**Document title:**

# METHOD STATEMENT

**Project:**

## FIFE ENERGY PARK DREDGING

**Subproject:**

## CAPITAL DREDGING OPERATIONS QUAY 2

**Employer: Cesscon Ltd**

**SubContractor:** GSS Marine Services

| Document no.: Fife Energy Park Dredging MS | | | | | | |
|---|---|---|---|---|---|---|
| 00 | 25/02/2021 | Initial draft | | | | |
| **Rev.** | **Date** | **Description of revision** | **Prepared** | **Checked** | **Approved** | |
| | | | **GssPlant** | | | **Client** |

# REVISION CHANGE DETAILS

| Revision | Brief description of change |
|---|---|
| 00 | Initial draft |

# DISTRIBUTION

The latest revision of this document is accessible to all members of the Project Management and Operational Team (onshore and offshore).

An internal memo of internal e-mail will notify all project staff on the latest project specific revision.

The controlled document is available on the project server at the discretion of all involved personnel.

# TABLE OF CONTENTS

# LIST OF TABLES

# 1 DOCUMENT SCOPE

This document describes the proposed execution methods for the Works and management of the performance of the Works. This method statement specifically addresses the dredging activity, safety and environment impact protection.

The scope of this method statement covers all activities and services associated with SubContractor that are related to the Project's works. Furthermore, it complies with Employer's requirements and with all applicable legal and contractual requirements.

The purpose of this method statement is to provide a system and instructions to safely perform operations for the Project by means of a Backhoe Dredger (BHD).

After contract award, SubContractor will further elaborate the draft version of this method statement, issued for tender, in coordination with Employer. SubContractor will perform the works in accordance with the finally approved method statement.

# 2 REFERENCES

## 2.1 CODES, STANDARDS AND GUIDELINES

- IMO: International Convention for the prevention of Pollution from Ships (MARPOL);
- IMO: International Safety Management;
- ISO 14001:2015 Standard; and
- ISO 9001:2015 Standard.

## 2.2 EMPLOYER'S DOCUMENTS

- Drawings and Design

## 2.3 CONTRACTOR'S DOCUMENTS

Latest revisions of (unless stated otherwise):

- Competence and training
- Dredging operations
- Emergency Preparedness & Response
- General Marine Operations
- Hazard Management
- Inspection and Monitoring
- Marine operations – auxiliary equipment
- Oil Spill Prevention and Response
- Permit to Work
- Personal Protective Equipment
- Waste Management

# 3 DEFINITIONS AND ABBREVIATIONS

## 3.1 DEFINITIONS

Table 3-1: Definitions

| Term | Definition |
|---|---|
| Project | Fife Energy Park Quay 2 Capital Dredging |
| Employer | Cesscon |
| SubContractor | GSS |

## 3.2 ABBREVIATIONS

Table 3-2: Abbreviations

| Abbreviation | Meaning |
|---|---|
| BHD | Backhoe Dredger |
| COLREG | International Regulations for Preventing Collisions at Sea |
| DGPS | Differential Global Positioning System |
| DROPS | Dropped Objects Prevention Scheme |
| DTM | Digital Terrain Model |
| EMS | Environmental Management System |
| EPIRB | Emergency Position-Indicating Radio Beacon |
| GMDSS | Global Maritime Distress and Safety System |
| HSE | Health, Safety and Environment |
| IMO | International Maritime Organisation |
| IRCA | International Register of Certificated Auditors |
| ISFT | Invitation to Submit Final Tender |
| ISM | International Safety Management |
| ISO | International Standards Organization |
| ISPS | International Ship and Port Facility Security |
| JHA | Job Hazard Analysis |
| KPI | Key Performance Index |
| LLW | Lowest Low Water |
| LOTO | Lock-Out / Tag-Out |

| | |
|---|---|
| MARPOL | International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78), MARPOL is short for maritime pollution |
| MOB | Man OverBoard |
| MSBS | Multi Beam Echo Sounder |
| PHSER | Project Health Safety and Environment Representative |
| PM | Project Manager |
| PPE | Personal Protective Equipment |
| PS | Port Side |
| QHSSE | Quality, Health, Safety, Security and Environment |
| RTK | Real Time Kinematic |
| SB | StarBoard |
| SDR | Siam Dredging and Reclamation Ltd, a member of the Jan De Nul Group |
| SHB | Split Hopper Barge |
| SOLAS | International Convention for the Safety of Life at Sea |
| SOPEP | Ship Oil Pollution Emergency Plan |
| SSS | Side Scan Sonar |
| SWL | Safe Working Load |
| SWP | Safe Work Practice |
| UHF | Ultra High Frequency |
| VHF | Very High Frequency |

# 4 SOPE OF WORKS

## 4.1 PROJECT SITE

The city of Methil is situated to the North of Edinburgh, Scotland across the bay Firth of Forth. Quay 2 of Fife Energy Park is the Southern quay of the complex.


