

**PROPOSED MARINE SITE INVESTIGATION FOR THE
CONSTRUCTION OF THE OUTFALL FOR THE
PROPOSED ARKLOW WWTP**

STAGE 1 APPROPRIATE ASSESSMENT SCREENING STATEMENT

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Prepared for

ARUP

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1. Introduction

The main aim of the Arklow Sewage Scheme is to replace the discharge of raw sewage to the Avoca River with treatment of the wastewater to such a level that it complies with national and EU standards. The proposed location for the Waste Water Treatment Plant (WWTP) is on a site at Ferrybank, Arklow immediately adjacent to the North Quay and the sea. The final effluent will discharge into the Irish Sea via a 900m long outfall pipe with a diffuser section at its end.

A number of surveys are required to provide information for the preparation of both the Environmental Impact Statement (EIS) and to aid in and inform the design of a long sea outfall for the Arklow Sewage Scheme - Marine Outfall. This Appropriate Assessment Screening Statement has been prepared to provide additional information on the proposed surveys, for inclusion with the Foreshore Licence Application for the proposed surveys. Eleanor Mayes Ecological Consultant has been retained by Arup to prepare this Appropriate Assessment Screening Statement.

The proposed works have an estimated duration of 2 months on site, and are anticipated to take place between May and August 2016. Surveys will be carried out in the estuary of the Avoca River, to the east of Arklow Bridge, and in coastal waters offshore.

2. Detailed description of the proposed site investigations

Geotechnical Investigations, Archaeological Surveys, and Ecological Survey Benthic Sampling will be carried out to provide information for the preparation of both the EIS and the detailed design of the Arklow Wastewater Treatment Plant (WWTP) outfall. The coastal offshore survey area for geotechnical and archaeological surveys is shown in Figure 1, and covers an area of c. 0.25km², extending from the existing rock armoured shoreline. The Admiralty Charts suggest that water depth is less than 15m in the survey area. The Avoca River Estuary survey area is shown in Figure 2. The survey methodologies are described below.



Figure 1. Arklow proposed WWTP site and outfall survey area (0.25km²).

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The proposed works have an estimated duration of 2 months on site, and are anticipated to take place between May and August 2016, and shall include the following activities:

- 1. Geotechnical Investigations**
 - Bathymetry
 - Geophysical surveys
 - Intrusive ground investigations: Cable percussive and drilled boreholes carried out from a jack up barge
- 2. Archaeological Surveys**
 - Archaeological surveys using geophysics
 - Archaeological dive surveys of the quay walls and river bed in the estuary
- 3. Ecological sampling through the collection of grab samples.**

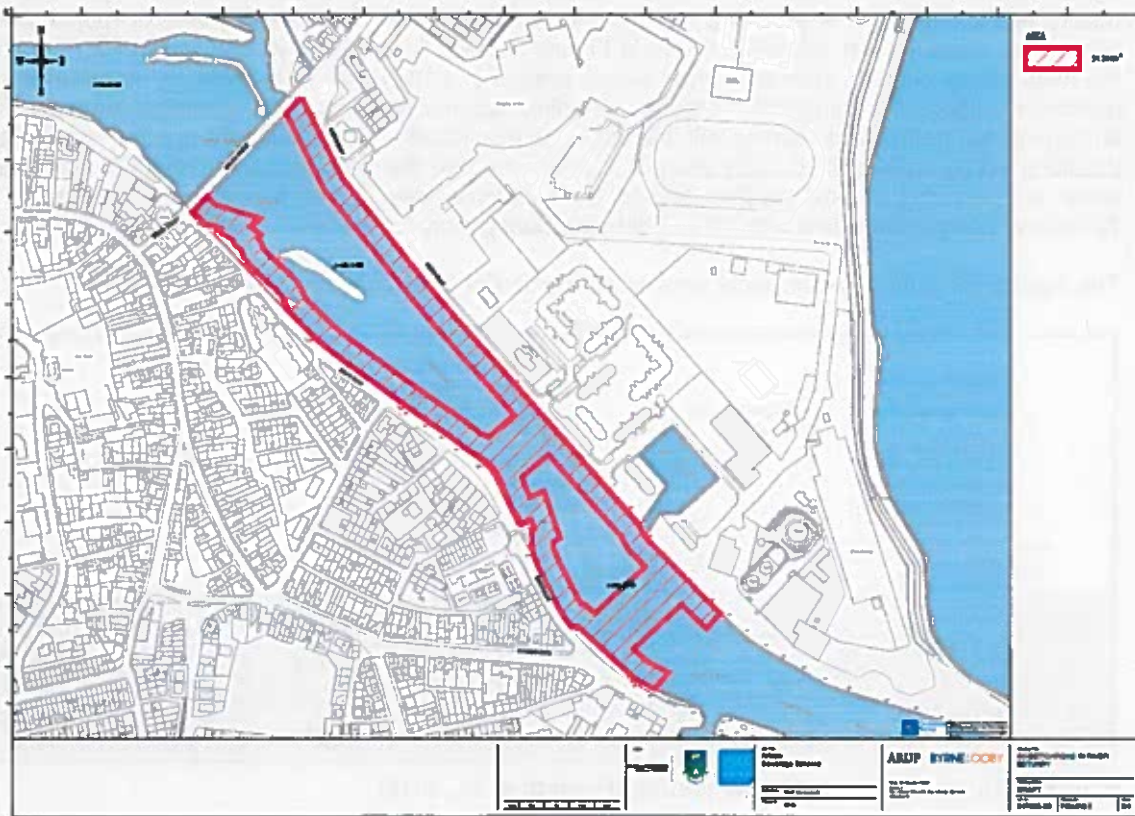


Figure 2. Survey areas within the Avoca River Estuary in Arklow (31,200m²)

2.1. Geotechnical Investigations

2.1.1. Bathymetry

An Orkney 19ft boat with outboard engine will be used on site.

Soundings will be recorded throughout the survey area along predefined survey lines. Depths will be obtained using an Odom Hydrotrac or SonarMite digital echo sounder (frequency 200 KHz). The echo

sounder measures depths to the nearest cm ($\pm 0.1\text{m}$ accuracy) and outputs this data to a laptop where hydrographic software (Hypack13) stores the information.

Calibration of the sounder would be by bar-check method pre/post survey and with any change of location over the full water column to take draft and velocity into account. Sounding lines would be run at specified intervals throughout the survey area perpendicular to the shoreline/contours. Water levels would be observed on site using Trimble VRS RTK. A Valeport 760 tide gauge will be used on site to record the water levels at 5 minute intervals.

Vessel squat will be eliminated by keeping boat speed at low level so that the vessel does not start to plane, typical survey speed 2-3 Knts. Trimble VRS will be used on site for positioning.

2.1.2. Geophysical surveys

The objectives of the proposed geophysical surveys are to map the type and thickness of the sediment layers, determine sediment stiffness, map the depth to bedrock, map variation in bedrock type and rock quality, and to determine engineering parameters across the outfall pipeline study area of approximately 0.25km^2 in coastal water offshore, shown in Figure 1. Geophysical surveys will also be carried out in the Avoca River estuary, in an estimated survey area of c. 3.1ha (Figure 2). These works will involve a number of different geophysical methods, including seismic reflection and refraction methods. The findings of the geophysical survey will influence the final location of the offshore ground investigation locations within the identified study area. It is estimated that the geophysical surveys will take five to seven working days to complete (two days for bathymetric survey, five days for seismic surveys) during 12 hour working shifts falling within daylight hours during summer months.

The equipment used in geophysical surveys will be similar to that shown in Figure 3 below.

