



TRANSNET SOC LTD

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

PORT OF DURBAN

SPECIFICATION – DREDGING EARLY WORKS

1785-CO-000-C-SPC-0011 Rev T-00

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1.0 SCOPE

1.1 Project

This specification is a project specific technical specification for the Early Dredging component of 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 dredging and reclamation, which includes the following:

1.2.1 Dredging

The deepening and extension of the basin including the entrance channel as indicated on drawing 1785-CO-190-C-DWG-0002-01.

1.2.2 Surveying and testing

All necessary surveying and testing for the dredging works.

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-190 series of drawings – Dredging early works
- e) Method statement prepared by the *Contractor*, as described in Section 4.1
- f) Project Geotechnical Reports, included in Part 4 - Site Information

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 completion of early works dredging and reclamation shall comply with the following standard specifications:

- a) SANS 1200 D - Earthworks
- b) BS 6349 Part 5 - Maritime Structures – Code of practice for dredging and land reclamation
- c) PIANC Report No 100 – 2009 – Dredging Management Practices for the Environment
- d) PIANC Report No 144 – 2014 – Classification of Soils and Rocks for the Maritime Dredging Process
- e) BS EN 1997-2: 2007 - Geotechnical design – Ground investigation and testing
- f) BS EN ISO 22476-1:2012 - Geotechnical investigation and testing - Field testing - Electrical cone and piezocone penetration test.
- g) IHO Standards for Hydrographic Surveys, Special Publication No.44, 5th Edition, February 2008.

2.3 *Employer's* Project Specific Specifications and Standards

The completion of early works dredging and reclamation shall comply with the following Project Specific Specifications and Standards:

- a) Project Environmental Specifications (PES) as contained in the Works Information and annexures
- b) Environmental Authorisation
- c) Disposal Permit to the above
- d) CSMP

3.0 DEFINITIONS

All definitions of responsibilities shall be in accordance to Inter Divisional Agreement (IDA, between TNPA Dredging Services & Transnet Group Capital) & NEC Engineering and Construction Contract (ECC) for the execution of the works. NEC Engineering and Construction Contract (ECC) Option B will be used for contract management during execution of works and will form part of the IDA.

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-190-C-DWG-0003-01.

3.6 Dredging

Excavation of all types of material within the marine environment using the types of Equipment and methodology prescribed in sections 4.3 and 4.4 below.

4.0 REQUIREMENTS

4.1 Method Statements

The *Contractor* shall prepare method statements that shall include, *inter alia*:

4.1.1 Dredging and disposal

- a) Description of the Equipment (type of dredger, basic dimensions and specifications, booster pump stations, hopper barge capacity, power characteristics, production rates per material and per length of delivery pipe etc.).
- b) The planned cycle times, production rates, expressed in terms of the in-situ bulk volume (m³) of solids dredged per week and per hour, allowing for mechanical and weather downtime and also capacity variation with respect to length of discharge pipeline and booster stations (if required).
- c) The sea state conditions under which the Equipment may operate safely for survival conditions and operational conditions for dredging, dumping and reclamation.
- d) The *Contractor's* methodology for controlling sedimentation and turbidity within the vicinity of dredging and discharge activities.

4.2 Materials

4.2.1 Nature of material to be dredged – Basin dredging

Various geotechnical investigations of the basin have been undertaken and the results thereof are provided in the various reports included in annexure A of the Site Information. The *Contractor* will be deemed to have made its own assessment of the materials to be dredged from the information provided in the Site Information and from the *Contractor's* own visual inspection of the Site and available cores.

The *Contractor* is made aware that the dredging operations are in a working port and adjacent to operational quays. The presence of debris or foreign matter, e.g. wires, chains, tyres and scrap can be expected. The *Contractor* shall plan his Dredging Equipment and procedures accordingly to minimise delays associated with encountering obstacles. The *Contractor* shall in planning its dredging works take note that there is a risk of encountering unforeseen objects or obstructions below ground level or seabed level, and shall maintain the ability to divert his dredging work to other areas until such time as the *Contractor* is able to remove the obstruction. The *Contractor* is to notify the *Project Manager* or *Supervisor* immediately if obstructions in the dredge area are identified.

4.3 Equipment

4.3.1 General

The *Contractor* shall take full and entire responsibility for the sufficiency of his Equipment to Provide the Works. The *Contractor* shall submit details of all Equipment to be used to the *Supervisor* for acceptance at least 3 weeks prior to dredging and reclamation work commencing.

