

ATTACHMENT 3.1 PROPOSED MARITIME USAGE – SCHEDULE OF WORKS

Oriel Wind Farm Project

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Table of contents

1.0	Introduction.....	1
1.1	Project Background.....	1
1.2	Need for the SI Works.....	1
1.3	Purpose of the Report.....	2
1.4	Statement of Authority.....	2
2.0	Proposed Maritime Usage	3
2.1	Site Location	3
2.2	Description of the SI Works.....	5
2.2.1	Overview.....	5
2.2.2	Estimated Project Schedule/ Programme.....	7
2.3	Marine Geophysical Survey	8
2.3.1	Multibeam Echosounder Survey.....	9
2.3.2	Side-Scan Sonar Survey	9
2.3.3	Magnetometer Survey	9
2.3.4	Sub-Bottom Profiling Survey.....	10
2.3.5	Ultra-high Resolution Seismic	10
2.4	Intertidal Geophysical Survey	10
2.4.1	Seismic Refraction.....	11
2.4.2	Ground Penetrating Radar.....	11
2.5	Marine Geotechnical Surveys	11
2.5.1	Rotary Core Boreholes	11
2.5.2	Standard Penetration Tests (SPTs).....	12
2.5.3	Vibrocore/Gravity Core Investigations	12
2.6	Intertidal Geotechnical Survey	13
2.6.1	Trial Pit/Borehole Investigations	13
2.7	Environmental Surveys	13
2.7.1	CPODs.....	13
2.7.2	Water Quality Sampling and Monitoring	13
2.7.3	Subtidal and Intertidal Sampling.....	14
2.7.4	Fish and shellfish surveys.....	14
2.8	Metocean Survey	14
2.8.1	Floating LIDAR	14
2.8.2	Acoustic Doppler Current Profilers	14
2.9	Survey Vessels	15

2.9.1	Offshore Vessels	16
2.9.2	Nearshore Vessel	16
2.9.3	Unmanned Survey Vessels	17
2.9.4	Survey Navigation.....	17
2.10	General Requirements	17
2.10.1	Quality Assurance	17
2.10.2	Operating permits.....	17
2.10.3	Health and Safety.....	17
2.10.4	PSDP/PSCS.....	18
2.10.5	Environmental Protocols	18
2.10.6	Access and egress arrangements.....	19

List of tables

Table 2-1 Overview of Proposed SI Activities	6
Table 2-2 Estimated Project Schedule	8

List of figures

Figure 2-1 Proposed MUL Map	4
Figure 2-2 Intertidal zone access via Legg Lane.....	19

Appendices

Appendix A Drawings

Appendix B Vessel and Equipment Data Sheets

1.0 Introduction

1.1 Project Background

The Oriel Wind Farm Project is a proposed offshore wind farm in the Irish Sea, off the coast of County Louth (approximately 22 km east of Dundalk town centre and 18 km east of Blackrock). The Project will have a maximum export capacity (MEC) of 375 MW and will consist of 25 offshore wind turbine generators (WTGs). The closest wind turbine will be approximately 6 km from the closest shore on the Cooley Peninsula. The offshore cable corridor extends approximately 11 km southwest from the offshore wind farm area to a landfall location south of Dunany Point. From the landfall, the underground onshore cable will connect the offshore wind farm to an onshore substation, located at Stickillin, east of Ardee, which will then connect to the existing National Electricity Grid at this point. The onshore cable route is approximately 20.1 km length and is predominantly routed along public roads. Oriel Windfarm Ltd (hereafter referred to as “the Applicant”) was granted a Maritime Area Consent (MAC) in December 2022 (Ref. MAC No. 2002-MAC 001).

This Maritime Usage Licence Application (MULA) is required to undertake site investigations (hereafter referred to as the SI works), within the MUL Area (defined as the Project planning application boundary below the high-water mark (HWM), plus a 4 km buffer around the offshore wind farm area). The Applicant obtained a Foreshore Licence (reference no. FS006840) in May 2019 for initial surveys in the offshore wind farm area and offshore cable corridor and was granted a further Foreshore Licence (FS007383) to undertake SI works in May 2023. Under these Foreshore Licences the Applicant undertook both intertidal and offshore surveys which informed the commencement of engineering design of the wind farm. The Applicant now intends to undertake further site investigations of the offshore wind farm area and the export cable corridor to investigate the stability of the soil (seabed sediments) for the design of foundations and the detailed routing of the inter array and offshore cable corridor, in addition to environmental surveys. These SI works, which are discussed in more detail in Section 2.0 below, are therefore required to support the detailed wind farm design.

1.2 Need for the SI Works

In response to the climate imperative, the Irish government set a national target of at least 5 GW (i.e. 5,000 MW) of offshore wind energy by 2030 in the Climate Action Plan (CAP) 2024 and reiterated in CAP 2025¹. The CAP 2025 targets 80% renewable electricity in Ireland by 2030. Therefore, the widespread development of offshore wind energy is a vital vehicle for achieving our renewable energy targets. The proposed SI works will support the Project in contributing towards Ireland’s net-zero emissions targets and transition to a low carbon and climate-resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy as underpinned by the Climate Action and Low Carbon Development Act 2015, as amended. The National Marine Planning Framework (NMPF), which is Ireland’s national marine spatial plan published in June 2021, supports offshore renewable energy development, recognising it as a pathway to decarbonisation. The NMPF also includes the target for at least 5 GW of offshore wind energy by 2030. The decarbonisation pathway to 2030 as set out in the Programme for Government ‘Our Shared Future’ also outlines that at least 5 GW of offshore wind is required in the renewable electricity mix by 2030 off Ireland’s eastern and southern coast.

The Oriel Offshore Wind Farm Project will generate up to 0.375 GW / 375 MW of renewable electricity, which represents approximately 6.6% of the 5 GW of offshore wind energy objective. The proposed SI works are critical to informing the design of the Project and therefore contribute towards the achievement of the national targets.

Therefore, this MULA represents a critical step towards meeting Ireland’s current and future energy targets including supporting a more sustainable future.

¹ [Climate Action Plan 2025 updated cover.pdf](#) Accessed July 2026

1.3 Purpose of the Report

The purpose of this document is to provide an overview of the proposed site investigation (SI) works which will be undertaken within the MUL Area and supporting information to accompany an application by the Applicant for a MUL from the Maritime Area Regulatory Authority (MARA).

1.4 Statement of Authority

The technical competence of the authors is outlined below.

Aoife Edgely is an Associate Marine Scientist in the Environmental Services Business Unit in Tetra Tech. She has over 15 years' experience in the marine science field and is a Chartered Environmentalist and a Full Member of the Institute of Environmental Sciences. Aoife holds an honours degree in Environmental Science from Trinity College Dublin and a Masters Degree in Marine Environmental Protection from Bangor University, Wales. Aoife has delivered the environmental assessments for a wide range of marine and coastal projects, including environmental impact assessment, appropriate assessment and Annex IV species reports.

Rachael Shaw is a Project Scientist in the Environmental Services Business Unit in Tetra Tech. She holds a Bachelor's Degree in Marine Science from the University of Galway and Masters Degree in Climate Change and Managing the Marine Environment from Heriot-Watt University Edinburgh. She has five years' experience working in consultancy, assisting on a wide range of projects from offshore renewable energy projects to flood relief schemes, including marine and terrestrial surveys. She is a full member with Institute of Environmental Sciences (IES).

Róisín Murphy is a Scientist in the Environmental Services Business Unit in Tetra Tech. She holds an honours degree in Zoology (B.Sc.) and Masters degree in Marine Biology, both from University College Cork. She has two years' experience as a Project Manager at Cork Nature Network, responsible for marine and river surveys, and one years' experience in marine licensing and flood relief projects within Tetra Tech. She is a qualifying member with IES.

2.0 Proposed Maritime Usage

2.1 Site Location

The SI works boundary is provided in Figure 2-1 will be referred to as the MUL Area throughout the application documents. The MUL Area encompasses an area of 17,013 Ha (170.13 km²).

The SI works will comprise geophysical, geotechnical, environmental and metocean surveys, and the proposed locations of these surveys area shown in Appendix A below. It should be noted that all locations shown are provisional only and subject to change due to evolving project design or due to the presence of obstructions/refusals at individual locations at the time of surveying.

For the avoidance of doubt, no construction works or site preparation works for the future construction works associated with the proposed Oriel Wind Farm Project are included under this MULA.

Oriel Wind Farm Project

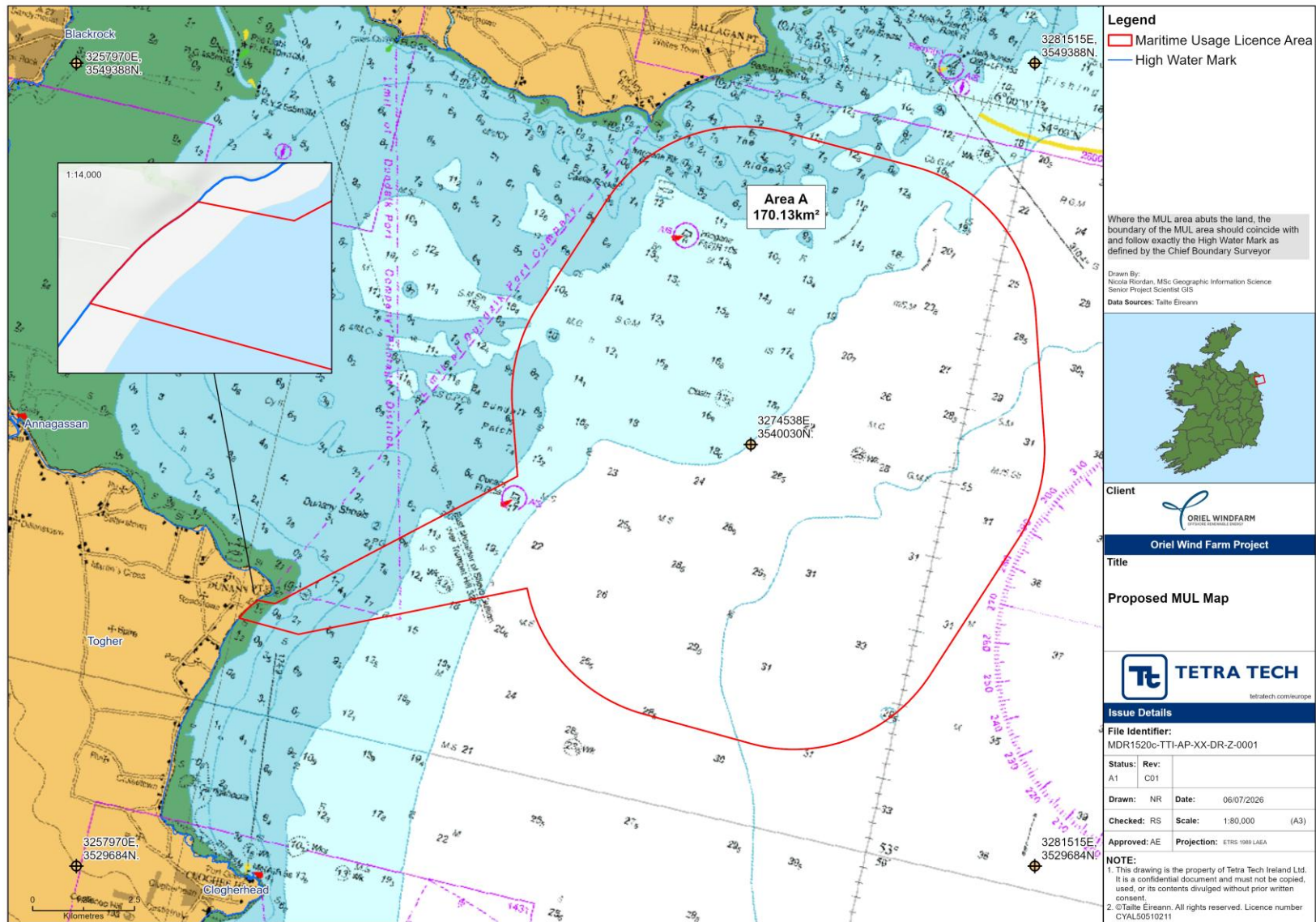


Figure 2-1 Proposed MUL Map

2.2 Description of the SI Works

2.2.1 Overview

The proposed SI works are detailed in Table 2-1 below. The purpose of these SI works is to provide a reliable basis for detailed design of the Project and to undertake further environmental investigations. The aim of the SI works is to acquire data to a high quality and specification for the site as summarised below and described in the following sections.

The Applicant is seeking a MUL for a period of five years from the date of the granting of the licence.

The proposed SI works will build on the existing detailed knowledge of the site which was gained under previous SI works under foreshore licences (FS006840, awarded 10th May 2019 for two years and FS007383, awarded 17th May 2023 for three years). The proposed activities within the MUL Area are planned to take place across phases. Geophysical and geotechnical surveys and investigations will be sequential with the results of the geophysical campaign and previous geophysical data used to inform the geotechnical campaign. The remaining surveys and investigations (e.g., environmental, metocean etc.) can take place at any time during the operational period of the MUL.

It should be noted that the geophysical and geotechnical campaigns may be further sub-divided depending on the availability of suitable vessels and equipment and the location of the surveys, e.g. intertidal, nearshore and offshore areas. Therefore, geophysical and geotechnical investigations in some areas may be completed in advance of geophysical and geotechnical activities in other areas.

Environmental surveys will be undertaken within the MUL Area to provide further information on the baseline conditions. Depending on the specific requirements of these surveys and logistics, they may be undertaken simultaneously with and/or independently from the geophysical and geotechnical campaigns.

Proposed SI locations are provided in Appendix A. These proposed locations are subject to refinement based on the results of the geophysical and environmental surveys, informed by previous and current survey campaigns, e.g. avoidance of a potentially sensitive habitat. Similarly, a location may be moved due to the presence of obstructions/refusals at individual locations, i.e. where a physical object, e.g. a subsurface boulder, prevents the borehole, cone penetration testing (CPT), etc., from reaching its target depth. In such circumstances, the borehole will be moved to another nearby location away from the obstruction and drilled again to the target depth.

Following the assessment of the results of the SI works, it may be necessary to undertake further SI works in particular areas within the MUL Area, e.g., along routes for the export cable corridor and approaches to the landfall. The proposed SI works, including the quantities detailed and assessed in this MULA, include contingencies to cover any follow up investigations that may be undertaken at refined locations.

An overview of SI works is presented below in Table 2-1, followed by a more detailed breakdown of the proposed survey elements.

Table 2-1 Overview of Proposed SI Activities

Survey Type	Survey Elements (indicative equipment)	Indicative Equipment (where applicable)	Maximum Quantity (where relevant)
Marine Geophysical Surveys (undertaken from survey vessel)	Multi beam echosounder (MBES)	Kongsberg EM series, Kongsberg Geoswath series, R2 Sonic series & Reson Teledyne Seabat series	N/A
	Side scan sonar (SSS)	Edgetech FS-4200 series, C-Max CM2 series and Klein System 3900-5000	
	Sub-bottom profiler (SBP) - parametric	Innomar smart, quattro (QBM) sixpack (HBM), Innomar SES 2000 compact light, Innomar standard quattro (DBM) sixpack (DBM), Innomar medium 100	
	SBP – Chirper/Pinger	Kongsberg Geopulse, Edgetech 424/512, Knudsen 3202, Klein K-Chirp	
	2D/3D Ultra-high-resolution seismic (UHRS)	Suitable Sparker / Boomer up to 1000 joules.	
	Magnetometer	G-882 Marine Magnetometer	
	Ultra short baseline (USBL) positioning system	Edgetech BATS, ORE offshore trackpoint, Sonardyne Fusion/Ranger/Scout, IxBlue GAPS, Kongberg HiPAP	
Intertidal Geophysical (land-based below HWM)	Seismic Refraction	Geophone Arrays: – Geosense 4.5 Hz Geophones; – Mark Products L-28LB Geophone; – Geospace GS-11D Geophone; or similar Digital Seismographs – Geometrics Geode Seismograph, – Seistronix RAS-24; – ABEM Terraloc Pro; or similar	N/A
	Ground Penetrating Radar (GPR)	IDS GeoRadar Stream DP GPR System Leica DS2000 GPR System; or similar.	
Marine Geotechnical Surveys	Vibrocore/gravity coring	Drill rig and JUB/drilling vessel	41
	Rotary core boreholes	Geobor-S	78

Survey Type	Survey Elements (indicative equipment)	Indicative Equipment (where applicable)	Maximum Quantity (where relevant)
(undertaken from survey vessel(s)/jack-up barge (JUB))	Cone penetration testing (CPT) and standard penetration testing (SPT) at borehole locations	Push sampler/rotary core, hammer sampler	60
Intertidal Geotechnical surveys (land-based below HWM)	Trial pit/borehole	Bobcat, backhoe or excavator Drill rig and JUB / drilling vessel	6 boreholes (max. depth 10m) 12 trial pits (max. depth 5m, 2m ² in plan)
Environmental Surveys (undertaken from survey vessel(s))	Marine mammal static acoustic monitoring (SAM)	CPODs/FPODs (incl. heavy weight mooring blocks of c. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy).	12
	Water quality samples	Sondes (incl. surface or seabed buoy) Niskin bottle	12
	Grab sampling	Mini Hammond grab or Van Veen grab (0.1m ²)	60
	Fish and shellfish surveys	Sondes (incl. surface or seabed buoy) Potting and trawl survey	6 12 locations
Intertidal Environmental Surveys	Quadrat and dig over surveys	Refer to section 2.7.3	12
Metocean Survey (deployed by vessel and moored to seabed)	Metocean buoy	Refer to section 2.8.1	1 (for 12-month period)
	Acoustic doppler current profiler (ADCP)	Refer to section 2.8.2.	8

2.2.2 Estimated Project Schedule/ Programme

The Applicant proposes a SI works schedule that will be phased over a five-year period. The intention is to begin the SI works as soon as feasible following license award, with a phased programme of investigations, capitalising on suitable weather windows and vessel availability over this time period. This phased approach will progress the overall development towards detailed design stage. The exact survey schedule is dependent on the availability of the supply chain and therefore exact timelines for the surveys cannot be determined in advance of securing a MUL.

The exact dates for the surveys are to be determined pending the appointment of survey contractors but based on the estimated scope of works to be conducted the likely timeframe for each project phase has been estimated in Table 2-2 below. Contingencies have been built into the quantities to allow for future SI works

within the MUL five-year period as more information becomes available. The estimated timeframes are subject to change based on variables such as weather conditions, unforeseen seabed conditions, unforeseen obstructions, vessel availability etc.

Geophysical site-specific surveys were conducted for the Oriel Wind Farm Project in 2019 and 2022 and information is available to inform geotechnical investigations. Geophysical surveys are also proposed under this MUL.

Mobilisation location will be dependent on the survey contractor, who may choose to mobilise from their home port, port of previous job or local port. The local port options for mobilisation, for example, could include Dundalk Port or Dublin Port depending on vessel size and marine traffic restrictions.

The SI survey works will be carried out on a 24-hour and 7 days per week basis, subject to sea state and tidal conditions, except for environmental surveys, which are expected to take place during daylight hours.

Table 2-2 Estimated Project Schedule

	Year 1 (2027)				Year 2 (2028)				Year 3 (2029)				Year 4 (2030)				Year 5 (2031)			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Geotechnical (Marine and Intertidal)																				
Geophysical (Marine and Intertidal)																				
Marine and Intertidal Environmental Surveys																				
Metoccean																				

2.3 Marine Geophysical Survey

The purpose of the geophysical survey is to characterise the seabed and sub-surface geology and geotechnical parameters within the survey area in order to supplement the information gathered in the 2019 and 2022 site-specific geophysical surveys and previous INFOMAR surveys of the site. This additional data will be used to better understand the surface and sub-surface structure and stratigraphy, including seabed sedimentation, morphology and mobility and sub-surface stratigraphy and geohazards. This will support the wind farm design, inter-array and offshore cable corridor and determine the design and installation methodology.

The objectives of the geophysical survey are to:

- Produce detailed bathymetric mapping;
- Obtain detailed seabed features, morphology and sediment;
- Obtain detailed sub-surface structure and stratigraphy;
- Acquire both shallow and deep geological cross-sections of the wind farm site; and
- Support cable design and installation including cable routing.

The geophysical survey will include bathymetric, SSS, magnetometry and seismic sounding of the proposed site. Details of the exact survey equipment will be made available prior to commencement of the works; however, it is envisaged that the geophysical data acquisition will involve the following acoustic-based techniques:

- Multi beam echosounder (MBES) system for detailed bathymetric mapping;

- Side scan sonar (SSS) for detailed seabed sediment and morphological mapping;
- Magnetometer for detecting geomorphological anomalies and ferrous objects;
- Sub-bottom profiling (SBP), both single and multi-sourcings, to identify and characterise the layers of sediment/rock underneath the seafloor along the cable route corridors;
- Ultra-high-resolution seismic (UHRs) to identify and characterise the layers of sediment/rock underneath the seafloor within the windfarm site; and
- Intertidal geophysical surveys including seismic, electrical resistivity and electromagnetic methods.

An ultra-short baseline (USBL) positioning system will be utilised where required to monitor the position of towed equipment. The USBL system consists of a multi-element transducer mounted on the hull of the vessel and a transponder attached to the towed equipment (e.g. SSS). Triangulation is achieved using acoustic signals transmitted and detected at regular intervals from which bearing, depth and distance can be calculated. The USBL is coincident with towfish surveys (e.g. SSS, magnetometer).

USBL equipment is widely used by offshore commercial and research vessels where positional accuracy of towed survey equipment is critical. The emitted pulses will be short pulse width 'pings', approximately in the range of 20-35kHz and with a source level of up to ~200dB re 1µPa @1m (peak).

The geophysical survey will comprise transects with a total length of circa 84 km and a line spacing distance from tens of metres up to 1km between each transect. The seismic source will detect the geological strata to a depth of 40 m below the seabed (bsb).

A suitably qualified archaeologist will review the geophysical survey outputs for anomalies. The findings will be compiled and presented in an archaeological assessment report. Where deemed necessary by the project archaeologist and as agreed with the National Monuments Service (NMS), an archaeologist/ geoarchaeologist may be required to be present during geotechnical investigations, to take samples for archaeological inspection. Samples will be removed from the investigation location, properly stored and transported from site for more detailed assessment and appraisal.

2.3.1 Multibeam Echosounder Survey

The MBES system will be used to provide detailed bathymetric mapping throughout the survey area. An MBES is a type of sonar (acoustic surveying) used in seabed mapping wherein acoustic waves are used to indicate depth-to-seabed. The device is typically affixed to a vessel's hull or towed in its wake. The process is non-intrusive, and the device will not make contact with the seabed at any point. The Norbit Winghead B51S is an indicative example of a MBES system to be used in the completion of these works and a datasheet for this echosounder is included in Appendix B. The equipment will operate at a nominal frequency of 400kHz.

2.3.2 Side-Scan Sonar Survey

The SSS will be used to achieve detailed seabed morphology and seafloor mapping of the survey area. The survey is carried out using a sonar device attached to a vessel that emits fan-shaped pulses down towards the sea floor across a wide-angle perpendicular to the path of the sensor through the water. The intensity of the acoustic reflections from the seafloor of this fan shaped beam is recorded in a series of cross-track slices.

When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath (coverage width) of the beam. The equipment will operate within a frequency range of 100-500kHz with source levels at 235dB Lpk re 1µPa at 1 metre range. The Edgetech FS-4200 series, Klein System 3900 or similar is an indicative example.

2.3.3 Magnetometer Survey

A magnetometer detects ferrous objects and as such is used to locate and identify ferrous objects on or buried in the seabed within the range of the magnetometer. The device precisely measures the earth's magnetic field

and detects any anomalies, which represent ferrous objects such as lost anchors, sunken ships and buried pipes. The magnetometer is typically towed behind a survey vessel or affixed to a vessel's hull. The process is non-intrusive, and the device will not make any physical contact with the seabed at any point. The G-882 Marine Magnetometer is an indicative example and datasheet for this device is included in Appendix B.

2.3.4 Sub-Bottom Profiling Survey

This device uses reflection seismology to give a 2D image of the sub-seabed geology. It is typically towed behind the vessel during survey works or affixed to the vessel's hull. The process is non-intrusive, and the device will not make any physical contact with the seabed at any point.

The Innomar SES-2000 Quattro Parametric SBP is an indicative example of a parametric type SBP while a Kongsberg Geopulse or Edgetech 424 is an indicative example of a chirper/pinger type SBP and the datasheet for this device is included in Appendix B. The shallow SBP system will be used within the cable route corridor and will have the following general specifications:

- A vertical resolution better than 0.2 metres; and
- Penetration of at least 5 metres.

The profiler will be supplied with the following recorders and peripheral processing equipment:

- Fire control unit;
- Time varied gain;
- Swell filter; and
- Bandpass or Time Varying Filters (TVF).

2.3.5 Ultra-high Resolution Seismic

Commonly used variants of this technology are known as "Sparkers" and "Boomers". It will have the following characteristics as a minimum:

- Repeatable source;
- Main output at frequencies between 1kHz and 5kHz;
- Broadband width in excess of 2.5kHz at -10dB;
- Vertical resolution better than 0.5 metres;
- Penetration of at least 50 metres; and
- Variable energy levels 100-1000 joules;

One or more hydrophone streamers will be supplied. The streamer will be neutrally buoyant or controlled, well maintained and free of air bubbles. The hydrophone will have a response appropriate to the source used but will generally have a flat response between 500Hz and 10kHz. The streamer will have at least 100 channels and be at least 100m long. A tail buoy with a radar reflector will be used to mark the streamer.

The survey may be conducted in either a 2D (single streamer) or 3D (dual streamer) format.

2.4 Intertidal Geophysical Survey

Conventional land-based geophysical surveys will be undertaken below the HWM. These surveys will include seismic refraction and ground penetrating radar (GPR). Those elements of the land-based survey that occur within the MUL Area are activities included in this MULA. This MULA is not seeking a licence for any land-based works which will take place outside of the maritime area.

Where required, prior to intrusive surveys in the intertidal zone, a suitably qualified archaeologist will undertake a walkover inspection of the intertidal area at low tide, during daylight hours. The inspection will include the use of handheld metal-detectors, photographic survey and drone survey, where applicable. Investigations involving handheld metal-detectors will include a series of transects at 10 m intervals across the accessible intertidal area. Where deemed necessary by the project archaeologist, and as agreed through consultation with the NMS, an archaeologist/ geoarchaeologist may be required to be present at the location of geotechnical investigations, to take samples for archaeological inspection. Samples may be removed from the investigation location, properly stored and transported from site for more detailed assessment and appraisal.

2.4.1 Seismic Refraction

The seismic refraction method utilises the refraction of seismic waves as they pass through various rock or soil layers to analyse underground geological conditions and structures.

Seismic refraction profiles will be conducted using onshore survey tools during low tide in the intertidal zone. A sound source (typically a sledgehammer striking a metal plate) will generate compressional wave energy. These refracted waves will be captured by a series of geophones and logged on a digital seismograph. The locations and elevations of the geophones will be documented using Global Positioning System (GPS) technology.

Indicative Equipment:

- Geophone Arrays:
 - Geosense 4.5 Hz Geophones;
 - Mark Products L-28LB Geophone;
 - Geospace GS-11D Geophone; or similar.
- Digital Seismographs:
 - Geometrics Geode Seismograph,
 - Seistronix RAS-24;
 - ABEM Terraloc Pro; or similar.

2.4.2 Ground Penetrating Radar

GPR utilises the reflection of electromagnetic waves as they are returned by rock or soil layers to analyse underground geological conditions and structures.

GPR will be completed during low tide in the intertidal zone. A GPR trolley will be pushed over the area to be scanned and the results analysed by a technician to determine subsurface characteristics. Indicative equipment such as the IDS GeoRadar Stream Dynamic Positioning (DP) GPR System, Leica DS2000 GPR System or similar will be utilised.

2.5 Marine Geotechnical Surveys

The purpose of the geotechnical survey is to provide relevant information about the stability of the soil to a depth below which possible existence of weak formations will not influence the safety or performance of the wind turbine and its support structure.

The geotechnical survey will include 26 no. deep investigation locations (boreholes) and 41 no. shallow investigation locations (vibrocores).

2.5.1 Rotary Core Boreholes

Deep investigations will be carried out at 26 proposed structure locations (25 wind turbine locations and one offshore substation location). Each deep investigation location may require up to 3 drilled boreholes with a target depth of 40 m bsb. Thus, up to 78 geotechnical boreholes may be drilled. See Appendix A for proposed borehole location.

The equipment used to drill the boreholes will follow the ISO and API technical specifications for drilling equipment and at a minimum will have:

- A heave motion compensator system on board (seabed frame and/or drill string) with a minimum heave compensation of 1.5m;
- Capability of mud production to different densities (when mud production is required for the works). The mud shall be water or bio-degradable organic polymer.

A detailed description of the soil types, and the in situ geotechnical properties determined for the boreholes will be recorded in the boring log to characterise the strata.

Coring and sampling will be done in general accordance with EN ISO22475-1 Geotechnical Investigation and Testing. Rotary coring equipment, such as Geobor-S is expected to be utilised.

In situ testing will include the option of either down-hole wireline piezocone penetration testing (PCPT) associated to PS logging or down-hole wireline seismic cone penetration testing (SCPT) over full length of borehole.

The boreholes are to be advanced by alternating PCPT/SCPT and push/core sampling; requirements will depend on the material type encountered. Within a granular deposit, the boreholes are to be advanced by alternating PCPT/SCPT and push sample. Where the sample recovery is poor using the push sampler, a hammer sampler will be used instead. Blow counts measured during hammer sampling will be recorded and presented on the Borehole Logs.

Within the cohesive deposits, the boreholes are to be advanced by PCPT/SCPT followed by two push samples (repeat cycle). Rotary coring may be used instead of push sampling in suitable materials, in which case the CPT and cores will be alternated.

The samples/cores will be recovered in liners or in Shelby tubes for all soil types and the appropriate technique will be selected to minimise soil disturbance and maximize recovery.

SCPT tests will be executed at a minimum of four of the locations, which will be confirmed in consultation with geophysical survey results. Two seismic measurements will be carried out during each SCPT stroke at a depth interval of 1m; the envisaged volume is 40-60 SCPT tests in total.

2.5.2 Standard Penetration Tests (SPTs)

SI works will include Standard Penetration Tests (SPTs) using a 50mm split spoon sampler and occasional jacking operations to deploy, stabilise, or demobilise the drill barge and associated equipment. Both SPTs and jacking of barge piles generate noise and low-frequency vibration including hammer impacts during SPTs and hydraulic jacking or driving systems used to set or adjust the position of the JUB.

2.5.3 Vibrocore/Gravity Core Investigations

The inter-array cable routes and offshore cable corridor will be surveyed with up to 41 vibrocores/gravity cores within the inter-array area and offshore cable corridor. The cores will be carried out along the line of the cable routes, which are still to be defined. See Appendix A for proposed vibrocore/gravity core locations.

Vibrocoreing will be performed where cohesionless soil is expected. The rig will be fitted with a PVC liner, core catcher and cutting shoe. The vibrocorer will be lowered onto the seabed, position and depth will be noted, after which the vibrocoreing process will start. Upon refusal or at the target depth, the stop condition will be recorded and the vibrocorer will be recovered on deck where the recovery rate will be measured. If required, a core catcher will be used to prevent the sample dropping out of the PVC liner.

All cores will be examined and tested offshore before any sealing of the sample. Soil found in the vibrocoring shoe will be stored in a bag.

Gravity coring (wireline self-weight penetration sampler) will be performed where cohesive soil is expected. The rig will be equipped with a PVC liner. The gravity corer will be lowered on the seabed and penetrates in the seabed under its own weight. Upon refusal or at target depth, the gravity core will be recovered on deck where the recovery rate will be measured.

All cores will be examined and tested offshore before any sealing of samples.

2.6 Intertidal Geotechnical Survey

2.6.1 Trial Pit/Borehole Investigations

Trial pits will be excavated across intertidal locations (below the HWM) along the proposed offshore cable corridor. Trial pits will be excavated, logged, backfilled and reinstated during a single tidal cycle. Excavated material will be temporarily stored and replaced following the sequence in which it was removed. Subject to access and anticipated ground conditions trial pits will be excavated manually or using a mechanical backhoe. Existing land access routes to investigation locations will be used to the extent practicable.

Up to 12 no. trial pit investigation locations are proposed in the intertidal area. Trial pits will be excavated to a depth of up to 5 m and will be 2 m² in plan. Up to 6 boreholes will be drilled in the intertidal area using a drilling rig with a target depth of up to 10m. All excavated locations to be backfilled immediately on completion of the investigation. Cores and CPTs may be taken from the boreholes or trial pits.

2.7 Environmental Surveys

The purpose of the environmental surveys is to update the baseline data collected from earlier environmental surveys and to ensure that the environmental data for the Project remains up to date. The proposed surveys are set out in the following sections.

2.7.1 CPODs

It is proposed to deploy up to twelve (12) FPOD or CPOD devices for static acoustic monitoring (SAM) of cetaceans. The devices will provide acoustic assessment of the presence/absence and species types of cetaceans (whales and dolphins) to i) allow for the recording species difficult to detect visually such as harbour porpoise, ii) provide data on other factors such as diel and tidal presence at the site and iii) to create a dataset with which to determine any effects of future construction or operation of a windfarm at a resolution which is relevant to managers.

A FPOD or CPOD is a self-contained computer and hydrophone in a sealed sonde approximately 1m in length. The FPOD or CPOD can log the times and duration of click trains which resemble the echo-location clicks produced by porpoises and dolphins. SAM is independent of weather conditions once deployed and thus ensures high quality data is collected. Data collection will be at a small spatial scale (typical detection distances of 250m (porpoises) to 800m (dolphins)). Each FPOD or CPOD will have a robust, heavy weight mooring blocks of c. 250kg, clump chain and rope with either an acoustic release mechanism and benthic buoy or a robust mooring with a surface marker buoy. Batteries will be replaced and data downloaded every 3/4 months. Deployment and servicing will be undertaken from a survey vessel.

2.7.2 Water Quality Sampling and Monitoring

It is proposed to sample water quality at different depths and locations throughout the offshore wind farm area. A Niskin bottle (or similar) will be used to obtain a sufficient sample of water at the surface (< 1m depth) and a

second sample just above the seabed (~1m) for the subsequent chemical analysis. This will be lowered and retrieved from a survey vessel.

It is proposed to deploy up to 12 sondes for water quality monitoring through the water column – these will be used to monitor a range of parameters including turbidity, salinity, temperature, pH, dissolved oxygen and electrical conductivity. Sondes will be either suspended from a surface marker buoy or a benthic buoy with acoustic release at a range of depths dependent on survey requirements. Each buoy will have a robust mooring on the seabed similar to the CPOD mooring described above.

2.7.3 Subtidal and Intertidal Sampling

Subtidal surveys will comprise drop down video (DDV) and/or remote operated vehicle (ROV) inspection and the taking of grab samples as required in order to identify benthic habitats and sediment characteristics. DDV/ROV activity will be passive and non-intrusive and will not interact with the seabed.

At locations determined suitable for grab sampling effort by the DDV analysis or geophysical data review, a 0.1 m² Day grab, mini-Hamon or Van Veen grab will be deployed from a suitable vessel to collect sediment samples. Each sample will be 1-5kg in mass. Up to 60 grab samples will be collected within the offshore wind farm area and along the offshore cable corridor.

A walkover transect survey will be undertaken. Quadrat sampling and manual digging will be undertaken by hand at 12 locations in the intertidal zone to collect sediment samples. Samples will be analysed to determine the benthic faunal community present and sediment geochemistry.

2.7.4 Fish and shellfish surveys

Up to 6 sondes will be deployed for the tracking of fish or shellfish within the wind farm and export cable corridor. Similar to the CPODs and water quality sondes, these sondes for the tracking of fish or shellfish will be attached to a robust mooring with either a benthic buoy and acoustic release and/or a surface marker buoy.

A potting survey and trawl survey will be conducted. Surveys will be designed to undertake investigative sampling. Indicatively it may include twelve locations for potting and trawl surveys within the proposed offshore wind farm area and/or along the proposed offshore cable corridor. The surveys may be conducted over several weeks.

2.8 Metocean Survey

The purpose of the metocean survey is to obtain site specific atmospheric, wave and wind data over a minimum period of 12 months. All metocean survey works will occur at one location within the marine survey area. The location will be determined following the appointment of a contractor.

2.8.1 Floating LIDAR

The data will be collected via a floating weather station, which will include a wave rider and a wind measurement LiDAR current profiler. The wave rider will be used to collect wave height and current data across the site, while the LiDAR system will be used to measure the wind characteristics within the site. This equipment will be mounted on specifically designed floating buoys which are moored to the seabed using an anchor chain and clump weights. All equipment including the moorings will be removed following completion of the survey.

2.8.2 Acoustic Doppler Current Profilers

Up to eight Acoustic Doppler Current Profilers (ADCPs) will be moored to the seabed using an anchor chain and clump weights at varying heights above the seabed. These will be periodically recovered by either

acoustic release systems or surface buoys. All equipment including the moorings will be removed following completion of the survey.

An ADCP is a hydroacoustic current meter similar to a sonar, used to measure water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. ADCP units containing both wave and current sensors, and turbidity and total suspended solids sensors will be deployed for no less than one continuous year with a maximum deployment period of up to 36 months at each location (servicing is anticipated every 12 weeks in order to replace ADCP batteries).

2.9 Survey Vessels

The proposed marine survey works will be carried out by dedicated marine vessels, suitable for the scope of the work required, the water depth and the anticipated conditions of the survey area and the transit routes. The exact equipment to be used will be confirmed following a tender process to procure the site investigation contractor.

Separate survey vessels will be used for each activity and are outlined in the following sections. A larger vessel or jack-up barge (JUB) will be required to complete the offshore geotechnical works with smaller vessels for the geophysical, metocean and ecological surveys. A smaller Rigid Hulled Inflatable Boat (RHIB) type vessel may be used for works in shallow waters. Unmanned survey vessels (USVs) may be used for geophysical surveys across the site. USVs will be fully licenced to operate in Irish waters. Up to three vessels may be required to operate concurrently in the MUL Area under coordinated simultaneous operations (SIMOPS). This will allow for flexibility to conduct proposed geotechnical and geophysical works within the MUL Area to ensure that the Applicant can act on available weather windows and sub-contractor availability. Land based drilling and excavators will be used for the investigations and surveys within the intertidal zone. The types of vessels proposed to be employed are described in the sections below.

These vessels will be comparable and of a similar size to those typically used in the industry for carrying out similar technical work and will possess all relevant classification certificates.

The vessels will conform to the following minimum requirements as appropriate:

1. Station-keeping and sea keeping capabilities required by the specified work at the proposed time of year; the appointed contractor may provide supplemental tug assistance if such assistance benefits the operation;
2. Endurance (e.g. fuel, water, stores, etc.) to undertake the required survey works;
3. Staffing to allow all planned work to be carried out as a continuous operation (on a 24 hour per day basis for the offshore activities and on a 12 hour per day basis for the inshore activities);
4. Equipment and spares with necessary tools for all specified works;
5. Appropriate accommodation and messing facilities on board; and
6. Adequate soil laboratory testing facility, as required.

The vessels used for the offshore surveys will be sound and capable of remaining safely at sea for a minimum of 30 days under weather conditions typically encountered in the MUL Area at the time of year that the operations are to take place. The appointed contractor will be responsible for all shipboard systems and equipment calibration and re-calibration, including spares. For every 30 days of operations the vessels will accrue at least one day of maintenance time.

