



Centre for Marine and Coastal Studies Ltd

Burbo Bank Extension Offshore Wind Farm



Benthic & Annex I Habitat Pre-construction Survey Field Report

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Head Office

CMACS Ltd
80 Eastham Village Road
Eastham
Wirral
CH62 0AW

Company No 4883990

Tel: +44 (0)151 327 7177
Fax: +44 (0)151 327 6344
e: info@cmacsltd.co.uk
web: www.cmacsltd.co.uk

Isle of Man

CMACS Ltd
Asahi House
10 Church Road
Port Erin
Isle of Man
IM9 6AQ

Wales

CMACS (Cymru)
Woodland View
Pen-y-Worlod Lane
Penhow
Newport
NP26 3A

Front Cover Photo: sunset at Burbo Bank Offshore Wind Farm during CMACS survey.

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1. Introduction

Burbo Bank Extension Offshore Wind Farm (“the Project”), which was awarded consent in September 2014, is an extension to the west of the existing Burbo Bank Offshore Wind Farm in Liverpool Bay. The Project is located approximately 7km north of Hoylake, Wirral and 12km from the Point of Ayr, Wales. It will comprise of 32 offshore wind turbines and one offshore substation in English waters and one subsea export cable extending from the wind farm into Welsh waters to the landfall between Rhyl and Prestatyn (Figure 1).

In 2011 and 2012, Centre for Marine and Coastal Studies Ltd (CMACS) undertook benthic ecology characterisation surveys of the proposed Project area on behalf of DONG Energy Wind Power A/S (DONG) to inform an Environmental Impact Assessment. The work consisted of an extensive Day grab and 2m scientific beam trawl programme, in addition to intertidal surveys (CMACS, 2013¹).

More recently, DONG contracted CMACS to undertake environmental monitoring for the Project, with a specific focus on Habitats Directive (92/43/EEC) Annex I habitat and habitats of conservation or ecological importance in order to satisfy requirements of the two English marine licences (EN010026) and one Welsh licence (13/17/ML). Schedule 2 of the English Development Consent Order (DCO) covers the Generation Asset (i.e. turbines, turbine foundations, and inter array cables) while Schedule 3 covers the Transmission Asset (i.e. the offshore substation, substation foundation and the section of the export cable in English waters). The Welsh licence covers the export cable in Welsh waters and the landfall.

Following an initial habitat screening exercise (CMACS, 2015a²), proposed methodology was drafted and consulted upon with statutory authorities and a programme approved in late June/early July (CMACS, 2015b³). Benthic surveys were undertaken accordingly in late July 2015. This report details field operations, which involved grab and drop down video (DDV) work. A short report detailing the presence/absence of Annex I Habitat will be generated following review of imagery and videos, potentially including a mitigation plan, if required. A comprehensive technical report detailing sediment and infaunal sample, image and video analysis and interpretation will be produced in due course, the results of which will then be used to generate post-construction methodology proposals.

¹ CMACS (2013) The proposed Burbo Bank Extension offshore wind farm development – Subtidal and intertidal benthic characterisation survey technical report. 108pp.

² CMACS (2015a) Burbo Extension Offshore Wind Farm – Benthic and Annex I Habitat Screening Exercise. Prepared by Centre for Marine and Coastal Studies Ltd for DONG Energy. 34pp.

³ CMACS (2015b) Burbo Extension Offshore Wind Farm – Benthic and Annex I Habitat pre-construction monitoring proposals. Prepared by Centre for Marine and Coastal Studies Ltd for DONG Energy. 35pp.

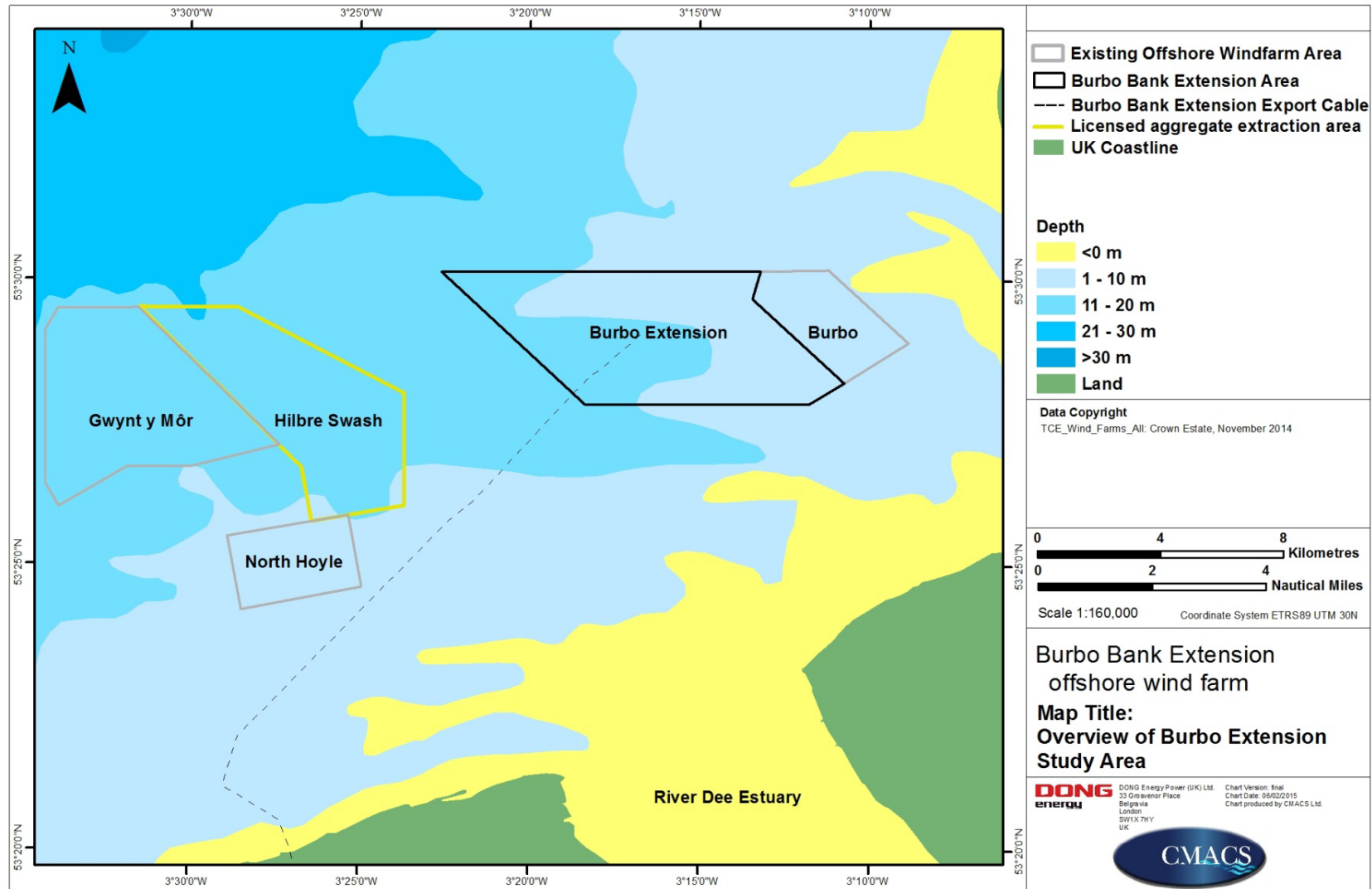


Figure 1. Overview of Burbo Bank Extension Offshore Wind Farm

2. Survey Programme

2.1 Objectives

The primary objectives of the pre-construction survey programme were to:

- 1) Determine whether Annex I reef habitat is present within 190m from proposed turbine locations, 100m from export cabling and 50m from array cabling, and if so, its extent.
- 2) Obtain baseline sediment and infaunal data from the two main habitats (medium sand and fine sediment) identified during characterisation.
- 3) Investigate epifauna at a subset of sampling stations, also for provision of baseline data.