All marine Equipment used to provide and inspect the works shall be subject to the requirements of the South African Maritime Safety Association (SAMSA). Floating *Contractor's* Equipment shall be maintained in a satisfactory and seaworthy condition, shall have adequate attendance by competent seamen at all times, shall be fully provided with sound and satisfactory ropes, line and moorings and shall be fully equipped with lights. At all times the *Contractor* shall be wholly responsible for the protection and safety of all floating craft engaged by him. The *Contractor* shall be cognisant of the expected sea and wave conditions within the port as well as outside of the port en route to and from the sand winning and disposal sites. The *Contractor* shall ensure the adequacy of his Equipment to operate in such conditions such that the program for the works is not affected by weather and wave conditions that fall within the 1:10 year return period storm conditions for the Port of Durban area as well as the offshore sand winning and disposal areas.

The *Contractor* shall immediately and at his own cost re-float or raise and remove any *Contractor's* Equipment (floating or otherwise), vessel, craft or Materials or any other property in his care or belonging to him or to any Sub-Contractor, which may be stranded or sunk in the course of execution and completion of the works. Until such sunken object is

raised and removed the *Contractor* at his own cost shall set buoys and display such lights and do all such things for the safety of navigation as may be required by the authorities concerned or by the *Supervisor*.

Should the *Contractor* fail to meet the foregoing obligations the *Employer* may buoy and light each sunken object and re-float or raise and remove the same (without prejudice to the right of the *Employer* to hold the *Contractor* liable) and the *Employer* shall be entitled to recover from the *Contractor* the cost thereof or may deduct the same from any monies due or that become due to the *Contractor*.

The provisions of this Section shall apply to all *Contractor's* Equipment, vessel, craft, Materials and property therein referred including such *Contractor's* Equipment, vessel, craft, materials and property which may be declared a total loss or may be covered by insurance.

Where work is carried out from pontoons or other un-powered floating equipment, a suitably powered craft shall be in attendance at all times.

The *Contractor's* floating equipment shall be in contact with TNPA, Port Control via radio on a VHF channel to be prescribed by the Harbour Master. An additional channel shall be made available for emergencies.

4.3.2 Basin Dredging Equipment

The specification is non-descriptive in terms of the type of dredging Equipment to be employed and the *Contractor* is responsible for selecting the type of Equipment and method of dredging to be employed to Provide the *works* in accordance with the technical and environmental specifications. The *Contractor* shall interpret the various geotechnical reports contained in Annexure 1 of the Site Information and shall select the dredging Equipment accordingly, in particular to meet the specified tolerances for the various aspects of the dredging *works*. The dredging and excavation Equipment used for the *works* shall be suitable for the work required, taking into consideration the volumes of material to be dredged, the type of material to be dredged, the programme to Provide the *works*, the climatic and sea conditions, the disposal of dredged material and the dredge and excavation tolerances specified.

Trailer Suction Hopper Dredgers are NOT permitted any dredging within 20 m of an existing structure.

The *Contractor* shall provide and maintain on board all dredging Equipment a position fixing systems giving the position of plant to an accuracy of ± 0.5 m in the horizontal plane, together with competent operators to ensure that the position of dredging plant can be accurately located.

All hoppers for transporting of material shall have load indicator equipment on board in order to ensure that the hopper doors are not leaking and that no part of the load is deposited anywhere other than in the designated disposal site. The hoppers shall, in addition, be fitted with track plotting equipment.

4.3.3 Discharge Equipment

4.3.3.1 Offshore disposal

Disposal of the material at the offshore disposal site shall be via bottom-dumping and the hoppers shall be suitably equipped to facilitate bottom dumping.

4.3.4 Survey Equipment

The *Contractor* shall provide Equipment required for the in-surveys, out-surveys and surveys of the offshore disposal and borrow sites as specified. This survey equipment is to be provided by the *Contractor* when the surveys are required, and is not required full time on site.

The minimum Equipment to be made available for surveys is the following:

- a) A seaworthy boat with a cabin suitable to accommodate and operate survey Equipment consisting of a sonar survey system capable of doing a continuous underwater survey of the seabed in the basin and the seabed at the offshore disposal site. The *Contractor* shall supply the necessary survey vessel suitable for the hydrographic and multibeam swath surveys, taking into account the different water depths, winds, waves, currents and other significant site conditions that may be experienced on site. All lighting, safety features and equipment required for the safe operation and mooring of vessels must be supplied by the *Contractor* and must be approved by the relevant Maritime Safety Authority. The *Contractor*

shall provide qualified personnel to operate the boat as well as the survey equipment and shall keep the equipment in working and seaworthy order at all times.

