

Leask Marine | Hatston Pier Rock Anchors

Project Information Summary

February 2021

Purpose

This Project Information Summary gives a high-level view of the company, the device, and the proposed project. This document is the foreword to the project's marine licence application, and will feed into the rest of the application supporting documentation, including but not limited to the following documents:

- Project Environmental Monitoring Plan
- Decommissioning Programme

Document History

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Executive Summary

Leask Marine are proposing to install two rock anchors at Hatston pier using their Submersible drill rig (SDR) which offers a low-cost anchoring solution. The SDR anchor installs are proposed to be located at Hatston pier. Rock anchors of up to 800mm diameter will be able to be installed using the SDR. The SDR will be winched from the vessel to the seabed using the vessel's onboard lifting and recovery system. Each drilling operation is expected to take between 6-12 hours before the SDR is recovered to the vessel. The SDR will be controlled from the surface through a single umbilical cable from the vessel; The anchoring solutions to be installed include:

- RAPTOR – Grouted Anchor Pile Tricone;
- RAPTOR – Strataloc.

The installation operation will be completed using a single multicat vessel and is expected to last a maximum of 3 weeks, including vessel mooring installation and retrieval.

1 Introduction

1.1 Company background

Leask marine was established in 1985 by Douglas Leask providing marine construction and diving services around the Orkneys and Northern Isles. As a highly qualified commercial diver and vessel master, his talents were increasingly called upon for many marine construction repairs, and over the first 20 years Douglas built up a fleet of small & medium sized workboats and numerous commercial diving teams to satisfy this accumulating demand.

1.2 Technology background

Leask Marine Ltd have developed a submersible drilling rig (SDR) with which the company seeks to offer a new anchoring possibility to the market. A low cost drilled anchoring system will interest wave and tidal developers, floating wind developers, aquaculture and harbour maintenance markets.

1.3 Project background

Orkney Islands Council Marine Services have contracted Leask Marine to install two rock anchors at Hatston Pier which will aid the mooring of large cruise ships visiting Orkney. The works will aim to be underway as soon as possible, although considering the timeframe for issuing of the marine licence, April has been chosen as the starting date.

2 SDR Technology

2.1 Description

The SDR (Figure 1) is composed of seven key elements which are highlighted below:

1. A rotary head in order to drill while casing;
2. A sliding drilling mast with a preferred stroke of 6m and a preloaded ground anchor that is able to move from up and down accordingly in order to situate the drill head in the best position for drilling.
3. A gravity base with bumper bar that protects that drilling mast, the drilling head and the subsea connections) of the SDR. The base includes two lifting points at the top of the frame which allows for an easy launch and recovery of the device;
4. Four hydraulic reversible stabilising legs that will be synchronised with vessel telemetric system in order to get the most stable position for the anchoring operation;
5. A single umbilical that will run from the surface to the SDR connector box located in the back of the gravity base. This umbilical will contain the power and control cable of the SDR;
6. A deck mounted control system, combining all telemetry and control of the SDR;



Figure 1. Leask Marine Submersible Drilling Rig (SDR)

2.2 Hydraulic stabilizing legs

One of the main characteristics of the SDR design (see Figure 2) is the use of proven technologies. In order to ensure a high-quality drilling operation, four independent hydraulic stabiliser legs have been integrated which ensure the device is level when on the seabed. With this advantage, the SDR is able to complete the installation of a ground anchor in a single deployment.