2.2 Overview of survey methodology and planning

The survey programme originally comprised:

- 18 Day grab stations – 10 for sediment analysis & infaunal analysis and 8 for sediment analysis only.
- Drop down video (DDV) drops at 7 of the same 18 stations to investigate epifauna.
- DDV transects on two reasonably large patches of potential cobble reef inshore of the export cable route highlighted by Natural Resources Wales using 2012 geophysical data.
- Potential further investigation with DDV should geophysical data (side scan data and bathymetry) acquired during 2015 UXO survey works identify other potential Annex I reef or sensitive habitat.

Following agreement of this programme with both the Marine Mammal Organisation (and their advisors, Cefas and Natural England) and Natural Resources Wales, applications for a marine small works licence and dispensation from relevant byelaws were sought from the Crown Estate and North Western Inshore Fisheries and Conservation Authority (NWIFCA) respectively. The former was granted once permission had been obtained or notifications made to relevant tenants or parties identified by a conflicts check (ref R1E BB 08), and dispensation under Byelaw 1 with derogation for Byelaws 3, 12, 13A and 19 was authorised (12885 SCIF15).

The majority of UXO geophysical data was made available immediately prior to survey commencement, with the remaining data becoming available once the survey was underway. Having reviewed side scan sonar and bathymetric data, a further five DDV drops were added to the programme to investigate a significant area of potential

coarse glacial till and a number of small patches of potential Annex I reef. A further four DDV transects were also added to ensure the patches of potential cobble reef inshore of the export cable route were sufficiently covered and to investigate two newly identified, reasonably large patches of potential reef.

The finalised programme of Day grab and DDV drops and transects is displayed in Figure 2 and Figure 3.

