	Level m, Chart Datum Port
Highest Astronomical Tide	HAT	2.287
Mean High Water Springs	MHWS	1.997
Mean Level	ML	1.097
Mean Low Water Springs	MLWS	0.197
Lowest Astronomical Tide	LAT	-0.013

#### 3.4 Method Statements

Method statements shall be compiled by the *Contractor* for all activities. The method statements shall be submitted to the *Supervisor* for acceptance three weeks in advance of the particular activity being undertaken. Full details of all proposed Equipment (including temporary works) and methods shall be provided for acceptance by the *Supervisor*.

No activity shall commence until the method statement has been accepted by the *Supervisor*.

Further details of the requirements of particular method statements are provided in Section 4.

#### 3.5 Approved Disposal Site

The Approved Disposal Site refers to a site located offshore, the locality of which is shown on drawing 1785-CO-020-C-DWG-010-01.

#### 3.6 Approved Offshore Borrow Site

The Approved Off-shore Borrow Site refers to a site located offshore, the locality of which is shown on drawing 1785-CO-020-C-DWG-010-01.

#### 3.7 Berth Dredging

Dredging of material below -16.5 m CDP for the caisson foundation trench, scour trench and the slope that extends from the caisson foundation trench to the existing wall. Material within this area above -16.5m CDP is classified as Basin Dredging.

#### 3.8 Dredging

Excavation of all types of material within the marine environment below the Highest Astronomical Tide (HAT) level, in accordance with the SA Navy Hydrographic Office (SANHO) and as defined in Section 3.3, regardless of the type of Equipment or methods employed.

#### 3.9 Reclamation

The process of creating new land or extending the sandbank from dredged/imported material.

## 4.0 REQUIREMENTS

### 4.1 Method statements

Prior to procuring and installation of the monitoring Equipment, the *Contractor* shall prepare method statements that shall include, *inter alia*:

- a) Details of all monitoring and measuring equipment including dedicated computer and software.
- b) Details of installation, calibration and maintenance procedures for the monitoring systems
- c) Details of anchoring of the stations in the specified positions
- d) Templates of the weekly, monthly and annual reports which are to be submitted to the *Supervisor*.

### 4.2 Equipment

Buoy based turbidity monitoring stations are to be provided, installed and maintained by the *Contractor* with measurement data provided in real time.

Measuring total suspended solids (TSS) directly is the best method for evaluating sediment concentrations. However, it is not feasible for real-time applications such as monitoring sediment re-suspension during dredging operations, since TSS can only be accurately measured by collecting water samples and conducting laboratory tests, which require filtering the sediment from the water, drying and weighing it. This procedure is too time-consuming for monitoring dredge sites, considering the quick feedback required to allow timely control measures.

To achieve the required real-time monitoring, a more practical measure of water clarity, i.e. turbidity, shall be substituted for TSS, using remote submersible sensors to monitor for sediment re-suspension. The *Contractor* shall propose particular models of sensor, using nephelometry or backscatter technology to measure the amount of light scattered by particles in the water. The selected turbidity sensors shall be compliant with ISO 7027 and have a wiper to prevent fouling. Turbidity shall be measured in Nephelometric Turbidity Units (NTU). Sensors should have a sensitivity of 0.01 NTU and an extended range to 1,100 NTU. The same type of sensor shall be used throughout the operations. As an example, a Seabird SBEv19 was used for turbidity data collection during the baseline monitoring phase. Each monitoring station shall house a sensor at 1m below free surface.

A dedicated computer with appropriate software shall be provided at the *Contractor's* site offices for real time monitoring display and data capturing.

### 4.3 Calibration

Calibration certificates shall be supplied with all equipment. After installation, a full installation and calibration report shall be provided by the *Contractor* to the *Supervisor*. Routine calibration shall also be carried out by the *Contractor*, on 3 monthly intervals and calibration reports supplied to the *Supervisor*. If the real time data shows that any part of the equipment is malfunctioning, the *Contractor* shall arrange to investigate, replace and recalibrate the malfunctioning equipment at its own cost.

Calibration shall be undertaken by measuring TSS directly from a single water sample taken from 2m below the surface at each station and comparing this to the real time NTU data recordings. This will allow for calibration and conversion of the NTU data to TSS (mg/l).

