Celtic Interconnector

Volume 3D2

Environmental Impact Assessment Report - Appendices

June 2021

Co-financed by the European Union
Connecting Europe Facility

Tionscadal Éireann
Project Ireland
2040

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Construction and Environmental Management Plan

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Management systems

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1 Introduction

1.1 General

This Construction Environmental Management Plan (CEMP) supports the application for development consent for the Irish offshore elements of the Celtic Interconnector Project (the 'Proposed Development'). The overall Celtic Interconnector Project is an electrical interconnection between Ireland and France to allow the exchange of electricity between the two countries. The Proposed Development in Ireland is being developed by EirGrid, who is the electricity Transmission System Operator (TSO) (hereafter the Applicant). The overall Celtic Interconnector Project is being jointly developed by EirGrid and its French counterpart, Réseau de Transport d'Électricité (RTE).

The Celtic Interconnector Project is, by its nature, multi-jurisdictional, and is being jointly developed by the two TSOs of Ireland and France. As will be specified later under Roles and Responsibilities (Section **Error! Reference source not found.**), the environmental manager d elivering the Proposed Development will coordinate regularly with the corresponding staff delivering other elements of the Celtic Interconnector Project (Ireland onshore, and in UK waters).

In addition, while not occurring within UK territory, the Celtic Interconnector Project will be located, in part, within the UK Exclusive Economic Zone (EEZ). An Environmental Impact Assessment Report (EIAR) has been prepared to accompany a Foreshore Licence application to the Department of Housing, Local Government, and Heritage (DHLGH) for the Proposed Development. A separate, though integrated, EIAR has been prepared to accompany an application for statutory approval to An Bord Pleanála (ABP) for the Ireland Onshore element of the Celtic Interconnector project.

The EIAR has been prepared having regard for relevant guidelines, including:

- The EPA Draft Guidelines 2017;
- Environmental Protection Agency (EPA) Advice Notes for Preparing Environmental Impact Statements (Draft 2015);
- Department of Housing, Planning and Local Government (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment; and
- European Commission Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU), 2017.

The environmental management of the construction works for the Proposed Development shall be delivered via the implementation of this CEMP. It outlines the environmental procedures that require consideration throughout the construction process in accordance with legislative requirements and construction industry best practice guidance. It aims to ensure that the adverse effects from the construction phase of the Proposed Development, on the environment and local communities, are minimised, as per the measures prescribed in the EIAR for the Proposed Development.

The CEMP will be implemented by the Applicant and secured through the conditions of the foreshore licence application. Revisions to this CEMP may be undertaken during the determination period of the foreshore licence application in agreement with the appointed contractors and the relevant authorities.

The appointed contractor(s) shall be responsible for safeguarding the environment and for mitigating the effects of the construction works by implementing general environmental requirements of the CEMP. The Applicant will audit and oversee the contractor(s) implementation of the CEMP via contractual arrangements.

1.2 Overall Celtic Interconnector Project

The Celtic Interconnector is primarily a subsea link that will enable the exchange of electricity between the electricity transmission grids in Ireland and France. The link will have the capacity to carry up to 700 MW of electrical energy between the two systems. The connection will link an existing electricity transmission substation located in Knockraha in east Cork, Ireland, with a substation in La Martyre in Brittany, France.

The transmission grids in both Ireland and France are operated at High Voltage Alternating Current (HVAC). High Voltage Direct Current (HVDC) is used for the transmission of electrical power over large distances where HVAC is not technically or economically feasible. Converter stations are therefore required in both France and Ireland to convert the HVDC power to HVAC.

Designated as a Project of Common Interest (PCI) by the European Union, the Celtic Interconnector project responds to European challenges regarding energy transition and addresses climate change by facilitating progress towards a low-carbon electricity mix. It will contribute to more secure, more sustainable, and better priced electricity.

The main elements of the overall Celtic Interconnector project are:

- A High Voltage Direct Current (HVDC) submarine cable of approximately 500 km in length laid between the coast in Brittany France, and the Cork coast in Ireland. The submarine cable will be either buried beneath the seabed or laid on the seabed and covered for protection;
- A landfall location in Ireland and France, where the HVDC submarine circuit will come onshore and terminate at a Transition Joint Bay (TJB);
- A HVDC underground cable (UGC) in both countries between the landfall location and a converter station compound;

- A converter station in both countries to convert the electricity from HVDC to High Voltage Alternating Current (HVAC) and vice versa;
- A HVAC UGC in both countries between the converter station compound and the connection point to the National Grid;
- A connection to the National Grid; and,
- A fibre optic link, with associated power supply, will also be laid along the route for operational control, communication, and telemetry purposes.

The key elements of the project are illustrated in Figure 1.1 and Figure 1.2.

Figure 1.1 Celtic Interconnector (Project Overview)

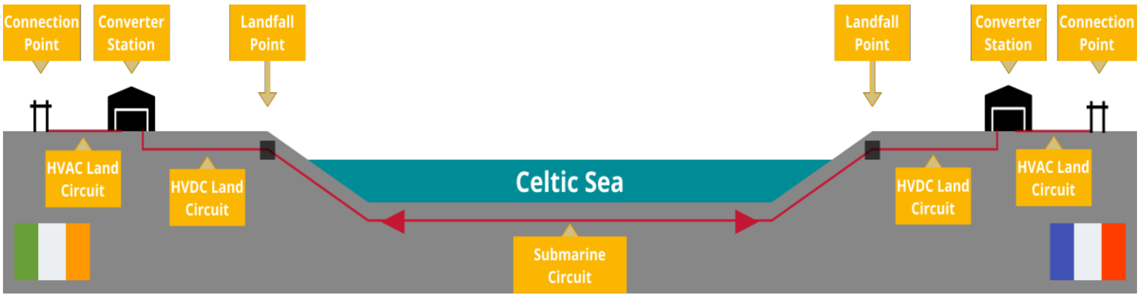
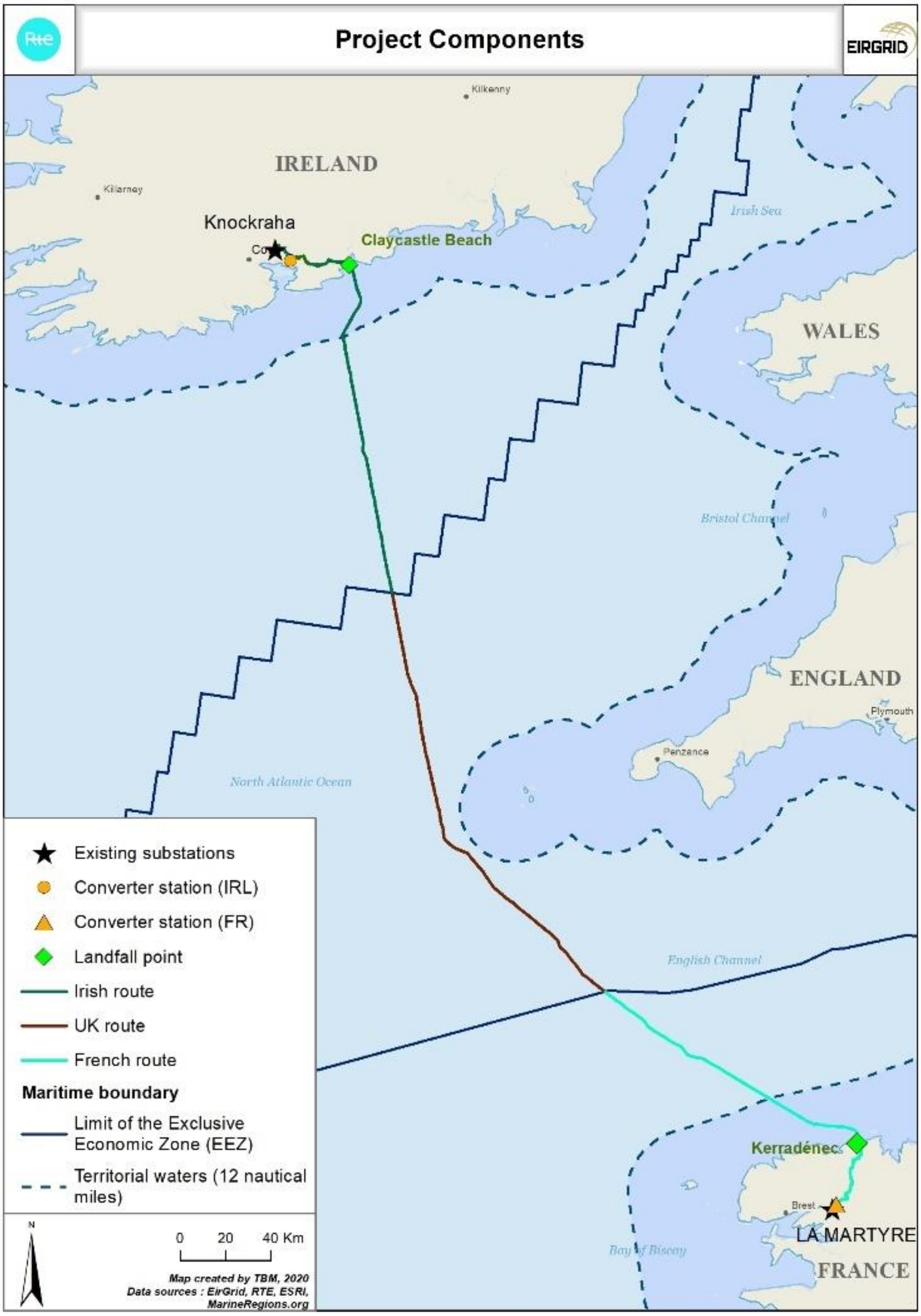


Figure 1.2 The route of the Celtic Interconnector project



1.3 Overview of Proposed Development

This CEMP relates to the Proposed Development (i.e. in Ireland Offshore), summarised in Section 2 of this CEMP.

A more detailed description of the Proposed Development is provided in Volume 3D Part 2 of the EIAR (see Chapter 5: Description of the Landfall, and Chapter 6: Description of the Offshore Cable).

1.4 Objectives of the CEMP

This CEMP provides an overarching framework for the environmental management procedure during the construction phase of the Proposed Development.

The objectives of the CEMP are as follows:

- To provide a mechanism for ensuring the delivery of environmental measures (other than those which will be secured through specific conditions of the application), to avoid, reduce or compensate for environmental effects identified in the EIAR;
- To provide an outline of the content that will be supplied in the detailed plans and schemes prior to construction of the relevant stage of works;
- To ensure compliance with legislation and identify where it will be necessary to obtain authorisation from relevant statutory bodies;
- To provide a framework for compliance auditing and inspection to ensure the agreed environmental aims are being met; and
- To ensure a prompt response to any non-compliance with legislative and EIAR. Requirements, including reporting, remediation and any additional mitigation measures required to prevent a recurrence.

1.5 Structure and content of the CEMP

The remainder of this CEMP is split into four further chapters:

- Chapter 2 describes the Proposed Development construction;
- Chapter 3 describes the roles and responsibilities of those on site;
- Chapter 4 describes the general environmental requirements that will be adopted for the Proposed Development. The general site operations cover the following elements:
    - Method Statements;
    - Audit and Inspections;
    - Competence, Training, and Awareness;
    - Communications;

  - Environmental Incident Procedure;
  - Health and Safety;
  - Construction Hours;
  - Construction Site Layout and Appearance;
  - Waste Management;
  - Security;
  - Welfare;
  - Biosecurity;
  - Unexploded Ordnance; and
  - Consents and Licences.
- Chapter 5 describes the environmental measures that will be adopted during the construction of the Proposed Development in accordance with the EIAR. The environmental measures will be implemented to avoid, reduce, or compensate for effects on receptors identified in the following environmental topics:
  - Population and Human Health;
  - Air Quality and Climate;
  - Marine Sediments Quality;
  - Marine Physical Processes;
  - Marine Water Quality;
  - Biodiversity;
  - Seascape and Landscape;
  - Archaeology and Cultural Heritage;
  - Material Assets;
  - Noise and Vibration;
  - Shipping and Navigation;
  - Commercial Fisheries; and
  - Major Accidents and Disasters.

This document is classified as a ‘live document’ and as such is required to be updated by the Contractor prior to the commencement of any construction related works or activities. An example CEMP Review Table is located within Appendix A of this report. Updates will take account of the following aspects:

- Changes to the design;
- Changes to external factors, including legislation;
- Unforeseen circumstances;
- Results from external audits and inspections; and
- Learning points from environmental near misses and incidents.

1.6 Conformance with the Environmental Statement

An EIAR has been undertaken for the Proposed Development. The EIAR has been prepared in accordance with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296/2018) (the 2018 Regulations). The EIAR includes assessments of the likely significant effects on the environment that are likely to be caused during the construction and operation phases of the Proposed Development.

This CEMP has been prepared in accordance with the environmental measures identified in the EIAR (Chapters 8 - 21) and supporting documentation to avoid, reduce or compensate for the adverse effects of the Proposed Development on the environment during construction.

2 Description of the Offshore Development

2.1 Introduction

A brief overview of the Proposed Development is provided below. The detailed description of the proposed development is provided in EIAR Volume 3D Part 2 Chapter 5: Description of the Landfall, and Chapter 6: Description of the Offshore Cable.

The subsea cable will connect to its onshore element at the Transmission Joint Bay (TJB) north of the car park at Claycastle Beach near Youghal in County Cork. The HVDC subsea cables will be buried within pre-installed conduits beneath the beach and car park at Claycastle Beach. The cables will be pulled ashore through the conduits and into the TJB by a temporary winch. Once the cable is secured in the TJB, the offshore cable laying and burial process shall commence. For this, a plough / jetter shall be transferred to the beach to bury the cable seaward.

The cable landfall installation method selected for Claycastle Beach is an open cut installation method to be constructed in two phases. Phase 1 of the installation involves the installation of conduits within a trench excavated across the beach and extending across an existing car park located above the beach to the area of the TJB. Two options are proposed for these works:

1. Install the conduits almost to the Lowest Astronomical Tide (LAT) level. This minimises disruption to the beach during the high amenity season as these works can be carried out in the winter season; however they involve a significant construction effort as a causeway and extensive cofferdam piling are required. This activity is expected to take up to 10 weeks.
2. Install the conduits for a shorter distance below the beach. This significantly reduces the construction effort, as in particular there would be no requirement for a causeway and the extent of cofferdam piling would be minimal, thereby reducing associated construction noise and movements of plant and vehicles. This option would result in a short duration (2-3 days) public exclusion from a 50m corridor of the beach for the installation of each of the two cables, with pedestrian diversions on the beach during the cable installation (the works might occur in the high amenity season). However, the car park would remain fully accessible, and would facilitate the diversion around the exclusion zone.

Option 1 has the greater potential for environmental impact, and so is the basis for assessment in the Ireland Offshore EIAR (Volume 3D Part 2 – Technical Chapters).

Phase 2 of the installation sequence involves pull-in of the submarine cables through the pre-installed conduits and into the TJB using a cable winch. The specific location of the receiver pit will vary between Option 1 and Option 2; however, all other activities are similar between the two options.

Temporary laydown areas and a construction compound will be required along the beach, in the car park, and on the section of grass which separates the car park from the year-round holiday park for the installation of the onshore trench, the TJB and the winch platform.

The offshore cable route through the Irish Territorial Waters is approximately 35km and a further 116km is within the Irish EEZ. The offshore works involve a number of vessels (survey vessels, cable lay vessels and support vessels). The installation of the submarine cable will follow the general sequence below:

- Contractor survey, route engineering and finalisation;
- Unexploded Ordnance (UXO) intervention campaign;
- Boulder clearance;
- Pre-lay grapnel runs;
- Construction of infrastructure crossings;
- Pre-lay route survey;
- Cable lay;
- Post-lay survey;
- Cable burial;
- External / Secondary protection; and
- Post-burial survey.

2.2 Proposed Construction Schedule and Timing of Works

Subject to the grant of statutory approvals, it is programmed that installation of the offshore route will commence in 2024, for it to become fully operational by 2027.

The offshore works involve a number of vessels and activities as discussed in EIAR Volume 3D Part 2 Chapter 6: Description of the Offshore Cable. The first activity of the offshore works will be the pre-lay survey expected to last 28 days in Irish waters and performed well in advance of the main construction activity.

The preparatory works shall be carried out in advance of cable lay for approximately 30 days in Irish TW and EEZ.

Offshore Cable installation is envisaged using standard burial tools (plough or a mechanical trenching tool). There is approximately 33km of the marine route in the Irish EEZ (Kilometre Point (KP) 57.5 to KP 90.7) that has more challenging strata, consisting of underling chalk. Sections of this route may pose a challenge to cable burial using standard burial tools and may require the use of specialist rock cutting tools for trenching. The overall schedule for cable lay and burial in Irish Territorial Waters and EEZ excluding weather or mechanical damage stand by is 60 days.

A rock placement vessel, only if required in the Irish EEZ, will follow cable installation, and be required in Irish TW and EEZ for up to 16 days.

The durations of the works provided are indicative only and based on 24/7 operations, and will be subject to relevant approvals, safety requirements for the installation operations / procedures, and weather conditions.

3 Project Team

3.1 Roles and Responsibilities

Establishing roles and responsibilities on site is important to ensure the successful construction of the Proposed Development, including the implementation of the CEMP.

3.1.1 Contractors

The contractors will be responsible for implementing the CEMP through contractual agreements with the Applicant.

Prior to each stage of construction commencing, the contractors will prepare or update the management plans required within the CEMP.

The contractors will prepare and update the site Safety Health and Environment (SHE) Plan, which details relevant safety, health and environmental information relating to all land within the construction site.

The contractors will prepare a list of Contractors Proposals, which will detail all of the environmental mitigation measures for each stage of the works that will be implemented. The Contractors Proposals will be in accordance with the CEMP.

The plans will be made available to all persons working on the Proposed Development.

Environmental issues that arise during the construction of the Proposed Development will be reviewed at the inaugural and subsequent regular meetings held by the contractors. Daily toolbox talks will be held by the contractors to inform the construction staff of any environmental issues and any changes to the CEMP, Contractors Proposals, and/or the SHE Plan.

The Applicant and the contractors will ensure that all staff, including sub-contractors are trained and competent in the management of environmental impacts to a level that is appropriate to their role.

3.1.2 Contractor Project Director

It is to be the responsibility of the Contractor Project Director (CPD) to ensure that adequate resources are made available to the Project Team so that the environmental policy is effectively implemented during the construction phase. The CPD will sign the Policy Statement confirming the commitment of the Project Team to ensure that all environmental aspects are managed in accordance with relevant legislative and contractual requirements, and environmental commitments detailed in the CEMP.

3.1.3 Contractor Environmental Manager

The Contractor Environmental Manager (CEM) is responsible for ensuring all environmental standards and commitments are adhered to throughout the construction design, implementation, maintenance, and monitoring periods of the scheme.

The CEM will also be responsible for the following:

- Developing and reviewing the CEMP and specialist procedures;
- Leading the appointment and management of environmental specialists at the construction stage;
- Facilitating environmental training and inductions to the workforce, as required;
- Communicate sustainability good practice, innovation and targets to the project team and supply chain;
- Keep a record of key performance indicators ('KPIs');
- Monitoring compliance of construction activities with the CEMP / environmental legislation and licences;
- Acting as the focal point of contact for all environmental issues on site;
- Convening and chairing environmental team meetings and meetings of external consultees;
- Providing such advice as is required by the CPD on environmental issues; and
- Coordinating regularly with the Environmental Clerk of Works (EnCoW) implementing the CEMP for the onshore Irish elements of the Celtic Interconnector Project, and the corresponding CEM delivering the CEMP in UK waters. Unless otherwise agreed between the EnCoW, CEMs the competent authorities, or other relevant stakeholders, coordination will be required at least weekly (but daily where onshore and offshore works are concurrent at the landfall, or Irish and UK offshore works are being undertaken concurrently). The CEM will be available to attend joint meetings with EnCoW and/or other CEM(s), if requested by competent authorities, or other stakeholders relevant to timely and effective delivery of the CEMP.

The CEM will also record and report on all environmental activities on the project. They will monitor and supervise construction activities where appropriate, maintain auditable environmental records and conduct audits as required by the CEMP and offer full time presence on site throughout the construction period.

3.1.4 Environmental Clerk of Works

The EnCoW will be responsible for taking the scheme through the environmental aspects of the statutory process and aid the development of the CEMP in liaison with the specialist advisors. The EnCoW will provide advice and assistance as necessary throughout the construction process.

3.1.5 Environmental Specialists

A team of experts will be employed and utilised to support the Project Team on specific issues as and when required. They will undertake pre-construction surveys and watching briefs, and oversee implementation, maintenance, and monitoring throughout the contract period.

Marine mammal observers (MMOs) will be present on the geophysical survey vessels in Irish waters. Throughout all works, suitably qualified MMOs will follow the DAHG (2014) guidelines established by the NPWS, recording continuously as appropriate.

The role of an MMO is to monitor for the presence of marine mammals, and where noise-generating works are being completed (for example geophysical surveys), that direct and indirect impact risks (mortality, hearing loss and/or disturbance) are mitigated and operations are controlled when animals come within close proximity prior to the sound source being generated e.g. 500-1,000m.

This 500-1000m ZoI relates to typical mitigation zones, as per the DAHG (2014) guidance. DAHG (2014) guidance indicates that piling and geophysical acoustic surveys (not seismic) should not commence if marine mammals are detected within 1,000m (piling) and 500m (geo acoustic survey, not seismic), unless a distance modification has been agreed with the Regulatory Authority.

Whilst focusing on marine mammals, the survey methodology dictates that surveyors are also instructed to record any sightings of marine reptiles.

3.1.6 Engineering Manager

The Engineering Manager is responsible for ensuring the environmental issues and constraints are included in individual designs, in accordance with environmental design procedures.

