REPORT

Holyhead Port Expansion Environmental Statement

Appendices Volume II

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Stena Line

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Marine Ecology and Sediment Quality Surveys

Holyhead Approaches:

Marine Ecological Survey 2018

Produced on behalf of Stena Line
by
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1. PROJECT BACKGROUND

1.1 Introduction

The expansion of Holyhead Port, on Holy Island (Ynys Gybi), Isle of Anglesey, is proposed by Stena Line through the reclamation of land for port-related use and capital dredge. Land claim is proposed in areas A (predominantly subtidal) and B (predominantly intertidal), with dredging of the approach channel being proposed to enable navigable access to the port by larger vessels (Figure 1.1).

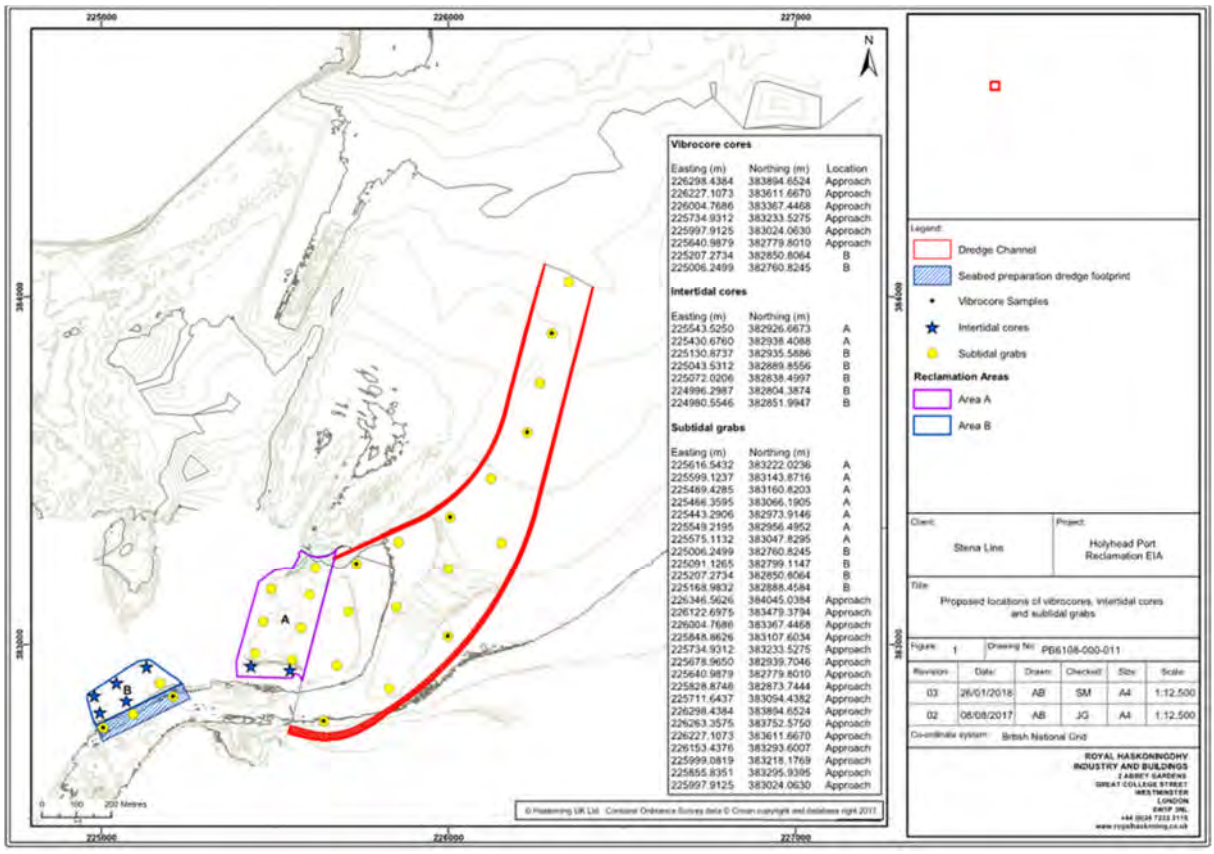

Figure 1.1: Proposed development area showing the proposed areas for land claim and dredging as well as sampling locations (map provided by Royal HaskoningDHV).

1.2 Survey Focus

Natural Resources Wales and the Welsh Government have confirmed that an Environmental Impact Assessment will be required to support any application for consent for this development, and as such, a marine environmental survey is required to understand the potential impacts on the marine environment.