NTU readings are also to be compared against the baseline data provided to ensure they fall within the turbidity range recorded during baseline monitoring.

The baseline data provided in the Site Information at Stations WQ3, WQ4 and WQ5 in Figure 1-1 shall be collated by the *Contractor* and compared against its own equipment at least over a period of 14 days before any dredging or reclamation work starts.

### 4.4 Duration

Surveillance monitoring and data collection shall commence at a minimum 14 days before any dredging or reclamation work starts and shall continue fulltime until 14 days after completion of all dredging and reclamation activities.



#### 4.5 Locations

It is recognized that the threshold limits set in 5.0 cannot be met in the immediate vicinity of where the actual dredging activity is taking place at that time. For this reason a mixing zone shall apply. The extent of this mixing zone is defined as the basin adjacent to Berths 203 to 205 plus the turning circle; and accordingly monitoring will be outside of this defined mixing zone.

It is therefore recommended that surveillance monitoring is undertaken within the Maydon Wharf Channel, in the form of three floating sensors, buoyed and anchored outside traffic lanes but in close proximity to Baseline Stations WQ 3, 4 and 5. Furthermore, sensors are to be provided at stations WQ2 and WQ7 (control stations – see section 5.1) to measure the natural background port turbidity.

Floating sensors may need to be moved during specific operations, but should be relocated as close to fixed positions as possible to ensure consistency of results.

#### 4.6 Data Recording, presentation and reporting

Data shall be recorded in real time and either downloaded by telemetry or GSM data link with a Type Approval Certificate issued by the Independent Communication Authority of South Africa (ICASA). Results shall be monitored, preferably by an automatic alarm system that will identify when limits are exceeded.

Data shall be collated and presented to the *Supervisor* as follows:

- a) Weekly throughout the duration of dredging, backfill or reclamation specified above, plus
- b) At any time when particular threats of pollution, not due to the contract *works*, may be suspected or identified.

Records shall include:

- a) Date and Time.
- b) GPS location.
- c) Turbidity.
- d) Weather and sea conditions.

Data shall be presented in Excel and graphical or similar format with monthly and above data presented on CD.

Early warnings shall be provided to the *Supervisor* of any water conditions which approach trigger or threshold limits.



## 5.0 COMPLIANCE WITH REQUIREMENTS

### 5.1 Trigger Limits

A Total Suspended Solids (TSS) threshold has been developed for the dredging works at the Port of Durban to ensure that the environmental impact of dredging is limited. The *Contractor* is responsible for ensuring that the TSS threshold is adhered to. The *Contractor* shall reference and comply with the additional guidelines and requirements for the control of turbidity as detailed in specification 1785-CO-000-C-SPC-0004.

The TSS threshold limit is set as the greater of:

- a) The 80<sup>th</sup> percentile of the baseline monitoring data, which for stations WQ3, WQ4 and WQ5 corresponds to a TSS of 43 mg/l.
- b) Ten percent (10%) greater than the natural background port turbidity. For the purposes of this project, the natural background port turbidity is deemed to be the greater of the real-time readings at control stations WQ2 and WQ7.

If the TSS approaches the threshold limit set above at any of the surveillance monitoring stations (WQ3, WQ4 or WQ5), mitigation measures are to be put in place to prevent any further increase in suspended solid concentration (e.g. reduce rate of dredging, relocate dredger). If median turbidity levels (geometric mean of measured values in any one and a half hour period) exceed the threshold, dredging is to be suspended until measured levels drop below the threshold.

### 5.2 Monitoring requirements at dredge and reclamation sites

All monitoring of the TSS is not required within the mixing zone (see 4.5 above). Daily observation of plume extent with distances is required to ensure the plume extent remains within the mixing zone.

### 5.3 Monitoring requirements at offshore disposal site

Daily observation of plume extent with an estimation of plume distance and dispersion direction is required during offshore disposal. This is to be recorded on a sketch with the date and time of discharge and is to be submitted to the *Supervisor*. This monitoring requirement is for information only and there are no limitations placed on the *Contractor* in this regard.

### 5.4 Monitoring of Dissolved Oxygen and Chlorophyll

Monitoring of dissolved oxygen and chlorophyll during dredging works shall be conducted in accordance with the Project Environmental Specifications (PES) as contained in the Works Information and annexures.