- b) A differential GPS system capable of a horizontal positioning accuracy of better than 250 mm at the 95% confidence level must be used for all positioning. The DGPS receiver(s) aboard the vessel must be configured such that satellites below 8 degrees above the horizon are not used in position computations. The age of pseudo-range correctors used in position computation must not exceed 20 seconds. Horizontal Dilution of Precision (HDOP) must be monitored and recorded, and should not exceed 4 nominally. Satellite geometry alone is not a sufficient statistic for determining horizontal positioning accuracy. Other variables, including satellite pseudo-range residuals, are to be used in conjunction with HDOP to estimate DGPS horizontal accuracy. A minimum of four satellites must be used to compute all positions. Horizontal and vertical offsets between the GPS antenna and transducer(s) shall be observed and applied with a precision better than 0.05 m.
- c) Navigational instruments and vessel motion sensors including:
 - Roll, heave and pitch sensors.
 - Heading: Gyro/Fluxgate compass.
 - Navigational computer for on-line navigational control during the survey.
 - Digital acquisition (data logging) of all the above sensor outputs.
- d) A high quality multibeam echosounder with a frequency of not less than 200 kHz is to be used for the surveys. The multibeam sonar must have an effective beam width of no greater than 1.5 degrees in both the along-track and cross-track directions and lateral coverage of at least 30 m for depths greater than 10 m. The system shall be capable of measuring to depths of up to 90 m.
- e) Logging and Processing Equipment including:
 - A data logger system having adequate electronic storage capabilities. The system shall store multiple inputs (Date, Time, X, Y, Z Position, vessel movements and heading and echo sounder data) on an electronic medium, which can be transferred to a personal computer. The data shall be stored at 1-second intervals or less.
 - Post processing, for motion correction of the ship movements and heading.
 - Conversion of all bathymetry data into absolute (x, y, z) files for Digital Terrain Models (DTM) for producing special reports with maps, contours, cross profiles, etc.

The *Contractor* shall be responsible for calibration of the survey Equipment required on the survey boat and provide the *Supervisor* with proof thereof. The *Contractor* shall also be responsible for arranging of tidal recordings concurrent with underwater surveys where the tide is required to determine surveyed underwater levels.

The *Contractor* shall provide all personnel to operate the launch as well as the survey Equipment and shall ensure that the equipment is in working and seaworthy order when required by the *Supervisor*.

The *Contractor* shall provide and maintain for the duration of the Contract durable temporary automatic, continuously recording tide gauges at two locations agreed by the *Supervisor*. The Equipment shall be fixed in readily visible positions where practicable, and shall be arranged so that the tide level is readable to an accuracy of ± 25 mm at any time. At least one gauge shall be installed within 500 m of any area within which soundings or dip surveys are to be taken.

4.4 Methods and Procedures

4.4.1 Dredging and dredge material disposal

4.4.1.1 Extent of work

The extent of work, dredge profiles and levels are as shown on the 1785-CO-190 series of drawings. The following dredging and disposal cycles shall be undertaken:

- a) Dredge from basin and dispose of at offshore disposal site.

4.4.1.2 Dredging methodology

All excavation and dredging *works* shall be carried out in accordance with the principles contained in BS 6349: Part 5: 1991, except as amended herein.

The *Contractor* shall dredge any material which, during the periods between the dates of commencement and completion of all excavation and dredging operations, accumulates above the specified dredged levels within the areas to be dredged as defined in the drawings.

Agitation dredging, being the attempted removal of material by the use of natural water currents or artificially induced water currents, shall not be permitted.

When dredging is undertaken adjacent to structures, due care shall be taken to avoid damage to these structures. Should any damage or alleged damage to a structure take place, the *Contractor* shall arrange, in conjunction with the *Supervisor*, for an inspection. In the case where the damage is underwater, the *Contractor* shall arrange for a diver's inspection. Any damage to structures caused by the *Contractor's* operations shall be repaired at the *Contractor's* expense. The repair schemes shall be agreed with the *Supervisor* and any affected third party.