Vessels will have breadth and draft of suitable proportions to provide adequate stability for the duration of the intended operation. The vessels will be capable of passage speeds in excess of 10 knots and extended survey operations at speeds 4 knots or less.

In addition to AIS-A and Active Radar Enhancing Systems, the manned vessels will have the following communications equipment as a minimum:

- Multi-channel VHF and HF radio capable of working at all marine frequencies and with a dual watch facility;
- Mobile phone;
- Hand-held radios;
- Frame and winch for the deployment of equipment and sensors, sized for the required equipment/sensors loads and pulling force. The winch speed and size must be compatible with planned surveys;
- Gyro-compass;
- SATCOM (satellite communication) facilities (phone/fax and e-mail); and
- Two independent Differential Global Positioning Systems (DGPS), a primary and secondary system (DGPS has a greater degree of accuracy than GPS).

All drilling survey vessels and marine support vessels will conform to the relevant ISO (International Organization for Standardization) and API (American Petroleum Institute) technical specifications for drilling equipment.

2.9.1 Offshore Vessels

The survey vessels used for offshore works will be either a JUB and/or a DP vessel configuration. Typical examples of the types of vessels used to undertake these works are provided in Appendix B.

JUBs utilise a fixed anchoring system in order to maintain the required position within the site. The vessel consists of a self-elevating platform and several “legs”, which are deployed to the ocean floor mooring the vessel in place.

The survey works are carried out from the self-elevating platform, which is raised above the water’s surface. If used, the JUB will meet with the following minimum requirements:

- The vessel will have at least four mooring points;
- The self-elevating platform must be permanently manned (i.e. off-shift personnel to stay onboard even if the accommodation is not a permanent equipment of the JUB);
- The platform must be provided with a class certificate verifying the provision of adequate safety equipment for the type of vessel and the number of on-board personnel; and
- The platform should be certified in compliance with the MODU Code and the BWEA guideline.

DP vessels maintain station through thruster and propeller systems which use satellite DGPS signals, allowing the vessels to be positioned over any point on the seabed and maintain position without employing a fixed anchoring system. Using thrusters or propellers, a DP vessel can maintain position within a 2m to 0.5m window depending on the sea state/weather conditions and available power. The vessel may also transit under DP control along a given pre-determined path.

If used, a DP vessel will meet the following minimum requirements:

- The vessel must be fully equipped with a Class II DP system as a minimum; and
- Two DP certified operators with the necessary experience must be members of the crew.

The offshore works will be carried out on a 24-hour shift basis, with personnel working two 12-hour shifts. This will allow the works to be continuous. If the survey works are delayed through weather constraints or other matters then a second vessel may be used to ensure that the works are completed within the required time period. Full assessment of all SIMOPS will be carried out if a second vessel is used.

2.9.2 Nearshore Vessel

The smaller, nearshore vessel e.g., rib, will be used in locations where the water depth is too shallow for the larger, offshore vessel to carry out the works. This vessel does not need to have a dynamic positioning system, however, must have full DGPS capability. The vessel is usually held on station by joy-stick control and will deploy an anchor to assist in maintaining station (depending on sea state and weather conditions). The smaller vessel will use similar equipment to the larger vessel to carry out the required survey works.

2.9.3 Unmanned Survey Vessels

An USV may be used. The vessel would not carry any surveyors on board and would be controlled from the land. The USV would be escorted out to the survey area with a manned vessel and a pre-watch MMO survey completed prior to commencement of the survey.

Typical examples of vessels used to carry out this work are included in Appendix B.

2.9.4 Survey Navigation

All navigation equipment and instrumentation will be calibrated and used correctly. Calibration and/or verification will be repeated in the event of any equipment malfunction, which may nullify earlier calibrations and/or verifications.

Qualified surveyors will be used to operate the navigation and positioning equipment continuously throughout the survey while maintaining a continuous log of all navigation activities throughout the survey.

Sufficient survey and positioning spares and consumables will be provided to enable the survey to be completed without any degradation of navigation and positioning quality and effectiveness and without the need to return to port to acquire additional equipment.

2.10 General Requirements

2.10.1 Quality Assurance

The marine survey Contractor will:

- Operate Quality and Environmental Management Systems (EMS) based on and conforming to ISO9001:2008;
- Provide a Quality Management Plan (QMP) to Oriel for all the marine operations; and
- Provide operational procedures to Oriel for all the marine operations.

2.10.2 Operating permits

The marine survey Contractor will obtain and comply with all necessary marine operational permits including routine and customary vessel/crew/equipment clearances from Customs Agencies, Port Authorities, Marine Survey Office (MSO), etc.

2.10.3 Health and Safety

Health, Safety and Environmental protection will be given foremost consideration in the execution of the work and will be promoted in a proactive and highly visible manner throughout the workforce. The marine survey Contractor will operate International Safety Management (ISM) and Health Environmental and Safety (HES) systems based on legislation relevant to the proposed activities. The marine survey Contractor will have an overall Health, Safety, Security and Environmental (HSSE) plan for each stage of all marine operations. The plan will cover all parties and operations.

The Applicant's Health and Safety Protocols will be followed by both survey and ship's crew. Care will be taken to maintain contact with fishing vessels operating within the area of operations. The Applicant will not knowingly damage or interfere with the property of any fishers while carrying out SI activities. The contractor will ensure notifications of the intended work and timelines are posted in the relevant press well ahead of schedule and a fisheries liaison officer (FLO) will be employed.

All vessels will operate under a certificated Safety Management System (SMS) that provides policies, procedures, and a framework for continuous improvement to ensure the safety of personnel onboard.

2.10.4 PSDP/PSCS

The appointed contractor will designate a competent Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) under the relevant legislation. Method Statements and Risk Assessments will be prepared prior to any works commencing.

2.10.5 Environmental Protocols

The Applicant will implement a number of industry standard environmental protocols to address potential environmental impacts during the survey works.

Environmental factors will be taken into account in all decisions during the survey campaign. Environmental efforts will be preventative and where required as a condition of permitting, the Contractor shall conform and comply with the obligations of an appropriate Environmental Management Plan (EMP) and the conditions of the MUL relating to environmental protection.

All vessels will comply with the latest International Maritime Organization (IMO) and Safety of Life at Sea (SOLAS) and environmental requirements for their classification and with any national requirement of the territorial or continental / EEZ waters to be operated in. All vessels be operated and comply with the requirements of the Marine Co-ordination Management System operated by the Applicant for all its offshore wind farm project sites. This system includes the vetting and tracking of all vessels and personnel working offshore.

The appointed contractor will take particular care when handling or storing hazardous materials, radiation sources and chemicals. All storage and handling must be carried out in accordance with the Dangerous Substances Act (1972) and supporting regulations, appropriate safety precautions must be taken, and safety clothing must be worn as necessary. Liquid or non-liquid pollutants or waste material will not be dumped, thrown or otherwise disposed of into the sea. All refuse and materials will be kept onboard the vessel and safely disposed of onshore according to the MARPOL (International Convention for the Prevention of Pollution from Ships) convention. All substances handled and/or used whilst undertaking the works will be handled, used, stored and documented in compliance with the Dangerous Substances Act 1972 as amended and relevant supporting Regulations. The works will also be carried out in accordance with assessments and recommendations of international best practice including the UK Control of Substances Hazardous to Health (COSHH) Regulations 1994. Where Fuels, Oils and Lubricants are required to be stowed on boats, suitable containers will be used and stowed to allow ventilation and safe dissipation of any accidental leaked gas and retention of any leaked liquid. No liquid will be discharged into the water at any stage of the work on site. No smoking will be permitted in the vicinity of fuel in storage or when in use.

All geophysical survey works that involve the use of acoustic instrumentation will follow the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (2014) (as outlined in Section 6.1.2 of Attachment 4.3 - Natura Impact Statement (Report ref: MDR1520C-TTI-00-XX-RP-Z-0004)). Although published in 2014, this guidance remains relevant in Ireland and is listed by NPWS as best-practice guidance² and it provides the mitigation framework used in underwater-noise risk assessments in Ireland to date. This makes it directly applicable to the SI works, particularly geophysical and geotechnical surveys.

² [Underwater sound guidance Jan 2014.pdf](#) accessed July 2026

Furthermore, the risk minimisation measures proposed in this guidance remain appropriate today as these measures continue to be recommended as mitigation by marine mammal experts.

Measures to be implemented include but are not limited to

- A qualified and experienced marine mammal observer (MMO) shall be appointed to monitor for marine mammals and to log all relevant events using standardised data forms;
- Pre-start monitoring: If marine mammal species are detected within 500m distance of the sound source, seismic survey shall not commence;
- Periods of peak sensitivity to survey operations for marine mammals will be avoided where possible; and
- Ramp-up Procedures will be used - a controlled build-up of acoustic energy output shall occur in consistent stages to provide a steady and gradual increase over the ramp-up period.

2.10.6 Access and egress arrangements

All offshore works will be carried out from a vessel or JUB. The offshore survey vessel may mobilise directly to site from its base or from a suitable port in the Irish Sea close to the site.

Access to the intertidal zone may be made from the landward side down an existing lane (Legg Lane) at the southern boundary of Dunany Demesne as shown on Figure 2-2.

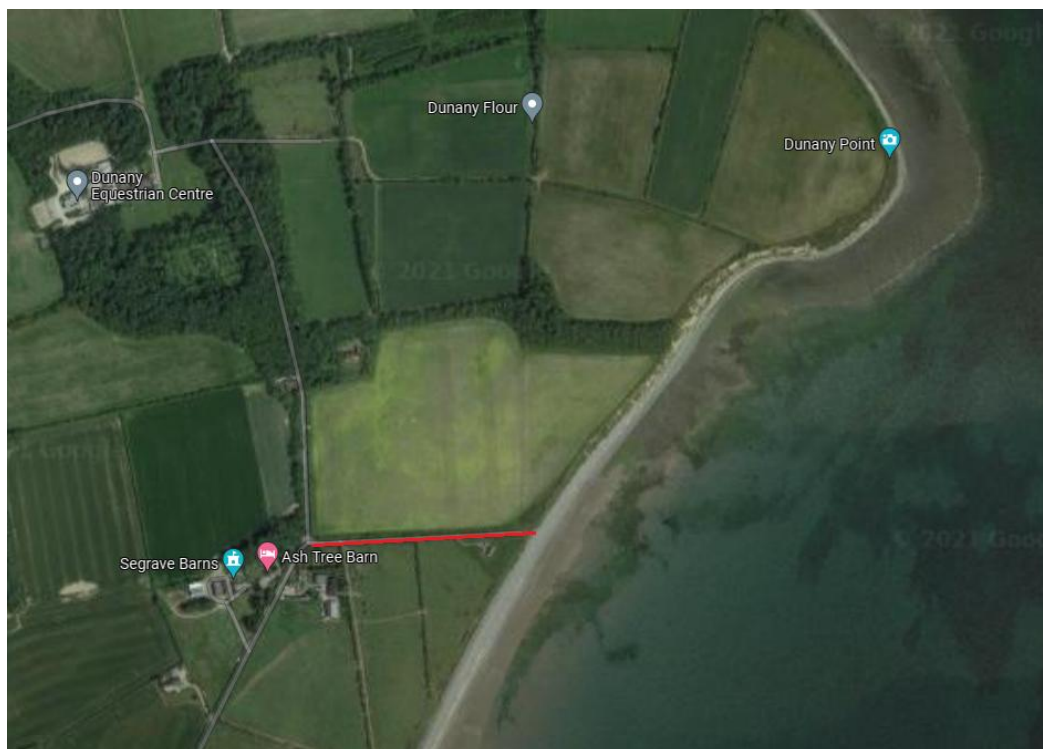
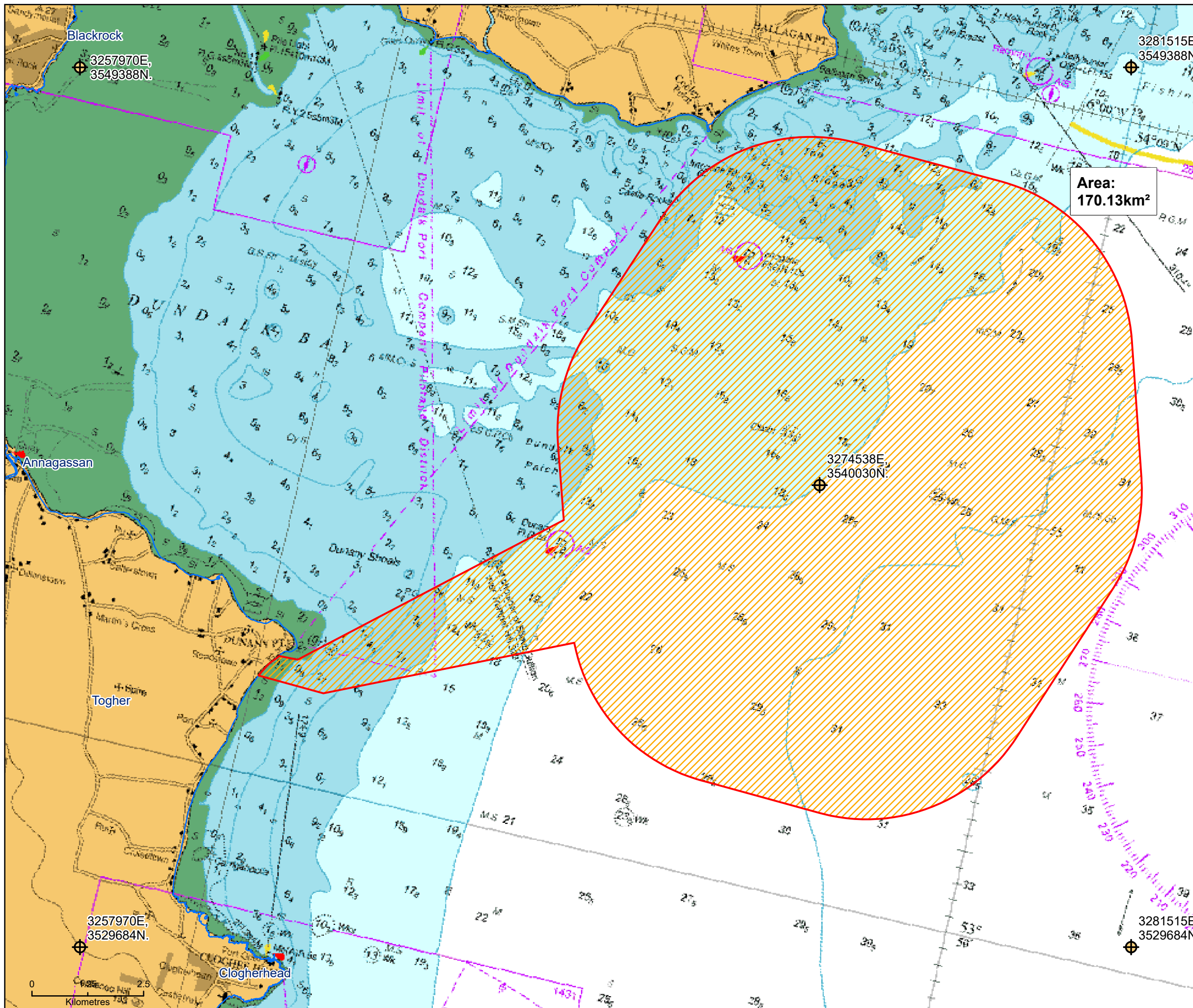


Figure 2-2 Intertidal zone access via Legg Lane

Appendix A Drawings



Legend

- Maritime Usage Licence Area
- High Water Mark
- Proposed Geophysical Survey Location

Area: 170.13km²

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann

Client

Oriel Wind Farm Project

Title

Proposed geophysical survey location

TETRA TECH
tetratech.com/europe

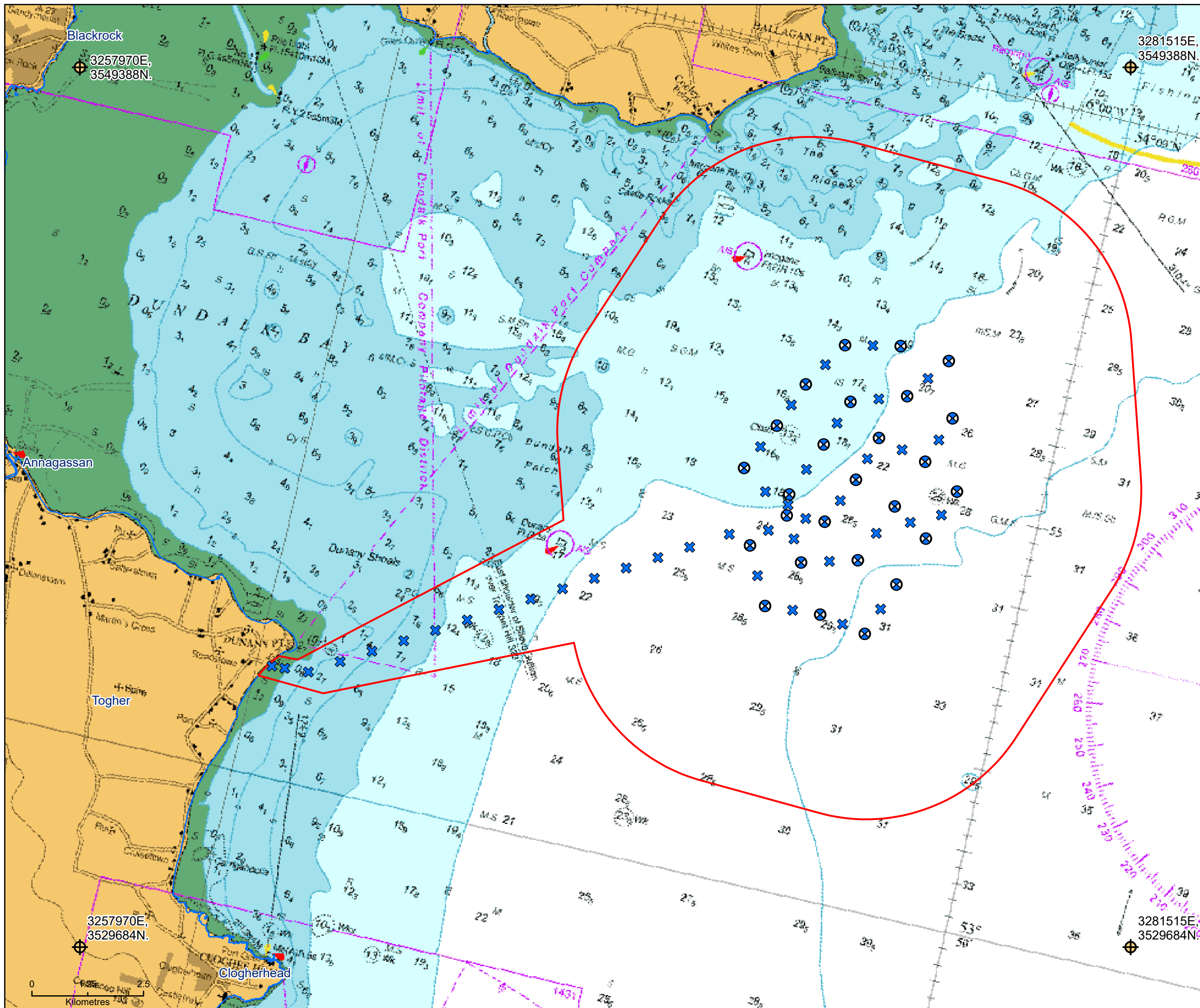
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MDR1520c-TTI-AP-XX-DR-Z-0002

Status: A1	Rev: C01
Drawn: NR	Date: 06/07/2026
Checked: RS	Scale: 1:80,000 (A3)
Approved: AE	Projection: ETRS 1989 LAEA

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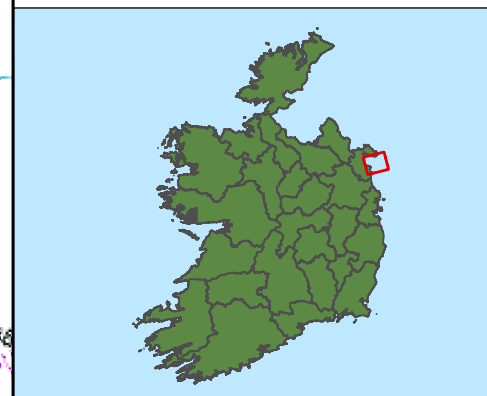


Legend

- Maritime Usage Licence Area
- High Water Mark
- Vibrocore/gravity coring
- Rotary core boreholes (3 replicates taken at each location)

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann



Client



Oriol Wind Farm Project

Title

Proposed marine geotechnical
survey locations rotary core
boreholes and vibrocores



Issue Details

File Identifier:

MDR1520c-TTI-AP-XX-DR-Z-0004

Status:

A1

Rev:

C01

Drawn:

NR

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06/07/2026

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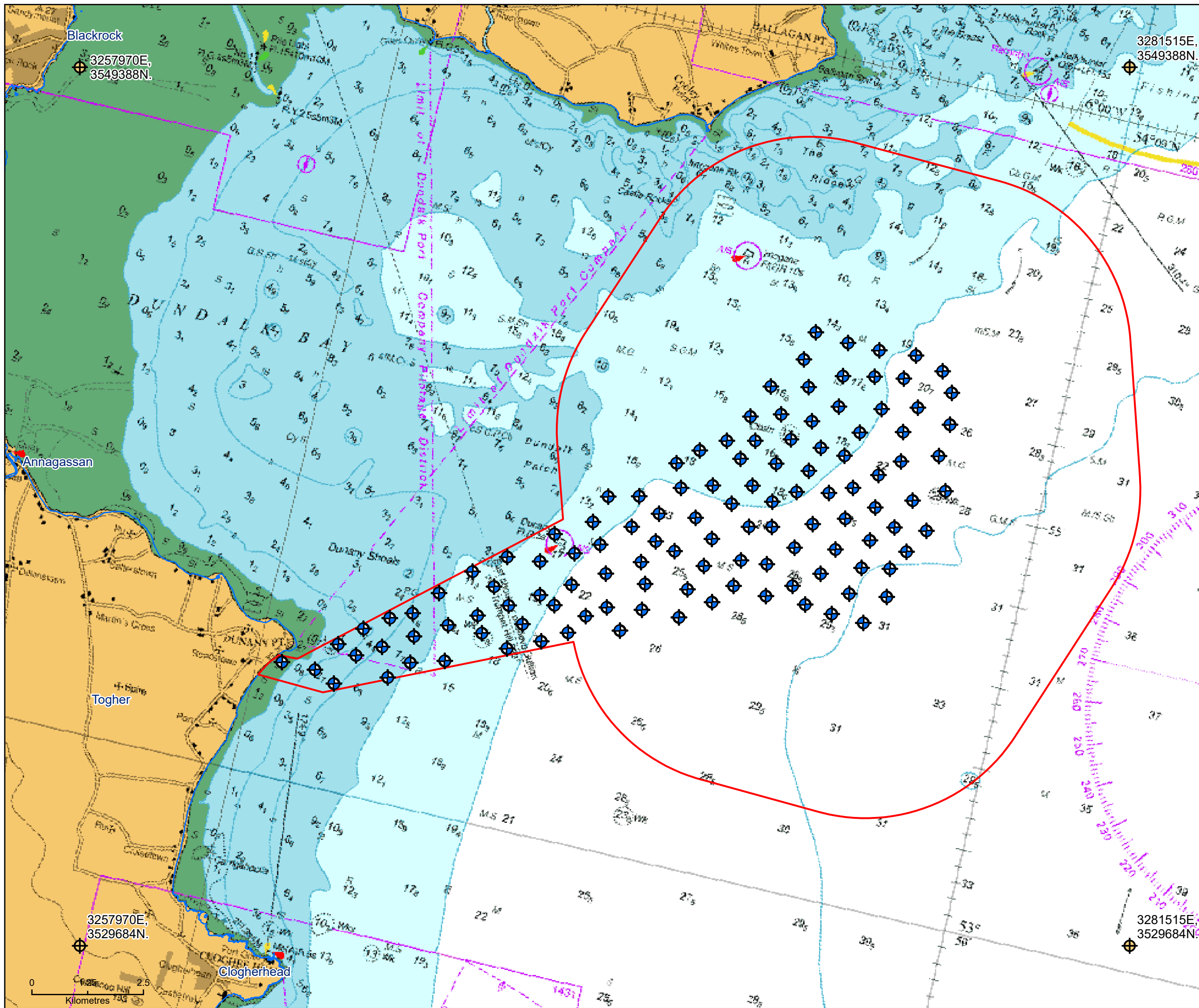
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Projection:

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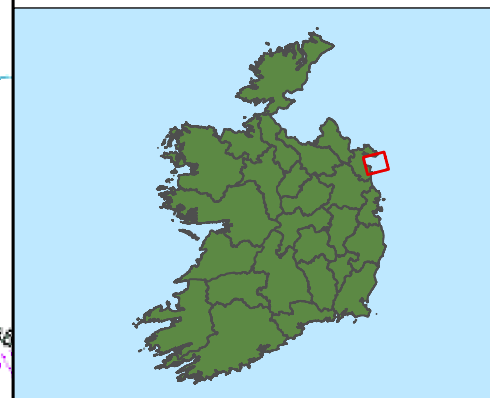


Legend

- Maritime Usage Licence Area
- High Water Mark
- CPT and SPT

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann



Client



Oriel Wind Farm Project

Title

Proposed marine geotechnical
survey locations-
CPT and SPT



TETRA TECH

tetrattech.com/europe

Issue Details

File Identifier:

MDR1520c-TTI-AP-XX-DR-Z-0006

Status:

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Rev:

C01

Drawn:

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06/07/2026

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Approved:

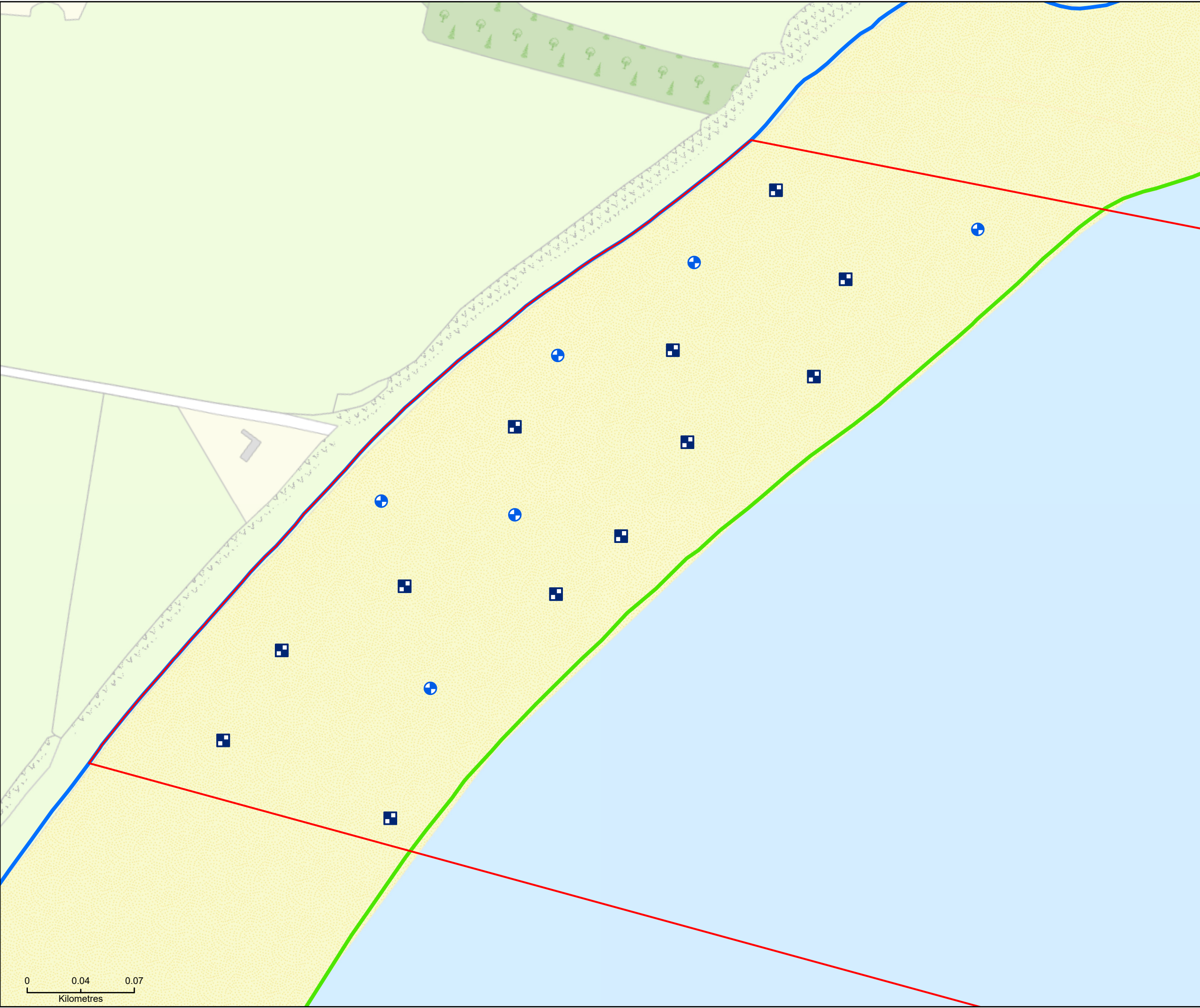
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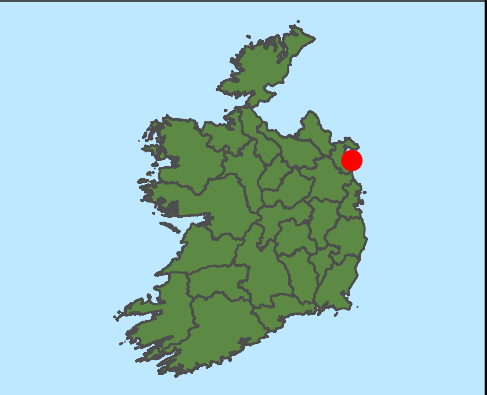


Legend

- Maritime Usage Licence Area
- High Water Mark
- Low Water Mark
- Borehole
- Trial Pit

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann



Client



Oriel Wind Farm Project

Title

Proposed intertidal geotechnical
survey locations-
Trial pit and boreholes



TETRA TECH

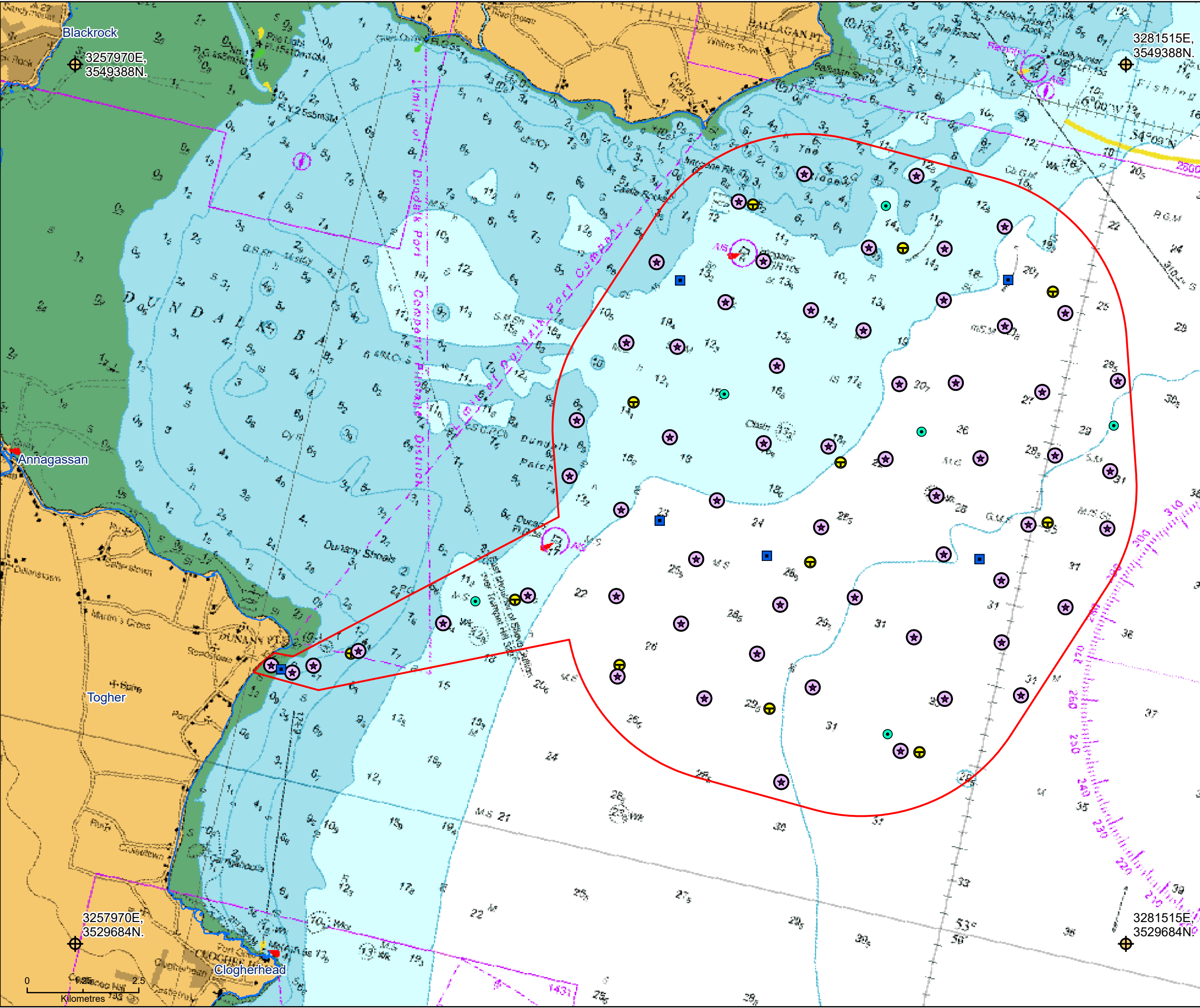
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Issue Details

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Legend

- Maritime Usage Licence Area
- High Water Mark
- Benthic Sample Locations
- CPODS
- Water Quality Sonde Locations
- Water Quality and Fish and Shellfish Sonde Locations

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann

Client

Oriol Wind Farm Project

Title

Proposed environmental survey locations

tetrattech.com/europe

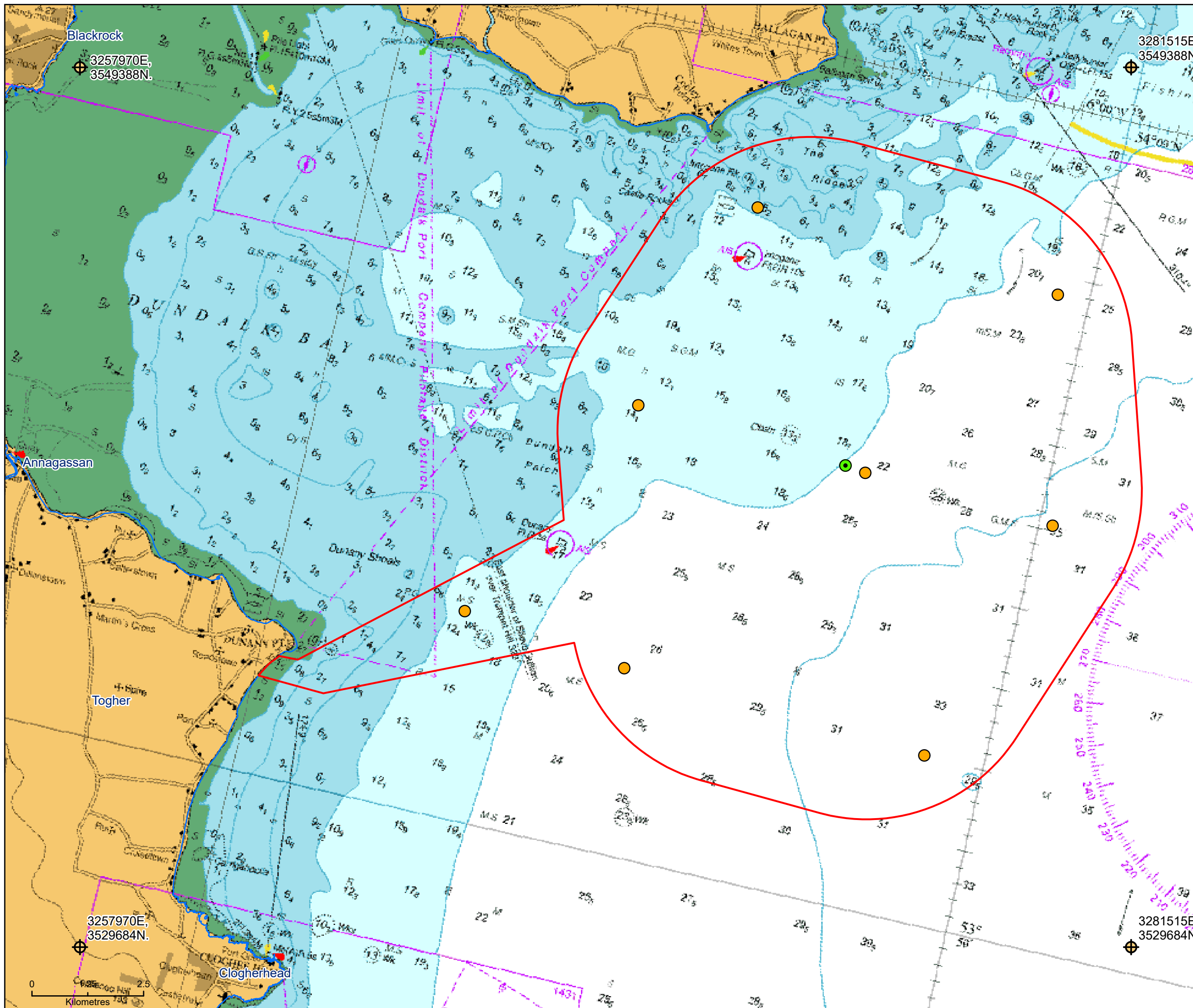
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Legend

- Maritime Usage Licence Area
- High Water Mark
- ADCPs
- Metocean buoy

Drawn By:
Nicola Riordan, MSc Geographic Information Science
Senior Project Scientist GIS

Data Sources: Tailte Éireann

Client

Oriol Wind Farm Project

Title

**Proposed metocean survey locations-
Metocean Buoy and ADCP**

tetrattech.com/europe

Issue Details

File Identifier:
MDR1520c-TTI-AP-XX-DR-Z-0012

Status: A1	Rev: C01
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Appendix B Vessel and Equipment Data Sheets

4125i

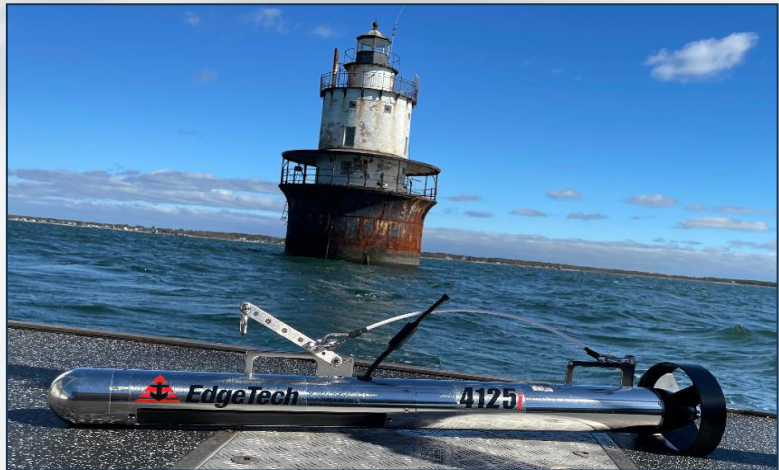
SIDE SCAN SONAR SYSTEM

FEATURES

- Ultra high resolution images
- Lightweight for one person deployment
- Standard heading, pitch, roll & pressure sensors
- Choice of dual simultaneous frequencies
- Runs on AC or DC
- Pole mount option for shallow water use

APPLICATIONS

- Hydrographic Surveys
- Geological Surveys
- Search & Recovery
- Channel/Clearance Surveys
- Bridge/Pier/Harbor Wall Inspection
- Hull Inspections



EdgeTech's 4125i Side Scan Sonar System was designed with both the Search & Recovery (SAR) and shallow water survey communities in mind. The 4125i utilizes EdgeTech's Full Spectrum® CHIRP technology, which provides higher resolution imagery at ranges up to 50% greater than non-CHIRP systems operating at the same frequency. This translates into more accurate results and faster surveys, thus cutting down on costs.