3.1.7 Community and Stakeholder Liaison Officer

The primary role of the Community and Stakeholder Liaison Officer is conducting all public liaison associated with the construction phase of the Proposed Development.

The responsibilities and duties of the Community and Stakeholder Liaison Officer include the following:

- Disseminating the construction programme to all relevant parties, including, for example, any work generating high levels of noise;
- Acting as first point of contact for members of the public;
- Ensure that all local residents and stakeholders are kept informed of progress and key issues;

- Maintaining a register of queries and complaints from the public which will inform the day-to-day construction activities;
- Responding to queries, responding to complaints, and resolving concerns in addition to informing the project manager as and when complaints are received; and
- Production of newsletters / bulletins / social media upon a regular basis to raise awareness of current issues both within the project team and throughout the local community.

3.1.8 Site Health and Safety Advisor

The Site Health and Safety Advisor’s main aim is to prevent accident, injuries, and work-related illnesses on site. They shall implement health and safety policies in accordance with the latest legislation, guidance, and codes of practice.

They will be responsible for the following tasks and responsibilities:

- Take overall responsibility for compliance with all health and safety requirements at the site and for achieving the required levels of health and safety performance;
- Take responsibility for implementation and management of emergency response procedures, while ensuring health and safety roles are being enacted in accordance with the requirements of these procedures, and in line with best industry practice;
- Ensure health and safety roles are provided with suitable environmental awareness training and provision of any specialist environmental training required generally to carry out their roles;
- Ensuring work is undertaken in a safe manner and machinery is used in accordance with manufactures guidance;
- Ensuring that the contractor and their associated employees work in accordance with approved risk assessments;
- Undertake regular (e.g. daily) checks to ensure that the site is tidy and secure;
- Provide health and safety toolbox talks to site employees upon a regular basis (e.g. weekly);
- Reviewing implemented health and safety procedures and where appropriate amending procedures. These reviews will be recorded; and
- Reporting and recording any incidents or near misses.

4 General Environmental Requirements

4.1 Introduction

This chapter of the CEMP provides an overview of the general environmental requirements that will be implemented during the construction of the Proposed Development to avoid, reduce, or compensate for adverse effects.

The CEMP can be updated to provide full details of environmental measures as identified by the contracted environmental specialists primarily having regard to any conditions of the relevant consents.

The relevant Contractor will ensure that all sub-contractors adhere to the environmental good practice guidelines for implementation during work activities.

4.2 Method Statements

The implementation of Method Statements for the different activities of the Proposed Development works shall be completed within the relevant contractor(s) by trained staff or other appropriate experienced personnel, in consultation with specialists as required. Their production shall include a review of the environmental / health and safety risks and commitments, so that appropriate control measures are developed and included within the construction process.

Method Statements will be reviewed by the Contractor’s Project Manager and, where necessary, by an appropriate environmental specialist. Where appropriate, and if required or necessary, Method Statements will be submitted to the relevant regulatory authorities.

Method Statements must contain as a minimum:

- Location and duration of the activity;
- Work to be undertaken and methods of construction;
- Plant and materials to be used;
- Labour and supervision requirements;
- Health, safety, and environmental considerations (including relevant control measures); and
- Permit or consent requirements.

Deviation from approved Method Statements (where this is a statutory requirement) will be permitted only with prior approval from relevant parties. This will be facilitated by formal review before any deviation is undertaken.

4.3 Audit and Inspections

The Contractor's CEM shall be responsible for updating the CEMP on a regular basis as required.

The CEM will undertake daily inspections, which will include monitoring conformance with the CEMP. Daily assessment forms will be completed by the CEM during the daily checks. Checks on equipment will be undertaken to reduce the risk of incidents occurring (for example oil leaks). As a minimum, unless otherwise agreed with the Foreshore Unit or other relevant stakeholders, the following equipment will be inspected:

- Waste storage facilities;
- Sediment management;
- Oil separators;
- Chemical storage facilities;
- Storage vessels (i.e. pumps, gauges, pipework, and hoses);
- Secondary containment (i.e., secondary skins for oil tanks);
- Spill response materials; and
- Equipment with potential to leak oils and other liquids, for example, compressors and transformers.

Regular external audits will be undertaken by the Applicant to ensure the mitigation in the EIAR is implemented correctly.

The external audits will also include:

- Reviewing the daily risk assessment forms;
- Ensuring that faults and defects are identified and rectified; and
- Providing data for performance monitoring.

Environmental performance data will be collected and collated into the SHE Plan.

The Contractor's CEM will be delegated sufficient powers under the construction contract so that she / he will be able to instruct the Contractor to stop works and to direct the carrying out of emergency mitigation / clean-up operations.

The Applicant will also have stop works authority, in the event of a non-conformance identified during an external audit.

4.4 Reporting

The Contractor's CEM will be responsible for carrying out regular monitoring of the Contractors CEMP and will report monitoring findings as required by the planning consent. The Contractor's CEM will also report monitoring findings in writing to the Applicant on a regular basis (at least weekly, but immediately in the case of incidents or accidents). Contractors shall be responsible for investigating and addressing any non- conformances raised by the CEM within an agreed time frame. The CEM will document in written reports, where additional corrective or preventative actions to those in the EIAR have been implemented

The CEM monitoring reports (and Applicant’s audit reports of same) will be made available to statutory and non-statutory bodies on request. Where specific environmental management and reporting is required, it will be set out in the relevant management plans.

Document control shall be in accordance with a Quality Management System and copies of all environmental audit reports, consents and licences shall be maintained by the Contractor’s Environmental Manager.

5 Competence, Training, and Awareness

Contractors shall identify the training needs of their employees and subcontractors so that they can implement the requirements of this CEMP (and any agreed updates to same) into briefings and construction method statements.

All personnel will be aware of their general environmental management responsibilities, and for those whose work may cause, or have the potential to cause, a significant impact on the environment, to receive specific environmental awareness briefings. Environmental awareness will be reinforced through information, such as poster campaigns, environmental / sustainability performance indicator reports and environmental alerts.

All contractors are responsible for ensuring the competency of their environmental staff. Where environmental training is needed for staff, a contractor is responsible for ensuring this requirement is fulfilled. Any environmental training provided to members of the project team will be logged by the CEM and any certification documents will be produced by the relevant members of staff as evidence that they hold the required competencies.

5.1.1 Toolbox Talks

To provide ongoing reinforcement and awareness training, the below topics, along with any other environmental issues which arise, will be discussed at regular toolbox talks provided by the CEM, or relevant specialists. Where applicable to the works the following topics will be included in the induction:

- Waste management;
- Pollution prevention and control;
- Biosecurity;
- Measures for marine mammals, including the role of Marine Mammal Observer
- Archaeology; and
- Emergency response procedures

Additional toolbox talks shall be added by the CEM or relevant specialists as required based on circumstances such as unforeseen risks, repeated observation of bad practices, or perceived lack of awareness.

Records of all toolbox talks and their attendees shall be maintained and recorded.

5.2 Communications

5.2.1 Internal Communication

Communication on environmental issues within the project team will take place through face-to-face conversations, e-mails, and telephone calls / virtual meetings. The Contractor’s

Project Manager will be made aware of all environmental issues at the earliest possible opportunity. Communication on environmental matters will be maintained through construction meetings chaired by the Environmental Advisor / Manager or a senior manager.

Environmental issues identified by any member of the project team will be communicated to the relevant personnel to ensure any required actions are carried out. Dissemination of information will take place in several forms, as appropriate, including meetings to discuss project issues, method statements, task/activity briefings, toolbox talks, inductions, environmental notices, and environmental alerts. Records that these have been carried out and who received them will be recorded. The Environmental Advisor / Manager will notify Supervisors of any legislation changes which may affect working practices.

Any unexpected finds / occurrences by project staff can be reported to their supervisors, which will then give notification to the relevant member of the Environmental Team who will advise on the course of action to be taken.

5.2.2 External Communication

Contractors will liaise regularly with the Applicant and their representatives regarding the programme of works, nature of the operations, and methods to be employed to minimise adverse environmental impacts. This will include progress meetings as well as the production and submission of progress reports which will cover environmental / sustainability issues. Contractors will also supply all relevant supporting information and documentation to the Applicant for matters concerning consents and the environment in accordance with the appropriate timescales.

In the event of stakeholder liaison being required with local authorities or other stakeholders, the Contractors will identify the requirement and seek authorisation from the Applicant to undertake the task. Where consultation is required, a representative from the Applicant will be invited to attend alongside the relevant Contractor personnel.

Project staff will keep an archive of any e-mail correspondence between themselves and statutory authorities and other stakeholders concerning the activities taking place. Where any complaints are received, a log of correspondence and complaints will be kept up to date by the relevant Contractor.

The Contractor will appoint a Community and Stakeholder Liaison Officer to carry out liaison duties with the public and others and will develop the Communications Plan for the Proposed Development. The responsibilities of the Community and Stakeholder Liaison Officer are outlined in section 3.1.

Contact details of the Community and Stakeholder Liaison Officer will be made publicly available and advertised clearly.

Contact details will be detailed and displayed on the site notice board. A template for the Emergency Contact List is provided in Appendix C.

5.2.3 Community and Stakeholder Relations

It is good practice to inform interested parties when works are due to commence. Contractors will not communicate with residents unless approval has been granted by the Applicant. A Community and Stakeholder Liaison Officer role will be appointed by the Contractor, as described above.

The Contractor's Community and Stakeholder Liaison Officer will interface with the Applicant's Community Liaison Officer.

Stakeholder meetings will be held as required.

Any letters issued to interested parties will be drafted and issued by the Applicant, with inputs from the Community and Stakeholder Liaison Officer.

5.2.4 Complaints Procedure

The Community and Stakeholder Liaison Officer will be responsible for dealing with any complaints and will have the appropriate authority to resolve any issues that may occur. Should it be required, an 'out of hours' telephone number will be available. The Community and Stakeholder Liaison Officer will also communicate complaints on environmental matters communicated to the Applicant's Planning and Environmental Unit, based centrally in EirGrid's Dublin office.

The Environmental Manager / Advisor will maintain a close liaison with the relevant Local Authority Environmental Health Officer ('EHO'), and offshore regulatory body at all times, and should any complaints regarding environmental nuisance (e.g. dust or noise) be received by the Community and Stakeholder Liaison Officer the details will be passed to the relevant persons for verification purposes.

5.3 Environmental Incident Procedure

All incidents associated with the construction of the Proposed Development, including environmental incidents and non-conformance with the CEMP, will be reported, and investigated.

The formal procedure for handling Environmental Incidents will be developed and agreed by the Contractor / Construction Manager and communicated through the CEMP, however it is envisaged that it will be similar to that detailed below:

- Environmental Incidents are to be reported to the Construction Manager;
- The Construction Manager (or nominated representative) will record full details of the Environmental Incident and ensure that they are responded to as soon as reasonably practicable (preferably within one hour but always within 24 hours); and
- The Construction Manager (or nominated representative) will undertake an investigation to assess what corrective and preventative action, or further investigation is necessary to avoid recurrence of the Environmental Incident.

5.3.1 Pollution Incident Control Plan

A Marine Pollution Contingency Plan will be developed for the Proposed Development, post-consent. The production of this document is a requirement of the Foreshore Licence and will be submitted to the licencing authority for approval prior to construction.

The final response procedure will be presented in the Marine Pollution Contingency Plan, which will be produced post consent.

Each vessel utilised on the project will have an effective spill response process in place, i.e. a Ship Oil Pollution Emergency Plan ('SOPEP'), or equivalent.

SOPEP is a MARPOL 73/78 requirement under Annex I. All ships with 400 GT and above must carry an oil prevention plan as per the norms and guidelines laid down by IMO under Marine Environmental Protection Committee ('MEPC') Act.

The Master of the ship has overall charge of the SOPEP of the ship, along with the chief officer as subordinate in charge for implementation of SOPEP on board. SOPEP also describes the plan for the master, officer, and the crew of the ship to tackle various oil spill scenario that can occur on a ship.

All vessels will carry spill kits, suitable individuals will be available to provide 24 hr spill response (where 24 hr working is planned). Individuals will have been trained by the CEM, or relevant specialists, in the use of spill kits and procedures so that any response is carried out immediately and efficiently.

In addition, Contractors will work with local authorities to provide support in event of any incident occurring where pollution of the marine environment occurs.

Emergency Response Plans and Emergency Notification Flowchart will be produced by the contractor. This will include project specific emergency contact details, notification requirements, and classifications for an environmental incident.

5.3.2 Dropped Objects

Dropped objects will be reported in line with the requirements set out in the Foreshore Licence.

5.4 Health and Safety

The Applicant is and Contractor are required to ensuring the health and safety of persons working on projects and the protection of the environment is maintained in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013, as amended[1] (the 2013 Regulations) and the principles and philosophy behind them.

[1] Safety, Health and Welfare at Work (Construction) Regulations 2013. Available [online] at: https://www.hsa.ie/eng/Legislation/New_Legislation/SI_291_2013.pdf (Accessed 08/06/2021).

In accordance with health and safety legislation[2], the contractors will prepare a Construction Phase SHE Plan prior to construction works commencing.

A SHE Plan will be prepared by the contractors for each element of the Proposed Development, including construction work. The Plan will ensure that adequate arrangements and welfare facilities are in place to cover:

- The safety of construction staff;
- The safety of all other people working at or visiting the construction site;
- Overall compliance with health and safety legislation, approved codes of practice and industry best practice;
- Emergency procedures being defined and adopted; and
- Appropriate training and information being provided to personnel.

The contractors' Construction Phase SHE Plan will be reviewed by the Applicant to ensure it meets the 2013 Regulations prior to construction commencing. As described at Section 2.1, the SHE Plan will be managed, implemented, and updated as necessary through the duration of the project by the Contractor Project Manager.

All staff, site visitors and delivery drivers will receive a relevant project induction by the contractors to ensure they are aware of site hazards and health, safety, and environmental management requirements. Site staff will be briefed daily by the contractors prior to work commencing. Site-specific risk assessments will be carried out to ensure the risk remains relevant. The contractors will be required to carry out audits and inspections throughout the proposed development in accordance with Section 2.1 of this CEMP.

5.5 Construction Hours

Proposed timings of the Proposed Development are outlined in the EIAR and in Chapter 2, subject to approval by the DHLGH prior to the commencement of the works.

5.6 Construction Site Layout and Appearance

The layout, appearance and operation of the construction site, site offices / compounds, and vessels will be detailed prior to construction commencing and will comply with the commitments in this CEMP.

[2] Safety, Health and Welfare at Work Act 2005

5.7 Waste Management

The Applicant and the contractors are responsible for managing waste arising from all activities in order to prevent pollution and to meet or exceed legal requirements[3, 4, 5, 6, 7].

The contractor will prepare a Waste Management Plan (WMP) to include matters related to any conditions of the Foreshore Licence and any other post consent related matters, including in respect of detailed design and scope activities and confirmatory survey works.

The contractor's WMP will include waste stream management procedures that include protocols for the correct handling, segregation, and disposal of waste in accordance with the Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment (DECC, 2006), as well as in accordance with Annexes IV and V of the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention).

In line with the revised 2011 EU (Waste Directive) Regulations 2011 [S.I. No. 126/20011], waste will be managed in accordance with the waste hierarchy as defined by the EU Directive 2008/98/EC on Waste. This means that waste will be reduced, reused, recovered, and recycled as far as reasonably practicable.

The contractor will operate control measures in accordance with industry best practice to ensure:

- No unauthorised keeping, deposit, or disposal of materials;
- No unauthorised treatment of material;
- No escape / release of waste material, either while the material is awaiting transportation or during transportation;
- Material is only transported by an authorised person / company who holds the correct Waste Carriers / Broker Licence; and
- A Waste Transfer Note is used with a written description of the material.

Temporary facilities for installation works will be provided in the hard standing car park area at the foreshore, including chemical toilets and additional wastewater holding capacity. These will be regularly serviced by a licensed wastewater treatment contractor, with effluents removed for discharge to a sewage treatment plant. The nearest wastewater treatment plant to the landfall site at Claycastle Beach is located less than 5km away, to the north of

3 European Union (Environmental Impact Assessment) (Waste) Regulations 2020. SI 505 of 2020.

4 European Union (Ship Recycling) (Waste) Regulations 2019 S.I. No. 13 of 2019.

5 Waste Management Act, 1996 No 10 of 1996

6 Protection of the Environment Act 2003 No 27 of 2003

7 Waste Framework Directive 2006/12/EC

Youghal. Having been upgraded in 2018 (Irish Water, 2020), the Youghal wastewater treatment plant is anticipated to have the necessary equipment and capacity for treating wastewater from site.

Vessels will manage on-board waste streams including wastewater and sewage in line with international agreements such as the International Convention for the Prevention of Pollution from Ships (the MARPOL convention), with Annex IV relating specifically to sewage management and Annex V relating to solid waste streams such as garbage.

Waste produced offshore will be stored in designated containers and returned to port by the EPC contractor. Onshore, waste will be segregated into designated containers that are made of materials appropriate to the content. Waste will be collected and disposed of by a licensed waste contractor.

Hazardous wastes arising from the works generated on board the vessels will be segregated based on its classification as (potentially) hazardous or non-hazardous. Under MARPOL 73/78 the following waste types are distinguished and on board the vessels, segregation takes places accordingly:

- Operational waste (general and recycling); and
- Hazardous wastes (which are expected to include waste oils, oil / fuel contaminated materials, and will not be mixed with non-hazardous or inert materials.

5.8 Security

The construction site and vessels will be controlled in accordance with the statutory duty[2] to prevent unauthorised access to the site. Site-specific assessments of the security and trespass risk will be undertaken at the site and appropriate control measures implemented. The control measures are likely to include:

- Consultation with An Garda Siochana on security proposals for the site and vessels with regular liaison to review security effectiveness and response to incidents; and
- Immobilisation of plant and vessel out of hours, removing or securing hazardous materials from site and compounds, and securing fuel storage containers.

5.9 Welfare

No living accommodation will be permitted on the onshore construction compound for the foreshore works. Onsite and on vessel welfare facilities will be provided for all site workers and visitors. Welfare facilities will be kept clean and tidy, in accordance with section 2.7 of this CEMP.

5.10 Biosecurity

The risk of Invasive Non-Native Species (INNS) will be reduced by the contractor in agreement with the Applicant by carrying out a Biosecurity Risk Assessment and implementing INNS Management Plan, drawing on the findings of the EIAR, including appropriate mitigation as outlined within Volume 3D2 Part 2 – Technical Chapters, Chapter 14 - Biodiversity. This will be done in relation to all marine operation activities associated to the Proposed Development. The risk assessment and management plan will include consideration of all activities, vehicles and equipment used as well as how the risk will be minimised through appropriate mitigation and adherence to best practice guidance and management measures. The risk assessment will include a review of all the available data in relation to the presence of marine INNS where applicable to the Proposed Development, and the potential risks associated to each species identified.

5.11 Unexploded Ordnance

Risk assessments will be undertaken prior to each stage of construction commencing for the possibility of unexploded ordnance being found within construction areas. These will be used to specify safe working requirements, which may include advance magnetometer surveys at piling locations and appropriate training for site operatives. An unexploded ordnance specialist will be available on-call for any works in high-risk areas. An Emergency Response Plan for unexploded ordnance will be prepared by the contractors and will be followed to respond to the discovery of unexploded ordnance. This will include notifications to the relevant local authorities, emergency services, and businesses.

5.12 Consents and Licences

A number of sections of this CEMP reference consents, permits, and licences that will be required during construction. The EIAR contains details of the consents and licences the Applicant currently believes will be required to construct the Proposed Development that will be obtained outside of the application process. A Consents Register will be maintained by the CEM which will document all existing consent conditions, record all new applications made and the status of the applications.

A Register of Legal and Other Requirements will be maintained in the CEMP. This will include information relevant to the Proposed Development. A draft Register of Legal and Other Requirements can be located in Appendix B.

6 Environmental Control Measures

6.1 Introduction

This chapter of the CEMP provides an overview of the environmental control measures that will be implemented during the construction of the Proposed Development to avoid, reduce, or compensate for adverse effects as identified in the EIAR chapters.

Any updated CEMP will provide full details of environmental control measures as identified by the contracted environmental specialists.

The Project Promoters will ensure that all sub-contractors adhere to the environmental good practice guidelines for implementation during work activities.

Table 5.1 provides a summary of the mitigation and monitoring measures, unless otherwise agreed with the NPWS and/or the Foreshore Unit, required to avoid, reduce, and minimise potential impacts which may arise from the Proposed Development during construction, and which have been committed to by the Project Promoters in the EIAR.

Table 5.1 Environmental Control Measures to be incorporated for the Construction Phase

Environmental Topic	Potential Impacts	Monitoring and Mitigation
Population and Human Health	• Impact on beach users due to reduced width of the beach and temporarily reduced parking capacity and access during landfall works. • Impact on participants of water sport and angling due to reduced parking affecting the transport of equipment to the beach, and due to limitations on access in offshore areas during installation.	• Installation activities are planned to take place over short periods, avoiding as far as possible the peak tourist season and to avoid specific events. The approach to design of the construction plan includes flexibility to allow for circumstances such as the combination of a fixed date for an event, a weather window, and restrictions on vessel deployment schedules. • Public information will be provided about the works including signage at and near the site; information at tourist information points; and timely distribution of information to civic authorities and local organisations. There will be identification of and engagement with organisations assessed as likely to be particularly concerned or affected.