The *Contractor* shall profile all slopes to the gradients and levels shown on the drawing in a controlled manner that prevents slope failure during dredging. Dredging/undercutting at the toe of the slope to intentionally cause slope failure and slothing of material is not permitted.

4.4.1.3 Sailing and navigation constraints

Vessels conveying material to and from the disposal and borrow sites will be required to navigate within the confines of the Port of Durban and its immediate approaches. All vessel movements are controlled by Port Control to ensure safe navigation. The *Contractor* shall allow for the fact that commercial shipping will take precedence over dredging vessel movements.

The fullest collaboration between the *Contractor*, Harbour Master and the *Supervisor* is essential with regard to the working of the port. All correspondence, applications and notices with the Port Authorities shall be directed through the *Supervisor*.

Dredging operations shall be planned and executed in conjunction with Port Control in order to limit the impact of dredging operations on port operations. The *Contractor* must take note that all works are subject to the provisions of the Harbour Regulations. It is the duty of the *Contractor* to obtain the regulations from the port authorities.

The *Contractor's* method for dredging and transporting materials shall be such as to avoid leakage, spillage, scouring on land or the deposition of dredged material in shipping channels, basins or berths. In the event of any such leakage or deposition occurring, the *Contractor* shall remove such leaked materials, repair scoured areas, or restore such channels, basins or berths to their original depths.

The *Contractor* is responsible for establishing limiting sea states for his vessels, obtaining forecasts of approaching weather and operating his vessels safely in terms of the criteria.

No vessel shall leave port if the forecast weather conditions are expected to approach any of these limits and the vessels shall return to port immediately if such conditions arise while out of port.

The *Contractor* shall take all precautions, and shall at all times maintain radio communication between all his vessels and Port Control. The *Contractor* shall comply at all times with the instructions of Port Control regarding shipping and navigation safety. Any disruption of port shipping due to encroachment of the *Contractor's* moorings into the designated shipping channel will not be permitted.

4.4.1.4 Offshore disposal

The approved offshore disposal sites are identified on drawing 1785-CO-190-C-DWG-0003-01. The dumping of any material outside the approved disposal site is not allowed. Disposal of the material at the offshore disposal site shall be via bottom-dumping. The *Contractor* shall ensure that material is not concentrated locally in the disposal site and shall ensure as even a spread as practicable with no dumping on top of an area that has had a load previously dumped on. The *Contractor* shall provide the *Supervisor* with a track plot of the dump location of each load as detailed in 4.4.1.5.

4.4.1.5 Dredging track plots

A Global Positioning Satellite (GPS) record is to be kept for all dredging and disposal activities. This record shall include the following data:

- a) Start time, end time and location of individual track plots for dredging (filling of hopper).
- b) Departure time from the dredge site (off shore borrow site or basin).
- c) Route followed by the vessel (GPS track) to disposal/discharge site.
- d) Time of arrival at the disposal/discharge site.
- e) Position of the vessel at the time of starting to discharge the dredge spoil.
- f) Heading and speed of the vessel at the time of starting to discharge the dredge spoil.
- g) Position of the vessel at the time of completion of discharge of the dredge spoil.
- h) Quantity of material discharged.
- i) Heading and speed of the vessel at the time of completion of discharge of the dredge spoil.
- j) Time of departure from disposal site.
- k) Route followed by the vessel on route back to the dredge site.

The daily long track plot shall be recorded electronically on a compact disk in ASCII format and shall be submitted to the *Supervisor* on a daily basis.

4.4.1.6 Dredging progress reporting

The *Contractor* shall keep daily written records as required by the *Supervisor*, and submit a signed copy to the *Supervisor* not more than 1 day after the date to which the record relates. The records shall give details of the dredging area, the material being dredged and any delays to the dredging operation.

The *Contractor* shall prepare a weekly report to cover the work executed each week from midnight on Sunday. The report shall be submitted to the *Supervisor* by Tuesday noon following the week covered by the report. The report shall include a return of the *Contractor's* Equipment and Personnel employed the previous week and of the works on which they were engaged. The *Contractor* shall submit to the *Supervisor*, on a weekly basis, a coloured chart showing the extent of dredging and profiling, together with the areas from which material has been dredged.

On the first weekday following the issue of the *Contractor's* monthly progress report to the *Supervisor*, the *Contractor* shall attend the *Supervisor's* office for a meeting to discuss the progress achieved during the previous month and the progress planned for the current month.