**Figure 1-1: Project Location**

## 4.2 PROJECT DESCRIPTION

The Project consists out of the capital dredging works of the quay 2 area in order to deep the existing berth pockets OSV Berth and Iron Lady. With existing depths to CD of -4/-5 m on average, both pockets should be deepened to the following depths.

- OSV Berth Pocket: 8.2 m
- Iron Lady Berth Pocket: 7.6m

Outer slopes are determined to be 1:4 while the slope towards the quay 2 is 1:1. To the South of the OSV Pocket, a shallow rock outcrop can be identified, reaching shallows around 0 m CD.

The underneath illustrated design will be dredged considering the following tolerances:

- Vertical: -0.5m
- Horizontal: +/- 1.0m

No dredging will be performed closer than 5 m to existing structure.

Following dredge volumes are expected to design level:

- Superficial materials of sand, silt and gravel: 46,635 m3
- Weathered rock materials : 18,609 m3

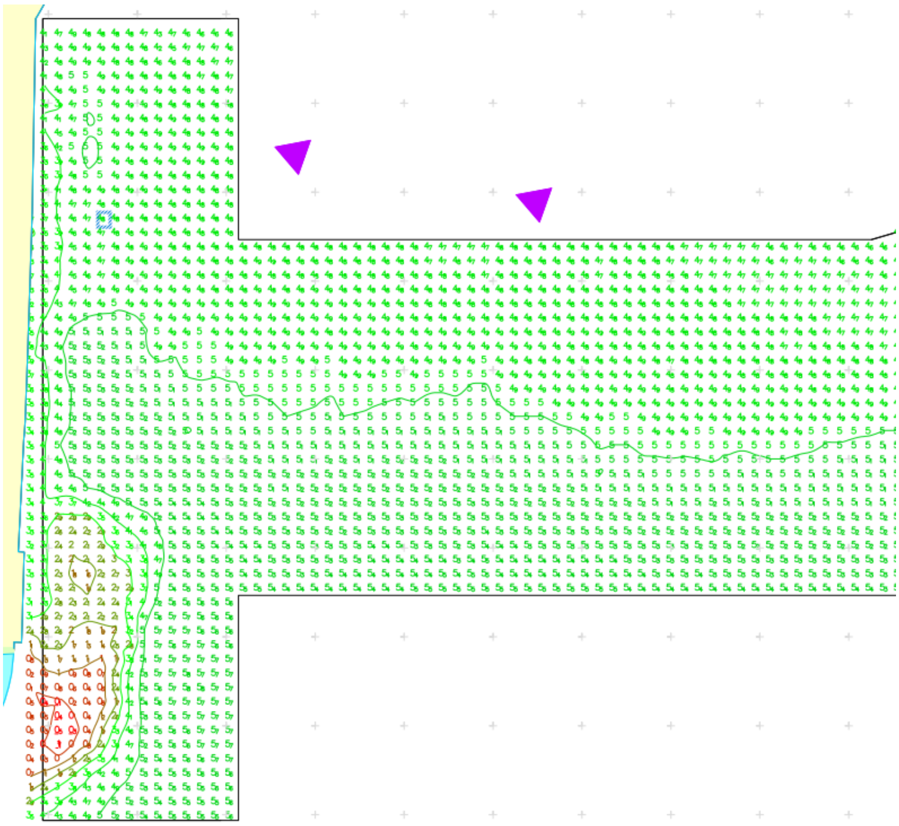

Figure 1-2: Preliminary in-survey of the dredge area

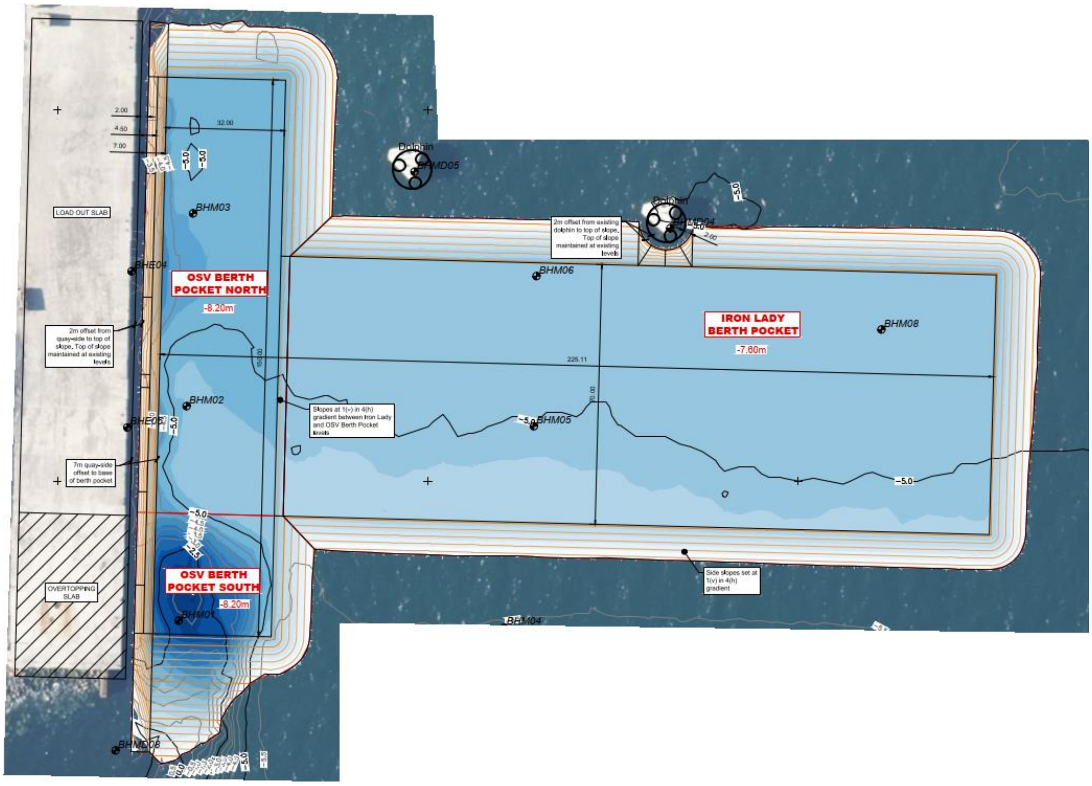


Figure 1-3: Dredge Design

## 4.3 SOIL PROFILE

The soil profile to be dredged consist out of a combination of:

- upper soft layer of silt, sand and gravel
- weathered rock layer underneath