Two dual simultaneous frequency sets are available for the 4125i depending on the application. The 400/900 kHz set is the perfect tool for shallow water survey applications, providing an ideal combination of range and resolution. The 600/1600 kHz set is ideally suited for customers that require ultra high resolution imagery in order to detect very small targets (SAR).

The 4125i system can be powered by both AC and DC for added versatility and is delivered in portable rugged cases for ease of transport from site-to-site. As is standard with all of EdgeTech's towed side scan systems, the 4125i comes with a safety recovery system which will prevent the loss of a towfish if it becomes snagged on an obstacle during a survey.

A standard 4125i System comes with a rugged stainless steel towfish and a portable water resistant topside processor including a laptop computer (Optional: Splash Proof/Ruggedized Laptop). A 50 meter Kevlar tow cable is included as standard with customer-specified lengths also available. Multiple options are available such as a v-fin depressor, keel weight, pole mount and hull scan bracket for added versatility.



For more information please visit EdgeTech.com

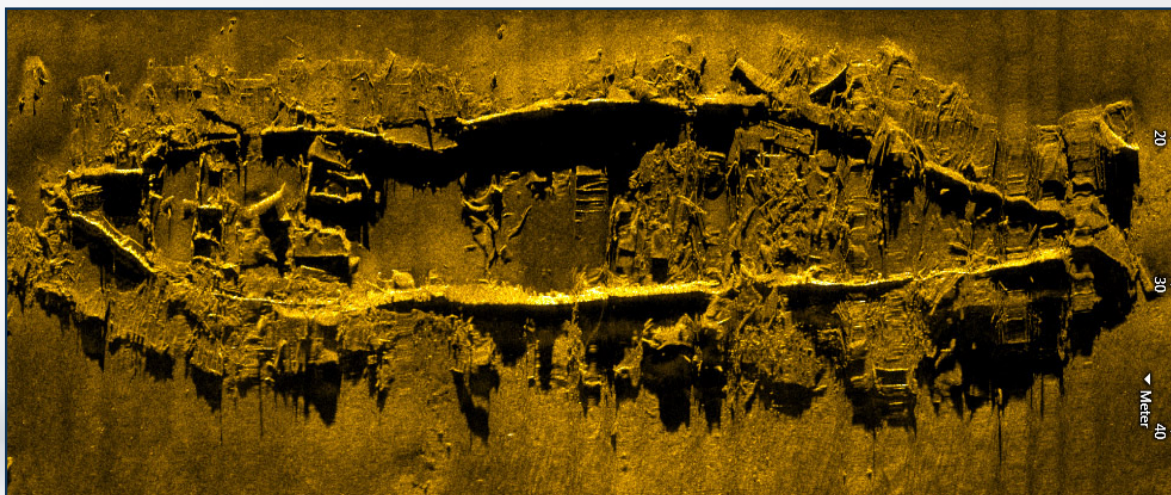
info@EdgeTech.com | USA 1.508.291.0057

4125i

SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

SONAR	
Frequencies (Dual Simultaneous)	Choice of either a 400/900 kHz or 600/1600 kHz towfish
Pulse Type	EdgeTech's Full Spectrum® CHIRP
Operating Range	200m @ 400 kHz, 75m @ 900 kHz; 120m @ 600 kHz, 35m @ 1600 kHz
Horizontal Beam Width	0.46° @ 400 kHz, 0.28° @ 900 kHz; 0.33° @ 600 kHz, 0.20° @ 1600 kHz
Vertical Beam Width	50°
Resolution Across Track	400 kHz: 2.3 cm, 900 kHz: 1.0 cm, 600 kHz: 1.5 cm, 1600 kHz: 0.6 cm
TOWFISH	
Diameter	9.5 cm (3.75 inches)
Length	112 cm (44 inches)
Weight in Air	20 kg (44 pounds)
Tow Cable Type	Coaxial up to 600m max length (will provide a typical operational depth down to 200m)
Max Depth Rating of Towfish	200m
Material	Stainless Steel
Standard Sensors	Heading, Pitch, Roll, Pressure (Depth)
TOPSIDE PROCESSOR	
Power Input	12-24 VDC or 115/230 VAC, 50/60 Hz
Connections	AC, DC, Ethernet (to laptop), Towfish
Hardware	Laptop Computer (Optional: Splash Proof/Ruggedized Laptop)
Operating System	Windows
Acquisition Software	EdgeTech DISCOVER
SYSTEM OPTIONS	
	Keel weight, v-fin depressor wing, pole mount, quick change hull scan bracket



For more information please visit EdgeTech.com

info@EdgeTech.com | USA 1.508.291.0057

4205

TRI-FREQUENCY / MOTION TOLERANT SIDE SCAN SONAR SYSTEM

FEATURES

- Tri frequency side scan sonar
- Motion tolerant mode
- Improved target positioning
- Crisp, high resolution CHIRP imagery
- Increased towfish power to support wider range of 3rd party sensors
- Single pulse high resolution mode

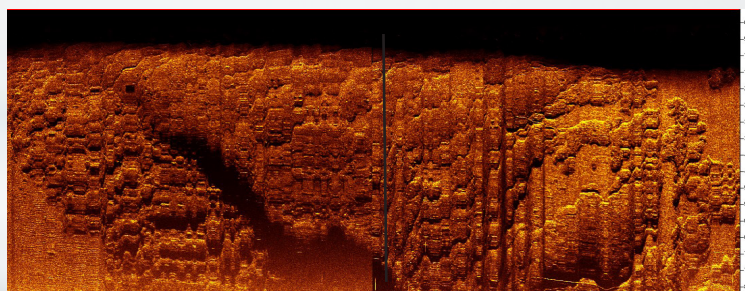
APPLICATIONS

- Cable & pipeline surveys
- Geological/geophysical surveys
- Mine countermeasures (MCM)
- Geohazard surveys
- Channel clearance
- Search and recovery
- Archeological surveys



The next generation 4205 is a versatile side scan sonar system that can be configured for almost any survey application from shallow to deep water operations. The 4205 utilizes EdgeTech's Full Spectrum® CHIRP technology to provide crisp, high resolution imagery at ranges up to 50% greater than non-CHIRP systems; thus allowing customers to cover larger areas and save money spent on costly surveys. In addition to the high-resolution imagery that EdgeTech is known for, the 4205 comes with a number of new features which makes the system even more flexible and powerful in offshore operations. The 4205 is available in either a tri-frequency side scan sonar configuration or motion tolerant and multi-pulse configuration. The tri-frequency version allows surveyors the option to operate any two frequencies simultaneously from the tri-frequency system. Long range operations for example can be achieved with a selection of 230/540 kHz combination. Then, on-demand the system can be changed to a 540/850kHz system for an even higher resolution survey. The 4205 motion tolerant configuration with multi-pulse provides surveyors the ability to operate either at faster survey speeds or in more adverse weather conditions while still obtaining high quality underwater imagery. Additionally, this configuration can be operated in a single pulse high-resolution mode for those operations that require an even more finite view of the seafloor.

In both the tri-frequency and motion tolerant/ multi-pulse configurations, towfish and target positioning has been improved with the integration of a more accurate heading sensor. Additionally, all systems now come with increased towfish power to support a wider range of additional 3rd party sensors. All EdgeTech 4205 systems are comprised of a topside system and a reliable stainless steel towfish. Topside processors are rack mountable and come with easy-to-use GUI software that can be installed on the optional industrial workstation, laptop or customer provided PC.



Motion Tolerant Mode Sonar example: During turbulent conditions, the data on the left of side of this image was recorded using the EdgeTech 4205 Motion Tolerant mode. The right side of the image, depicting motion induced striping was captured without the Motion Tolerant mode for comparison.

For more information please visit EdgeTech.com

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4205

TRI-FREQUENCY / MOTION TOLERANT SIDE SCAN SONAR SYSTEM

KEY SPECIFICATIONS

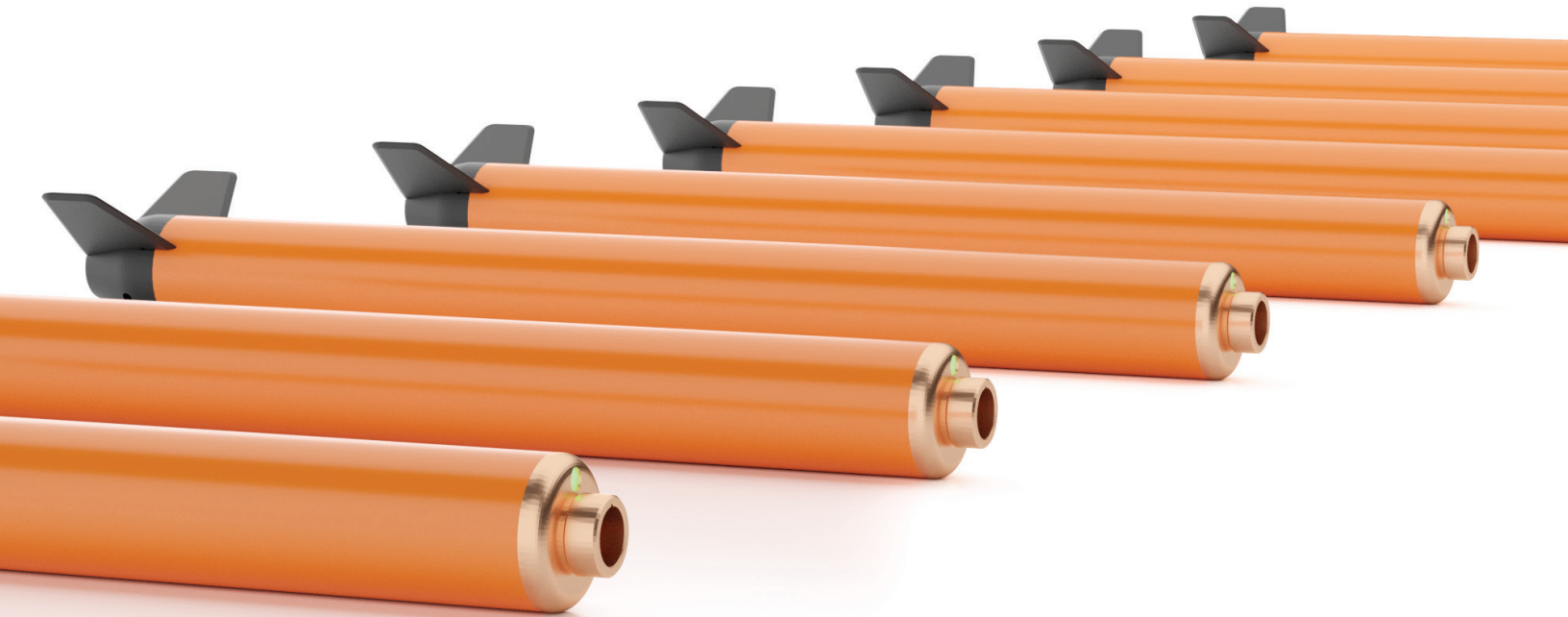
SONAR SPECIFICATIONS	4205 TRI-FREQUENCY	4205 MULTI-PULSE/MOTION TOLERANT (MP/MT) AND HIGH DEFINITION MODE	
Frequency	Choice of either 120/410/850 kHz or 230/540/850 kHz	Choice of either 120/410 kHz, 230/540 kHz, 540/850 kHz or 230/850 kHz	
Operating Range (meters/side)	120 kHz: 600m, 230 kHz: 350m, 410 kHz: 200m, 540 kHz: 150m, 850 kHz: 90m		
		MP/MT	HDM
Horizontal Beam Width	120 kHz: 0.70°	120 kHz: 0.95°	0.70°
	230 kHz: 0.44°	230 kHz: 0.62°	0.44°
	410 kHz: 0.28°	410 kHz: 0.40°	0.28°
	540 kHz: 0.26°	540 kHz: 0.36°	0.26°
	850 kHz: 0.23°	850 kHz: 0.33°	0.23°
		MP/MT	HDM
Resolution Along Track	120 kHz: 2.4m @ 200m	120 kHz: 3.3m @ 200m	2.4m @ 200m
	230 kHz: 1.2m @ 150m	230 kHz: 1.7m @ 150m	1.2m @ 150m
	410 kHz: 0.5m @ 100m	410 kHz: 0.7m @ 100m	0.5m @ 100m
	540 kHz: 0.45m @ 100m	540 kHz: 0.6m @ 100m	0.45m @ 100m
	850 kHz: 0.20m @ 50m	850 kHz: 0.26m @ 50m	0.20m @ 50m
Resolution Across Track	120 kHz: 8cm; 230 kHz: 3cm; 410 kHz: 2 cm; 540 kHz: 1.5cm; 850 kHz: 1cm		
Vertical Beam Width	50°		
Depression Angle	Tilted down 25°		
TOWFISH	STAINLESS STEEL		
Diameter	12cm (4.75 inches)		
Length	140cm (55 inches)		
Weight in Air	52 kg (115 pounds)		
Depth Rating (Max)	2,000m		
Standard Sensors	Heading, pitch & roll		
Optional Sensor Port	(1) Serial – RS 232C, Bi-directional & 28 VDC +/- 4% at 1 amp max (with 701-DL topside) or 2.6 amps max (with Starmux topside)		
Options	Pressure Sensor, Magnetometer interface, USBL Responder interface, Depressor and Custom Sensors		
TOPSIDE PROCESSOR	4205 INTERFACE		
Hardware	19" rack mount interface (150 watt or 400 watt)		
Display & Interface	Optional industrial workstation, laptop or customer provided PC		
Power Input	115/230 VAC		
File Format	Native JSF or XTF		
Sensor Interfaces	Ethernet, RS 232		
TOW CABLE			
	Coaxial Kevlar or double-armored up to 6,000m, winches available		

For more information please visit EdgeTech.com

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Synapse

Synchronized Magnetic Gradiometer Array



Net it and Forget it

Scalable up to 30 nodes, the network array is practically self-configuring, requiring minimal setup and troubleshooting to operate.

More is less

A survey company can stockpile a few dozen nodes, grab however many they need based on a survey's parameters, connect them and "go."

The nodes are identical and interchangeable. Instead of humans micro-managing sensor relationships, they figure it out independently. One of the sensors takes charge, coordinates data from the network and sends it to the humans topside.

If you add another sensor, the sensor in charge recognizes and integrates the new sensor.

Less downtime can lower on-vessel equipment setup from half a day to half an hour.

Crush Survey Ops Costs

The network array weighs a fraction of the payload of comparable systems, creating cascading returns:

- Requires a smaller, less expensive vessel
- Survey in shallower water
- Survey in rougher weather = Less downtime
- Less payload to lift off the deck = Safer to crew and lower risk of damaging expensive boat machinery

Innovation

Time-Synced Precision

The consequences of poor time synchronization range from bad data to useless data. **Synapse** keeps its nodes synchronized to within microseconds. Automatically.

Scale up to 30

Right size your network up to 30 nodes based on a survey parameters.

Higher Definition

Get sharper data with faster sampling rates and tighter survey tracks with more compact mags.

Ultralight

Our smaller sensors can reduce an array's size and weight by a factor of 4-5.

System Configurations:

Synapse Node

- **Any combination of sensors:**
Scalar Magnetometer, Pressure, Altimeter, and Tilt IMU
- Network Status LED
- Leak Detector

Practical Configurations Might Include:

- **Magnetometer Only:** Magnetometer Sensor
- **Combined:** Magnetometer, Pressure, and Altimeter Sensors
- **Accessory Tow-fish:** Pressure, Altimeter, and Tilt IMU Sensors

Additional Components

- Larger pressure housing for greater depth rating (Optional)
- 24V universal AC power supply or battery clip cable
- USB or RS-232 cable
- BOB data acquisition and visualization software
- Shipping case

Max Flexibility

Combine support sensors in any magnetometer node to keep arrays small.

Or use a dedicated support tow-fish (without the magnetometer) for larger gradiometer arrays. This keeps the magnetometer nodes identical for maximum interchangeability.

Specifications

Performance

Operating Zones	Worldwide
Absolute Accuracy	TBD
Sensor Sensitivity	10 pT/rt-Hz
Resolution	1 pT
Dead Zone	1 Zone (+/- 6 degrees from center) <i>Sensor can be easily rotated for worldwide operation</i>
Sampling Rate	Up to 20hz
Sensor Type	Scalar (Rubidium optically-pumped)
Power Consumption	4.5 W per node
Range	18,000 nT to 120,000 nT
Gradient Tolerance	Over 10,000 nT/m
Depth Rating	1000m (1420 psi)
Interface	USB or RS232
Power Supply	24 VDC (120-240 VAC compatible) (Acceptable range 9-30 VDC)

Magnetometer

Length	86 cm (33.75 in)
Diameter	7.6 cm (3 in)
Weight in Air	3.5 kg (7.7 lbs)
Weight in Water	Neutral

Accessory Tow-fish (Optional)

Sensors	Pressure-depth, Echosounder-altitude, and Tilt Inertial Measurement Unit (IMU)
Length	43 cm (17 in)
Diameter	7.6 cm (3 in)
Weight in Air	2.4 kg (5.5 lbs)
Weight in Water	Neutral



NORBIT

WINGHEAD® B51S

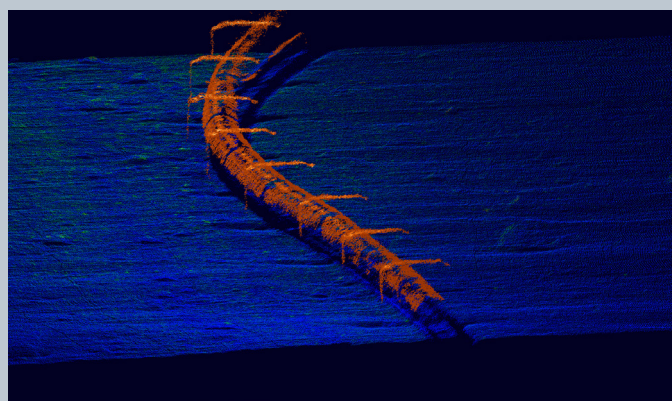
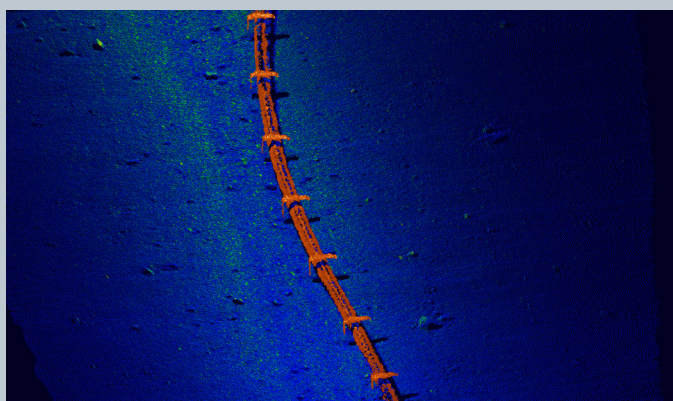


Superior Performance Ultra High-Resolution 3D&4D Medium Range Motion Stabilised Bathymetric System.

Designed to perform in extreme operational environments with high vessel motion, this cylindrical ultra-high resolution curved array bathymetric system, allows for rapid anywhere anytime mobilisation

NORBIT WINGHEAD sonars are based on a state of the art analogue and digital platform featuring powerful signal processing capabilities, offering active roll and pitch stabilized bathymetry plus several imagery and backscatter outputs as standard ensuring the highest quality survey data performance. With broad R&D expertise, NORBIT has developed - from the ground-up - exciting new technology that allows existing and new applications to benefit from the advantages offered by a compact wideband curved-array multibeam sonar.

The NORBIT WINGHEAD B51S is a compact ultra-high resolution curved array broadband multibeam sonar designed for use in the most demanding operational environments. Characterised further by a small form factor; low power draw and tight integration, WINGHEAD B51S installation can occur on surface survey platforms ranging from small USVs to large vessel permanent hull mounts.





WINGHEAD B51S

NORBIT
- explore more -

Features

- ✓ Active Roll and Pitch Stabilisation
- ✓ 80kHz Bandwidth
- ✓ Backscatter Outputs (Intensity, Sidescan, Snippet Sidescan, Snippets, Water Column)
- ✓ Multidetector
- ✓ Pipeline Mode
- ✓ Simple Ethernet Interface
- ✓ Integrated Sound Velocity Probe
- ✓ 1024 Dynamically Focused Beams
- ✓ Mounting Bracket Included
- ✓ FM & CW Processing
- ✓ Exceeds IHO *Special Order*, CHS *Exclusive Order* & USACE *New Work*

Options

- ✓ Yaw Stabilisation w. Single Head
- ✓ Dual Swath w. Single Head
- ✓ 2048 Dynamically Focused Beams
- ✓ Backscattering Strength Output
- ✓ Titanium Version
- ✓ Sound Velocity Profiler
- ✓ STX 4D scanning capability
- ✓ Permanent Hull Mount Option
- ✓ Pole Mount
- ✓ Supports NORBIT iLiDAR
- ✓ Dual Head Configuration
- ✓ Can be Delivered with Software Packages e.g. HYPACK, Qinsy, EIVA, CARIS and Others

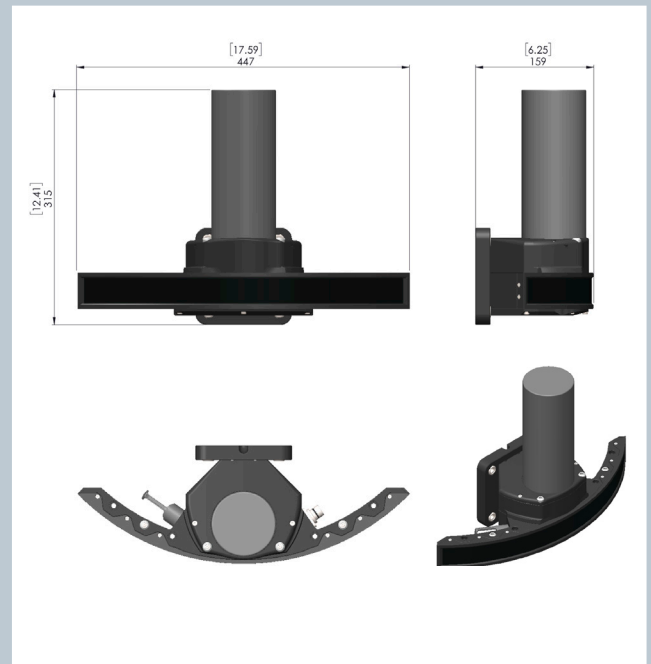
Applications

- ✓ SV, USV & UUV platforms
- ✓ Offshore Inspection, Repair and Maintenance (IRM) operations
- ✓ Harbour; Quay wall, Bridge and Structure Engineering Inspection Surveys
- ✓ Wreck and Seabed Search and Investigation
- ✓ Pond, River, Lake and Estuary Surveys
- ✓ Coastal Surveys
- ✓ Renewable Energy
- ✓ Mineral and Geological Surveys

TECHNICAL SPECIFICATION

SWATH COVERAGE	5-210° FLEXIBLE SECTOR (SHALLOW WATER IHO SPECIAL ORDER >155°)
RANGE RESOLUTION	<10mm ACOUSTIC w. 80kHz BANDWIDTH
NUMBER OF BEAMS	EA & ED: 256, 512, 1024 (2048 OPTION)
STABILISATION	ROLL, PITCH (YAW OPTION)
OPERATING FREQUENCY	NOMINAL FREQUENCY 400kHz (FREQUENCY AGILITY 170-700kHz)
DEPTH RANGE	0.2m to 300m*
PING RATE	UP TO 60Hz, ADAPTIVE
RESOLUTION (ACROSS X ALONG)	STANDARD: 0.5° X 0.9° @400kHz
INTERFACE	ETHERNET
POWER CONSUMPTION	TYPICAL <90W (10-28VDC, 110-240VAC) TOTAL SYSTEM POWER CONSUMPTION
DIMENSIONS	DIMENSIONS: H: 315mm/12.41", L: 447mm/17.59", W: 159mm/6.25"
WEIGHT	6.7kg (AIR) 3.0kg (WATER)
CABLE LENGTH	STD 8m, OPTIONAL: 25m FOR OTHER CABLE LENGTHS PLEASE CONTACT NORBIT
OPERATING TEMP.	-4°C to +40°C (TOPSIDE -20°C to +55°C)
STORAGE TEMP.	-20°C to +60°C
ENVIRONMENTAL	TOPSIDE: IP67: DUST TIGHT, PROTECTED AGAINST THE EFFECT OF IMMERSION UP TO 1m WET-END (SONAR): 100m

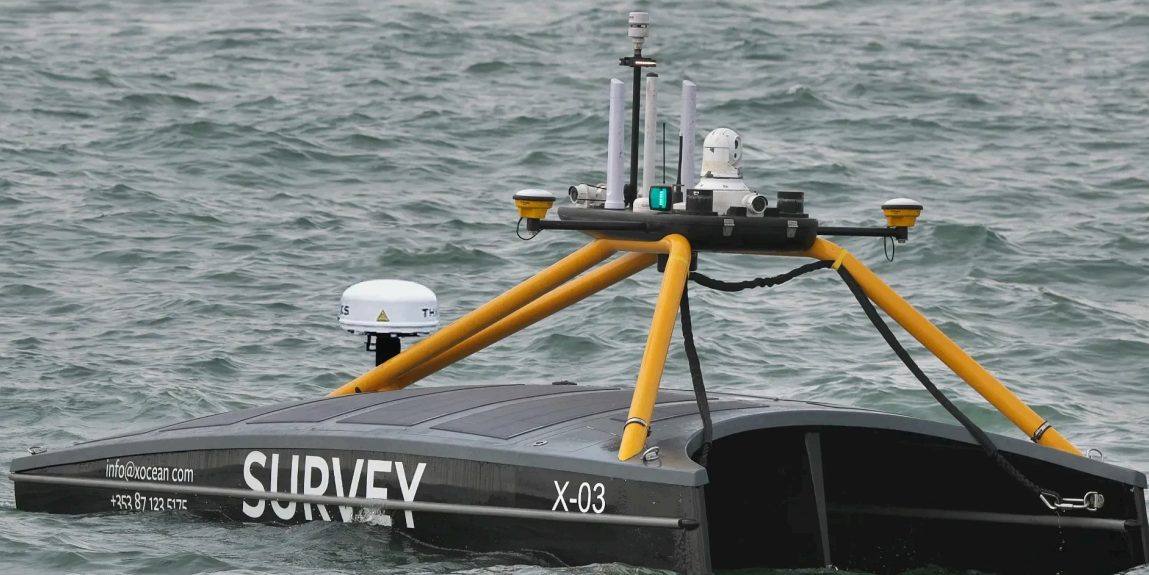
OUTLINE DRAWING



*Observed with 40deg swath, salinity 30ppm, 10°C

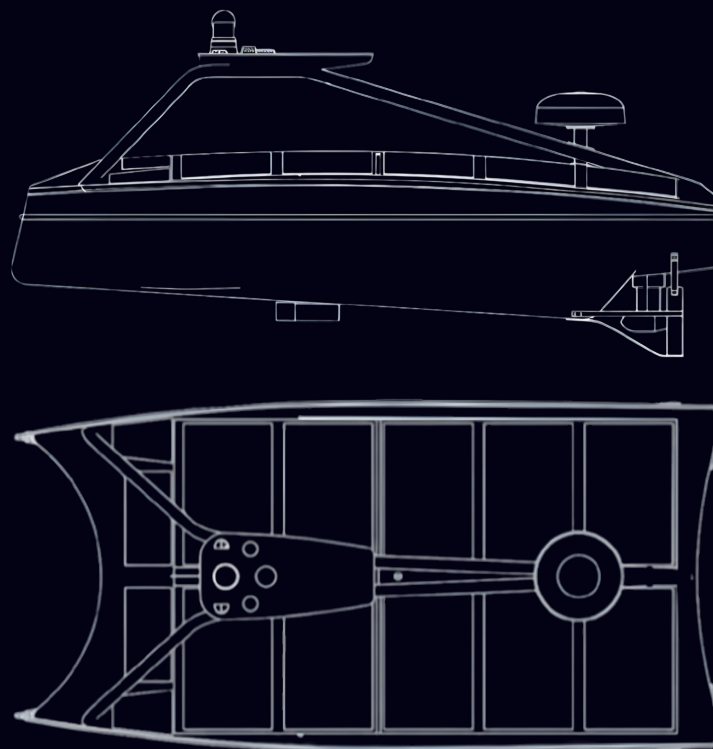
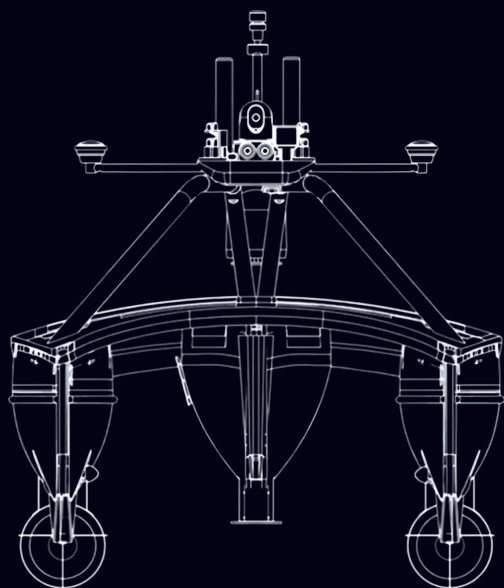
XO-450

XOCEAN is a global ocean data company delivering geophysical, geotechnical, and environmental data to support critical offshore decisions. We are transforming ocean data delivery through a digitally integrated operating platform, enabled by the world's largest fleet of ultra low impact survey class uncrewed surface vessels USVs.



XO-450

Uncrewed Surface Vessel (USV) Specification



Physical Dimensions

Length	4.5m
Width	2.2m
Draft	0.8m

Data Types

Multibeam Echosounder
Sub-Bottom Profiler (SBP)
Side-Scan Sonar (SSS)
Magnetometer
Ultra-Short Baseline (USBL)

Applications

Subsea Cables
Offshore Wind
Civil Hydrography
Carbon Capture & Storage
Oil & Gas

Technical Specification

Model	XO-450
Hull	Composite wave piercing catamaran type
Weight	1,150 kg
Payload	200 kg
Propulsion	4 x DC drives (6.8 kW thrust power)
Steering	Differential steering
Hybrid power system	Solar panels Lithium-ion batteries Micro diesel generator
Continuous electrical	4 kW
Speed	4 knots
Communications	Over horizon via satellite broadband
Control	Control via XOCEAN Cyberdeck
Situational awareness	Visible light cameras Thermal imaging camera AIS Radar VHF
Conspicuity	Active radar reflector AIS transmissions Navigation lights Sound signals
Mobilisation	Road trailer Shipping container LARS
Sensor Mounting	Sensor post SVP winch MRU Weather station Towfish winch Inspection camera

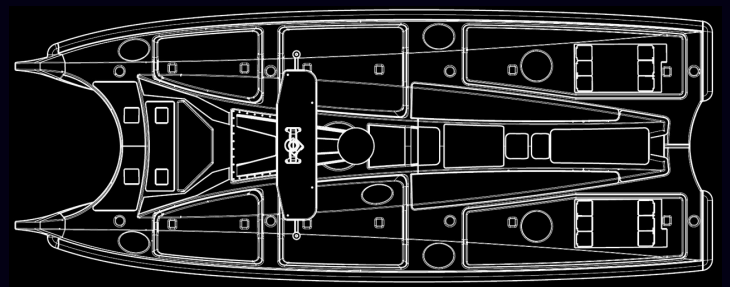
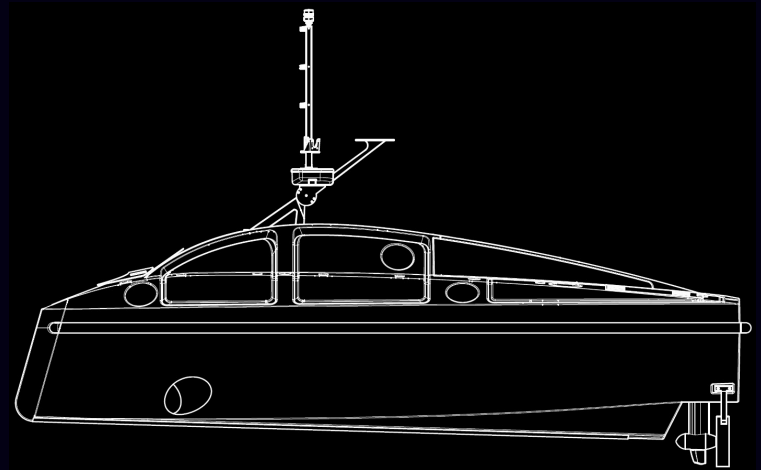
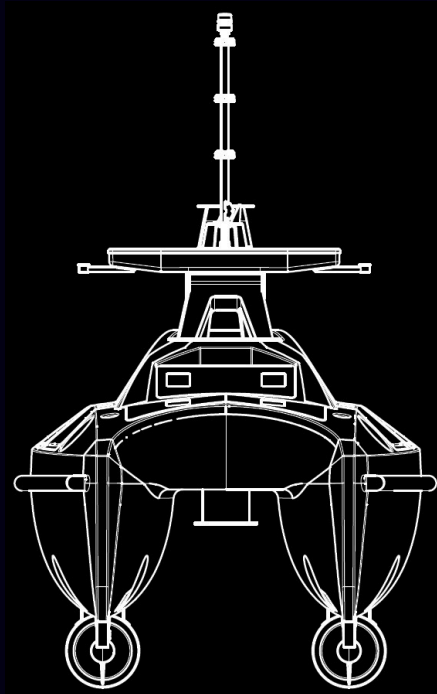
XO-580 NextGen

Engineered to meet the highest regulatory standards, the XO-580 is the next generation in uncrewed ocean data acquisition. Delivering longer endurance, higher data acquisition rates, and the capability to collect multiple datasets concurrently, it represents a step change in ocean data productivity. With ultra-low CO₂ emissions, a low acoustic signature, and advanced autonomy, the XO-580 delivers faster, smarter, and more sustainable ocean insights.



XO-580 NextGen

Uncrewed Surface Vessel (USV) Specification



Physical Dimensions

Length	5.8m
Width	2.2m
Draft	1.1m

Data Types

Multibeam Echosounder
Sub-Bottom Profiler (SBP)
Side-Scan Sonar (SSS)
Magnetometer
Ultra-Short Baseline (USBL)

Applications

Subsea Cables
Offshore Wind
Civil Hydrography
Carbon Capture & Storage
Oil & Gas

Technical Specification

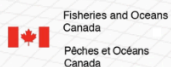
Model	XO-580
Hull	Composite wave piercing catamaran type
Weight	2,100 kg
Payload	770 kg
Propulsion	4 x DC drives (14 kW thrust power)
Steering	Differential steering
Hybrid power system	Solar panels Lithium-ion batteries Micro diesel generator
Continuous electrical	10 kW
Speed	5.5 knots
Communications	Over horizon via satellite broadband
Control	Control via XOCEAN Cyberdeck
Situational awareness	Visible light cameras Thermal imaging camera AIS Radar VHF
Conspicuity	Active radar reflector AIS transmissions Navigation lights Sound signals
Mobilisation	Road trailer Shipping container LARS
Sensor Mounting	Twin sensor post SVP winch MRU Weather station Towfish winch Inspection camera

XOCEAN

Ocean data, delivered.