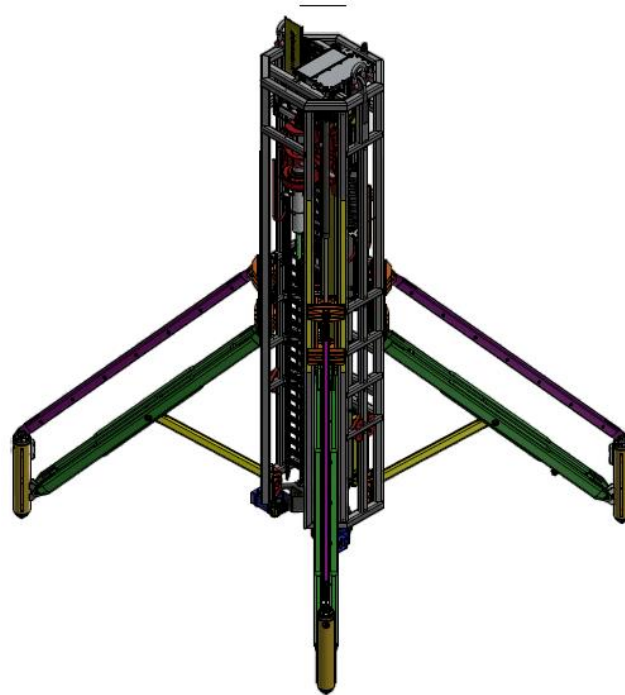


Figure 2. SDR design

The SDR is connect to a HPU located onboard of the operational vessel, the control system has been design as such that a single umbilical line will be coming from the drilling rig to the surface. This will reduce the cable drag and minimise the complications during the drilling operation as well the launch and recovery of the unit.

The complete control system for the drilling rig requires to remain on the deck of the vessel which operate the self-levelling and drilling components subsea. The subsystems of the SDR will be integrated into one single control panel that will be located on the deck of the vessel. The operator will be able to control all subsystems from a single point which will allow easy substitution of subsystems in case of malfunction or failure. This has been possible through the use of underwater plug board which minimises the number of cables and hoses for better performance of the SDR.



2.3 Corrosion mitigation

Salinity in the marine environment can cause an accelerated build-up of scale on all pipe and hose connections, therefore, all connectors are made of stainless steel..

3 Deployment and removal of the SDR

Prior to transit to site, the SDR will be secured on the deck of the multicat involved in the operation. The SDR has been designed to be deployed using a customised launch and recovery system (LARS) or if the vessel has the capacity through the vessel crane. The lifting points, located on the frame of the SDR, are designed and tested. The drilling unit is placed into its launch position in its LARS frame over the bow of the vessel using a land crane, the SDR is secured in its position and vessel is ready to mobilise to site. Once in site the device is then lowered by the LARS winches. The umbilical is simultaneously paid out while the device is lowered to the seabed.

Once the SDR is free of interference with the vessel, the legs of the SDR are extended (see Figure 3). By extending the legs of the SDR during the descent to the seabed, this ensures the system experiences less water pressure and also proves less onerous on the hydraulic system. In the case of a malfunction, having the legs pre-extended also allows for an easier recovery to deck. There are cameras within the SDR to provide visual support for the operation.