In the South of quay 2 a rock outcrop can be identified consisting of mainly weathered rock.

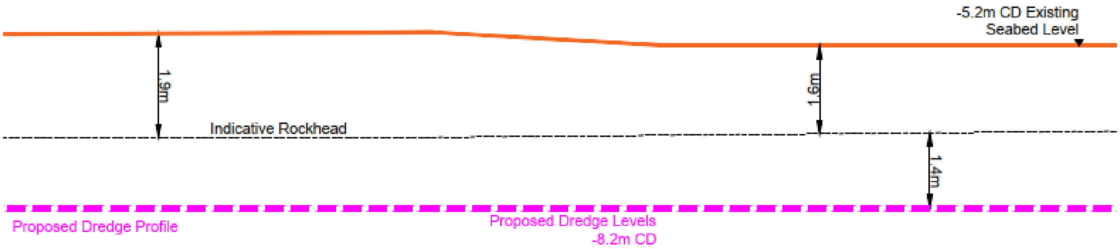


**Figure 1-4: Indicative rockhead -8.2m section**

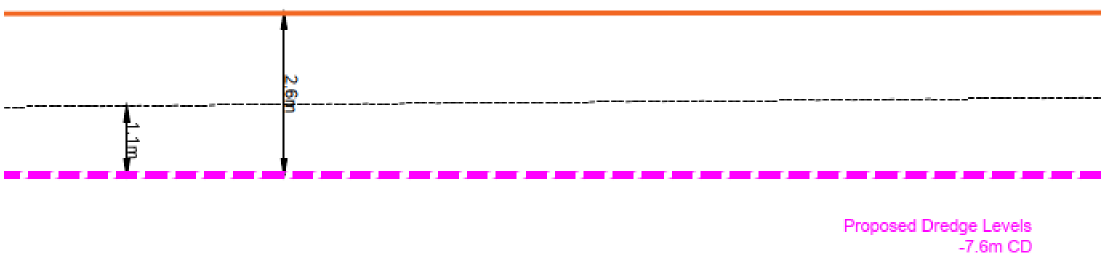


**Figure 1-5: Indicative rockhead -7.6m section**

## 4.4 TIDE

Tidal variations in the wider Methil area are as follows.

| | |
|---|---|
| M.H.W.S. | + 2.60 m O.D. |
| M.L.W.S. | + 1.40 m O.D. |
| O.D. | O.D. |
| M.L.W.N. | − 1.00 m O.D. |
| M.L.W.S. | −2.20 m O.D. |
| C.D. | −3.00 m O.D. |

**Figure 1-6: Tidal variations**

## 4.5 OFFSHORE DISPOSAL AREA

Dredged Soils, both rock and softer material should be disposed in the illustrated offshore Methil spoil ground, at a distance of approx 3 km to the East of the dredge area. The offshore spoil ground overlaps with the anchorage area in front of Methil. Depths at the spoil ground are 15.5m approx and the area itself is 500,000 m2.

We are aware that there is a max level of spoil that we can spread, every effort will be made to stay within the bounds of the license. We will conduct daily surveys and any high spots will be noted and avoided on further disposals. In the event that any large lumps of material are extracted these will be taken to the deep dumping ground.