Environmental Topic	Potential Impacts	Monitoring and Mitigation
		• Regular physical monitoring of the site and additional monitoring of the construction site as appropriate before, during and after natural events, organised events (such as festivals) or other circumstances in which any aspect of works, barriers or associated safety equipment and procedures may be detrimentally affected.
Air Quality and Climate	• No potential impacts are identified which require monitoring or mitigation.	• N/A
Marine Sediment Quality	• Disturbance of surficial sediments at Claycastle Beach and along the marine cable route during installation causing increased turbidity and sediment plumes. • Potential release / remobilisation of contaminants held within the sediment when the seabed is disturbed during installation. • Installation of cable protection has the potential to impact marine water quality via the release of hazardous substances through loss of	• During the pre-construction engineering and design phase, a detailed analysis of the seabed along the route of the interconnector will be undertaken. From this, the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance and hence minimise effects on marine water quality. • Vessels used for installation will be compliant with the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations. These regulations cover the prevention of pollution from accidents and routine operations. • During installation, measures will be taken to minimise the risk of collision between installation vessels and other vessels, including issue of appropriate notifications via official channels. • All vessels used during installation will have Shipboard Oil Pollution Emergency Plans (SOPEP) in operation.

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	chemicals / fuels from installation vessels.	• Throughout the Proposed Development's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.
Marine Physical Processes	• Disturbance to, and loss of, seabed features during cable installation. • Disturbance to, and loss of, seabed features during installation of cable protection. • Changes to coastal erosion patterns due to installation works at the cable landfall.	• During the pre-construction engineering and design phase, detailed sub-bottom profiling, and accompanying analysis of the seabed along the route of the interconnector will be undertaken. From this, the most appropriate installation techniques will be established to minimise sediment disturbance. • Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance.
Marine Water Quality	• Disturbance of the seabed along the route through release of contaminants held in surficial sediments.	• When the trench is excavated at Claycastle Beach spoil will be stored within the compound on the hard standing to allow the site to be restored to its previous conditions following the installation of the conduits. • Stored spoil shall be adequately covered to prevent exposure to the elements and leaching of sediment. • During the pre-construction engineering and design phase, a detailed analysis of the seabed along the route of the Celtic Interconnector will be undertaken. From this,

Environmental Topic	Potential Impacts	Monitoring and Mitigation
		the most appropriate installation techniques will be established, as determined by seabed type, to minimise sediment disturbance and hence minimise effects on marine water quality. • Where the need for external rock protection is identified, this will be designed according to the receiving environment, based on seabed type, and the need to reduce seabed disturbance. Cable protection will be designed to minimise scour, and hence resuspension of sediments. • Vessels used for any monitoring or maintenance activities during the operation phase of the Proposed Development will be expected to be compliant with MARPOL regulations. These regulations cover the prevention of pollution from accidents and routine operations. • Throughout the Proposed Development's lifespan, periodic monitoring of the cable route will be undertaken; should such monitoring identify significant changes in the bathymetry or seabed features (i.e. sediment type) in the vicinity of the cable route, appropriate measures will be taken, including replacement or addition of further external cable protection, as necessary.
Biodiversity	• Potential for loss of chemicals, fuels, or other pollutants as a result of accidental spills from installation vessels and other	• Project-related vessels to be operated in line with IMO Guidelines for the reduction of underwater noise to address adverse impacts on marine life; • Operations in the Irish marine environment to be undertaken in line with the 'Guidance to manage the risk to marine mammals from

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	associated heavy plant affecting biodiversity. • Underwater noise and disturbance effects on marine mammals in the intertidal zone (seals) and subtidal zone (all groups) during the installation phase particularly as a result of piling causing potential disturbance, hearing loss / injury and/or direct mortality, subsea survey and monitoring equipment (causing potential disturbance, hearing loss/injury, and / or direct mortality) and increased vessel movements (causing seal injury from ducted propellers). • Disturbance to seabirds due to installation works including temporary habitat loss from installation works including due to increases in suspended sediment and pollution events reducing habitat quality or having direct toxic effects.	man-made sound sources in Irish waters', as published by DAHG (2014). This guidance recommends the use of MMOs for pre-start monitoring, ramp up procedure, breaks (>30 mins) in sound output and reporting; • For the Proposed Development, different development activities have been assessed, including piling, geophysical acoustic surveys (not seismic), high frequency (>200kHz) bathymetric surveys, using multibeam and single beam echosounders, cable laying and cable protection. From these, and to be in line with this assessment and guidance (i.e. mitigation required >180dB and a ramp up procedure >170dB), an MMO (dedicated) is only required for piling and the geophysical acoustic surveys (not seismic), and not for cable laying and cable protection. High frequency (>200kHz) bathymetric surveys, using multibeam and single beam echosounders, are above the low-mid hearing frequency ranges of marine mammals, basking shark, marine turtles and fish. Cable laying and cable protection have been assessed as being below level that would require mitigation (<180dB). Also, the sound pressure levels are expected to be in the same range, as those from the installation vessels; • DAHG (2014) guidance outlines operational requirements concerning MMOs. These requirements require MMOs to be familiar with the Irish regulatory procedures, be provided with full details of all licence/consent conditions, be dedicated to and engaged solely in monitoring development activities and conducting

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	• Installation of the cofferdam will result in the loss of any trapped fish and shellfish not displaced by site disruption and noise.	survey effort for marine mammals in accordance with the guidance. The use of a crew member or team member with other responsibilities is not considered to be satisfactory. A sufficient number of MMO personnel must be assigned to ensure that the role is performed effectively and to avoid observer fatigue. General conditions for effective visual monitoring by MMOs are: (1) during daylight hours; (2) in good visibility extending 1km or more beyond the limits of the assigned Monitored Zone (1,000m for piling and 500m for geophysical acoustic surveys, not seismic); and (3) sea conditions WMO Sea State 4 (*Beaufort Force 4*) or less. Efficacy in the visual detection of marine mammal species improves considerably below Sea State 3 (*Beaufort Force 3*); • Unless otherwise agreed with the NPWS and/or the Foreshore Unit, MMOs must be located on an appropriate elevated platform from which the entire Monitored Zone (1,000m for piling and 500m for geophysical acoustic surveys, not seismic) can be effectively covered without any obstruction of view. For geophysical acoustic surveys and other moving platforms from which sound-producing activity is taking place, MMOs must be located on the source vessel; • DAHG (2014) guidance also recommends that, in some cases involving the persistent significant risk of injury to marine mammals in Ireland, the supplementary use of passive acoustic monitoring (PAM) may be recommended, or required, as part of the licence/consent conditions, in order to

Environmental Topic	Potential Impacts	Monitoring and Mitigation
		optimise marine mammal detection around the site of a plan or project. It is also indicated that PAM has/should not be regarded as the primary or sole monitoring approach for risk management purpose. It was identified that for PAM be effective, animals are required to vocalise, and their detection depends on the range capability of the technology. It should also be recognised that this was related to the method/technology that was available back in 2014; • Use of noise-attenuation fencing, solid hoarding or other acoustic barriers to reduce in-air noise propagation and to conceal human activity. The barrier material shall have a mass per unit area exceeding 7kg/m^2 in accordance with the recommendations of BS 5228 Part 1:2009+A1:2014 Part B.4; • Use of piling types and techniques that limit noise propagation: namely vibratory sheet piling installation and piling at low tide; • Use of ramp up/soft start procedures for piling and geo acoustic survey techniques to prevent receptors from being startled e.g. birds, marine mammals, marine turtles and fish (inc. basking shark); • Project-related vessels will adhere to international best practise regarding pollution control, including the MARPOL convention; and • Ensure appropriate burial depths and heat shielding from cable burial and rock placement (where applicable). This will indirectly reduce effects from heat emissions and electro-magnetic fields (EMF).

Environmental Topic	Potential Impacts	Monitoring and Mitigation
		• Seek to avoid noisiest works in January and February as these months typically coincide with peaks in bird numbers as reported on in the wintering and monthly bird surveys undertaken in 2019 and 2020, and as recorded at high and low tide at the landfall point, and elevated sensitivity due to heightened food scarcity and winter climatic conditions. •
Seascape and Landscape	• Changes to landscape / seascape character at the landfall site (up to mean high water mark (MHWM)) during the operational phase. • Changes to visual receptors' views close to the landfall site (up to MHWM) during the operational phase.	• Following completion of the installation works across Claycastle Beach to MHWM, the installation corridor (incorporating the cofferdam and raised causeway) would be reinstated using native materials previously excavated from the beach to original beach levels and gradients.
Archaeology and Cultural Heritage	• Near-shore peat deposits would be directly disturbed by the installation of the cable trench through the intertidal zone. • Disturbance and removal of remains of geoarchaeological interest and through the disruption of a single stratigraphic sequence.	• Implementation of an agreed scheme of archaeological work aimed at identifying and recording deposits of archaeological interest, retrieving, and analysing archaeological material would allow for these deposits to be adequately understood. • An agreed programme of further archaeological investigation and recordings combined with analysis of archaeological material already recovered and appropriate publication / dissemination of the results. • Archaeological exclusion zones will be established round the sites of known and

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	• Offshore deposits of geoarchaeological interest would be directly disturbed during the insertion of the marine cable where the cable is installed by jetting or ploughing. • Disturbance of archaeologically significant deposits.	potential wrecks along the cable route. These exclusion zones would be 100m from the recorded location of a wreck or location of any high potential sites, and 50m from the location of any medium potential sites.
Material Assets	• Risk of damage to existing subsea cables at cable crossings intersected by the Proposed Development. • Proposed Development intersecting with concept or early planning area for an offshore windfarm.	• Consultation with existing cable operators, use of crossing-specific cable protection specifications, and approval of Cable Crossing Agreements prior to works. • Consultation with windfarm developers to determine the likelihood of the offshore windfarm proceeding in this location, the level of risk associated with the cable location and the cable installation methods including cable protection.
Noise and Vibration	• Noise and noise from vessel movement during installation.	• Vessels used by the Proposed Development will be operated and maintained in line with IMO Guidelines for the reduction of underwater noise from commercial shipping.
Shipping and Navigation	• Temporary presence of work vessels with limited ability to manoeuvre during the construction phase and potentially an	• Compliance by both work and passing vessels with the COLREGS for vessel safety during installation. This will be encouraged and facilitated by keeping all sea users fully informed of plans and progress regarding the cable installation and procedures in

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	associated temporary exclusion zone. • Presence of rock armour above the previous seabed level, resulting in localised reduction in water depth available for navigation. • Presence of cables within anchor burial depth of the seabed, imposing restrictions on where vessels may anchor. • Installation of the cable landfall at Claycastle Beach will involve construction of a temporary cofferdam and causeway down the beach causing a temporary restriction on use of part of the beach which may affect users of beach-launched craft, such as personal watercraft, kite surf boards, or other water sports.	place to ensure their safety when navigating in the vicinity. • Supply of information to appropriate authorities to enable marine charts and sailing directions to be updated to show the cable route.
Commercial Fisheries	• Displacement of fishing activity by cable installation activities. Structures on the seabed represent	• A Fisheries Liaison Officer (FLO) will be maintained throughout the Proposed Development, to facilitate ongoing communication with fisheries representatives and organisations

Environmental Topic	Potential Impacts	Monitoring and Mitigation
	potential snagging points for fishing gear and could lead to damage to, or loss of, fishing gear. • Seabed obstructions from cables on the seabed and from cable protection.	throughout construction and installation in accordance with good practice. • Application for and use of 500m (radius) mobile safety zones around all maintenance operations. • Advanced warning and accurate location details of construction operation and associated mobile safety zones. Safety zones to be brought to the attention of mariners with as much advance warning as possible via frequent notification and other means e.g. the Kingfisher Bulletin, VHF radio broadcasts. and through direct communications via the FLO. • Bathymetric survey to be undertaken following completion of installation or repair works to ensure that the cables have been buried or protected and sediment is able to move over any installed cable protection.
Major Accidents and Disasters	• Vessel collision with potential for loss of property, injury, or loss of life. • Accidental leak or spill of fuel or lubricants during use of plant and machinery. • Accident involving plant or machinery and Hazardous offshore working conditions.	• Impacts managed through installation planning, adherence to navigational best practice, issue of Notice to Mariners, and use navigational markers. • Construction and site management good practice including preparation of a CEMP, and adherence to the International Convention for the Prevention of Pollution from Ships (MARPOL). These will limit the likelihood and size of leaks or spills and provide measures to contain accidental releases such that they cannot discharge into the environment.

Environmental Topic	Potential Impacts	Monitoring and Mitigation
		• Offshore works will not typically be undertaken in storm conditions above sea state 3. • Safety measures onboard vessels and the adequate training of crew will minimize risk to personnel.

Appendix A.

CEMP Review Table

Proposed Review Period	Due Date of Review	Actual Date of Review	Sections Amended	CEMP Issue Number	Reviewed by		
					Project Manager / Supervisor	Contractor's Project Director	Contractor's Environmental Manager

Appendix B.

Draft Register of Consents and Legal Responsibilities

Environmental Topic	Consent Licence / Permit Type	Description	Consent Granting Body	Responsibility	Date Required	Programme Risk	Additional Comments

Appendix C.

Emergency Contact Details Template

Name	Company	Person	Contact Number(s)	Contact Address
Project Hotline				
Employer				
Contractor				
Contractor's Project Manager / Supervisor				
Environmental Manager				
Environmental Co-ordinator				
Waste Management Contractor				
Fire Service				
Environmental Protection Agency				

Celtic Interconnector

Volume 3D2 – Appendix 11A

UXO Assessment

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Table of Contents

1 Introduction

1.1 Objective

The purpose of this report is to present an assessment of the potential effects that may arise as a result of the *in situ* detonation of an unexploded ordnance (UXO) target within the immediate route of the marine route of the Celtic Interconnector. This assessment is desk-based in nature, drawing on a number of key resources, including:

- EirGrid and RTE (2021) Celtic Interconnector Environmental Impact Assessment. Volume 3D – Ireland Offshore (primarily Chapter 13: Biodiversity and Chapter 17: Noise and Vibration);
- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (Department of Arts, Heritage and the Gaeltacht, 2014); and
- Greenlink Marine Environmental Impact Assessment Report – Ireland. Appendix C: Underwater Sound Modelling Greenlink (2019).

Additional references are included within footnotes throughout report, as required.

1.2 Risk of encountering UXO within Irish waters

As presented in Chapter 6 of Volume 3D Part 1 of the EIAR, it is anticipated that UXO clearance and/or detonation will not be necessary within Irish Territorial Waters or the Irish Exclusive Economic Zone (EEZ). Magnetometer surveys completed in 2015 and 2018 have not identified a high potential for UXO targets along the cable route within either Irish Territorial Waters or the Irish EEZ; however, this will be confirmed during pre-installation confirmatory surveys along the cable route.

In the unlikely event that UXO targets are found, they will be either avoided (the preferred approach for any targets identified), removed and detonated or detonated *in situ* under appropriate licencing, held by the Engineering, Procurement and Construction (EPC) contractor. A full UXO survey campaign will be performed prior to cable installation.

This assessment has been prepared to inform licencing conditions for the Celtic Interconnector, enabling detonation of a single UXO target, if identified along the cable route.

1.3 Approach to assessment

For the purposes of this assessment, an assumption has been made regarding the possible scale of the UXO target considered. The UXO targets that have potential to occur in Irish waters include a range of sizes and types, with sea mines typically containing the largest volumes of explosives. The Greenlink EIAR (Greenlink, 2019) was informed by a desk-based assessment that reported on the UXO size classes that have potential to occur. It concluded that British sea mines were a worst-case and based its assumptions on the presence of an “M Mark III” mine, containing 794kg of explosive material. To allow for greater conservatism and flexibility within the Celtic Interconnector Project, should a UXO target be identified, the assessment presented here has been based on a target containing up to 1,000kg of explosive material. It has also been assumed that the target will be detonated *in situ*, rather than being transported elsewhere for disarmament or detonation.

Additional information on the methodology applied to determine the potential zones of influence (ZOI) for such a detonation is provided in **Section 1.4**.

1.4 Underwater noise

1.4.1 Prediction of underwater sound source levels due to UXO detonation

Detonation of explosives at the seabed generates high levels of sound at the location of the explosives. The prediction of source sound levels due to the detonation carries a high level of uncertainty. This is due to the fact that the source sound levels are a function of a number of parameters (e.g. charge weight of the explosives, the condition and specification of the explosives, or the amount of sediment covering the explosives). Given that the majority of these parameters are unknown at the impact assessment stage, a worst-case scenario will be considered, where the explosives are assumed to be at the surface of the seabed, and in full working order. As such, the estimation of the sound level generated at the source of the UXO will be defined within this assessment only by its charge weight.

The method used in this assessment to predict the source sound levels due to the detonation of UXO follows the methodology presented by Arons (1954)[1], recently revalidated by Soloway and Dahl (2014)[2]. According to this methodology, the peak pressure due to the initial positive-going shock wave (P_{peak} in Pascals) due to a charge weight W (in kg of TNT equivalent) at a distance R (in meters) from the source is given as:

$$P_{peak} = K_p \left(\frac{R}{W^{1/3}}\right)^a$$

where $K_p = 52.4 \times 10^6$ is the shock coefficient, and $a = -1.13$ is the pressure coefficient. The equivalent sound pressure level is given as:

$$SPL_{peak} = 20 \log(P_{peak}/P_0)$$

The predicted sound pressure levels from the detonation of typical UXO are presented in **Table 1-1**. In this table, the charge weights are also compared to those used in the Greenlink Interconnector (GI) assessment[3], where a different formula was used. From **Table 1-1**, it can be seen that the approach in this assessment is more conservative, predicting a sound level of 3dB above that used in the GI assessment.

[1] Arons, A. B. (1954). Underwater explosion shock wave parameters at large distances from the charge. The Journal of the Acoustical Society of America, 26(3), 1948–1951.

[2] Soloway, A. G., & Dahl, P. H. (2014). Peak sound pressure and sound exposure level from underwater explosions in shallow water. The Journal of the Acoustical Society of America, 136(3).

Table 1-1 Typical UXO charge weights and predicted sound pressure levels

Charge weight, W (kg)	SPL dB re 1μPa @ 1m	SPL dB re 1μPa @ 1m [GI[3]]
55	287	284
120	290	287
250	292	289
500	295	291
770	296	293
794*	296	293
1,000	297	294

***Value proposed in the Greenlink Interconnector EIA[3].

In this assessment, a charge weight of up to 1,000kg will be assumed, as previously described, leading to a predicted sound pressure level of 297 dB (re 1μPa).

1.4.2 Prediction of propagation of underwater sound

As sound propagates through the water, it tends to attenuate with distance. Most often, this is accounted for in calculations in terms of spherical spreading (inverse relationship of sound pressure with range) for continuous noise sources. However, as described by Cheong et al (2020)[4], the reduction of the peak sound pressure with range is not equivalent to spherical spreading because of the non-linear nature of the wave.

It is also common in the literature to account for other propagation characteristics, such as frequency-dependent loss coefficients that take into account the increased attenuation of sound at different frequencies. Other factors that tend to affect the attenuation of underwater sound with distance are the variable bathymetry, the seabed type, the salinity of the water etc.

In this assessment, the model used to predict the ranges of impact will be similar to that used by Mason and Braham (2018)[5], which is based on the principles of Soloway and Dahl (2015) as presented above. Mason and Braham (2018) also accounted for an attenuation correction to the absorption over long ranges (R>1km). Due to the lack of equivalent data in the vicinity of the Celtic Interconnector cable route, this is discounted in the present assessment, leading to a conservative approximation of the impact ranges.

[3] Greenlink Interconnector. (2019). Marine environmental impact assessment report - Ireland.

[4] Cheong, S.-H., Wang, L., Lepper, P., & Robinson, S. (2020). Characterisation of acoustic fields generated by UXO removal - Phase 2. In NPL REPORT AC 19.

[5] Mason, T., & Barham, R. (2018). Estimated ranges of impact for various UXO detonations, Norfolk Vanguard.

2 Key environmental receptors and sensitivity to underwater noise

2.1 Marine mammals

Marine mammals (cetaceans and pinnipeds) are dependent on sound for almost every aspect of their lives, including prey-location, communication, detection of potential hazards, navigation and general communication (Weilgart, 2007[6]). As a result, they can be sensitive to anthropogenic changes in underwater sound pressure or noise levels. Effects of changes to underwater noise levels can vary between species, but can include behavioural changes (such as altered swimming patterns, foraging behaviour, or avoidance of an area) and physiological changes (including changes in respiration rates, hearing damage, and stranding, potentially leading to mortality).

As with the following subsections, effects can be considered in terms of permanent threshold shift (PTS) and temporary threshold shift (TTS), referring to changes in the auditory range of the species being considered. These changes can ultimately, with PTS, result in permanent hearing loss or death as a worst-case.

For the purposes of this assessment, cetaceans have been divided into three categories: low-frequency, mid-frequency, and high-frequency, based on the thresholds for the onset of PTS and TTS, and their levels of functional hearing (Southall et al 2019[7]). Examples of species within each group include[3]:

- Low-frequency cetaceans: Minke whale (*Balaenoptera acutorostrata*); humpback whale (*Megaptera novaeangliae*); fin whale (*B. physalus*). Hearing range of 7-35kHz.
- Mid-frequency cetaceans: Short-beaked common dolphin (*Delphinus delphis*); bottlenose dolphin (*Tursiops truncatus*); Risso's dolphin (*Grampus griseus*); Atlantic white-sided dolphin (*Lagenorhynchus acutus*); white-beaked dolphin (*L. albirostris*); killer whale (*Orca orca*); long-finned pilot whale (*Globicephala melas*). Hearing range of 150-160kHz.
- High-frequency cetaceans: Harbour porpoise. Hearing range of 275Hz to 160kHz.