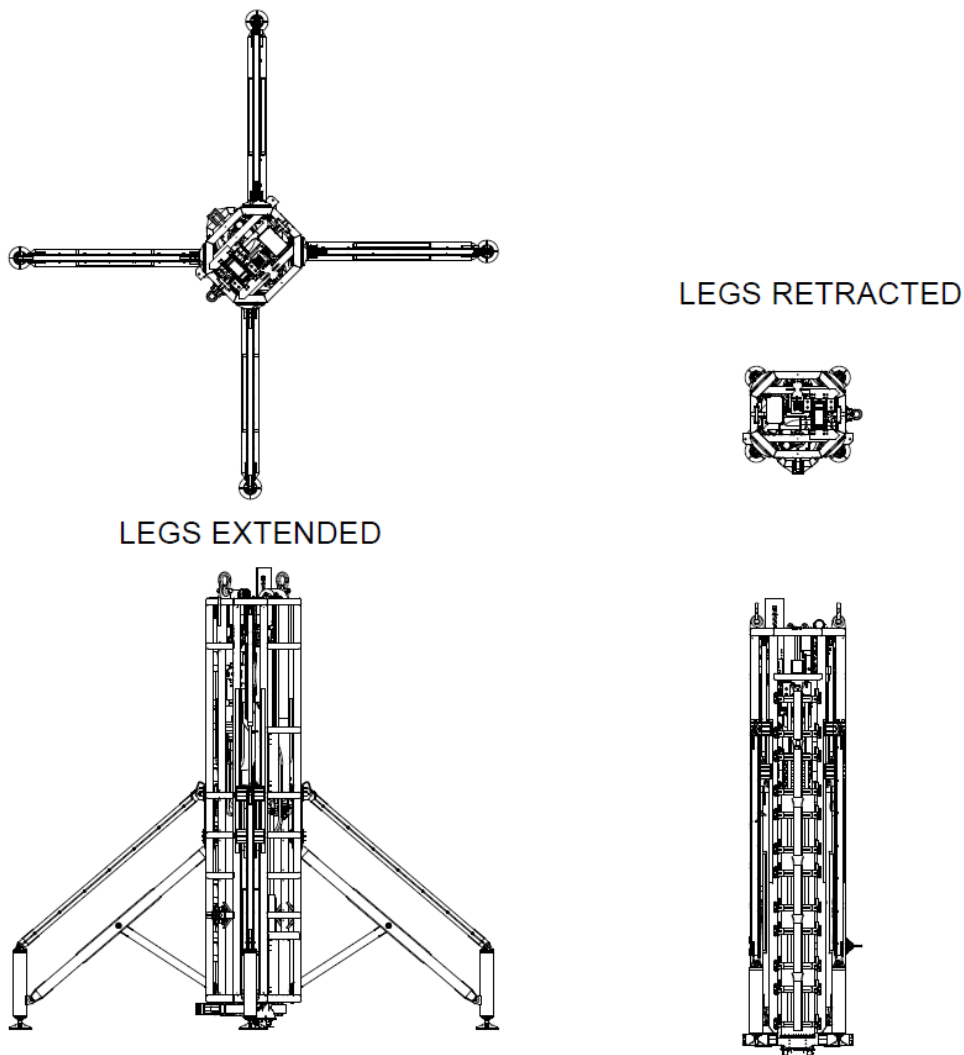


Figure 3. SDR legs extended and retracted

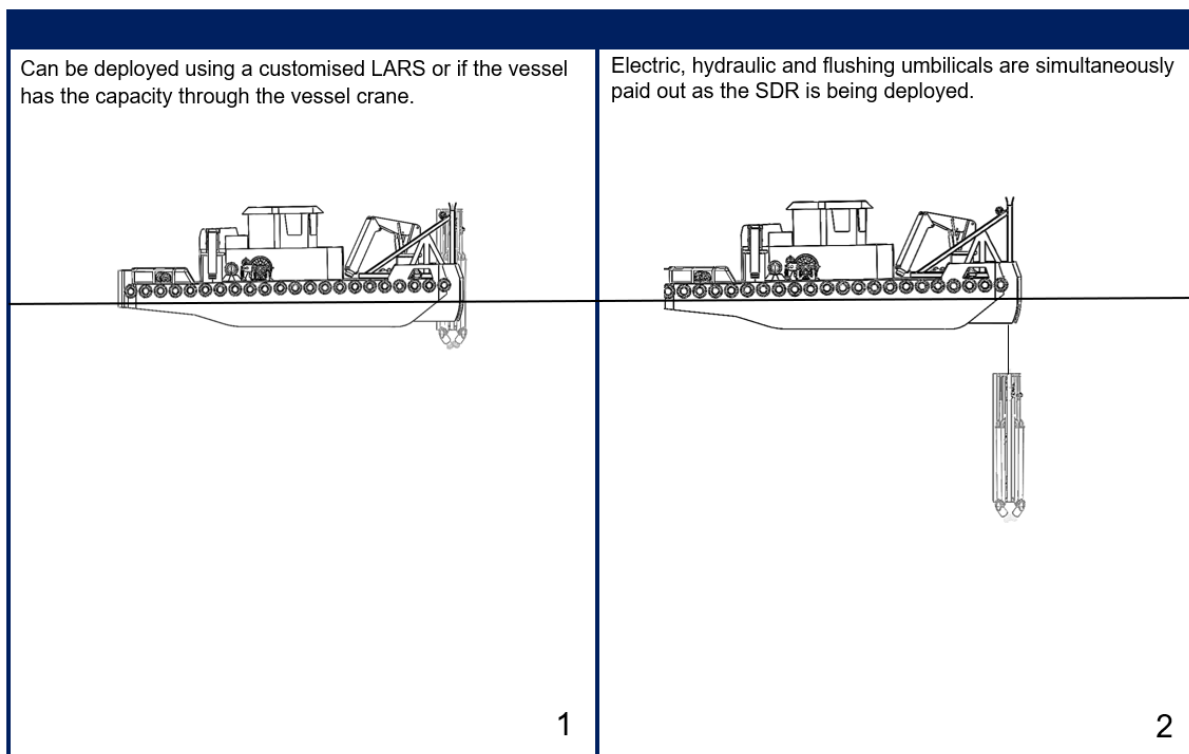
When the SDR reaches the seabed, the onboard telemetry provides the surface control unit with tilt angle information of the rig, which allows the operator to use the four independent hydraulic legs to level the unit and ensure the ground anchor is drilling into the seabed in a vertical position.