To this end, The Institute of Estuarine & Coastal Studies (IECS) at the University of Hull was commissioned by Royal HaskoningDHV on behalf of Stena Line to undertake the marine ecological survey of the proposed development area.

1.3 Survey Requirements

In order to characterise the area and understand the potential impacts of the proposed development the marine ecological survey programme was required to address aspects of the prevailing physical, chemical and biological components. Specifically then, there are a series of operations necessary to address this:

1. **Vibrocore** survey to provide a depth-profiled indication of contamination.
2. **Marine ecology survey** to include:
    - Phase 1 intertidal biotope survey of areas A and B (a walk-over survey) to determine the predominant substratum and community types;
    - Intertidal core sampling for infaunal species and sediment particle size analysis;
    - Subtidal grab sampling for infauna and particle size.
3. **Laboratory analysis** to include (intertidal and subtidal):
    - Infaunal identification, enumeration and biomass;
    - Particle size analysis.
4. **Underwater video survey for *Didemnum vexillum***, an invasive species known to be present in the adjacent Holyhead Marina.
5. **Reporting**:
    - Biotope classification.
    - Identification of species of interest (conservation interest, rare species, non-native / invasive species, indicators of disturbance etc.).
    - Standard benthic community characterisation for intertidal and subtidal habitats indicating species present, abundance, diversity, biomass and broad community types.
    - Overall comments on the likely sensitivity of the species and communities present to physical disturbance (habitat loss, sediment resuspension, increased turbidity and sedimentation).
    - Stand-alone report relating to the underwater video survey of *D. vexillium*.

The details of these survey components (methods and results) are addressed in the following sections of this report.

2. VIBROCORING PROGRAMME

2.1 Vibrocore Survey Methodology

Vibrocore samples were required to be collected from 8 stations, these identified by Royal HaskoningDHV (6 within the proposed dredge channel and 2 in proposed land claim area B),(Figure 2.1).

Vibrocoring was undertaken over 4 days (7th August 2018 to 10th August 2018), although with the first day used to set-up and calibrate equipment and the second day largely lost due to equipment issues on the survey vessel.

Sample stations were located using the survey vessel's DGPS but with a back-up handheld DGPS system also carried. The vibrocore was rigged to a potential 6m penetration (a modular system using 1m sections and thus having a *potential* 6m penetration rather than the specified 5m). The survey vessel initially used was the *Vital*, this was replaced by the *Forth Constructor* during the second day because of equipment failure. The vibrocore used was supplied by Feritech and featured a high power 75kN thrust operation deployable in up to 10 knot tides (Plate 2.1). The internal liners were of a continuous plastic tube construction which were sectioned and capped on completion of each deployment and sample extraction.

Plate 2.1: Vibrocorer design (Source: Feritech).

Once on station, the vibrocoring device was lowered to the seabed to recover a sample to a maximum depth of 5m. Where there was a deployment issue e.g. insufficient penetration of bed profile not permitting a stable siting, then the sample location was repositioned 10m from the original sample point (or as near as possible to this).

The minimum sample recovery percentage specified was for at least 80% of the vibrocore penetration depth, otherwise the sample should be rejected and the core re-deployed. A maximum of 3 attempts were required to collect a viable sample from each station.

However, in practice, depth penetration was relatively low at a number of sample locations, and where time and consumables allowed, additional attempts were made to gain a sample. In most instances, sample penetration was less than 4m (80% of potential depth penetration) and as such, the 'best' depth penetration sample was retained from each station, e.g. often equating to c. 1m.

The specification required that on retrieval of the sample at the surface, three subsamples would be taken (at the surface, at 2m and at 5m). However, as noted above, this depth of penetration was not generally achieved and instead, samples were taken as appropriate, representing surficial, bottom and if sufficient depth allowed, intermediate locations from the core profile).

On retrieval of each vibrocoring sample, the core liner was then cut to extract the sediment samples for subsequent analysis at the profile depths as described above. The samples were then placed in appropriate containers (according to the nature of the contaminants in question), provided by NLS, and stored in a cool box between 0°C and 4°C. Given that NLS do not receive samples on a Friday, they were transported back to the IECS laboratory on completion of the survey on the Friday and immediately frozen, samples being sent to NLS at the start of the following week.

On site the residual core material was then capped and retained in the liners to, where possible, maintain core stratigraphy. On completion of the survey, the cores were then transported to Stena Line offices for subsequent storage to be provided prior to additional archaeological investigation.