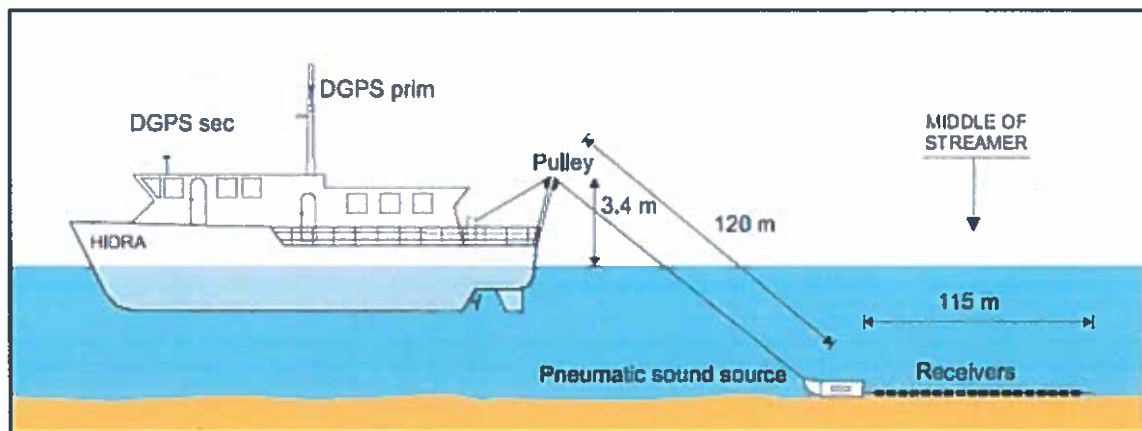


Figure 3. Typical offshore MASW testing (Paoletti et al., 2010)

Multichannel Analysis of Surface Waves (MASW)

MASW is a seismic survey technique that utilizes Surface waves (Rayleigh waves) to determine the elastic properties of the shallow subsurface ($<15\text{m}$). The MASW method employs multi-channel recording and processing techniques. An airgun is used to generate vertical ground motions, which are measured using low frequency hydrophones, and recorded using either a conventional seismograph, oscilloscope or spectrum analyser.

Sub Bottom Profiler

The sub bottom profiler survey is a seismic survey technique that utilises a single channel reflection method to provide information on the stratigraphy of the sedimentary units and to determine the morphology of the bedrock.

Seismic refraction profiling

Seismic refraction profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made.

2.1.3. Contractor's standard management conditions for bathymetry and geophysical surveys

Specific sound propagation data are not currently available for all of the equipment to be used by the contractor. The contractor's conditions of engagement will specify that a qualified Marine Mammal Observer shall be appointed to monitor for marine mammals and to log all relevant events during the geophysical investigations. Seismic surveying shall not commence if marine mammals are detected within a 1,000m radial distance of the sound source. For bathymetric survey only, surveying shall not commence if marine mammals are detected within a 500m radial distance of the sound source.

The Operations Reports and Marine Mammal Observer Reports will be prepared and submitted to the regulatory agency within 30 days, as required. The Marine Mammal Observer Reports will also be copied to the project team for reference to inform other site investigation surveys and baseline studies.

2.1.4. Intrusive ground investigations

The marine ground investigation works will extend across the study area of the proposed marine outfall, as shown in Figure 1, and within the Avoca River estuary (Figure 2). The marine ground investigation will comprise of the collection of sediment and bedrock cores. These works will provide a greater understanding of the benthic (sea floor, the sediment surface and sub-surface layers) and bedrock character along the proposed outfall route. Cable percussion boreholes will be carried out in the study area followed by rotary core drilling at the same location to obtain samples of the firm to hard cohesive sediments and bedrock cores. It is estimated that these works will have a duration of 30 days, investigating 10 individual locations with an estimated works duration of three days at each location. Work will be carried out during 12 hour working shifts falling within daylight hours during summer months.

The exact locations of the boreholes shall be confirmed prior to commencement of these works, and will be influenced by the results of the offshore geophysical surveys. Further investigations are also anticipated in the river estuary, with the relevant area shown in Figure 2 with a red hatch. These investigations will be carried out to inform the selection of crossing points for the siphon.

Soft sediment samples will be taken using a cable percussion-operated core, and the hard rock samples will be taken with a rotary corer. Two drilling rig types will be required to accommodate the selected sampling techniques.

The chosen vessel housing the drill rig and associated drilling equipment will be towed into position over the proposed sampling locations using a tug boat. The extendable legs will be deployed into the foreshore/seabed for stabilisation. This will enable the cable percussion and drilling works to be undertaken from a stable platform, and will avoid the rig being affected by tidal fluctuations.

Cable percussion boreholes

All boreholes will be advanced by cable percussion boring until rock level is reached, which is expected to be in the region of 6.0m to 10.0m. The cable percussion rig will be used for soft sediment samples. Once the chosen vessel is set up over the borehole location this method of investigation will involve driving metal casing into the seabed until rock head is encountered. Exploratory holes will be approximately 200mm in diameter.

Site Investigation soft sediment sampling will include granulometry and assessment of current levels of sediment contamination in estuarine and coastal sediments at Arklow. Sampling and analytical protocols will follow the Guidelines for the Assessment of Dredge Material for Disposal in Irish Waters (Marine Environment and Health Series, No. 24, 2006, Marine Institute) as regards contaminants to be determined, and threshold levels relevant to disposal options during the construction phase of the proposed WWTP and associated interceptor sewers, pipelines, siphon, and sea outfall.

Rotary cored boreholes

Rotary drilling techniques are used where boreholes are required in bedrock. The rotary drilling will continue in the same position as the cable percussive borehole to depths up to a maximum depth of 55.0m below existing sea bed level. Continuous rock cores will be recovered and removed for analysis. The hole drilled will be approximately 150mm in diameter and the rock will be backfilled with cement bentonite grout to rock head. Natural consolidation of soft sediments will be used to backfill the remaining borehole above rock level.

It is not proposed to use oil-based drilling fluids. A standard water flush will be used to lubricate and cool the drilling process; any water introduced will be re-circulated within the borehole casing and this will minimise turbidity in the water column in the vicinity of ground investigation works.

In-situ testing

In-situ Standard Penetration Testing (SPT) shall be carried out. SPT will be carried out in boreholes just before the recovery of bulk samples and involves driving a standard rod into the ground at the bottom of a borehole by using a slide hammer. No samples are collected during this operation.

Contractor's standard management conditions for Intrusive ground investigations

Specific sound propagation data are not currently available for the equipment to be used in intrusive ground investigations. The contractor's conditions of engagement will specify that a qualified Marine Mammal Observer shall be appointed to monitor for marine mammals and to log all relevant events during the intrusive ground investigations. Since cable percussion equipment can be classified as pile driving, use of this equipment shall not commence if marine mammals are detected within a 1,000m radial distance of the sound source. Use of rotary drilling equipment alone shall not commence if marine mammals are detected within a 500m radial distance of the sound source.

The Operations Reports and Marine Mammal Observer Reports will be prepared and submitted to the regulatory agency within 30 days, as required. The Marine Mammal Observer Reports will also be copied to the project team for reference to inform other site investigation surveys and baseline studies.

2.2. Archaeological Surveys

The survey specification must conform to the DAHG's recommendations for marine geophysical survey for archaeological purposes. In addition, the archaeological marine geophysical survey should be carried out across the project area at a spacing of no less than 20m line spacing E/W + 100m line-spacing N/S.

The specific survey techniques required are:

1. Side-scan sonar
2. Marine Magnetometry
3. Sub-Bottom Profiling
4. Bathymetry
5. Dive survey

It is envisaged that all marine geophysical surveys will be carried out during one to three days, subject to weather conditions. These surveys will be scheduled for calm weather conditions. A Marine Mammal Observer (MMO) will be present before and during the sub-bottom profiling, marine magnetometry, bathymetric survey, and sidescan sonar elements of the work, to ensure compliance with the Department of Arts, Heritage and the Gaeltacht 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters' (January 2014), issued as an official guideline and code of practice under Regulation 71 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011). The Operations Reports and Marine Mammal Observer Reports will be prepared and submitted to the regulatory agency within 30 days, as required. The

Marine Mammal Observer Reports will also be copied to the project team for reference to inform other site investigation surveys and baseline studies.