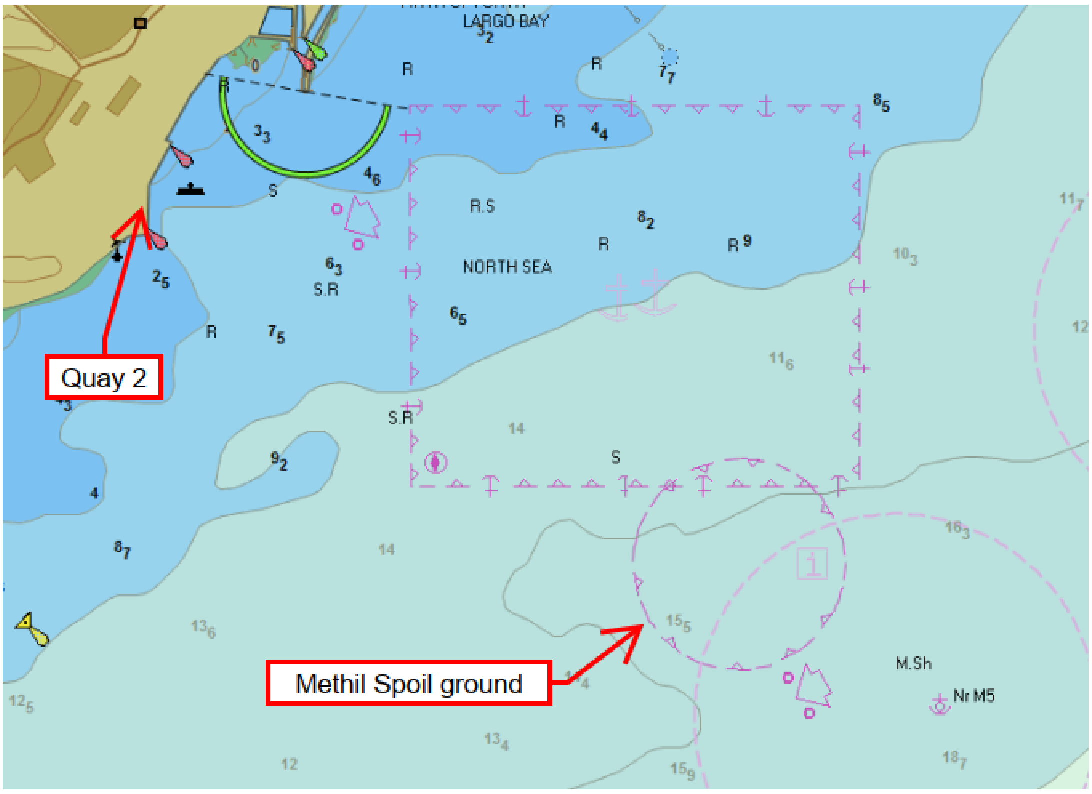


**Figure 1-7: Spoil ground for dredged materials**

# 5 METHODOLOGY

In order to execute the works, the Contractor opts for the use of a backhoe dredge (BHD) with a split hopper barge to transport the dredged materials to the spoil ground. BHD Vitruvius and SHB Tiger will be mobilised to execute the project. Technical leaflets for the equipment have been annexed to this document.


Figure 2-1: SHB being loaded by BHD Vitruvius

# 6 BACKHOE DREDGER

In this chapter the working principles of a Backhoe Dredger or BHD is elaborated.

## 6.1 LAYOUT

A BHD (**Error! Reference source not found.**) consists of a hydraulic crane mounted on a **pontoon** (**Error! Re ference source not found.**). Whilst working, spuds keep the pontoon fixed in position.

The pontoon is equipped at the front with a **turning table**, accommodating the crane. The height of the turning table above water level is a compromise between depth of excavation, excavating forces and required freeboard.

Three **spud-poles** deliver reaction force whilst maintaining the pontoon's position. The hoisting system is capable of both hoisting the spuds from the seabed, so as to allow repositioning of the pontoon, and lifting the pontoon partly out of the water, in order to increase the reaction forces. The aft spud is sited in a carriage, which moves the aft spud and the pontoon in a horizontally relative to one another.

The hydraulic **crane** comes equipped with different sizes of boom, stick and bucket. They are constructed much more robustly than for typical land use. A shorter boom and stick yield higher excavating forces.

Depending on soil type and excavation depth the most suitable **bucket** size is selected. Hydraulic cylinders on the boom and stick position the bucket on the seabed and power the excavating motion. The bucket may be equipped with a lid for environmental performance.

## 6.2 DREDGING PROCESS

The spuds lift the pontoon partly out of the water for reaction force. This has the added benefit of rendering the pontoon less sensitive to wave action.

The dredging process consists of

1. Digging and filling the bucket;
2. Lifting the bucket;
3. Swinging towards the barge;
4. Emptying the bucket into the barge;
5. Swinging towards the next digging location;
6. Lowering the bucket;
7. Positioning at the next digging location; and
8. Digging and filling the bucket.

Steps 2 and 3, as well as 5 and 6 are often combined.