The hearing capacity of European otter (*Lutra lutra*) and pinnipeds (seals, including grey seal [*Halichoerus grypus*) and common seal [*Phoca vitulina]*) have also been considered within this assessment, focusing on their hearing abilities within water, with hearing ranges of 60Hz to 39kHz and 50Hz to 86kHz, respectively. However, it is noted that otters are mainly coastal in distribution, and unlikely to be found along the main cable route of the

[6] Weilgart, L. (2007) A brief review of known effects of noise on marine mammals. International Journal of Comparative Psychology, Vol. 20, 2.

[7] Southall, E. B. L., Finneran, J. J., Reichmuth, C., Nachtigall, P. E., Ketten, D. R., Bowles, A. E., Ellison, W. T.

Nowacek, D. P., Tyack, P. L. (2019). Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2).

Celtic Interconnector. Therefore, on this basis, they have been scoped out of the remainder of this assessment.

Within this assessment, and based on previous, comparable studies, the threshold for behavioural disturbance for marine mammals is determined to be 160 dB rms (SEL for impulsive sound), and 120 dB rms (SEL, for continuous sound)[3].

2.2 Sea turtles

Although sea turtles' use of underwater noise is not as understood as for some other species groups, they are known to be able to detect and respond to noise, and may use this for navigation, foraging and general communication in the same way as marine mammals do.

Popper et al. (2014)[8] sought to establish sound exposure guidelines for sea turtle species, defined by the way they detect sound. Due to the limited information available, data has been extrapolated from other, similar species, as appropriate, concluding that sea turtles are more aligned with fish than mammals, in terms of the functioning of their ears, and thus hearing ability.

For key species, the following hearing ranges have been established[3]:

- Green turtle (*Chelonia mydas*): 50-1,600Hz.
- Loggerhead turtle (*Caretta caretta*): 50-800Hz.

2.3 Fish

As with sea turtles above, the key resource for understanding hearing in fish species is Popper et al. (2014)[8]. Due to the variability in fish behaviour, ecology and physiology, there is also wide variation in species' ability to detect and use sounds, and the potential effects which may arise due to anthropogenic changes in underwater noise levels.

The key driver in fish species' relationship with underwater noise, and their hearing capability, is the presence or absence of a swimbladder, and where it is present, its physiological connection with the rest of the body. An underwater explosion, as predicted from the detonation of a UXO target produces a pressure wave, which may result in rapid volume changes of gas within organs, including the swimbladder in fish, and other body cavities. This is the focus of potential impacts on fish, with limited information available on how such pressure waves affect hearing or behaviour. For consideration of potential impacts, the hearing range considered for fish is 100-400Hz.

For an *in situ* UXO detonation, it is likely that any fish in the immediate vicinity of the explosion will be injured or killed due to these pressure changes.

[8] Popper, A.N. et al. (2014) Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

2.4 Crustaceans

There is limited information on how crustacean species respond to increases in anthropogenically-generated underwater noise; they do not have an internal air-filled chamber, therefore are unlikely to be affected in the same way as fish species. Further, studies with airguns were not conclusive in terms of behavioural responses, although reduced mobility and burrowing may be an effect.

It is noted that there is no threshold for the assessment of sound exposure for crustaceans (Tidau and Briffa 2016)[9], therefore a detailed assessment of potential effects, in terms of a ZOI, is not possible, and they have been scoped out of the remainder of this assessment.

2.5 Zooplankton

As with crustaceans, there is limited evidence as to the effects on zooplankton of underwater noise, although some experimentation has been undertaken in relation to airgun noise, which showed increased mortality within a range of up to 1.2km from the noise source[3].

It is noted that there is no threshold for the assessment of sound exposure for zooplankton (Solan et al. 2016[10], McCauley et al. 2017[11]), therefore a detailed assessment of potential effects, in terms of a ZOI, is not possible, and they have been scoped out of the remainder of this assessment.

2.6 Summary of TTS and PTS onset criteria

Table 2-1 presents a summary of the injury thresholds for each of the species groups being considered within this assessment, as calculated for the *in situ* detonation of a UXO target containing up to 1,000kg of explosives.

Table 2-1 Summary of injury thresholds for identified environmental receptors from impulsive (SPL, unweighted) sound[3]

Species	Temporary injury (TTS) Threshold (dB)	Permanent injury (PTS) Threshold (dB)
Low-frequency cetaceans	213	219
Mid-frequency cetaceans	224	230
High-frequency cetaceans	196	202
Seals in water (PCW)	212	218

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[9] Tidau, S., & Briffa, M. (2016). Review on behavioral impacts of aquatic noise on crustaceans. Proceedings of Meetings on Acoustics, 27(1). https://doi.org/10.1121/2.0000302

[10] Solan, M., Hauton, C., Godbold, J. A., Wood, C. L., Leighton, T. G., & White, P. (2016). Anthropogenic sources of underwater sound can modify how sediment-dwelling invertebrates mediate ecosystem properties. Scientific Reports, 6.

[11] McCauley, R. D., Day, R. D., Swadling, K. M., Fitzgibbon, Q. P., Watson, R. A., & Semmens, J. M. (2017). Widely used marine seismic survey air gun operations negatively impact zooplankton. Nature Ecology & Evolution, 1(7).

Species	Temporary injury (TTS) Threshold (dB)	Permanent injury (PTS) Threshold (dB)
Otters in water (OCW)	226	232
All fish species	229	-
Sea turtles	234	-

3 Impact assessment

As described above, targeted magnetometer surveys along the route of the Celtic Interconnector in 2015 and 2018 identified no potential UXO targets, and a low potential for such targets to be identified during the planned pre-installation UXO survey campaign. This will be confirmed prior to installation of the subsea cable.

However, for the purposes of this assessment, a worst-case scenario of the identification of a UXO target with a maximum charge weight of 1,000kg has been assumed, to identify potential zones of influence that may arise from an *in situ* detonation. These ZOI are presented in **Table 3.1**.

Table 3.1 Zones of influence used in impact assessment for impulsive sound arising from in situ detonation of a UXO target of 1,000kg explosive charge

Species	Temporary injury (TTS) (km)	Permanent injury (PTS) (km)
Low-frequency cetaceans	5.2	2.8
Mid-frequency cetaceans	1.7	0.9
High-frequency cetaceans	29.4	16.0
Seals in water	5.8	3.1
Sea turtles	0.6	-
All fish species	1.0	-
Zooplankton	-	-
Crustaceans	-	-

3.1 Marine mammals

From **Table 3.1**, it can be seen that the greatest potential impact arising from the modelled detonation is on cetaceans classified as 'high-frequency' based on their hearing capacity. As outlined above, this group primarily contains harbour porpoise, one of the most frequently-recorded cetacean species in Irish waters. For harbour porpoise, there is the potential for TTS within 29.4km of the detonation, and PTS within 16km.

It is noted that the use of a hypothetical UXO target containing 1,000kg is highly conservative, and such targets are unlikely to be encountered along the route of the Celtic Interconnector. However, there is still the potential for permanent injury or mortality to occur in the unlikely event that an UXO is identified and requires detonation. It is proposed that any detonation, regardless of scale, will be undertaken in compliance with the marine mammal mitigation outlined in the *Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters* (Department of Arts, Heritage and the Gaeltacht, 2014). This would include the deployment of Marine Mammal Observers (MMO) and the use of Passive Acoustic Monitoring (PAM), as required, and agreed in conjunction with the regulators and their key advisors. This will allow the clearance of an appropriate area (to be agreed with the Foreshore Unit prior to works taking place) before the detonation is undertaken, following an agreed method statement, as established by a suitably-qualified and experience contractor.

The employment of MMO / PAM will reduce the potential for PTS / TTS to affect marine mammals within all frequency groups. MMOs may also provide mitigation for seal and sea turtle species, if they are present at the surface whilst the pre-detonation watches are underway. On this basis, effects are considered to be low.

3.2 Sea turtles

Sea turtles have been identified as being at risk of TTS within 0.6km of an in-situ detonation of an UXO target of 1,000kg explosive charge. While sea turtles do occur in the Atlantic Ocean, their distribution in Irish Territorial Waters and the Irish EEZ is understood to be sparse (see Volume 3D Part 2, Chapter 3: Biodiversity for further detail). Sea turtles are not characteristically inquisitive and do not tend to be attracted to vessel activity. They will tend to dive away from perceived threats and are therefore the likelihood of sea turtles being present in the vicinity of any vessels involved in the UXO survey campaign is low. The MMO operating on-board the UXO survey campaign vessels to mitigate potential impacts to marine mammals would keep a watching brief for sea turtles but it is accepted that sea turtles are difficult to identify at the sea surface due to their relatively small size and that they typically remain partially submerged. It is not possible to identify sea turtles beneath the surface using PAM. Therefore, there remains a low risk of injury to sea turtle species as a result of UXO detonation.

3.3 Fish

The TTS injury threshold for all fish species has been identified as 1km from of an in-situ detonation of a worst-case 1,000kg UXO target. Use of standard mitigation measures, including the presence of MMO / PAM operators, is not effective for fish. Therefore, the risk of TTS is likely to occur over an area of approximately 0.79km^2. Although this has the potential to cause harm to fish within the zone of influence, this is a small area in comparison to the area over which fish populations will be spread, and it is considered that there is a low risk of injury to fish species as a result of UXO detonation.

4 Conclusions

Although initial magnetometer surveys along the route of the Celtic Interconnector have identified a low risk of encountering UXO targets along the cable route, this assessment has been undertaken to assess the potential effects which may arise should there be the need for such a detonation.

This assessment determined a zone of influence which may arise as a result of the *in situ* detonation of a UXO target containing up to 1,000kg of explosives.

This assessment has concluded that there is the potential for effects to arise for marine mammals, sea turtles and fish in the vicinity of the detonation activity, including the potential for both PTS and TTS affects. However, with standard mitigation measures in place, including the use of MMO and PAM, combined with the low risk of encountering UXO targets along the cable route, the likely effects will be low.

Celtic Interconnector

Volume 3D2 – Appendix 15A
Marine archaeology and cultural heritage technical report

June 2021

Co-financed by the European Union
Connecting Europe Facility

Tionscadal Éireann
Project Ireland
2040

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Cotswold Archaeology *marine*

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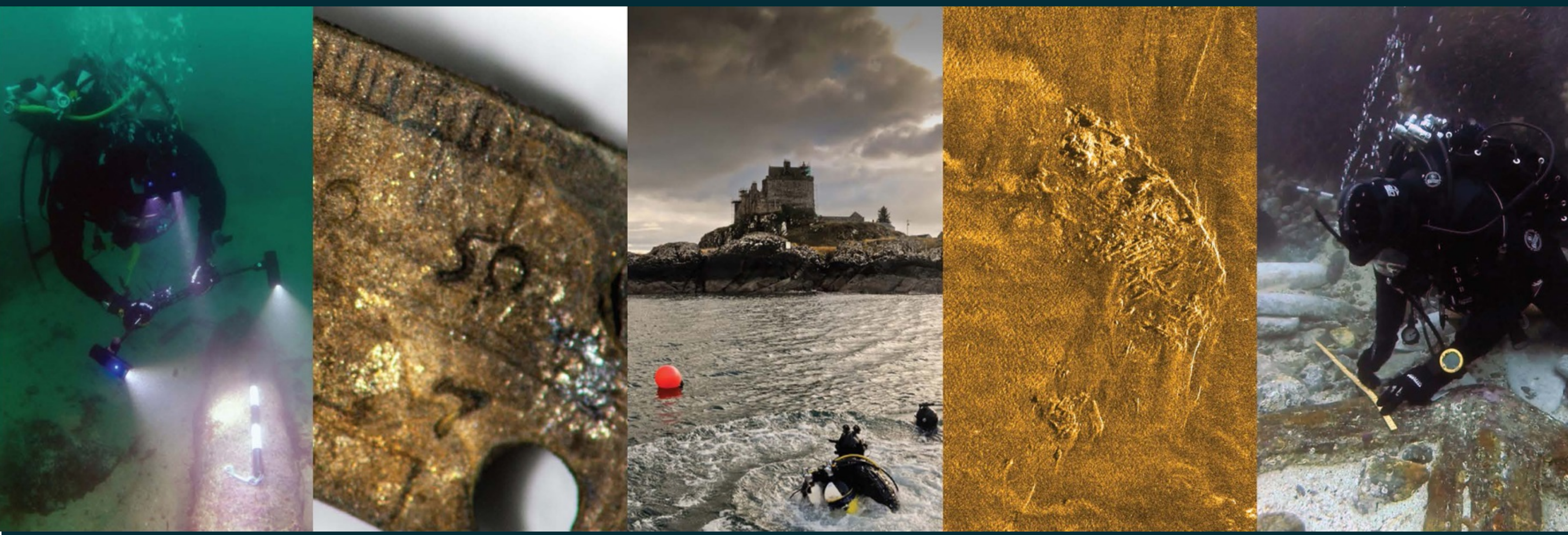
Celtic Interconnector Project

Marine archaeology and cultural heritage technical report



for

EirGrid plc

CA Project: 770617

CA Report: 770617_01

July 2019

Celtic Interconnector Project

Marine archaeology and cultural heritage technical report

CA project: 770617

CA report: 770617_01

prepared by	[redacted] Senior Marine Consultant [redacted] Marine Archaeologist
date	May 2019
checked by	[redacted] Senior Marine Consultant
date	July 2019
approved by	[redacted] Senior Marine Consultant
signed	*Not usually signed unless requested by client*
date	July 2019
issue	1.0

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SUMMARY

Project name: Celtic Interconnector project

Cotswold Archaeology (CA) was commissioned by EirGrid plc in 2017 to provide marine archaeological support for the Celtic Interconnector project. The proposed project involves the installation of a submarine cable between Ireland and France. This report summarises all the previous archaeological assessments relating to the current proposed routes in Irish, English and French waters including those produced by Headland Archaeology (2014; 2015) and by Wessex Archaeology (2016).

These include archaeological desk-based assessments (DBAs) (Cotswold Archaeology 2017; Headland Archaeology 2014) foreshore and inter-tidal archaeological surveys, including walkover, metal detector and geophysical surveys (Cotswold Archaeology 2018a; Headland Archaeology 2015), archaeological assessments of marine geophysical survey data (Headland Archaeology 2015; Cotswold Archaeology 2018a), an underwater archaeology impact assessment (Cotswold Archaeology 2018b), a watching brief during foreshore geotechnical investigations (IAC Archaeology 2018), archaeological assessments of geotechnical data collected along the proposed route corridors (Cotswold Archaeology 2019a; Wessex Archaeology 2016); a hand auger survey at Claycastle beach to investigate exposed peats in the inter-tidal zone, and a geoarchaeological assessment of the results (Cotswold Archaeology 2019b;). These reports include assessments of archaeological potential in proximity to the cable study corridor (CSC).

An initial route, with two potential landfall locations in Ireland, at Ballycroneen beach and Ballinwilling Strand, was assessed by Headland Archaeology (2014; 2015). The route in Irish territorial waters (12 nautical miles (nm)) was subsequently revised and included two new potential landfall locations, at Claycastle and Redbarn beaches, in addition to Ballinwilling Strand. The route in the Irish exclusive economic zone (EEZ) beyond the 12nm limit has not changed substantially. Cotswold Archaeology was commissioned in 2017 to undertake archaeological assessments along these revised routes and at the two new landfall locations (Redbarn beach and Claycastle beach) as well as a reassessment of Ballinwilling Strand.

This technical report incorporates relevant information from all the archaeological assessments that have been completed to date. This report therefore summarises our current knowledge of the archaeology and the archaeological potential along the

route and at the preferred landfall locations of the Celtic Interconnector project. Wherever possible, data from redundant route and landfall options has been removed.

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LIST OF ILLUSTRATIONS

1. INTRODUCTION

Outline

1.1. Cotswold Archaeology (CA) was commissioned by EirGrid plc in 2017 to provide marine archaeological support for the Celtic Interconnector project. The proposed project involves the installation of a submarine cable between Ireland and France. This technical report collates all previous archaeological reports for the project into one overarching assessment. This report comprises the results of the desk-based assessments (Cotswold Archaeology 2017; Headland Archaeology 2014), and the archaeological assessment of marine and foreshore surveys (Cotswold Archaeology 2018a; 2019a; 2019b; Headland Archaeology 2014; 2015; Wessex Archaeology 2016; IAC Archaeology 2018). Where possible, any information relating to routes that are no longer under consideration has been removed.

Proposed development

1.2. The project aims to install a 700+ MW HVDC interconnector, which will include two HVDC converter stations, subsea cabling, and onshore lines/cables as appropriate. The cable route, including revisions, runs for c. 600km between Ireland and France passing to the west of the Isles of Scilly, just beyond UK territorial limits. Three landfall options are currently under consideration in Co. Cork (Ballinwilling Strand, Claycastle beach and Redbarn beach) and two options on the coast of Brittany (Pontusval and Moguériec) (Fig. 1, Fig. 2 and Fig. 3).

1.3. Initially the route included two options within Irish territorial waters (12 nautical miles (nm)), with proposed landfalls at Ballycroneen beach or at Ballinwilling Strand. These route options and landfall locations were assessed by Headland Archaeology (2014; 2015). Subsequent route revisions in Irish territorial waters have included two new potential landfall locations, at Redbarn and Claycastle beaches, as well as one previously considered location (Ballinwilling Strand), and two revised routes and a spur in Irish territorial waters; These revised routes/landfalls were assessed by Cotswold Archaeology (2017; 2018a; 2018b). The route beyond Irish territorial waters has not altered substantively since the initial assessments.

Project background

1.4. In 2013, two national electricity transmission system operators, EirGrid plc in Ireland and Réseau de Transport d'Electricité (RTE) in France, signed a Memorandum of Understanding. The agreement was to commission further preliminary studies on the feasibility of installing a submarine electricity interconnector between the south coast of Ireland and the north-west coast of France, a distance of some 600km. EirGrid and RTE then conducted studies which indicated that an interconnector between Ireland and France could be beneficial for electricity customers in both countries.

1.5. EirGrid holds licences as independent electricity Transmission System Operator (TSO) and Market Operator (MO) in the wholesale trading system in Ireland and is the owner of the System Operator Northern Ireland (SONI Ltd), the licensed TSO and MO in Northern Ireland. The EirGrid Group includes EirGrid plc, SEMO JV, EirGrid Interconnector Ltd, and EirGrid Telecoms Ltd.

1.6. RTE, an independent subsidiary of EDF, is a public service company responsible for operating, maintaining and developing the high and extra high voltage network in France. It guarantees the reliability and proper operation of the power network.

1.7. In 2013, EirGrid and RTE undertook the exploratory phase of this interconnector project with initial studies focused on desk-based analysis of the seabed to identify potential route corridors. Between 2014 and 2015 EirGrid completed a feasibility study of the potential marine routes between Ireland and France, including geophysical and geotechnical / environmental marine surveys along the corridor between East Cork in Ireland and Brittany in France as well as investigations at two potential landfall sites in Ireland.

Archaeological assessments

1.8. Archaeological assessments of the entire route were undertaken by Headland Archaeology (2014; 2015) including a DBA, and assessment of marine geophysical survey data for the entire route and the two landfall locations in Ireland. A geoarchaeological assessment of vibrocore logs was also conducted (Wessex Archaeology 2016). These assessments include sectors of the route that are no longer under consideration so, wherever possible, the information from these redundant routes has been removed from this report.

Current assessments

1.9. CA was commissioned by EirGrid plc in 2017 to undertake further archaeological assessments on the new / revised routes. These included a DBA, assessment of marine geophysical survey data, non-intrusive foreshore surveys including walkover, hand-held metal detector, and geophysical (electrical conductivity) surveys at two new locations (Claycastle & Redbarn), and a walkover survey at Ballinwilling Strand that had been assessed previously (Headland Archaeology 2015). The aim was to assess and to map the extent of archaeological remains at these three potential landfall locations.

1.10. The archaeological assessment of marine geophysical data for the revised routes in Irish territorial waters was undertaken for Cotswold by Coastal and Offshore Archaeological Research Services (COARS), University of Southampton in 2018. The aim was to identify, locate and characterise features with possible archaeological potential, and to assess the sub-bottom profiler (SBP) data in order to establish the archaeological and palaeo-environmental potential of the sub-surface sediments that may be encountered (Cotswold Archaeology 2018a).

1.11. In advance of geotechnical site investigations, which used intrusive techniques such as vibrocores, boreholes and test pits, an underwater archaeology impact assessment was undertaken at the landfall locations. This mapped features of archaeological potential at each of the landfall locations, including the exposed peat deposits at Claycastle beach, highlighting their palaeo-environmental potential. It then suggested mitigation in the form of archaeological exclusion zones to avoid any impact to these sites (Cotswold Archaeology 2018b). The impact assessment has not been included in this report as the details contained therein are addressed in other assessments.

In addition to the original site investigations along the original proposed cable route (Wessex Archaeology 2016), further site investigations were undertaken in 2018 along the revised routes in Irish territorial waters. These comprised test pits and boreholes on the landfall and nearshore locations, and vibrocores in deeper water (Cotswold Archaeology 2019a). A watching brief (or 'archaeological monitoring') was conducted during the site investigations on the foreshore and in the intertidal zone (IAC Archaeology 2018).