2.2.1. Side Scan Sonar

Side scan uses a sonar device that emits fan-shaped pulses down toward the seafloor across a wide angle perpendicular to the path of the sensor through the water. The intensity of the acoustic reflections from the seafloor of this fan-shaped beam is recorded in a series of cross-track slices. When stitched together along the direction of motion, these slices form an image of the sea bottom within the swath. Survey lines will be streamed at 20m line spacing parallel to the proposed pipeline route within the survey area.

An L3_Klein System 3000 simultaneous dual frequency side-scan sonar system will be employed for the side-scan sonar survey. This system operates at 100kHz and 500kHz simultaneously, thereby providing a greater possibility of detecting objects and providing a clear image of the seabed. Data from both frequencies is logged digitally using "SonarPro" software and either or both datasets can be interpreted during post-processing.

2.2.2. Marine Magnetometry

A Geometrics G881 marine magnetometer will be employed for this aspect of the survey. The G-881 system is particularly well suited for the detection and mapping of all sizes of ferrous objects. It is an extremely high resolution Caesium vapour, small size, system for professional surveys. The G-882 is focussed for operation in small boat, shallow water surveys. The magnetometer survey will be carried out simultaneously with the side-scan sonar survey and over the same planned survey lines.

2.2.3. Sub Bottom Profiling

Sub Bottom profilers use powerful low frequency echo-sounders to provide profiles of the upper layers of the ocean bottom. These systems are particularly useful for the detection of palaeolandscapes. It is proposed to use a Datasonics chirp sub-bottom profiling system. Survey lines will be streamed at 20m line spacing parallel to the proposed pipeline route. Additional cross lines will be surveyed as required.

2.2.4. Bathymetric survey

Bathymetric data will be acquired using a Knudsen 320M simultaneous dual frequency (33kHz, 210kHz) precision survey echosounder. Speed of sound in water will be measured using an Odom Hydrographics Inc. 'Digibar'.

2.2.5. Archaeological Dive Survey

An underwater archaeological survey of the River Avoca Quay Walls and potential siphon crossing points is proposed, and will be carried out by a team of four qualified divers. Hand held metal detectors and GPS receivers will be used during the dive survey.

2.3. Marine ecology – benthic survey

It is estimated that 13 benthic stations will be examined for fauna and sediment (3 within the estuary and 10 outside, Figure 4). One grab will be taken to collect data on the invertebrate fauna and a second to obtain a sample for sediment analysis using a Van Veen or Day Grab (0.1m²). The macroinvertebrate samples will be sieved on-board the survey vessel using a seawater hose and a 1 mm sieve, with the residue placed in labelled container, fixed with formalin and transported back to the laboratory for processing.

Granulometric analysis will be carried out in order to obtain a picture of the particle size distribution of the sediment in the area (2 mm – 0.063 µm fractions) using dry sieving techniques. This, in conjunction

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with the species lists will provide valuable information as to the nature of the sediment characteristics. The total organic carbon content of the sediment at each site will also be calculated, using loss on ignition (LOI) techniques. This analysis will be carried out by an appropriately accredited laboratory.

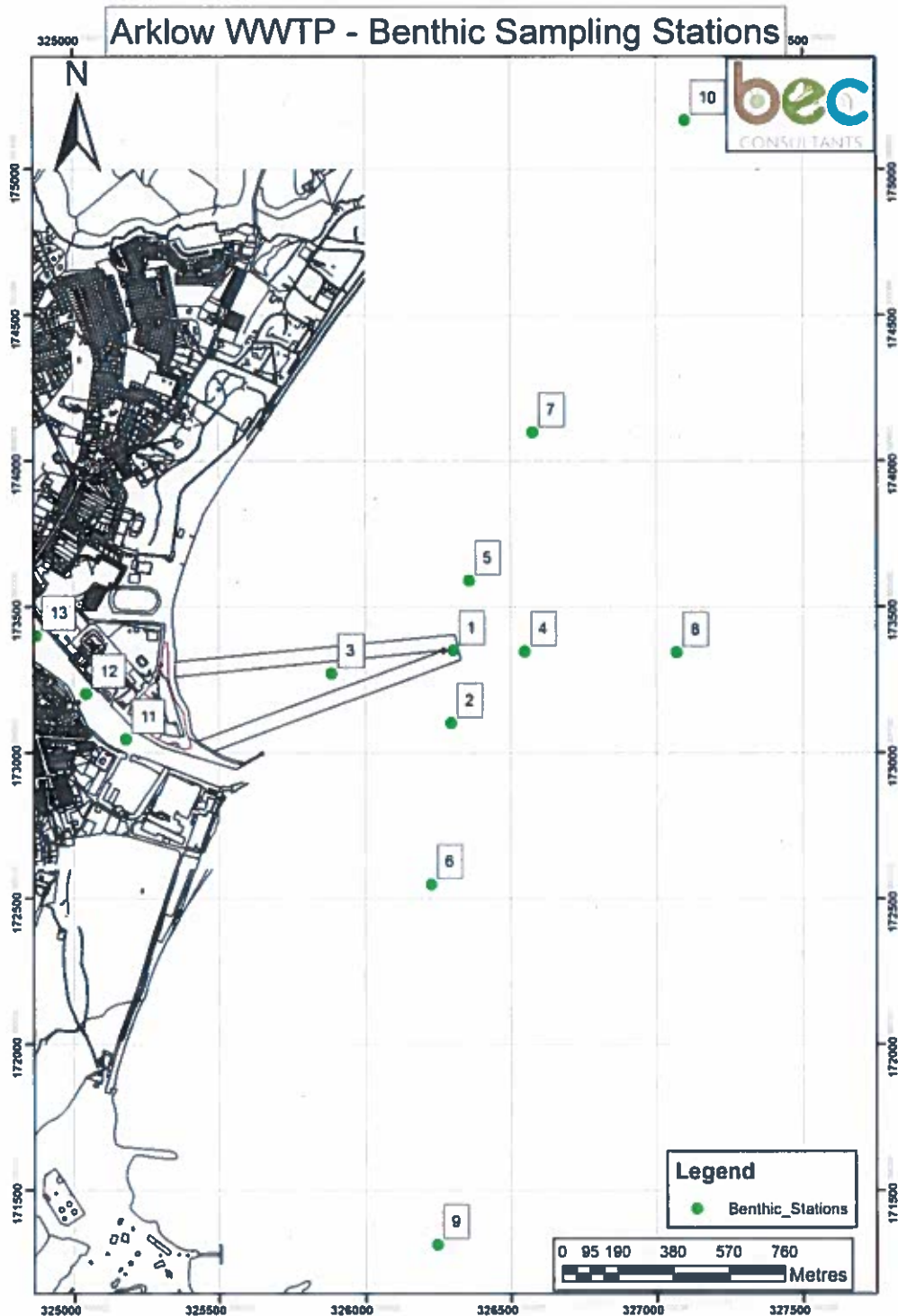


Figure 4. Marine ecology benthic survey sampling stations.

3. Statement of authority

This Appropriate Assessment Screening Statement was prepared by Eleanor Mayes, Ecological Consultant.

Eleanor Mayes, Ecological Consultant, graduated in 1978 with a B.A. (Mod.) in Natural Science from Trinity College Dublin, specialising in Zoology. She also holds an M.Sc. in Zoology from Trinity College Dublin. She has carried out bird surveys and related ecological research for governmental and non-governmental conservation agencies, and has also been involved in policy work on the implementation of conservation legislation, the effectiveness of conservation designations in Ireland, and on cross-compliance issues between the Birds Directive, and Habitats Directive and the Water Framework Directive.

She has worked as an independent ecological consultant since 1989. She has carried out flora and fauna studies, and compiled and contributed to Appropriate Assessments and Environmental Impact Assessments for a wide range of projects including waste water treatment plants and associated pipelines, communications masts, power lines, power stations, flood alleviation schemes, river and canal navigation schemes, and public marinas. She also carries out pre-construction, construction phase, and post construction ecological monitoring as required by planning and licensing approvals for a range of project types.

