Greater Dublin Drainage Project Addendum

Environmental Impact Assessment Report Addendum: Volume 3A Part B of 6

Appendix A9.1 Marine Habitat Assessment Survey Report

Uisce Éireann

October 2023

1 Contents

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Glossary

Abbreviation	Meaning
BSL	Benthic Solutions Limited
DDV	Drop Down Video
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EOL	End of Line
GDD	Greater Dublin Drainage Project
GPS	Global Positioning System
HAS	Habitat Assessment Survey
HSE	Health and Safety Executive
LED	Light Emitting Diode
MOD4.0	BSL MOD4.0 Camera System
RPS	RPS Group Plc
SAC	Special Area of Conservation
SD	Standard Definition
SOL	Start of Line
WGS84	World Geodetic System 1984

2 Introduction

Benthic Solutions Limited (BSL) was commissioned to complete updated marine habitat assessment surveys to inform the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project) Environmental Impact Assessment Report (EIAR) Addendum Report.

An Environmental Impact Assessment Report (EIAR) was prepared for the Proposed Project and submitted for planning in 2018. Chapter 9 (Biodiversity (Marine)) of the EIAR in the 2018 planning application considered marine biodiversity.

As detailed in Chapter 1A (Introduction) in Volume 2A of the Environmental Impact Assessment Report (EIAR) Addendum Report, we have reviewed the Chapter 9 (Biodiversity (Marine)) and the associated appendices of the EIAR submitted with the original 2018 planning application, in the light of:

- Changes to the baseline environment;
- The requirement for updated surveys; and
- Any changes to the law, policy, or industry standards and guidance in the intervening period.

In updating the baseline ecology information for the Proposed Project this was completed cognisant of the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (hereafter referred to as the CIEEM Guideline) (CIEEM 2018), with respect to the validity of baseline data.

This Appendix is a factual account of the update surveys which have been completed for the Proposed Project. The update surveys that have been completed are:

- Wetland Estuary Walkover,
- Offshore Habitat Assessment; and
- Benthic Video Survey.

These surveys were undertaken using an estuary walkover survey and using seabed photography and videography data spanning the length of the proposed outfall pipeline route (marine section), in addition to five transects surrounding and immediately to the south of Ireland's Eye (Figure 2.1).

In addition, the data has been compared with the relevant baseline in Chapter 9 (Biodiversity (Marine)) in Volume 3 Part A of the EIAR in the 2018 planning application to identify any material changes to the baseline conditions in the intervening period. Any identified material changes have then been used to inform Chapter 9A (Biodiversity (Marine)) in Volume 3A Part A of the EIAR addendum.

2.1 Project Information

Client:	Uisce Éireann
Project:	Greater Dublin Drainage Project
Contractor:	RPS and Benthic Solutions Limited (BSL)
BSL Contractor Reference:	2241
Survey Areas:	Irish Sea
Survey Type:	Wetland Estuary Walkover, Offshore Habitat Assessment and Benthic Video Survey
Survey Period:	14/11/22 (Walkover Survey) and 05/01/23 to 10/01/23 (Offshore habitat and video survey)
Survey Vessel:	*Ros Aine*
Survey Equipment:	BSL MOD4.0 camera with freshwater lens, Kongsberg 14-408 camera with freshwater lens

2.2 Background

Detailed marine environmental surveys were previously carried out along the proposed outfall pipeline route (marine section) and surrounding environments by BSL to inform the EIAR in the 2018 planning application, as follows:

Broad survey assessment of benthic conditions between Dublin Bay and Skerries in August 2012 (29 sampling stations). As a regional assessment, this survey covered other possible outfall locations not selected for the final route. The eight sites pertinent to the Proposed Project were targeted for further assessments in 2013 and 2017 (see bullet points below):

- The water quality component of the August 2012 survey was repeated in December 2012 (three sampling stations);
- Estuarine / wetland walkover habitat survey of Baldoyle Bay was completed in summer 2013;
- Assessment of eight sampling stations focused along the proposed outfall pipeline route (marine section) was completed in July 2013;
- Ireland's Eye sublittoral reef drop down video survey was completed in 2014;
- Ireland's Eye littoral and sublittoral reef survey carried out using intertidal walkover and sub-tidal diving assessment was completed in 2015; and
- Repeat assessment of eight sampling stations focused along the proposed outfall pipeline route (marine section) was completed in August 2017.

The full reports relating to these surveys can be found within the supporting appendices of the EIAR in the 2018 planning application.

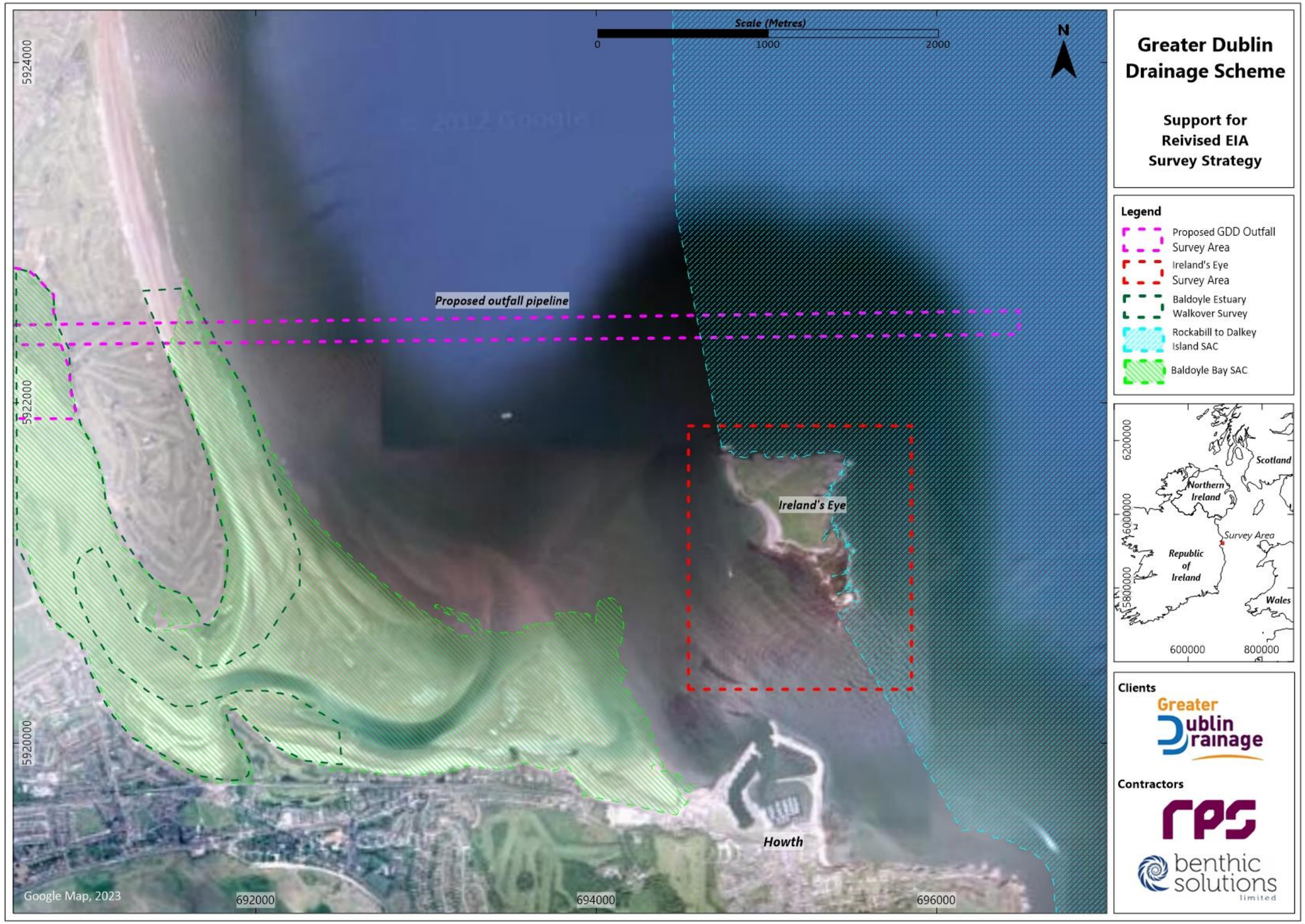


Figure 2.1: Survey Area Overview

2.3 Scope of Work

In November 2022, RPS completed a walkover survey of Baldoyle Estuary and in January 2023. BSL completed a video inspection survey of the Proposed Outfall Pipeline Route (Marine Section) and surrounding areas to assess the distribution of seabed habitats to support the preparation of the EIAR Addendum for the Proposed Project.

The main objectives of these updated habitat assessment surveys are as follows:

- Baldoyle walkover survey - to identify any material changes since the last survey completed in 2013;
- Video inspection survey - to provide video / photographic footage along the proposed outfall pipeline route (marine section) to assess the identity and distribution of seabed habitats and identify any material changes to the seabed since the original surveys completed in 2012 and 2017;
- Video inspection survey - to provide video / photographic footage of the sublittoral reefs surrounding and immediately to the south of Ireland's Eye to identify any material changes to the condition of sublittoral reefs since last survey completed in 2015.