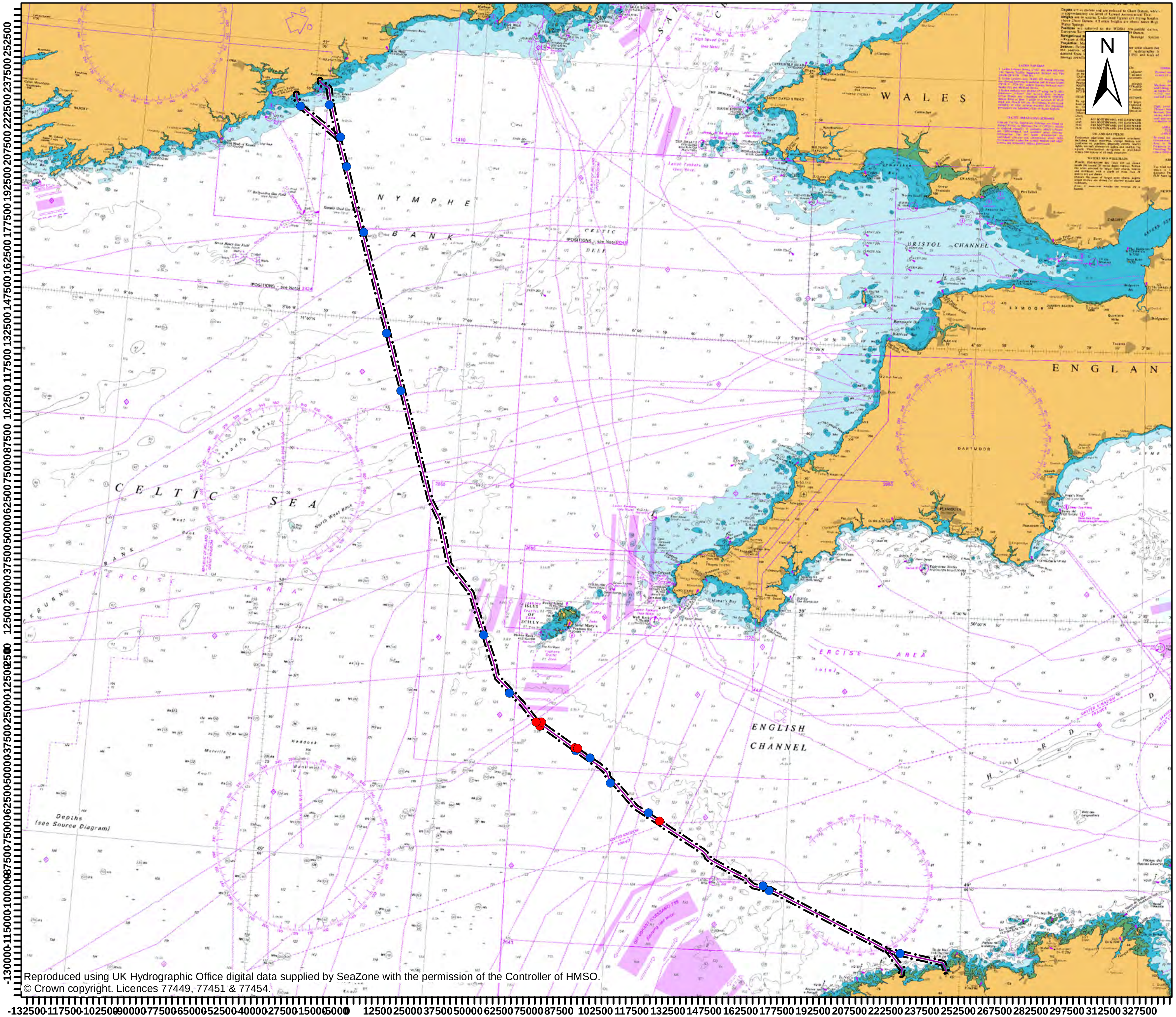
1.12. The peat deposits found exposed in the inter-tidal zone at Claycastle beach were further investigated using a hand auger and hand-dug test pits. A geoarchaeological assessment was then undertaken of the results of these investigations. This assessment was undertaken to understand the nature and extent of the buried peat deposits, to recover any material which might be of archaeological significance, and to enhance our understanding of the nature of the deposit (Cotswold Archaeology 2019).

Aims and objectives

1.13. The aim of this technical report is to present our current understanding of the marine archaeology and cultural heritage in the vicinity of the proposed development.

1.14. The objectives of this report are:

- To synthesise all the project-specific archaeological assessments that have been completed to date; and
- To include only information relevant to the current proposed development. All other information relating to routes that are no longer under consideration has been removed.



HEADLAND ARCHAEOLOGY

Key

- Obstruction
- Wreck
- Marine Survey Route
- Inner Search Area

Kilometers

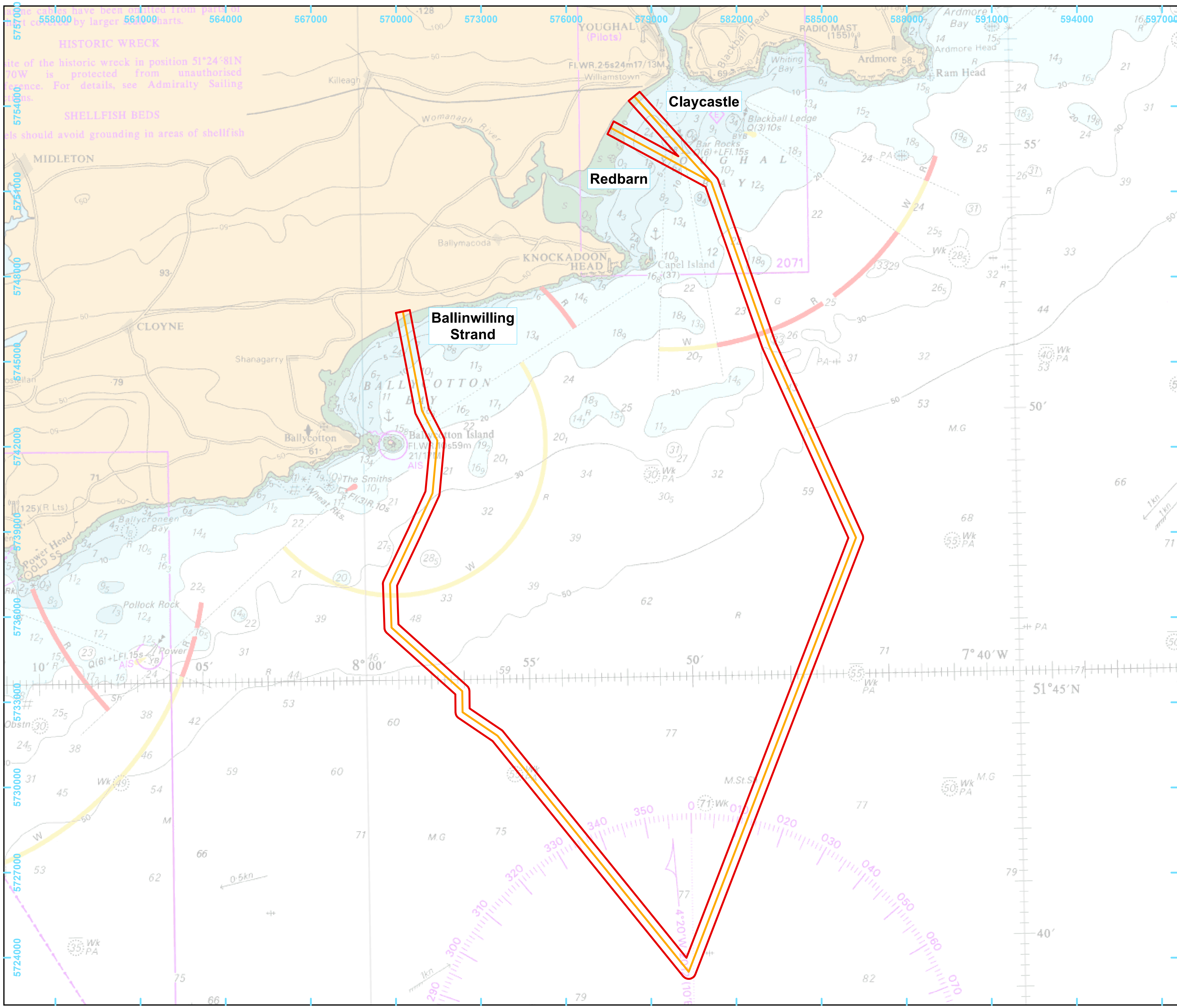
0 50

1:1,550,000

Ireland-France Celtic Interconnector [EIFI13]

DRAFT

Figure 1: Overview of the cable study corridors (CSCs) for the entire route of the Celtic Interconnector



Legend

N

500m wide CSC

Cable Route

0 5km

Coordinate System: WGS 1984 UTM Zone 29N
Projection: Transverse Mercator
Datum: WGS 1984
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -9.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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PROJECT TITLE
Celtic Interconnector

FIGURE TITLE
Close up of the CSC in Irish territorial waters

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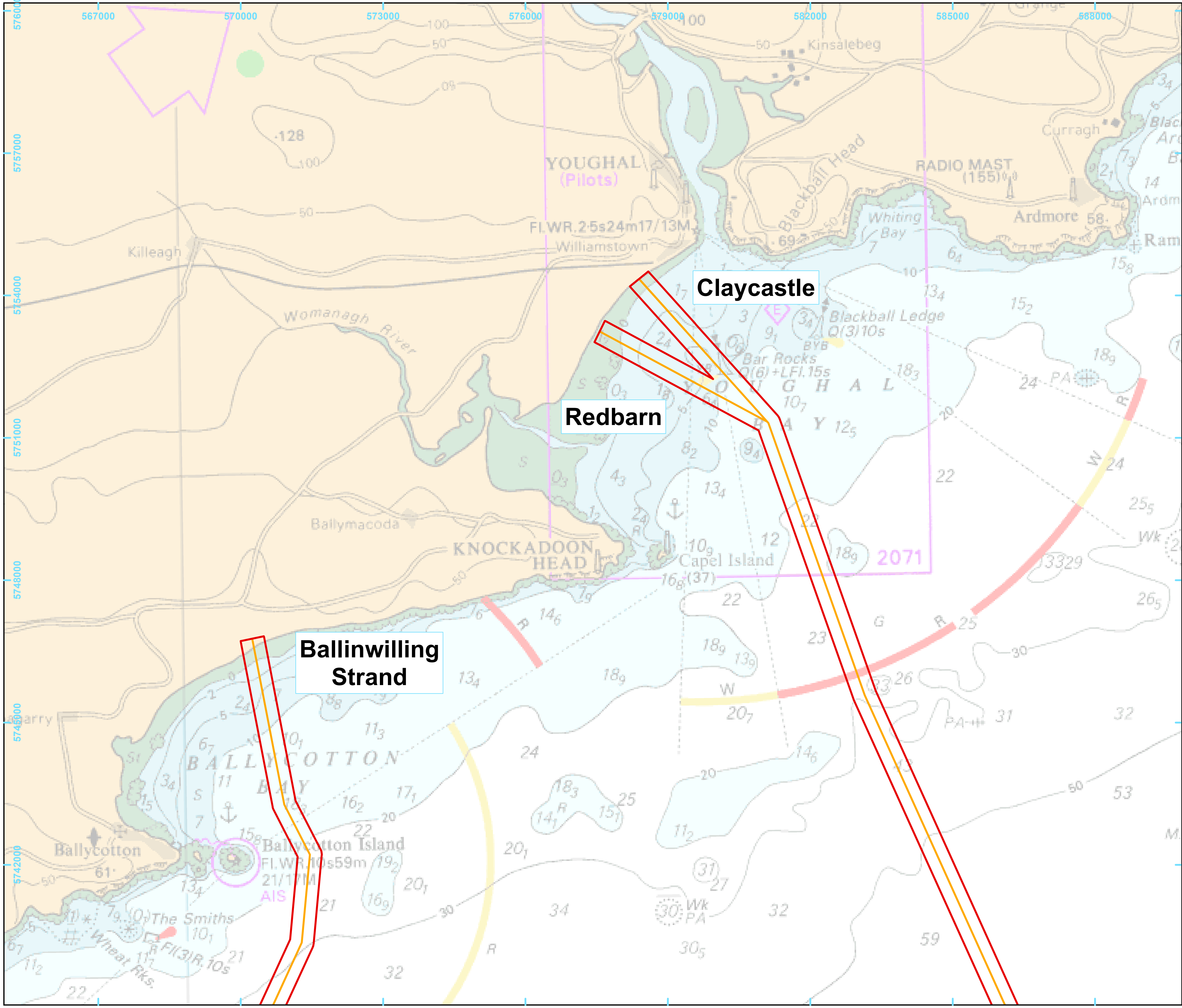

Legend

N

500m wide CSC

Cable Route

0 3.25km

Coordinate System: WGS 1984 UTM Zone 29N
Projection: Transverse Mercator
Datum: WGS 1984
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -9.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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PROJECT TITLE

Celtic Interconnector

FIGURE TITLE

Revised proposed landfall locations for the Celtic Interconnector in Irish territorial waters

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2. LEGISLATIVE FRAMEWORK AND GUIDANCE

2.1. As the project is located within Irish and French territorial waters and within the continental shelves of Ireland, France and the UK (adjacent to England within the UK Exclusive Economic Zone (EEZ)), all assessments considered the following national and international legislative procedures and guidelines:

Republic of Ireland

- National Monuments Acts (1930-2004);
- Heritage Act (Ireland, 1995); and
- Framework and Principles for the Protection of the Archaeological Heritage (Department of Culture, Heritage and the Gaeltacht 1999).

France

- *Code du Patrimoine* (France, 2004).

UK

- Protection of Wrecks Act 1973;
- Protection of Military Remains Act 1986;
- Merchant Shipping Act 1995; and
- Burial Act 1857.

General

- European Convention on the Protection of the Archaeological Heritage (Valetta) 1992;
- UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001);
- International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage (1996) (the Sofia Charter); and

- United Nations Convention on the Law of the Sea (UNCLOS) 1982.

2.2. All assessments have been compiled in line with industry best practice and the relevant offshore renewables and marine historic environment guidance. These include:

Republic of Ireland

- Institute of Archaeologists of Ireland code of conduct for archaeological assessment excavation (2006).

UK

- Chartered Institute for Archaeologists (CIfA) guidelines: Standard & guidance for archaeological desk-based assessment (2014);
- Joint Nautical Archaeology Policy Committee (JNAPC) code of practice for seabed development (2008);
- COWRIE Historic environment guidance for the offshore renewable energy sector (2007);
- COWRIE Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy (2008);
- COWRIE Guidance for offshore geotechnical investigations and historic environment analysis: guidance for the renewable energy sector (2011);
- The Crown Estate (2014). Offshore renewables protocol for archaeological discoveries; and
- The Crown Estate (2010). Round 3 offshore renewables projects model clauses for archaeological written schemes of investigation.

General

- EIA Directive 85/337/EEC as amended by 97/11/EC and 2003/35/EC.

3. METHODS AND DATA SOURCES

3.1. The following section sets out the methods used for the assessment of the proposed CSC, including the sources used for collation of data and the relevant legislative framework and guidance.

Desk-based assessment methodology

3.2. The DBA consisted of a documentary and cartographic search, utilising a variety of sources, in order to locate all known cultural heritage assets and to identify the archaeological potential within the CSC (Cotswold Archaeology 2017).

3.3. Sources consulted for this assessment include, where relevant:

Republic of Ireland

- Information held by the Underwater Archaeology Unit (UAU) of the Department of Culture, Heritage and the Gaeltacht (DCHG);
- Information held by Heritage Ireland on protected wrecks;
- Information held by Integrated Mapping for the Sustainable Development of Ireland's Marine Resources (INFOMAR);
- National Museum of Ireland archives;
- National Library of Ireland (for historic charts and maps only); and
- Geological Survey Ireland.

France

- Information held by *Le Département des Recherches Archéologiques Subaquatiques et Sous-Marines* (DRASSM);
- Information held by *Le Service Régional de l'Archéologie* (Brittany); and
- Service *Hydrographique et Océanographique de la Marine* (SHOM), - the French hydrographic office, for records of wrecks.

UK

- Information held by Historic England on designated wrecks and the National Monuments record (NMR – maritime section);

- United Kingdom Hydrographic Office (UKHO) Wrecks and Obstructions Database (SeaZone);
- UKHO review of cartography, historic charts and sailing directions;
- Ministry of Defence (military remains only);
- Receiver of Wreck (RoW);
- Records held with the Archaeology Data Service (ADS); and
- Marine Environment Data Information Network (MEDIN).

General

- Readily accessible published sources and grey literature (e.g. results from previous studies);
- Relevant external marine historic environment specialists;
- British Geological Survey regional guide and previous work in the area;
- Relevant dive groups and local interest groups;
- Relevant external marine historic environment specialists (eg palaeo-environmental); and
- Relevant Strategic Environmental Assessment (SEA) reports (eg UK Continental Shelf SEA archaeological baseline) and Coastal Survey Assessment reports.

Consultation with statutory bodies

3.4. For this assessment, the following statutory bodies and stakeholders were consulted, including:

- Underwater Archaeology Unit (UAU) of the National Monuments Service, Department of Culture, Heritage and the Gaeltacht (DCHG); and
- INFOMAR.

3.5. In addition, the following statutory bodies and stakeholders were consulted as part of the assessment produced by Headland Archaeology in 2014:

- Heritage Ireland;
- Historic England;
- Ministry of Defence (military remains only);
- Receiver of Wreck (UK Maritime Coastguard Agency); and
- *Centre départemental d'archéologie Conseil General de Finistere*.

Limitations of data

3.6. One of the greatest limitations when researching known and potential offshore cultural heritage is the difficulty of locating recorded maritime losses. For many losses the location of the sinking of the vessel can be in the form of a general area description, as in 'SW and W from southern Ireland' or '30 miles north of Ushant', which is not useful practically for accurate assessment, except to show the potential exists to encounter lost cultural remains (Cotswold Archaeology 2017).

3.7. Many wrecks have been identified through sonar survey, but this too presents difficulties as many of these wrecks have been located using GPS, which until relatively recently was only accurate to 100m (Baird 2009; see also Satchell 2012); or by DECCA which can give locations accurate to only one kilometre. In addition, recorded maritime losses are heavily biased towards the 19th and 20th centuries when more comprehensive records of losses began to be compiled by the UKHO.

3.8. To prevent a large error range in sonar measurements due to tidal range varying across bays and coastlines during the recent INFOMAR surveys, onshore and offshore tidal gauges were installed to ensure accurate tide height data.

3.9. The details for specific offshore cultural heritage assets within this study area were acquired from the three main sources cited above. Other sources, also cited above, were consulted by Headland Archaeology for the feasibility phase of this project in 2014. All these databases are each derived, in turn, from a variety of sources including various published lists of marine losses and marine surveys. Consequently, there are considerable overlaps and discrepancies between the datasets.

3.10. Wrecks discussed below are generally referred to as either 'live', 'dead' or 'lifted'. 'Live' wrecks are those for which there is a known location which has been verified by recent surveys. 'Dead' refers to sites or reports of incidents that have been recorded in a certain location, but which have not been detected by repeated or the most recent surveys. Whilst there is no recorded evidence of any lifted wrecks within the study areas, this refers to wrecks that have been removed from the seabed.

3.11. Where a live wreck has been identified this information is provided in Tables 2 and 3; a wreck in a known location that has not been identified is referred to as unidentified. Where the status of a wreck is given as 'unknown', this means that it is not recorded whether the wreck is live, dead or lifted.

3.12. The assets listed in this report relate to the current route options and cover all UAU, INFOMAR, UKHO entries (as held by SeaZone), DRASSM and *Le Service Régional de l'Archéologie* within the study areas including dead entries. Dead entries are included because although wrecks may not have been detected in recent surveys the recorded locations may still contain remains of cultural heritage interest. Given locational discrepancies (Satchell 2012) the possibility that wrecks lie outside previous search areas cannot be discounted.

3.13. All relevant data held by the UAU, INFOMAR, UKHO / SeaZone, DRASSM and *Le Service Régional de l'Archéologie* – the primary historic data repositories for this assessment - were considered, and for completeness, listed and cross-referenced. The data supplied by the UAU appears to include multiple entries which refer to the same site, such as an unidentified wreck recorded in the same position, or same place of loss (i.e. latitude and longitude). Whilst the data has been recorded as individual entries by the UAU, and usually relates to separate UKHO entries, in this report multiple entries recorded in the same location have been listed as one wreck. These sites have been indicated in Tables 2 & 3 with the addition of an asterisk (i.e. CA1*). Each wreck is discussed in more detail below (Cotswold Archaeology 2017).

Foreshore survey methodology

3.14. The landfall surveys, conducted on the foreshore and in the inter-tidal zone, comprised walkover, hand-held metal detector, and geophysical (electro-magnetic conductivity) surveys. The aim of the surveys was to assess and map the extent of any archaeological remains within the proposed development (Cotswold Archaeology 2018a).

3.15. The surveys were conducted in during Spring tides to achieve full overlap with the offshore marine surveys. All surveys were positioned using the geodetic datum WGS 1984, with projection in the Universal Transverse Mercator Zone 29 North (UTM 29N).

Walkover survey

3.16. A walkover survey was undertaken at all potential landfall locations which entailed the identification of physical features relating to the historic environment. The locations of identified features were recorded using a hand-held Garmin GPS unit, and were recorded photographically together with a brief descriptive record.

Metal detector

3.17. Hand-held metal detectors were used to conduct surveys at all potential landfall sites. The survey followed 5m wide traverses in accordance with the geophysical surveys. The detector was set to detect all metal and the sensitivity was adjusted to compensate for the high salt content of the beach sand.

3.18. As this was a non-intrusive survey, where possible the numeric values displayed on the detector were recorded to assist potentially in the identification of the type of metal detected. A higher value is more likely to indicate a non-ferrous metal (Minelab 2017:11); no finds spots were excavated. All finds spots were recorded using a hand-held Garmin GPS and were plotted using ArcGIS.

Geophysics

3.19. The most recent foreshore geophysical surveys used a Geonics EM31 electromagnetic conductivity meter to perform a terrain electrical conductivity survey, similar to those conducted previously. The instrument is a non-intrusive frequency-domain electrical conductivity measuring device that records the spatial variations of apparent ground conductivity of the earth in units of milliSiemens/metre (mS/m). The ‘siemen’ is the international (SI) unit of measurement for volume electrical conductance and is the equivalent to an ampere/volt. Differences in deposits, principally variations in thickness between deposits with different conductivities, can produce spatial variations in conductivity readings.