Ocean data, delivered for:



AMS RETRIEVER DAMEN SHOALBUSTER 2409



GENERAL

BASIC FUNCTIONS	Towing, Pushing, Anchor Handling, Dredge Support, Ploughing, Dive Support, Supply, Salvage, Survey
CLASSIFICATION	Bureau Veritas I  HULL • MACH Tug Coastal Area. Temporary Unrestricted Navigation
CERTIFICATION	MCA Workboat Category 2, 60 nm MCA Loadline Exemption Irish Loadline Certificate Irish P5 Passenger Vessel Certificate
FLAG	UK
YEAR OF BUILD	1997

DIMENSIONS

LENGTH O.A.	24.80 m
BEAM O.A.	9.00 m
DEPTH AT SIDES	3.20 m
DRAFT AFT (LIGHT/FULL LOAD)	2.00/2.20 m
DISPLACEMENT (FULL LOAD)	255 tonnes
GROSS TONNAGE	94 tonnes
FREE DECK AREA	+/- 50 m ²

TANK CAPACITIES

FUEL OIL	59.0 m ³
FRESH WATER	33.0 m ³
LUBRICATION OIL	2.2 m ³
HYDRAULIC OIL	1.1 m ³
SEWAGE	3.5 m ³
BILGE WATER	3.5 m ³
DIRTY OIL	2.1 m ³

PERFORMANCE

BOLLARD PULL (CERTIFIED)	18.5 tonnes
SPEED (MAX)	9.5 knots
SPEED (ECON)	8.0 knots

PROPULSION SYSTEM

MAIN ENGINES	2 x Caterpillar 3412 DI-TA
TOTAL POWER	1014 bkW (1360 bhp) @ 1800 rpm
GEARBOXES	2 x Reintjes WAF 360/4.92 : 1
PROPULSION	2 x Promarin fixed pitch propellers
DIAMETER	2 x 1500 mm in Optima Nozzles

AUXILIARY EQUIPMENT

GENERATOR No.1	Hatz 4L41C Silent Pack
OUTPUT	35 kVA, 50 Hz, 230/400V
GENERATOR No.2	John Deere 6068 TF
OUTPUT	97 kVA, 50 Hz, 230/400V
TRANSFER PUMPS	For Fresh Water : SIHI 24 m ³ /h at 2.5 bar For Fuel Oil : SIHI 34 m ³ /h at 2.5 bar
FUEL OIL SEPARATOR	Facet MV 11 AG 1200 L/hr
HYDRAULICS	2 x Denison PW29 pumps - Engine driven

DECK LAY-OUT

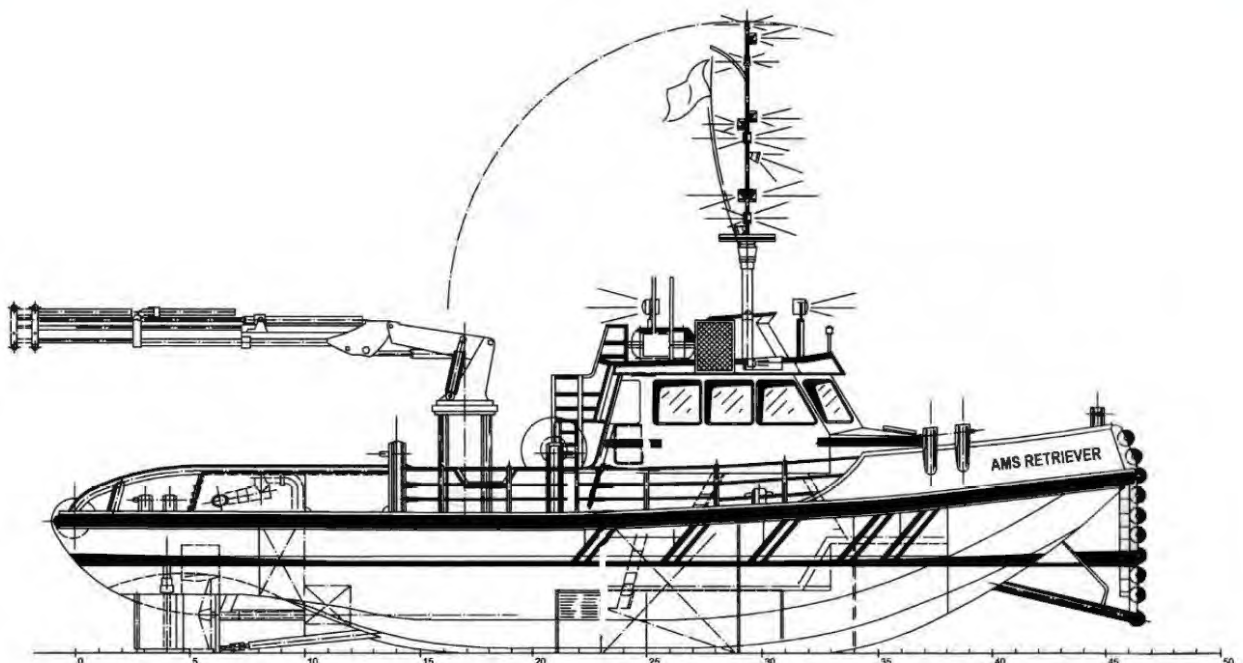
ANCHOR WINDLASS	2 x Ridderinkhof CAW-H-136
ANCHORS	2 x 180 kg Pool (HHP)
CHAIN	2 x 120 m x 17.5 mm U2 Stud link
DECK CRANE	Heila 65/3s, 5.4 t @ 10.58 m, 13 t @ 4.6 m
TOWING/AH WINCH	Ridderinkhof TW-H-400-95 Split Drum
PULL	32 tonnes at 6m/min and 6 tonnes at 24m/min
WIRE CAPACITY	400 m dia. 32mm/75 m dia. 32mm
BRAKE HOLDING	40 tonnes on first layer
TOWING HOOK	Mampaey DCX 8/15
TOWING/AH PINS	BMM – SWL 50 tonnes

ACCOMMODATION

Heated and air-conditioned living spaces for 5 persons, consisting of a master's cabin, an officer's cabin and one three berth cabin, a galley and sanitary facilities.

NAVIGATION & COMMUNICATION EQUIPMENT

MAGNETIC COMPASS	Sestrel Observator MK 12
SATELLITE COMPASS	Furuno SC-50
RADAR	Raymarine e125 HD Digital
GPS	Furuno GP 80
AUTOPILOT	Anschutz Pilotstar D
AIS	Transas T105
ECHOSOUNDER	Furuno FE-700
VHF	2 x Sailor RT2048 with DSC
HANDHELD VHF	2 x Sailor, 1 x Jotron
NAVTEX	JRC NCR-333
MF/HF TRANSCEIVER	Furuno FS-1562 DSC
INMARSAT C	Furuno Felcom 12
SATELLITE PHONE	Thrane & Thrane Cobham
BRIDGE WATCH ALARM	NavGard BNWAS
CCTV	MCB H 264
INTERCOM	Vingtor VRC-110M
SEARCHLIGHTS	2 x Francis





FUGRO

M.V. FUGRO PIONEER

M.V. Fugro Pioneer has been built to the highest standards demanded of a modern internationally operating multi-purpose survey vessel.

The diesel electric propulsion, specially designed hull, resilient engine mounts and rudder propellers maximise station keeping and navigational control while ensuring acoustically quiet running at survey speeds.

Designed with consideration for safety and environment, Fugro Pioneer is a compact flexible platform supporting a wide range of offshore services with a typical operational profile of geophysical, geotechnical survey operations up to 500 m WD.

Its limited 3 m draft adds to its capabilities to operate in shallow water nearshore. The vessel can easily be configured to support light ROV and environmental operations. The 53 metre-long vessel is prepared for dynamic positioning and equipped with state-of-the-art survey equipment.



State of the Art Kongsberg Dual Head Dual Ping Multibeam in retractable moonpool system



Limited draft makes it specifically suitable for survey nearshore

M.V. FUGRO PIONEER

Technical Specifications

General

Names	Fugro Pioneer
Classifications society	BV
Flag state/ port	Bahamas Maritime Authority / Nassau
Build(er)	September 2014 – Damen Shipyards Galati
IMO/Cal sign	9701645 / C6BH3
Official number	7000674

Dimensions

LOA	53.7 m
Beam	12.5 m
Draft (summer) max.	3.1 m + 0.26 m blister
Net tonnage	1,322 T
Deck area aft	250 m ²
Deck strength	5 T / m ²
Deck load	81,6 T

Machinery

Propulsion	2 x Azimuth thrusters (electric)
Bowthrusters	1 x Tunnel thrusters (electric)
Cruising speed	10 kn
Survey speed	Variable as required
Maximum speed	11.2 kn

Electric power

Diesel generator sets	4 x 372 kW
UPS supply survey	1 x 30 kVA, 220 vac

Capacities

Fuel capacity	305 m ³
Fuel consumption (FOC t/day)	Survey 3 T / Stationary (DP) 4.2 T / Transit 6 T
Potablewater capacity	115 m ³
Watermaking	6 m ³ / d

Accommodation

Cabins	30+4 bunks / 10 x single cabins, 11 double cabins
Crew (typical)	13 x marine crew, 18 x survey crew
Recreational	1 x dayroom, 1 x gym
Work offices	2 x survey, 1 x meeting room

Control and navigation

DP system	Imtech DP-0
Radar	Sperry Marine Visionmaster FT CAT 1 / 2 S-band and X-band
Electronic chart	ECDIS Transas (double)
DGPS	1 x Kodan KGPZGO / 2 x Fugro Starpack
Magnetic compass	Sperry Jupiter

Deck machinery

Deck crane aft	Palfinger PK65002 MD
Storage crane forward	Palfinger PK15000 MC
Hydraulics ring main system	300 bar / 200 ltr
T-frame aft (geophysical)	1 x 2 / 3 T SWL
A-frameside (geotechnical)	1 x 9 T SWL
CTD winch / davit	1 x 200 kg / 1000 m (environmental sampling)
Tugger winch aft deck	4 x 3 T SWL
Moonpool	Rectangular 1630 x 883 mm (freespace)
Geophysical tow winch	2 x EMCE (3.5 Te / 1000 m / Rochester)
Geotechnical hoisting winch	1 x EMCE (9 Te / 1500 m / 19 mm)

Communications

GMDSS	Motorola - 3 x VHF handheld
Vsat	2 x Seatel 5009 Ku-band
Iridium	Iridium Openport (Fall back)
UHF/ VHF radios (operational coms)	Motorola - 2 x VHF handheld / 3 x UHF mobile / 9 x UHF portable
CCTV camera system	Orlaco
TVRO	Intellian t40W

Safety

MOB boat	RIB
Liferafts	6 x 20 persons
Survival suits & life jackets	44 pcs
Lifeline Pulley System	Yes
Personal Locator Beacons (PLB)	Ocean M100

Survey equipment

DGPS positioning	Fugro Starfix Starpacks
Navigation package	Fugro Starfix Suite
Acoustic positioning	Kongsberg HiPap 501 incl Cymbal
Motion Reference Unit	Hydrins + Octans
Echosounder	Simrad EA400
Draft monitoring	2 x Rosemount Pressure Sensors
Multibeam echosounder	Kongsberg Maritime EM 2040 (Dual head/ Dual ping)
Side Scan Sonar	Edgetech 4200FS Dual frequency (different permutations of dual frequency subject to requirements)
Sub Bottom Profiler	Innomar Medium / Massa array 4 x 4 c.w. SES transceiver
Magnetometer	Geometrics G-882 / EIVA 3D Scanfish Katria / Fugro Geowing
Seismic compressor	Hamworthy 185E MK2 / 2 x Wärtsilä Water Systems Ltd
2D & 3D UHR Seismic	as required
Geotechnical sampling	Vibro coring CPT sampling
Environmental sampling	as required



G-882

Cesium Marine Magnetometer



Geometrics' G-882 Marine Magnetometer is the leading marine system in the industry with over 1,000 systems sold! The G-882 is the only system that meets the standards for UXO clearance in the North Sea.

This very high-resolution Cesium vapor marine magnetometer is low in cost, small in size, and offers flexibility for professional surveys in shallow or deep water. Use your personal computer with our MagLog™ software to log, display and print GPS position and magnetic field data.

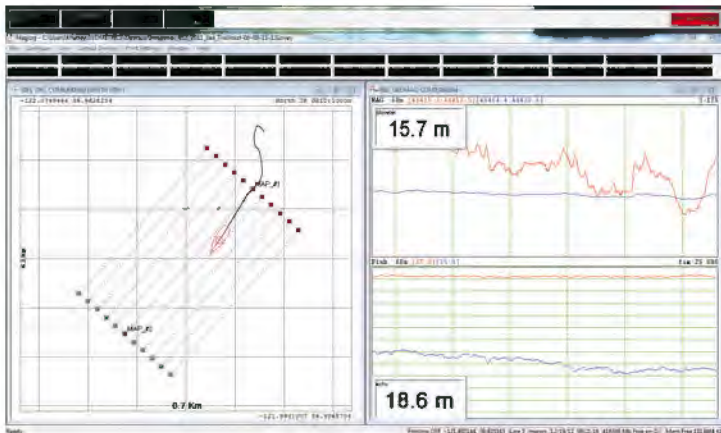
The system directly interfaces to all major side-scan manufacturers for tandem tow configurations. Being small and lightweight, it is easily deployed and operated by one person. But add several streamlined weight collars and the system can quickly weigh more than 100 lbs for deep-tow applications.

This marine magnetometer system is particularly well-suited for the detection and mapping of all sizes of ferrous objects. This includes anchors, chains, cables, pipelines, ballast stones and other scattered shipwreck debris, munitions of all sizes (UXO), aircraft, engines and any other object with a magnetic expression. The G-882 is also perfect for geological studies. Its high sensitivity and high sample rates are maintained for all applications.

Objects as small as a 5-inch screwdriver are readily detected provided that the sensor is close to the seafloor and within practical detection range (refer to table on back).

FEATURES & BENEFITS

- **Cesium Vapor High Performance** – Highest detection range and high probability of detecting all sized ferrous targets.
- **Streamlined Design for Tow Safety** – Low probability of fouling in fishing lines or rocks. Rugged fiber-wound fiberglass housing.
- **Sample at up to 20Hz** – Unparalleled data density while also covering larger areas per day.
- **Sensor can be Rotated for Optimal Signal** – Can be used worldwide.
- **Easy Portability and Handling** – No winch required. Built-in easy-carry handle. Operable by a single man; only 44 lb with 200 ft cable.
- **Combine Multiple Systems for Increased Coverage** – Internal CM-221 Mini-counter provides multi-sensor sync and data concatenation, allowing side-by-side coverage which maximizes detection of small targets and reduces noise.
- **Export Version Available** – Use anywhere in the world without need for an export license (except embargoed countries). See specifications.



MagLogLite™ Data Logging software is included with each magnetometer and allows recording and display of data and position with automatic anomaly detection. Additional software options include: MagLog Pro™, advanced logging software; MagMap™, a plotting and contouring package; and MagPick™ post-acquisition processing software.

MAGNETOMETER / ELECTRONICS

Operating Principle: Self-oscillating split-beam Cesium vapor (non-radioactive).

Operating Range: 20,000 to 100,000 nT.

Operating Zones: The earth's field vector should be at an angle greater than 10° from the sensor's equator and greater than 6° away from the sensor's long axis. Automatic hemisphere switching.

Noise: $<0.004 \text{ nT}/\sqrt{\text{Hz}}_{\text{rms}}$ (SX (export) version: $<0.02 \text{ nT}/\sqrt{\text{Hz}}_{\text{rms}}$).

Max Sample Rate: 20 Hz.

Heading Error: $< 1 \text{ nT}$ (over entire 360° spin).

Output: RS-232 at 1,200 to 19,200 Baud.

Power: 24 to 32 VDC, 0.75 A at power-on and 0.5 A thereafter.

MECHANICAL

Sensor Fish

DIA: 7 cm; L: 137 cm (2.75x54 in) (with fin assembly).
Weight: 18 kg (40 lb).

Includes sensor and electronics and 1 main weight. Additional collar weights are 6.4 kg (14 lb) each; total of 5 capable.

Tow Cable

DIA: 12 mm; L: 800 m (0.47 in x 2,625 ft).
Weight: 7.7 kg (17 lb) with terminations.
Break strength: 1,630 kg (3,600 lb)
Bend diameter: 30 cm (12 in).

Typical Detection Range for Common Objects

- | | |
|-------------------------|----------------------------------|
| 1. Ship: 1000 tons | 0.5 to 1 nT at 800 ft (244 m) |
| 2. Anchor: 20 tons | 0.8 to 1.25 nT at 400 ft (120 m) |
| 3. Automobile | 1 to 2 nT at 100 ft (30 m) |
| 4. Light Aircraft | 0.5 to 2 nT at 40 ft (12 m) |
| 5. Pipeline (12 inch) | 1 to 2 nT at 200 ft (60 m) |
| 6. Pipeline (6 inch) | 1 to 2 nT at 100 ft (30 m) |
| 7. Iron: 100 kg | 1 to 2 nT at 50 ft (15 m) |
| 8. Iron: 100 lb | 0.5 to 1 nT at 30 ft (9 m) |
| 9. Iron: 10 lb | 0.5 to 1 nT at 20 ft (6 m) |
| 10. Iron: 1 lb | 0.5 to 1 nT at 10 ft (3 m) |
| 11. Screwdriver: 5-inch | 0.5 to 2 nT at 12 ft (4 m) |
| 12. Bomb: 1000 lb | 1 to 5 nT at 100 ft (30 m) |
| 13. Bomb: 500 lb | 0.5 to 5 nT at 50 ft (16 m) |
| 14. Grenade | 0.5 to 2 nT at 10 ft (3 m) |
| 15. Shell: 20 mm | 0.5 to 2 nT at 5 ft (1.8 m) |

ENVIRONMENTAL

Operating Temperature: -35°C to +50°C (-30°F to +122°F).

Storage Temperature: -45°C to +70°C (-48°F to +158°F).

Altitude: 9,000 m (30,000 ft).

Depth: 4,000 psi (2,730 m; 8956 ft).

Water Tight: O-Ring sealed for up to 4,000 psi depth operation.

ACCESSORIES

Standard: Operation manual, shipping/storage container, ship kit with tools and hardware, power supply, MagLogLite™, MagMap™ and MagPick™ processing software, depth transducer, altimeter.

Optional: Steel tow cable to 6,000 m (19,600 ft) with telemetry, longitudinal or transverse gradiometer, plastic Pelican® case, MagLogPro™, collar weights.

Specifications subject to change without notice. G-882_v1 (0118)



GEOMETRICS
Innovation • Experience • Results

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GEO OCEAN IV

Offshore Survey & Support Vessel

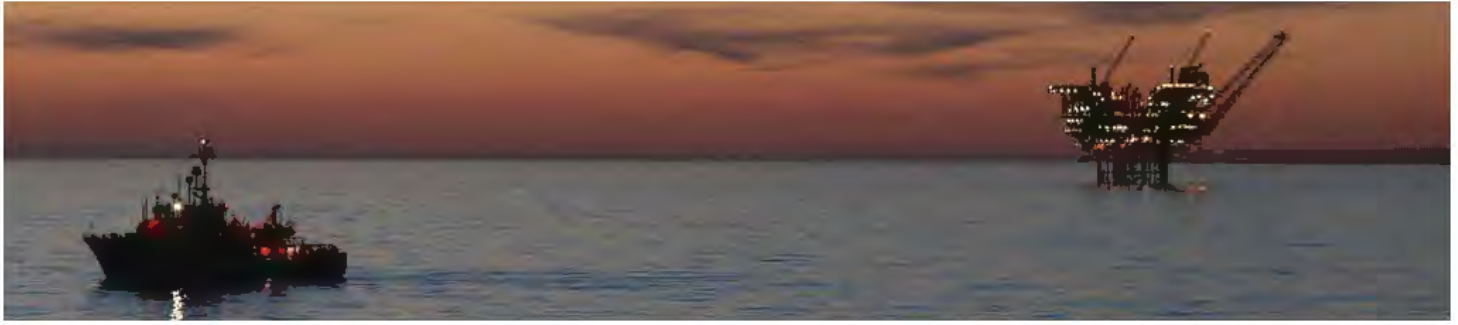


Picture: Port of Ostend



SUPPORT ACTIVITIES / VESSEL CAPABILITIES

The GEO OCEAN IV is a multi-disciplined Offshore Survey Vessel. With specifically selected equipment and capabilities for North Sea Survey and Support activities, she is the ideal candidate for the Oil & Gas and Renewable sectors .



TECHNICAL SPECIFICATION

General

Name	Geo Ocean IV
Port Registry	Luxembourg
Call Sign	LXHD
IMO Number	8704858
MMSI	253641000
Classification	BV
Vessel Type	Survey Vessel SV
Special Service:	Standby/Resue Vessel, Guard vessel
Unrestricted navigation	

Dimensions and Construction

Built:	Johs Kristensen Skibsbyggeri - Denmark 1989 (Conversion 2001/2010/2019)
LOA:	41,90 m
Width Moulded:	9,10 m
Draught Moulded:	5,2 m
Gross Tonnage:	723

Accommodation

Total Berths:	20 persons
Total Cabins:	19
Single cabins with shower and toilet:	13 x 1 person
Double cabins with shower and toilet:	6 x 2 persons

Crew

Min. Safemaning:	6 crew + 1 cook
Min. standby maning:	6 crew
MCA Standby:	12 crew

Capacities & delivery Rates

Main Deck area:	110 m ²
Max Deck Loading	15 tons

Safety Equipment

Search Lights:	1x 5000w with remote control from 3 positions 2x 1000w with manual handling
Helicopter Winch zone:	Free operational area on forecastle deck Second zone on aft deck
Rescue crafts:	Viking 4x25 persons

Fast Rescue Craft

1x ESVAGT STB 15C with modified forecastle to secure maximum transfer capabilities of personnel and goods. Rescue craft, self righting, rigid wiht inflatable tubes and with 2x 140HP Volvo Penta Diesel inboards. SOLAS approved for 15 persons.	
Rescue capacity:	100 persons

Propulsion & Machinery

Main propulsion:	High screw CP-propeller - no nozzle
Main Engine:	1 x 1,860 KW Wärtsila 12V 25F derated from 2900 KW, New 1992
Gear:	Reintjes gearbox for 1860 KW
Thrusters:	Retractable azimuth 450 KW independent driven by Cummins KTA19 diesel engine
	Brunvoll 184 KW Stern thruster, Brunvoll 184 KW Bow thruster,
Generators:	Mitsubishi 1x450kVA 380V 50Hz (aft engine room) Cummins 1x165kVA 380V 50Hz (fore engine room)
Emergency generator:	1 Valmet 80kVA 380V 50Hz

Speed & Consuption (Information only)

Approx. 13 kts	5m ³ / day
Approx. 10 kts	2,5m ³ /day
Approx. 7 kts	1,7m ³ /day
Standby	1m ³ /day

Tank capacity

Fuel capacity	87m ³
Drill Water	57m ³
Potable water	68m ³

Deck Equipment and Cranes

Winches:	1x 6t Hägglund anchor winch, type HOH2165 1x 14t Hägglund gilson winch, type HDH436,8
Crane:	1x Amco Veba 823M sea crane (12t/m) 1x1500HP hydr. Gear off the PTO

Electronics:

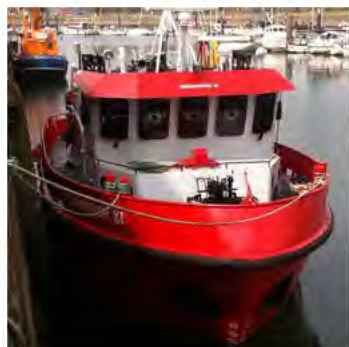
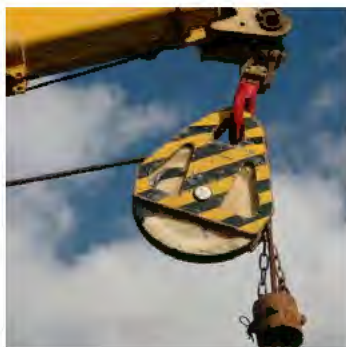
Radar:	Deca Bridgemaster Koden MD-3604
Echo sounder	Simrad skipper colour
Fuel Meter	OB 991
Radio Telephone	Skanti 400W
VHF	3x Sailor Compact RT 2048 3x Handheld VHF
UHF	Jotron Transiver Type Tr6102
Alarm System	OB 481
GPS Navigator	Koden KGP-900
Autopilot	Furuno GP-50 MK3
AIS	Koden KS538
Electronic Seachart	Furuno Universal FA-100
Log	Maxsea Simrad NL

Survey Sensors

MBES	Kongsberg EM2040-04 Dual Head
Single Beam	TC2122
Sound Velocity Sensor	AML Basic X2
Sidescan Sonar	Edgetech 4200
Sub Bottom Profiler	Dual Neptune with Silas EBP

GEOSURVEYOR XI

Survey & Support Vessel



SUPPORT ACTIVITIES / VESSEL CAPABILITIES

- Site investigations
- Diving & ROV support
- Geophysical surveys
 - multibeam
 - singlebeam
 - high resolution seismic
 - side scan sonar
 - magnetometry
- Cable & Pipe route surveys
- Wreck investigations
- Environmental surveys
- Bottom and sediment sampling
- Density and shear strength measurements



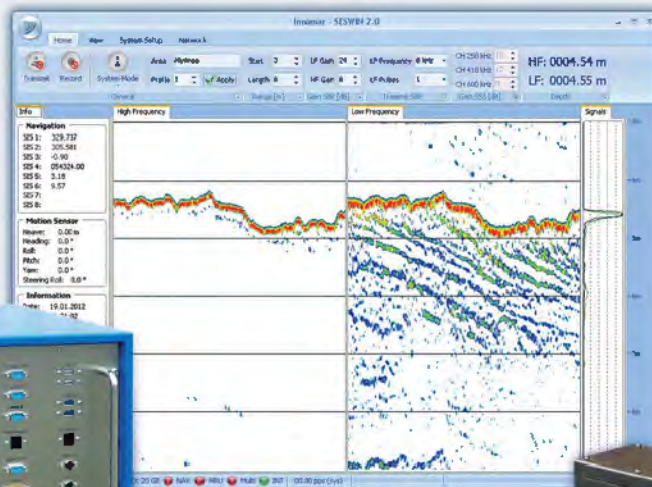
TECHNICAL SPECIFICATION		Control and navigation	
General		Radars	
Name	Geosurveyor XI	JMA 5110	
Classification	MCA Cat. 2 - 60 miles	JMA 2254	
Built	1988 by I.D.P. Belgium	JRC auxiliary radar	
Hull material	Steel	Raymarine C120	
Port / Flag	London	Raytheon	
Call Sign	ORVI	Raytheon	
Type vessel:	Seagoing Survey Vessel	JHS182	
Dimensions		Gyrocompass/motion sensor	
		Ixsea Octans FOG	
Overall length		Communications	
Width	21,11 m	VHF	
Draft	6,40 m	Liton TR 4822 / Sailor RT2048	
Hight above waterline	2,00 m	Emergency handset	
Gross Tonnage	13,00m	Safety	
Accomodation		Liferafts/Lifejackets	
		According to class	
Cabins		Survey Equipment	
Licensed for	4 berth cabin / Galley / Toilet & Shower	GNSS	
Electrical Systems	12 passengers + 2 crew 380 volt / 220 volt	Trimble BD982	
Machinery		Motion sensor	
Main engines	2x Caterpillar 3406B	Sound Velocity Profiler	
Propulsion	Twin fixed Propellers	Multibeam	
Power output	554KW/752 BHP at 1800rpm	Singlebeam	
Cruising speed	11 knots	Modem	
Deck Crane	HIAB 120 - 5,3t on 2,00M 1,4t on 8,20m	Robustel 4G Modem	
Tank Capacities			
Fresh Water	3000 ltr		
Fuel	22000 ltr		



Top-side unit



Screenshot of the operating software



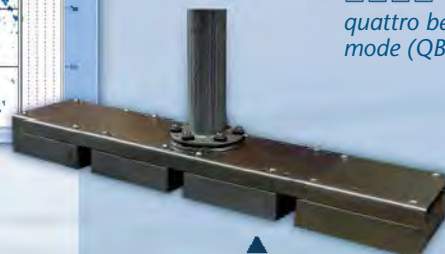
single beam mode (SBM)



dual beam mode (DBM)



quattro beam mode (QBM)



Transducer (QBM)

► Performance

- water depth range:
SBM: 1 – 500 m
QBM: 0.5 – 30 m
(depends on array geometry)
- sediment penetration:
SBM: up to 50 m
QBM: up to 20 m
- layer resolution: up to 5 cm
- motion compensation: heave
- beam width @ 3 dB for all frequencies:
SBM: $\pm 1.5^\circ$ / footprint < 5.5 % of water depth
QBM: $\pm 2.5^\circ$ / footprint < 9.0 % of water depth

► Transmitter

- primary frequencies:
approx. 100 kHz (band 85 – 115 kHz)
- secondary low frequencies:
4, 5, 6, 8, 10, 12, 15 kHz (band 2 – 22 kHz)
- primary source level:
SBM: > 245 dB/ μ Pa re 1 m
QBM: > 235 dB/ μ Pa re 1 m
- pulse width: 0.07 – 1 ms
- pulse rate:
SBM: up to 60/s
QBM: up to 15/s per transducer
- multi-ping mode (SBM)
- pulse type: CW, Ricker

► Acquisition

- primary frequency
(echo sounder, bottom track)
- secondary low frequency
(sub-bottom data, multi-frequency mode)
- sample rate 96 kHz @ 24 bit

SES-2000 quattro

Parametric Sub-bottom Profiler

► System Components

- transceiver unit 19 inch / 6 U
(WHD: 0.52 m x 0.30 m x 0.40 m; 32 kg)
- transducer excl. 15 m cable
(WHD: 4 x [0.21 m x 0.06 m x 0.21 m];
4 x 5 kg)
- system control: internal PC

► Software

- SESWIN data acquisition software
- SES Convert SEG-Y/XTF data export
- SES NetView remote display
- ISE post-processing software
- 3D volume renderer

► Power Supply Requirements

- 100 – 240 V AC / 50 – 60 Hz
- power consumption: < 300 W



www.innomar.com

DINA POLARIS



Introduction

The Dina Polaris is a 2017 build, DP2 vessel, specially designed for offshore installation services in harsh weather conditions. The Dina Polaris is an ice class vessel constructed according to Baltic rules allowing her to operate in cold climate environments in ice thickness up to 0.8m. Certificated Clean Design she was designed and built to minimise her working footprint on the environment. Geoquip Marine's twin derrick fully heave compensated GMTR120 drilling rig has been installed over the 7.2m² midship moon pool. At 99m length and 21m beam she is one of the largest geotechnical vessels currently available in the industry, creating an extremely stable platform, allowing seabed PCPT equipment and ROV to be mobilised alongside the GMTR120.

Positioning

DP2 System Installed: ICON by Rolls-Royce (Autoposition, Auto Track, Follow Target, Joystick System), Reference Systems (DGPS, CyScan, RADAscan, HiPAP501)

Key Features:

- Class 2 Dynamic Positioning
- Clean design vessel minimising carbon footprint
- Ice class vessel
- Heave compensated deep water drilling rig
- Combined water and borehole depth of 2,500m
- Downhole push/piston sampling
- Downhole APvdB Piezocone Penetration Testing (PCPT)
- Comprehensive on board soils testing laboratory
- 97 berths, 5 offices and one conference room
- Built in hangars for WROV, port and starboard

On Board Laboratory

The Dina Polaris has been fitted with Geoquip Marine's soil laboratory. The laboratory is equipped with the necessary tools to conduct standard soil testing experiments. Routine sample handling, photography, classification and storage are part of the everyday work process in the laboratory. The scope of work performed on the sample can vary depending on the client or project. Lab experiments that can be performed include:

- Water content, bulk and dry density
- Qualitative carbonate content
- Laboratory vane
- Fall cone
- Torvane
- Pocket penetrometer
- Unconsolidated Undrained (UU) triaxial
- Point load (determination of $I_{s(50)}$ for rock)

Recovered samples are stored in a temperature controlled environment prior to shipment to an onshore facility.



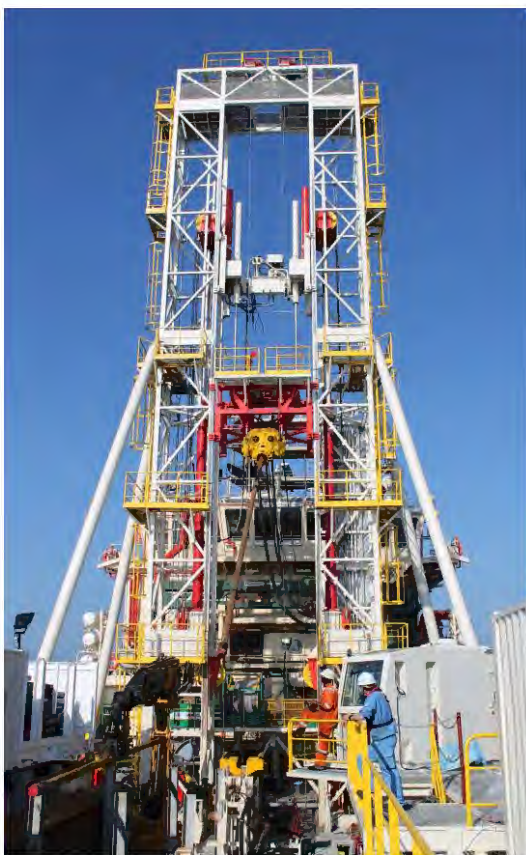
DINA POLARIS	
Flag, IMO, Call Sign	Norway, IMO: 9765031, Call Sign: LAXB7
Class	DnV + 1A1, SF, E0, OFFSHORE SERVICE VESSEL, DK(+), HL(2,8), CLEAN DESIGN, NAUT OSV(A), RECYCLABLE, BWM-T, ECA(SOx-A), LFL(*), COMF V(3)C(3), DYNPOS AUTR, SPS, ICE 1A, WINTERISATION BASIC
Built	Besiktas, Turkey # 75, 2017
Tonnage	GRT 6966 NRT 2089 Deadweight at 7,08 m 6018 t
Principal Dimensions	LOA 98.90 m Breadth (moulded) 21.00 m Depth (to main deck) 8.60 m Draft (max) SF 7.08 m
Fuel Capacity	2500 m ³
Machinery	Main Engines 4 x MTU-16V 4000 M63L-2240 kW, 900-1800rpm, Total 8960 kW-12185 bhp Generators 2x 2240 kW 575/690V Harbour Generator 1 x 350 Kw Bow Thrusters 2x Tunnel 970 kW-CPP Azimuth Propellers 1 x AZIMUTH 883 KW-FP, 2200 kW, Ø3000 mm
Environmental Features	Ballast water treatment system, Exhaust Gas Cleaning by Selective Catalytic Reduction Converter with 95 % NOx reduction. Rolls Royce SaveCube for Energy Optimisation. LED lighting fitted where possible.
Deck Machinery	Capstans 2 x 10 t Tugger Winches 2 x 15 t Mooring Winches-aft 2 x 10 t 0-16 m/min Anchor windlass 2 x 21 t 0-38m/min Deck Crane STB 5t@13,5 m, 2t@24 m, foldable, manriding Anchor Chain 2 x Stockless Anchor Chain Ø52 mm Garbage Incinerator Fitted
Navigation Equipment	Navigation Control RR Unified Bridge Joystick Rolls Royce DP Rolls Royce ICON References Rada Scan (1), CyScan (1), MRU (3), DGPS (2) Wind Sensor (2), HiPap 501 (follow Sub.) 1 x 10cm. 1 x 3 cm Fitted Fitted 3 3 TECDIS
Accommodation	Single Cabins: 17 2 bunk Cabins: 32 (64 bunks) 4 bunk Cabins: 4 (16 bunks) Gymnasium 1, Treatment Room 1, Dayroom/Lounges 3, Messroom/duty mess 2, Conference room 1, Offices 5 All cabins with separate WC/Shower, fully airconditioned. Local area Network CAT 7 in the entire accommodation.

GMTR120 - Innovative Design

The design has maintained the advantages of light construction, low centre of gravity and hoist loads whilst utilising a more efficient method of heave compensation, delivering greater sensitivity, resulting in improved core recovery and sample/data quality. In addition the design introduces a number of new safety features, including mechanical pipe handling and use of nitrogen as a compensator buffer gas.

Drilling Monitoring and Downhole Tools

The geotechnical drilling rig is fully instrumented for the electronic display of drilling parameters; torque, bit weight, mud pressure, mud flow rate and rotation speed. A comprehensive range of wireline downhole sampling and testing tools is available including PCPT (Piezocone Penetration Test), piston sampling, push sampling, wireline core barrel and percussion (hammer) sampling. All downhole tools (coring, sampling, dilatometers, p-s logging) are fully compatible within the 5.5" API drill string. A range of drag and specialised coring bits are provided. Large diameter drill pipe can also be used to allow large diameter cores to be taken.



GMTR120	
Drilling System	Ram hoist system with twin wire suspension giving safe, efficient and compensated handling of the drill string and all in-hole tooling
Heave Compensation	6m stroke passive heave compensation (semi active under development) using nitrogen gas as compensation buffer with Olmsted valve slingshot protection. Seabed frame compensation 0.0 to 7.0m
Top Drive/Power Swivel	Top Drive / Power Swivel-Edeco swivel 19,400 N/M 0-120 rpm and 5,000 N/M 400 RPM breakout torque 22,500 N/M. Load capacity 120t capacity.
Seabed Frame	Up to 20t submerged, with hydraulic clamps
Pipe Handling	Single range two drill pipe handling using a proprietary mechanical handling system utilising pipe handling crane and pipe grabble; remote operated iron rough neck and spinner; proprietary catwalk system. Handles pipe with minimum manual intervention and hence improved safety
Hydraulic System	2x electro hydraulic power packs of 310kW each. Hydraulic distribution from a control module beneath the centralised control cabin
Mud System	Project-specific modular mud systems installed as required
Rig Winches	Seabed Frame: 3,500m, 36mm wire rope; SWL 32t / Head Line: SWL 3t, Tail Line: SWL 3t / Sampling: 3,000m, 10mm wire rope; SWL 1.5t
Drill Control Cabin	Proprietary designed control cabin for remote control via hydraulic/electric interface of all drilling and sampling operations. 3 man cabin for driller, assistant driller and PCPT operator giving coordinated control of all drilling/sampling operations. Rig specific DMS recording
Transport	Derrick sections and modular components designed to be transported within standard open-top shipping containers
Capability	Utilising a standard geotechnical drill string of BHA, drill collars and 5½" API drill pipe the 120t SWL gives a combined bore hole and water depth capacity up to 2,500m. Use of a aluminium drill string would increase this capability
Sampling <i>in situ</i> Testing	Can utilize 6½" API drill string to allow large diameter coring. Fitted with AP v. d. Berg downhole PCPT / push/piston sampling equipment and wireline coring equipment. Presently 1,200m PCPT umbilical and winch capacity – can be extended to 1,600 m
Soil Testing Laboratory	Installed on board as per project requirements
200kN Seabed CPT	As an option Geoquip's GMC201 20t seabed unit can be deployed through the vessel moonpool using the rig derrick and compensation system



TRUSTED OFFSHORE GEOTECHNICAL SOLUTIONS

Downhole Sampling Wireline Sampling Tools



Introduction

Geoquip Marine provide a suite of wireline downhole tools with their heave compensated drill rigs to recover high quality undisturbed samples and disturbed samples for description, classification and laboratory analysis.

Deployment

All wireline tools are deployed through the mud valve located in the rooster box of the drill rig and do not require the changing of 'back ends' prior to use when alternating with different sampling methods.

Piston and Push Sampling

Piston and push samplers are used to recover high quality undisturbed samples and are advanced hydraulically at a constant rate to minimise disturbance. The stroke of the wireline piston and push tools are 1.0m. The piston tool would only be used in very soft to soft cohesive layers where sample recovery can be difficult. The push sampler would be used in all other non-cemented cohesive and non-cohesive layers.

Percussion / Hammer Sampling

In layers where the push tool can not be advanced, such as weakly cemented material, gravel or where damage to the sample tube is likely then the sample tube is likely then the percussion/hammer sampler is used. This robust tool will recover samples in those layers in which the push and piston can not be used. A disturbed sample is recovered suitable for classification which is retained in the split spoon by a tulip catcher.

Advantages

The wireline deployment of all tools mobilised with Geoquip Marine's drill rigs allows the geotechnical engineers to alternate sampling and testing methods so that the most meaningful samples and data are recovered for a project without delaying the progress of the borehole.

Wireline Sampling Tools			
	Piston Sampler	Push Sampler	Percussion / Hammer Sampler
Sample Diameter	72mm	63.5mm 70.5mm 72.0mm	65mm
Sample Tool Stroke Length	1.00m	1.00m	0.65m
Available Thrust	15t	15t	75kg free fall hammer
Sample Tube	Seamless stainless steel	Seamless stainless steel	Hardened steel with cutting shoe and tulip catcher
Ground Conditions for Use	Very soft to soft cohesive layers	All non-cemented cohesive and non-cohesive layers	Weakly cemented and gravel

Downhole Sampling Wireline Rock Coring



Introduction

The wireline rock coring tool is one of a range of downhole tools employed by Geoquip Marine that can be readily interchanged without having to pull the drill string. For example there is no need to pull rods when changing from rotary flush drilling in sands and clay layers to rotary coring in cemented sand and competent rock or vice versa.

Technical Features

There are two types of triple tube wire line core barrels available which are used to recover cores in different rock/cemented conditions. The first is the traditional design triple tube, plastic lined, wireline inner barrel. The second is an in-house developed triple tube, plastic lined wireline inner barrel that has a sprung loaded leading cutting shoe on the inner tube.