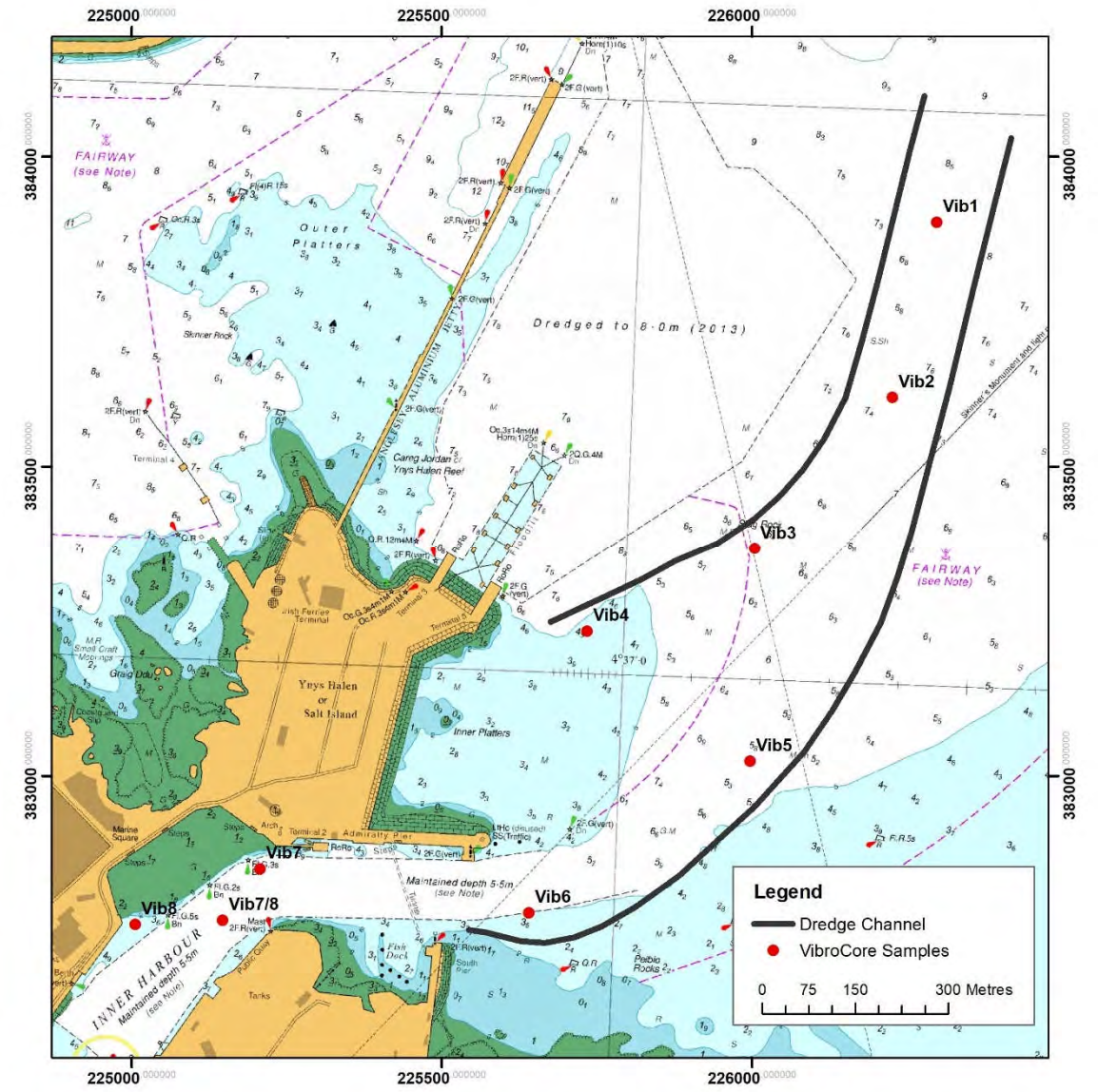

Figure 2.1: Vibrocoring stations including the additional station 7/8 (see text).

A survey log was maintained throughout survey period and sample containers labelled as per NLS requirements.

2.2 Vibrocoring Survey Log

As described in Section 2.1, the survey was carried out over four consecutive days, this including equipment set-up and trial, as well as a period of vessel equipment failure at the start of the work.

Weather during the programme was good (Table 2.1) with light to moderate winds from the south-westerly quadrant. The survey was conducted during a period of tides moving to large spring conditions (Table 2.1).

Table 2.1: Weather and tide conditions for the vibrocoring survey.