3.20. The system provides two measurements, quadrature (apparent conductivity) and in-phase (metallic response) data. The system has, subject to the vagaries of differing soil conditions, an effective operation depth of approx. 6m.

3.21. The instrument has various environmental applications and its data can be used to map landfills, to locate buried metal objects, to detect shallow groundwater contamination and to measure soil thicknesses.

3.22. A survey grid was set out at the required locations and subdivided into 5m transects, using a GPS system utilising the Irish Transverse Mercator Grid (UTM) with an accuracy of 0.5m or greater.

3.23. The primary focus of the survey was to identify buried metal objects on the beach that might relate to heritage assets. In addition, some success was gained at mapping variations in silting patterns within the foreshore area. Variations in response might occur where timber structures have influenced the deposition of sediments and could therefore be used to identify the presence of wooden material which could be indicative of wreck material or other wooden structures buried in the sand.

3.24. In addition, as ground conductivity is influenced by soil moisture content, an electromagnetic conductivity survey can be used to differentiate between areas of solid substrata and sand. This could help to define the former physical topography of the survey area by identifying former channels or basins in the sub-strata. Identification of these features could help to define areas of archaeological potential within the survey area.

3.25. The data was digitally recorded and periodically downloaded to a field computer for quality assurance and preliminary interpretation.

3.26. At the end of the survey, the Geonics EM31 data was interpreted and mapped using Terrasurveyor V3.0.32.4 software (DWConsulting), a surface mapping software that allows topographic data to be contoured and presented in a manner that allows for the interpretation of sub-surface features (Cotswold Archaeology 2018a).

Marine geophysical survey methodology

Irish territorial waters

Bathymetric and geophysical survey specification and data acquisition

3.27. The bathymetric and marine geophysical surveys in Irish territorial waters were conducted by Next GeoSolutions in 2017. The archaeological assessment of this survey data was undertaken for Cotswold Archaeology by Dr Michael Grant of COARS (Cotswold Archaeology 2018a).

3.28. Bathymetric data were acquired using a dual head R2Sonic 2024 (200-400 kHz) multibeam echo sounder (MBES).

3.29. Side scan sonar (SSS) survey was undertaken using an Edgetech 2200 Series dual frequency (410 and 125 kHz), set to 50m range to provide a total swath of 100m. The magnetometer survey was conducted using a Geometrics G882 magnetometer.

3.30. The SBP seismic data were acquired by means of a combined SSS/SBP Edgetech 2200 Series with a SBP DW216 operating at 2-12 kHz at 20ms with a 4Hz ping rate.

3.31. The Sparker data were acquired by means of a Multi-tip Sparker System Geo Marine Survey Systems Geo-Source / Geo-Spark 200. Positioning was acquired using a Teledyne PDS2000/ PosMv system.

Geodetic and projection parameters and vertical datum

3.32. Vertical datum was referred to the required vertical reference level, lowest astronomical tide (LAT), referred to Ordnance Survey Ireland (OSi) datum in the nearshore sector, and Vertical Offshore Reference Frames (VORF) vertical reference for the Irish offshore sector.

Assessment methodology

3.33. Geophysical assessment was undertaken using the programs Coda Octopus Survey Engine 4.3 and ArcGIS 10.5. SBP data were analysed using the former with the positions of sub-surface anomalies exported in shapefiles to be uploaded into ArcGIS 10.5 alongside processed magnetometer data provided by Next

GeoSolutions, following the professional guidelines of Plets *et al*. (2013). The geophysical data was assessed for archaeological potential, based on the presence of multiple lines of evidence (confirming datasets) (Cotswold Archaeology 2018a).

Irish territorial limit out to the Irish / UK median line

Assessment methodology

3.34. The bathymetric and marine geophysical surveys from Irish territorial limit out to the Irish / UK median line were conducted by Osiris Projects in 2015 (Osiris 2015). The archaeological assessment of the marine survey data was undertaken by Headland Archaeology by (2015).

3.35. Bathymetric data were acquired using a multibeam echo sounder (MBES). The data were visualized using the Fledermaus 7.3.3 suite; DMagic was used to produce a digital terrain model (DTM) gridded at 1 m and shadow and geographic information objects were then assembled. These were exported for interpretation into Fledermaus with a 32 step colour map overlaid to aid interpretation and later into ArcGIS 10.2.1.

3.36. Side scan sonar (SSS) survey data, from Irish territorial limits out to the Irish / UK median line, were received as navigation-corrected and post-processed .cod files which were associated with accompanying CODA Octopus software projects; coverage was provided in Coda Octopus SurveyEngine 4.2 format.

3.37. The SBP seismic data were provided by Osiris Projects as CODA SurveyEngine 4.2 projects for all cable route sections.

3.38. Magnetic data were reviewed using the Geometrics MagPick. The raw xyz profile files were imported and individually assessed. Correlation between magnetic targets and other datasets was based on a 50m buffer owing to the problems inherent in accurately positioning magnetic targets by their detectable magnetic field. Concentrated clusters of magnetic anomalies are usually associated with coherent ferrous structure of post-medieval and later origin. Isolated features may correspond to debris, anchorage material, or unexploded ordnance. All such features are cross-referenced with the available geophysical data and are graded in terms of archaeological potential where possible. These anomalies may be subject to archaeological exclusion zones where high magnetic returns (> 100nT) are consistent across multiple records.

Geotechnical investigations methodology

Marine and foreshore geotechnical investigations

Irish territorial waters and landfall options

3.39. A total of 85 geotechnical site investigations were undertaken in Irish territorial waters in 2018, ranging in elevation height from 11m to -83m LAT (Fig. 4).

3.40. Archaeological monitoring was undertaken on the foreshore at Ballinwilling Strand, Redbarn beach and Claycastle beach at the 12 locations where geotechnical investigations, comprising boreholes and test pits, were conducted (IAC Archaeology 2018) (Table 1).

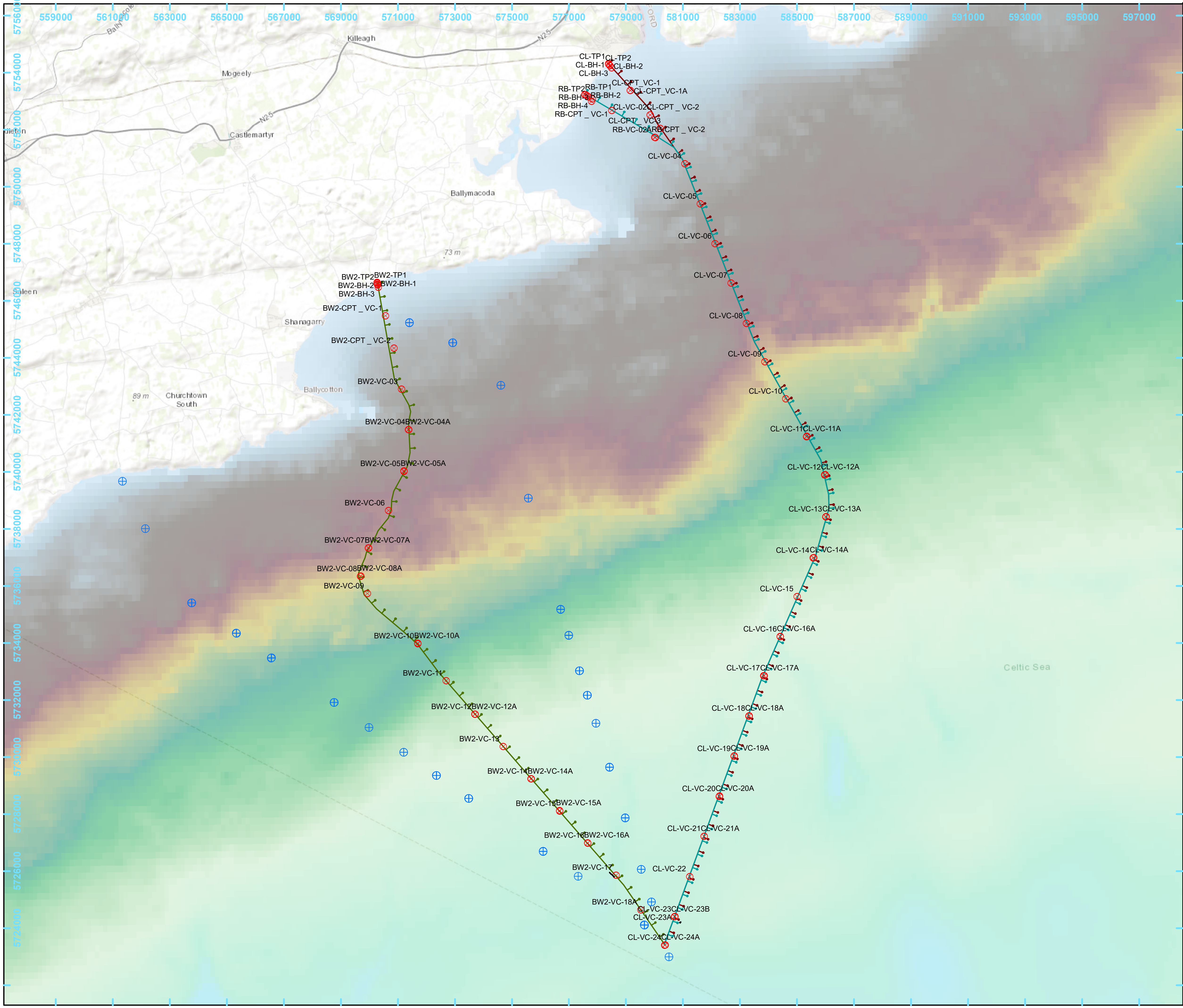
3.41. Following excavation, the test pits were backfilled using only native materials while the boreholes were backfilled using pellet bentonite (compactonite).

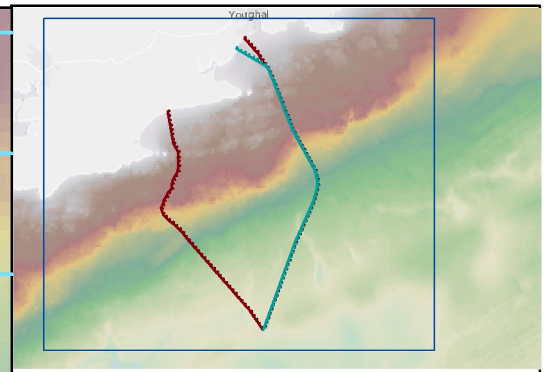
3.42. The equipment used included:

- Borehole – PSM-8G hydraulic drilling rig
- Test Pit – 21 tonne tracked excavator
- Metal detector – Garret EuroAce

3.43. Marine and foreshore geotechnical samples were collected to inform the engineering design, with recording and laboratory-testing undertaken by Next GeoSolutions. All samples were split longitudinally and photographed prior to recording of the deposits by the geotechnical specialists, prior to sub-sampling with respect to both the stratigraphy encountered and the testing scheduled. The destructive laboratory testing included:

- Moisture content – at least 50g (fine grained soil), 3kg (coarse grained);
- Atterberg Limits – at least 600g passing 425µm sieve;
- Particle size distribution – at least 500g (for samples with grain sizes <10mm), 35kg (for samples with grain sizes <50mm);





Legend

- 2018 Sample Locations
- Previous Coring
- Redbarn Route
- Claycastle Route
- Ballinwilling route

Bathymetry (m LAT)

High : 3

Low : -85

0 5,000m

Background bathymetry: EMODnet Bathymetry Consortium (2016): EMODnet Digital Bathymetry (DTM).

Cotswold Archaeology marine

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Exeter	01392 826185
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PROJECT TITLE

Celtic Interconnector project

FIGURE TITLE

Geotechnical coring locations

DRAWN BY	MJG (UoS)	PROJECT NO	17758	FIGURE NO.
CHECKED BY	MW	DATE	23/01/2019	4
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- Minimum/maximum density – at least 6kg (sand), 16kg (gravelly soil);
- Oedometer – undisturbed sample at least 1 x diameter in length;
- Unconsolidated undrained triaxial – undisturbed sample at least 2 x diameter in length; and
- Consolidated triaxial – undisturbed sample at least 2 x diameter in length.

3.44. Core sections not subjected to destructive testing were retained by Next GeoSolutions and were made available to Cotswold Archaeology. Core photographs and descriptions were provided to enable Cotswold to undertake an assessment of the geo-archaeological potential of the samples.

Geoarchaeological recording method

3.45. The geoarchaeological assessment followed Historic England (2015) guidelines, with descriptions according to Hodgson (1997) including sediment type, depositional structure, texture and colour. Interpretations regarding mode of deposition, formation processes, likely environments represented, and potential for palaeo-environmental analysis were also noted. As all the samples had been sub-sampled, there was little information available regarding sedimentary structures (bedding, laminations, etc) or stratigraphic boundaries. A photographic record of the samples, including key stratigraphic features, was made to supplement the sedimentary descriptions.

Table 1 Borehole and test pits monitored at Ballinwilling Strand, Redbarn beach and Claycastle beach

SI Code	Location	ITM Eastings	ITM Northings	Max. Width	Max. Length	Max. Depth
BW2-BH1	Ballinwilling	570265	**5746647**	165mm	165mm	21m
BW2-BH2	Ballinwilling	570282	**5746588**	165mm	165mm	20m
BW2-TP1	Ballinwilling	570276	**5746622**	3m	5.5m	2m
BW2-TP2	Ballinwilling	570308	**5746478**	3.5m	4.5m	1.9m
RB-BH1	Redbarn	**577581**	**5753228**	165mm	165mm	20m
RB-BH2	Redbarn	**577683**	**5753162**	165mm	165mm	20m

SI Code	Location	ITM Eastings	ITM Northings	Max. Width	Max. Length	Max. Depth
RB-TP1	Redbarn	**577557**	**5753240**	2m	5m	3m
RB-TP2	Redbarn	**577621**	**5753202**	2m	5m	3m
CL-BH1	Claycastle	578396	5754300	165mm	165mm	20m
CL-BH2	Claycastle	578440	5754248	165mm	165mm	20m
CL-TP1	Claycastle	578387	5754308	2.5m	5m	3m
CL-TP2	Claycastle	578432	5754258	2m	5m	3.6m

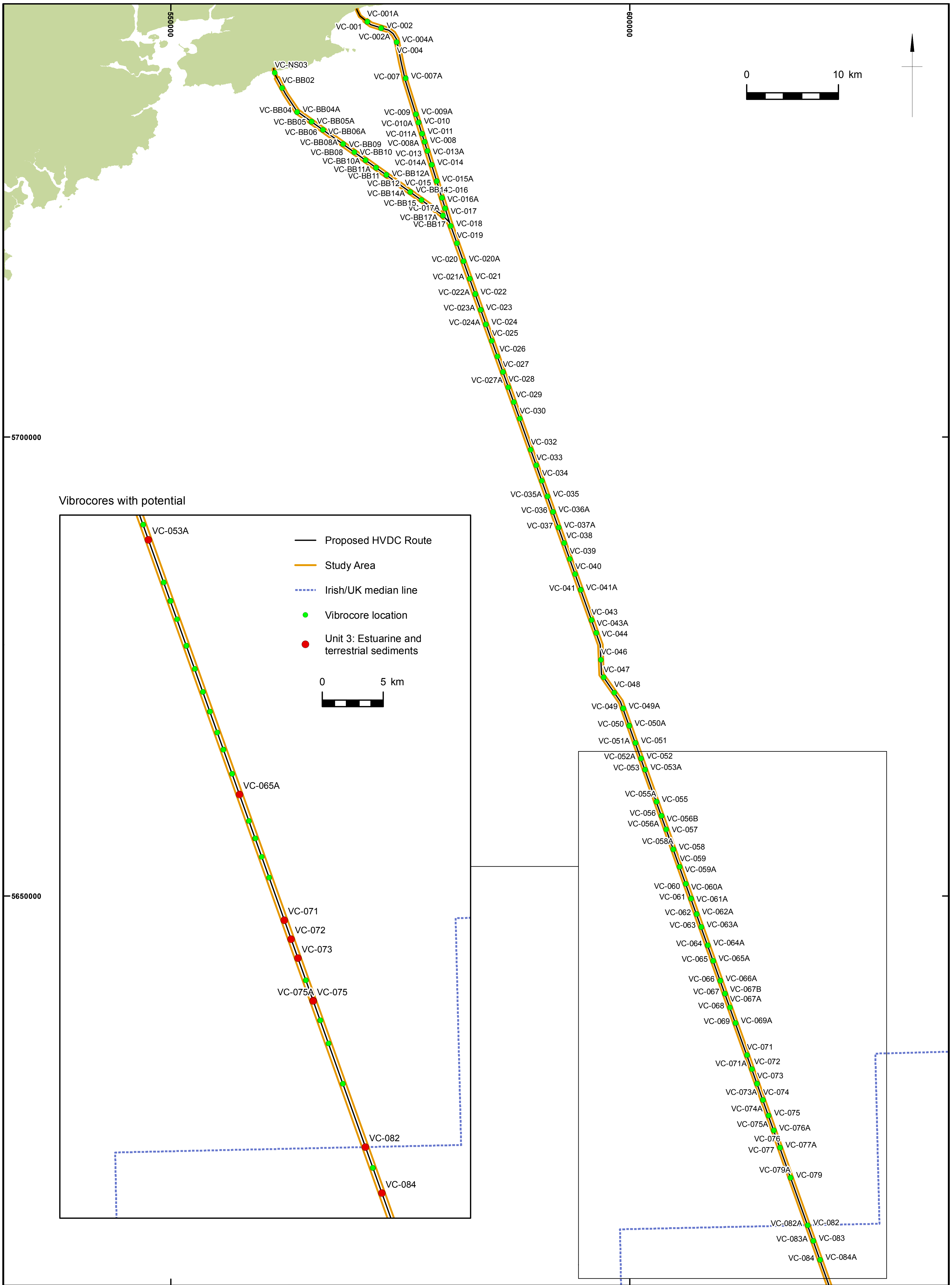
Irish territorial limits out to Irish / UK median line

3.46. The logs of 148 vibrocores acquired by Osiris in 2015 out to the Irish / UK median line (Osiris 2015) were reviewed by Wessex Archaeology (2016) (see Fig. 5). However, 48 of these cores relate to redundant routes in Irish territorial waters and have therefore been removed and will not be considered further; only the 100 logs that are located from the Irish territorial limit out to the Irish / UK median line will be discussed. The vibrocore logs were sampled along the route to 3m below the mudline with retests performed where recovery or penetration was less than 2m (Osiris 2015).

3.47. Two vessels were utilised for the geotechnical survey, owing to the variable water depth along the route. RRS Ernest Shackleton was employed for the offshore section, while SV Bibby Tethra was used nearshore. Both vessels were equipped with marine piezocone cone penetrometer (CPT) and vibrocoring systems. The vibrocore locations up to the Irish/UK median line were all recorded in WGS84 UTM29N.

3.48. Each log has been reviewed and interpreted based on comparison with each other and to the known sequence recorded by BGS (Evans et al 1990; Tappin et al 1994). Data from the logs were input manually into Rockworks 17™ software creating a geospatial database including coordinates, vibrocore identification number, depth, recovery and date acquired.

3.49. The lithologies have been grouped with regard given to geoarchaeological and palaeo-environmental deposits of interest to derive an overall stratigraphic interpretation of the logs.



Company Name: Wessex Archaeology
Client Name: EirGrid plc
Project: Celtic Interconnector - Feasibility Study
Drawing Title: Location of vibrocores
Drawing Number: 112110_Fig02.mxd

Proposed HVDC Route
Study Area
Irish/UK median line
Vibrocore location

Date:	17/02/2016	Revision Number:	1
Scale:	1:400,000 & 1:300,000 (A3)	Illustrator:	KJF
Path:	X:\PROJECTS\112110\GIS\FigsMXD\Geoarch\2016_02_04		

Figure 5 Original map of the location of vibrocores provided by Wessex Archaeology (2016). No alterations have been made regarding route revisions.

3.50. The SBP data were assessed at targeted locations where palaeo-channels had been identified in a previous archaeological assessment (Headland Archaeology 2015). The geophysical data were also re-assessed over the locations of a selection of logs in which organic remains were identified. SBP data were processed using Coda Seismic+ software.

Foreshore geotechnical investigations at Claycastle beach

3.51. 20 locations (four locations along five transects running landward to seaward) were proposed for a hand auger survey (Cotswold Archaeology 2018a). Owing to the specific nature of the intertidal zone (very loose sand / gravel sediments), the proposed auger locations had to be adapted in order to obtain suitable locations for the survey.

3.52. To establish the extent of the peat deposits, 20 additional test pits (TPs) were dug in randomly-chosen locations between the previously proposed transects. Most of the TPs were situated c. 10m to the north-west of the area of exposed peat to establish the presence of the peat deposits under the beach sand (Cotswold Archaeology 2019b). The auger and test pit locations are illustrated in Figure 6.

The auger survey was conducted using a standard hand-operated Dutch auger with 1m long extension rods. Hand auguring was conducted in eight locations (**CL4001**, **CL4002**, **CL4003**, **CL4005**, **CL4007**, **CL4011**, **CL4012**, and **CL4024**). Unsuccessful attempts were made in numerous other locations but were aborted owing to the instability of the sand. The sediment recovered was laid out and recorded following standard procedures (Cotswold Archaeology 2017; Munsell 2018; Tucker 2011).

3.53. Augers **CL4002**, **CL4003** and **CL4011** were drilled in areas where the peat was exposed in order to provide a full sedimentary sequence. Three environmental bulk samples were taken from the top, middle and bottom of the peat in each of these auger cores (nine samples in total). All samples were placed inside sealable plastic bags and labelled using CA's standard procedures (Cotswold Archaeology 2017).