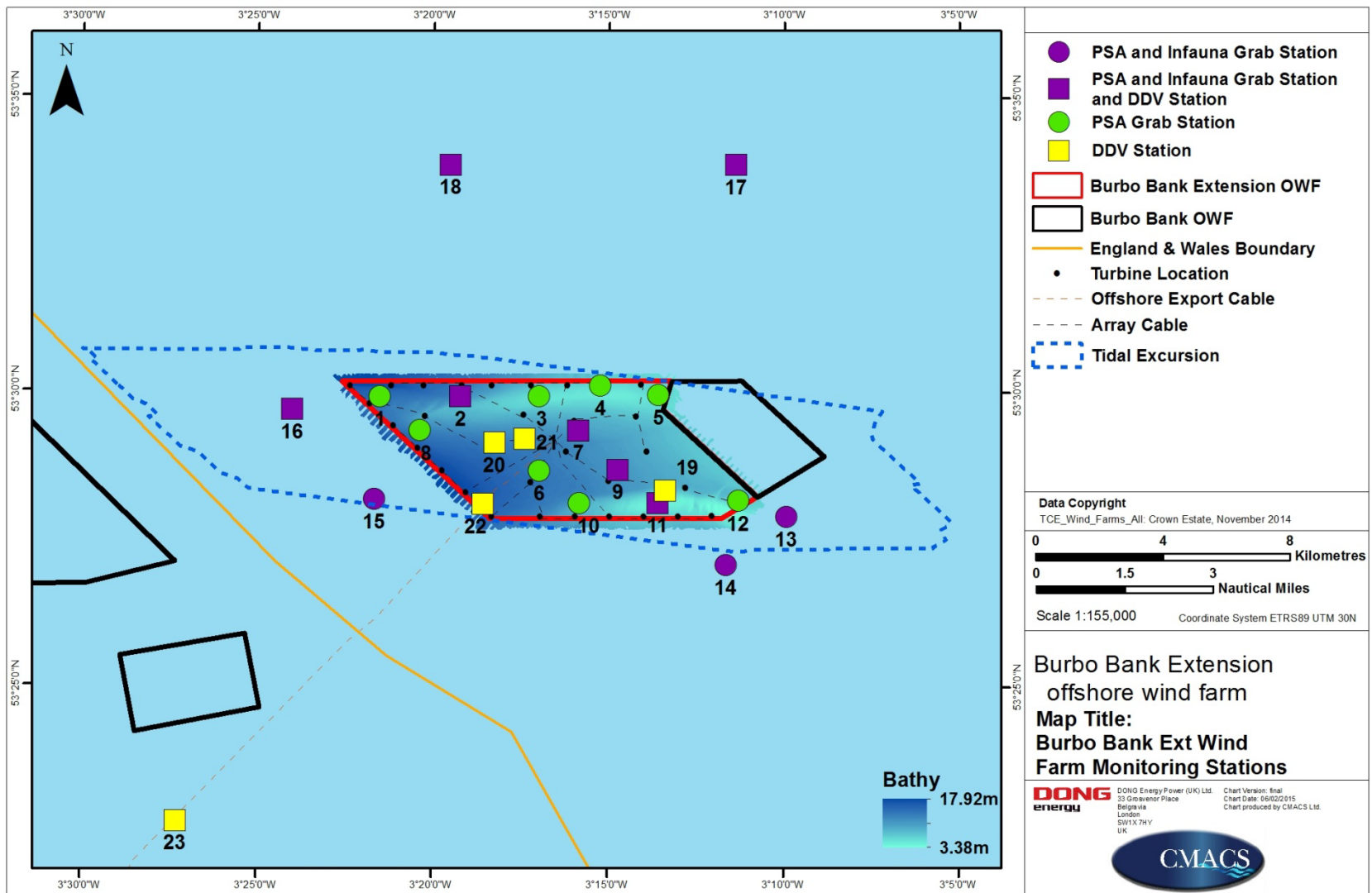


Figure 2. Location of grab sample and DDV drop locations

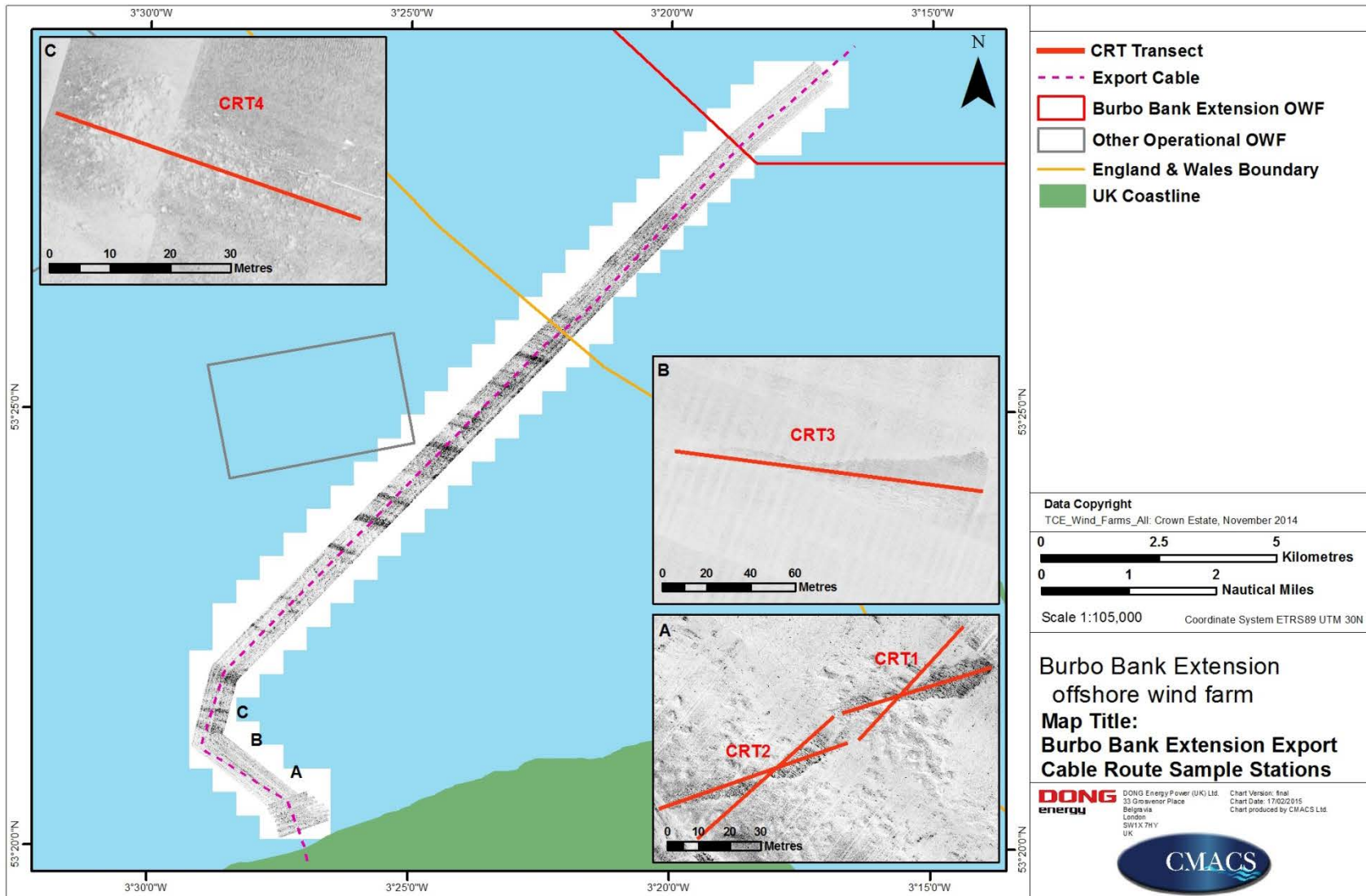


Figure 3. Location of DDV transects

3. Survey Log

The survey vessel, Aquadynamic, operated by Aquatech, was used for all survey work, operating from Liverpool Marina on a daily basis (Plate 1). Survey progress is detailed in Table 1, below.



Plate 1. Survey vessel, Aquadynamic

Table 1. Survey progress

Date	Activity	Progress
20/07/2015	Mobilisation	Vessel transported to Liverpool Marina
21/07/2015	Mobilisation/ weather	Vessel lifted into water. Biologists mobilise gear to vessel. Weather, tide and sea state conditions not suitable for survey
22/07/2015	Survey	Good weather & sea state for grabbing. 18 triplicate grab stations successfully sampled. Samples returned to CMACS Eastham
23/07/2015	Weather	Poor weather & sea state for camera work
24/07/2015	Survey	Weather & sea state exceptionally good – all DDV stations & transects surveyed. Biologists demobilise.
27/07/2015	Demobilisation	Vessel lifted out of the water.

3.1 Grab survey

A standard weighted Day grab with a 0.1m² sample area was used (Plate 2). Upon retrieval of each sample, the position, date, time and water depth were recorded (Appendix 1). The majority of samples were collected from within approximately 5m of the target location. Particular care was required when sampling Station 13, which is located within approximately 50m of two existing Burbo Bank Offshore Wind Farm export cables, and which was successfully sampled within 2.4m of the target.



Plate 2. The Day grab aboard the Aquadynamic

A digital photograph of each faunal grab was taken of the sample prior to any sieving. Notes were made on sediment type, colour, volume and any species of note in each grab sample (Appendix 2). Triplicate grab samples were successfully acquired from each station and replicate (none were rejected for being too small or for the grab jaws not being closed).

After initial observations and photographs a representative subsample of no less than 10% of sample volume or ten times the volume of the largest particle was removed for particle size analysis (PSA). All sediment samples were kept in cool boxes. At PSA only stations, the remaining contents of the grab sample were discarded.

At stations also targeted for infaunal analysis, the remaining material was gently washed over a 1mm sieve using a low pressure hose. The retained material was back-washed into containers labelled both internally and externally and fixed by addition of 10% formalin to a final concentration of approximately 4%.

All samples were taken to the CMACS laboratory in Eastham (Wirral), where sediment samples were immediately frozen prior to PSA analysis. Infaunal samples were dispatched to the CMACS laboratory on the Isle of Man for taxonomic analysis.

3.2 DDV survey

A drop down video/camera with freshwater housing suitable for use in low visibility/high turbidity environments was used (Plate 3). At locations chosen to investigate epifauna or small patches of potential cobble reef, the camera was deployed to the seabed directly over the target while the vessel was on position. Five images and continuous video footage were obtained at each station. At stations 20, 21 and 22, further images were taken beyond the initial target along cardinal points to delineate cobbly areas.

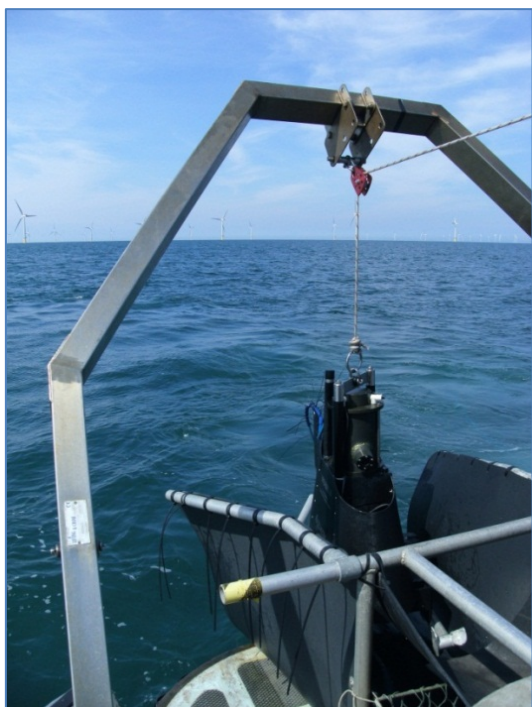


Plate 3. The DDV system aboard the Aquadynamic

At locations chosen to investigate larger patches of potential Annex I stony reef, the DDV was deployed to the seabed over the start of each transect and ‘bed-hopped’ along the transects to obtain both continuous video footage and still images approximately every 5 or 10m, depending upon transect length.