3 Field Survey Programme and Analytical Methods

3.1 Geodetic Parameters

The horizontal datum was referenced to the WGS84 Datum, UTM 29N projection. The geodetic parameters used are provided below in Table 3.1.

Table 3.1: Geodetic Parameters

GPS Satellite System – WGS84	
Datum	WGS84
Spheroid	WGS 1984
Semi-Major Axis	a = 6378137.000m
Semi-Minor Axis	b = 6356752.314m
First Eccentricity Squared	E I= 0.006694379990
Inverse Flattening	1/f = 298.257223563
Project Projection Parameters for Site Surveys	
EPSG Map Projection Code	32629
Projection	UTM Zone 29N
Central Meridian	0°
Longitude of Origin	3° East
Latitude of Origin	0° North
False Easting	500000.00m
Scale Factor at Central Meridian	0.9996
Units	Metres

3.2 Logistics

An estuarine survey was conducted on 14 November 2022 at Baldoyle Estuary by an experienced RPS ecologist. The survey comprised a walkover survey undertaken during daylight hours, commencing during low tide at approximately 09.00hrs and finishing at approximately 17.00hrs. The weather conditions during the survey were sunny and dry, with temperatures ranging from 10-12°C (degrees Celsius).

Between 4 January and 10 January 2023, video transects were conducted along the proposed outfall pipeline route (marine section) and around Ireland's Eye aboard the *Ros Aine* working on a 12 hour basis. Throughout the survey there were no health, safety and environmental (HSE) incidents reported. Environmental survey equipment was deployed using the onboard crane and positioned using a Garmin Global Positioning System (GPS). An overview of the survey operations and dates is outlined in Table 3.2 below.

Table 3.2: Summarised Operational Timings

Date	Activity	Details of Activity
14/11/2022	Operations	Baldoyle wetland walkover survey (RPS)
04/01/2023	Personnel travel	Personnel and equipment travel to Howth, Ireland.
05/01/2023	Mobilisation Operations Weather Standby	Mobilisation of equipment onto the *Ros Aine*. Camera transects attempted but poor data acquired due to marginal weather conditions encountered along the proposed route. Standby for weather
06/01/2023	Operations Demobilisation Travel	Camera transects completed at the Proposed Outfall Pipeline Route (Marine Section) and around Ireland's Eye. Demobilisation of equipment from *Ros Aine*. One personnel travelled back to Norfolk.
07/01/2023	Standby	Standby due to customs delays in Dublin.
08/01/2023	Standby	Standby due to customs delays in Dublin.
09/01/2023	Standby Travel	Standby due to customs delays in Dublin. Remaining personnel travelled to Liverpool on the overnight ferry.
10/01/2023	Travel	Remaining personnel travelled back to Norfolk.

3.3 Estuarine Habitats Survey

The main estuarine habitats were mapped according to A Guide to Habitats in Ireland (Fossitt 2000). Habitat types were also considered with reference to Annex 1 habitat types, in order to be consistent with the habitat mapping prepared for a Saltmarsh Monitoring Survey conducted in Baldoyle Estuary between 2006 and 2008 (McCorry and Ryle 2009), as documented in the EIAR in the 2018 planning application. Field notes included information on species composition, habitat structure and features. The most abundant and characteristic species were recorded and used to distinguish the main habitat types.

The results of the survey were mapped using the Geographic Information System (GIS) and used to compare key changes in habitat extent since the previous walkover survey in 2013, as documented in the EIAR in the 2018 planning application.

Such surveys can be completed at any time of year, however optimally during the spring and summer. The completion of the update surveys during the autumn of 2022, however, is not considered a significant limitation given that the area had been previously mapped, and it was the aim to identify any material changes.

3.4 Benthic Habitat Surveys

Camera transects were carried out at predetermined locations in line with previous operations and Proposed Project requirements targeting the proposed outfall pipeline route (marine section), sublittoral reef transects surrounding Ireland's Eye and a historic environmental sampling station between Ireland's Eye and Howth Harbour, in which maerl was previously found to be present. Actual sampling locations are presented in Figure 3.1.

The aim of these surveys was to update the understanding of these dynamic environments and identify any material changes to the distribution or description of the habitats within close proximity to the proposed outfall pipeline route (marine section) or the proposed marine diffuser location. The survey was consistent with previous surveys carried out at the site using drop-down camera equipment. However, an additional 'freshwater lens' adaptation was required to allow for the high turbidity in the

waters in the region and during the winter months. The weather conditions during the survey were marginal with slight to moderate seas of around 1m (metre) wave height.

Such visual survey assessments can be completed at any time of the year, however, optimally during the spring and summer for more detailed biodiversity assessments. The completion of these update surveys during the winter of 2023 is not considered a significant limitation given that the primary requirement for these surveys was to assess possible habitat changes and that the area had been significantly mapped and described previously.

3.5 Seabed Photography and Video

Seabed video footage and stills were acquired along predetermined transects in line with survey requirements. A total of six camera transects were carried out using both the BSL MOD4.0 and Kongsberg 408 camera systems. One transect was positioned along the length of the proposed outfall pipeline route (marine section), with a further four transects positioned around Ireland's Eye and one between Ireland's Eye and Howth Harbour (~400m north-northeast of Howth harbour).

Video footage and stills were acquired along the proposed outfall pipeline route (marine section) using a MOD4.0 camera system mounted within a BSL 'freshwater lens' drop-down frame, equipped with separate strobes and LED (light-emitting diode) lamps. Footage and stills from the transects surrounding and immediately south of Ireland's Eye were acquired using a Kongsberg 14-408 underwater camera system also mounted within a 'freshwater lens' drop-down frame equipped with separate LED lamps. Once at the seabed, the camera was moved along the length of the transect at an approximate speed of 0.8 knots. Still photographs were captured remotely using a surface control unit via a towed umbilical cable. The stills were uploaded in real-time and saved to the camera and a laptop via specialist software. Live video footage, overlaid with the date, time, position and site details were viewed in real-time. The live video stream was used to assist with targeting of the stills camera and to facilitate a habitat assessment. Footage was saved internally by the video camera and data was downloaded after approximately six hours of camera operations and backed-up onto a hard drive.

A total of six camera transects were conducted over the survey area (one along the proposed outfall pipeline route (marine section), four surrounding Ireland's Eye and one between Ireland's Eye and Howth Harbour). Due to the presence of fishing gear over the proposed outfall pipeline route (marine section) transect approximately 1km (kilometre) to the west of the proposed marine diffuser location, a continuous transect was not achievable. Consequently, the transect was therefore split into two sections running from the shore up to the fishing gear (west to east, Section 1) and from the proposed marine diffuser location to the fishing gear (east to west, Section 2) with two further drop-down video (DVV) deployments undertaken within the area between the fishing gear to achieve as much coverage as possible (Figure 3.1). A summary of the surveyed transects and acquired video and photography data is provided below in Table 3.3.

Table 3.3: Summary of Camera Transect Data Acquired

Geodesy Universal Transfer Mercator (UTM) zone 29N, WGS84 Datum							
Transect	**Date and Time**	**Rationale**	**Length (m)**	Start or End of Line	**Easting (m)**	**Northing (m)**	**Video/Photos (hh:mm:ss/ images)**
Proposed Outfall Pipeline Route (Marine Section) Section 1	06/01/23	Proposed outfall pipeline route	3,500	SOL	691 734	5 922 406	02:20:06/519
				EOL	695 146	5 922 447	
Proposed Outfall Pipeline Route (Marine Section) Section 2	06/01/23	Proposed outfall pipeline route	722	SOL	696 459	5 922 480	00:34:21/38
				EOL	695 812	5 922 466	
	06/01/23		175	SOL	695 230	5 922 464	00:07:22/21

Geodesy Universal Transfer Mercator (UTM) zone 29N, WGS84 Datum							
Proposed Outfall Pipeline Route (Marine Section) DDV 1		Proposed outfall pipeline route		EOL	695 133	5 922 431	
Proposed Outfall Pipeline Route (Marine Section) DDV 2	06/01/23	Proposed outfall pipeline route	269	SOL	695 601	5 922 466	00:13:42/120
				EOL	695 388	5 922 441	
S1	06/01/23	Sublittoral transect positioned around northern extent of Ireland's Eye	1,085	SOL	694 914	5 921 799	00:09:53/33
				EOL	694 867	5 921 824	
S2	06/01/23	Sublittoral transect positioned around northern extent of Ireland's Eye	442	SOL	695 167	5 921 803	00:03:39/14
				EOL	695 147	5 921 691	
S3	06/01/23	Sublittoral transect positioned around northern extent of Ireland's Eye	158	SOL	695 579	5 921 128	00:03:14/7
				EOL	695 565	5 921 158	
S4	06/01/23	Sublittoral transect positioned around northern extent of Ireland's Eye	96	SOL	695 599	5 920 731	00:04:57/23
				EOL	695 573	5 920 802	
ENV_27	06/01/23	Transect targeting historic maerl between Ireland's Eye and Howth harbour.	1,206	SOL	695 301	5 920 347	00:19:14/101
				EOL	695 048	5 920 638	