4. Methodology

4.1. Introduction to Appropriate Assessment

Article 6 of the Habitats Directive (92/43/EU) provides the legislative framework for the consideration of developments which could have an adverse impact on sites which are protected under the Habitats and the Birds Directives (i.e. Natura 2000 sites). The Habitats Directive does not prohibit development in, or affecting sites protected under the Directive. An 'appropriate assessment' must be carried out for a proposed plan or project, to assess the implications of the proposed development in the context of the conservation objectives for the protected site (Article 6 (3)):

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."

The Appropriate Assessment process potentially involves four stages. Stage 1 is a screening process, to establish whether a plan or project has a potential to give rise to adverse impacts on the conservation objectives or integrity of a Natura 2000 site. The first two tests of Article 6(3) are:

- i) whether a plan or project is directly connected to or necessary for the management of the (Natura 2000) site, and
- ii) whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

If the effects are deemed to be significant, potentially significant, or uncertain, then the process must proceed to Stage 2. Screening should be undertaken without the inclusion of mitigation, in accordance with the precautionary principle, and in cases of uncertainty it should be assumed that the effects could be significant (Department of the Environment, Heritage and Local Government (December 2009, revised February 2010).

Stage 2 of the Appropriate Assessment process considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000

site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects (DoEHLG, 2009, revised 2010).

Article 6(4) of the Habitats Directive discusses alternative solutions, overriding public interest and compensatory measures:

"If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted."

In certain cases, mitigation measures and avoidance measures cannot remove an adverse effect on the conservation objectives or integrity of the SPA or SAC. In such cases, Stages 3 and 4 of the Appropriate Assessment process arise. In accordance with the precautionary principle where it is uncertain whether adverse effects will occur, the following steps must be taken:

- Consider alternative solutions that do not have an adverse impact; and
- Declare Imperative Reasons of Overriding Public Interest (IROPI Test); and
- Develop and agree compensation measures.

4.2. Conservation objectives

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats Directive and in the Birds Directive. Special Areas of Conservation (SACs) are designated under the Habitats Directive, and Special Protection Areas (SPAs) are designated under the Birds Directive, to afford protection to the most vulnerable habitats and species. These two designations are collectively known as the Natura 2000 network.

Each Natura 2000 site is designated for the protection of specified habitats and species that occur within the site, these can be referred to as the Qualifying Interests.

The maintenance of the habitats and species identified as Qualifying Interests within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level, and is the primary conservation objective of the designations.

The favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

4.3. Preparation of Appropriate Assessment Screening Statement

This Appropriate Assessment Screening Statement has been prepared having regard to the following guidance and Regulations:

- Department of the Environment, Heritage and Local Government (December 2009, revised February 2010). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities
- European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011)
- Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. ISBN 92-828-9048-1 © European Communities, 2000
- Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EU. DG Environment © European Communities 2002.
- Guidance document on Article 6 (4) of the 'Habitats Directive' 92/43/EEC. (January 2007)
- Guidelines on the information to be contained in Environmental Impact Statements (EPA, 2002).
- Revised Guidelines on the information to be contained in Environmental Impact Statements. EPA, Draft September 2015).
- Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (January 2014). Department of Arts, Heritage and the Gaeltacht

The DoEHLG guidance on Appropriate Assessment states that while any Natura 2000 site within 15 km of a plan area should be considered, for projects this could be much less, and in some cases more. This is to be decided on a case-by-case basis, depending on the nature of the proposal, and on its location in relation to individual Natura 2000 sites and their individual Qualifying Interests and Conservation Objectives, and with reference to the sensitivities of the ecological receptors, and the potential for in combination effects. The area within a 15km radius of the proposed Arklow WWTP outfall was taken as a starting point in this assessment. Potential *ex-situ* effects on highly mobile protected species that have known sensitivities to man-made sound sources, and that occur as Qualifying Interests in more distant Natura 2000 sites, have also been considered.

A desk study was carried out to collate and review existing information on Natura 2000 sites, their Qualifying Interests and Conservation Objectives, and other available information on the marine ecology in the vicinity of the proposed site investigation works and also the Avoca River Estuary. This included data sources such as National Parks and Wildlife Service (NPWS) Wildlife Manuals, the National Biodiversity Data Centre, previous ecological reports prepared relating to the proposed Arklow WWTP, scientific papers, and an internet search of any relevant information.

5. Natura 2000 sites and protected species

5.1. Natura 2000 sites

Natura 2000 sites within 15km of the proposed Ferrybank WWTP site and 900m long sea outfall are shown in Figure 4. Three Natura 2000 sites lie at least partially within 15km.

Buckroney – Brittas Dunes and Fen SAC (Site Code 000729) lies 4.5km to the north, and Kilpatrick Sandhills SAC (Site Code 001742) lies 6.5km to the south, within 15km of the proposed Ferrybank WwTP site and proposed 900m long sea outfall (Figure 5). Part of Maharabeg Dunes SAC (Site Code 001766) lies within 15km of the proposed Ferrybank WwTP site and proposed 900m long sea outfall.

Part of the upper river catchment within Slaney River Valley SAC (Site Code 000781) lies within 15km to the south west. Harbour Seal, a highly mobile protected species that has known sensitivities to man-made sound sources, is a Qualifying Interest that occurs in the estuarine portion of this SAC, and is considered further below.

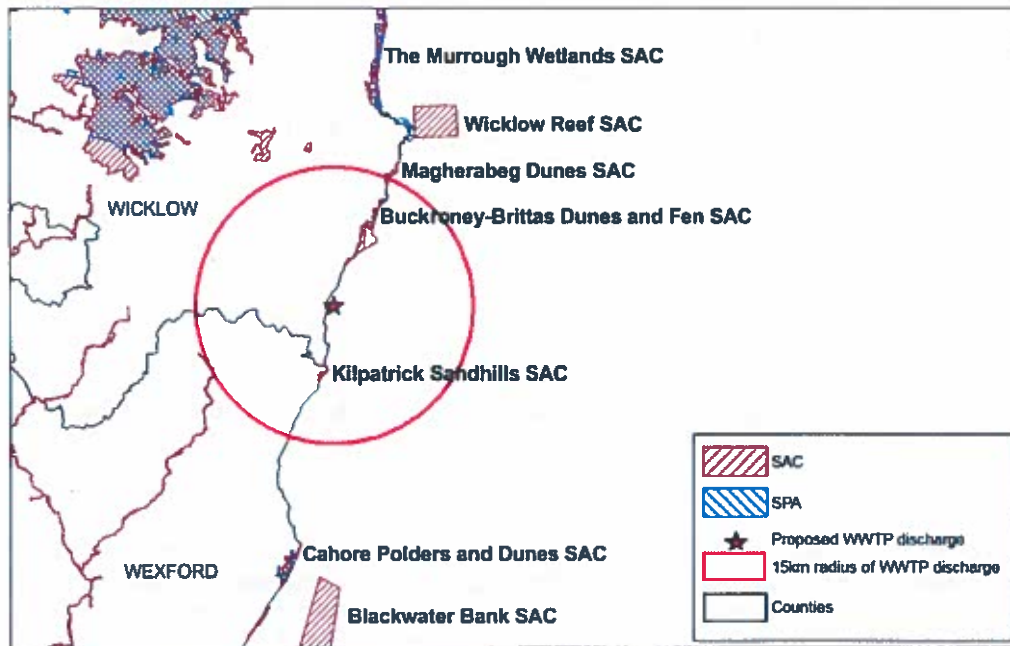


Figure 5. Natura 2000 sites in relation to a 15km radius of the proposed Ferrybank WwTP discharge (900m long)

All of the Habitats Directive Annex 1 habitats that are listed as Qualifying Interests for the three SACs listed in Table 1 are considered to be water dependent (O'Riain *et al*, 2005). Drift line, stony bank, and sand dune habitats have been grouped as coastal onshore habitats in Mayes (2008). These coastal onshore habitats depend on coastal geomorphological and sediment transport processes for their formation and continued existence, and derive their 'water dependent' status, with regard to the Water Framework Directive, from these processes. For this reason, they are considered to be dependent on coastal and transitional water sources (Table 1). However, all of these habitats lie above high water spring tide level, are located at a minimum of 4.5km from the proposed site investigation works, and the conservation status of these Qualifying Interests will not be impacted by the site investigation works at Arklow either directly or indirectly.