When the SDR is in position and has been levelized, the operator will activate one of the hydraulic rams located on the cavity of the gravity base. By doing so the hydraulic ram will adjust the height of the mast to ensure the adequate distance between the anchor and the seabed before commencing drilling operations. A set of guiding clamps are located at the bottom of the SDR this allows to keep the anchor align whilst drilling.

The following storyboard provides an indication of the deployment and readying operation for the SDR, see Figure 4.

The lifting lines would remain attached to the SDR throughout the drilling operation. Each drilling operation is expected to take between 6-12 hours to complete, however might be shorter if the rock is softer.

Once the anchor installation operation has been completed, the SDR would be recovered to the surface in a reverse method to the deployment. The SDR would be lifted towards the vessel and prior the potential interference with the vessel, the hydraulics extending legs would be retracted. The SDR would be lifted to breach the water surface and then mounted and secured on the LARS frame before being returned to shore.



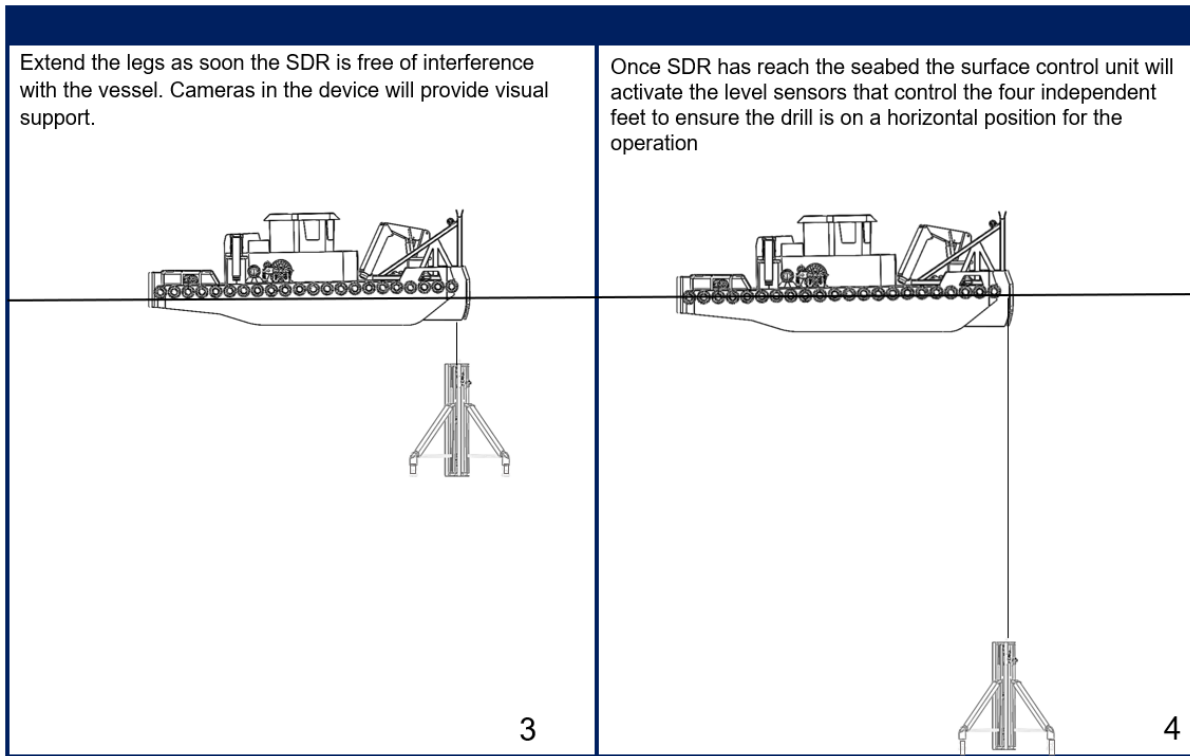


Figure 4. Installation operation storyboard

4 Anchor concepts

4.1 Background

The location for anchor installation is Hatston Pier. The characteristics of the seabed in this area is predominately sandstone with water depths of 4m to 9m.