4.4.2 Dredging Surveys

4.4.2.1 Requirements of marine surveys

All co-ordinates used during this contract shall be to WG31.

All survey work shall be carried out and certified by a qualified hydrographic surveyor (IHO Cat A/B recognised hydrographic surveying course or equivalent). The *Contractor* shall give the *Supervisor* an unlimited access to the survey vessels at all times.

4.4.2.1.1 Tidal Data

Regardless of whether RTK GPS is used for position fixing, independent tidal measurements for purposes of water level corrections are required. The tide gauge must be calibrated using a local benchmark to determine the installation level to within 2 cm. Tidal records shall be corrected for onsite barometric pressure changes.

4.4.2.1.2 Multibeam Echosounder

The hydrographer shall ensure that the multibeam coverage shall have an overlap of at least 50% in order to check the surveyed data. Heave, roll, pitch, heading, and navigation timing error (latency) corrections shall be applied to multibeam soundings to correct the effect of vessel motion caused by waves and swells (heave, roll, pitch), the error in the vessel's heading, and the time delay from the moment the position is measured until the data is received by the data collection system (navigation timing error). Heave shall be observed in no coarser than 0.05 m increments. Roll and pitch shall be observed in no coarser than 0.05 degree increments. Heading shall be observed in no coarser than 0.1 degree increments. Navigation timing error shall be observed in no coarser than 0.01 second increments.

4.4.2.1.3 Multibeam Sonar Calibration

Prior to commencing the survey operation, the hydrographer shall conduct a system accuracy test to quantify the accuracy, precision, and alignment of the multibeam system. Testing shall include determination of residual biases in roll, pitch, heading, and navigation timing error. These values will be used to correct the initial alignment and to calibrate the multibeam system. System accuracy testing should be conducted in an area similar in bottom profile and composition to the survey area, and during relatively calm seas to limit excessive motions and ensure suitable bottom detection. The order in which these biases are determined may affect the accurate calibration of the multibeam system. The hydrographer should determine the biases in the following order: navigation timing error, roll, pitch, and heading (yaw).

4.4.2.1.4 Sound Velocity Profile

To ensure that the overall depth measurement accuracy criteria are met, velocity of sound observations shall be taken with sufficient frequency, density, and accuracy. The accuracy with which the speed of sound correction can be determined is a complex function of the accuracy with which salinity, temperature, and depth, or alternately, sound speed and depth, can be measured. The sound speed profile in the survey areas must be measured and monitored at sufficient frequency and to an appropriate depth to assure that the bathymetric data provided meets the required depth accuracy specification. The sound speed profile should be determined with a calibrated system capable of measuring the speed of sound with errors no greater than 2 m/sec (at the 95% confidence level). A calibrated sound speed measuring system capable of measuring the sound-speed profile to at least 95% of the deepest anticipated depth in the survey area must be available, though collection of sound speed data to 95% of the full depth of the survey area will only be required before and after the completion of the surveys. Velocity of sound correctors shall be applied to soundings to compensate for the fact that echosounders may only display depths based on an assumed sound velocity profile while the true velocity may vary in time and space.

4.4.2.1.5 Error Budget Analysis for Depths

The accuracy of measured depths in the hydrographic survey applies to the systematic measurement of general water depths and to the least depths determined over any obstructions. The total sounding error in a measured depth at the 95 percent confidence level, after systematic and system specific errors have been removed, shall not exceed ± 100 mm (Z co-ordinate) and the Total Horizontal Uncertainty (THU) 250mm horizontal (X and Y co-ordinates). The maximum allowable error in measured depth includes all inaccuracies due to residual systematic and system specific instrument errors; the velocity of sound in water; static vessel draft; dynamic vessel draft; heave, roll, and pitch; and any other sources of error in the actual measurement process. The hydrographer shall document in the Descriptive Report the methods used to minimize the errors associated with the determination of depth (corrections to echo soundings).

4.4.2.1.6 Towed Side Scan Sonar

Dual frequency digital side-scan sonar and PC-based acquisition system is required to collect the sonar graphs. The scan range on the sonar should be set to 37 m or less in order to image any potential debris on the sea floor and 200% bottom coverage is required. Both frequencies must be processed to enable target detection. The towfish altitude must be kept between 10-20% of the scan range used in order to obtain an acceptable slant range.