The immediate hinterland of sand dune systems often includes low-lying areas of other water dependent habitats. At Buckroney – Brittas Dunes and Fen SAC, these include the fen habitat Alkaline fen (7230) located to the west of the R750, inland and above tidal influence, and a small area of the saltmarsh habitat Mediterranean salt meadow. Annex 1 listed saltmarsh habitats (1330, 1410 and 1420) develop in sheltered areas in estuaries and to the lee of islands and other coastal barriers and spits, where muddy sediments can accumulate. They occur on the upper shore, and tend to form zones or habitat mosaics of halophytic and salt tolerant plant species in relation to the extent of tidal submergence and salinity. Mediterranean salt meadow generally occupies the upper zone of the saltmarsh, adjacent to the boundary with terrestrial habitats, with minimal inundation on spring tide high water. At Buckroney-

Brittas, a small area of Mediterranean salt meadow is described, associated with the Buckrone River (McCorry and Ryle, 2009). These habitats are located at a minimum of 4.5km from the proposed site investigation works, and the conservation status of these Qualifying Interests will not be impacted by the site investigation works at Arklow either directly or indirectly.

Sand dune systems may include the wetland habitats Humid dune slacks 2190, and Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) 2170, which occur in topographic depressions within dune systems and are mainly ground water dependent, generally with a lens of fresh water overlying more saline water. Both of these habitats occur at Buckrone-Brittas Dunes and Fen SAC. These habitats are located at a minimum of 4.5km from the proposed site investigation works, and the conservation status of these Qualifying Interests will not be impacted by the site investigation works at Arklow either directly or indirectly.

Table 1. Qualifying Interests for the three coastal SACs located within 15km of Arklow.

Annex 1 Habitat	Magharabeg Dunes SAC	Buckroney/ Brittas Dunes and Fen SAC	Kilpatrick Sandhills SAC	Main water source
Annual vegetation of drift lines [1210]	✓	✓	✓	c, (t)
Embryonic shifting dunes [2110]	✓	✓	✓	c, (t)
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2120]	✓	✓	✓	c, (t)
Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]*	✓	✓	✓	c, (t)
Atlantic decalcified fixed dunes (<i>Calluno-Ulicetea</i>) [2150]*	✓	✓	✓	c, (t)
Perennial vegetation of stony banks [1220]		✓		c, (t)
Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]		✓		c, t, s, g
Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (<i>Salix arenariae</i>) [2170]		✓		g, c, (t)
Humid dune slacks [2190]		✓		g, c, (t)
Alkaline fens [7230]		✓		g, s
Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220]*	✓			g

Note: * Priority Annex 1 habitats. Main water source based on O'Riain *et al* (2005);
c = coastal; t = transitional; s = surface; g = ground water.

Petrifying springs with tufa formation are listed as a Qualifying Interest at Magherabeg Dunes SAC. These are ground water dependent habitats, developed in this SAC where groundwater seeps through exposed rock above the littoral zone (NPWS Conservation Plan). This habitat is located at a minimum of 15km from the proposed site investigation works, and the conservation status of this Qualifying Interest will not be impacted by the site investigation works at Arklow either directly or indirectly.

5.2. Coastal and marine Annex listed species

5.2.1. Marine mammals

Habitats Directive Annex II listed marine mammals occur in coastal and marine waters off Arklow. The proposed WWTP 900m marine outfall lies within 10km square T27 (Figure 6). Harbour Porpoise (Common Porpoise) *Phocoena phocoena* and Bottle-nosed Dolphin *Tursiops truncatus* have been recorded in 10km square T27. Records held by the National Biodiversity Data Centre include several databases compiled by the Irish Whale and Dolphin Group: IWDG Cetacean Strandings Database, IWDG Casual Cetacean Sightings, and IWDG Ferry Survey sightings Data. Records for coastal and offshore 10km squares to the north and south of Arklow T26, T27, T36, T37, T38, T39, T46, T47, T48 and T49 include the following additional cetacean species: Common Dolphin *Delphinus delphis*, Striped Dolphin *Stenella caeruleoalba*, Risso's Dolphin *Grampus griseus*, and Minke Whale *Balaenoptera acutorostrata* (Data from the Irish Whale and Dolphin Group held by the National Biodiversity Data Centre www.biodiversityireland.ie (downloaded 26.04.2016))

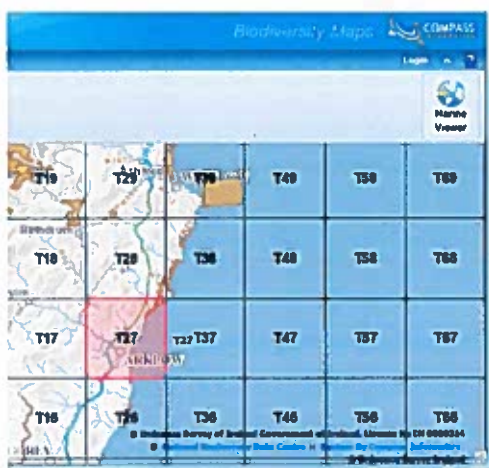


Figure 6. Coastal and offshore 10km grid squares in the Arklow area. SACs are also shown in orange (refer to Figure 5).

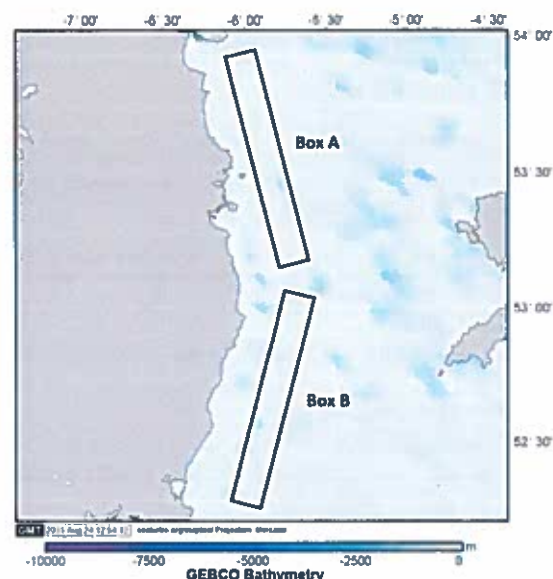


Figure 7. Map of Ireland showing the locations of survey blocks surveyed for cetaceans in 2011. Reproduced from Berrow *et al*, 2011.

The Harbour Porpoise *Phocoena phocoena* is the smallest cetacean species that occurs in Irish waters, and is the most frequently reported and widespread cetacean species. It occurs throughout the year in continental shelf waters, and is frequently recorded in shallow bays, estuaries and tidal channels, in waters less than 20m deep. Line transect cetacean surveys in the Irish Sea in 2011 recorded a total of 57 sightings in Block A in the northern Irish Sea (Figure 7); 51 Harbour Porpoise sightings and six sightings of individual Minke Whales. In Block B in the southern Irish Sea (Figure 7), 14 cetacean sightings were recorded, all Harbour Porpoise sightings. This provided sighting rates of Harbour Porpoise of 0.29 sightings per km or 5.24 sightings per hour in Block A, and 0.10 Harbour Porpoise per km or 1.91 sightings per hour in Block B (Berrow *et al*, 2011). There are three marine coastal areas where high numbers of Harbour Porpoise have been recorded (Figure 8), one off Co. Dublin on the east

coast, and two off the south west coast of Ireland. Three SACs include Harbour Porpoise as a Qualifying Interest: Rockabill to Dalkey Island SAC off the east coast (more than 50km to the north of Arklow), and Blasket Islands SAC and Roaringwater Bay and Islands SAC in the south west of Ireland.