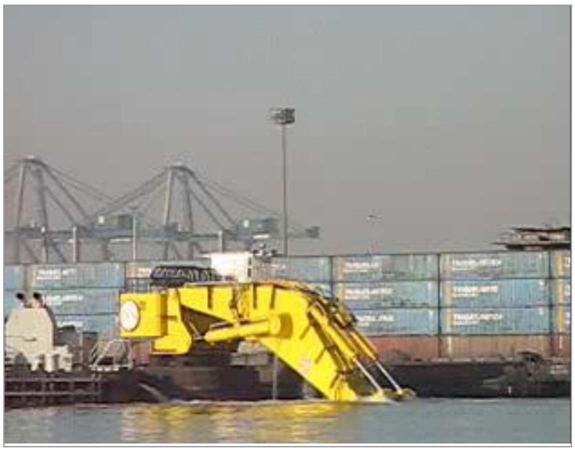

Figure 3-1: Digging and filing the bucket

Figure 3-2: Lifting the bucket

Figure 3-3: Swinging towards the barge

Figure 4-4: Emptying the bucket into the barge

Figure 4-5: Swinging towards the next digging location

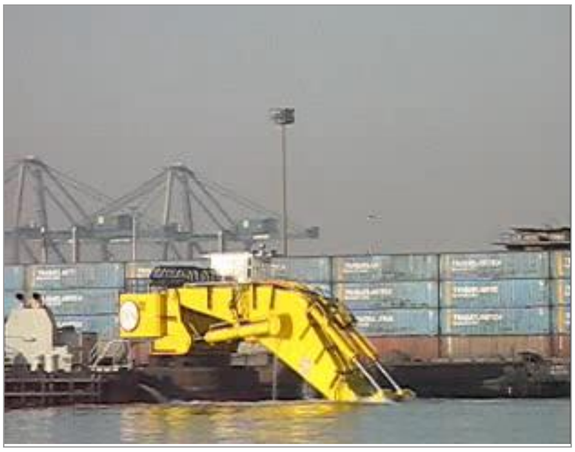

Figure 5-5: Lowering the bucket and positioning

The excavator is located above the dredged face and digs towards itself, in an upward motion, to ensure maximum filling of the bucket. With the pontoon positioned in one location, the crane covers an area as large as possible by swinging from side to side along an arc, first at maximum reach and subsequently at ever-smaller reach. The arc length depends on the length of boom and stick. Swing arcs of more than 60° are not effective. The chosen step size of the decreasing reach is a function of bucket size and excavated layer thickness. The thickness of the layer dredged in one pass is limited by the stability of the dredged slopes, and is typically 1 to 2m.

The dredged material is loaded into an SHB

## 6.3 SPLIT HOPPER BARGE

Split Hopper Barges or SHB's are the self-propelled barges, which transport the dredged material once loaded by the BHD to the assigned disposal/dump area.

**Figure 6-1: Filling an SHB**


**Figure 6-2: SHB dumping its load**

## 6.4 POSITIONING PROCESS

After all the soil within reach has been dredged, the pontoon needs to **reposition** itself by means of its spud carriage system:

1. The spud hoisting system lowers the pontoon until it floats;
2. The crane places its bucket onto the seabed;
3. The spud hoisting system hoist both front spuds
4. The spud carriage moves the pontoon backward, whilst the crane extends its boom and stick accordingly
5. The spud hoisting system lowers both front spuds into the seabed
6. The aft spud hoisting system raises the aft spud from the seabed
7. The spud carriage moves the aft spud backward
8. The aft spud hoisting system lowers the aft spud into the seabed
9. The spud hoisting system raises the pontoon.

Figure 6-3: Raise front spuds

Figure 6-4: Push pontoon back

Figure 6-5: Lower front spuds

Figure 6-6: Raise aft spud

Figure 6-7: Move aft spud back

Figure 6-8: Lower aft spud

# 7 APPLICATION

A BHD is able to dredge a wide range of **soils**. The BHDs hydraulic crane is capable of exerting great excavation force, rendering it particularly useful for dredging harder soil types, such as stiff clay, boulder clay, blasted rock and even soft rock.

Since the BHD does not rely on anchors and anchor wires for securing its position, it has a **small working area**, with obvious benefits for working in restricted environments and minimizing interference with marine traffic and port operations.

The length of the spuds, the stick and boom length, and the size of the bucket determine the maximum **dredging depth**. The bucket size is chosen to suit the dredging depth and the soil type. Efficient dredging operations require enough water depth for the BHD and its barges to have sufficient keel clearance. If site conditions are such that this is not the case, then the methodology has to be adapted, and the BHD will have to dredge and step forward, rather than backward, thus creating enough water depth under the pontoon and the barges. However, the digging motion downslope of the dredged face, instead of upward, leaves more spill and will likely result in an additional clean up pass. A barge moored alongside the pontoon may restrict the swing length on that side. In that case the pontoon may be positioned at an angle to the direction of dredging cut, so as to enable the crane to reach and dredge in front of the moored barge.

The spuds fixing the pontoon to the seabed, and the solid construction of stick and boom, cause the BHD to be a highly **accurate** dredging tool. To maximize the accuracy of dredging a slope, the bucket, due to its width, must be aligned with the slope. This, of course, necessitates additional repositioning and reduces the productivity of the operation.

Workability under influence of **waves** depends on pontoon size, spud strength and angle of wave incidence. Mooring of barges may be restricted to the lee side of the pontoon.