Advantage of the in-house Developed Triple Tube

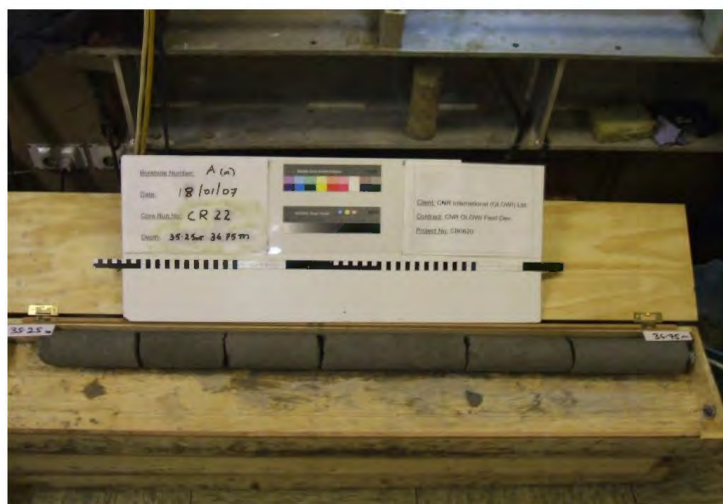
The traditional core barrel is used to recover rock cores where ground conditions are competent rock and there is little variation in strength, fracturing and/or weathering. Where considerable variation in these three parameters does exist the sprung loaded inner tube barrel is much better suited due to its unique design. The inner tube cutting shoe will completely retract in material that is strongly cemented to allow the PCD (polycrystalline diamond) face discharge bit to cut the core in the same way a traditional core barrel would. In less cemented or non-cemented layers the inner shoe will spring forward to protect the sample in front of the bit from being washed away before entering the plastic liner.

Better Design - Better Recovery

The Geoquip Marine leading shoe core barrel therefore recovers the weaker/non-cemented material between the competent rock that would have been lost if the traditional core barrel had been used. This core barrel is therefore ideally suited for use in such areas as the Middle East where highly variable calcarenite layers are common between clays and non-cemented sands.

Wireline Rock Coring

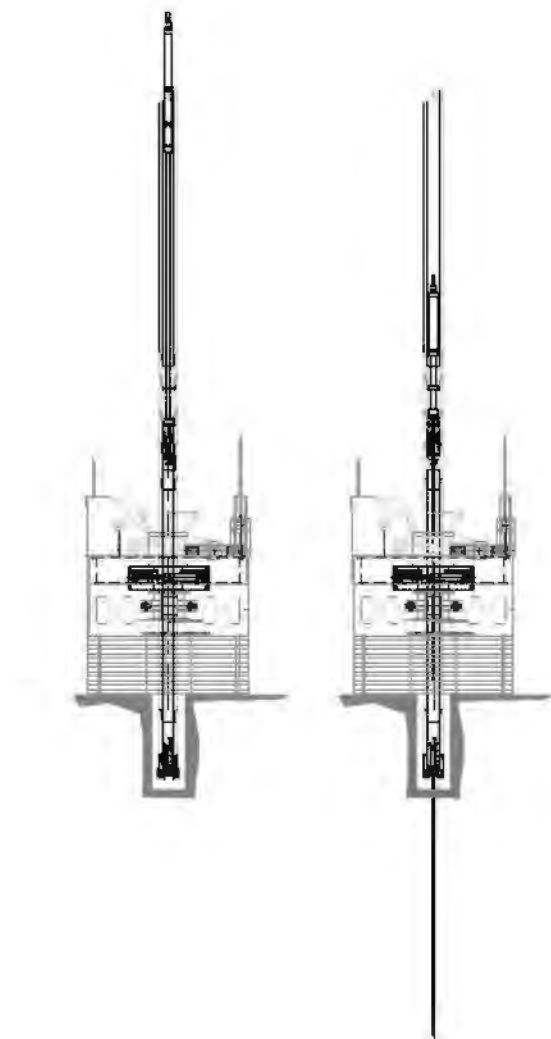
	Traditional Core Barrel	GMUK's Leading Shoe Core Barrel
Core Diameter	80mm	70mm
Core Length	1.5m	1.5m
Ground Conditions for Use	Consistent competent rock	Highly variable layers e.g. calcarenite, interbedded non-cemented sand and rock





TRUSTED OFFSHORE GEOTECHNICAL SOLUTIONS

In Situ Piezocone Penetration Test Tool



Introduction

Geoquip Marine provides offshore drill rigs with the capability to conduct Piezocone Penetration Testing (PCPT) using the AP van den Berg PCPT system (WISON-APB).

Data Acquisition

Parameters recorded by the cone and displayed in real-time on the acquisition computer include tip resistance, sleeve resistance and pore water pressure.

Technical Features

Tests with this PCPT equipment can be conducted with a 1.5m or 3.0m stroke length utilising a 10cm² or 5cm² cone. The wireline PCPT tool is designed to be operated within the rig's API drill string with the cone advanced into the soil ahead of the drill bit using the WISON internal hydraulic cylinder.

The cone is advanced at the industry standard constant rate of 2cm/s.

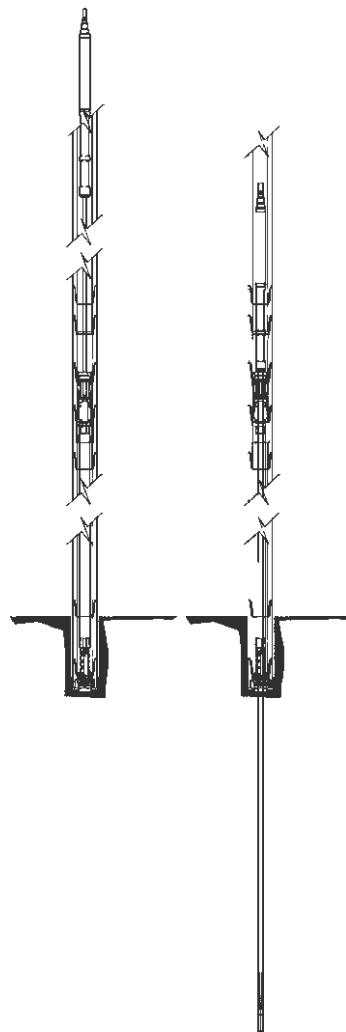
On completion of each test the PCPT tool is reset on deck by pumping the stroked length back into the tool's body with high pressure water.

Operation

The stroke length during a test is measured by a calibrated flow cylinder integrated within the power pack. Two electronic baseline checks are performed on all three channels for each test.

The first is recorded with the tool at the bottom of the borehole prior to starting the test. The second baseline is taken upon completion of the test prior to retrieving the tool from the borehole. The first baseline is used to zero the sensors for recording the test data. The second baseline serves as a quality control check to monitor the integrity of each sensor. Additional baselines are recorded before and after each test with the tool on deck.

Wireline Sampling Tools		
	1.5m WISON-APB PCPT	3.0m WISON-APB PCPT
Maximum Test Stroke Length	1.5m	3.0m
Penetration Rate	2cm/s	2cm/s
Derived Parameters	Net cone resistance MPa Friction ratio % Pore water pressure ratio %	Net cone resistance MPa Friction ratio % Pore water pressure ratio %
Ground Conditions for Use	Dense to very dense non-cohesive layers	All cohesive layers and up to very dense non-cohesive layers





TRUSTED OFFSHORE GEOTECHNICAL SOLUTIONS

Geotechnical Tools PCPT Cones



Introduction

The cones Geoquip Marine use with their CPT tools are of industry standard 5cm² or 10cm² effective areas and have a maximum tip resistance of 100MPa. CPT measurements are crucial for offshore engineering purposes and are required by most of our clients. Our crew is experienced in handling all the necessary instrumentation to ensure highest quality data is obtained.

Range of Use and Method of Employment

Typically Geoquip Marine uses these electronic cones in geotechnical site investigations conducted by their heave compensated drill rigs where the reaction for each test is provided by the seabed frame (SBF).

Pore Water Pressure	
Bridge Feeding	1.277mA
Sensitivity	15.6617mV/mA
Bridge Feeding	3.929V
Sensitivity	5.0910mV/V
Inaccuracy less than	40kPa
Nominal Pore Pressure	4,000kPa
Maximum Pore Pressure	6,000kPa
Output at Nominal Tip Resistance	20mV

Data Transfer

The cones data signals are transferred through the CPT's umbilical (from which the cone is powered) and displayed in real time on the acquisition computer.

Additional Measurements

A pore water pressure sensor on the cones positioned between the cone tip and sleeve provide an additional parameter for Geoquip Marine's geotechnical engineers to utilise when classifying soil types from the tests.

Tool Specifics

Typical load range, accuracies and sensitivities of the three cone sensors are detailed in the tables.

PCPT Accuracy classes

Geoquip normally adopt Class 1 PCPT cones although depending on ground conditions Class 2 may be used subject to agreement.

PCPT Cones		
	Tip Resistance	Tip and Local Friction
Bridge Feeding	12.563mA	12.563mA
Sensitivity	1.1191mV/V	1.1320mV/V
Inaccuracy less than	0.1MPa	0.1MPa
Nominal Tip Resistance	50MPa	50MPa
Maximum Up Resistance	100MPa	100MPa
Output at Nominal Tip Resistance	5mV	5mV
Effective Area	5cm ² /10cm ² /15cm ²	5cm ² /10cm ² /15cm ²

Accuracy class	Measured parameter	Allowable minimum accuracy	Max. length between measurements
1	Cone resistance Sleeve friction Pore pressure Inclination Penetration depth	50 kPa or 3% 10 kPa or 10% 5 kPa or 2% 2° 0.1 m or 1%	20mm
2	Cone resistance Sleeve friction Pore pressure Inclination Penetration depth	200 kPa or 3% 25 kPa or 15% 25 kPa or 3% 2° 0.2 m or 2%	20mm

IN SITU TESTING SEISMIC PIEZOCONES



Introduction

Geoquip Marine provide a Seismic Piezocone Penetration Testing (S-PCPT) system for use in conjunction with offshore drilling spreads. The system comprises a seismic shear wave generation source, seismic cones with built in geophones and a seismic recorder. The seismic source is fitted to the drilling seabed frame and deployed at the start of each borehole. The seismic cones are compatible with Geoquip Marine's Wison-APB Piezocone Penetration Testing (PCPT) tool which Geoquip Marine have been operating for several years from their various drilling vessels.

Innovative Design

Downhole *in situ* seismic measurement enables this data to be acquired more economically offshore than by using a cross borehole method. Traditional PCPT data is also acquired by the system more details of which can be found in Geoquip Marine's Wison-APB PCPT tool information sheet. The main specifications of the S PCPT system.

Key Features:

- 3m test stroke length
- 2cm/s penetration rate during testing
- 2-6 shear waves generated per 3.0m test
- 70dB shear wave source
- 4 hydrophones (in 2 pairs in X and Y orientation with 1m separation)

Data Acquisition

The data acquisition system records the time taken for a shear wave to reach the geophones at different penetration intervals through the depth of a borehole. Seismic data acquired by the system can be used for the assessment of the shear moduli for small strains. This parameter is often required for earthquake analyses, foundation evaluation with regard to vibration and the assessment of wave loading on structures.



TRUSTED OFFSHORE GEOTECHNICAL SOLUTIONS

Offshore Laboratory Testing



Introduction

The Geoquip Marine containerised laboratories allows technicians and geotechnical engineers to determine soil classification and strength parameters for use in engineering and pile design, pipeline route assessments and dredging applications offshore during fieldwork operations.

Data Acquisition

The system provides a continuous profile of tip resistance, sleeve friction and pore water pressure, which can be used for the derivation of shear strength in cohesive soils and the relative density of non-cohesive soils. The system has the ability to operate a range of cone sizes and optionally seismic CPT cones, T-bar and ball PCPT equipment.

Data Transfer

The latest updates on drilling progress, data from downhole measurements and the results of laboratory testing can be sent to our clients shortly after they have been acquired. This allows our customers to monitor progress and to receive relevant information as soon as possible.



FUGRO

FUGRO SYNERGY

Fugro Synergy represents a new generation high technology drillship built in response to an increasing demand for cost effective drilling solutions.

The Fugro Synergy is a new build vessel that has been specifically designed to deliver Drilling and Sub Sea well services to the Global Oil and Gas industry. With an impressive technical specification, the Synergy is capable of removing many MODU based activities off the critical path. Fugro is focused on developing niche subsurface markets in the shallow section from mudline down to approximately 3,000m, dependent on water depth.

CAPABILITIES

Utilizing our core drilling knowledge and experience, we can install and construct the shallow section of subsea wells and seafloor infrastructure. The main development areas that will add maximum value to a Client project include:

- Subsea and Well Activity
- Conductor / Casing Installation
- Well De-risking
- Pre-Drill Activities
- Well Abandonment



Lifting pipe on the drill deck.



FUGRO SYNERGY

Technical Specifications

General

Vessel Name	Fugro Synergy
Builder / Year	Bergen Group Halsnøy AS / 2009
Owner / Operator	Fugro Synergy, Inc. / Fugro Drilling & Well Services
Flag	Bahamian
Speed	Transit 12 knots (Economic Cruise)
Call Sign	C6XR3 (Charlie Six X-ray Romeo Three)
Classification	+1A1 R ICE-C Ship-shaped Drilling Unit SF, COMF-V(3) HELDK-SH EO DYNPOS-AUTR CLEAN, DRILL DK (+)
Port of registry	Nassau
Endurance	45 days cruising
Operational water depth	25 m to 3000 m

Dimensions

Length over all (L.O.A.)	103.7 m
Beam (mid)	19.7 m
Free board	8.7 m
Draft	6.3 m (6.5 m Summer)
Displacement	9287 tons (deadweight 3775 tons)
NRT	1963 tons
GRT	6543 tons
Helideck	D= 21 m; suitable for Sikorsky S92 helicopter
Moopool	7.2 m x 7.2 m

Accommodations / Rooms

Cabins	24 x single, 28 x double, 1 x 4 man cabins
Day room	1 Non-Smoking – 1 Smoking
Fitness room	Yes
Conference room	Yes
Client office	1
Hospital	1 x 1 bed

Machinery

Main engine	(5) Caterpillar type 3516C - 2,188 kW @1,800 rpm
Main engine generators	(5) Siemens - 2,188 kW @1,800 rpm
Electrical system	690/450/230V-60 Hz
Propulsion	(2) Ulstein-Aquamaster Azimuth Thruster type AZP100/M-280 - 2,200 kW @1,200 rpm
Side thruster	(2) Kamewa Ulstein TT2200 SS DPN CP Tunnel Thruster - 1,050 kW @1,190 rpm
Azimuth thruster	(1) Ulstein-Aquamaster Azimuth Thruster type UL 1201 - 883 kW @1,800 rpm
Emergency generator	(1) 219 kVA 690 V 60 Hz @ 1,800 rpm
Emergency generator engine	(1) Volvo Penta 339 kW @ 1,800 rpm

Capacity

Fuel capacity	1,357 m³
Fuel consumption	DP 12 m³/day; Transit 28 m³/day
Water capacity	Potable 805 m³; Ballast 2,873 m³; Drill 1737 m³
Water making	1 x 40 m³/day

Communications

V-sat	Voice + Data access (multiple bands)
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Safety

Lifeboats (TEMPSC)	2 x Schat-Harding KISS 1000 - 90 person
Fast rescue boat	1 x Mare Safety GRP700 230 hp
Liferafts	2 x Viking & 4 x DSB (35 men each)
Survival Suits	113
Life jackets	114 + 8 Children Sized

Deck Machinery

Deck Cranes	5-ton Knuckle-boom Provisions crane
Aft Deck Crane	25-ton AHC Knuckle-boom Offshore Crane

Positioning / Navigation

Echosounder	1 x Furuno FE-700
S-band radar (ARPA)	1 x Furuno FAR-2837-S
X-band radar	1 x Furuno FAR-2827, 1 x Furuno FAR-2117
Gyro compass	(3) Simrad GC-80
Automatic pilot	Simrad AP 50
Doppler log	Furuno DS-80
Anemometer	Gill OMC-139
GPS	(2) DGPS Furuno GP-150
ECDIS	2 x TRANSAS 4000 (Main & Backup)
Transporter (SART)	2 x Tron SART-20 plus 2 in lifeboats

Drilling System / Seabed Frame System

Drilling Derrick	Fugro SeaCore R-190
Drilling Rig	SeaCore R-190
Max Load	150 tonnes, SWL Below Top Drive
Heave Compensation	BoschRexroth stroke 7m, Passive
Top Drive	National Oilwell Varco TDS 250
Drill Pipe Length	Drill Pipe API Range 2 (trips Doubles)
Pipe Handling	Aker PDPH Pipe Handler
Rotary Slips	Hydraulic Power Slips
Mud Pumps	(3) Wirth TPK800; each 949 l/min @340 bar to 2,762 m³/min @ 115 bar
Mud Mixing Pumps	(2) Baker SPF MUD HOG 2.5, each 227 m³/h @ 4 bar
Mud Tanks	(2) 85.9 m³ + (1) 65.9 m³ + (1) 44.9 m³ + (1) 23.8m³
Bulk Cement Tanks	2 x 75 m³
Barite/Gel Dry	4 x 75 m³
Heavy Load Winch	2 x 32 tonne, 60 m/min (3,000 m WD)
Seabed Frame	15 tonnes Air weight, 4.5 m wire separation

Geotechnical Systems / Laboratory

Downhole	WISON®
Seabed	SEADEVIL, SEACALF®
Onboard Laboratory	Permanent, 259 m²
Sample Storage	2.4 m x 3 m refrigerated container

Control and Navigation

DP System	DP2 - Kongsberg K-POS
Reference systems	2 x DGPS, 2 x Starpack, 1 x Taut Wire, 2 x HPR
Wind indicators	3 Indicator (OMC-139D)
Vertical reference system	2 x Seatex MRU



FUGRO

FUGRO VOYAGER

The Fugro Voyager is a new build vessel, part of a series of Fugro custom designed and constructed DP2 geotechnical drilling vessels.

GEOTECHNICAL DRILLING VESSEL

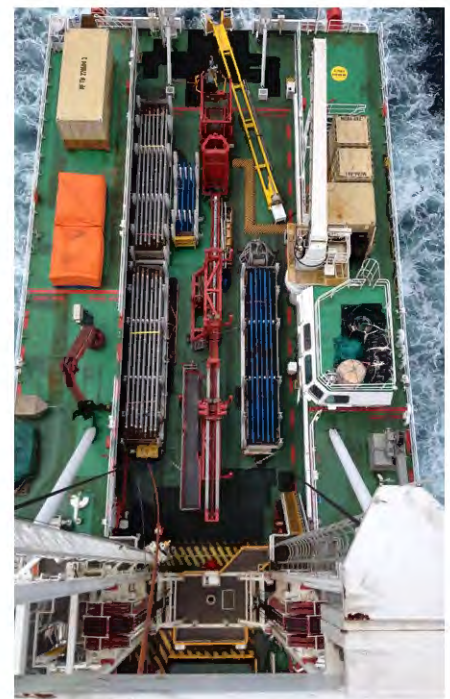
The Fugro Voyager is a fit for purpose designed and constructed geotechnical drilling vessel that provides a stable platform capable of operating independently in remote regions around the world. The design of the Fugro Voyager allows integrated investigation methods to be deployed during one survey program.

The Fugro Voyager is designed and constructed in compliance with the Code of Safety for Special Purpose Ships (2008). It has been specifically designed for operating in water depths up to 3000

meters for both drilling and seabed sampling and in situ testing.

The twin tower type drilling derrick is installed over a centrally located moonpool, drilling is performed with a heave motion compensated ram type drilling system.

The drilling machinery and equipment, rig pumps, drilling fluid bulk storage and mixing equipment, and ancillary equipment is installed below deck providing a clear, uncluttered main deck / drill floor area that when combined with automated pipe and tool handling equipment promotes safe drill floor operations.



Plan View of Drill Floor.



FUGRO VOYAGER

Technical Specifications

General

Vessel name	Fugro Voyager
Builder/Year	Tebma Shipyard/2013
Owner/Operator	ICON Voyager Pte. Ltd./Fugro Singapore
Flag	Singapore
Speed	Transit 10 – 12 knots
Call sign	9V3888
Classification	DNV+1A1, -E0-SF, SPS, Dynops AUTR, CLEAN, COMF-V(3), NAUT-OSV(T), DK(+), h1(1.2)
Port of registry	Singapore
Endurance	Max 35 days
Operational water depth	25 m to 3000 m

Dimensions

Length over all (L.O.A.)	82.9 m
Beam (mid)	19.8 m
Free board	2.5 m
Draft	5.65 m
Displacement	6,600 tons
NRT	1,394 tons
GRT	4,644 tons
Derrick height above keel	42 m
Moonpool	3.1 m x 3.1 m

Accommodation / Rooms

Cabins	14 x Single cabin, 23 x Double cabin
Day room	1
Fitness room	Yes
Conference room	16-18 persons
Client office	1
Hospital	Yes

Machinery

Main Engine	4 x MAN 9L21/31 @ 1980kW each
Main Engine Generators	4 x Hyundai HFJ7 @ 2351 kVA each
Power Management	ConverTeam 690V Distribution
Propulsion	2 x Berg CPP, 233 rpm; 2300 kW each with Becker rudders
Bow Tunnel Thruster	2 x Schottel 800 kW
Stern Tunnel Thruster	2 x Schottel 590 kW
Emergency Generator	1 x 300 kW

Capacity

Fuel capacity	800 m ³
Fuel consumption	DP 12-15 m ³ , Transit 14-24 m ³
Water capacity	Fresh 327 m ³ /Drill 753 m ³
Water making	50 m ³ /day

Communications

V-sat	K/Cu Band; Internet & Communications Singtel, Voice Fleet Broadband 77, Voice & Data (Fax)
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Safety

Hospital	1 x 2 beds
Lifeboats	N/A
Life rafts	4 x 35 men RFD, 2 x 25 men RFD
MOB boat	1 x 6 men NOREQ 25 hp
EPIRB	1 x Jotron, 1 x Sailor
Other aids	140 x Life jackets, 74 x Immersion Suits, 11 x Life buoys

Deck Machinery

Deck Crane 1	1 x SWL 5 tons McGregor
Deck Crane 2	1 x SWL 3 tons Plimsoll
A-Frame	Stern Mounted 15T SWL

Positioning/Navigation

Echosounder	1 x Skipper GDS 102, 50 & 200 Khz
S-band radar (ARPA)	1 x Sperry, Vison Master FT CATI 34
X-band radar	1 x Sperry, Vison Master FT CATI 34
Gyro compass	3 x Teledyne
Automatic pilot	1 x Sperry /Navipilot 4000
Doppler log	1 x Sperry /Naviknot
GPS	2 x SAAB R4 Navigation
ECDIS	TRANSAS 4000
Transporter (SART)	2 x Sailor, 9 Ghz

Drilling System/Seabed Frame Systems

Drilling Derrick	Twin Mast, 100T SWL
Drilling Rig	R100 Heave Compensated Ram Rig
Max Load	70T Compensated (80T Ratchet Mode)
Heave Compensation	Passive with Hard Tie Option, 6 m Stroke length
Top Drive	Seacore T1.0-A100
Drill Pipe Length	2500 m
Pipe Handling	Knuckle Boom Pipe Handler
Iron Roughneck	Aker Hydraulic
Automatic Tool Handler	Fugro design
Rotary Slips	Calvins FFH 100-S, Hydraulic
Mud Pumps	2 x Gardner Denver THE Triplex
Mud Mixing Pumps	2 x 50HP
Mud Tanks	2 x 30 m ³ , 1 x 28 m ³
Bentonite Dry/Liquid	3 x 50 m ³ /2 x 80 m ³
Barite Dry	1 x 50 m ³
Heavy Load Winch	Traction Winch 35T @ 9m/min, 10T @ 30m/min
	2 x 3200 m of 32 mm wire rope
Seabed Frame	3 m x 3 m x 4 m

Geotechnical Systems/Laboratory

Downhole	Wison MK IV and EP systems
Seabed	Wheeldrive SEACALF, Box Corer, Piston Corer
Seismic/Vane/Coring	Optional upon request
Onboard Laboratory	Permanent 7 m x 5 m
Sample Storage	1 x 20 ft Reefer Container

Control and Navigation

DP System	Converteam DPS 21 Duplex DP, WS x 2, DP IJS x 1, DP Portable Joystick x 1
Reference systems	1 x HiPAP Sonardyne USBL, 2 x DGPS, Fugro SeaStar 9205, 1 x ATW Series LTW
Wind Indicators	2 x Ultrasonic Gill Wind Observer, 1 x Young 09106
Vertical reference system	3x DMS 05



HORIZON GEOSCIENCES

HORIZON GEOBAY

VESSEL FEATURES

- DP-2
- Multipurpose site investigation vessel
- Kongsberg SDP 21 – HiPAP
- Helideck, Super Puma
- 30 t seabed crane with constant tension (1,500 m)
- Conference room, offices, online/offline rooms
- Accommodation for 66 people
- Dayrooms, mess and gym
- 469 m² deck area

The following equipment is available subject to project requirements:

GEOTECHNICAL EQUIPMENT

- Fully Heave Compensated Drill Rig
- Wison-APB Sampling, PCPT and Down-hole Vane Testing Equipment
- Containerized mud mix & transfer system
- Fully equipped offshore soil testing Laboratory
- 200 kN seabed CPT system
- ROSON 40 kN CPT system
- Vibro / Drop / Gravity Coring

GEOPHYSICAL EQUIPMENT

- Analogue geophysical
- 2D HR Digital geophysical (optional)
- Multi Beam Echosounder
- Single Beam Echosounder
- Magnetometer / Gradiometer for UXO Surveys

ROV EQUIPMENT

- Horizon Shark G2 inspection class ROV

POSITIONING SYSTEM

- CNAV & Veripos (Primary & Secondary)

PRINCIPAL PARTICULARS

- Flag: Panama
- Call Sign: 3ETG2
- IMO Number: 7801556
- Classification Society: American Bureau of Shipping (ABS)
- Class Notations: A1, AMS, ACCU, DPS-2
- Rebuilt: 1999

DIMENSIONS

- LOA: 87.0 m
- Beam: 15.6 m
- Draught: 6.91 m
- Gross tonnage: 3,502 t
- Net tonnage: 1,051 t

GENERATORS

- (4) Stamford LVSM 814 C2
- Output: Total 6,000 kW (440V 60 Hz)

AUXILLIARY ENGINES

- (2) YANMAR 6GL-HT 720
- 750 kW each

THRUSTERS / PROPULSION

- Stern thrusters / Propulsion (2) 1,400 kW CRP Aquamaster (azimuth)
- Bow thrusters: (2) 925 kW CP Kamewa (tunnel) (1) 830 kW Ulstein CP (azimuth)



HORIZON-GEOSCIENCES.COM

FIRST-CLASS SURVEY AND GEOTECHNICAL SERVICES

DECK EQUIPMENT

- 1 capstan
- 1 anchor winch
- 1 Hydralift crane (30 t / 10 m; 10 t / 20 m) wire length 1,500 m)
- Moon pool (4.8 m x 4.53 m)
- Power supply on deck (for trencher, etc.): 2,000 amp (440 v / 60 Hz)

ACCOMMODATION

- 66 persons
- 26 single cabins / 20 doubles

MAIN ENGINES

- (2) Caterpillar 3516B
- (2) Mitsubishi S12R-MPTK

NAVIGATION & INSTRUMENTATION

- 2 JRC ARPA Radars
- 1 Navigation Echo Sounder
- 1 MARIS ECDIE900
- 1 Trimble DGPS
- 1 Ashtech DGPS/GLONASS
- 1 Simrad Autopilot AP 9 Mk III
- 1 Anschütz 20 digital gyroscope
- 1 Sperry Marine NAVIGAT 2100 fiber optic gyrocompass
- BNWAS

COMMUNICATIONS

- System in accordance with SOLAS requirements for GMDSS-A3
- 1 Nera Mini-M (Voice/Fax)
- 1 Schlumberger Rignet (V-Sat /
- KU-band) (optional)
- 2 GSM mobile telephones
- FBB (Fleet Broad Band)

DYNAMIC POSITIONING SYSTEM (DP)

- 1 Kongsberg SDP 21 dual-redundant DP
- 2 Kongsberg HiPAP (dual mode)

HELICOPTER DECK

- 19.5 m x 19.5 m (Super Puma)

LIFE-SAVING EQUIPMENT

- 8 life rafts, capacity each: 25 persons
- 1 Norsafe Magnum (7,7 m) FRC
- 1 Vestdavit PL 3250

Note: This specification is subject to change without notice.

Dina Polaris



Introduction

The Dina Polaris is a 2017 build, DP2 vessel, specially designed for offshore installation services in harsh weather conditions. Certificated Clean Design she was designed and built to minimise her working footprint on the environment. Geoquip's twin derrick fully heave compensated GMTR120 drilling rig is installed over the 7.2m x 7.2m midship moon pool. At 98.9m length and 21.0m beam she is one of the largest geotechnical vessels currently available in the industry, creating an extremely stable platform, allowing seabed PCPT equipment and ROV to be mobilised alongside the GMTR120.

Positioning

The vessel uses a Rolls Royce ICON dynamic positioning (DP) system for station keeping. The system consists of a dual DP controller unit and operator stations. The DP system provides a direct interface to the azimuth propellers, and bow thrusters, and includes the necessary interfaces to power plants, position-reference systems and sensors. This provides accurate and precise station-keeping during all borehole and seabed testing

Key Features:

- Class 2 Dynamic Positioning
- Iron roughneck and remote tool handling
- Clean design vessel minimising carbon footprint
- Heave compensated offshore geotechnical deep water drilling rig
- Combined water and borehole depth of 2,500m
- Comprehensive on board soil and rock testing laboratory
- Built in hangars for WROV, port and starboard

Drilling Monitoring and Downhole Tools

The GMTR120 drill rig is fully instrumented for the electronic display of drilling parameters; torque, bit weight, mud pressure, mud flow rate and rotation speed. A comprehensive range of wireline downhole sampling and testing tools is available including PCPT (Piezocone Penetration Test), piston sampling, push sampling, wireline core barrel and percussion (hammer) sampling. All downhole tools (coring, sampling, PS logging) are fully compatible within the 5½" API drill string. A range of drag and specialised coring bits are provided. Large diameter drill pipe can also be used to allow large diameter cores to be taken.

Drilling Rig GMTR120	
Power Swivel	Top Drive / Power Swivel-Edeco swivel 19,400N.m ⁻¹ . 0rpm to 120rpm and 5,000N.m ⁻¹ 400rpm breakout torque 22,500N.m ⁻¹ . Load capacity 120t.
Drill String	5½" or 6¾" API drill string Iron roughneck and pipe handling systems installed
Seabed Frame	Up to 20t submerged, with hydraulic clamps
Heave Compensation	6m stroke passive heave compensation (semi active under development) using nitrogen gas as compensation buffer with Olmsted valve slingshot protection. Seabed frame compensation 0m to 7m
Mud	Project-specific modular mud systems installed as required
Downhole Sampling	Wireline piston / push sampler, percussion / hammer sampler Remote tool handling system
Downhole <i>in situ</i> Testing Tools	WISON-APB PCPT cone penetration testing with pore water pressure and seismic velocity measurements PS wireline logging
Downhole Coring	Traditional and leading shoe core barrel
Drill Control Cabin	Control cabin for remote control via hydraulic / electric interface of all drilling and sampling operations. Allows driller, assistant driller and PCPT operator coordinated control of all drilling / sampling operations. Rig specific DMS recording
Drill Rig Workshop	ISO 20ft container sized fully equipped workshop, tools and equipment. 220v supply
Equipment Winches	Braden draw-works winch, seabed frame umbilical winch, 2 x piston sample winch (electro mechanical), 2 x headline tugger winch, tail line tugger winch.
Seabed CPT Unit	20t deep push seabed CPT system. Straight rod push thrust mechanism allows recording of <i>in situ</i> data to 40m below mudline, or greater, depending on soil conditions.

Dina Polarix	
Flag, IMO, Call Sign	Norway, IMO 976031, Call Sign: LAXB7
Class	DnV + 1A1, SF, E0, OFFSHORE SERVICE VESSEL, DK(+), HL(2,8), CLEAN DESIGN, NAUT OSV(A), RECYCLABLE, BWM-T, ECA(SOx-A), LFL(*), COMF V(3)C(3), DYNPOS AUTR, SPS, ICE 1A, WINTERISATION BASIC
Built	2017
Tonnage	GRT 6,966 NRT 2,089
Principal Dimensions	LOA 98.9m Breadth (moulded) 21.0m Draft (max) 7.1m
Tank Capacity	Fuel Oil 3,000m ³ Fresh Water 1,060m ³
Speed / Consumption	Standby 3m ³ /24h On DP 6m ³ /24h Economic (transit) 11m ³ /24h at 12 knots
Endurance	>28days
Machinery	Main Engines 4 x MTU-16v 4000 M63L-2240kW, 900rpm to 1800rpm, Total 8960kW-12185bhp Generators 4 x 2240kW 575v/690v Harbour Generator 1 x 350kW Bow Thrusters 2 x Tunnel 97 kW-CPP Azimuth Propellers 1 x Azimuth 883kW-FP 2 x Azipuli 120 CPP 2,200kW, Ø3,000mm
DP System	Rolls-Royce Icon
Moon Pool	Main Deck 7.2m x 7.2m
Cargo Deck	1,000m ²
Accommodation	17 x Single berth cabins 32 x Double berth cabins 4 x Four man cabins 2 x Messroom/duty mess 1 x Conference room 5 x Offices 1 x Gymnasium 1 x Hospital All cabins with separate WC / shower, fully airconditioned. Local area Network CAT 7 in the entire accommodation.

Geoquip Saentis



Introduction

The Geoquip Saentis is a 2005 build, DP2 MPSV vessel, designed for offshore support and ROV services in harsh weather conditions. The Geoquip Saentis comes with good spacious accommodation and workspace. Geoquip's fully heave compensated GMR600 drilling rig has been installed over the 4.0m x 4.0m midship moonpool. At over 80m length and 18m beam she provides a stable platform for offshore geotechnical operations allowing seabed PCPT equipment and ROV to be mobilised alongside the GMR600.

Positioning

DP2 System Installed: Kongsberg Simrad SDP21, Reference Systems (2 x DGPS, taut wire) and Sonardyne (Ranger 2) HPR system for subsea positioning.

Key Features:

- Class 2 Dynamic Positioning
- Remote tool handling and pipe handler
- Heave compensated offshore geotechnical drilling rig
- Combined water and borehole depth of 600m
- Comprehensive on board soil and rock testing laboratory

Drilling Monitoring and Downhole Tools

The GMR600 drill rig operates with standard safety features, including remote tool handler, mechanical pipe handling and use of nitrogen as a compensator buffer gas. A range of wireline downhole sampling and testing tools is available including PCPT (Piezocone Penetration Test), piston sampling, push sampling, wireline core barrel and percussion (hammer) sampling. All downhole tools (coring, sampling, PS logging, etc.) are fully compatible with the 5½" API drill string. A range of drag and specialised coring bits are provided. Large diameter drill pipe can also be used to allow large diameter cores to be taken.

Drilling Rig GMR600	
Power Swivel	Dando 1000 twin motor with dual speed setting for high torque / high rotation - Max torque: 9600 Nm - Max speed: 280 RPM - Max dynamic load: 40t Max static load: 50t
Drill String	5½" or 6½" API drill string
Seabed Frame	12t, with hydraulic clamps and compensation up to 4.0m
Heave Compensation	Effective drill string compensation 0m to 4m. Seabed frame and seabed CPT unit heave compensation with an effective stroke from 0m to 4m
Mud	4,000l mix tank, 8,000l storage tank guar gum seawater miscible
Downhole Sampling	Wireline piston / push sampler, percussion / hammer sampler
Downhole <i>in situ</i> Testing Tools	WISON-APB PCPT cone penetration testing with pore water pressure and seismic velocity measurements PS wireline logging
Downhole Coring	Traditional and leading shoe core barrel
Drill Control Cabin	Control cabin for remote control via hydraulic / electric interface of all drilling and sampling operations. Allows driller, assistant driller and PCPT operator coordinated control of all drilling / sampling operations. Rig specific DMS recording
Drill Rig Workshop	ISO 20ft container sized fully equipped workshop, tools and equipment. 220v supply
Equipment Winches	Braden draw-works winch, seabed frame umbilical winch, 2 x piston sample winch (electro mechanical), 2 x headline tugger winch, tail line tugger winch.
Seabed CPT Unit	20t deep push seabed CPT system. Straight rod push thrust mechanism allows recording of <i>in situ</i> data to 40m below mudline, or greater, depending on soil conditions.

Geoquip Saentis	
Flag, IMO, Call Sign	Bahamas, IMO 9282132, Call Sign: C6UMB8
Class	DNV GL 1A1 Supply Vessel DYNPOS(AUTR) E0 SF TMON
Built	2005, converted 2019
Tonnage	GRT 3,404 NRT 1,131
Principal Dimensions	LOA 80.5m Breadth 18.0m Draft (max.) 6.1m
Tank Capacity	Fuel Oil 1,000m ³ Fresh Water 933m ³
Speed / Consumption	Standby 3m ³ /24h On DP 10m ³ /24h Economic (transit) 8m ³ /24h at 7 knots
Endurance	>28days
Machinery	Main Engine 2 x MAK 8L26 marine diesel engines each developing 3,217bhp @ 750rpm each driving 1,600kW shaft alternator and CP propeller. Total developed power 4,800kW Shaft Generators 2 x 1,600kW Other Generators 2 x 350kW and 1 x 190kW Bow Thrusters 2 x 610kW Stern Thrusters 2 x 610kW Propellers 2 x CPPs Fuel Type MGO
DP System	Kongsberg K-POS DP 21
Moon Pool	
Main Deck	4.0m x 3.8m
Cargo Deck	600m ²
Accommodation	11 x Single berth cabins 23 x Double berth cabins (en-suite) 3 x Offices 1 x Messroom / duty mess 1 x Conference room 1 x Dayroom / lounge 1 x Recreation room 1 x Hospital Dedicated survey area Fully air-conditioned.



FUGRO

ARAN 120

The Aran 120 is a medium sized, high payload, container transportable, modular jack-up platform. The jack-up has low international transport costs coupled with high performance capabilities.

The jack-up's modular design allows the Aran 120 to provide a cost-effective solution to perform a wide variety of functions from geotechnical investigations to excavation and construction.

With a large deck area of 324 m² the Aran 120 can cater for a wide application of drilling and specialist in situ sampling & testing.

The Aran 120 has a rapid deck elevating system and is equipped with four legs mounted externally to provide maximum strength and stability.

Assembly and commissioning of the jack-up superstructure is achieved in 2-3 days, allowing a rapid mobilisation of the required plant, equipment and ancillaries.

The jack-up can be fitted with one of Fugro's hydraulic thrusters to provide self-propulsion and to aid in the final positioning of the jack-up.

In a compact configuration, this fast elevating jack-up is ideal for confined intertidal areas, where swift, accurate moving and positioning is required.

In a larger configuration, the Aran 120 jack-up platform is capable of working safely and productively in exposed open waters and high tidal ranges.

For maximum safety, the jack-up is equipped with rigid steel bulwarks and 110 V fluorescent lights, providing full inboard and outboard illumination for the continuation of safe working conditions over a 24 hour working period.