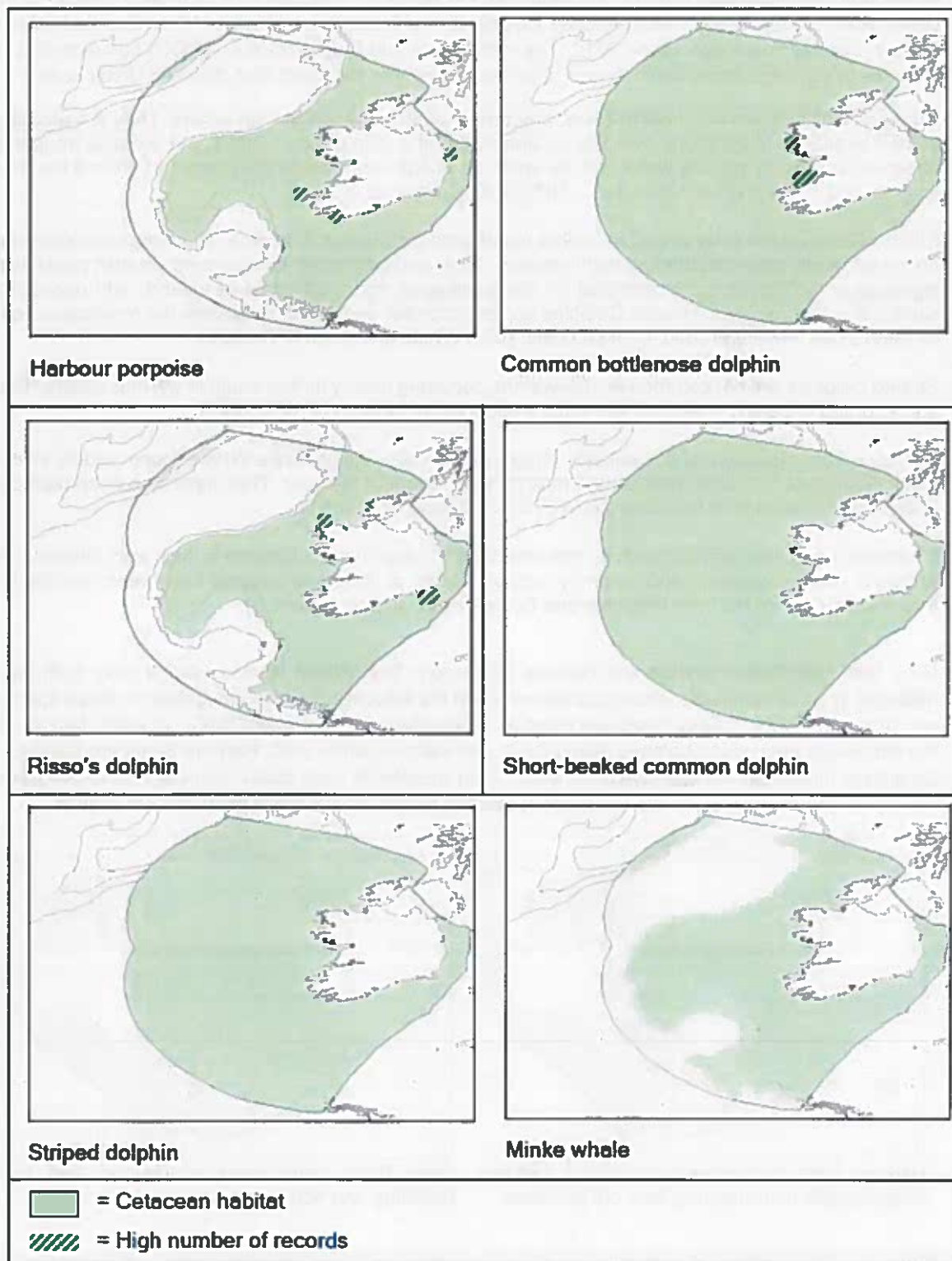


Figure 8. Generalised distribution of cetacean species that have been recorded in coastal waters in the Arklow area. Figures reproduced from Department of Arts, Heritage and the Gaeltacht (January 2014); Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters

Bottle-nosed Dolphins have been seen in all Irish waters, particularly along the west coast, where three distinct populations are now recognised: the offshore, inshore and Shannon Estuary populations (see Figure 8). One of the most important resident populations in Europe is the group of 120-140 Bottle-nosed Dolphins living year round in the Shannon; the species is included as a Qualifying Interest of the Lower River Shannon SAC. Bottle-nosed Dolphin is the Qualifying Interest of West Connacht Coast SAC, in Galway and Mayo. Since 2010, The Irish Whale and Dolphin Group (IWDG) has recorded an increase in sightings along the Irish east coast extending into the North Irish Sea and Ulster coast.

Common Dolphins are the most frequently recorded dolphin species in Irish waters. They are recorded in their largest concentrations over the continental shelf and in deeper waters, but are also frequently observed in shallow inshore waters off the south and southwest coasts of Ireland and around the Aran Islands, and in the southern Irish Sea. (NPWS 2013, Ryan et al 2010).

Risso's Dolphins are fairly abundant with a world-wide distribution in tropical and temperate seas, but do not generally penetrate far into high latitudes. They are sighted regularly around the Irish coast, with sightings and strandings concentrated on the south-west and west coast of Ireland, with occasional sightings in the Irish Sea. Risso's Dolphins appear to prefer deep offshore waters but on occasion can be seen close inshore around the Irish coast. (Irish Whale and Dolphin Group).

Striped Dolphins are not common in Irish waters, occurring mainly further south in warmer waters. They are recorded annually, mainly off the south west coast of Ireland (NPWS, 2013)

Evidence from multi-annual surveillance programmes indicate that Minke Whales occur widely in Irish continental shelf and slope waters, and may do so throughout the year. They have also been recorded in the Celtic Sea and the Irish Sea (NPWS, 2013; Berrow *et al* 2011).

Information on cetacean distribution, movements and seasonal occurrence in Irish and international waters is relatively recent, and currently concentrations of individual species have been identified in Irish waters only for Harbour Porpoise and Bottle-nosed Dolphin (Figure 8).

Grey Seal *Halichoerus grypus* and Harbour (Common) Seal *Phoca vitulina vitulina* have both been recorded in small numbers inshore coastal waters in the Arklow area. Important sites for these species are shown in Figure 9. Grey Seals are listed as a Qualifying Interest in ten SACs, of which two are on the east/south east coast: Lambay Island SAC, and Saltee Islands SAC. Harbour Seals are listed as a Qualifying Interest in thirteen SACs of which 2 on east/south east coast: Lambay Island SAC, and Slaney River Valley SAC. These SACs are located at distances in excess of 50km from Arklow.