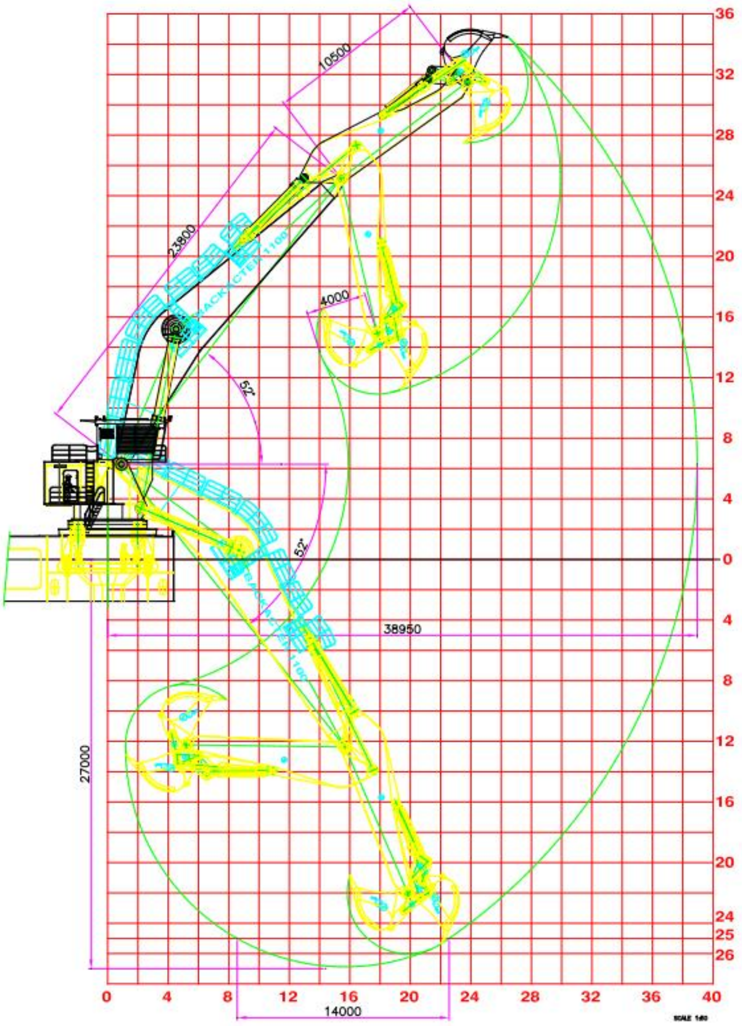


**Figure 7-1: Dredging diagram for BHD with 23.8m boom, 10.5m stick and 15m3 bucket**

# 8 CONTROL

## 8.1 DREDGE PROCESS

The dredging process is monitored, controlled an automated by integrated dredge and survey systems. Daily bathymetric updates will be provided to the BHD.

Unlike in land excavation, the dredge operator cannot see the result of his actions and must rely on information acquired by sensors and measurements:

- DGPS location;
- Design location;
- Heading;
- Bucket position;
- Bucket attitude;
- Seabed level;
- Design level; and
- Tidal level.

Positioning during all dredging works will be provided by Differential Global Positioning Systems (DGPS). C-Nav StarFire™ receives the DGPS correction signal from the satellites. Differential corrections for GPS positioning correct the coded raw pseudo ranges received from selected GPS satellites. The mobile receiver applies these corrections to its own observed satellite pseudo ranges and so obtains the corrected pseudo ranges to be used for the position computations. The positions derived by the DGPS receiver are calculated in WGS84 co-ordinates.

The StarFire™ global subscription service provides real-time accuracy typically better than 10cm. Its globally corrected signal is available virtually anywhere on the Earth's surface on land or sea, from 76ºN to 76ºS latitude. To accomplish this, StarFire™ utilizes a network of more than 60 GPS reference stations around the world to compute GPS satellite orbit and clock corrections. Two completely redundant processing centres and multiple communication links ensure the continuous availability of StarFire™ GPS corrections. These corrections are broadcast via three geostationary satellites, providing worldwide coverage and enabling precise real-time navigation without the need for local ground base stations.

The navigation/positioning system to be installed on the dredging equipment will comprise of (or similar):

- DGPS Positioning: SEPTENTRIO AsteRx-U / Trimble SPS852;
- Gyro compass Anschutz Standard 22 (or similar);
- Tidal Receiver Pacific Crest Radio Modem;
- Heave compensator;
- Data Collecting Computer;
- Navigation Package; and
- UPS / power stabiliser

For controlling the bucket position, the dredger is fitted with IHC Digviewer / Seatools Digmate systems, or similar. These systems measure:

- Angles for the boom, stick and bucket;
- Pontoon draught;
- Pontoon tilt; and
- Bearing

The operator follows the excavation operation on two video screens, one for horizontal bucket position and the other for vertical bucket position. The system enables the dredge operator to follow the exact movements and the depth of the bucket, and facilitates digging in a controlled manner to the designed limits. The required dredging levels and slope angles are pre-set in the computer, so the operator sees the digging lines as well as the bucket position, in relation to the pre-set limits, on his video screens.