Table 1. Typical geotechnical parameters for intact Sandstone within Orkney waters

| Rock Type | RQD (%) | UCS (MPa) | Range | Density (Tonnes/m ³) |
|-----------|-----------|-----------|-------|----------------------------------|
| Sandstone | 65 (fair) | 80-110 | | 2.71 |

The bearing capacity of the rock has been evaluated for the anchors to be installed. A safety factor of 3 has been utilised during the design and specification of the anchors, due to unknown fractures that might be present on the seabed.

A total of two different anchoring solutions will be tested with two rock anchors installed at Hatston Pier. The anchoring solutions to be installed are:

- RAPTOR – Grouted anchor pile tricone
- RAPTOR – Strataloc

The anchors are 300mm with a length of 6m, which can be extended if required for the grouted anchor pile. The top of each anchor can be customised to meet the necessary requirements, for instance a padeye with high grade shackle can be mounted or a subsea ball-grab can be fitted.

Further details regarding the two anchoring solutions employed are outlined in the following sections.

4.2 Raptor G.A.P Tricone Anchor

The Raptor Grouted Anchor Pile (GAP) is composed of a sacrificial drill bit that is connected to an outside casing sleeve that works as a driving shaft. Once the anchor has been drilled in place, the gap between the casing sleeve will be filled with grout. This increases the stiffness of the anchor and allows a higher resistance of lateral loads. The SDR can accommodate Raptor Tricone anchors from sizes 200-800mm.

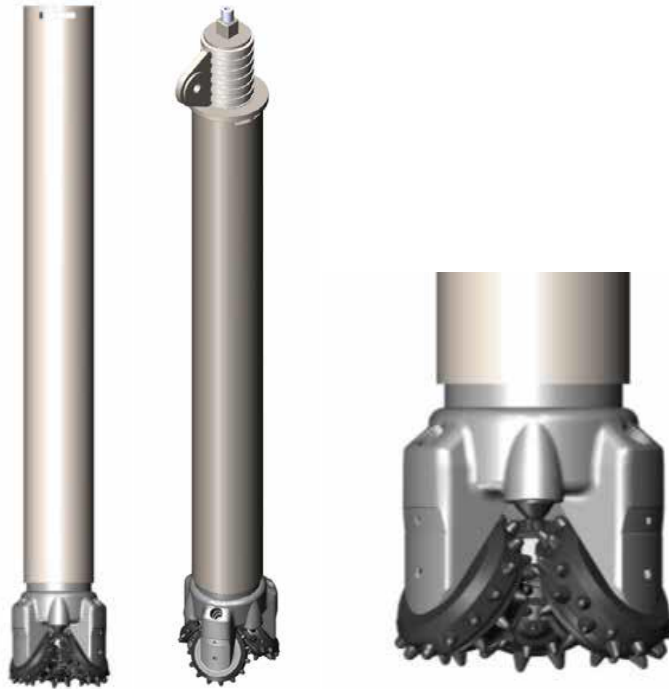


Figure 5. Raptor G.A.P Tricone Anchor

4.3 Raptor Strataloc Anchor

Raptor Strataloc anchor is a double sleeve anchor that is drilled into the bedrock. Once the anchor is completely drilled, the inner stem stops rotating. The outer stem continues rotating, reaming the upper taper into the rock. The cutting fingers are simultaneously forced over the lower cone, reaming the lower taper into the rock. With this process the cutting fingers are expanded and secure the anchor. Top anchor attachments can be customised as required. The Strataloc anchor can be removed if required using a customised recovery unit. The SDR can install Raptor Strataloc anchors from sizes 200mm – 800mm.