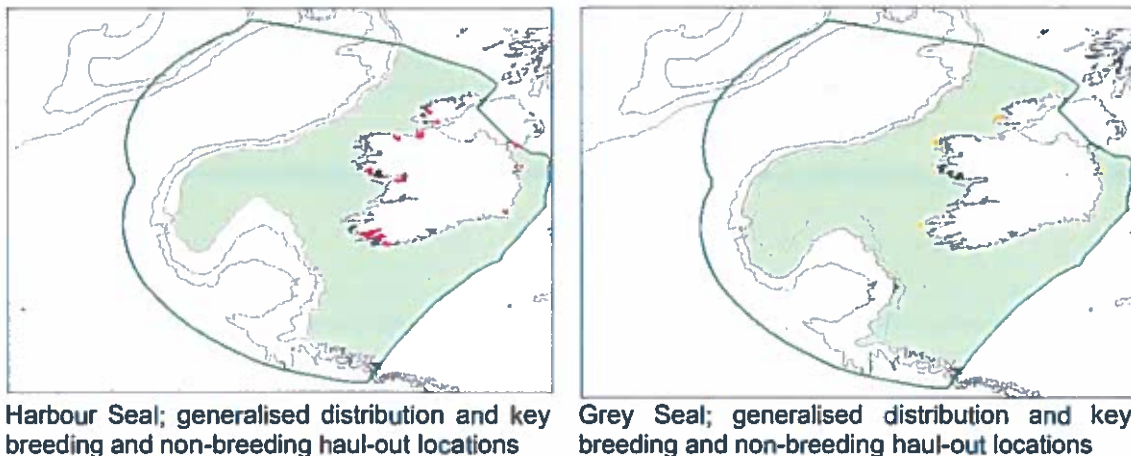


Figure 9. Generalised distribution and key breeding and non-breeding haul-out locations for Harbour Seal (left) and Grey Seal (right). Figures reproduced from Department of Arts, Heritage and the Gaeltacht (January 2014); Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters

5.2.2. Fish

The Habitats Directive Annex II listed fish species that occur in the Avoca River and migrate through its estuary are Salmon, Sea Lamprey and River Lamprey.

5.2.3. Other protected species

With regard to Birds Directive Annex 1 listed bird species, Red-throated Diver *Gavia stellata* has been recorded in nationally important numbers in coastal waters between Brittas Bay and Mizen Head. A peak count of 49 Red-throated Divers was recorded in 1996, with a single Black-throated Diver *Gavia arctica* and two Great Northern Divers *Gavia immer* (Crowe, 2005). Boland and Crowe (2012) do not note Red-throated Diver numbers in coastal waters between Brittas Bay and Mizen Head more recently, though the species is likely to continue to occur. No divers were recorded in coastal waters within 1km of Ferrybank, Arklow during waterbird surveys carried out for the proposed Arklow WWTP in February and March 2016. Divers are primarily wintering migrants to Irish waters. Red-throated Divers are recorded mainly in shallow sandy inshore waters along the south and east coasts of Ireland (Pollock *et al*, 1997).

Kingfishers *Alcedo atthis* occur in the Avoca River catchment, and have been observed at Three Mile Water in Magherabeg Dunes SAC (NPWS Conservation Plan), and are likely to occur at the inflowing rivers at Buckronev – Brittas Dunes and Fen SAC.

Otter signs were not found along the Avoca river bank during Arklow WWTP site selection surveys in April 2015, but Otters are likely to occur in riverine, estuarine and coastal habitats in the Arklow area.

6. Assessment of likely effects of the proposed site investigation works

6.1. Natura 2000 sites

The proposed site investigations that are planned to inform detailed design and EIS studies for the proposed Arklow WWTP are not located within or near to any areas subject to Natura 2000 designations. With reference to the location, nature and scale of the site investigation works proposed at Arklow, there is no potential pathway for adverse direct or indirect effects to arise to any Natura 2000 site or to its *in-situ* Qualifying Interests.

6.2. Protected marine mammals risk assessment

Marine mammal sensory systems are adapted to life in the water or, in the case of seals, both in water and on land. The sound receiving systems of marine mammals have become specialised to meet the physical demands of water and to diving to considerable depth, while retaining many of the characteristics of land mammals (e.g., ear canal, air-filled middle ear, spiral cochlea of the inner ear). Marine mammals rely on sound to navigate, to communicate with one another and to sense and interpret their surroundings.

Cetacean species may currently be distinguished by three groupings related to their known auditory ability and functional frequencies. Seal species that occur in Irish waters, and other pinniped species occurring elsewhere, demonstrate differing auditory ability in air and in water, so from a functional point of view they may be subdivided into two groups: (i) pinnipeds in water, and (ii) pinnipeds in air (Table 2). Further information on marine mammal noise exposure criteria for permanent injury and for disturbance/behavioural response is given in Appendix 2.

Cetaceans			Pinnipeds in water	Pinnipeds in air
Low frequency 7 Hz-22 kHz	Mid-frequency 150 Hz-160 kHz	High frequency 200 Hz-180 kHz	75 Hz-75 kHz	75 Hz-30 kHz
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoises	All species	All species
<i>Species- Ireland</i> Humpback whale Blue whale Fin whale Sei whale Minke whale	<i>Species- Ireland</i> Sperm whale Killer whale Long-finned pilot whale Beaked whale species Dolphin species	<i>Species- Ireland</i> Pygmy sperm whale Harbour porpoise	<i>Species- Ireland</i> Grey seal Harbour seal	<i>Species- Ireland</i> Grey seal Harbour seal

Table 2. Functional frequency ranges in Cetacean and Seal species. Reproduced from Department of Arts, Heritage and the Gaeltacht (January 2014); Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters

Due to the concern regarding levels of anthropogenic sound associated with human activities in the marine environment, there is a growing body of literature and metrics describing the sound pressure level (SPL), sound exposure level (SEL) and other acoustic characteristics associated with specific machinery, vessels and operations, examples of which are given in Appendix 1, reproduced from the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters.

With reference to the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters (Department of Arts, Heritage and the Gaeltacht, January 2014), and to the descriptions of the proposed investigations included in Section 2 of this report, the proposed site investigation works at Arklow fall into the following categories:

Geophysical acoustic surveys

ii) all seismic surveys (including the testing and full operational use of airguns, water guns, sparkers, boomers and vertical seismic profiling [VSP] or checkshot systems) in inshore and offshore Irish waters;

(iii) all multibeam, single beam, side-scan sonar and sub-bottom profiler (e.g., pinger or chirp system) surveys within bays, inlets or estuaries, and within 1,500m of the entrance of enclosed bays/inlets/estuaries;

Intrusive ground investigations

These site investigations involve cable percussion boreholes, and rotary core drilling, and together include sound sources characteristic of both pile-driving and drilling.

Occurrence of marine mammals in the vicinity of the proposed works

Harbour Porpoise, Bottle-nosed Dolphin and Grey Seal have been recorded in the vicinity of the proposed works (10km square T27). This area is not known to hold important concentrations of these species. Identified areas of importance for these species are located at a distance of at least 50km from the proposed works area.

Additional marine mammal species recorded in coastal and offshore waters near Arklow are Common Dolphin, Striped Dolphin, Risso's Dolphin, Minke Whale, and Harbour Seal. This area is not known to hold important concentrations of these species. Identified areas of importance for these species are located at a distance of at least 50km from the proposed works area.

Potential risk to marine mammals

Airguns used in seismic geophysical surveys emit low frequency sound (50Hz) at high Sound Pressure Level 256dB re: 1µPa @ 1m (Appendix 1), within the auditory range of Baleen whales such as Minke

Whale, and capable of causing injury if an animal was within a few metres of the sound source, and a disturbance/behavioural response if an animal was present in the vicinity of the sound source (Table 2, Appendix 2).

Sidescan sonar frequencies of 33kHz and 100kHz are within the auditory ranges of dolphins and Harbour Porpoise. The sonar frequency of 33kHz is also within the auditory range of seals. Sonar frequencies of 200kHz, 210kHz, and 500kHz are above the auditory range of marine mammals (Table 2, Appendix 2). Sound Pressure Level data at 1m distance from the sound source are not currently available for the proposed equipment. Taking the precautionary approach, it is assumed that there is a potential for a disturbance/behavioural response if a sensitive marine mammal was present in the vicinity of the sound source.

Intrusive ground investigations include the use of cable percussion and this is taken to represent the worst case sound scenario, similar to pile driving, and potentially involving Sound Pressure Levels in the range of 192 to 261 dB re: 1µPa @ 1m within the auditory range of all cetaceans and seals, with a potential for causing injury if an animal was within a few metres of the sound source, and a potential for a disturbance/behavioural response if an animal was present in the vicinity of the sound source (Table 2, Appendices 1 and 2).

In-combination activities include existing boat traffic entering and leaving Arklow Port, and existing activities at the quarry at Arklow Head. The site investigation survey areas include estuarine waters, and nearby coastal waters into which the survey area extends from the existing rock armoured shoreline.