Water level information is provided by a radio-linked tide gauge. The tide gauge is placed in the water close to the dredging area. The dredger is equipped with a radio-linked receiver to monitor the tide level during the dredging operation. The Digviewer system receives the actual tide level several times per minute and the dredging depth is automatically updated.

The supervisor or the main operator on each shift keeps a log of significant events, such as operation hours, breakdowns, repairs, production rates, weather conditions, dredging area and dredging depth. The dredged area is marked on specially designed dredging lay out drawings.

## 8.2 DUMPING PROCESS

The transportation of soil from the dredging areas to the dump area is executed by means of self-propelled Split Hopper Barges (SHB). On board the barges, a barge report is completed for each load, specifying date, shift, load number, departure time from dredger and unloading location.

It is expected the SHB to perform 4 dumps per day (24/7 operations). The averagely expected load to be dumped in each trip is 2,200 m3. 95 % of the loads will contain 50 % weathered weak rock and 50 % softer superficial material. Due to their size, SHB's dump over a surface of 70 x 4 m at the water surface. At a spoil ground depth of -15.0m the load will be distributed over a larger surface.

The appointed offshore Methil spoil ground will be completely in-surveyed at the beginning of the Project, after which a dump strategy will be discussed. Areas overlapping with the Methil anchorage area and areas with depths above 15.0m will not be used to dump dredged material. Current depths on the spoil area will be assessed and the spoil area will be divided in a squared grid, which will be visible on the survey screen of the SHB operator (see illustration). A dumping sequence will be determined, dumping the first load in the deepest areas, assuring the Project volume to be evenly spread in the spoil area, avoiding sudden heaps of material. Through daily reporting the dumped volume in each square will be registered. By means of regular bathymetric updates, the situation will be monitored.

Similar to the dredge area, the spoil ground is expected to count with an upper softer layer which will partly absorb the dumped rock fragments as it will be compacted under the weight. The majority of the volume to dump will spread widely due to its nature (sand, silt, gravel) during dumping, raising the spoil ground level evenly. Field testing results show a very weak weathered rock, for which the size of the excavated rock fragments will be very limited. Considering the size of the spoil area and the very small estimated rock volume of 18,600 m3, heaps of material in the spoil area can be avoided. Working through the abovementioned method and considering the depth of the spoil ground being 15.0m, it is impossible to cause heaps of dredged which might cause a danger to vessels transiting the area.