The on-board marine biologist captured and logged stills and video imagery from each station and along each transect in addition to associated data such as depth, time and brief notes on the sediment type and any identifiable epifauna or Annex I habitat (positional data in Appendix 3, and field notes in Appendix 4 & Appendix 5).

4. Field Observations

Observations made during the grab and DDV surveys are summarised in Appendix 2, Appendix 4 & Appendix 5.

Review and analysis of potential cobbly patches will be detailed in a specific Annex I Habitat report. Sediment types were otherwise generally as expected considering the majority of survey stations were chosen to target the main medium sand and muddier habitats. The suspected area of glacial till identified by recent geophysical data seemed to consist of coarse sand with shell fragments and pebbles (Station 19). Fauna noted during field work were generally typical of this coastal area of the Irish Sea (including tube worms, anemones, starfish, brittle stars, crabs, gobies and sand eels). Detailed sediment and taxonomic data from grab samples, DDV video and imagery will be incorporated into subsequent technical reporting.

A number of marine mammals were incidentally observed during the DDV survey on 24th July (Table 2).

Table 2. Marine mammal recorded during DDV survey

Date	Time	Location	Species	Nos.	Behaviour
22/07/15	09:31	Near Station 10	Bottlenose dolphin	8	Swimming east
24/07/15	07:20	250m from T1	Grey seal	1	Drifting in tide
24/07/15	08:23	200m from T2	Grey seal	3	Feeding
24/07/15	08:30	150m from T3	Bottlenose dolphin	2	Swimming east
24/07/15	11:03	Near Station 23	Grey seal	1	Spy hopping
24/07/15	12:43	50m from Station 9	Grey seal	1	Spy hopping
24/07/15	12:59	300m from Station 7	Grey seal	1	Spy hopping
24/07/15	13:14	50m to 300m from Station 21	Grey seal	1	Spy-hopping then logging
24/07/15	16:08	Between Stations 17 & 18	Habour porpoise	1	Swimming south

5. Health and safety

There were no accidents, incidents or near misses during the grab or DDV surveys.

Appendix 1. Grab station positional data

NB -all obtained on 22nd July 2015

Station	Attempt	Fix No	Time UTC	Easting	Northing	TGT Brg (°)	TGT Dist (m)	Depth (m)
17 A	First	1	05:14:29	487460.2	5935072	349	0.83	10.2
17 B	First	2	05:16:08	487461.2	5935075	216	1.75	10.2
17 C	First	3	05:17:14	487460.2	5935073	345	0.42	10.1
18 A	First	4	05:50:04	478462.7	5935081	149	5.86	20.1
18 B	First	5	05:53:08	478456.5	5935067	46	12.7	20.1
18 C	First	6	05:54:59	478464.4	5935072	19	3.91	20
1A	First	7	06:22:54	476217.3	5927787	186	4.14	16.1
1 B	First	8	06:24:50	476218.2	5927785	214	2.51	16.1
1 C	First	9	06:26:11	476218.3	5927786	205	3.47	16
16 A	First	10	06:39:39	473459.9	5927397	173	5.79	18.3
16 B	First	11	06:40:58	473457	5927394	129	4.37	18.5
16C	First	12	06:43:02	473458.2	5927394	131	3.33	18.3
15 A	First	13	06:59:46	476049.8	5924562	165	0.59	17.7
15 B	First	14	07:01:21	476053	5924563	240	3.61	17.7
15 C	First	15	07:03:47	476051.2	5924562	242	1.31	17.7
8A	First	16	07:17:29	477483.5	5926717	101	5.3	13.5
8 B	First	17	07:18:59	477488.8	5926720	181	4.19	13.4
8 C	First	18	07:20:19	477484.2	5926715	81	4.36	13.4
2A	First	19	07:29:57	478759.1	5927791	193	6.89	12.9
2 B	First	20	07:31:36	478755.8	5927784	100	1.61	12.8
2 C	First	21	07:32:48	478755	5927784	96	2.42	12.9
3A	First	22	07:46:30	481233.9	5927786	172	5.07	7.7
3 B	First	23	07:48:03	481233.8	5927784	154	3.43	7.7
3 C	First	24	07:49:17	481231.6	5927781	88	3.43	7.5
7A	First	25	08:02:46	482479.4	5926717	147	4.11	11.2
7 B	First	26	08:04:05	482478.9	5926711	44	3.49	11.2
7 C	First	27	08:06:00	482478.1	5926711	57	4.24	11.2
6A	First	29	08:17:37	481243.7	5925449	240	12.86	13.8
6B	First	30	08:18:23	481231.6	5925441	24	2.03	13.7
6C	First	31	08:20:40	481232.4	5925442	357	0.61	13.8
10A	First	32	08:32:28	482507	5924422	9	2	10.8
10 B	First	33	08:33:52	482511.5	5924429	211	6.91	10.9
10 C	First	34	08:36:14	482510.1	5924423	281	2.93	10.9
9A	First	35	08:47:38	483731.2	5925473	98	1.11	11.4
9 B	First	36	08:49:46	483730.3	5925476	149	3.87	11.5
9 C	First	37	08:51:13	483732.8	5925471	346	1.28	11.6
11A	First	38	09:07:55	484978	5924428	127	2.67	6.3
11 B	First	39	09:09:04	484981.7	5924431	199	4.62	6.2
11 C	First	40	09:10:20	484981.5	5924423	335	3.46	6.2
14 A	Second	41	09:28:00	487140	5922468	269	5.58	9.8
14 B	First	42	09:30:08	487138.5	5922461	328	7.56	9.9
14 C	First	43	09:31:58	487138.5	5922469	249	4.43	9.9
12A	First	44	09:47:23	487525	5924488	323	3.92	8.9
12 B	First	45	09:48:54	487526.2	5924496	219	5.7	9
12 C	First	46	09:50:39	487525.6	5924489	312	3.85	9.1
13 A	First	47	10:01:17	489030	5923988	133	2.26	7

Station	Attempt	Fix No	Time UTC	Easting	Northing	TGT Brg (°)	TGT Dist (m)	Depth (m)
13 B	First	48	10:02:53	489030.7	5923987	107	1	7
13 C	First	49	10:04:54	489030.4	5923989	150	2.37	7
5A	First	50	10:26:58	485000.9	5927827	140	5.07	8.1
5 B	First	51	10:28:52	485007.8	5927819	317	5.25	8.3
5 C	First	52	10:30:18	485005.1	5927824	238	1.16	8.3
4A	First	53	10:42:10	483162.9	5928123	150	3.35	8.8
4 B	Second	54	10:44:46	483166.1	5928126	196	5.82	8.7
4 C	First	55	10:46:21	483169.3	5928124	231	6.31	8.8