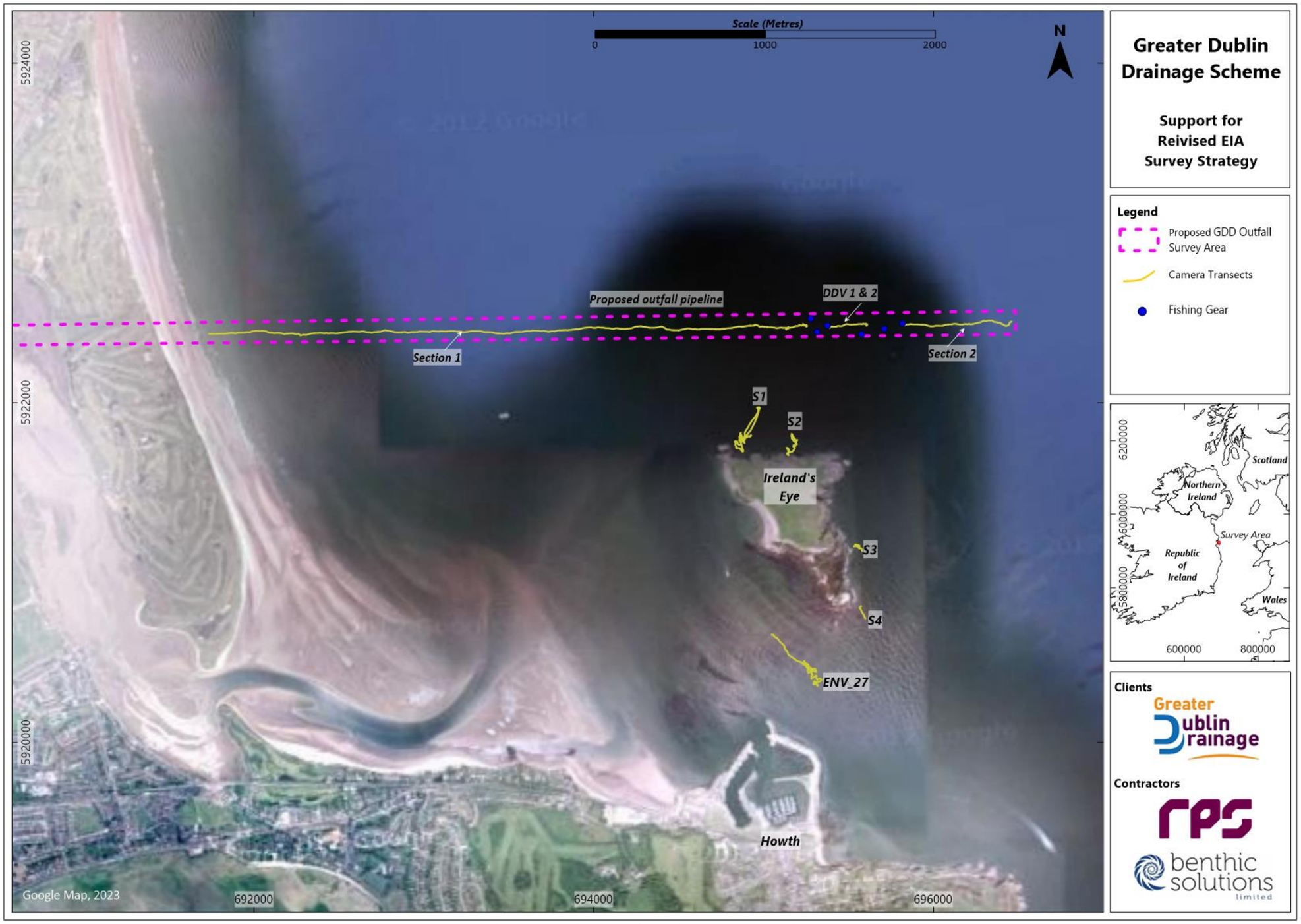


Figure 3.1: Environmental Sampling Strategy Overview

4 Habitat Investigation Methods

4.1 Environmental Habitat Assessment

The habitat assessment was based on a review of high resolution still images and the recorded standard definition (SD) video footage with consideration of historical data acquired over the same area. The sediment type and conspicuous fauna observed within each still image was recorded and used in conjunction with the SD video footage as a basis for habitat determination.

4.2 Legislative Species Protection Assessment

The conspicuous fauna recorded from review of the underwater video footage and stills were inputted into a database developed by BSL staff which identifies any species that are afforded protection under several legislative conventions / directives implemented in the United Kingdom (UK) and Ireland.

5 Results and Discussion

5.1 Estuarine Habitats

This Section should be read with reference to Figure 5.1 Habitat Map of the Fossitt Habitats of Baldoyle Estuary, Figure 5.2 Habitat Map of Annex I habitats of Baldoyle Estuary, and Figure 5.3 Habitat Map of Annex I Habitats of Baldoyle Estuary prepared by McCorry and Ryle (McCorry and Ryle 2009), and review notes from 2013 revisit survey (Appendix A9.1 of the 2018 EIAR submission).

5.1.1 North of the Proposed Outfall Pipeline Route (Marine Section) – Eastern Side

The previous 2013 survey (Appendix A9.1 of the 2018 EIAR submission) described a similar habitat to that surveyed in the 2022 survey; with the upper vegetation dominated by Spartina swards, creeping bent grass (*Agrostis stolonifera*), sea beet (*Beta vulgaris*), rushes (Juncus sp.), sea aster (*Aster tripolium*) and sea purslane (*Halimione portulacoides).*

The previous study reported a wider extent of Atlantic salt meadow directly above the proposed outfall pipeline route (marine section), which in the 2022 survey was dominated by Spartina swards and only extended into Atlantic salt meadow at the uppermost section of the marsh. Overall, the extent of Mediterranean salt meadow remained broadly unchanged since the previous survey. Some of the species recorded in the previous survey, such as common scurvy grass (*Cochlearia officinalis*) and sea pink (*Armeria maritima*) were not encountered in the 2022 survey.

It should be noted that the 2022 study was recorded in the field using primarily the Fossitt Habitat classification code (Fossitt 2000), whereas the previous survey used Annex I Habitat classification code, therefore explaining slight differences in mapping classifications.

5.1.2 South of the Proposed Outfall Pipeline Route (Marine Section) – Eastern Side

The previous 2013 survey (Appendix A9.1 of the 2018 EIAR submission) reported a similar extent of Spartina swards along the western side of the Portmarnock golf course to that recorded in the 2022 survey. However, there were patches of Mediterranean and Atlantic salt meadows Annex I habitat south of Portmarnock golf course which were not noted in the 2022 survey. In the 2022 survey, this area was identified as a broadly Marram grass dune habitat. A distinct cluster of sea buckthorn (*Hippophae rhamnoidesi*), associated with Dune Scrub and Woodland habitat (CD4) was observed to the south of Portmarnock golf course in 2022, which was not previously recorded in the 2013 survey (Appendix A9.1 of the 2018 EIAR submission).

5.1.3 North of the Proposed Outfall Pipeline Route (Marine Section) – Western Side

Overall, in 2022, the western section of the proposed outfall pipeline route (marine section) was similar to the previous survey. The scrub vegetation, and mosaic of Mediterranean and Atlantic salt meadow marsh was also documented, although this represented a smaller area in the 2022 survey.

The previous survey in 2013 recorded species such as bush vetch (*Vicia sepium*), common comfrey (*Symphytum officinale*), tall fescue (*Festuca aruninacea*), common scurvy grass (*Cochlearia officinalis*) and glasswort (*Salicornia sp*.), which were not encountered in the 2022 survey.