4.4.2.1.7 Deliverables and Data Presentation

The *Contractor* shall submit a survey quality control plan to the *Supervisor*. A survey report shall be submitted to the *Supervisor* on completion of all in and out surveys. It must give a clear account of how the survey was carried out, the results achieved, the difficulties encountered and the shortcomings. Emphasis must be placed on the analysis of achieved accuracies.

The *Contractor* upon completion of the survey shall produce the following:

- a) Shoal-biased (or median biased) high-resolution multi-beam colour bathymetric image map of the areas, inserted geographically referenced into a DXF or DWG file, contoured at 0.5m intervals.
- b) Two hard copies of the bathymetric image map and electronic copies (pdf) are required.
- c) Track Chart of all survey lines in DXF or DWG format.
- d) ASCII data files of all the points recorded.
- e) ASCII data files reduced to give one point per square meter (mean of all points in a m2).
- f) All details with regards to the co-ordinate transformation and calibration procedures and results.
- g) A report detailing the findings and all details with regards to the survey. This is to include: Survey personnel, date, time, area, conditions, survey vessel, positioning system, equipment used, software used, accuracies achieved and the respective confidence levels, etc.

4.4.2.2 In-surveys

Before any dredging or profiling may commence, the *Contractor* shall carry out surveys of the area to be dredged or profiled, including adjacent side slopes. These surveys shall be carried out in collaboration with the *Supervisor*. Both parties shall agree on the existing sea bed levels before commencing work. A copy of the final agreed in-survey shall be furnished to the *Supervisor* for record purposes.

The in-survey shall form the basis for calculations of quantities of materials dredged or profiled as detailed in the Pricing Instructions.

4.4.2.3 Out-surveys

The following out-surveys are required:

- a) On completion of dredging and profiling within the basin, the entire dredge area shall be surveyed to ensure compliance with the dredging tolerances.
- b) On completion of all dredging and reclamation, a survey of the offshore disposal sites.

The respective areas shall be surveyed as per 4.4.2.1 and the final levels shall be recorded on a drawing. The results of this survey shall be made available to the *Supervisor* for acceptance.

Should it be found that the correct levels have not been achieved, the *Contractor* shall carry out further work until the prescribed levels have been achieved.

The out-surveys will be used by the *Supervisor* for assessing the acceptability of the work.

4.4.2.4 Timing of surveys

Surveys shall be carried out as follows

- a) In-surveys: no longer than two weeks before commencing dredging or profiling in the relevant area.
- b) Out-surveys: as soon as dredging or profiling of the relevant area has been completed and the required tolerances have been achieved.

All surveys shall be witnessed by the *Supervisor*. The *Contractor* shall notify the *Supervisor* of his intention to carry out surveys at least 48 hours prior to commencement of the survey and shall provide facilities for the *Supervisor* to witness the survey when required.

Over and above the *Contractor's* own frequency of bathymetric surveys, in and out surveys are to be undertaken between every shift / operation to ensure material volumes dredged are recorded per shift.

5.0 COMPLIANCE WITH REQUIREMENTS

5.1 Sampling, Testing, Commissioning and Completion

5.1.1 Dredging Completion

Certification of dredging Completion will be by the *Supervisor* and shall be determined based solely on the levels obtained from the Employer's survey measured against the levels shown on the drawings.

5.2 Tolerances

The *Contractor* shall ensure that cumulative tolerances meet with tolerance requirements as defined within this specification.

5.2.1 Dredging

Dredging shall be carried out to the required levels and profiles or such modified levels and profiles. Any out of tolerance work will be rectified by the *Contractor* at his own cost. For final acceptance the following tolerances shall be applied to dredged areas:

Horizontal (x,y) lines: A maximum deviation of +1.5 m (overdredging) shall be permitted. No negative tolerance shall be allowed.

Levels: A deviation of +0mm above the theoretical CD (Port) level as shown on the drawings will be required. There is no restriction on the over-dredging below the levels shown on the drawings. Although there are no restrictions on overdredging, there is a restriction on the amount of material allowed for disposing of offshore. The maximum volume is stated in the Project Environmental Specification (PES) and the *Contractor* is to ensure that the amount of material disposed of, and hence the amount of material dredged, is below the value stated in the PES.

Within 20 m of any existing structure or proposed new structure the maximum permitted over-dredge, below the specified dredged levels, shall be 500 mm. Ploughing of material from under-dredged areas into over-dredged areas is not permitted.

5.2.1.1 Side slopes

Slopes shall be profiled such that the average gradient of the slope indicated on the drawings is not exceeded.