Estimation of the numbers of individuals of marine mammal species potentially affected suggests that risk is likely to be low, because the area is not known to be used by important concentrations of marine mammals. However, since marine mammals do occur in the area, it is not possible to rule out a risk of injury or a disturbance/behavioural response to protected marine mammals. The Contractor's Standard Management Conditions requiring the retention of Marine Mammal Observers during geophysical surveys and during intrusive ground investigations included in Section 2 are appropriate. The Marine Mammal Observers retained during the site investigation works will ensure that no marine mammals are present in the estuarine area and trapped there during site investigation works, and that all measures specified in the Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters for Geophysical Acoustic Surveys, Drilling, and Pile Driving, will be fully implemented during the works.

6.3. Other protected species

It is not envisaged that protected fish, birds and Otter noted in Section 5 of this report will be adversely affected by the proposed site investigation works.

7. Natura 2000 Screening Statement

With reference to the detailed description of the proposed site investigation works given in Section 2, including the Contractor's Standard Management Conditions, the limited geographic extent of the project, its location outwith and at a distance from any Natura 2000 site, and the provision of Marine Mammal Observers during the relevant site investigations, there is no potential for the conservation status of any Qualifying Interest of any Natura 2000 site to be adversely affected by the proposal. No adverse impacts on the integrity of any Natura 2000 site will arise as a result of the proposed site investigation works.

It is not considered necessary to proceed to Stage 2 of the Appropriate Assessment process.

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PROPOSED MARINE SITE INVESTIGATION FOR THE CONSTRUCTION OF THE OUTFALL FOR THE PROPOSED ARKLOW WWTP

Wall, D., Murray, C., O'Brien, J., Kavanagh, L., Wilson, C., Ryan, C., Glanville, B., Williams, D., Enlander, I., O'Connor, I., McGrath, D., Whooley, P. & Berrow, S. (2013). Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 - 2011. Irish Whale and Dolphin Group, Kilrush, Co. Clare. 62pp.

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Appendix 1. Examples of general underwater sound information from a range of anthropogenic sources

Appendix 1 - Examples of general underwater sound information from a range of anthropogenic sources, ordered by their potential for introduction of high level sound (based on information in Hildebrand¹; Richardson *et al.*³; OSPAR⁴⁵; Nedwell & Howell⁵²).

Source	Sound Pressure Level dB re: 1µPa @1m	Sound Exposure Level dB re: 1µPa ² -s	Sound Duration seconds	Peak Frequency Hz	Band Width Hz	Direction
Ship Shock Trial (10,000 lbs TNT)	299	302	2 s	Low	Broad	Omni
Explosives (1-100lbs TNT)	272-287	-	0.001-0.01	6-21	2-1,000	Omni
Airgun Array (2000 psi, 8000 in ²)	256	241	0.03 s	50	150	Vertical
Pile-driving (4m diameter monopile)	192-261	210-215	-	-	100-1,000	Omni
Military Sonar (SURTASS/LFA)	235	243	6-100 s	250	30	Horizontal
Multibeam echosounder (hull-mounted)	235	218	0.02 s	12,000	Narrow	Vertical
Super Tanker 337m long @ 18 knots	185	-	constant	23	5-100	Omni
Drilling (Ship/Semi-submersible)	145-191	-	constant	-	1-600	Omni
Dredging (Suction/Hopper dredge)	177	-	constant	80-200	20-8,000	Omni
Acoustic Harassment Device (AHD)	185	185	0.5-2.0 s	10,000	600	Omni
Tug vessel (while towing)	145-170	-	constant	-	37-5,000	Omni
Wind turbine (power output - 1MW)	142-153	-	constant	16	15-20,000	Omni
Fishing vessel (12m long @ 7 knots)	150	-	constant	300	250-1000	Omni
Acoustic Deterrent Device (ADD)	132	127	0.3 s	10,000	2000	Omni

Reproduced from Department of Arts, Heritage and the Gaeltacht (January 2014); Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish Waters

Appendix 2. Marine mammal noise exposure criteria

Appendix 3 - Transcription of marine mammal noise exposure criteria given by Southall *et al.*²³. Table B includes received levels (RL) from multiple pulse and non-pulse sound events reported to elicit significant behavioural responses* in previous studies. [* w.r.t. Irish-occurring species]

A. Criteria for Permanent Injury - estimated values for PTS-onset.

Cetaceans			Pinnipeds	Pinnipeds
<i>Low frequency</i>	<i>Mid-frequency</i>	<i>High frequency</i>	<i>In Water</i>	<i>In Air</i>
7 Hz-22 kHz	150 Hz-160 kHz	200 Hz-180 kHz	75 Hz-75 kHz	75 Hz-30 kHz
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoises	All species	All species
<u>Single Pulse:</u> 230 dB SPL 198 dB SEL	<u>Single Pulse:</u> 230 dB SPL 198 dB SEL	<u>Single Pulse:</u> 230 dB SPL 198 dB SEL	<u>Single Pulse:</u> 218 dB SPL 186 dB SEL	<u>Single Pulse:</u> 149 dB SPL 144 dB SEL
<u>Multiple Pulse:</u> 230 dB SPL 198 dB SEL	<u>Multiple Pulse:</u> 230 dB SPL 198 dB SEL	<u>Multiple Pulse:</u> 230 dB SPL 198 dB SEL	<u>Multiple Pulse:</u> 218 dB SPL 186 dB SEL	<u>Multiple Pulse:</u> 149 dB SPL 144 dB SEL
<u>Non-pulses:</u> 230 dB SPL 215 dB SEL	<u>Non-pulses:</u> 230 dB SPL 215 dB SEL	<u>Non-pulses:</u> 230 dB SPL 215 dB SEL	<u>Non-pulses:</u> 218 dB SPL 203 dB SEL	<u>Non-pulses:</u> 149 dB SPL 144.5 dB SEL

B. Criteria and values for TTS-onset (single pulses only) and Disturbance/Behavioural Response (multiple pulses and non-pulses).

Cetaceans			Pinnipeds	Pinnipeds
<i>Low frequency</i>	<i>Mid-frequency</i>	<i>High frequency</i>	<i>In Water</i>	<i>In Air</i>
7 Hz-22 kHz	150 Hz-160 kHz	200 Hz-180 kHz	75 Hz-75 kHz	75 Hz-30 kHz
Baleen whales	Most toothed whales, dolphins	Certain toothed whales, porpoises	All species	All species
<u>Single Pulse:</u> 224 dB SPL 183 dB SEL	<u>Single Pulse:</u> 224 dB SPL 183 dB SEL	<u>Single Pulse:</u> 224 dB SPL 183 dB SEL	<u>Single Pulse:</u> 212 dB SPL 171 dB SEL	<u>Single Pulse:</u> 109 dB SPL 100 dB SEL
<u>Multiple Pulse:</u> 120-180 dB RL Not applicable	<u>Multiple Pulse:</u> 120-180 dB RL Not applicable	<u>Multiple Pulse:</u> Data unavailable Not applicable	<u>Multiple Pulse:</u> 150-200 dB RL Not applicable	<u>Multiple Pulse:</u> Data unavailable Not applicable
<u>Non-pulses:</u> 120-160 dB RL Not applicable	<u>Non-pulses:</u> 90-200 dB RL Not applicable	<u>Non-pulses:</u> 90-170 dB RL Not applicable	<u>Non-pulses:</u> 100+ dB RL Not applicable	<u>Non-pulses:</u> 110-120 dB RL Not applicable

* Units of measurement:

Sound Pressure Level, SPL (in water): measured in dB re: 1 μ Pa (peak) (flat)
 Sound Exposure Level, SEL (in water): measured in dB re: 1 μ Pa²-s
 Sound Pressure Level, SPL (in air): measured in dB re: 20 μ Pa (peak) (flat)
 Sound Exposure Level, SEL (in air): measured in dB re: (20 μ Pa)²-s

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