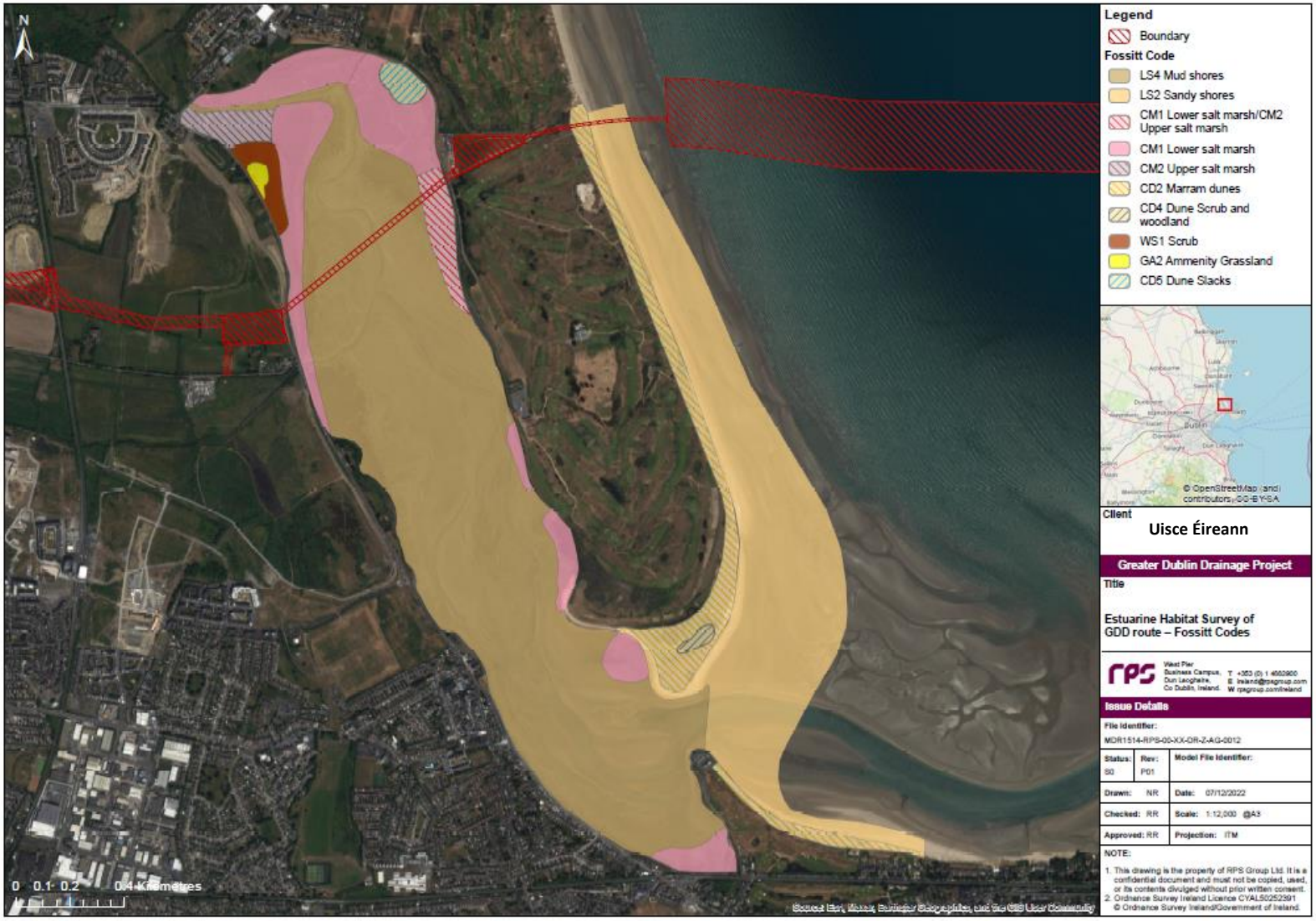


Figure 5.1*: Habitat Map of the Fossitt Habitats of Baldoyle Estuary (Based on 2022 Update Survey)*

Figure 5.2 ***Habitat Map of Annex I habitats of Baldoyle Estuary (Based on 2022 Update Survey)***

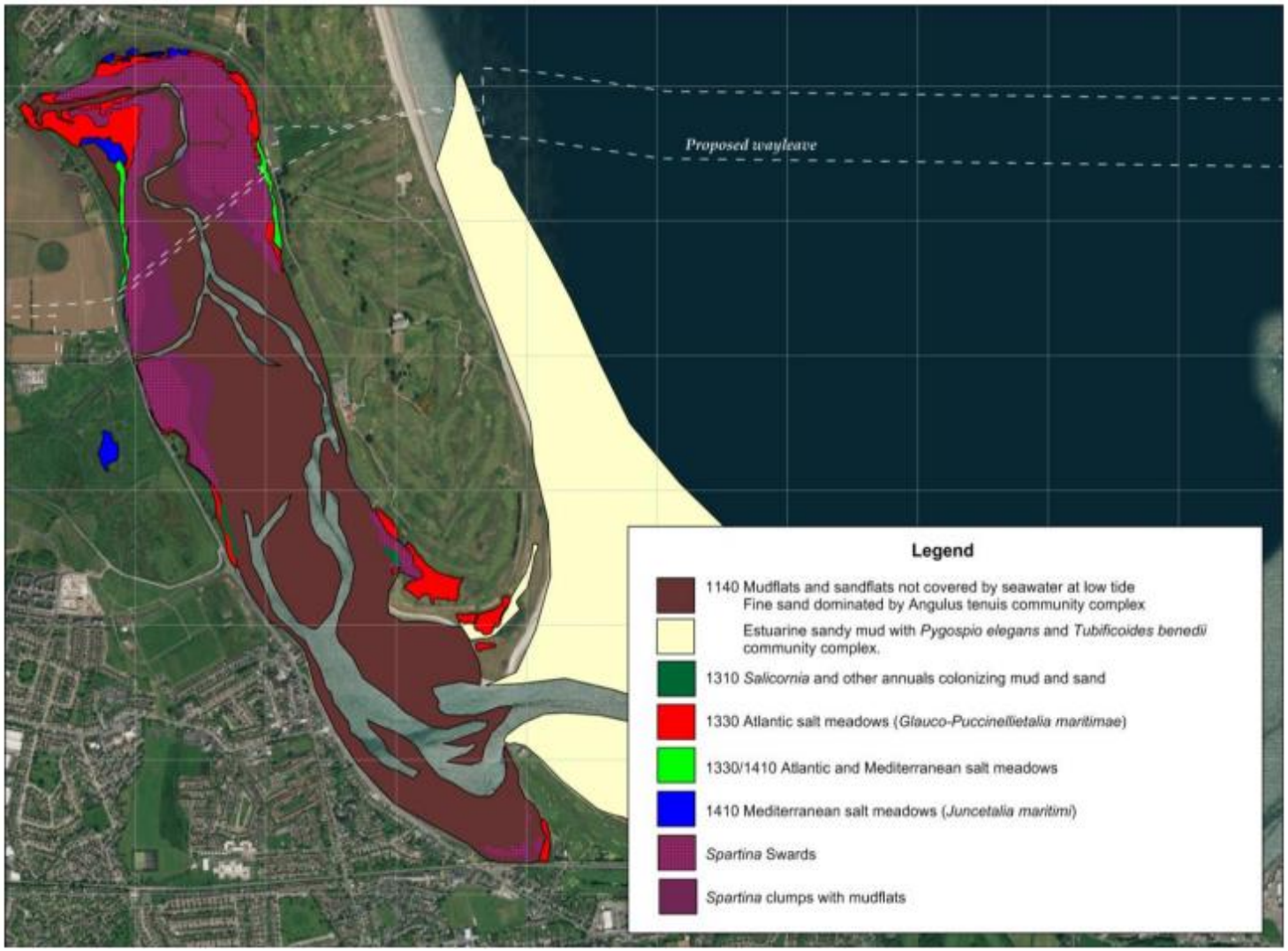


Figure 5.3: Habitat Map of Annex I Habitats of Baldoyle Estuary (Prepared by McCorry and Ryle (2009) (2013 Survey- Appendix A9.1 of the 2018 EIAR submission)

5.1.4 South of the Proposed Outfall Pipeline Route (Marine Section) – Western Side

The previous study in 2013 (Appendix A9.1 of the 2018 EIAR submission) documented Spartina swards at the lowermost sections of estuary. However, the extent of this habitat was greater in the 2022 survey. The previous study reported an Annex I Atlantic salt meadow habitat, which was not identified in the 2022 study. There was no mention of Marram grass dune habitat in the previous study.

In 2022, the Sand shore (LS2) and Mud shore (LS4) habitats occupied a similar extent to that described in the previous survey. The previous survey habitat map (Figure 5.3) excluded sections of the mudflats within the centre of the estuary which were likely covered by channels of seawater at the time of the survey. In the 2022 survey, due to tidal conditions and health and safety constraints, this area in the centre of the estuary was not surveyed. However, based on previous survey results and desk-based review using aerial photography, it was mapped as LS4 Mud shore.

5.2 Offshore Environmental Habitats

A detailed review of the seabed photography data revealed the presence of five main sediment types along the proposed outfall pipeline route (marine section) with substrates ranging from fine rippled sands to cobbles with minor variations in-between. Four main sediment types surrounding and immediately south of Ireland's Eye were observed, ranging from bedrock to a mixed mosaic of fine sands, fragmented rock and shell fragments. All substrate categories for both the proposed outfall pipeline route (marine section) and Ireland's Eye survey areas are described in Table 5.1 below, whilst the sediment assignments and conspicuous fauna of each of the assessed still images can be found in Appendix II.

Using the seabed substrate categories outlined in Table 5.1, it was possible to delineate sections of camera transects characterised by different substrates, with an overview for both survey areas displayed in Figure 5.5.