3.54. 31 small TPs (**CL4004**, **CL4006**, **CL4007** to **CL4010**, **CL4013**, **CL4014**, **CL4016** to **CL4023**, and **CL4025** to **CL4040**) were dug by hand in locations where unstable sediments prevented the use of the hand auger. The TPs were recorded following standard procedures as above. All TPs were backfilled as soon as recording had been completed.

3.55. At the time of the survey, the local authority (Cork County Council) was undertaking groundworks just to the front of the boardwalk on the beach. The opportunity was therefore taken to examine the excavation. This TP was mechanically excavated through drier sand to a depth of c. 2.7m.

Legend

- Auger
- Test pit
- Test pit and auger
- Machine test pit
- Youghal Strand Core 2002
- Exposed peat
- Cable Route
- 500m wide CSC

N

0 0.05km

Coordinate System: WGS 1984 UTM Zone 29N
Projection: Transverse Mercator
Datum: WGS 1984
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -9.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Cotswold Archaeology marine

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Milton Keynes	01908 564660
Suffolk	01449 900120

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PROJECT TITLE
Celtic Interconnector

FIGURE TITLE
Auger and test pit locations

DRAWN BY	RLF	PROJECT NO	770617
CHECKED BY	MTW	DATE	22/05/2019
APPROVED BY	MTW	SCALE@A3	1:1,600

FIGURE NO. 6

4. RESULTS

Desk-based assessment

Baseline environment

4.1. The aim of this section is to provide a brief assessment of the palaeo-environmental potential of sediments potentially impacted by the proposed cable routes and three potential landfall locations. This assessment will provide data that will assist in identifying potential sediments of palaeo-environmental and archaeological interest. The specific objectives of this palaeo-environmental assessment are to review available data in respect of seabed and sub-seabed deposits to identify those likely to be of palaeo-environmental and archaeological interest.

4.2. A number of radiocarbon dates are referred to in the text below. The uncalibrated dates are conventional radiocarbon ages. The radiocarbon ages were calibrated using the University of Oxford Radiocarbon Accelerator Unit calibration programme OxCal v4.3.2 (2017) (Bronk Ramsey 2009) using the IntCal13 curve (Reimer *et al* 2013). All radiocarbon dates in this report are to 95.4% probability.

4.3. This baseline environmental assessment considers previous work done in the areas of the proposed revised cable routes in order to place project-specific investigations into the wider context of the palaeo-environment of the three areas potentially affected.

Ballinwilling Strand, Redbarn Beach and Claycastle Beach, Co. Cork, Ireland

4.4. There is a paucity of relative sea-level (RSL) information for the south of Ireland; research that has been undertaken has been documented by Brooks and Edwards (2006) and provides a key insight into the impact of RSL change at both national and regional levels.

4.5. Although there are no RSL studies specifically relating to Ballinwilling Strand, Redbarn beach and Claycastle Beach, RSL data are available for the southwest of Ireland and in particular for Co. Cork. These can be used to interpret how RSL has changed in this area since the last glacial period. RSL index points from areas closest to the proposed landfall sites have been generated from Dungarvan Bay, Co. Waterford (Sinnott 1999), *c.* 25km northeast of Claycastle Beach, and from Ballycotton Bay, Co. Cork (Carter *et al* 1989), *c.* 3km south of Ballinwilling Strand.

4.6. A conjectural RSL curve was produced for the southwest of Ireland by Taylor *et al* (1986), which suggested that RSL in this area stood at *c.* 5m below ordnance datum (OD) at 15,000 years before present (BP) and fell to 10m below OD around 9,500 BP. RSL than began to rise steeply to attain its current level at approximately 3,500 BP. The curve produced by Taylor *et al* (1986) suggests that submerged landscapes of Mesolithic and Neolithic date may be present around the coast of southwest Ireland.

4.7. These models have been updated by Brooks *et al* (2008) suggesting that for the areas of east Cork, west Cork and south Wexford, RSL rose sharply from *c.* 80m below OD to *c.* 50m below OD (west Cork) and to *c*. 40m below OD (south Wexford) between 15,000 to 14,000 BP before the rate of rise slowed down to *c.* 40m below OD to *c.* 35m below OD by 11,500 BP. Following this more gradual rate of rise, RSL rose steeply once more to reach *c.* 1m below OD by c. 6,000 BP before slowly rising to its current level. The new models by Brooks *et al* (2008) concur with those proposed by Taylor *et al* (1986) in the potential for submerged landscapes to be present from the Mesolithic to at least the Neolithic period.

4.8. These submerged landscapes have also been signalled by intertidal peats which have been recorded in the area just south of Ballinwilling Strand at Ballycotton Bay, where it has been estimated that land has receded by *c.* 6-6.5m per year since 1840 (Carter *et al* 1989). Not all land recession along this coastline, however, is due to sea level rise. At Youghal, for example, *c.* 2km northeast of Claycastle beach, dredging for marine aggregates in the 19th century led to major coastal changes. An estimated 270,000m^3 yr^{-1} of gravel was removed from inshore shoals over the period 1850 to 1900, leading to beach lowering and shoreline recession (Carter *et al* 1989).

4.9. Remains of submerged forest (remnant woodland) have been recorded in the peats at Ballycotton Bay, with pollen analysis indicating that this woodland may have consisted of oak (*Quercus sp.*), hazel (*Corylus avellana*) and alder (*Alnus glutinosa*), which was later replaced by sedge (*Carex sp.*) and reed (*Phragmites australis*) swamp (Carter *et al* 1989). The woodland is estimated to have been present at around 5,000 BP, indicating a Mesolithic date (Carter *et al* 1989). Intertidal peats, containing wood and monocotyledon fragments (indicating good preservation of organic material), have also been recorded at 0.5 to 0.8m below OD at Lakeland Strand, Cork Harbour (Devoy 1984). These peats were radiocarbon dated and seem to have accumulated between 2350±45 BP (736–239 cal BC; Q-2382) and 1810±40 BP (87–332 cal AD; Q-2381), when they were replaced by saltmarsh, which indicates that terrestrial surfaces were present until the Iron Age (Carter *et al* 1989).

4.10. Beyond Co. Cork intertidal peats have been located at other locations along the southern Irish coastline (predominantly in estuarine locations) (e.g. Devoy *et al* 2006; Timpany 2008; Brooks & Edwards 2006) which further indicate the potential for these deposits to occur. For example, in Dungarvan Bay carr peats were identified at Killingongford and Ballinacourty by Sinnott (1999). At the former a basal reedswamp peat, dated 4205±70 (2922–2577 cal BC; Q-2876), is overlain by a carr peat straddling modern data dated between 3470±70 (1964–1620 cal BC; Q-2875) and 780±50 (1157–1295 cal AD; Q-2874). At Ballinacourty the carr peat, below modern datum, accumulated between 3515±70 (2029–1665 cal BC; Q-2873) and 2630±70 (972–541 cal BC; Q-2872).

4.11. In addition to intertidal peats, offshore peats have also been recorded in marine waters outside Cork harbour, such as at Curlane Bank (W794633). Here a wood and monocotyledon peat containing remains of oak, hazel, pine (Pinus sp.), common reed (*Phragmites australis*) and sedges (*Cyperaceae*) signals the presence of previous fen woodland in the area. The formation of this peat sequence has been dated between 8200±75 BP (7455–7057; Q-2379) and 7840±75 BP (7028–6503 cal BC; Q-2378) indicating terrestrial woodland was in existence during the Mesolithic period (Carter *et al* 1989).

4.12. From these studies it seems most likely that at the three potential landfall sites, RSL rose gradually from the early Mesolithic, peaking sometime in the Iron Age. There is, therefore, the potential for previously terrestrial deposits (e.g. peats) and cultural materials from the early Mesolithic to the Iron Age to be present in submerged and intertidal areas around these locations.

4.13. In addition to the Holocene-age deposits associated with bays and estuaries, there have also been older Pleistocene deposits encountered, such as the Pleistocene interglacial estuarine deposits found at depth beneath glacial diamicton in Cork Harbour (Dowling *et al* 1998). Although the age of these deposits is unclear, with contradicting dates from marine isotope stage (MIS) 9 to 5e, they do demonstrate that evidence of earlier Pleistocene warm periods can be found along the coastline.

4.14. The first arrival of humans in Ireland has been traditionally suggested as being soon after 10,000 BP (Woodman 2012; 2015), although recent evidence from Co. Clare has suggested that Ireland might have been populated as early as 12,500 BP during the late Upper Palaeolithic (Dowd & Carden 2016). Evidence for the presence of early Mesolithic peoples in the Cork area prior to 8,000 BP, is confirmed by the presence of lithic finds and radiocarbon dating (Woodman 1985), with later Mesolithic materials having also been recorded (Andersen 1993). This suggests habitation of this area throughout the Mesolithic.

4.15. Proxy-evidence for the presence of Mesolithic peoples in the southwest of Ireland has also been recovered from pollen evidence taken from peatlands (e.g. Mitchell 1990; Mighall *et al* 2008; Mitchell *et al* 2013). This indicates that people were mobile and impacting the landscape during this period, which further highlights the information that may be attained from intertidal and submerged peats. Co. Cork has a rich archaeological heritage; in addition to Mesolithic cultural materials there is evidence of settlement and activity from the Neolithic onwards (e.g. Twohig & Ronayne 1993) which indicates the potential for archaeological finds from the Mesolithic onwards. Evidence of such activity is supported by the isolated find of a retouched flint blade (leaf shaped, abrupt retouch on both lateral edges and butt-trimmed - a so-called 'Bann' flake), dating from *c.* 3,000BC. The retouched flint blade was found in 1967 (NMI acc. no. 1972: 354; **CA25**), in a *fulacht fiadh*, on the edge of Ballycrenane beach (see Fig. 7) (Cotswold Archaeology 2017).

Pontusval & Moguériec, Brittany, France

4.16. In comparison to the UK there is relatively little information on Holocene RSL changes for this part of the North Atlantic coast (Leorri *et al*. 2012; Goslin *et al*. 2013) and there are no studies available specific to the sites of Pontusval and Moguériec. In order to interpret potential RSL change for this area, therefore, studies around Brittany have been considered together with palaeo-geographic models and other RSL studies from locations along the North Atlantic coast.

4.17. Studies of RSL change in the Atlantic coastal area of France (e.g. Ters 1986) have suggested that at around 20,000 to 18,000 BP, RSL was approximately 100m below present levels, with a main period of RSL rise occurring between 15,000 and 6,000 BP. Following this period of rise RSL change then stabilized near to its present level (Lambeck 1997). Palaeogeographic models of RSL change produced by Lambeck (1997) indicate that in the region of Ploudalmézeau, close to Brest and to the two sites of Pontusval and Moguériec, RSL change appears to follow this general trend.

4.18. The predicted RSL curve constructed by Lambeck (1997) shows that RSL in this area rose steadily from 95m below OD to 85m below OD between 18,000 and 14,000 BP. There is then a sharp rise in sea-level with RSL rising to 10m below OD by around 6,000 BP. Following this period of rapid change, RSL continued to rise to its present level but at a more gradual rate. Similar changes in RSL during the Holocene have been recorded in the Bay of Biscay (Leorri *et al*. 2012) and Audierne Bay (Vliet-Lanoë *et al*. 2014) to the south, comparing well to those at Brittany (Lambeck 1997) and further strengthening this model.

4.19. From these studies it seems most likely that at Pontusval and Moguériec, RSL rose sharply from the end of the last glacial period c. 14,000 BP to 6,000 BP and then more gradually to its present level. There is, therefore, a potential for submerged terrestrial deposits from the early Mesolithic onwardsin the offshore area. This potential has also been shown in the palaeogeographic maps produced by Lambeck (1997) and by Sturt *et al*. (2013) who have shown that the palaeo-shoreline of this area of France has changed considerably over the last 18,000 years and that it would have extended seaward, particularly during the Mesolithic period.

4.20. At a number of sites along the Atlantic coast of France (e.g. Ters 1986; Mariette 1971; Delibras & Guillier 1971; Frouin *et al*. 2007, 2009; Vliet-Lanoë *et al.* 2014a, 2014b) submerged and terrestrial peat deposits have been utilised to provide sea level index points (SLIPS) to reconstruct RSL change through the Holocene. Early peat deposits have been found at depths of up to26.7m below OD at La Havre and 26.4m below OD at Becquet Bay, dating from as early as 9,900±300 BP (GIF-744) and 9,880±230 BP (GIFF-1023), respectively (Delibras & Guillier 1971).

4.21. The dates for the peats respect the RSL curve produced by Lambeck (1997) for the region of Ploudalmézeau with the age of the peat generally decreasing with increasing OD height for those peats dating to approximately 5,000 BP or more. Peats with dates from c. 5,000 to 600 BP show greater variation in OD height in relation to age and suggest that oscillations in RSL change occurred during this time. These oscillations have been confirmed, by recent studies in western Brittany and in the Bay of Biscay, as occurring between c. 7,000 to 3,000 BP (Allard *et al*.

2008; Goslin *et al*. 2013) indicating that RSL changed at different rates on a more regional scale than shown in the models by Lambeck (1997) and Leorri *et al*. (2012).

4.22. There is therefore good potential for buried peats to be present in the estuarine areas of Pontusval and Moguériec, which would provide information on RSL change, landscape change and human activity from the Mesolithic to the Iron Age periods. The palaeo-environmental potential of such deposits has been realised from other estuarine sites in France such as at the Dives estuary, Normandy (Lespez *et al*. 2010).

4.23. The anaerobic nature of these sediments also indicates that they have good potential to contain cultural material such as wooden objects and structures. This potential is increased when taking into consideration the rich coastal and island archaeological heritage of Brittany, which includes fish traps of multiple periods, megalithic monuments, tombs and settlement sites (Scarre 2002; Daire 2009, Shi *et al*. 2012). Fish traps in particular have been recorded within the two areas under consideration here (Langouët & Daire 2009).

4.24. Palaeo-environmental and palaeo-climate information along the French coastline has also come from offshore cores (e.g. Naughton *et al*. 2007) indicating that there is potential for sediments in maritime locations to contain valuable palaeo-environmental and archaeological information.

Sites of cultural heritage interest within or in proximity to the CSC

4.25. The datasets used in the compilation of the various baseline assessments (Headland Archaeology 2014; Cotswold Archaeology 2017) have been amalgamated with duplicate entries removed.

4.26. DBAs have been conducted over the entire route from the Irish to the French coasts (Headland Archaeology 2014), and more recently to address route revisions in Irish territorial waters (Cotswold Archaeology 2017). These assessments included a wider study area (WSA) of c. 5km which has now been refined to the current proposed CSC of c. 0.5km.

Irish territorial waters

4.27. Two unidentified wrecks (**CA1 & CA8**; Table 2; Fig. 7), and one findspot on the foreshore of Ballinwilling Strand (**CA25**; Table 3; Fig. 7), were recorded within (the findspot) or in proximity (the two wrecks) to the CSC (Fig. 7) in Irish territorial waters. As neither wreck has been identified they are protected under Section 3 of the National Monuments (Amendment) Act, 1987) until they have been assessed further; this protection is not an indication of archaeological potential.

4.28. An unidentified live wreck (**CA1**) includes two entries in the same location which are presumed to relate to the same site. The wreck was detected by sonar at a depth of 74.6m, *c.* 91.4m (300ft) by 7.3m (24ft) in height.

4.29. The second unidentified wreck, (**CA8**), is recorded at a depth of 72.98m.

Table 2 Wrecks and obstructions in proximity to the CSC in Irish territorial waters (* = wrecks with multiple data entries)

CA no.	Name	Type	Date	Status	Latitude	Longitude	Source
CA1*	Unidentified	Wreck	Unknown	Live	51.72033	-7.92567	UKHO UAU
CA8	Unidentified	Wreck	Unknown	Unknown	51.661445	-7.827655	UKHO INFOMAR UAU

4.30. A retouched flint blade (leaf shaped, abrupt retouch on both lateral edges and butt-trimmed - a so-called ‘Bann’ flake), dating from *c.* 3,000BC, was found in 1967, in a *fulacht fiadh*, on the edge of Ballycrenane beach (NMI acc. no. 1972:354; **CA25**).

Table 3 DBA assets within the CSC

CA no.	Name	Type	Date	Status	Latitude	Longitude	Source
CA25	‘Bann’ flake	Retouched flint blade	c. 3000BC	Stored in National Museum of Ireland (NMI)	51.865834	-7.979895	NMI acc. no. 1972:354

4.31. The UAU has records of a number of wrecks that ran ashore in Ballycotton Bay (Cotswold Archaeology 2017: Table 3), mostly dating from the 18th and 19th centuries. No spatial data is recorded, but the project-specific geophysical survey (Cotswold Archaeology 2018a) did not detect any unknown wrecks so these will not be considered further.

Irish territorial limit to the French coast

4.32. Twenty wrecks, obstructions or sites were recorded in the CSC beyond Irish territorial waters (**HA1-HA5, HA7, HA9-HA22**; Table 4; Figs 8-11; Headland Archaeology 2014), including:

- Fourteen wrecks (**HA1-HA5, HA7, HA9-HA16**), ten of which are live and four of which are dead; and
- Six obstructions (**HA17-HA22**), one of which is live and five of which are dead.

4.33. Wreck sites **HA1, HA2, HA5 & HA11** will not be considered further as no corresponding anomalies were detected by the project-specific geophysical surveys, so their locations remain unknown.

4.34. The Alit (**HA3**; Fig. 11) was a French merchant ship which sank close to the French coast on 22 October 1916, but details such as ship type and cause of sinking are not known. The location of this wreck has not been confirmed and therefore cannot be removed as there is no corresponding geophysical data to confirm or deny its existence as it lies beyond the Irish / UK median line.

4.35. The *Auguste Marie* (**HA4**; Fig. 11) was a French steam vessel sunk on 28 November 1916 by U-18 commanded by Claus Lafrenz. The wreck lies *c.* 48km north of Ushant.

4.36. HMS *Woodpecker* (**HA9**; Fig. 10) was a Royal Navy sloop of the Black Swan class which was torpedoed on 20 February 1944 by U-256 whilst on convoy duty. The explosion removed the stern of the ship and she sank seven days later whilst under tow. This is one of two possible locations for the wreck. Although the locations have not been confirmed they cannot be removed as there is no corresponding geophysical data to confirm or deny their existence as it lies beyond the Irish / UK median line.

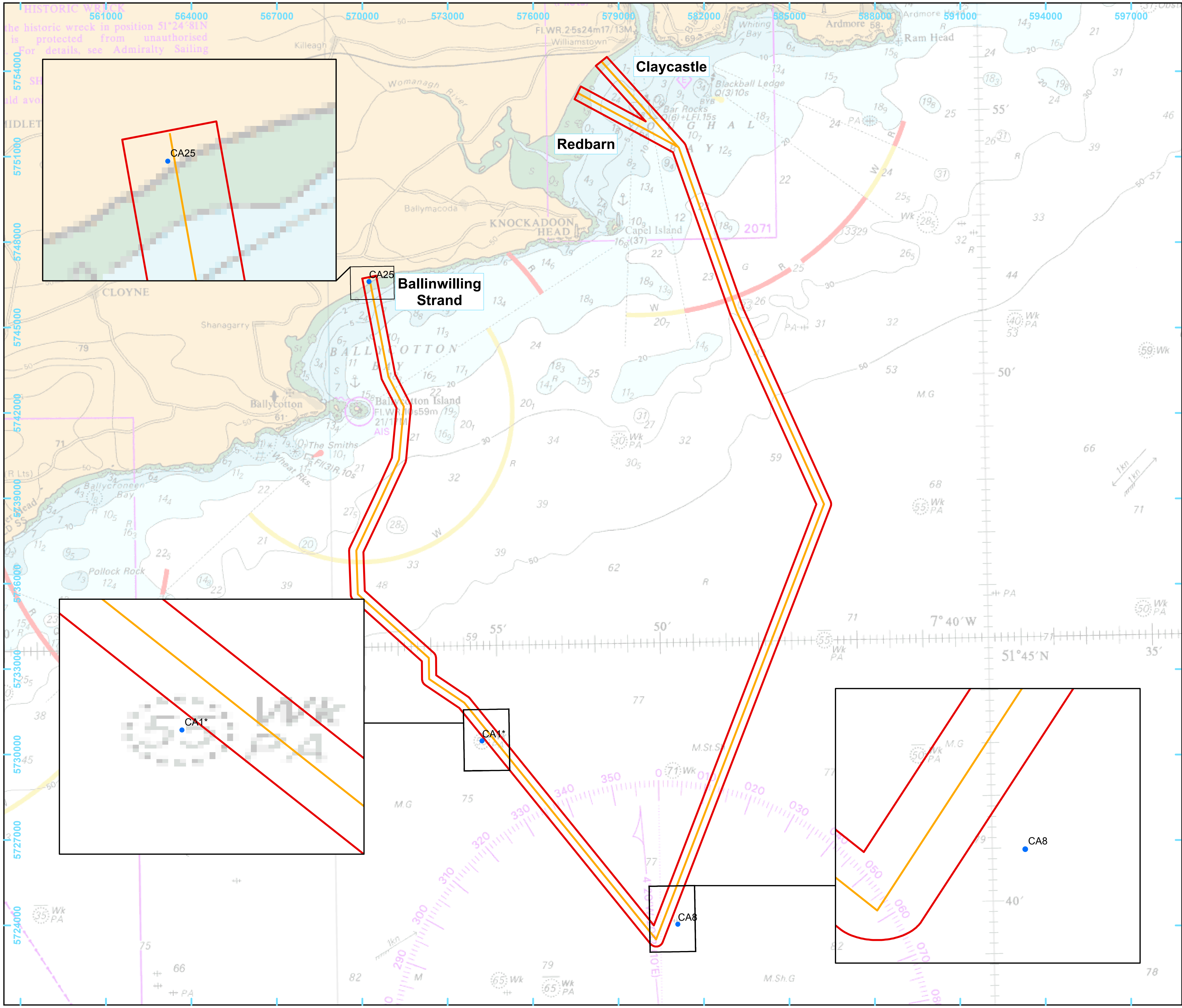
4.37. The *Zane Spray* (**HA10**; Fig. 8) was a leisure yacht which sank on 4 July 1995 whose location has been confirmed.