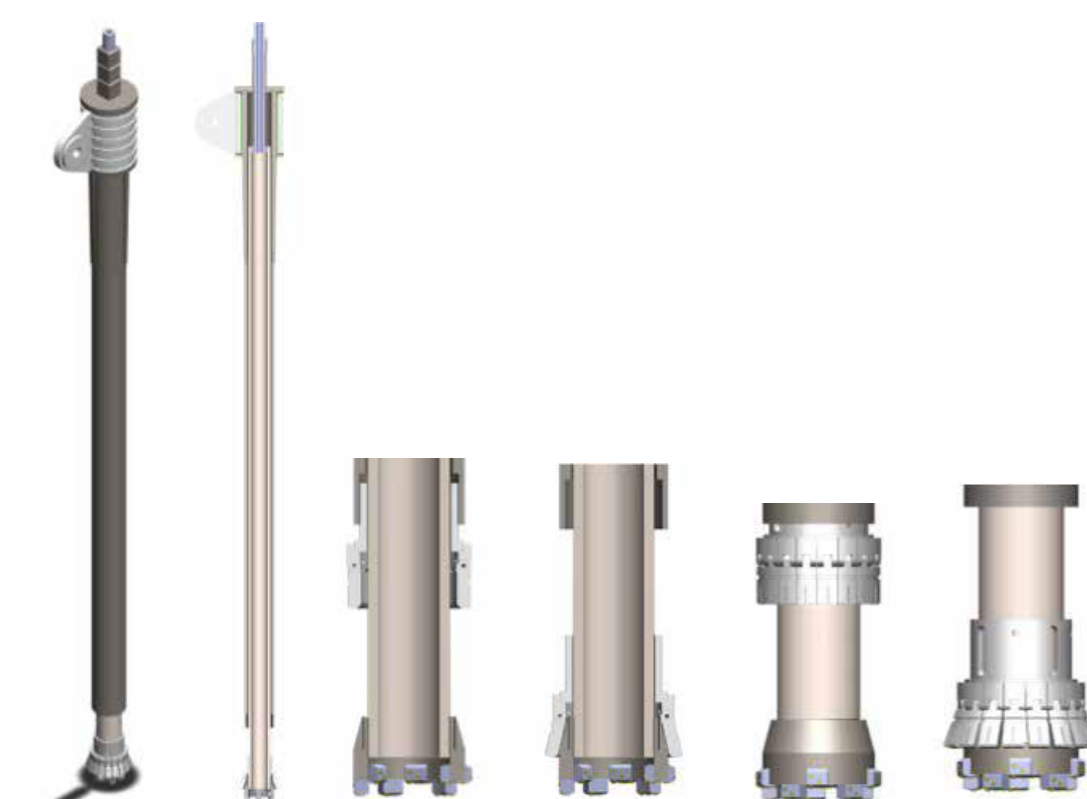


Figure 6. Raptor Strataloc Anchor

5 Vessel spread and traffic

Leask Marine vessels will be used to install, operate and remove the SDR at Hatston Pier. A single multicat vessel is required for the operation. Vessel moorings will be installed the day prior to operations and removed shortly after work has been completed. It is expected that a maximum of 3 weeks at the site will be required in order to conduct the work. This estimate includes the time required to install and recover the vessel moorings.

One of the multicat vessels, specified in **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**, operated by Leask Marine will be utilised for the work.

Table 2. Vessel information

| | | |
|--|--------------------------|---------------------|
| Vessel Name | MV C-Fenna | MV C-Odyssey |
| Type of vessel | Neptune Eurocarrier 2611 | Multiworker Twenty6 |
| Flag state | UK | UK |
| Port of registration | Kirkwall | Kirkwall |
| Year built | 2013 | 2011 |
| Vessel International Maritime Organisation Number (IMO) | 9675963 | 9636307 |
| Official number | 922340 | 917987 |
| Call sign | MBAH3 | 2ETW7 |
| Vessel Owner | Leask Marine | Leask Marine |
| Operating Company | Leask Marine | Leask Marine |
| Length | 26.48 m | 26 m |

| | | |
|----------------|--------|--------|
| Beam | 11 m | 10.5 m |
| Depth | 3.5 m | 3.5 m |
| Draught | 2.61 m | 2.5 m |



Figure 7. MV C-Fenna



Figure 8. MV C-Odyssey

Once installed, an initial post-installation survey will be conducted and then the anchors will be surveyed by a diver, drop camera or ROV on a yearly basis.

Anchor retrieval is expected to utilise a similar vessel spread and require three weeks at each site.

6 Deployment location

As described, Leask Marine are proposing to install two anchors at Hatston Pier.