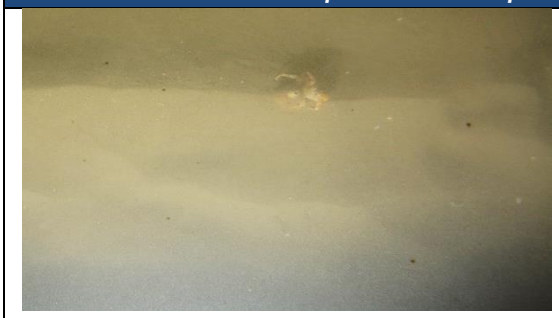
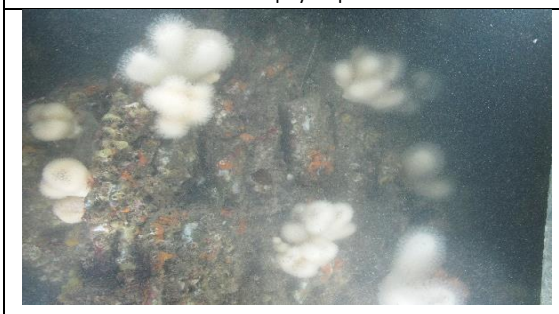
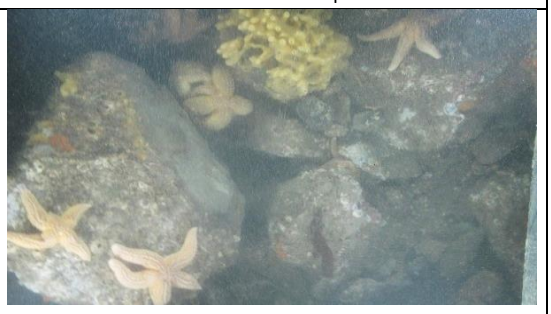
5.2.1 Proposed Outfall Pipeline Route (Marine Section)

Analysis of the photographic stills revealed the presence of a fine rippled sand spanning the initial approximately 1km of the proposed outfall pipeline route (marine section). Conspicuous fauna observed over this substrate type was sparse and was primarily comprised of mobile crustaceans (*Pagurus* sp. and Pleocyemata sp.), likely due to the high mobility of the surface sediments this close to the shore. This fine sand was replaced by sand with a minor gravel component spanning out to approximately 3km from the shore, with razor clams (*Ensis* sp.) and Ophiuroidea sp. (*Ophiura ophiura* and *Ophiura albida*) being the most dominant fauna observed (Figure 5.6). A coarser and more variable substrate to the north of Ireland's Eye spanned a distance of approximately 1km and ranged from sandy gravel to cobbles with minor variation in-between. Fishing gear was observed along this section of the proposed outfall pipeline route (marine section) with Pectinidae sp. frequently observed in addition to a notable sessile epifaunal community that included *Alcyonium digitatum*, Porifera sp., encrusting bryozoans and calcareous tube dwelling worms (Serpulidae sp.). The easternmost extent of the proposed outfall pipeline route (marine section), spanning a distance of approximately 0.5km from the proposed marine diffuser location, was also classified as gravelly sand; albeit with a higher gravel component reflected by the presence of sporadic sessile epifauna including Actinaria sp., Porifera sp. and *Alcyonium digitatum*. Example images of conspicuous fauna observed along the proposed outfall pipeline route (marine section) are provided in Figure 5.4.

Table 5.1: Seabed Substrate Categories Identified

Substrate Category	Description
Proposed Outfall Pipeline Route (Marine Section)	
Sand	Fine rippled sand covering the westerly extent of the proposed outfall pipeline route (shore to diffuser) with relatively sparse conspicuous fauna observed consisting primarily of mobile crustaceans (*Pagurus* sp. and Pleocyemata sp.).
Gravelly Sand	Fine sand with a minor gravel component covering the largest extent of the proposed pipeline route including the proposed diffuser location. Ophiuroidea sp. and *Ensis* sp. were the most dominant conspicuous fauna observed across this substrate type. A slightly coarser variation of this substrate was found at the easternmost extent of the proposed pipeline.
Sandy Gravel	This substrate type was encountered within the central portion of the proposed Proposed Outfall Pipeline Route (Marine Section) in proximity to the location of fishing gear encountered during the survey. Conspicuous fauna included Pectinidae sp. and the presence of sessile epifauna including Porifera sp., Serpulidae sp. and *Alcyonium digitatum*. This area is expected to coincide with a bathymetric slope.
Gravel	This substrate type was also encountered within the central portion of the Proposed Outfall Pipeline Route (Marine Section) and overlapped in extent with that of sandy gravel. Conspicuous fauna was similar to that observed over sandy gravel substrate types and included a notable sessile epifaunal component.
Cobbles	Cobbles often encrusted with calcareous tube dwelling worms (Serpulidae sp.); this substrate type was also present within the central portions of Proposed Outfall Pipeline Route (Marine Section) area and overlapped in extent with that of sandy gravel and gravel.
Ireland's Eye and ENV_27 Survey Area	
Bedrock	Sloping and flat bedrock encountered at all transects excluding transect S2, often heavily encrusted with sessile epifauna with some areas displaying high levels of siltation.
Boulders	Boulders of varying size typically found in proximity to areas of bedrock, displaying heavy encrustation of sessile epifauna and high levels of siltation in some areas.
Shelly Sand	This sediment type consisted of fine sand with varying levels of shell fragments and was present within the northern transects surrounding Ireland's Eye (S1 and S2). Conspicuous fauna included encrusting sessile epifauna (Serpulidae sp. and encrusting bryozoans) and occasionally *Asterias rubens*.
Mixed Sediment	This sediment comprised of a highly variable mosaic of fine sand, shell fragments and rock fragments, and was observed at transect ENV_27. Exposed areas of rock were often heavily encrusted with sessile epifauna including Cirripedia sp., Actinaria sp., encrusting bryozoans and Porifera sp. Mobile fauna observed included *Necora puber* and *Asterias rubens*.

Comparison of the sediment types observed during the course of the current survey are comparable with the broadscale findings of the historical marine surveys outlined within the EIAR in the 2018 planning application, namely the presence of a fine sand spanning the western extent of the proposed outfall pipeline route (marine section) that transitions to a coarser sediment, that in turn sub-crops a thin fine sand veneer toward the easternmost extent of the proposed outfall pipeline route (marine section).

Examples of Conspicuous Fauna	
Proposed Outfall Pipeline Route (Marine Section)	
	
Pagurus sp.	Actinaria sp. & Brachyura sp.
	
Ophiuroidea sp.	Crinoidea sp. and Pectinidae sp.
Ireland's Eye and ENV_27	
	
Rhodophyta sp.	Mussel bed and *Laminaria* sp. on bedrock
	
Alcyonium digitatum	*Porifera* sp. & *Asterias rubens*
	
Crinoidea sp.	Actinaria sp.

Serpulidae sp. & Cirripedia sp.

Necora puber

***Figure** 5.4: Examples of Conspicuous Fauna*

5.2.2 Ireland's Eye and ENV_27

Areas of flat and sloping bedrock were observed to the north (S1) and south-east of Ireland's Eye (S3 and S4) as well as immediately to the south (ENV_27), with boulders typically in close proximity. Exposed rock was often heavily encrusted with sessile epifauna including barnacles (Cirripedia sp.), encrusting bryozoans, anemones (Actinaria sp.), encrusting and erect sponges (Porifera sp.), dead man's fingers coral (*Alcyonium digitatum*), red seaweeds (Rhodophyta sp.) and kelp (*Laminaria* sp.). However, in some areas, notably transect S3, high levels of siltation were apparent which led to an obvious reduction in the quantity and range of sessile epifauna. Mobile epifauna observed across the areas of bedrock and boulders consisted predominantly of the velvet crab (*Necora puber*) and the common starfish (*Asterias rubens*), with aggregations of feather stars (Crinoidea sp.) observed in some instances. Areas of fine sand featuring varying levels of shell fragments were found to the north of Ireland's Eye and were characterised by sparse conspicuous fauna with the occasional common starfish (*Asterias rubens)* and encrusting sessile epifauna such as calcareous tube dwelling worms (Serpulidae sp.) and encrusting bryozoans in areas featuring higher concentrations of shell fragments. Finally, a mixed mosaic of fine sands, shell fragments and rock fragments interspersed between areas of boulders and bedrock was apparent across transect ENV_27. Exposed rock fragments were often heavily encrusted with barnacles (Cirripedia sp.) and calcareous tube dwelling worms (Serpulidae sp.) as well as encrusting bryozoans, whilst areas of coarse shell fragments were typically associated with the presence of anemones (Actinaria sp.). Example images of conspicuous fauna observed across the Ireland's Eye survey area can be found in Figure 5.4 and Figure 5.6.