Appendix 2. Field notes from Grab survey

Station	Date	Time (UTC)	Rep	Fix	Vol (L)	Description & notes
1	22/07/2015	06:22	A	7	10	Medium sand with shell fragments - a few tube worms
			B	8	10	Medium sand with shell fragments
			C	9	10	Medium sand with shell fragments
2	22/07/2015	07:29	A	19	10	Fine sand with many shell fragments
			B	20	10	Fine sand with many shell fragments
			C	21	10	Fine sand with many shell fragments
3	22/07/2015	07:46	A	22	10	Medium sand with shell fragments
			B	23	10	Medium sand with shell fragments
			C	24	10	Medium sand with shell fragments
4	22/07/2015	10:42	A	53	5	Muddy with shell fragments
			B	54	7	Muddy with shell fragments - bivalves & crab
			C	55	8	Muddy with shell fragments - bivalves
5	22/07/2015	10:26	A	50	5	Medium sand - annelids, tubeworm
			B	51	8	Medium sand - annelids & razor clam
			C	52	8	Medium sand - annelids
6	22/07/2015	08:17	A	29	10	Fine sand - anoxic layer immediately below surface
			B	30	10	Fine sand - anoxic layer immediately below surface
			C	31	10	Fine sand - anoxic layer immediately below surface
7	22/07/2015	08:02	A	25	8	Fine sand with anoxic layer - sea potato
			B	26	8	Fine sand with anoxic layer - sea potato
			C	27	8	Fine sand with anoxic layer - brittle stars & tube worm
8	22/07/2015	07:17	A	16	10	Medium sand with shell fragments & annelids
			B	17	7	Medium sand with shell fragments & annelids

Station	Date	Time (UTC)	Rep	Fix	Vol (L)	Description & notes
			C	18	8	Medium sand with shell fragments & annelids
9	22/07/2015	08:47	A	35	10	Fine sand with some mud/clay & anoxic layer 2 inches- sea slug?
			B	36	10	Fine sand with some mud/clay & anoxic layer 2 inches- sea slug?
			C	37	10	Fine sand with some mud/clay & anoxic layer 2 inches - razor clam, annelid, brittlestar & tube worm
10	22/07/2015	08:32	A	32	10	Medium sand with shell fragments - tube worms
			B	33	10	Medium sand with shell fragments
			C	34	10	Medium sand with shell fragments
11	22/07/2015	09:07	A	38	10	Medium sand with shell fragments
			B	39	10	Medium sand with shell fragments - crab & annelids
			C	40	10	Medium sand with shell fragments
12	22/07/2015	09:47	A	44	10	Medium sand - razor clam, bivalve, annelid, tube worm
			B	45	10	Medium sand - polychaete
			C	46	10	Medium sand - brittlestar & crab
13	22/07/2015	10:01	A	47	10	Medium sand with shell fragments - brittlestar, tube worm, bivalve
			B	48	10	Medium sand with shell fragments - tube worm & bivalves
			C	49	7	Medium sand with shell fragments - tube worm, bivalves, hermit crab , brittlestar
14	22/07/2015	09:28	A	41	10	Medium sand with shell fragments - polychaete, annelid, tube worm
			B	42	10	Medium sand with shell fragments
			C	43	10	Medium sand with shell fragments - polychaete
15	22/07/2015	06:59	A	13	10	Medium sand with anoxic layer 3 inches - shell fragments & annelids
			B	14	10	Medium sand - shell fragments, annelids, sea potato
			C	15	10	Medium sand with anoxic layer 3 inches - shell fragments & annelids
16	22/07/2015	06:39	A	10	10	Fine/medium sand with shell fragments - annelids
			B	11	8	Fine/medium sand with shell fragments - annelids

Station	Date	Time (UTC)	Rep	Fix	Vol (L)	Description & notes
			C	12	10	Fine/medium sand with shell fragments - annelids
17	22/07/2015	05:14	A	1	8	Medium sand and anoxic layer 1 inch - sea potato
			B	2	8	Medium sand and anoxic layer 1 inch - hermit crab, tube worm
			C	3	8	Medium sand and anoxic layer 1 inch - tube worm
18	22/07/2015	05:50	A	4	10	Fine sand & mud with anoxic layer 1 inch - sea potato, polychaetes, brittlestars
			B	5	10	Fine sand & mud with anoxic layer 1 inch - annelids, spiny cockles, brittlestars
			C	6	10	Fine sand & mud with anoxic layer 1 inch -annelids, spiny cockles, sea potato, brittlestars

Appendix 3. DDV positional data

NB – all obtained 24th July 2015

Station	Fix No	Time (UTC)	Easting	Northing	Image No	Image Time (UTC)	Depth (m)
T1A	3	06:34:25	469267.7	5910711	002	06:34:44	7.5
T1A	4	06:36:40	469273.4	5910715	003	06:37:12	7.5
T1A	5	06:37:59	469277.1	5910716	004	06:38:44	7.6
T1A	6	06:39:34	469280.9	5910717	005	06:39:53	7.5
T1A	7	06:41:04	469286.8	5910718	006	06:41:43	7.6
T1A	8	06:42:27	469295.3	5910720	007	06:42:56	7.6
T1A	9	06:43:45	469295.8	5910721	008	06:44:31	7.6
T1A	10	06:45:19	469301.6	5910724	009	06:45:46	7.5
T1A	11	06:47:24	469305	5910725	010	06:48:00	7.5
T1A	12	06:49:04	469311.2	5910725	011	06:49:33	7.4
T1A	13	06:50:25	469315.6	5910728	012	06:51:01	7.4
T1B	14	06:58:46	469272.2	5910703	013	06:59:00	7.1
T1B	15	07:00:59	469278.3	5910706	014	07:01:13	7.0
T1B	16	07:02:07	469278.4	5910713	015	07:02:27	7.1
T1B	17	07:03:59	469284.5	5910715	016	07:04:07	7.1
T1B	18	07:05:44	469289.1	5910719	017	07:06:14	7.2
T1B	19	07:08:16	469293.4	5910723	018	07:08:43	7.1
T1B	20	07:11:19	469293.5	5910726	019	07:11:58	7.0
T1B	21	07:13:14	469297.5	5910729	020	07:13:31	7.0
T1B	22	07:14:52	469301.4	5910732	021	07:15:09	6.9
T1B	23	07:15:43	469302.3	5910734	022	07:16:10	6.9
T1B	24	07:17:03	469307.2	5910738	023	07:17:36	6.9
T2B	25	07:30:56	469222.1	5910671	024	07:31:51	6.4
T2B	26	07:34:27	469225.6	5910675	025	07:34:57	6.4
T2B	27	07:35:36	469230.5	5910679	026	07:36:27	6.5
T2B	28	07:38:00	469234.4	5910682	027	07:38:42	6.5
T2B	29	07:39:25	469237.3	5910684	028	07:39:58	6.5
T2B	30	07:40:52	469241.3	5910690	029	07:41:25	6.5
T2B	31	07:42:14	469245.9	5910691	030	07:42:51	6.4
T2B	32	07:43:37	469249.1	5910697	031	07:44:24	6.5
T2B	32	07:43:37	469249.1	5910697	032	07:44:47	6.5
T2B	33	07:46:31	469252.2	5910700	033	07:47:03	6.4
T2B	34	07:48:02	469256.8	5910702	034	07:48:59	6.4
T2B	35	07:50:06	469259.5	5910705	035	07:50:43	6.4
T2B	36	07:51:33	469263.2	5910708	036	07:52:15	6.2
T2B	37	07:53:08	469266.8	5910710	037	07:53:49	6.2
T2A	38	08:01:43	469209.7	5910680	038	08:02:23	6.2
T2A	39	08:03:21	469214.3	5910683	039	08:03:39	6.1
T2A	40	08:04:45	469219.9	5910686	040	08:05:08	6.1
T2A	41	08:06:07	469225.5	5910686	041	08:06:42	6.1
T2A	42	08:07:49	469229.2	5910687	042	08:08:13	6.1
T2A	43	08:08:55	469233.7	5910690	043	08:09:38	6.0
T2A	44	08:10:20	469239.5	5910692	044	08:10:39	6.0
T2A	45	08:11:23	469244.8	5910694	045	08:11:54	6.0
T2A	46	08:12:38	469250.5	5910693	046	08:13:15	6.1
T2A	47	08:14:02	469257.2	5910698	047	08:14:45	6.0
T2A	47	08:14:02	469257.2	5910698	048	08:15:15	6.0