Rather than specifying the exact location, in order to allow for micro-siting, a deployment area at the site has been identified. The boundary points for the deployment location are marked in Table 3 and on Figure 9. Following installation, the exact deployment coordinates will be confirmed with Marine Scotland.

Table 3. Boundary of marine licence for anchors installation

| Location Description | Latitude and longitude (WGS 84) | UTM (Eastings and Northings) |
|----------------------|---------------------------------|------------------------------|
| Point A | 59°00.131'N, 2°58.547'W | 501392E 6540297N |
| Point B | 59°00.219'N, 2°58.742'W | 501204E 6540461N |
| Point C | 59°00.132'N, 2°58.915'W | 501039E 6540299N |
| Point D | 59°00.042'N, 2°58.716'W | 501229E 6540132N |

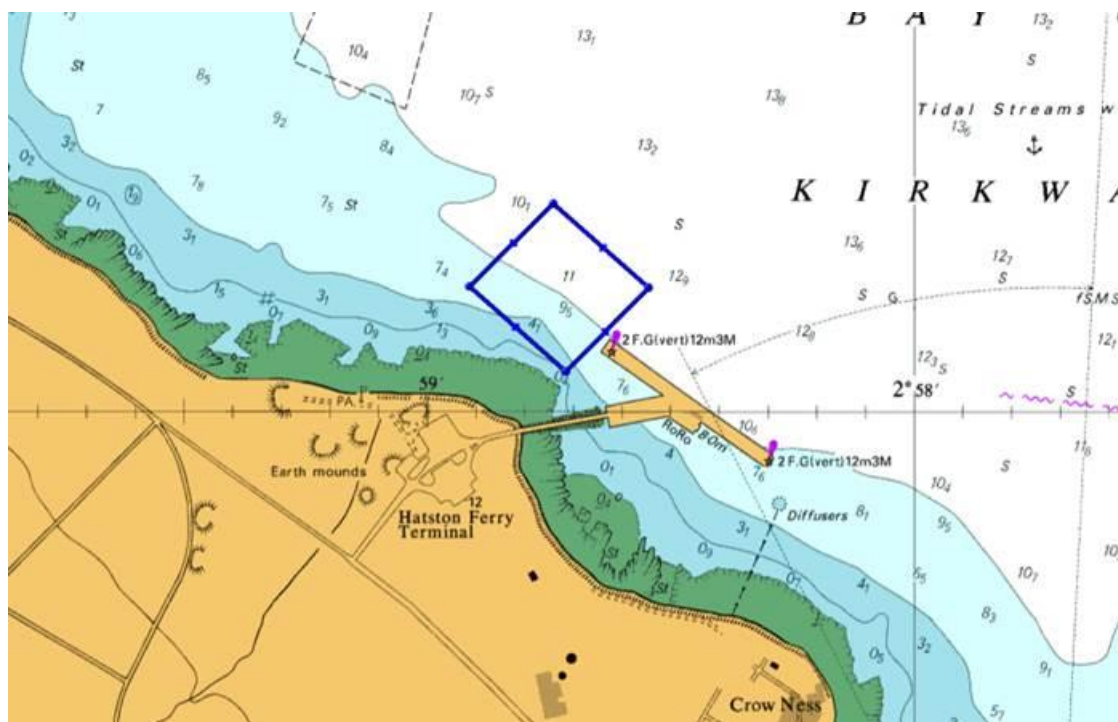


Figure 9. Proposed marine licence boundary (blue outline)

7 Proposed Schedule

The following figure provides an overview of the proposed schedule for the project. A window of three months has been specified for installing the rock anchors. It is planned that the installation period will be a maximum of 3 weeks. There will be no schedule for decommissioning specified due to the length of the licence, however the method of decommissioning will be described in the Decommissioning Programme. A review of the decommissioning schedule will be completed with Marine Scotland closer to the time of decommissioning.

At this stage, there are no plans to use the anchors between installation and decommissioning.

Table 4. Project schedule Gantt

| Project Stage | W1 | W2 | W3 | W4 | W5 |
|-----------------------------------|----|----|----|----|----|
| Vessel and Equipment Mobilisation | | | | | |
| Vessel Mooring Installation | | | | | |
| Drilling Operation | | | | | |
| Post Installation Survey | | | | | |
| Demobilisation | | | | | |