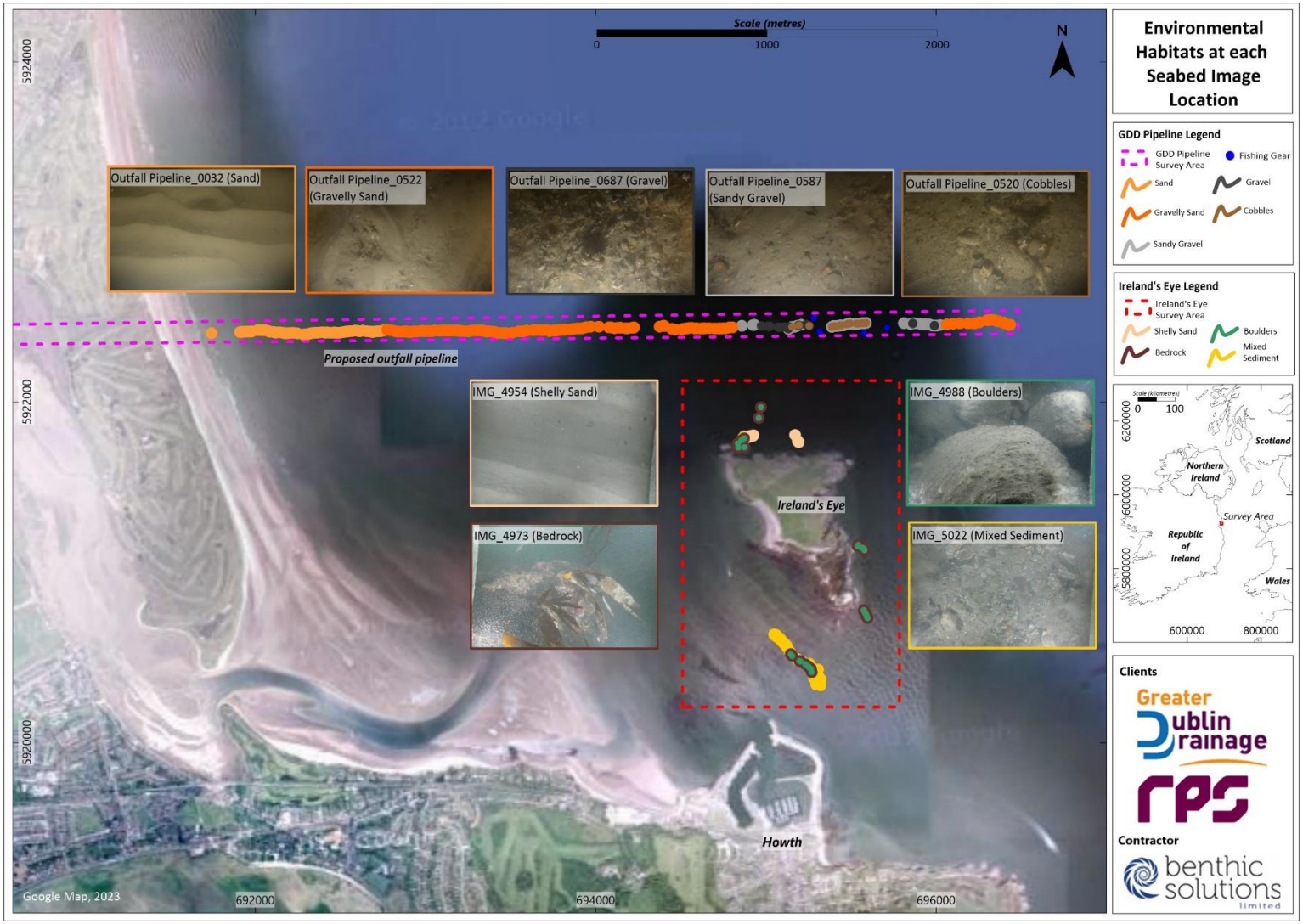


Figure 5.5: Summary of Environmental Habitats at each Seabed Location

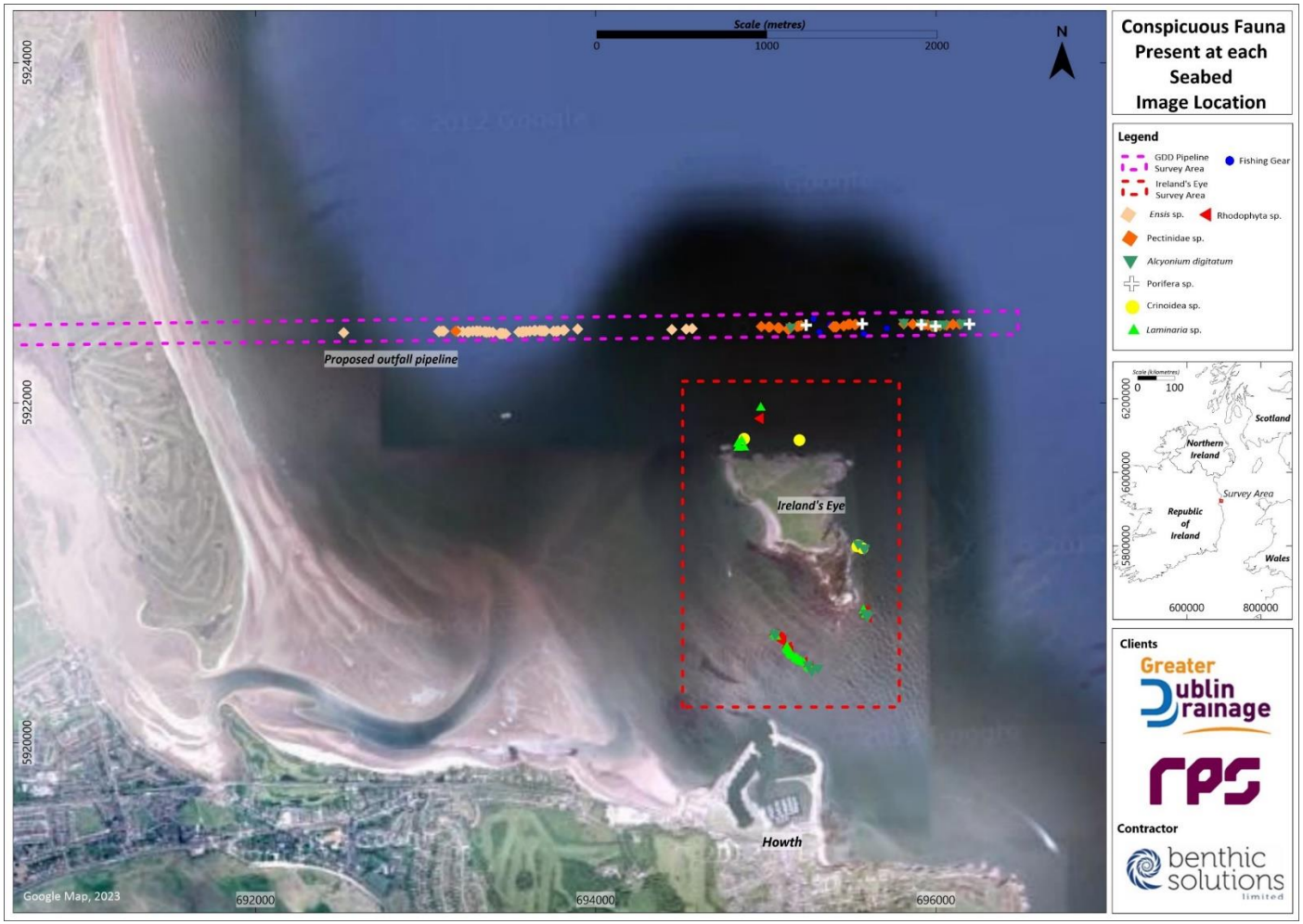


Figure 5.6: Summary of Conspicuous Fauna Present at each Seabed Image Location

5.2.3 Potential Sensitive Habitats and Species

5.2.3.1 Legislative Species Protection

In order to assess if any species which are afforded legislative protection were present within the survey area, the identified conspicuous fauna were run through a listed species database developed by BSL staff. However, none of the species / taxa identified were designated with legislative protection.

5.2.3.2 Annex I Stony Reef

Whilst the extent and elevation of the bedrock formations surrounding and immediately to the south of Ireland's Eye meet the classification criteria for Joint Nature Conservation Committee (JNCC) Annex I reefs, which are described as: "*Rocky reefs occur where bedrock or stable boulders and cobbles arise from the surrounding seabed creating a habitat that is colonised by many different marine animals and plants. Rocky reefs can be very variable in terms of both their structure and the communities they support. They provide a home to many species such as corals, sponges and sea squirts as well as giving shelter to fish and crustaceans such as lobsters and crabs*" (JNCC, 2016); these features have already been designated as reefs as a qualifying feature within the Rockabill to Dalkey Island Special Area of Conservation (SAC) displayed in Figure 2.1.

6 Conclusion

6.1 Proposed Outfall Pipeline Route (Marine Section)

Previous investigations along the proposed outfall pipeline route (marine section) outlined in Section 9.3.2 (Geomorphology and Seabed Sediments) of Chapter 9 (Biodiversity (Marine) in Volume 3 Part A of the EIAR in the 2018 planning application), gave a broad description of the proposed outfall pipeline route (marine section) based on a number of surveys using both acoustic mapping and biological habitat techniques. The proposed outfall pipeline route (marine section) was originally separated into three sections east of the landfall beneath Velvet Sands beach break. Here, the proposed outfall pipeline route (marine section) will run along a consistent shallow shelving fine sand (gradient <0.5°) out to a distance of 3.3km from the beach with no bedforms observed. After this, the slope notably steepens to approximately 3° for around 150m, before returning to the shallow slope, but also becomes rougher and harder, indicative of mixed gravelly sand with some large sediment clasts (such as cobbles). At 4.8km from the beach, the seabed returns to a smoother morphology but remains at a high reflectivity until arrival at the proposed marine diffuser location. This is indicative of a thin veneer of fine sands overlying a mixed gravelly sand and shell. Detailed sediment analysis from sampling and camera operations near the proposed outfall route (marine section) between 2012 and 2017, similarly, interpreted these sites into three sediment habitat types. These were fine sands along the first 3.3km of the proposed outfall pipeline route (marine section), but with the presence of a coarser outcropping of sandy gravels in the central section of the shelf break. Evidence from photography and samples indicated patchy exposures of coarser sediments, including some cobbles. This sediment type then sub-crops beneath a fine sand veneer at the eastern end of the proposed outfall pipeline route (marine section) near the proposed marine diffuser location.