4.38. There are five further unidentified wrecks (**HA12-16**; Figs 8-11) whose locations are known. **HA16** was classified as a rock (obstruction) by UKHO but has recently been identified (by UAU) as a demasted brig of unknown date and origin and is therefore protected.

4.39. A further six assets are recorded as 'obstructions' (**HA17-22**), only one of which is live (**HA17**; Fig. 10), identified though a sonar contact as lying at 107m depth. The remaining five obstructions (**HA18-22**) are dead, so will not be considered further.

Table 4 Wrecks and obstructions in proximity to the CSC from then Irish territorial limit out to the French coast

HA no.	Name	Type	Date	Status	Latitude	Longitude	Source
3	*Atlit*	Wreck	22/10/1916	Live	48.74908	-4.3346	UKHO
4	*Auguste Marie*	Wreck	28/11/1916	Live	48.96567	-5.08483	UKHO
9	*HMS Woodpecker* (poss)	Wreck	27/02/1944	Live	49.85782	-6.78308	UKHO
10	*Zane Spray*	Wreck	04/07/1995	Live	51.31717	-7.64567	UKHO
11	*Honeydew*	Wreck	11/01/2007	Live	50.95	-7.46667	UKHO
12	Unknown	Wreck	Unknown	Live	48.98233	-5.11983	UKHO
13	Unknown	Wreck	Unknown	Live	51.6625	-7.82817	UKHO
14	Unknown	Wreck	Unknown	Live	49.33703	-6.01112	UKHO
15	Unknown	Wreck	Unknown	Live	49.23425	-5.78732	UKHO
16	Unknown	Wreck	Unknown	Live	50.74167	-7.35833	UKHO
17	Foul	Obstruction	Unknown	Live	49.53314	-6.43117	UKHO



Legend

N

- Wrecks and obstructions
- 500m wide CSC
- Cable Route

0 5km

Coordinate System: WGS 1984 UTM Zone 29N
Projection: Transverse Mercator
Datum: WGS 1984
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -9.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

Service Layer Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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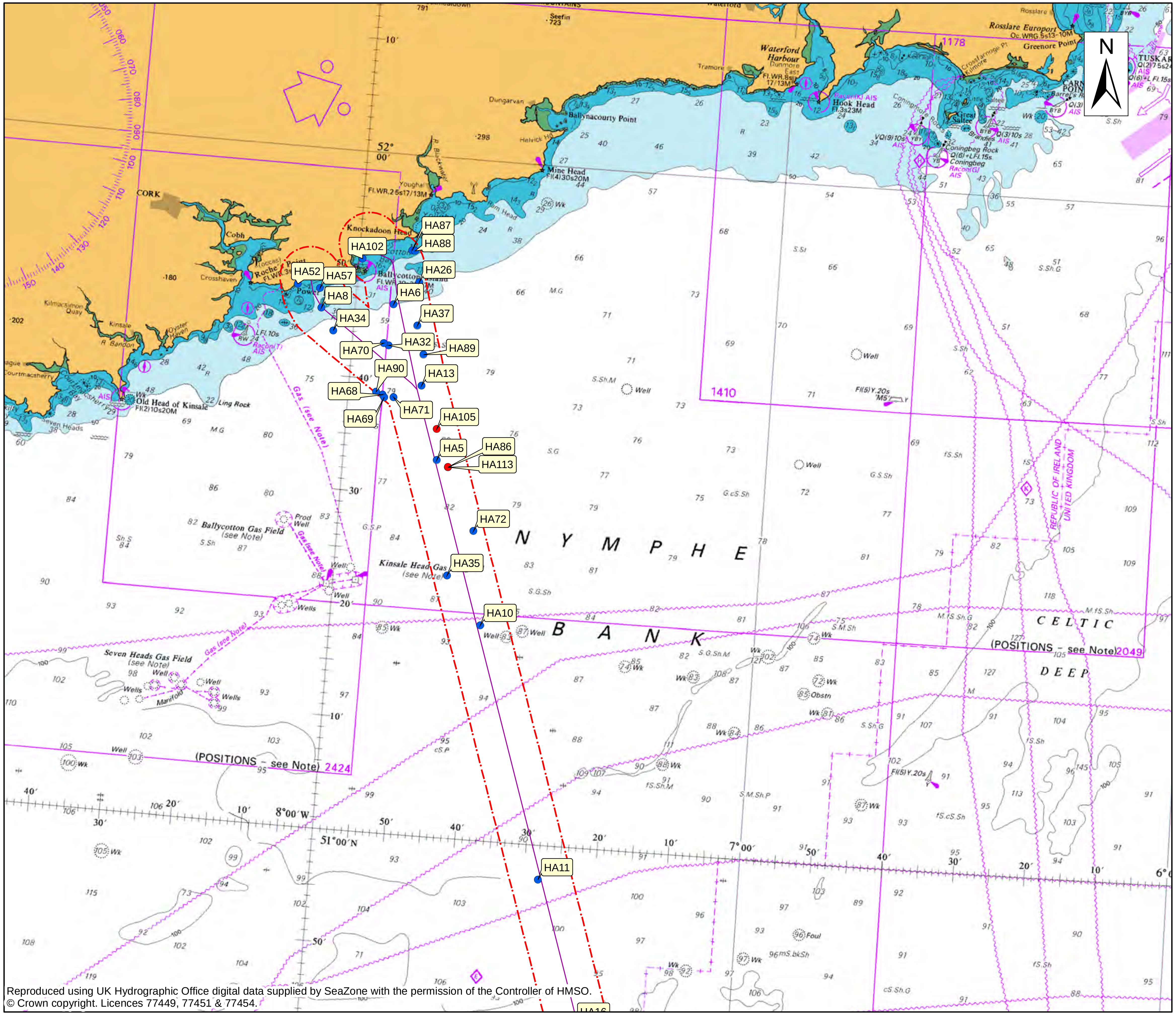
PROJECT TITLE
Celtic Interconnector

FIGURE TITLE
Wrecks, obstructions and findspots within or in proximity to the CSC in Irish territorial waters

DRAWN BY	RLF	PROJECT NO	770617	FIGURE NO.
CHECKED BY	MTW	DATE	16/05/2019	7
APPROVED BY	MTW	SCALE@A3	1:125,000	



HEADLAND ARCHAEOLOGY

Key

- Obstrn
- Wreck
- Marine Survey Route
- 5km Search Area

Kilometers

0 20

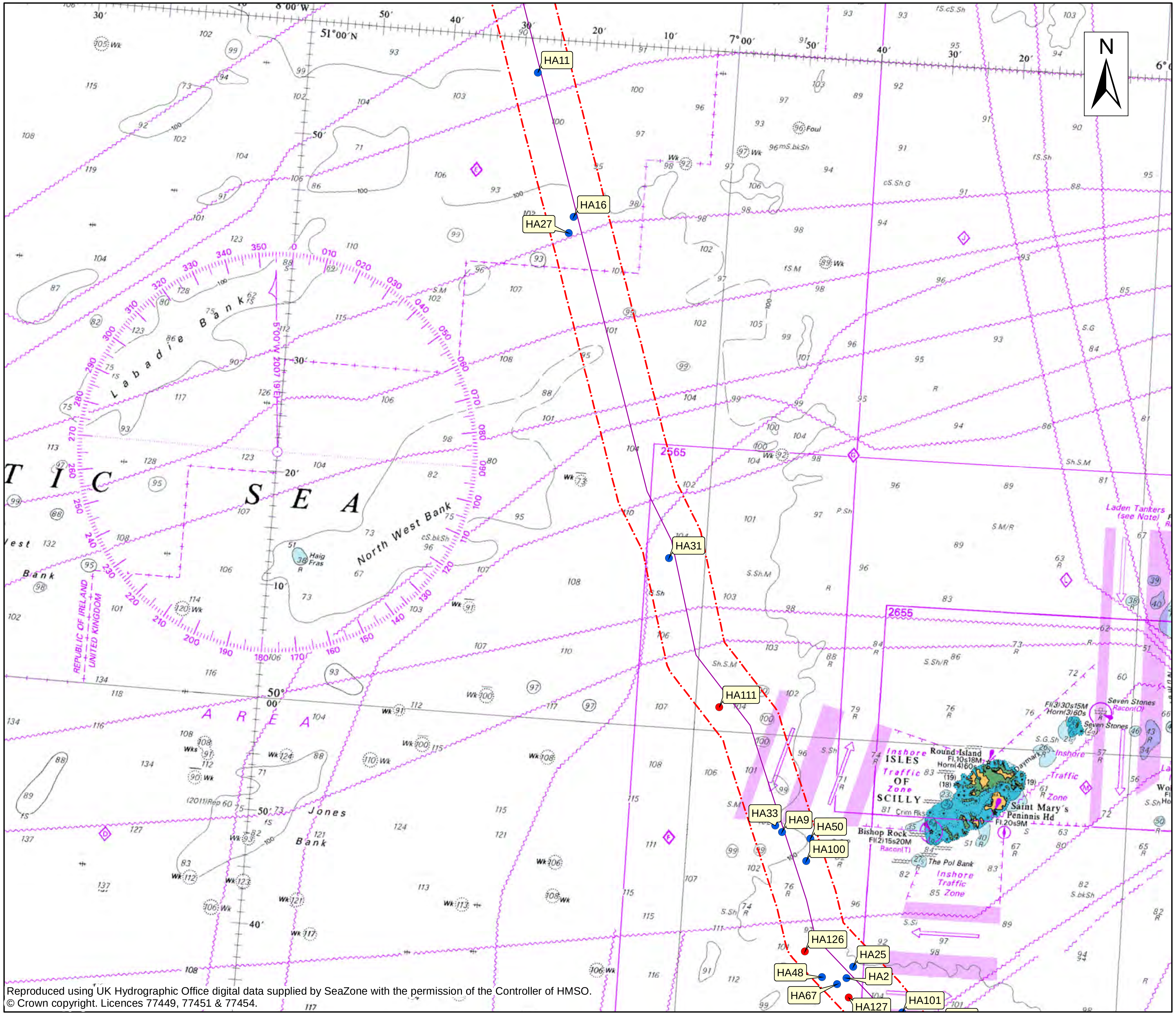
1:625,000

Ireland-France Celtic Interconnector [EIFI13]

DRAFT

EIFI13

Figure 8 Original map of wrecks and obstructions within the CSC and WSA in Irish waters, provided by Headland Archaeology (2015). No alterations have been made regarding revised routes and redundant sites.



HEADLAND ARCHAEOLOGY

Key

- Obstrn
- Wreck
- Marine Survey Route
- 5km Search Area

Kilometers

0 20

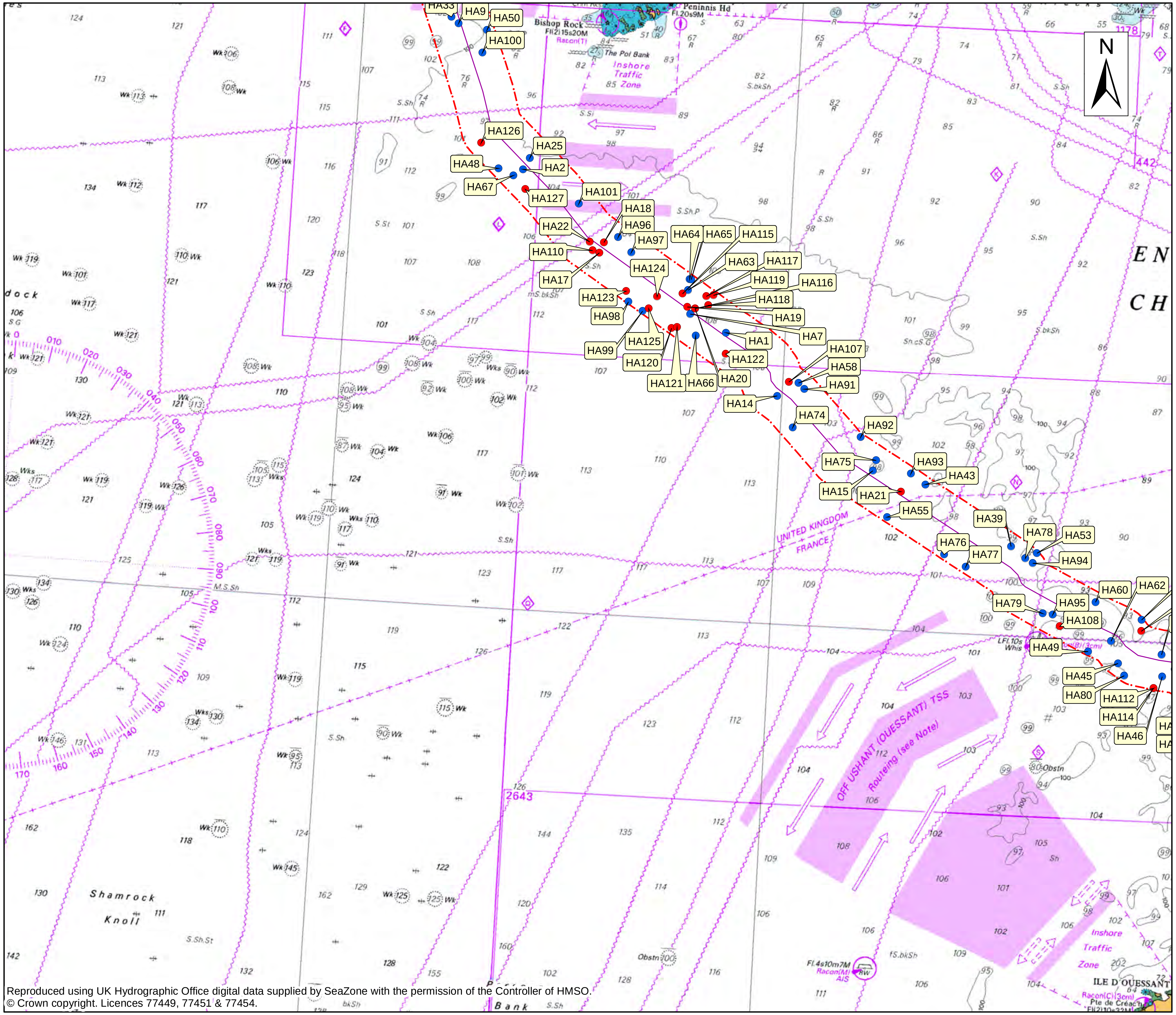
1:625,000

Ireland-France Celtic Interconnector [EIFI13]

DRAFT

EIFI13

Figure 9 Original map of wrecks and obstructions within the CSC and WSA from Irish / UK median line to French waters, provided by Headland Archaeology (2015). No alterations have been made regarding revised routes and redundant sites.



HEADLAND ARCHAEOLOGY

Key

- Obstrn
- Wreck
- Marine Survey Route
- 5km Search Area

Kilometers

0 20

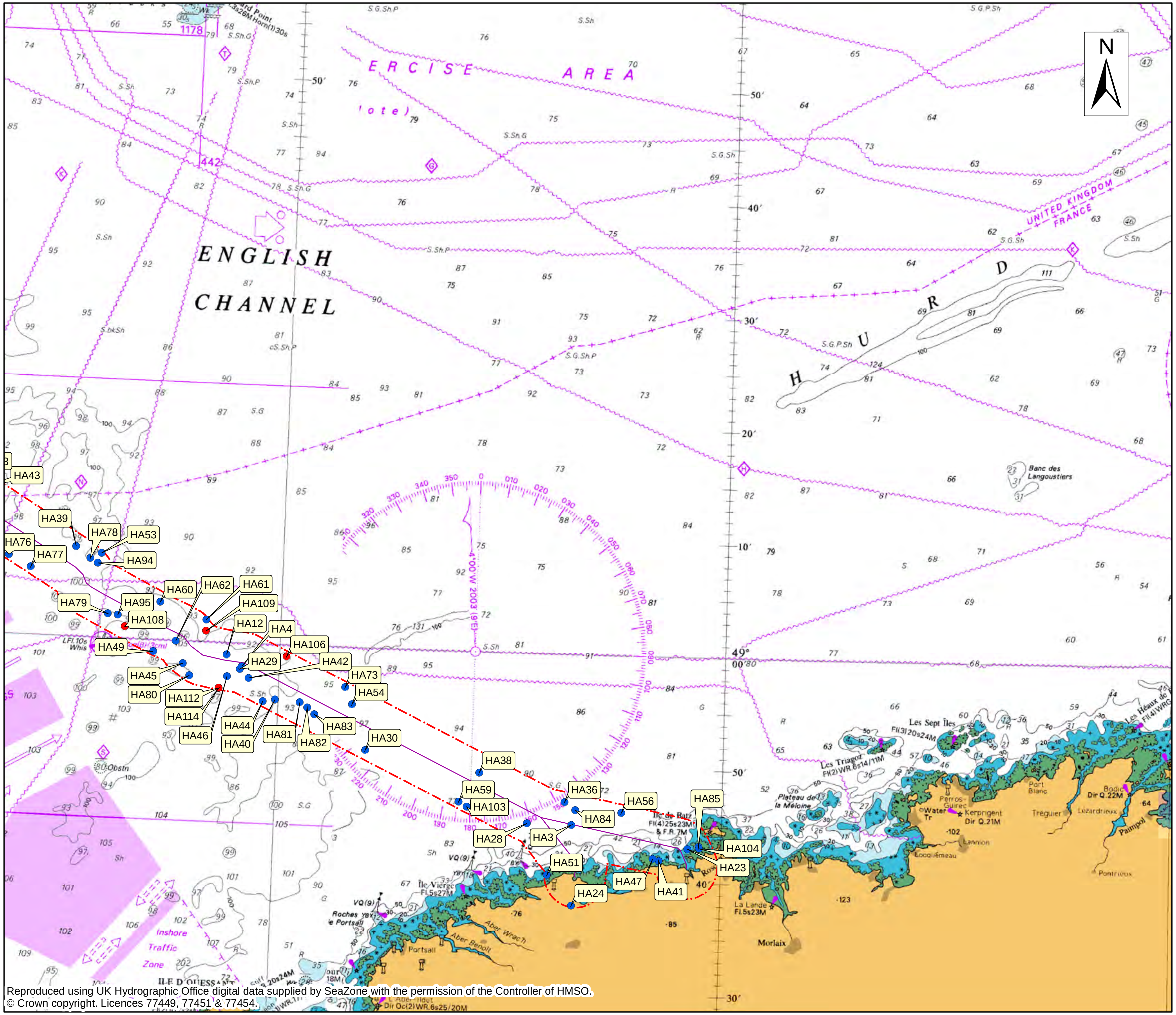
1:625,000

Ireland-France Celtic Interconnector [EIFI13]

DRAFT

EIFI13

Figure 10 Original map of wrecks and obstructions within the CSC and WSA in French waters, provided by Headland Archaeology (2015). No alterations have been made regarding revised routes and redundant sites.



HEADLAND ARCHAEOLOGY

Key

- Obstrn
- Wreck
- Marine Survey Route
- 5km Search Area

Kilometers

0 20

1:625,000

Ireland-France Celtic Interconnector [EIFI13]

DRAFT

EIFI13

Figure 11 Original map of wrecks and obstructions within the CSC and WSA in French territorial waters, provided by Headland Archaeology (2015). No alterations have been made regarding revised routes and redundant sites.

Foreshore survey results

Walkover survey

Ballinwilling Strand

4.40. A series of features relating to sea defences (Table 5) were identified during the walkover survey conducted by Headland Archaeology (2015: 5).

Table 5 Features identified at Ballinwilling Strand in 2015 walkover survey by Headland Archaeology

ID	Latitude	Longitude	Material	Description
101	51,51.982	-7,58.690	Concrete	Cut water, 0.40m wide, 4m visible extending from beach, aligned SE-NW, constructed from concrete with iron reinforcing bars.
102	51,51.949 51.51.992	-7,58.829 -7,58.636	Wooden piles/ Stone	A series of wooden piles driven into the beach, running for approximately 180m, aligned with the cliff edge and forming a retaining barrier for a deposit of large white rounded stones. The piles have worn down and some of the stones have spread down the beach.
103	51,51.560 51,51.580	-7,58.510 -7,58.460	Concrete	Concrete and stone access slipway aligned with the cliff edge. The structure provides access to the beach via a long ramp; the lower quarter has been recently damaged. The external sea face has been reinforced with wooden facing.

Claycastle beach

4.41. A series of exposed peat deposits (**CA3008-CA3011**) were observed in the inter-tidal zone in the south-west of the survey area (Table 6 and Figs 12 & 13). These peat deposits included evidence of plant remains (tree roots; **CA3002-CA3005**), as well as evidence of excavation in the form of recti-linear cuts (**CA3007**), possibly for use as *fulachtai fia*.

4.42. An eroded and heavily encrusted circular object, possibly a pot (**CA3001**) lying half exposed in the intertidal zone (Fig. 13) was also recorded. It could, possibly, be the fossilised remains of a hollowed-out trunk but this seems less likely as the other wooden remains associated with the peat do not appear fossilised.

4.43. This section of beach also included the remains of eight dilapidated wooden groynes (**CA3012-CA3018**) that were relatively evenly spaced (c. 60m apart) in the inter-tidal zone (Fig. 14).