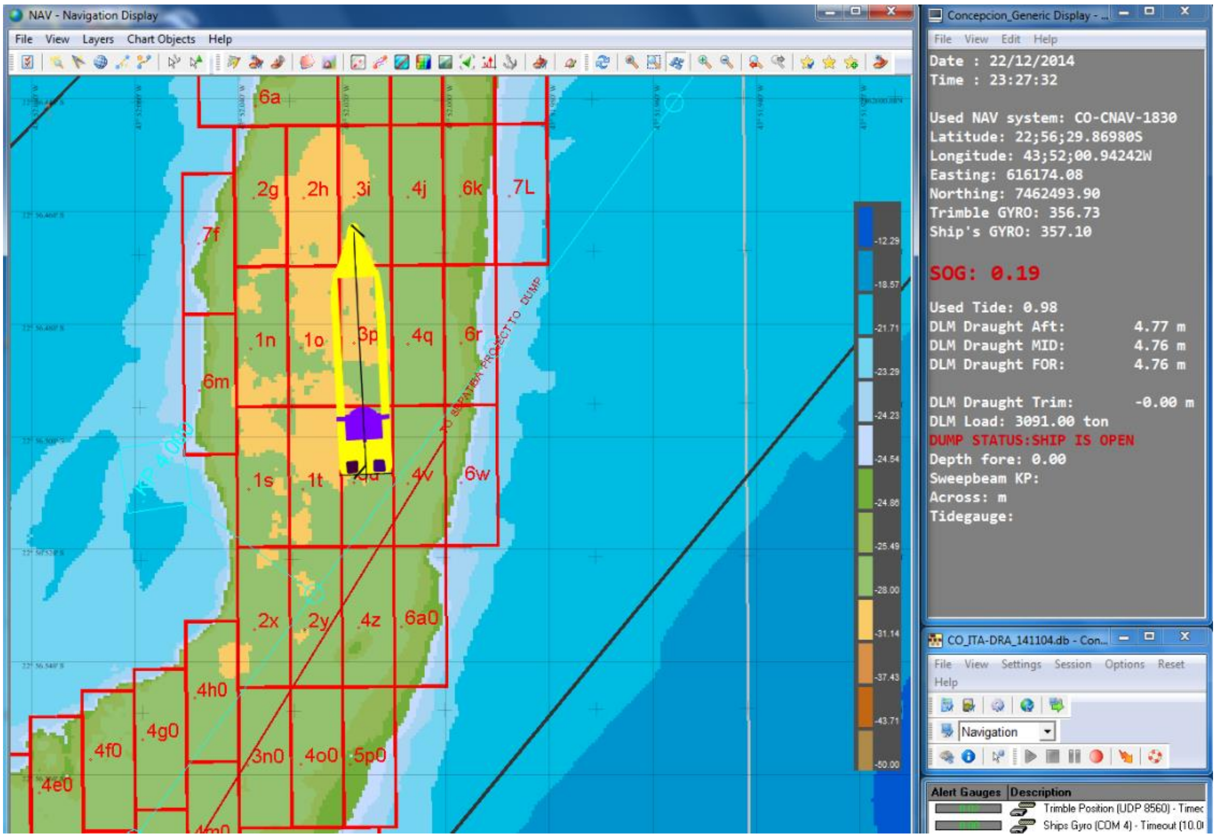


**Figure 8-1: Dumping survey screen of SHB operator**

In order to closely monitor the dumping activities, subcontractor designed a tool updating all the different dumping boxes within a spoil ground with the latest survey, indicating the SHB operator in which deepest area to dump, and calculating the remaining capacity to a certain level in the dump boxes.

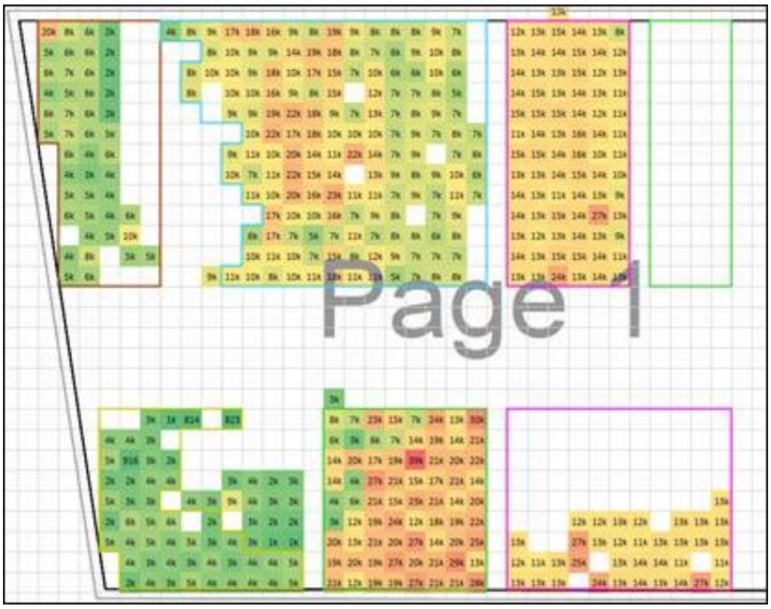


**Figure 8-2: Dump strategy and follow up of a previous project**

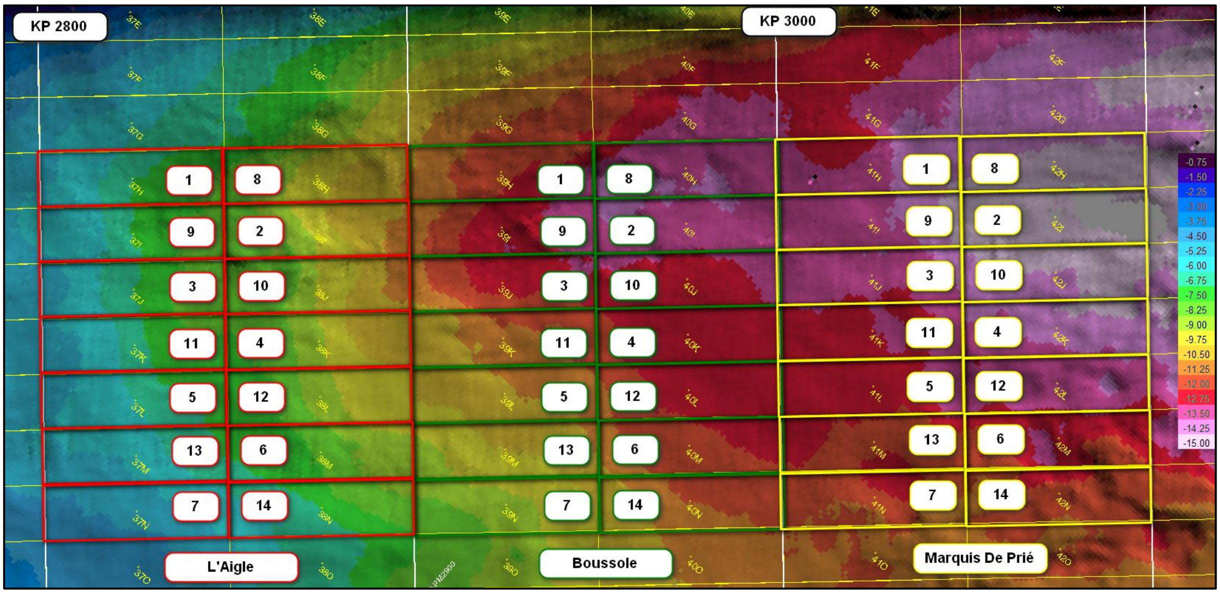


**Figure 8-3: Example of dumping sequence**