The marine sediments are expected to remain in a consistent state of flux with finer sediment components, such as the fine and medium sands, migrating in and out of the shorelines during storm events, and up and down the coastline through tidal currents and long-shore drift. The video survey provided evidence that the status of the habitat along the entire length of the proposed outfall pipeline route (marine section) has remained largely unaltered since the previous assessment in 2017 (Figure 6.2), despite some storm events within the intervening years. The sandy habitat remained consistent from close to the shoreline, through to the shelf break, where the rippled sands are replaced by the exposure of a gravelly underlying fraction. This harder, more heterogenic seabed remained in place until the very end of the proposed outfall pipeline route (marine section) and the proposed marine diffuser location, where evidence of a thin veneer of fine sands was noted. Previous surveys have demonstrated changes in the thickness of these sands immediately surrounding the proposed marine diffuser location (Figure 6.2) with erosion and accretion expected to occur periodically.

Observations of epifaunal species recorded using seabed photography have also confirmed earlier observations, which identified a significant epifaunal community, particularly towards the east end of the proposed outfall pipeline route (marine section) relating to the coarser gravels. Taxonomic records previously showed that both solitary and colonial species of epifauna were recorded during the benthic surveys in 2012 and 2017, with large number of bryozoans, cnidaria (in particular hydroids), and sponges found. Whilst previous operations had indicated occasional settlement from juvenile *Mytilus* and *Modiolus* mussels, the recent 2022 survey showed no evidence of biogenic reef species or sensitive habitats along the proposed outfall pipeline route (marine section).

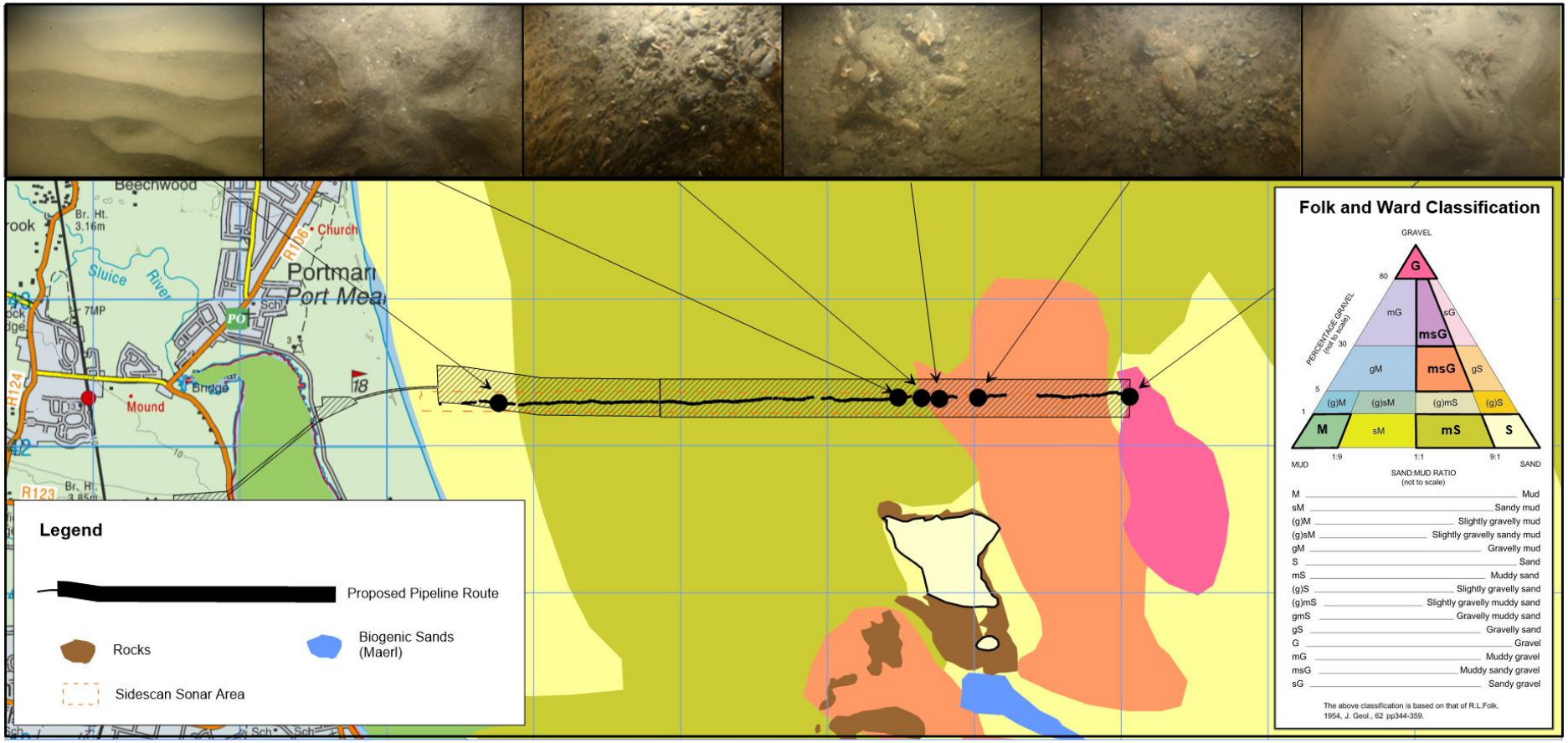


Figure 6.1: Summary of Conspicuous Fauna Present at each Seabed Image Location

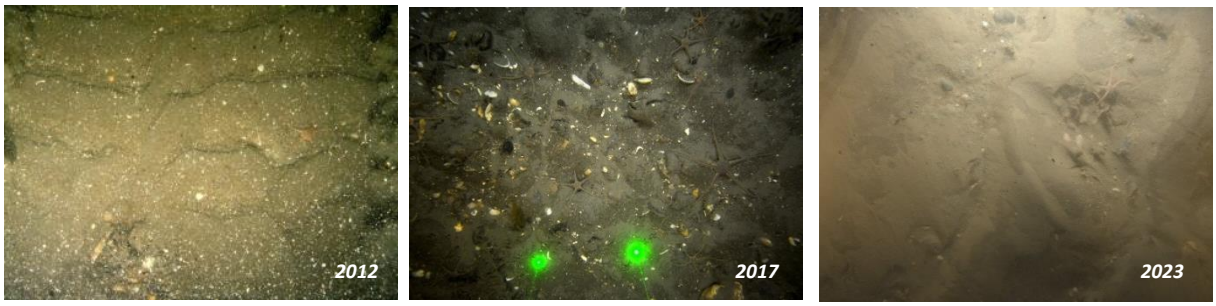


Figure 6.2: Seabed Sediments at the Proposed Marine Diffuser Location Showing Changes in Sands in 2012, 2017 and 2023

6.2 Sublittoral Reef (Rockabill to Dalkey Island SAC)

The conservation objectives for the sublittoral reefs located within Rockabill to Dalkey Island SAC were outlined by the National Parks and Wildlife Service (NPWS) so as to remain a stable or increasing habitat subject to natural processes. Furthermore, the community structure of the intertidal and subtidal reef community complex was to be maintained. The SAC was initially based on drop-down video surveys (MERC 2010; 2012a; 2012b). A reef community complex is recorded off the northern, eastern and southern shores of Ireland's Eye, immediately south of the proposed outfall pipeline route (marine section) and the proposed marine diffuser location. The substrate, as recorded by the earlier MERC studies and subsequent assessments carried out during the surveys for the Proposed Project (in 2014 and 2015), ranges from that of flat and sloping bedrock, to bedrock with boulders and also a mosaic of cobbles and boulders. Vertical rock walls occur on the north and east of Ireland's Eye, whilst the northern reaches of the island show both sediment scouring and a thin veneer of silt covering the reef. In general, the surveys undertaken for NPWS to determine the physical and biological nature of the Annex I habitat within the SAC (MERC 2010; 2012a; 2012b) noted that where the reef was subjected to the effects of sediment, either through scouring or settlement of silt, low numbers of species and individuals occurred, although these observations were based on extremely limited site investigation works with only a couple of drop-down video sites acquired. A detailed assessment of the subtidal reefs was carried out in 2015 during two separate surveys based on a specialist drop-down camera system (BSL 2015a) and a more detailed assessment was carried out using a scientific dive team at four locations on the northern and eastern sides of the island in June / July 2015 (BSL 2015b). Sites were selected using the earlier video system looking for representative examples based on transects at the base of the reef structure up to the eulittoral zone. As recorded by the earlier MERC surveys, the sublittoral reefs were all found to be heavily silted, but were moderately diverse.

The recent survey visit carried out at each of the sublittoral reef sites has allowed for observations at the deeper parts of each sublittoral transect but only obtained intermittent results close to the shoreline and cliffs due to limited vessel access or steep seabed gradients. As with the previous surveys, two sites were located beneath the steep cliff face of the northern coast of Ireland's Eye (S1 and S2), and two located adjacent to the rocky shorelines in the south-east of the island (S3 and S4). Habitats and biotopes at the sublittoral stations were characterised by *Laminaria digitata* forests in the shallower part and replaced by the biotope 'Foliose red seaweeds with dense *Dictyota dichotoma* and/or *Dictyopteris membranacea* on exposed lower infralittoral rock'. The deeper extent was dominated by a 'Mixed turf of bryozoans and erect sponges with *Sagartia elegans* on tide-swept circalittoral rock' or in the case of Sublittoral S2, '*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock'. The deeper biotope at Sublittoral S4 was categorised as possible '*Polyclinum aurantium* and *Flustra foliacea* on sand scoured tide-swept moderately wave-exposed circalittoral rock'. The 2023 survey confirmed a high level of suspended sediment within the water column and areas on the rocky reef substrate and confirmed high levels of sedimentation and silt burden both on open rocky surfaces as well as within the faunal swards (Figure 6.3).