Station	Fix No	Time (UTC)	Easting	Northing	Image No	Image Time (UTC)	Depth (m)
T2A	48	08:15:56	469261.4	5910699	049	08:16:03	5.9
T2A	49	08:17:13	469265.1	5910700	050	08:17:54	5.9
T2A	50	08:18:46	469271.1	5910702	051	08:19:42	5.8
T3	51	08:35:53	468214.7	5911373	052	08:36:30	7.5
T3	52	08:37:23	468224.2	5911370	053	08:37:58	7.7
T3	53	08:38:47	468234.9	5911370	054	08:39:28	7.7
T3	54	08:40:27	468243	5911368	055	08:41:34	7.6
T3	55	08:42:37	468255.2	5911368	056	08:43:24	7.5
T3	56	08:44:17	468264.7	5911367	057	08:45:12	7.5
T3	57	08:46:06	468275.3	5911366	058	08:46:38	7.4
T3	58	08:47:25	468284.5	5911364	059	08:48:16	7.2
T3	59	08:49:00	468295.1	5911363	060	08:49:41	6.9
T3	60	08:50:25	468304.4	5911361	061	08:51:18	6.9
T3	61	08:52:11	468314.2	5911360	062	08:52:48	6.8
T3	62	08:53:42	468324.4	5911359	063	08:54:23	6.7
T3	63	08:55:17	468334.1	5911356	064	08:56:16	6.9
T3	64	08:56:59	468343.5	5911356	065	08:57:37	7.4
T3	65	08:58:30	468354	5911354	066	08:59:32	7.7
T3	66	09:08:15	468306.3	5911321	067	09:08:53	7.2
T3	67	09:09:52	468309.8	5911330	068	09:10:22	7.4
T3	68	09:11:43	468311	5911341	069	09:12:25	7.4
T3	69	09:13:01	468312.3	5911347	070	09:13:39	7.1
T3	70	09:14:15	468312.7	5911351	071	09:15:31	7.0
T3	71	09:16:36	468313.9	5911356	072	09:17:21	6.7
T3	72	09:18:18	468315.9	5911367	073	09:19:45	6.7
T3	73	09:20:25	468315.6	5911373	074	09:21:27	7.1
T3	74	09:22:24	468316.5	5911377	075	09:23:24	7.0
T3	75	09:24:44	468316.9	5911382	076	09:25:37	7.0
T4	76	09:39:08	467981.9	5911945	077	09:39:46	7.2
T4	77	09:41:01	467988.2	5911943	078	09:42:18	7.0
T4	78	09:43:32	467992.1	5911943	079	09:44:17	7.2
T4	79	09:44:59	467996.9	5911940	080	09:45:40	7.1
T4	80	09:46:29	468000.3	5911938	081	09:47:35	7.2
T4	81	09:49:39	468006.7	5911938	082	09:50:12	7.2
T4	82	09:52:05	468010.5	5911936	083	09:52:46	7.3
T4	83	09:53:59	468017.3	5911931	084	09:54:41	7.1
T4	84	09:55:46	468023.3	5911932	085	09:56:44	7.1
T4	85	09:57:38	468027.2	5911929	086	09:58:14	7.1
T4	86	09:59:11	468032.9	5911926	087	09:59:45	6.9
T4	87	10:15:50	468010.4	5911960	088	10:16:29	7.1
T4	88	10:17:32	468007.7	5911955	089	10:18:25	8.1
T4	89	10:19:27	468004.3	5911951	090	10:20:21	9.0
T4	90	10:21:34	468002.9	5911947	091	10:23:39	7.0
T4	91	10:25:43	468002.9	5911939	092	10:27:14	7.2
T4	92	10:30:48	468000.2	5911935	093	10:32:08	7.2
T4	93	10:33:19	467997.8	5911921	094	10:33:42	7.4
23	94	11:01:52	469758.3	5914448	095	11:02:29	8.7
23	94	11:01:52	469758.3	5914448	096	11:03:29	8.7
23	94	11:01:52	469758.3	5914448	097	11:05:02	8.7
23	94	11:01:52	469758.3	5914448	098	11:06:12	8.7
23	94	11:01:52	469758.3	5914448	099	11:07:11	8.7