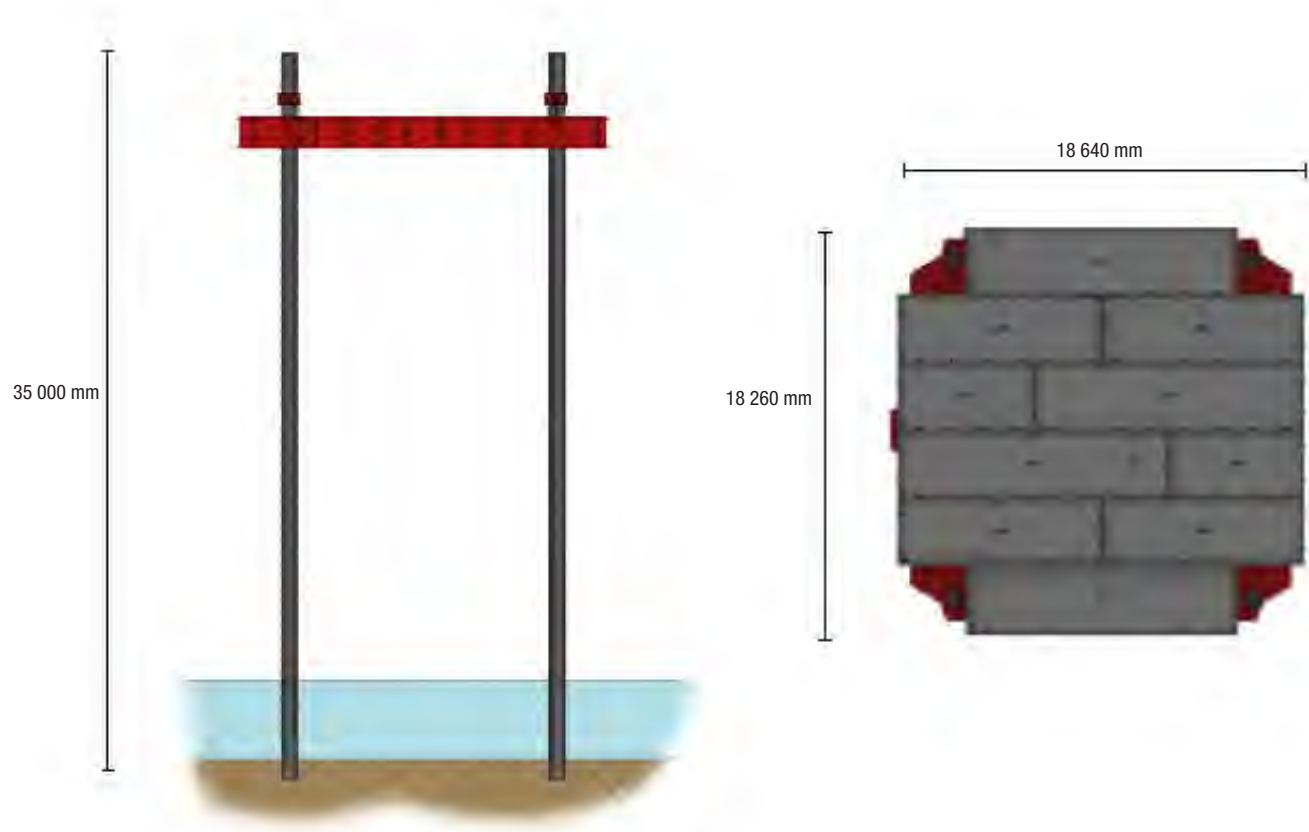
Operated and maintained exclusively by Fugro's trained and experienced marine crew, the Aran 120 jack-up is a versatile, stable, self-elevating platform which provides a cost-effective solution for overwater work.



SPECIFICATIONS

Aran 120 Jack Up Barge

Classification society:	Germanischer Lloyd
Max. separation:	32 m (subject to environmental conditions at location)
Draught:	1.52 m
Max. payload:	120 t (dependent on spud length)
Max. deck load:	15 t / m ²
Jacking system:	Twin hydraulic ram and locking ring
Length:	18.3 m
Beam:	18.3 m
Number of legs:	4
Max. leg length:	35 m
Leg dia.:	0.76 m





FUGRO ARAN 250

The Aran 250 is a medium sized, high payload, modular jack-up platform. Has low international transport costs coupled with high performance capabilities. The vessel has recently undergone works to provide more expansive use of deck space and hydraulic system enhancement to provide jacking speed 3 times faster than 'standard'.

The jack-up's modular design allows the Aran 250 to provide a cost effective solution to perform a wide variety of functions from geotechnical investigations to excavation and construction.

With a large deck area, the Aran 250 can cater for a wide range of drilling, craneage and specialist in situ sampling and testing applications.

The Aran 250 has a rapid deck elevating system and is equipped with four legs to provide maximum strength and stability.

Assembly and commissioning of the jack-up superstructure is achieved in two or three days allowing a rapid mobilisation of the required plant, equipment and ancillaries.

The Aran 250 is equipped with three moon pools through the deck.



Tug boat towing Aran 250 to site.



Aran 250 on site in Storstrom, Denmark.

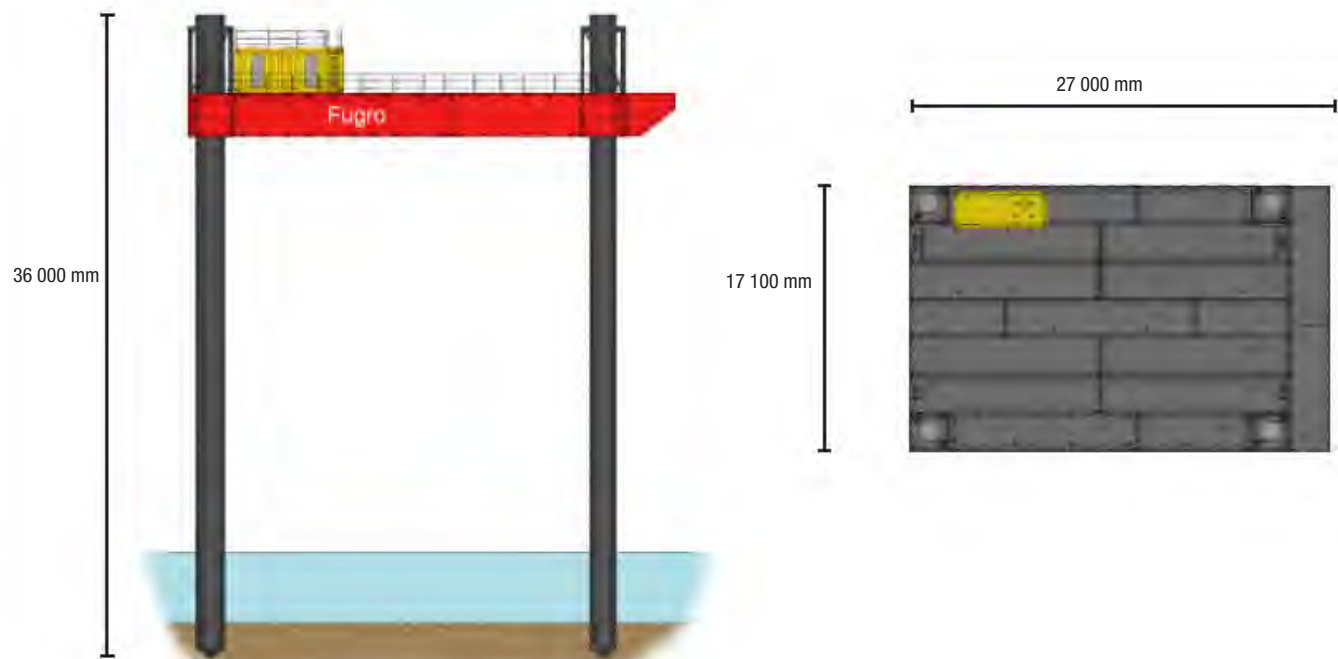


SPECIFICATIONS

Aran 250 Jack-up Barge

Classification society:	GL (Germanischer Lloyd)
Notation:	Non propelled self-elevating unit
Build year:	2008 (full upgrade 2018)
Jacking system:	Hydraulic/leg pucks
Max. separation:	30 m (length of leg below hull)
Max. payload:	250 t
Gross tonnage:	275 t

Length:	27 m (total including scow ends)
Breadth:	17.1 m
Moulded depth:	2.44 m
Number of legs:	4
Max. leg length:	36 m (3 x 12 m sections)
Leg dia.:	1.220 m





HORIZON GEOSCIENCES

QUEST HORIZON

VESSEL FEATURES

- DP-2
- Multipurpose Site Investigation Vessel
- Kongsberg K-Pos DP-21
- cJoy Independent Joystick System
- Conference room, offices, online/offline rooms
- Accommodation for 58 personnel
- Dayrooms and mess rooms
- 370 m² deck area
- Moon-pool 4 m x 3.6 m

The following equipment available subject to project requirements:

GEOTECHNICAL EQUIPMENT

- Heave Compensated Drill Rig
- Wison-APB Sampling, PCPT and Down-hole Vane Testing Equipment
- Containerized mud mix & transfer system
- Fully equipped offshore soil testing laboratory
- 200 kN seabed CPT system
- ROSON 40 kN CPT system
- Vibro / Drop / Gravity Coring

POSITIONING SYSTEM

- Dual Veripos Apex DGPS

GEOPHYSICAL EQUIPMENT

Analogue Geophysical

- Side scan sonar
- Sub bottom profiler (pinger / boomer)
- Magnetometer / Gradiometer for UXO Surveys
- Multi Beam Echosounder
- Single Beam Echosounder
- Motion sensors
- CTDS system

- Underwater positioning system

2D HR DIGITAL SEISMIC EQUIPMENT

- (optional)

ROV EQUIPMENT

- Rovotics Shark G2 inspection class ROV

PRINCIPAL PARTICULARS

- Year Built: 2013
- Builder: POET, China
- Classification Society: American Bureau of Shipping (ABS)
- Class Notifications: ⌘A1, Offshore Support Vessel, ⌘, ⌘AMS, ⌘DPS-2
- Additional Notations: UWILD, CRC, RW
- Flag: Panama
- Call Sign: 3FQR9
- IMO Number: 9694218
- ISPS Code Compliant: YES

DIMENSIONS

- Length Overall: 65 m
- Breadth Moulded: 16.2 m
- Depth, Main Deck: 6 m
- Design Draft: 4.70 m
- Dead Weight: 1,569 T (Full Load)

CAPACITIES

- Fuel Oil: 430 m³
- Portable Water: 500 m³
- Clear Deck Area: 370 m²
- Open Deck Strength: 5 T / m²



HORIZON-GEOSCIENCES.COM

FIRST-CLASS SURVEY AND GEOTECHNICAL SERVICES

PERFORMANCE

- Maximum Speed: 12 knots
- Endurance: 45 days

MACHINERY

- Main Engines: 2 x Niigata 6L 26 HLX 1471 KW @ 750 Rpm
2 x Nigata
- Propulsion: Fixed pitch Z drive propeller, kort nozzle
- Bow thrusters: 2 x 630 kw Rolls Royce
- Generators: 4 x 560 kw Caterpillar 3 phase – 415 volts, 50 HZ
- Emergency Generator:
1 x 136 kw Volvo Penta D7A-T

DYNAMIC POSITIONING

- Make: Kongsberg K-Pos DP
- Capacity: 1 x HiPAP 501, 2 x DGPS Veripos, 1 x Radius 1000, 1 x LWT Taut wire

DECK CRANE

- Make: S. China Marine Mcy Co
- Capacity: Two fall @ 12 m 30 T, Two fall @ 24 m 15 T

COMMUNICATIONS

- V-SAT Internet and telephone
- VHF, GMDSS Radio Equipment etc.

DECK MACHINERY

- Anchor Windlass: Hydraulic Driven Double Gypsies
- Anchors: 2 x 1,980 kg HHP Stockless Bower Type
- Capstans: 2 x Vertical Type Capstans

LIFE SAVING APPLIANCE

- In Compliance with SOLAS 1974
- 1 x Fast Rescue Craft

ACCOMMODATION

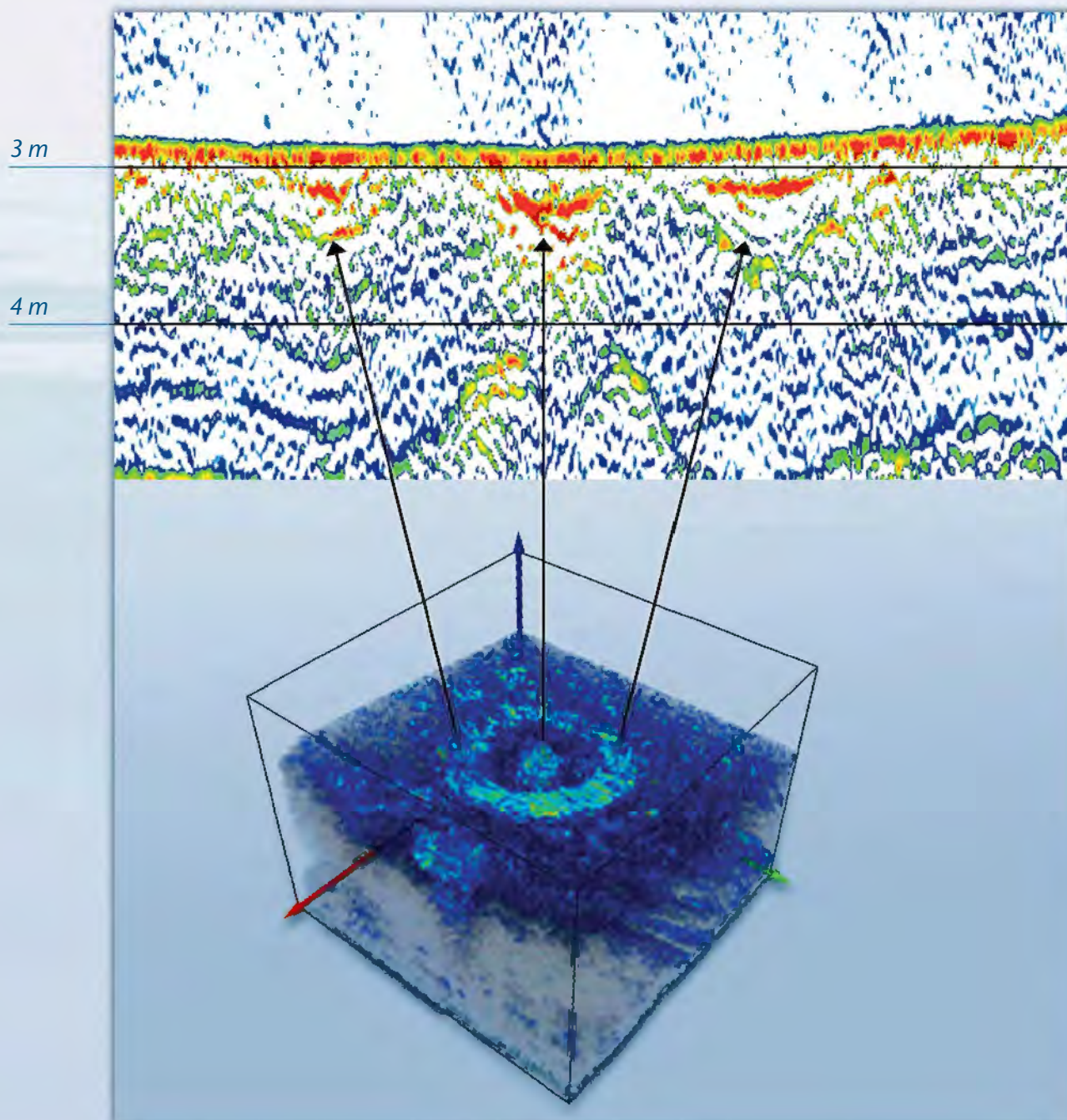
- Total Capacity: 58
- Single Berth Cabins: 8
- Double Berth Cabins: 17
- Four Berth Cabins: 4
- Offices: 4
- Client: 1
- Vessel: 1
- Ops/Survey: 2
- Hospital: 1 x 1 bed
- Gymnasium: 1
- Recreation room: 1
- Mess room: 1

NAVIGATION EQUIPMENT

- 1 x Radar X band / 1 x Radar S Brand
- DGPS (IMO Approved)
- ECDIS (Transas)
- AIS
- Echo Sounder
- Speed Log
- 3 x Gyro Compass System
- Autopilot (Simrad)
- Weather Fax Receiver
- BNWAS
- GMDSS Radio Equipment
- Navtex Receiver

Note: This specification is subject to change without notice.

Survey example of SES-2000 quattro



*Wismar Bay echo plot example and 3D volume rendered area with embedded circular structure
Frequency 10 kHz, pulse length 100 μ s, profile length 40 m (3D volume: 40 m x 40 m x 3 m)*

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FUGRO

M.V. FUGRO HELMERT

The 41m M.V. Fugro Helmert, built in 2013, complements Fugro's existing fleet of vessels of a versatile, high-end and dynamic specification, designed for geophysical and hydrographic survey work on the continental shelf, up to water depths of 2000m.

The Fugro Helmert (capable of dynamic positioning – DP 1) is deployed for ROV inspection operations, geotechnical sampling, geophysical seabed charting and environmental data acquisition, catering in particular for the renewable energy market.

The survey systems carried aboard include: a Kongsberg EM 710 Mk2 (0.5 x 1.0°) high resolution multibeam echo sounder, an Innomar SES 2000 (Medium) and Knudsen 3260 (3 x 3 array) sub-bottom profilers, an Edgetech 4200 side scan sonar, a Geometrics G-882 marine magnetometer as well as a Kongsberg HiPAP 500 SSBL underwater acoustic positioning system.

A working deck of 180m² features an innovative container / equipment deck-fastening rail system, an interchangeable A-frame (9.4T capacity, working from either the stern or starboard position), an oceanographic, side scan and tugger winches, as well as a foldable-knuckle-boom deck crane. The vessel can accommodate a marine and survey crew of up to 20 persons, with an operational endurance of four weeks.



Equipment Deployment for Geological Sampling.



Shaded Relief Bathymetry showing Sandwave detail.



M.V. FUGRO HELMERT

Technical Specifications

General

Name	M.V. Fugro Helmert
Built	2013
Builder	Fr.Fassmer (Germany)
IMO No.	9662978
Call Sign	ZDNM8
Classification	DNV GL
	Research Vessel (+) MC E AUT DP1
Flag / Port	Gibraltar

Dimensions

Length Overall	41.53 m
Beam	10.00 m
Draft	3.4 m
Gross Tonnage	498
Net Tonnage	150
Deck space	180 m ²

Performance

Speed	11 kts (Cont. Transit)
Endurance (days)	20 Transit, 30 Survey

Accommodation

20 (6x1, 7x2)

Capacities

Fuel (MGO)	70 m ³
Fresh water	15 m ³
Fresh water production	6 m ³ / day

Machinery

Main Engine	2 x 331 kW Shaft Power
Propulsion	2 x Schottel Rudder Propeller
Bow Thruster	1 x 200kW electric-drive
Generator	2 x 285 kVA or 244 kW
Power	400 V / 50 Hz 3 AC / PE 230V / 50 Hz 1 AC / PE

Communication

GMDSS A4 / INMARSAT/ VSAT / IRIDIUM

Facilities

1 x Data Acquisition room
1 x Processing room
1 x Survey workshop
1 x Client's office
1 x Survey store

Main Survey Systems

Multibeam Echo Sounder	Kongsberg EM 710 Mk2 (0.5 x 1°) Kongsberg EM 2040 (0.4 x 0.7°) dual RX
Side Scan Sonar	Edgetech 4200 (300/600 kHz)
Sub-Bottom profiler	INNOMAR SES 2000 Medium Knudsen 3260 3 x 3
Magnetometer	Geometrics G-882
Other	EIVA ScanFish Profiler Various SVP/CTD, XBTs
Acoustic Positioning	Kongsberg HiPAP 501 SSBL

Testing / Sampling

Cone Penetration Tester
Vibro Corer
Piston & Gravity Corer
Grab Sampler

Handling Equipment

Crane	1 x Palfinger PK50002 M knuckle-boom SWL 3 t / 12 m
A-frame	SWL 10 t Interchangeable (stern / stbd)
Winches	1 x 0.5 mt SWL
Primary	1 x Oceanographic SWL 5t, capacity 6,000 m (17 mm Coax), 1 x Geotechnical SWL 9 t Capacity 4,000 m (9 mm Dyneema®)
Secondary	1 x Oceanographic SWL 1.2 t Capacity 2,000 m (11 mm Coax)
Tugger	2 x SWL 3 t
Stern roller	4.2 m wide, max. load 10 t Multi-purpose deck-rail system to fit containers, lifting and handling gear

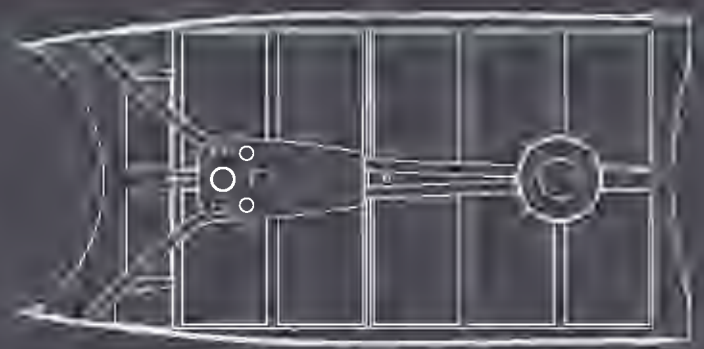
Other

ROV / Crawler capability
GL certified Kongsberg K-POS DP-11 (DP 1)

Information may be subject to change without prior notice.

Ocean data, delivered.

Using Unmanned Surface Vessels (USVs) XOCEAN provides turnkey data collection services to surveyors, companies and agencies.



Physical Dimensions

Length	4.5m
Width	2.2m
Height	2.2m

Applications

Fisheries
Bathymetric Survey
Data Harvesting
Metocean Data
Environmental Monitoring

Technical Specification

Model name	XO-450
Hull	Composite wave piercing catamaran type
Weight	750kg
Payload	100kg
Propulsion	2 x DC drives
Steering	Differential steering
Hybrid power system	Solar deck lithium-ion batteries micro diesel generator
Continuous electrical load	3kW
Speed	4.0 knots
Endurance	18 days range 1,512nm
Communications	Over horizon via satellite broadband
Control	Control via XOCEAN Cyberdeck
Situational awareness	AIS thermal imaging camera visible light cameras image detection
Conspicuity	Active radar reflector AIS transmissions navigation lights sound signals
Transportation	Road trailer shipping container
Sensor mounting	Sonar post SVP winch MRU weather station

 **XOCEAN®**

xocean.com
info@xocean.com



xoceansocial



xocean

XO-450

Unmanned Surface Vessel (USV) Specification



XOCEAN®



Oriel Wind Farm Landfall

Geophysical Investigation

Risk Assessment and Method Statement

For

Causeway Geotech Limited

Unit 6
Knockmullen Business Park
Gorey
Co. Wexford

Tel. 0402-21842
Fax: 0402-21843

Email: info@apexgeophysics.ie

PROJECT NUMBER	AGP21133		
PROJECT NAME	<i>Oriel Wind Farm Landfall Geophysical Investigation</i>		
AUTHOR	CHECKED	VERSION NO.	DATE
██████████	██████████	1	02/09/2021
██████████	██████████	2	07/09/2021

TABLE OF CONTENTS

1. BACKGROUND.....	3
1.1 Introduction.....	3
1.2 Methodology.....	4
1.3 Personnel.....	4
1.4 Safety Policy.....	4
1.5 Insurance.....	5
1.6 Tax Clearance.....	5
1.7 Working Hours.....	5
1.8 Work Program.....	5
1.9 Site Access.....	5
1.10 Topographic Data.....	5
1.11 On-site Interpretation.....	5
1.12 Deliverables.....	5
1.13 Requirements from the client.....	5
2. DETAILED METHODOLOGY AND RISK ASSESSMENT.....	6
2.1 Hazard Identification and Risk Assessment System:.....	6
2.2 ERT Profiling.....	7
2.3 Risk Assessment for ERT Profiling.....	7
2.4 P-Wave Seismic Refraction.....	8
2.5 Risk Assessment for P-Wave Seismic Refraction.....	8
2.6 Hospital Location.....	9
2.7 Site Welfare.....	9
2.8 Oriel Wind Farm Landfall Hazard Assessment and Risk Assessment.....	9
3. PERSONNEL RESOURCES ALLOCATED TO PROJECT.....	10
4. COMMUNICATION.....	11
4.1 Tool-Box Talks.....	11
APPENDIX A – SAFETY.....	12
APPENDIX B – FINANCIAL INFORMATION.....	13
APPENDIX C – EMERGENCY PROCEDURE.....	16
C.1 Introduction.....	16
C.2 Minor Accident on Site.....	16
C.3 Major Accident on Site.....	16
C.4 Accident Reporting.....	16
C.5 Assembly Point.....	17
C.6 First Aid.....	17
C.7 Emergency Contact Numbers.....	17
APPENDIX D – COVID 19 SPECIAL PRECAUTIONS: (HSE GUIDELINES).....	18

1. Background

1.1 Introduction

Apex Geophysics Limited has been commissioned by Causeway Geotech Limited, on behalf of ESB, to carry out a geophysical investigation at the shoreline of the landfall point for the Oriel Windfarm 220 kV Grid Connection. The geophysical profiles will be carried out along the profiles shown in Figure 1. The purpose of the ground investigation is to determine ground conditions, to facilitate the design and construction of a high voltage cable route and landfall works.

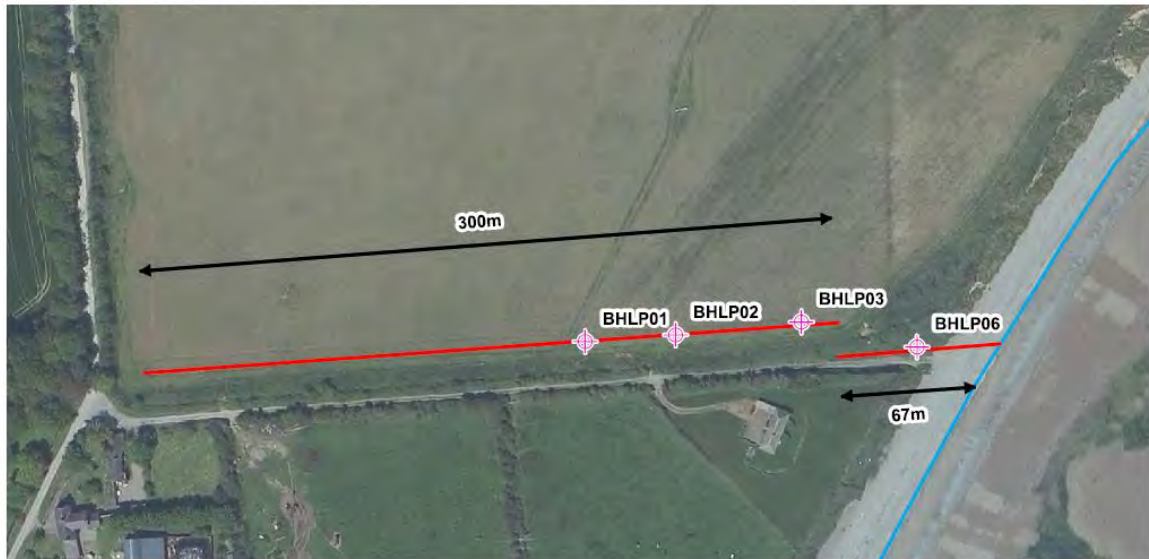


Figure 1: Proposed Survey profiles - red profiles.

This Method Statement has been prepared by Apex Geophysics Limited in order to demonstrate our planned site works methodology.

This RAMS document has been developed with cognisance to previous experience we have gained from working on similar sites.

OBJECTIVES

The objectives of the survey are to provide the following information:

- Type and thickness of the soils,
- Depth to and type of bedrock
- Presence of fracture zones and fault zones

1.2 Methodology

The following geophysical survey methodology will be carried out:

Method	Property Measured	Depth Range (m)	Information Obtained	Deliverables
Electrical Resistivity Tomography	apparent resistivity (Ohm-m)	0-20	• overburden type • bedrock profile • bedrock variations	• factual cross section • geological interpretation section
Seismic Refraction	seismic velocity (m/s)	0-15/23	• soil stiffness • bedrock profile • rock quality	• factual cross section • geological interpretation section
Report	Geological background, description of survey, factual data, discussion of results, conclusions and recommendations. Scaled maps and sections. Digital copies. All drawings in AutoCAD format.			

Electrical Resistivity Tomography

The ERT Profiles will be carried out, along the profiles, to provide information on type and thickness of the soils, depth to and variation in bedrock depth. The ERT profiles will be carried out using a 3 m electrode spacing to give depth of penetration of 15 to 20 m bgl. The profile on the beach/access road will be extended to 120m in length to provide sufficient depth of investigation and overlap with the profile in the field to the north.

During the works on the beach a marker will be placed at the high-water mark and no works will be carried out beyond this point.

Seismic Refraction

The seismic refraction profiles will be carried out along the ERT profiles. The seismic refraction method will provide information on the stiffness of the soil material, the depth to bedrock and the quality and degree of weathering of the bedrock. The seismic refraction spreads will consist of 24 geophones and 2 or 3m geophone spacing giving a depth of penetration of 15 to 23m bgl.

Limitations

As with all geophysical methods the interpretation of the data and resulting report are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by the variations of these properties. The presence of underground cables may affect the quality of the geophysical data.

The presence of underground services, buried foundations can cause interference on the geophysical datasets.

1.3 Personnel

The survey will be carried out under the direction of qualified and professionally registered geophysicists and experienced field personnel. All survey work will be supervised by a qualified crew leader who will be responsible for the correct use of all the equipment, the health and safety on the site and will liaise with the engineer to confirm any alterations or additions to survey works. The crew leader will remain in daily contact with the engineer with regard to survey progress and findings.

1.4 Safety Policy

Staff safe pass cards and manual handling certificates are included in Appendix A - Safety.

1.5 Insurance

APEX Geophysics Limited holds the following insurances:

- Employers Liability; €13,000,000
- Public Liability; €6,500,000
- Professional Indemnity; €2,500,000

A copy of the insurance details is shown in Appendix B - Financial.

1.6 Tax Clearance

APEX Geophysics Ltd. is fully tax compliant.

1.7 Working Hours

The field work will be carried out between the hours of 9:00 am and 5.30 pm.

1.8 Work Program

It is estimated that the survey will take 2 days to complete. The proposed work program is subject to ongoing change for the duration of the survey. The geophysical survey is planned to be carried out on the 9th and 10th September 2011. Changes in the work program may be caused by a number of internal and external factors including but not limited to: access difficulties, equipment failure.

1.9 Site Access

The client is responsible for clearing site access prior to mobilisation.

1.10 Topographic Data

The location of the geophysical readings will be surveyed using a sub-metre accurate GPS System.

1.11 On-site Interpretation

On-site interpretation of data will be carried out in order to monitor results and to allow for changes to be made to recording parameters as appropriate.

1.12 Deliverables

A report with maps and sections will be compiled in digital format

The geophysical report will include the following:

- An executive summary
- Introduction to the project, background, methodology, geology and site description
- Discussion of the results
- Appendices detailing the methods used, equipment used, field procedure and data processing.
- Maps and sections
- The maps and sections will be presented on an A3/A1 drawing. This drawing will detail the locations of the geophysical readings, the site extents and information on the underlying geology

1.13 Requirements from the client

We understand the client will provide:

- Site maps in digital format (if available)
- Existing trial pit and borehole logs
- Clear access to the survey area
- Removal of any surface obstructions
- Removal of livestock for the duration of the survey
- Any other relevant and available information prior to commencement of survey

2. Detailed Methodology and Risk Assessment

2.1 Hazard Identification and Risk Assessment System:

Hazard: Generally means anything that can cause harm. APEX Geophysics Limited has identified foreseeable workplace hazards, so far as reasonably practicable, associated with their business.

Risk: is the likelihood High, Medium or Low- that someone will be harmed by the hazard, together with the severity of the harm suffered. Risk is also dependent on the number of people exposed to the hazard.

Risk Assessment: is a careful examination of what could cause harm to people at work so that the employer can decide whether enough control measures are in place or if more are required.

Risk Rating Formula:

In the Risk Assessment severity and likelihood have been calculated as follows:

The risk factor is the multiple of Severity and Likelihood.

Severity	Likelihood	Value	Risk Rating	Characteristics
Major (3)	High (3)	7-9	High Risk	Possible Fatality
Serious (2)	Medium (2)	4-6	Medium Risk	Possible Minor Injury
Slight (1)	Low (1)	1-3	Low Risk	Unlikely /minor injury

		Severity		
		Major 3	Serious 2	Slight 1
Likelihood	High (3)	9	6	3
	Medium (2)	6	4	2
	Low (1)	3	2	1

Note:

The risk rating indicated is applicable when the controls in place are implemented. It is the responsibility of APEX Geophysics Limited to ensure that these precautions are adequate and put in place site specific controls, if necessary.

The list of hazards and controls in this Safety Statement are non-exhaustive and it is foreseeable that additional hazards will be encountered. If this situation occurs, then the work will stop and APEX Geophysics Limited must carry out a risk assessment and complete the "Hazards Not Identified" section in the Safety Statement to ensure that adequate control measures are in place and implemented.

If the work to be carried out is not safe, workers must not perform any tasks until management have been informed and the control measures are put in place.

2.2 ERT Profiling

Equipment:	Tigre AC resistivity meter capable of variable power inputs, ImagePro 2006 and Res2dinv imaging software, two 32 takeout multicore cables and 64 stainless steel electrodes. Equipment carried in 4WD vehicle 2 person crew Equipment calibrated across 100 ohm- resistor.
Field procedure:	Resistances are recorded to 10 levels using an expanding Wenner (or similar) array with a 3 or 5m electrode spacing as appropriate. Saline solution may be added to the electrodes in areas of high contact resistance. Local conditions and variations are noted.
Surveying:	Measurement and storage of each profile in ING using GPS system.
Data Processing:	Following conversion of the data to apparent resistivities, topographic corrections are applied to the data and an inversion is carried out using a least squares deconvolution technique to produce an apparent resistivity depth model.
Interpretation:	Assignment of material types and possible anomaly sources.
Presentation of Results:	Scaled plates produced for each profile showing the apparent resistivity and a corresponding interpretation of ground conditions. List of targets in order of priority with National Grid co-ordinates. All output in AutoCAD. Hard copy & digital data.

2.3 Risk Assessment for ERT Profiling

Procedure	Hazard	Risk	Risk Factors (Before Control Measures)	Hazard Prevention	Risk Factor After Control Measures
Mobilise resistivity equipment to survey area	Manual Handling	Physical Injury, strain	2	Use correct manual handling procedure	1
Lay out resistivity cable and electrodes to required geometry	Manual handling	Physical injury, strain	2	Use correct lifting procedure, get assistance	1
Connect laptop to power source and connect resistivity cable	Electric equipment	Electrocution	3	Follow manufacturer's guild lines for operating equipment	1
Check electrode resistivities	Electric equipment	Electrocution	2	Follow manufacturer's guild lines for operating equipment	1
Collect resistivity cable and electrodes	Manual handling	Physical injury, strain	2	Use correct lifting procedure	1
Disassemble resistivity equipment and return to Vehicle	Manual Handling	Physical Injury, strain	2	Use correct manual handling procedure using two operatives	1

2.4 P-Wave Seismic Refraction

Equipment:	Geode 24 channel digital seismograph, 10HZ vertical geophones, energy source (hammer source) as required to provide unambiguous first breaks. 1 or 1 x 24 take out cable and trigger geophone. Equipment carried in 4WD vehicle 2/3 person crew.
Field procedure:	Reversed refraction spreads with at least seven shots per spread. Geophone spacings and shot offsets used to allow continuous coverage of main refractor and adequate resolution of overlying refractors. Ongoing estimation of refractor velocities to monitor refractor type and depth.
Surveying:	Measurement and storage of each profile using GPS system in NG using GPS system. Tie to local control or OS base.
Data Processing:	First break picking in digital format suitable for input into Gremix or SIP software. Input topographic data. Inline spreads shall be compiled into longitudinal sections.
Interpretation:	Assignment of material types and estimation of material properties. Cross-reference to other data.
Presentation of Results:	Individual scaled plates of each spread or longitudinal section showing traveltimes plot.

2.5 Risk Assessment for P-Wave Seismic Refraction

Procedure	Hazard	Risk	Risk Factors (Before Control Measures)	Control Measures	Risk Factor After Control Measures
Lay out seismic cable and geophones to required geometry	Manual handling	Physical injury, strain	2	Use correct lifting procedure, get assistance	1
Connect laptop to power source and connect seismic cable	Electric equipment	Electrocution	1	Follow manufacturer's guidelines for operating equipment	1
Hammer seismic plate to generate seismic wave	Loud noise, manual handling	Ear injury, physical injury	2	Wear correct PPE (ear protectors), use correct handling procedure for sledge hammer	1
Collect seismic cable and geophones	Manual handling	Physical injury, strain	2	Use correct lifting procedure	1

P.P.E.

All personnel shall arrive to site with the appropriate PPE for the task at hand. PPE shall include high visual vest, gloves, safety helmet and safety boots.

Manual Handling Risk Assessment

APEX Geophysics Ltd has identified the following field operations which have been assessed following guidance from HSA documents INDG383 and L23.

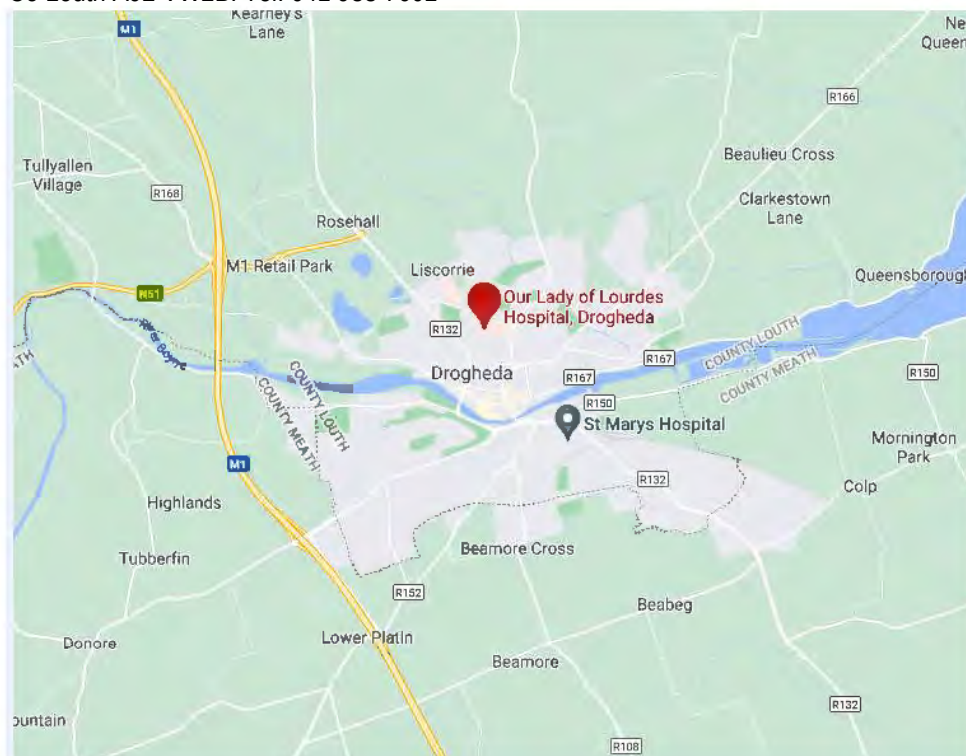
These are the following: -

- Instrument lifting and carrying
- Cable lifting and carrying

These field operations are all considered low to medium risk and are carried out on a daily basis by APEX Geophysics Ltd staff with appropriate manual handling training.