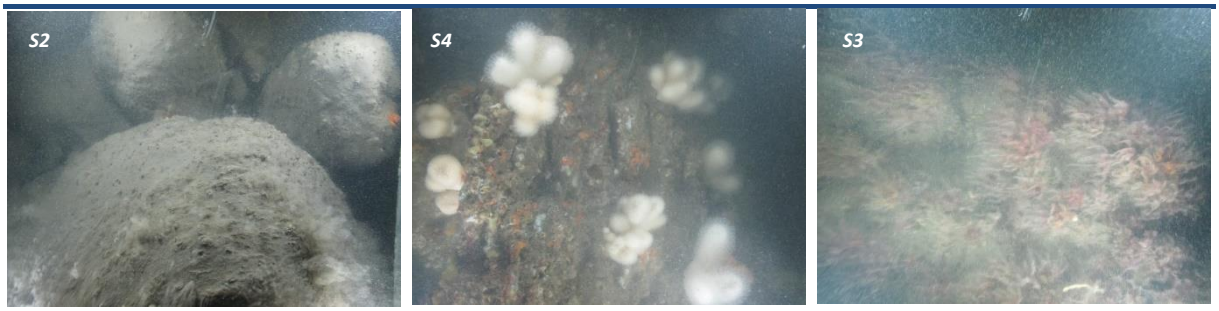


Figure 6.3: Seabed Camera Observations Show Example Images Taken in High Water Turbidity Showing Heavily Silted Boulders (S2), Soft Corals on Bedrock (S4) and Heavily Silted Foliose Red Algaes (S3), January 2023

6.3 Investigation of Biogenic Sands (Maerl) South of Ireland's Eye

An important substrate found during the initial benthic surveys in 2012 was that of biogenic maerl sands in isolated patches at Station 27, south of Ireland's Eye. This is coralline red algae which can create a diverse biological community at the seabed through sediment modification and habitat creation, although only isolated pockets of dead debris were recorded during the 2012 survey. The presence of maerl has also been previously recorded by the geological Survey of Ireland (GSI) as part of the INFOMAR project in this area of Dublin Bay (data available through www.INFOMAR.ie). This site was not investigated during the later surveys (2012 and 2017) as this location was on the opposite side of Ireland's Eye to the study area and no impacts were expected from the proposed outfall pipeline route (marine section). This interpretation of biogenic sands has therefore only been covered as part of this re-investigation of the site using a drop-down and stills camera operations during the 2023 study.

Figure 6.4: Seabed Camera Observations From Reference Site Station 27, Showing Silty Sands and Gravels (Left), Boulders with Occasional Soft Corals (Middle) and Boulders Punctuated by Biogenic Sands (Right), January 2023

As with the 2012 survey, the site was only investigated using photography in 2023. Images confirmed the presence of a heterogeneous seabed made up of mixed sandy gravels and areas of weathered bedrock and boulders punctuated by areas of biogenic sands and gravels. Close inspection of these granular pockets indicated a biogenic sand composed predominantly of dead shell fragments rather than that of dead maerl algae, although the presence of this substrate cannot be ruled out. Whilst the 2023 survey covered a significantly longer transect (i.e. 1.2km) than that previously surveyed by the drop-down video in 2012 (approximately 50m), no additional habitats of conservation importance were recorded, other than the existence of geogenic sublittoral reefs. The evidence of the 2023 survey shows that this rock habitat can be considered as a dominant component of the seabed between Irelands Eye and Howth Harbour. An example of the range of observed habitats recorded during the current survey are summarised in Figure 5.5 and Figure 5.6.

7 Key Material Changes in Baseline

7.1 Estuarine Habitats

The previous study reported a wider extent of Atlantic salt meadow directly above the proposed outfall pipeline route (marine section), which in the 2022 survey was dominated by *Spartina* swards and only extended into Atlantic salt meadow at the uppermost section of the marsh. There was also a distinct cluster of sea buckthorn (*Hippophae rhamnoidesi),* associated with Dune Scrub and Woodland habitat (CD4), to the south of Portmarnock golf course which was not previously recorded in in 2013. While the same study documented *Spartina* swards at the lowermost sections of estuary, the extent of this habitat was greater in the 2022 survey.

7.2 Marine Habitats

The habitat mapping based visual investigation surveys carried out in 2023 confirmed that the habitat distribution, whilst in constant flux, has largely remained unaltered since the previous surveys in 2012 and 2017. The majority of the proposed outfall route (marine section) remains a rippled sand, becoming gravelly at the shelf break and out to the proposed marine diffuser location. A veneer of surface sands was shown to accumulate above the gravels at the diffuser, reversing the trend of sand erosion previously recorded during the intervening surveys in 2017. Observations at the sublittoral reefs at Ireland's Eye, within the Rockabill to Dalkey Island SAC, reconfirm earlier observations in 2015 that the reefs display a high diversity with a high settled silt burden recorded over most of the substrate. The presence of geogenic reef complex south of Ireland's Eye was also shown to be more extensive and likely to cover a much larger area than previously thought at Station 27, south of Ireland's Eye. This area was previously designated as 'maerl'-based biogenic sands, although the recent survey has shown that this is predominantly shell-sands.

8 References

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MERC, 2012b. Subtidal Reef Survey of Lambay Island SAC and SPA, Rockabill Island SPA, Ireland's Eye SAC, Dalkey Islands SPA and Muglins. Carried out by MERC on behalf of the Marine Institute in partnership with National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.

Appendix I – Field Operations and Survey Methods

Seabed Photography and Video

Seabed video and still image acquisition along the proposed outfall pipeline route (marine section) was performed using the BSL MOD 4.0 camera system mounted within a BSL freshwater lens drop down frame equipped with separate strobes and LED lamps. A Kongsberg 408 underwater camera system mounted within a freshwater lens drop down frame equipped with separate LED lamps was used for video and still image acquisition at the transects surrounding and immediately south of Ireland's Eye. Live video streaming was available during operations with SD footage recorded continuously throughout each transect. Still images were captured remotely using a surface control unit via an umbilical to the camera system. The key acquisition parameters of the MOD 4.0 camera system used during the course of this survey are outlined in the brochure manual below.

BSL MOD4 Camera System

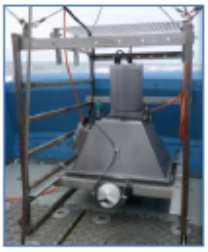
benthic solutions limited

UNDERWATER CAMERA – MOD4
Seabed Monitoring & Underwater Real-time Footage

- **General Specifications**
  - Flexible deployment scenarios
  - Depth rated to 3500m
  - Superior stills and streaming video quality
  - Near zero-delay shutter release
  - Unattended time lapse photography
  - Solutions for very low visibility environments

- **4 Camera Configurations**
  1. Deepwater real time
  2. Shallow water real time
  3. Ultra deepwater timelapse
  4. Remote timelapse

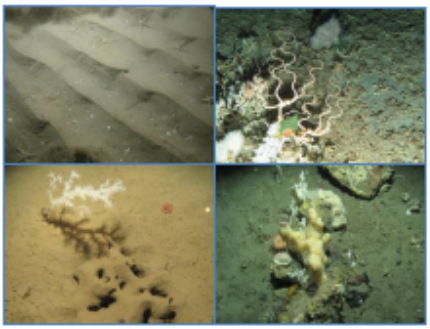
- **4 Deployment Configurations**
  1. Towed system (deep to shallow)
  2. Bed-hop ultra deep water
  3. Remote mooring timelapse
  4. Poor visibility freshwater lens



- **Services**

Benthic Solutions Ltd have an array of underwater cameras for various deployment scenarious. Our latest development (MOD4) is the most flexible camera to date. For water depths of less than 400m it is capable of communicating with the surface via a multicore umbilical cable, which provides a very high quality live view of the seabed. Zero-delay still images of 24 megapixels can be captured and transmitted to the surface for instant review.

For deeper waters the camera can be controlled via an armoured coax cable, of the type commonly used for towing sidescan sonar. A theoretical maximum cable length of 12km can be used. In this setup, the live feed quality is slightly reduced. To compensate for this an additional 1080p 30fps camera can be added if very high quality seabed video footage is desired.



High output lighting has been developed using the latest LED technology. 2x 2200 lumen lamps provide flood lighting ahead of the camera for video streaming, whilst a multi-head strobe system (up to three heads) can be utilised in TTL configuration to give perfectly exposed under water still images.

Benthic Solutions can also provide different camera frames suitable for seabed towing or 'drop down' use. These can be small and lightweight, or larger with increased ballast for deep water scenarios.

Shipping weight	200kg *
Shipping dimension	2 x 1 x 0.2m *
Specifications	2 x 1 x 1m *

**as multiple configurations are available, values shown indicate the maximum*

www.benthicsolutions.com

Appendix II – Service Warranty

This Appendix, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with Uisce Éireann. If used in other circumstances, some or all of the results may not be valid and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult BSL.