Station	Fix No	Time (UTC)	Easting	Northing	Image No	Image Time (UTC)	Depth (m)
22	95	11:45:23	479464.6	5924393	100	11:46:07	16.4
22	95	11:45:23	479464.6	5924393	101	11:46:59	16.4
22	96	11:47:35	479462.6	5924396	102	11:47:41	16.4
22	96	11:47:35	479462.6	5924396	103	11:48:37	16.4
22	96	11:47:35	479462.6	5924396	104	11:49:52	16.4
22	96	11:47:35	479462.6	5924396	105	11:51:02	16.4
22	97	11:52:54	479476.5	5924389	106	11:53:30	16.5
22	98	11:54:44	479469.2	5924390	107	11:55:27	16.5
22	99	11:58:27	479463.9	5924398	108	11:59:01	16.5
11	100	12:16:18	484978	5924429	109	12:16:43	7.7
11	100	12:16:18	484978	5924429	110	12:17:29	7.7
11	100	12:16:18	484978	5924429	111	12:18:22	7.7
11	100	12:16:18	484978	5924429	112	12:19:08	7.7
11	100	12:16:18	484978	5924429	113	12:19:51	7.7
19	101	12:26:16	485226.3	5924822	114	12:26:39	10.3
19	101	12:26:16	485226.3	5924822	115	12:27:32	10.3
19	101	12:26:16	485226.3	5924822	116	12:28:29	10.3
19	101	12:26:16	485226.3	5924822	117	12:29:37	10.3
19	101	12:26:16	485226.3	5924822	118	12:30:41	10.3
9	102	12:42:29	483731.3	5925472	119	12:43:01	13.4
9	102	12:42:29	483731.3	5925472	120	12:43:53	13.4
9	102	12:42:29	483731.3	5925472	121	12:44:59	13.4
9	102	12:42:29	483731.3	5925472	122	12:45:52	13.4
9	102	12:42:29	483731.3	5925472	123	12:46:30	13.4
7	103	12:59:29	482480.5	5926716	124	12:59:37	13.2
7	103	12:59:29	482480.5	5926716	125	13:00:14	13.2
7	103	12:59:29	482480.5	5926716	126	13:01:01	13.2
7	103	12:59:29	482480.5	5926716	127	13:01:41	13.2
7	103	12:59:29	482480.5	5926716	128	13:02:40	13.2
21	104	13:13:44	480799.8	5926444	129	13:14:28	15.2
21	104	13:13:44	480799.8	5926444	130	13:15:28	15.2
21	104	13:13:44	480799.8	5926444	131	13:16:51	15.2
21	104	13:13:44	480799.8	5926444	132	13:17:49	15.2
21	105	13:19:08	480807.7	5926438	133	13:19:19	15.1
21	106	13:21:00	480799.4	5926437	134	13:21:20	15.4
21	107	13:22:53	480790.1	5926443	135	13:23:28	15.3
20	108	13:31:36	479844.4	5926327	136	13:32:09	16.2
20	108	13:31:36	479844.4	5926327	137	13:33:15	16.2
20	108	13:31:36	479844.4	5926327	138	13:34:18	16.2
20	109	13:35:51	479842.9	5926329	139	13:36:04	16.2
20	110	13:37:30	479851.3	5926326	140	13:37:47	16.5
2	111	13:52:01	478761.4	5927783	141	13:52:15	15.6
2	111	13:52:01	478761.4	5927783	142	13:52:43	15.6
2	111	13:52:01	478761.4	5927783	143	13:53:19	15.6
2	111	13:52:01	478761.4	5927783	144	13:54:55	15.6
2	111	13:52:01	478761.4	5927783	145	13:56:20	15.6
16	112	14:13:08	473460.6	5927389	146	14:13:27	20.7
16	112	14:13:08	473460.6	5927389	147	14:14:32	20.7
16	112	14:13:08	473460.6	5927389	148	14:15:30	20.7
16	112	14:13:08	473460.6	5927389	149	14:16:10	20.7
16	112	14:13:08	473460.6	5927389	150	14:17:14	20.7

Station	Fix No	Time (UTC)	Easting	Northing	Image No	Image Time (UTC)	Depth (m)
18	113	14:42:12	478467.3	5935077	151	14:42:46	21.9
18	113	14:42:12	478467.3	5935077	152	14:44:18	21.9
18	113	14:42:12	478467.3	5935077	153	14:45:33	21.9
18	113	14:42:12	478467.3	5935077	154	14:46:41	21.9
18	114	14:48:17	478466.4	5935063	155	14:48:56	22.1
17	116	15:13:58	487458.7	5935074	156	15:14:32	11.5
17	116	15:13:58	487458.7	5935074	157	15:15:16	11.5
17	116	15:13:58	487458.7	5935074	158	15:16:05	11.5
17	116	15:13:58	487458.7	5935074	159	15:17:46	11.5
17	116	15:13:58	487458.7	5935074	160	15:19:19	11.5

Appendix 4. Field notes from DDV drops

Station	Date	Time (UTC)	Fix	Image Number	Description & notes
23	24/07/2015	11:02	94	95	Sand and shell fragments. Average visibility.
		11:03	94	96	Sand and shell fragments. Average visibility.
		11:05	94	97	Sand and shell fragments, brittle star. Average visibility.
		11:06	94	98	Sand and shell fragments, brittle star. Average visibility.
		11:07	94	99	Sand and shell fragments. Average visibility.
22	24/07/2015	11:46	95	100	Sand and shell fragments. Good visibility
		11:46	95	101	Sand and shell fragments. Good visibility. Crab on video, brittle stars.
		11:47	96	102,103	Colonised cobbles. Good visibility. Hermit crab, anemones.
		11:49	96	104	Sand and shell fragments. Good visibility. Hermit crab on video.
		11:51	96	105	Sand and shell fragments. Good visibility
		11:53	97	106	Sand and shell fragments. Good visibility. Flatfish sp. on video. (15m SE)
		11:55	98	107	Mainly sand, some pebbles. Good visibility. (6m SE)
		11:59	99	108	Sand and shell fragments. Good visibility. (5m N)
11	24/07/2015	12:16	100	109	Sand. Poor visibility.
		12:17	100	110	Sand. Poor visibility.
		12:18	100	111	Sand. Poor visibility.
		12:19	100	112	Sand. Poor visibility. Sand eel on video.
		12:19	100	113	Sand. Poor visibility. Sand eel on video.
19	24/07/2015	12:26	101	114	Sand and shell fragments. Poor visibility.
		12:27	101	115	Sand and shell fragments. Poor visibility.
		12:28	101	116	Sand and shell fragments. Poor visibility.
		12:29	101	117	Sand and shell fragments. Poor visibility.
		12:30	101	118	Sand and shell fragments. Poor visibility. Fish in video, sand eel?

Station	Date	Time (UTC)	Fix	Image Number	Description & notes
9	24/07/2015	12:43	102	119	Sandy mud. Very poor to no visibility.
		12:43	102	120	Sandy mud. Very poor to no visibility.
		12:44	102	121	Sandy mud. Very poor to no visibility.
		12:45	102	122	Sandy mud. Very poor to no visibility.
		12:46	102	123	Sandy mud. Very poor to no visibility.
7	24/07/2015	12:59	103	124	Sand. Poor visibility.
		13:00	103	125	Sand. Poor visibility.
		13:01	103	126	Sand. Poor visibility.
		13:01	103	127	Sand. Poor visibility.
		13:02	103	128	Sand. Poor visibility.
21	24/07/2015	13:14	104	129	Encrusted cobbles. Anemones, <i>A. rubens</i> . Good visibility.
		13:15	104	130	Encrusted cobbles. Anemones, <i>A. rubens</i> . Good visibility.
		13:16	104	131	Encrusted cobbles. Anemones, <i>A. rubens</i> . Good visibility.
		13:17	104	132	Sand. Brittle stars. Good visibility. (4m N)
		13:19	105	133	Sand and shell fragments. Good visibility. (5m E)
		13:21	106	134	Sand. Brittle stars on video. Good visibility. (4m S)
		13:23	107	135	Sand and fines. Dead razor shell. Good visibility. (6m W)
20	24/07/2015	13:32	108	136	Sand. Brittle stars. Good visibility.
		13:33	108	137	Sand. Brittle stars. Good visibility.
		13:34	108	138	Sand. Anemones, brittle stars, <i>A. rubens</i> . Good visibility.
		13:36	109	139	Sand. Brittle stars. Good visibility. (4m N)
		13:37	110	140	Sand. Brittle stars. Good visibility. Occasional patches of anemones in video on buried cobbles. (4m N)
2	24/07/2015	13:52	111	141	Sand and shell fragments. Good visibility.
		13:52	111	142	Sand and shell fragments. Good visibility.