2.6 Hospital Location

The closest hospital to the site is Our Lady of Lourdes Hospital, Windmill Road, Moneymore, Drogheda, Co Louth A92 VW2B. Tel: 041 983 7601



2.7 Site Welfare

Toilets	To be assessed upon arrival to site. If none on site, closest welfare facilities available for use
Washing Facilities:	To be assessed upon arrival to site. If none on site, closest welfare facilities available for use. Carry antiseptic hand cleaner in vehicle as a minimum
Rest Areas:	To be assessed upon arrival to site. If none on site, closest welfare facilities available for use
Drinking Water:	Carry own drinking water
Area for changing clothes and storing clothing:	To be assessed upon arrival to site. If none on site, closest welfare facilities available for use

2.8 Oriel Wind Farm Landfall Hazard Assessment and Risk Assessment

HAZARD IDENTIFICATION & RISK ASSESSMENT

Project	Oriel Wind Farm		Company	APEX Geophysics Ltd	
Techniques	ERT and SR		Address	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford	
Date	02/09/2021		Phone	+353 402 21842	
Prepared	■■■■		Checked	TL	
Hazard	Risk	Risk Assessed As	• Control Measures	Risk After Control Measure	

Covid -19	Serious Illness/Death	6	- Follow HSE Guidelines included in Appendix E - Separate vehicles will be used for each crew member - Each item of equipment will be assigned to individual crew member and no crossover allowed - wash your hands frequently with soap and water or use an alcohol-based hand rub if your hands are not visibly dirty - practice good respiratory hygiene, that is, when coughing and sneezing, cover your mouth and nose with flexed elbow or tissue – discard tissue immediately into a closed bin and clean your hands with alcohol-based hand rub or soap and water - maintain physical distancing, that is, leave at least 2 metres (6 feet) distance between yourself and other people, particularly those who are coughing, sneezing and have a fever - avoid touching your eyes, nose and mouth – if you touch your eyes, nose or mouth with your contaminated hands, you can transfer the virus	3
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HAZARD IDENTIFICATION & RISK ASSESSMENT

Project	Oriel Wind Farm		Company	APEX Geophysics Ltd	
Techniques	ERT and SR		Address	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford	
Date	02/09/2021		Phone	+353 402 21842	
Prepared			Checked	TL	
Hazard	Risk	Risk Assessed As	Control Measures		Risk After Control Measure

			- from the surface to yourself - Gloves to be worn at all times	
Interaction with general public	Confrontation	2	- Remain polite and courteous at all times - Refer any enquires Causeway Geotech Limited	1
Working in a public track, trips on cables/equipment	Minor/major injury	3	- Men-at-work and surveying warning signs will be placed along the seismic and ERT cables. - The survey profile along the access road to the beach will be placed at the edge of the track and access to the beach will be kept clear from obstruction at all times	1
Driving to and on site in vehicle	Minor, major injury or death	4	- Driver has current driving licence, valid 'business' insurance, NCT and road tax. - Vehicle fuelled prior to arriving on site - Maintain vehicle in a roadworthy condition. - Ensure person is fit to drive. - Adhere to Rules of the Road, speed limits. - Do not drive in adverse weather or when excessively tired. - Allow sufficient time to familiarise oneself with the controls of vehicle. - Consider overnight stay and/or shared driving if practicable. - Where possible use designated parking spaces or	2

HAZARD IDENTIFICATION & RISK ASSESSMENT

Project	Oriel Wind Farm		Company	APEX Geophysics Ltd	
Techniques	ERT and SR		Address	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford	
Date	02/09/2021		Phone	+353 402 21842	
Prepared			Checked	TL	

Hazard	Risk	Risk Assessed As	Control Measures	Risk After Control Measure
--------	------	------------------	------------------	----------------------------

			- liaise with landowner/site rep to agree parking arrangements - All vehicles will have an orange flashing beacon for use on site if required	
Working on uneven and steep ground, and areas of poor access, Slips, trips and falls	Minor/major injury	4	- Visual appraisal of work area. - Work in adequate level of lighting. - Wear safety footwear. - Constantly review work area and keep tidy. - The work is to be carried out at a pace suitable to the local ground conditions - Work in brashed and open areas and report any access issues	1
Animals. Rats	Leptospirosis (Weil's Disease)	6	- When working near/on landfill or where rats are likely to be, care to be taken to disinfect all cuts and cover them with waterproof plasters. - Report to supervisor or to GP if feeling unwell	2
Low vegetation cover on the ground, slip/trip/fall	Minor/major injury	4	- Experienced personnel - Wear correct safety footwear - When setting out resistivity cables two crew members will set out the profiles	1
Adverse Weather	injury /hyperthermia	3	- Consult weather forecast prior to work - suspend working in extreme weather conditions	1

HAZARD IDENTIFICATION & RISK ASSESSMENT

Project	Oriel Wind Farm		Company	APEX Geophysics Ltd	
Techniques	ERT and SR		Address	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford	
Date	02/09/2021		Phone	+353 402 21842	
Prepared			Checked	TL	
Hazard	Risk	Risk Assessed As	• Control Measures		Risk After Control Measure

Using Geophysical Equipment	Physical Injury, Cuts. Pinching. Puncture. Impact Injuries. Eye Injuries. Electric Shock. Hearing impaired deafness. Strain / Sprain.	4	• Hold tool-box talks at the start of each morning to discuss all risks • Always use correct tool for job on hand. • Wear suitable protective equipment depending on method– gloves, safety glasses, ear protection, hard hat and safety boots. • Quickly inspect equipment before use – make sure equipment is in good working order • Unplug tools when not in use. • Don't use damaged, worn or dangerous equipment – report to supervisor.	1
	Fire risk	2	• All equipment will be in good working order • Keep clear from all identified explosion risk zones • No 220V equipment will be used	1
Manual Handling	Physical Injury, strain	4	• Avoid hazardous manual handling operations so far as is reasonably practicable • Make a suitable and sufficient assessment of any hazardous manual handling operations that cannot be avoided • Follow safe manual handling procedures • Ensure personnel have received manual handling training	1

HAZARD IDENTIFICATION & RISK ASSESSMENT

Project	Oriel Wind Farm		Company	APEX Geophysics Ltd	
Techniques	ERT and SR		Address	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford	
Date	02/09/2021		Phone	+353 402 21842	
Prepared			Checked	TL	
Hazard	Risk	Risk Assessed As	• Control Measures		Risk After Control Measure

Un-clean work areas	Illness	2	• Suitable safety gloves to be worn at all times • Wash hand before eating • Wash hands after using bathroom	1
General Health	Tiredness, illness	4	• Use site facilities including toilet, drying rooms and canteen if available • Ensure vehicle first aid box is easily accessible and fully stocked • Ensure personnel are in good health before carrying out the survey.	1
Other Hazards on Site (to be completed by project supervisor)			•	•

P.P.E. All personnel shall arrive to site with the appropriate PPE for the task at hand. PPE shall include high visual vest and trousers, gloves, safety boots, hard hat, and safety glasses.

3. Personnel Resources Allocated to Project

The following table details the project team that will be responsible for the survey.

name	position	mobile	email	responsibilities
	Managing Director	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Health and Safety Processing and Reporting
	Senior Geophysicist	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Project Manager Processing and Reporting
	Senior Geophysicist	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Processing and reporting
	Senior Geophysicist	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Senior Geophysicist
	Geophysicist	00353 [REDACTED]	[REDACTED]@apexgeophysics.ie	Processing and Reporting
	Contracts Manager	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Contracts Data Acquisition
	Geophysicist	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Data Acquisition Processing and Reporting
	Geophysicist	00353 87 [REDACTED]	[REDACTED]@apexgeophysics.ie	Processing and Reporting
	Senior Geophysical Technician	00353 87 [REDACTED]		Data Acquisition

The APEX Geophysics Limited Project Manager will be [REDACTED]. [REDACTED] will manage all aspects of the project including the data acquisition, processing and reporting. The processing, interpretation, drafting and reporting will be carried out by [REDACTED].

[REDACTED] will be the site supervisor and will be directly responsible for the acquisition of the data. The survey team will consist of [REDACTED].

Client Contacts:

name	company	telephone	email
[REDACTED]	Causeway Geotech Limited	Tel: +353 (0)1 526 7465 M: +44 (0)75 [REDACTED]	[REDACTED]@causewaygeotech.com
[REDACTED]	ESB	089 [REDACTED] 0044 [REDACTED]	[REDACTED]@esb.ie

4. Communication

4.1 Tool-Box Talks

Every morning a tool-box talk will be held by the field crew prior to the start of work. The APEX Geophysics Limited site supervisor will discuss the following with the field crew:

- Review previous day's work and highlight any hazards identified
- Set out the proposed work schedule for the day
- Ensure all staff have correct PPE and are in good health
- Check weather forecast to ensure safe working conditions
- Check all survey equipment and vehicle

I confirm that I have read and understood this method statement and risk assessment.

Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		
Signed:	_____	Date:	_____
Print Name	_____		

APPENDIX A – Safety

Enclosed are:

Safety Certificates

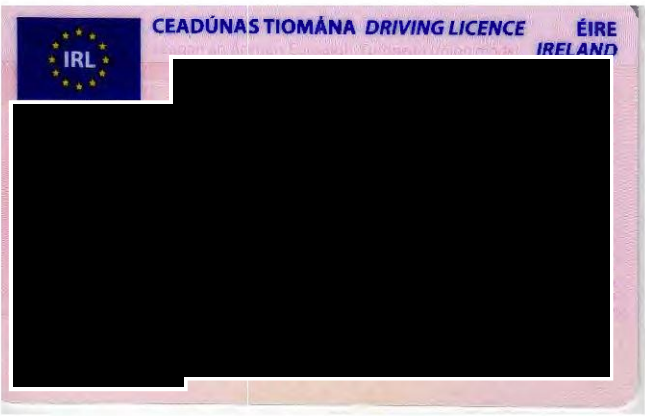
		Contracts Manager
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 Profession	Irish Contracts Manager	DOB
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Safe Pass		
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Driving Licence		
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Manual Handling	ASL
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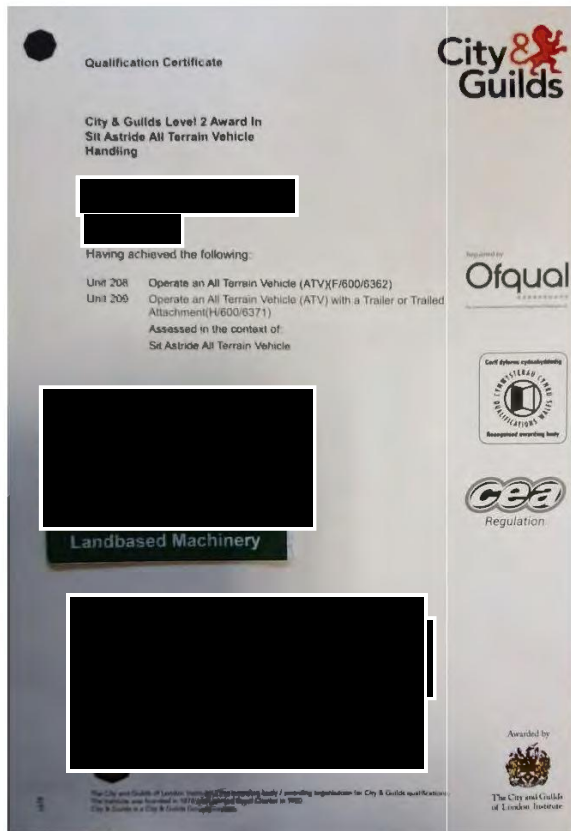


PTS	04/09/2023
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ATV Certification

Sit Astride ATV



Sea Survival

Sea and Shore Safety Services Limited



Geophysical Technician

Nationality
Profession

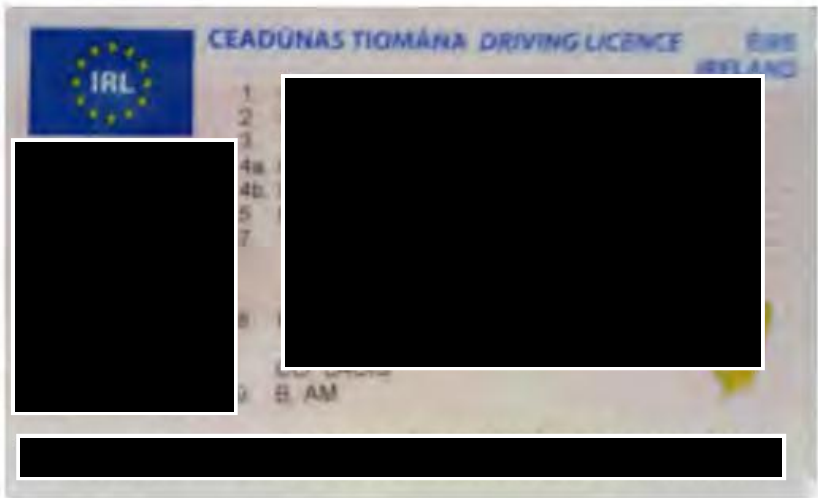
Irish
Geophysical Technician

DOB

Safe Pass



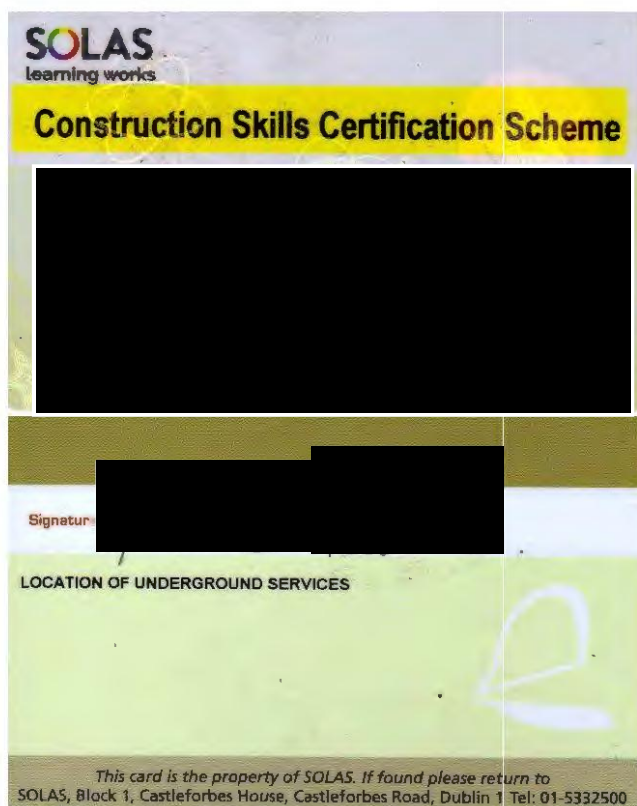
Driving Licence



Manual Handling



Location Underground
Services

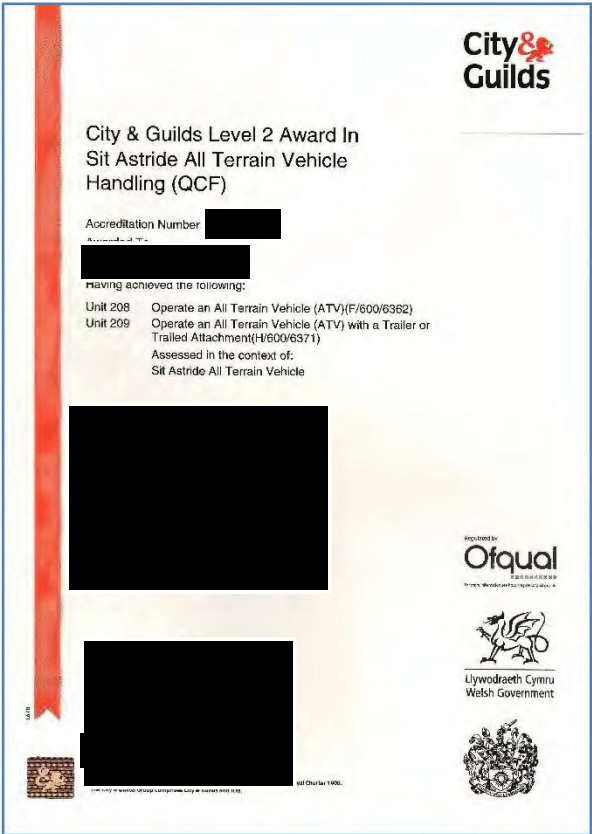


PTS		
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ATV Certification

Sit Astride ATV



ATV Certification

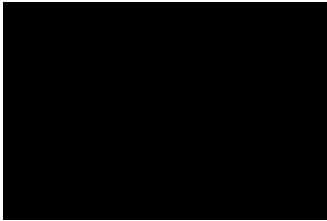
Sit In ATV



APPENDIX B – Financial Information

Enclosed are:

Insurance Certificates

BUSINESS INSURANCE MOTOR INSURANCE HOME INSURANCE FARM INSURANCE	
 DOYLE MAHON INSURANCES	Unit 1 Ardavan Business Park, Ardavan, Wexford Y35NP49 Tel: 053 91 23630 Email: info@doylemahon.ie
<u>EVIDENCE OF LIABILITY COVER NOTE</u>	
INSURED:	Apex Geophysics Ltd
ADDRESS:	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford
TYPE:	Combined Liability Policy
BUSINESS DESCRIPTION:	Geophysical Surveyors
RENEWAL DATE:	26/02/2022
UNDERWRITERS:	Axis
POLICY NUMBER:	B1759IC128666X
EMPLOYERS LIABILITY	
Limit of Indemnity	€13,000,000
PUBLIC LIABILITY	
Limit of Indemnity	€ 6,500,000
EXCESS:	€ 5,000
For Doyle Mahon Insurances	
	
IMPORTANT NOTICE: Please examine this Cover Note carefully and return it immediately to us if it is not in accordance with your instructions. Similarly, if there is any aspect of this Cover Note which you do not fully understand, you should contact us without delay.	
We would particularly draw your attention to the section outlining Policy Conditions - any breach of Suspensive Conditions of failure to comply with Conditions will render your cover null and void. If you have any query in this regard you should contact us immediately.	
WWW.DOYLEMAHON.IE WWW.IRISHPROFESSIONALINDEMNITY.IE	
Doyle Insurance Brokers (Wexford) Ltd. trading as Doyle Mahon Insurances Is regulated by The Central Bank Directors: Patrick Doyle (Managing) Andrew Doyle Colm Mahon Registered Office: Unit 1 Ardavan Business Park, Wexford, Y35 NP49 Registered Number: 463420	
	

BUSINESS INSURANCE MOTOR INSURANCE HOME INSURANCE FARM INSURANCE	
 DOYLE MAHON INSURANCES	Unit 1 Ardavan Business Park, Ardavan, Wexford Y35NP49 Tel: 053 91 23630 Email: info@doylemahon.ie
<u>EVIDENCE OF PROFESSIONAL INDEMNITY COVER NOTE</u>	
INSURED:	Apex Geophysics Ltd
ADDRESS:	Unit 6, Knockmullen Retail Park, Gorey, Co. Wexford
TYPE:	Professional Indemnity Policy
BUSINESS DESCRIPTION:	Geophysical Surveys & Geological Surveys to the Engineering, Environmental & Natural Resources
RENEWAL DATE:	01/07/2021
UNDERWRITERS:	First Ireland Risk Management
POLICY NUMBER:	IE00018115EO17A
LIMIT OF INDEMNITY:	€2,500,000 any one incident
EXCESS:	€15,000 each and every claim
	For Doyle Mahon Insurances
	
IMPORTANT NOTICE: Please examine this Cover Note carefully and return it immediately to us if it is not in accordance with your instructions. Similarly, if there is any aspect of this Cover Note which you do not fully understand, you should contact us without delay. We would particularly draw your attention to the section outlining Policy Conditions - any breach of warranties of failure to comply with Conditions will render your cover null and void. If you have any query in this regard you should contact us immediately.	
WWW.DOYLEMAHON.IE WWW.IRISHPROFESSIONALINDEMNITY.IE	
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APPENDIX C – Emergency Procedure

C.1 Introduction

The first step upon becoming aware of an emergency situation is to assess that situation to determine if it is a minor or major incident. Once this has been clarified follow the relevant procedure detailed below.

C.2 Minor Accident on Site

- 1) Notify the Site Supervisor [REDACTED] or designated representative immediately
- 2) The Site Supervisor will then contact the APEX Geophysics Limited Project Manager ([REDACTED]).
- 3) Site Supervisor to make the area around the scene of the accident safe and cordon it off.
- 4) The Project Manager will notify the Causeway Geotech Limited representative ([REDACTED]).
- 5) First aid kit is available in the site vehicle.
- 6) Site Supervisor to arrange transportation for the injured person to Connolly Hospital to be examined by a doctor.
- 7) All personnel to comply with the Site Supervisors instructions.
- 8) Area to remain cordoned off until further notice from the Site Supervisor.
- 9) All personnel to assist the Site Supervisor in filling out details of the accident for the H & S file – please refer to Accident Reporting procedure hereafter.

C.3 Major Accident on Site

- 1) Notify the Site Supervisor or designated representative immediately.
- 2) The Site Supervisor will then contact the APEX Geophysics Limited Project Manager [REDACTED].
- 3) Dial Emergency Services on 999/112, state the emergency and give the site location.
- 4) The Project Manager will notify the Causeway Geotech Limited representative ([REDACTED]).
- 5) All personnel on site shall be instructed to report to designated Assembly Area
- 6) Under the direction of the Site Supervisor a role call will be undertaken to determine who is on site and that everyone is accounted for.
- 7) Site Supervisor to make the area safe around the scene of the accident and cordon off.
- 8) First aid box available in available in the Site Vehicle
- 9) Site Supervisor to co-ordinate with the emergency services so they can be directed to the scene of the accident.
- 10) All personnel to comply with Emergency Services upon arrival on site.
- 11) Area to remain cordoned off after Emergency Services have left the site.
- 12) All personnel to assist the Site Supervisor in filling out details of the accident for the H & S file – please refer to Accident Reporting procedure hereafter.

C.4 Accident Reporting

- 1) All accidents and near misses are to be reported to the Site Supervisor
- 2) The Site Supervisor will then contact the APEX Geophysics Limited Project Manager [REDACTED] to alert her of the situation
- 3) The Project Manager will investigate every incident/near miss through consultation with the relevant parties and collate all the resultant information.
- 4) An incident report form shall be filled out by the Site Supervisor/Project Manager once all the facts have been gathered and then reported back to Causeway Geotech Limited.

- 5) Corrective action procedures or mitigation measures shall be implemented by the Site Supervisor and Project Manager.
- 6) Accidents that result in more than three days absence from work will be reported to the Health and Safety Authority (HSA) in accordance with statutory requirements.

C.5 Assembly Point

- 1) Due to the size of the site and mobile nature of the works a temporary assembly point will be selected at the start of each work session and communicated to all personnel on site.

C.6 First Aid

- 1) First aid box available is available in the Site Vehicle.

C.7 Emergency Contact Numbers

name	telephone
Emergency Services • Fire Service • An Garda Síochána • National Ambulance Service	999 or 112
Our Lady of Lourdes Hospital,	041 983 7601
Dundalk Garda Station	042 938 8400

APPENDIX D – COVID 19 Special Precautions: (HSE Guidelines)

To protect yourself and others from coronavirus (COVID-19) it is important to think about how the virus is spread. Coronavirus is spread in sneeze or cough droplets. To infect you, it has to get from an infected person's nose or mouth into your eyes, nose or mouth. This can be direct or indirect (on hands, objects, surfaces). Keep this in mind. It will help you remember all the things you need to do to protect yourself and others from the virus.

Social distancing

Social distancing is important to help slow the spread of coronavirus. It does this by minimising contact between potentially infected individuals and healthy individuals.

Some of the things you can do:

Do

- keep a space of 2 metres (6.5 feet) between you and other people
- reduce physical interactions with people
- reduce the number of people you meet every day
- avoid communal sleeping areas
- avoid crowded places

Do not

- Do not shake hands or make close contact, if possible
- Help slow the spread of coronavirus
- To help slow the spread of coronavirus:
- anyone who has symptoms should behave as if they have the virus and [self-isolate](#) for 14 days
- everyone should limit unnecessary social contact as much as possible
- [at-risk groups](#) should avoid close contact with people outside the home
- How to protect yourself and others from coronavirus
- Follow this advice as strictly as possible and encourage others to follow this advice too.

Do

- [Wash your hands properly and often.](#)
- Cover your mouth and nose with a tissue or your sleeve when you cough and sneeze.
- Put used tissues into a bin and wash your hands.
- Clean and disinfect frequently touched objects and surfaces.
- Avoid close contact with people - keep a distance of 2 metres (6.5 feet) between you and others.
- Avoid crowded places, especially indoors.
- Stay at home if you are sick to help stop the spread of whatever infection you may have.

Do not

- Do not touch your eyes, nose or mouth if your hands are not clean.
- Do not share objects that touch your mouth – for example, bottles, cups.
- Do not shake hands.
- Wash your hands properly and often
- You should wash your hands:
- after coughing or sneezing
- before and after eating
- before and after preparing food

- if you were in contact with someone who has a fever or respiratory symptoms (cough, shortness of breath, difficulty breathing)
- before and after being on public transport if you must use it
- when you arrive and leave buildings including your home or anyone else's home
- if you have handled animals or animal waste
- before having a cigarette or vaping
- if your hands are dirty
- after toilet use
- Keep your hands in good condition, moisturise them often. Any basic product that is not perfumed or coloured is OK.

Disposable gloves

- Do not wear disposable gloves instead of washing your hands. The virus gets on them in the same way it gets on your hands. Also, your hands can get contaminated when you take them off.
- Disposable gloves are worn in medical settings. They are not as effective in daily life.
- Wearing disposable gloves can give you a false sense of security.

You might:

- sneeze or cough into the gloves - this creates a new surface for the virus to live on
- contaminate yourself when taking off the gloves or touching surfaces
- not wash your hands as often as you need to and touch your face with contaminated gloves

Face masks

- Wear a face mask when indoors and when the 2m rule cannot be followed
- Sick people will be advised by their doctor when to use a mask. Healthcare workers need masks and other personal protective equipment to protect them from infection during their work.

Keeping well

Infectious disease outbreaks like coronavirus (COVID-19) can be worrying. This can affect your mental health.

Coronavirus COVID-19



Help prevent coronavirus



Wash your
hands



Cover mouth if
coughing or sneezing



Avoid touching
your face



Keep surfaces
clean



Stop shaking
hands and hugging



Keep a safe
distance

The virus spreads in sneeze and cough droplets, so regularly taking the above measures helps reduce the chance of it spreading.

Visit **HSE.ie**

For updated factual information and advice
Or call 1850 24 1850

Protection from coronavirus.
It's in our hands.



Rialtas na hÉireann
Government of Ireland

Coronavirus COVID-19



Know the signs



High Temperature



Shortness of Breath



Breathing Difficulties



Cough

For 8 out of 10 people, rest and over the counter medication can help you feel better.



Wash



Cover



Avoid



Clean



Stop



Distance

If you have symptoms, self-isolate to protect others and phone your GP. Visit [hse.ie](https://www.hse.ie) for updated factual information and advice or call 1850 24 1850.

Protection from coronavirus.
It's in our hands.



Rialtas na hÉireann
Government of Ireland

Coronavirus COVID-19



Who is most at risk?



People over 60



People with long term
medical conditions
like heart disease, lung
disease, diabetes and cancer

Please take extra care if this affects
you or someone you know.

If you have symptoms, self-isolate
to protect others and phone your GP.
Visit [hse.ie](https://www.hse.ie) for updated factual information
and advice or call 1850 24 1850.



Wash



Cover



Avoid



Clean



Stop



Distance

Protection from coronavirus.
It's in our hands.



Rialtas na hÉireann
Government of Ireland

Protect yourself and others from getting sick

Wash your hands



- after coughing or sneezing
- when caring for the sick
- before and after you prepare food
- before eating
- after toilet use
- when hands are visibly dirty
- after touching cuts, blisters or any open sores
- you can use alcohol hand rub, if hands are not visibly dirty

RESIST

www.hse.ie/handhygiene





Covid-19 Questionnaire / Self-Declaration

In the interests of safety of the people of this site, their families and the community, Site Management ask that you complete the following questionnaire / self-declaration. Your co-operation and support are appreciated. You will be requested to leave the site if you answer 'YES' to Questions 1, 2 or 3.

Question	Yes	No
1. Have you been in close contact with anyone who are confirmed with having COVID-19 virus?		
2. Do you live in the same household with someone who has symptoms of COVID-19 who has been in isolation within the last 14 days?		
3. Do you have any of the following typical COVID-19 symptoms; fever, high temperature, persistent coughing, or breathing difficulties / shortness of breath		
4. Have you returned to the island of Ireland from another country within the last 14 days?		
If 'YES', where?		

I confirm that I have responded to the questions above truthfully based on my current condition and I commit to advising the Site Management Team and excluding myself from site if this situation changes, (i.e. if a point in the future, I would answer "Yes" to any of the above questions).

Name _____
 Company _____
 Signature _____
 Date _____



FUGRO

CABLE PERCUSSION BORING

Cable percussion boring has many technical advantages over other intrusive investigation techniques when operated by experienced and competent drillers.

DESCRIPTION

This relatively lightweight rig can be towed on the road and across sites to the borehole location by a 4x4 vehicle. The rig can excavate boreholes throughout a wide range of weak to solid engineering soils. As the borehole is progressed the hole can be stopped at any depth to perform in situ tests or monitor water/gas levels.

As it excavates in comparatively small lengths at a time it can be remarkably accurate when compared to alternative rotary techniques. Fugro's ancillary equipment includes a wide range of sampling and in situ testing equipment. Fugro's personnel resource ensures

equipment is operated by competent, accredited and experienced drillers.

We have experience of constructing boreholes to depths in excess of 70 m using these rigs and can start in a range of casing sizes between 150 mm and 300 mm diameter. On completion various monitoring installations can be installed.



Working off a scaffold platform.



Craned to location.



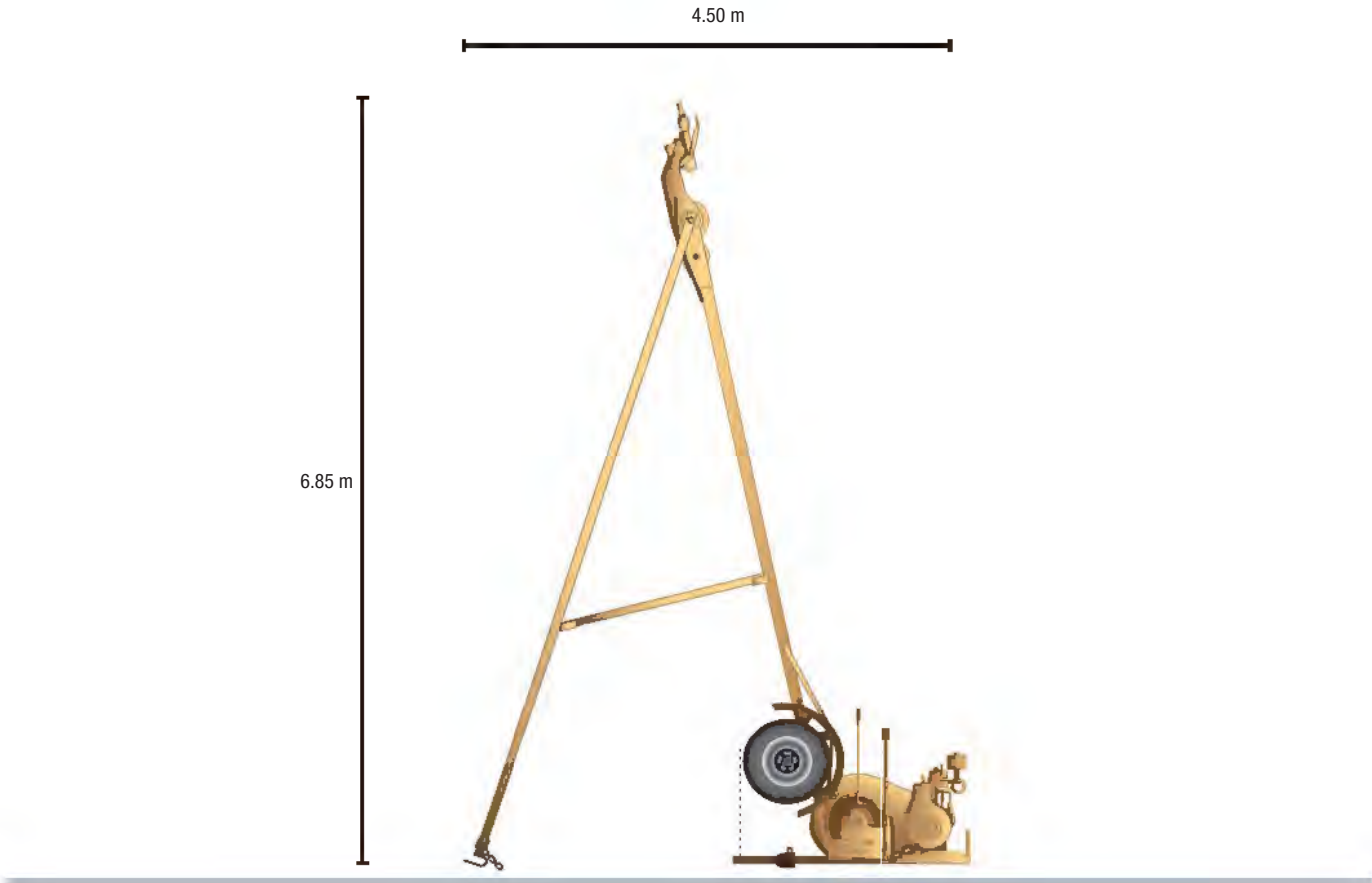
CABLE PERCUSSION BORING

Technical specifications

Dimensions of Equipment	
Length travelling / in use	8.50 m/4.50 m
Width travelling / in use	1.80 m/2.20 m
Height travelling / in use	2.1 m/6.85 m
Drill hole to rear	3.50 m
Drill hole to right flank	1.10 m

Equipment Information	
Make/Model	Dando 3000 Mk2
Plant No.	16908
Weight	2200 kg
Mode of transport	2 wheel, normally towed by 4x4 truck
Maximum diameter casing	300 mm

Power	
Pull up (single line)	3000 daNm
Derrick max. loading	9000 kg





DUKE

Available in both trailer and track mounted versions, the new cutting edge Dando Duke cable percussion rig boasts a range of innovative features for increased efficiency and productivity.



WWW.DANDO.CO.UK

Easy Transportation

The Duke is available in both trailer and track mounted versions.

Mounted on a heavy duty twin axle trailer with built in lights, the Duke can be easily towed behind a regular pickup truck or van for easy transportation between sites.

Alternatively the Duke is available mounted on heavy duty tracks fitted with 2 speed tracking motors and the option of radio remote control or umbilical tracking.



Track mounted at max mast height (5.5m)



Various Drilling Positions

The mast has a large hydraulic ram built into the main mast body which allows it to extend to a maximum working height of 5.5m and a lower height of 4m.

The stainless steel support legs are also telescopic which allow the rig to be used in areas of restricted head room. There is no longer the need for the supports to be “walked around” into position therefore greatly reducing setup space.

Track mounted at low mast height (4m)



Hydraulically Powered

Driven by a water cooled modern diesel engine, hydraulic pumps provide hydraulic power to the stabilisers, mast, PTO and an infinitely variable winch which offers impressive speed and pulling power. The brake and clutch are pneumatically operated.

Hydraulic PTO

The external hydraulic power take off facilitates the quick connection of a variety of equipment including road breakers and casing jacks.

On-board Compressor

An 8m recoil air hose with 1/4" quick connect is fitted inside the rig for use with air tools and tyre inflation equipment.



Stability

When faced with uneven terrain, levelling of the rig is made easy thanks to four hydraulic stabilising jacks.

Optional Casing Jacks

With a PTO, Dando's separate casing jacks can easily be coupled up to pull stuck casing.