Station	Date	Time (UTC)	Fix	Image Number	Description & notes
		13:53	111	143	Sand and shell fragments. Good visibility.
		13:54	111	144	Sand and shell fragments. Good visibility.
		13:56	111	145	Sand and shell fragments. Good visibility.
16	24/07/2015	14:13	112	146	Sand and shell fragments. Brittle star. Good visibility.
		14:14	112	147	Sand and shell fragments. Small burrows (worms?). Good visibility.
		14:15	112	148	Sand and shell fragments. Small burrows (worms?). Good visibility.
		14:16	112	149	Sand and shell fragments. Small burrows (worms?). Good visibility.
		14:17	112	150	Sand and shell fragments. Small burrows (worms?). Good visibility.
18	24/07/2015	14:42	113	151	Burrowed mud. Brittle stars, <i>Nephrops</i> burrows. Fish on video. Good visibility.
		14:44	113	152	Burrowed mud. Brittle stars. Good visibility.
		14:45	113	153	Burrowed mud. Brittle stars, <i>Nephrops</i> burrows. Good visibility.
		14:46	113	154	Burrowed mud. Brittle stars. Good visibility.
		14:48	114	155	Burrowed mud. Brittle stars. <i>A. rubens</i> in video. Good visibility.
17	24/07/2015	15:14	116	156	Sand and shell fragments. Average to poor visibility.
		15:15	116	157	Sand and shell fragments. Average to poor visibility.
		15:16	116	158	Sand and shell fragments. Average to poor visibility.
		15:17	116	159	Sand and shell fragments. Average to poor visibility.
		15:18	116	160	Sand and shell fragments, some burrows. Average to poor visibility.

Appendix 5. Field notes from DDV transects

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	06:34	Time End (GMT/BST)	06:51
Position Start	469267.72 E 5910771.19 N	Position End	469315.64 E 5910728.09 N
Video Label	T1A		

NOTES:

Depth: 7.5m

Images: 2 - 12

Fix: 3 – 13

1 hr 30 mins after high water.

Fish sp. in videos, *A. rubens*, soft sediment, footage cloudy on landing but clearing after a few seconds. Still low visibility on screen.

Coarser ground towards end of transect (images 10 and 11).

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	06:58	Time End (GMT/BST)	07:17
Position Start	469272.17 E 5910703.20 N	Position End	469307.20 E 5910738.45 N
Video Label	T1B		

NOTES:

Depth: 7.1m

Images: 12 - 23

Fix: 14 – 24

2 hours after high water.

Hermit crab, crab sp., soft sediment, footage cloudy on landing but clearing after a few seconds. Still low visibility on screen.

Possible cobbles in image 18.

Image 20 - potential rocky reef. Small area of larger cobbles. *A. rubens*. Roughly 3m in length, nothing along remainder of transect.

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	08:01	Time End (GMT/BST)	08:19
Position Start	469209.66 E 5910680.02 N	Position End	469271.13 E 5910701.62 N
Video Label	T2A		

NOTES:

Depth: 6.2m

Images: 38 - 51

Fix: 38 – 50

Image 39 – Cobble, anemones. *A. Rubens*

Image 41, flat sand seabed

2 fish in image 47 goby sp.

Image 50 – *A. rubens*

Image 51 – jelly fish sp.

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	07:30	Time End (GMT/BST)	07:53
Position Start	469222.05 E 5910670.80 N	Position End	469266.78 E 5910710.49 N
Video Label	T2B		

NOTES:

Depth: 6.4m

Images: 24 - 37

Fix: 25 – 37

Crab in video towards start of transect. Flat sand sea bed.

Several fish seen in video, most likely sand eel (approximately 35m along transect).

Image 34 – Coarser ground

Image 35 Hermit crab.

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	08:35	Time End (GMT/BST)	09:24
Position Start	468224.16 E 5911372.96 N Cross - 468306.29 E 5911330.42 N	Position End	468354.50 E 5911354.43 N Cross - 468316.92 E 5911381.70 N
Video Label	T3		

NOTES:**Depth: 7.5m****Images: 52 - 76****Fix: 51 – 75****Coarser ground, some pebbles amongst flat sand, images clouds on camera landing and lifting.****Image 53 – *A. rubens*****Image 54 – Large cobbles, *A. rubens*****Image 55 – Large cobbles, anemone, *A. rubens*.****Image 56 – Cobble/ pebbles, *A. rubens*.****Image 57 – Pebble, anemone, *A. rubens*.****Image 58 – Anemone, *A. rubens*.****Image 59 – Cobbles, anemone, *A. rubens*.****Image 60 – Cobbles, large orange anemone, *A. rubens*.****Image 61 – Large orange anemone, *A. rubens*.****Image 62 – *A. rubens*.****Image 63 – Sand and pebbles.****Image 64 – Cobbles, *A. rubens*****Image 65 – Cobbles, *A. rubens*****Image 66 – Sand and fish sp.****Image 67 – Sand. Start of cross transect, Fix 66.****Image 68 – Sand.****Image 69 – Sand and dead razor shells.****Image 70 – Sand.****Image 71 – Cobbles, anemone, *A. rubens*.****Image 72 – Cobbles, anemone, *A. rubens*.****Image 73 – Cobbles, anemone, hydroids?, *A. rubens*.****Image 74 – Cobbles, anemone, *A. rubens*.****Image 75 – Sand****Image 76 – Sand**

Date	24/07/15	Personnel	C. Hulley
Time Start (GMT/BST)	09:39	Time End (GMT/BST)	10:33
Position Start	467981.88 E 5911944.55 N Cross - 468007.74 E 5911954.92 N	Position End	468032.90 E 5911925.90 N Cross - 467997.78 E 5911920.79 N
Video Label	T4		

NOTES:

Depth: 7.0m

Images: 77 - 94

Fix: 76 – 93

Good visibility.

Image 77 – Sand and pebble. *A. rubens*

Image 78 – Coarse sand. Hermit crabs.

Image 79 – Coarse sand.

Image 80 – Coarse sand, shells and shell fragments.

Image 81 – Coarse sand, pebbles, shells and shell fragments.

Image 82 – Sand, cobbles, shell fragments. *A. rubens*.

Image 83 – Sand, cobbles, razor clam shells. *A. rubens*.

Image 84 – Sand, cobbles, razor clam shells. *Brittle stars*.

Image 85 – Sand, razor shells, shell fragments.

Image 86 – Sand, pebble, shell fragments. Hermit crab, crab sp.

Image 87 – Sand, shell fragments. *A. rubens*

Image 88 – Sand and shell fragments. Poor visibility, use video. Start of cross transect, Fix 87.

Image 89 – Sand and shell fragments. Poor visibility, use video.

Image 90 – Sand, pebble, shell fragments. Brittle star, *a. rubens*.

Image 91 – Large cobble, *a. rubens*. Look at video.

Image 92 – Sand, pebble, shell fragments, razor shells. Orange anemone.

Image 93 – Sand, shell fragments. *A. rubens*. Use video, poor visibility.

Image 94 – Sand, shell fragments. Crab sp.