CHASSIS

Type	The main chassis of the rig is manufactured from steel laser cut and folded sections providing a rigid base
Levelling	The rig is levelled by 4 hydraulic jacks, one at each corner of the rig
Lifting Points	Rated lifting/tie down points as standard on all 4 corners

CARRIER

Mounting Options	Trailer (Type O2) Crawler Unit
------------------	-----------------------------------

TRAILER SPECIFICATION

Description	Heavy duty twin axle trailer rated to 3500kg
	Over-run auto reverse brakes
	Towing lighting fitted into canopy
	Quick change number plate as standard
	Reverse alarm
	Spare wheel carrier and tyre built into the front of the tow assembly, as standard
	HD serrated jockey wheel
	Hitch is available as eye or 50mm ball depending on the customer's preference

CRAWLER SPECIFICATION

Description	Heavy duty tracks fitted with 2 speed tracking motors
	Tracks can be rubber, steel or hybrid steel rubber blocks
	Rear of the chassis is fitted with a combination towball and pin hitch
Approx. Ground Pressure	38 kPa (5.5 psi)
Tracking	Radio remote or umbilical
	Emergency override levers are fitted to the tracking valve

ENGINE

Type	Perkins 1.5 L 403D-15 . Water cooled normally aspirated diesel engine fitted with a chalwyn spark arrestor as standard
Power	23.9 kw (32 hp)
Torque	94.4 Nm
Fuel Tank	Stainless steel construction Capacity: 44 L
Fuel Consumption	1-2 L per hour

MAST

Type	Main mast section consists of a large box section that extends hydraulically allowing for variable working heights
	Telescopic support legs with adjustable feet for easy levelling and compact setup
Max Derrick SWL	6000 kg
Max Working Height	5.5 m
Min Working Height	4 m

HYDRAULIC SYSTEM

Type	Main closed loop pump + two gear pumps
Hydraulic Tank	Stainless steel construction Capacity: 80 L
System Pressure (Max)	300 bar (4351 psi)
Filtration	10 micron charge filter and return line filter
Hydraulic PTO	20-30 l/min @ max 180 bar (2610.7 psi)

PNEUMATIC SYSTEM

Type	Hydraulically driven single cylinder air compressor with automatic start/stop. An 8m recoil air hose with 1/4" quick connect is fitted inside the rig for use with air tools and tyre inflation equipment.
Flow (Max)	450 l/min
System Pressure (Max)	8 bar (116 psi)
Reservoir	4.3 L

MAIN FREE FALL WINCH

Description	Hydraulically driven 2 speed winch with large centrifugal mass for "snappy feel"
	Multi plate pneumatically actuated clutch
	Multi plate pneumatically actuated brake with fail to safe actuation
	Large diameter 60/40 split drum: 90m of 16mm LH lay wireline

WINCH PERFORMANCE

	Bare Drum	Full Drum	Max Pull
High Speed (Max)	70 m/min	157 m/min	3000 kgf
Low Speed (Max)	35 m/min	79 m/min	3000 kgf

TOOLING WINCH

Type	Hydraulically driven winch to aid tool handling operation
Drum Capacity	38.5m of 6mm wireline
Max Line Speed	38 m/min
Max Pull	500 kg

ELECTRICAL SYSTEM

Battery	12v. Fitted with isolator key
External Power	External heavy duty 12v plug socket to run lighting tripods
	Console is equipped with 12v charging socket

SAFETY FEATURES

3 emergency stop buttons
Spark arrestor
Over hoist switch
Fail to safe brake
Horn and warning beacon
LED lighting fitted as standard - 2 x lights mounted to mast body; 1 x lamp over main winch drum; 1 x console light
EN16228 compliant

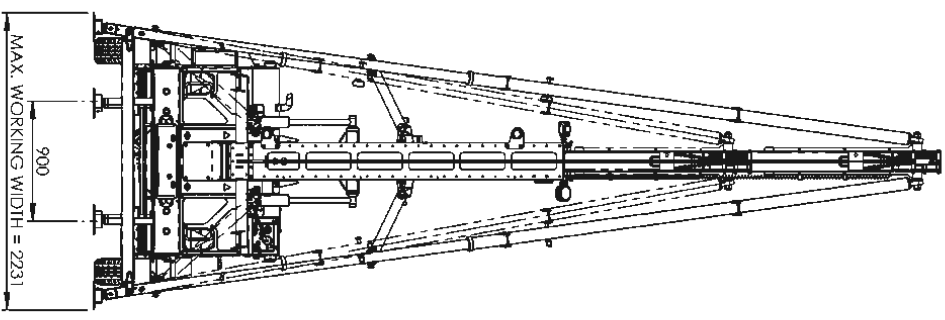
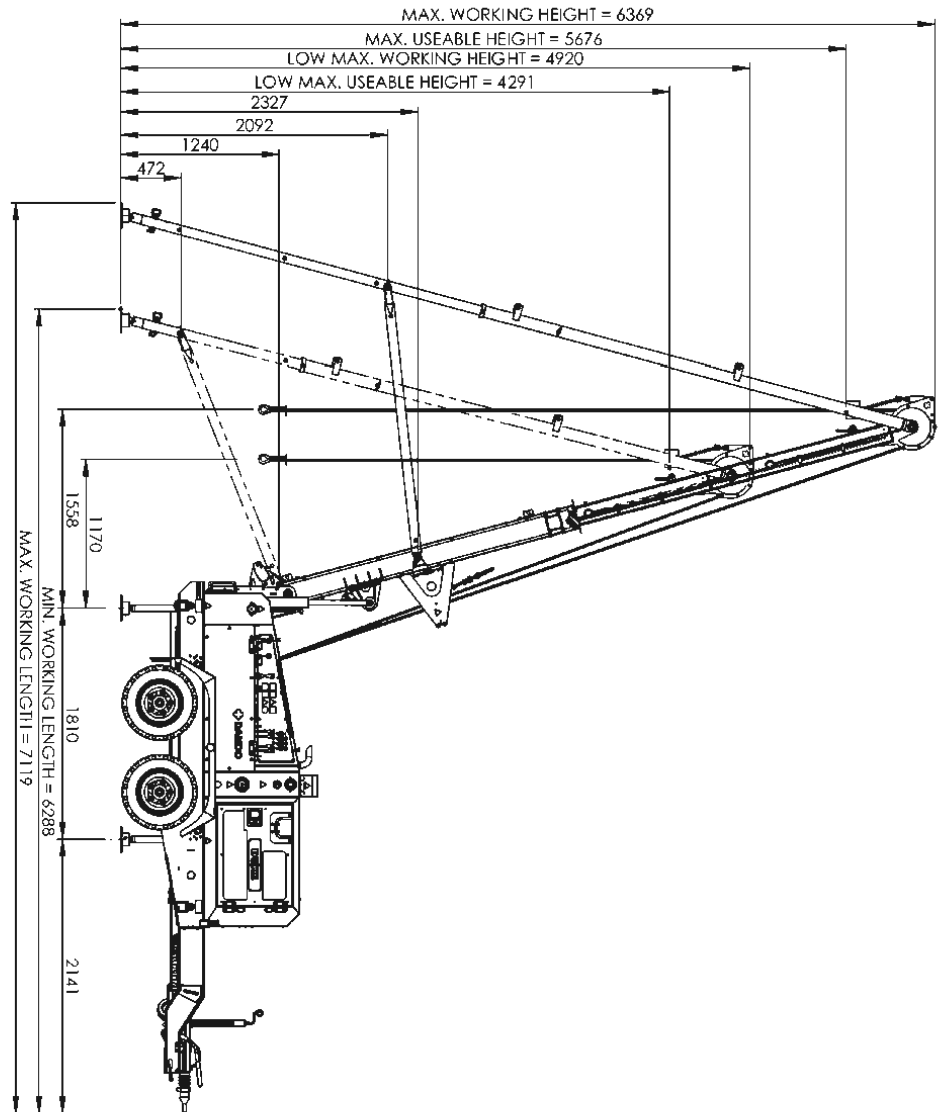
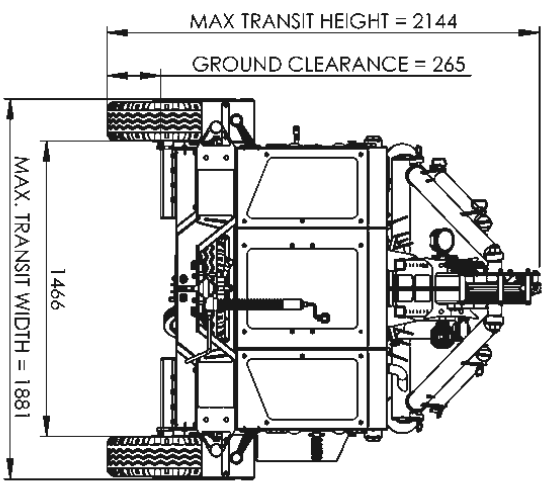
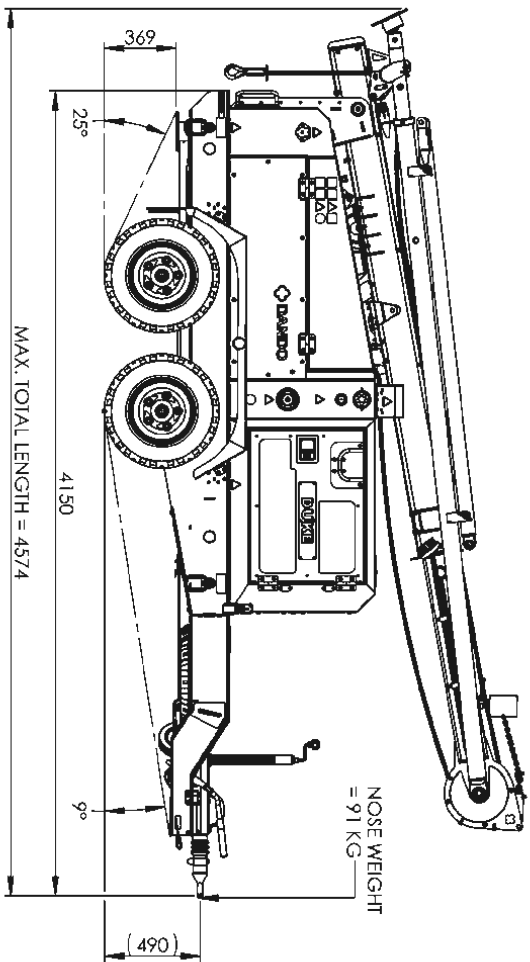
OPTIONAL EQUIPMENT

Hydraulic Casing Jacks
Flotation Tyres - 24x13.00-12 6PR TL
Fire Extinguisher
Lighting Tripods
Tooling Storage
Chalwyn Valve

* Please note that the figures provided in this specification are subject to change in the future.

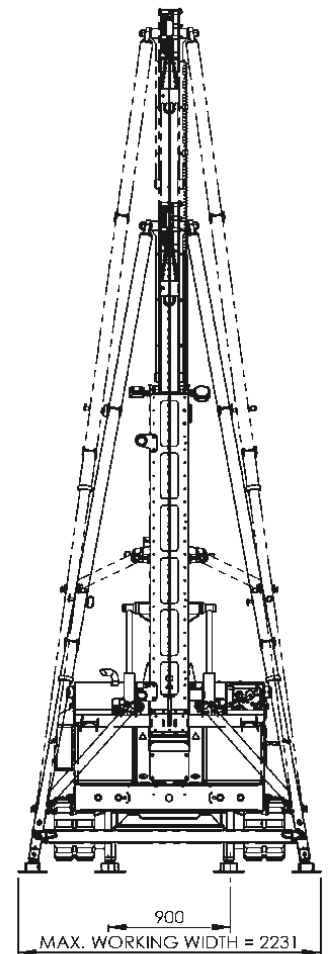
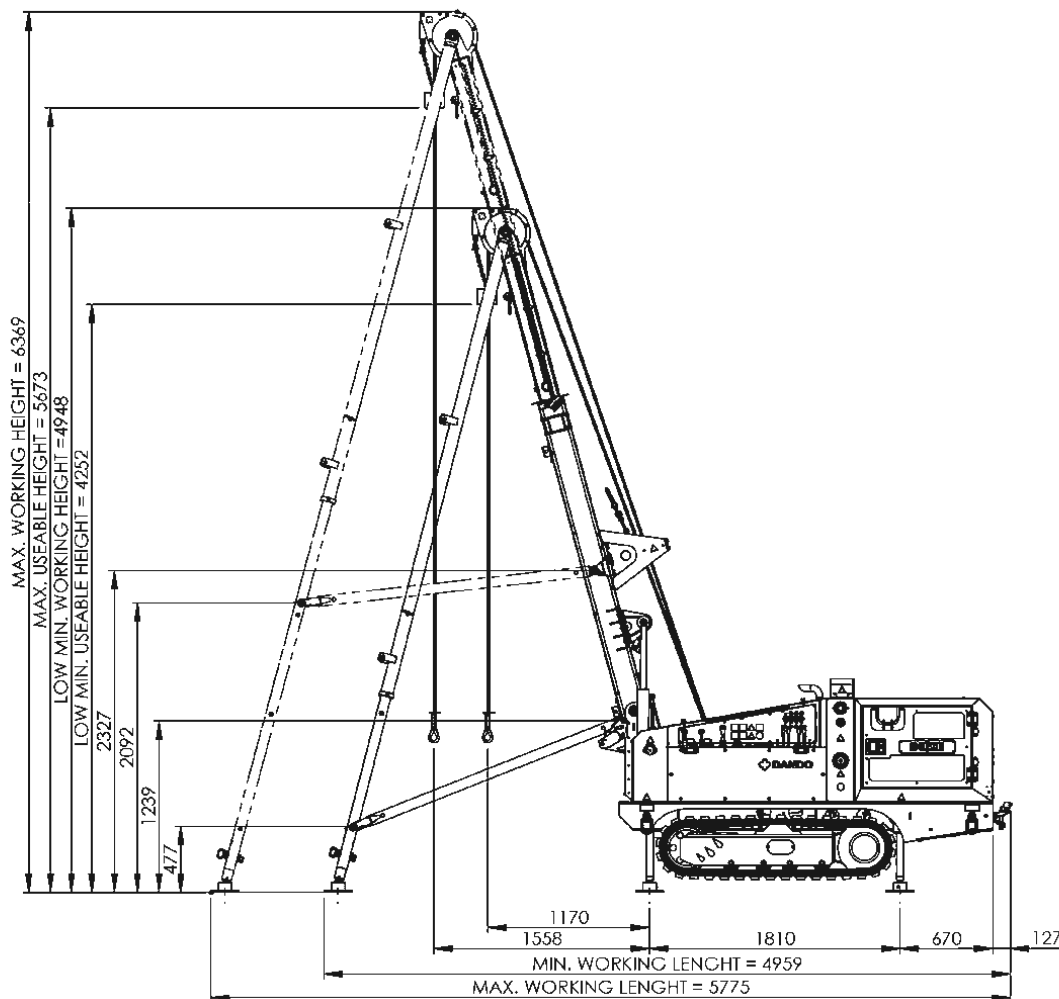
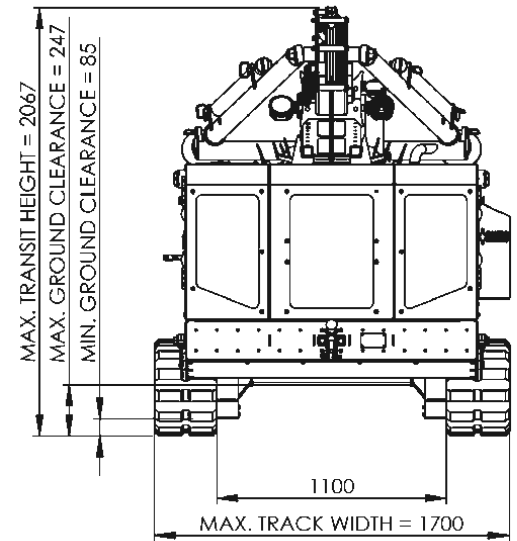
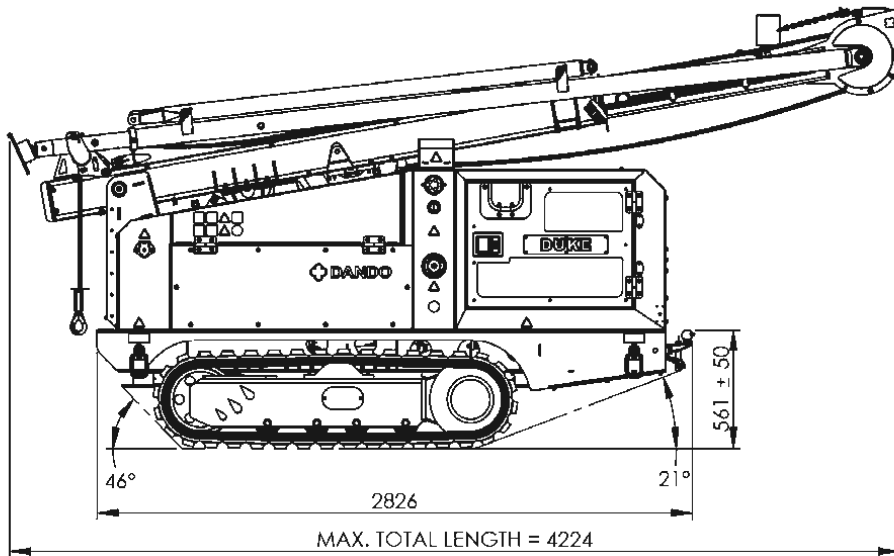
Trailer Mounted Dimensions

* Dimensions in mm



Track Mounted Dimensions

* Dimensions in mm



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TERRIER

Designed for site investigation and environmental analysis, the Terrier's ultra-small footprint and crawler mounted design allows the user to carry out a wide range of sampling methods in confined spaces where access is limited. Available with percussive mast, rotary mast or both.

Percussive

Rotary

Interchangeable Masts



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Made in Britain
since 1867

Versatility

The percussive Terrier is capable of disturbed and undisturbed sampling, SPT, U4 and dynamic probing. The rotary mast attachment extends the rig's range of use to include continuous flight and hollow stem augering, tricone & drag bits, rotary core drilling as well as DTH hammers.

2-Piece Drop Hammer

A 2-piece drop hammer for sampling and testing is incorporated in the mast assembly, with a hydraulic cylinder for recovery of casing and sampling tools.



Small Footprint

Mounted on a small crawler unit, the compact and extremely versatile Dando Terrier is capable of a wide range of drilling techniques in areas of restricted space and difficult access. The rig can even fit through a standard doorway.

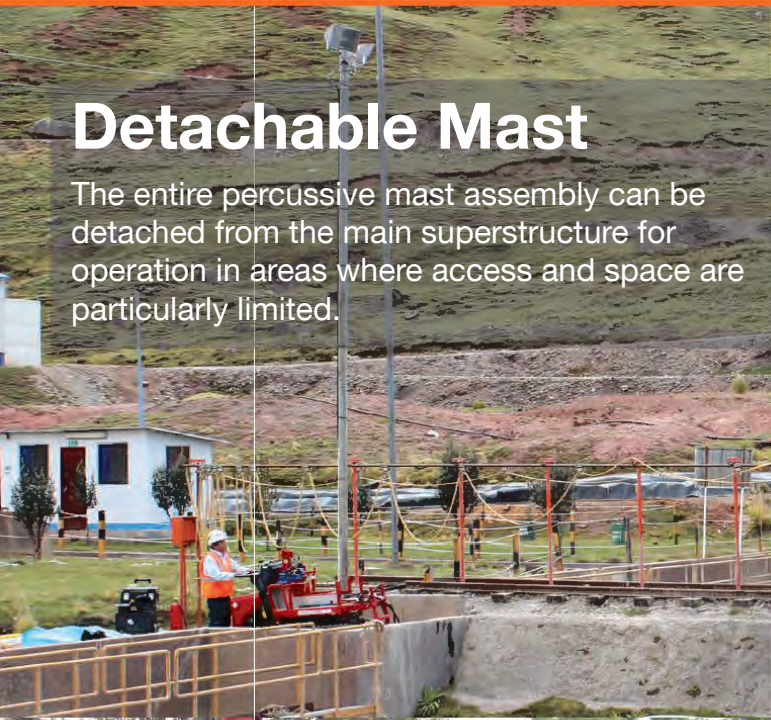
Easy Transportation

The Terrier can be tracked easily across difficult terrain and through tight spaces, causing very little disturbance to its surroundings. Its compact design also allows for easy transportation to and from site by van, trailer or large pickup truck.



Detachable Mast

The entire percussive mast assembly can be detached from the main superstructure for operation in areas where access and space are particularly limited.



Inclined Slopes

A hydraulic tilting undercarriage allows operation on inclined slopes up to 30 degrees from horizontal.



On-board Storage

The rig's deck area includes storage space for all required drilling tools and accessories.

Concrete Coring

Available as an option, the rotary concrete coring head is useful for when concrete and tarmac overlie the area to be sampled.



Rotary Drilling Version

The Terrier is also available as an ultra-compact multipurpose rotary drilling rig capable of:

- Continuous flight and hollow stem augering
- Drilling with tricone & drag bits
- Rotary core drilling
- DTH hammer drilling
- Rotary Air Blast (RAB)

The interchangeable mast option allows the operator to switch easily between rotary and percussive drilling.



19 HP Engine

Now fitted with a 3 cylinder 19 HP diesel engine providing increased power and smoother operation. Easy to access for simple maintenance.



Hammer Percussive Specification

CHASSIS

Description	Purpose built crawler chassis with rubber tracks
	Incorporates controls, engine mounting and tool storage
	Steel deck fitted with tilt mechanism

ENGINE

Type	19 HP water cooled 3 cylinder diesel engine. Other options available.
------	--

MAST ASSEMBLY

Description	Steel mast hydraulically raised and lowered. Entire mast assembly can be detached from the main superstructure for operation in areas of restricted space. 1m measurement scale for easy monitoring of depth progress
Working Stroke	1.3m stroke
Head Travel Speed Up	12 m/min (39 ft/min)
Head Travel Speed Down	17 m/min (55 ft/min)
Pullback	5000 kgf (11023 lbf)

DRIVE HAMMER

Description	Two-piece drive hammer running on 2 guide bars
	Fully guarded weight
Hammer Speed	0-50 blows pm
Hammer Drop	500-750 mm
Hammer Weight	50 kg or 63.5 kg

CONTROL PANEL

Drilling Controls	Located at the side of the rig. Includes emergency stop
Tracking Controls	Located at rear of the rig, with folding foot plate. Option: Radio remote control tracking

STABILISERS

Type	Removable stabiliser legs
------	---------------------------

HYDRAULIC PTO

Max. Flow for PTO	48 lpm
Max. Working Pressure	152 bar

OPTIONAL EQUIPMENT

Rotary concrete coring head
Remote drilling kit - the whole control panel and mast can be removed and operated at up to 30m away from the main base unit
Casing extractor

Rotary Specification

ROTARY HEAD

Description	Driven by a hydraulic motor fitted with a 2 speed gearbox with manual gear change. 3/4" integral side inlet air/water swivel with BW rod connection.	
Motor	63, 75 or 160 cc. Other options available	
Guide Ring	200 mm effective ID. Other options available	
Gearbox Ratio	7:1 - 1:1	

ROTARY HEAD MOTOR OPTION 1 *

Motor	63 cc	
High Range	Max Torque: 140 nm/ 103 ft-lb	Max Spindle Speed: 600 rpm
Low Range:	Max Torque: 980 nm/ 723 ft-lb	Max Spindle Speed: 85 rpm

ROTARY HEAD MOTOR OPTION 2 *

Motor	75 cc	
High Range	Max Torque: 180 nm/ 133 ft-lb	Max Spindle Speed: 470 rpm
Low Range:	Max Torque: 1260 nm/ 929 ft-lb	Max Spindle Speed: 70 rpm

ROTARY HEAD MOTOR OPTION 3*

Motor	150 cc	
High Range	Max Torque: 320 nm/ 236 ft-lb	Max Spindle Speed: 250 rpm
Low Range:	Max Torque: 2240 nm/ 1652 ft-lb	Max Spindle Speed: 35 rpm

*Head performance figures are theoretical. Speeds given are for an unloaded head

FEED AND HOIST SYSTEM

Description	Provided by a single double-acting ram transmitting adjustable hydraulic load to the rotary head.
Head Travel Speed Up	11.5 m/min (37.7 ft/min)
Head Travel Speed Down	16 m/min (52.5 ft/min)
Pullback	5000 kgf (11023 lbf)
Pulldown	500 kgf (1102 lbf)
Working Stroke	2.2 m to accommodate 1.5 m effective length drill rods
Drilling Inclination	45° to 90° (Optional)

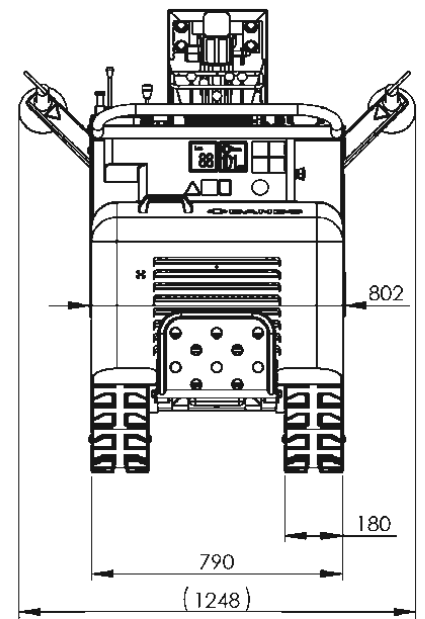
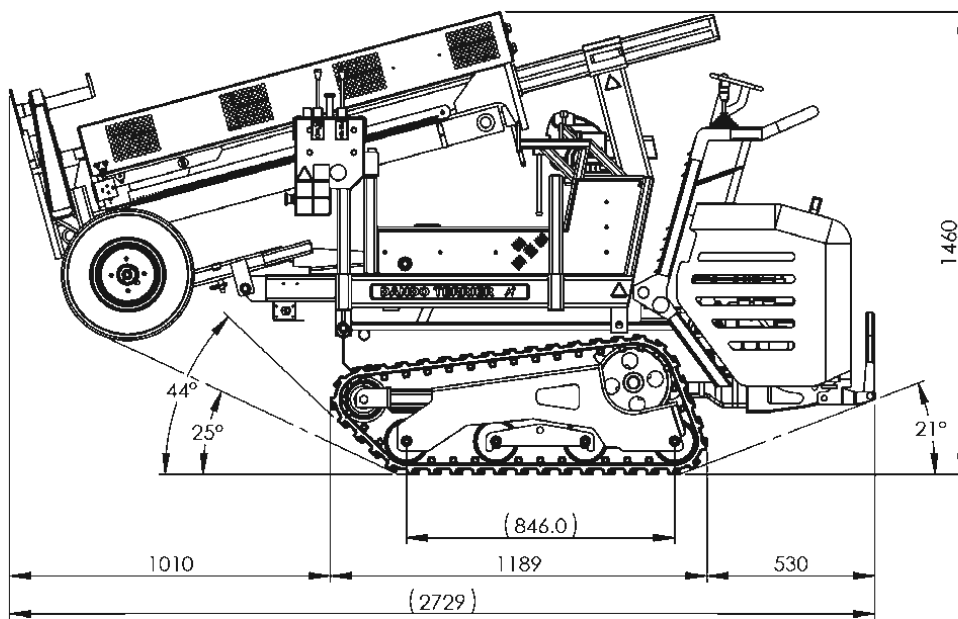
SAFETY FEATURES

2 emergency stop buttons
Hydraulic system protection via relief valves
Safety cage

OPTIONAL EQUIPMENT

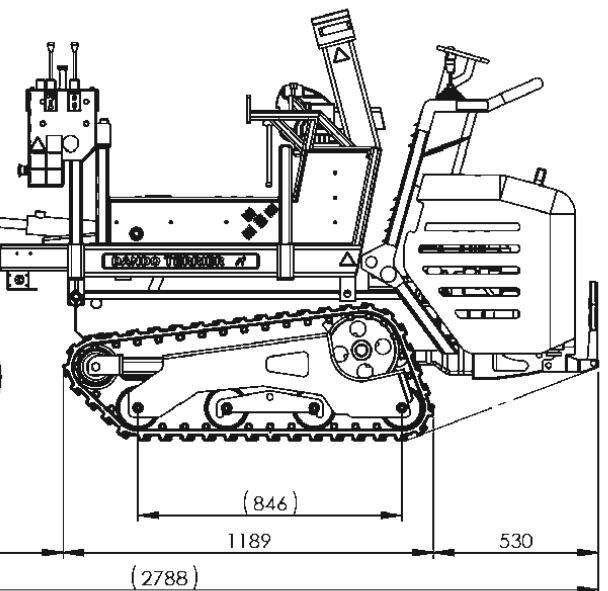
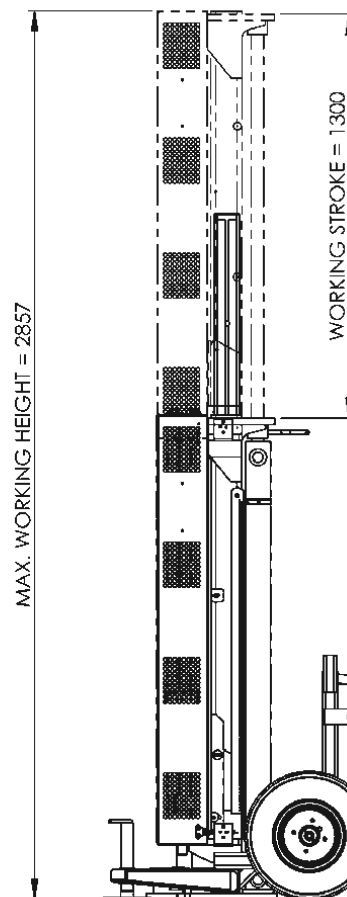
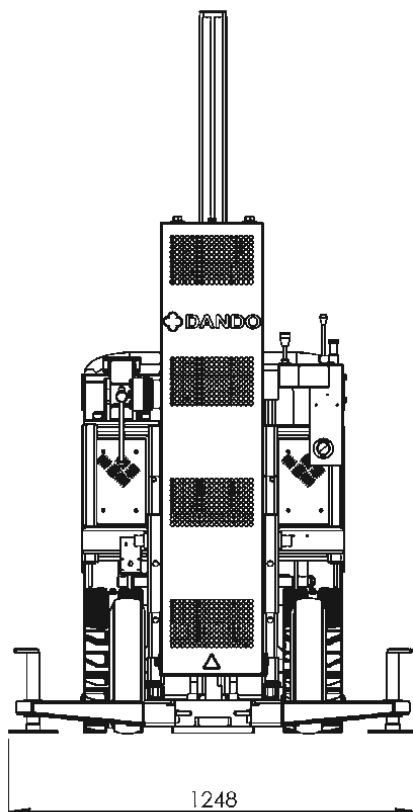
Chalwyn valve and spark arrestor
Wireless remote for tracking
Casing extractor
Angle drilling to 45°

Percussive Terrier Dimensions

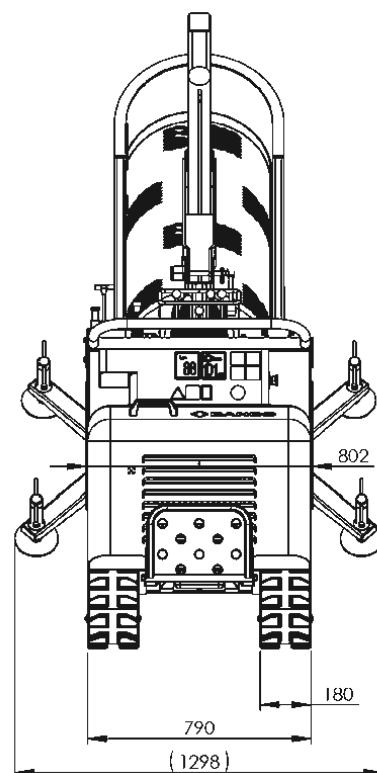
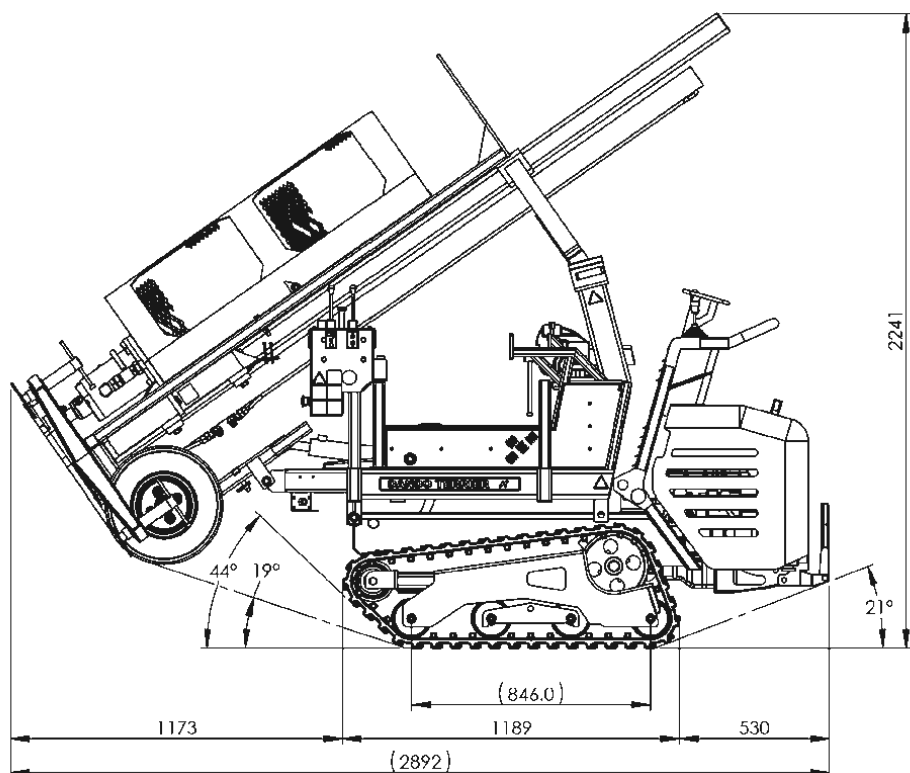


WEIGHT

Base	830 kg (1830 lb)
Mast	336 kg (740 lb)
Total	1166 kg (2570 lb)

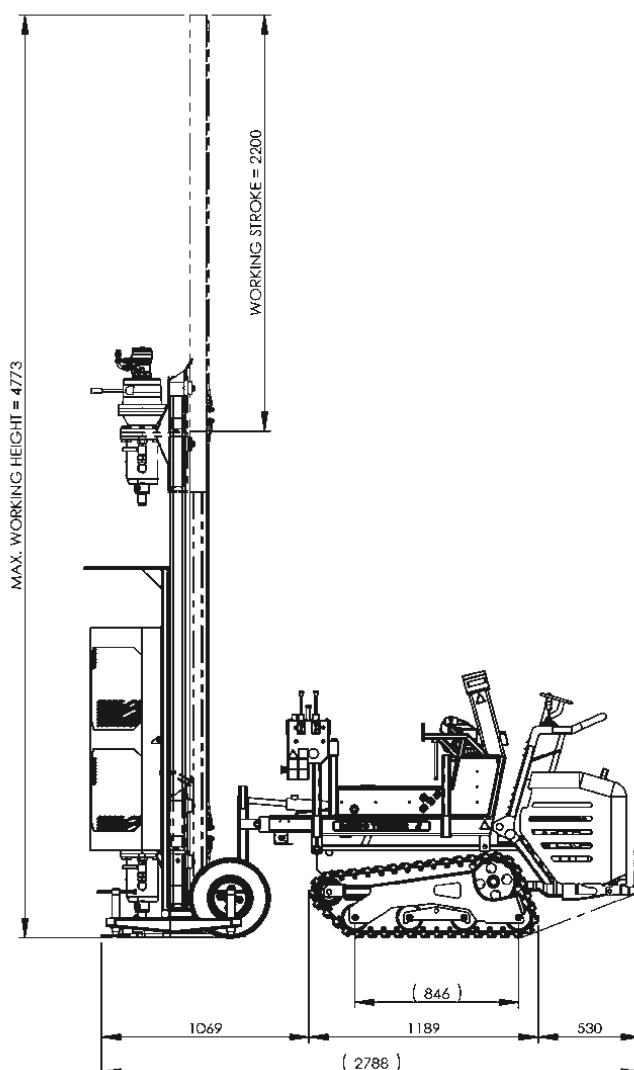
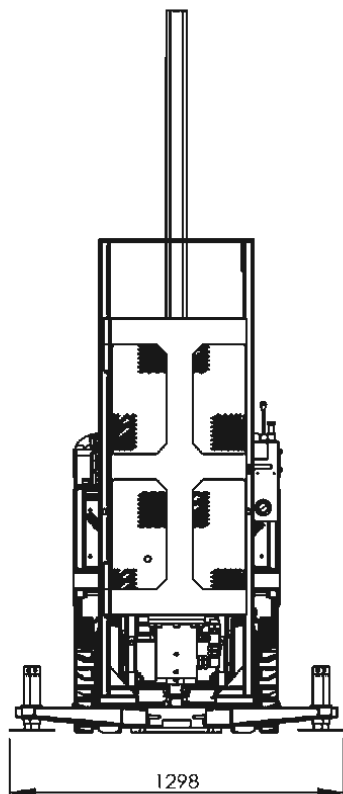


Rotary Terrier Dimensions



WEIGHT

Base	830 kg (1830 lb)
Mast	408 kg (899 lb)
Total	1238 kg (2729 lb)

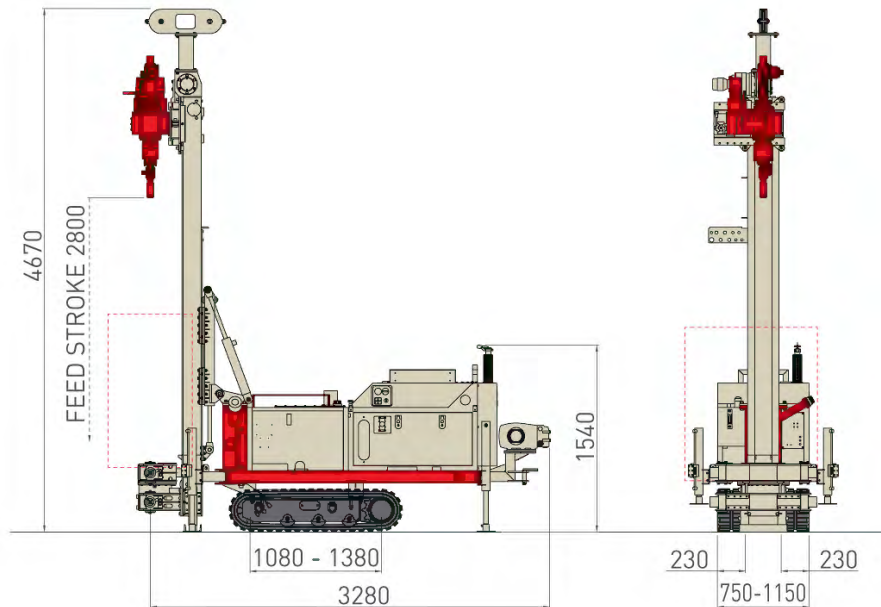


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GEO 205



	m.s.	i.s.		
Potenza Motore Engine Power	kW	HP	33	44
Livello Emissioni Emission Level	-	-	Step 3A / Tier 4i	
Corsa Mast Mast Feed Stroke	mm	ft	1.030 - 2.800	3.4 - 9.2
Forza di Spinta Feed Force	daN	lbs	2.500	5,620
Forza di Tiro Retract Force	daN	lbs	2.500	5,620
Coppia Rotary Rotary Torque Range	daNm	lb*ft	200 - 480	1,475 - 3,540
Giri Rotary Rotary Speed Range	rpm		80 - 580	
Serraggio Morse Clamp Range	mm	in	45 - 220	1.8 - 8.6
Peso Perforatrice Rig Weight	kg	lbs	2.400 - 2.800	5,300 -6,200

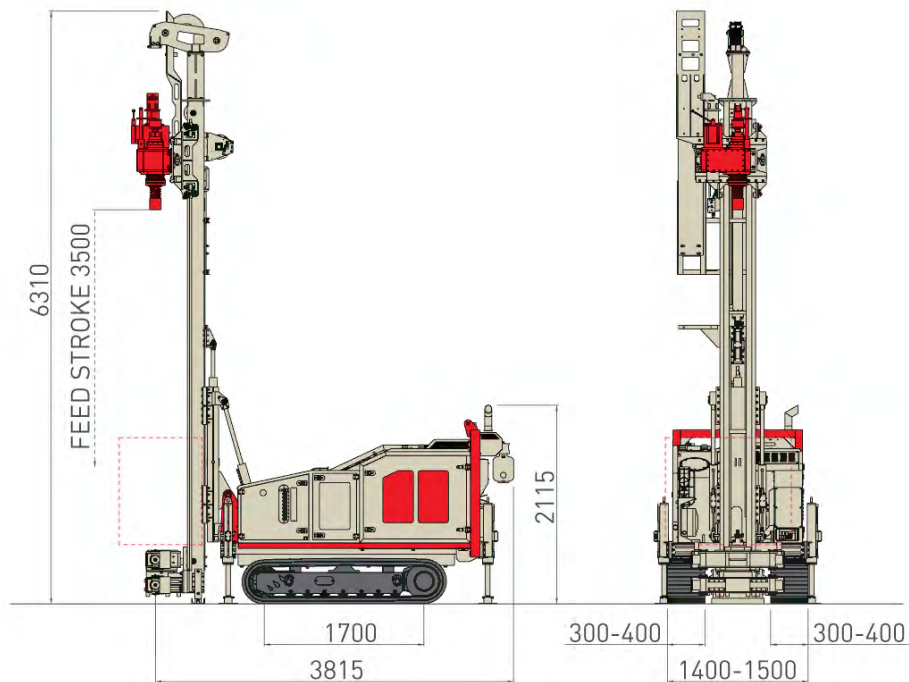


iThis is a simplified data sheet that does not show all possible rig configurations. For further information [click here](#).

Specifications shown are only indicative and subjected to change without prior notice



GEO 405



	m.s.		i.s.	
Potenza Motore Engine Power	kW	HP	55 - 74	74 - 99
Livello Emissioni Emission Level	- Step 3A/Tier 3 - Step 5 / Tier 4f (HT Line)			
Corsa Mast Mast Feed Stroke	mm	ft	2.500 - 3.500	8.2 - 11.5
Forza di Spinta Feed Force	daN	lbs	4.500	10,116
Forza di Tiro Retract Force	daN	lbs	6.500	14,612
Coppia Rotary Rotary Torque Range	daNm	lb*ft	450 - 1.400	3,319 - 10,325
Giri Rotary Rotary Speed Range	rpm		55 - 980	
Serraggio Morse Clamp Range	mm	in	45 - 325	1.8 - 12.8
Peso Perforatrice Rig Weight	kg	lbs	5.800 - 7.000	12,800 - 15,400



This is a simplified data sheet that does not show all possible rig configurations. For further information [click here](#).

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