Date	Wind Direction & Strength	Precipitation	Air Temperature	Tide Time & Height (Low Water BST)
07/08/18	SSW F3	Dry	17C	13:13, 1.7m
08/08/18	SW F3-4	Dry	14C	14:31, 1.5m
09/08/18	SSW F3-4	Dry	17C	15:20, 1.2m
10/08/18	W F3	Dry	14C	16:12, 0.9m

At many of the vibrocoring locations, only limited bed penetration was possible. Where possible (time and consumables allowing), additional attempts to gain some depth penetration were attempted above the standard three attempts cut off (see Section 2.1). Details of the coring positions and sediment etc. are provided in Table 2.2 and shown in Figure 2.1.

In summary the vibrocoring sampling programme results were as follows:

Station 1 featured a stony layer at around 1m depth that could not be driven through. A 1m core was retained for analysis as the best achievable.

Station 2 was similarly found to have a harder substratum layer at shallow bed depth, with penetration only to 1m.

Station 3 had reasonable penetration to almost 3m with the core retained for analysis.

Station 4 also featured a softer substratum with a sample at 3m depth retained for analysis.

Station 5 had poor bed penetration depth, the best achieved and retained for analysis being 1.5m, with a stony layer encountered at this depth which could not be cored through.

Station 6 was also found to have a hard substratum at between 1 and 2m depth, with a core penetration depth of 1.7m retained for analysis.

Station 7 was assessed to have had potential issues with bed slope affecting the corer deployment, although with a hard substratum also noted restricting penetration.

At Station 8 (the first sampled) seven attempts were made to gain a viable core depth without success. In this instance the bed slope was again considered to be affecting corer stability.

As such, at the end of the survey programme an additional series of attempts were made at a new survey location mid-way between stations 7 and 8 (Station 7/8), and located further off shore in the mid channel, with slightly better results allowing for a 3m depth penetration on one instance, this sample being retained and taken for subsequent analysis.

The location of the vibrocoring stations is provided in Figure 2.1, including the additional Station 7/8 as described above.

In general, most stations were found to have only a relatively shallow layer of unconsolidated soft sediment of between 1m and 2m, this covering a harder substratum of either stone or compacted clay which could not be penetrated. The unconsolidated sediment had a high water content and in some instances was quite fluid.

As each core was contained within a continuous plastic sheaf or liner tube, once returned to deck, measurements along the liner were made to define 'top', 'bottom' and 'middle' locations for sediment extraction (for contaminant analysis). The residual sections were then capped and sealed and retained for potential subsequent archaeological analysis. As such, there was no way to photograph each of the core details without removal from the liner, and potential loss of any profile stratigraphy due to the relatively fluid nature of the sediment.

Photographs of the corer, deployment and core cutter head are provided in Plates 2.2, 2.3 and 2.4 respectively.

Plates 2.2, 2.3 and 2.4 (clockwise from left): Coring rig, rig deployment and cutter head.

A detailed log of the vibrocoring survey is provided in Table 2.2.

Table 2.2: Vibrocoring survey log.

Site	Date	Time (BST)	Position (WGS84) Lat.	Long.	Water Depth (m) (uncorrected)	Penetration (m)	Notes	Core Samples Taken Top	2m	Bottom	Core sections retained at Stena
	07/08/2018	12:00					Vibrocore set-up commences on MV Vital				
	07/08/2018	17:00					Depart berth for trial following delays to the vibrocore set-up (software)				
Vib 8	07/08/2018	17:20	53 18.766	4 36.689	9.0	0.0	Unsuccessful (no penetration)				
	07/08/2018	17:30					Return to berth. End of survey day				
	08/08/2018	07:50					Depart berth				
Vib 8	08/08/2018	08:00	53 18.770	4 37.688	9.6	0.0	Unsuccessful (no penetration and then loss of stability - slope?)				
Vib 8	08/08/2018	08:03	53 18.661	4 37.682	9.9	0.0	Unsuccessful (no penetration and then loss of stability - slope?)				
Vib 8	08/08/2018	08:20	53 18.659	4 37.675	9.8	0.0	Unsuccessful (no penetration). Crane failure				
	08/08/2018	08:20					Return to berth to fix crane. No fix possible. End of survey day. New vessel sourced for next day				
	09/08/2018	07:45					Vibrocore set-up commences on new vessel MV Forth Constructor				
	09/08/2018	10:50					Depart berth				
Vib 8	09/08/2018	11:00	53 18.764	4 37.891	10.5	0.0	Vibrocore failure				
Vib 8	09/08/2018	11:15	53 18.751	4 37.691	10.5	0.0	Unsuccessful (no penetration and then loss of stability - slope?)				
Vib 8	09/08/2018	11:15	53 18.737	4 37.695	10.0	0.0	Unsuccessful (no penetration and then loss of stability - slope?)				
Vib 7	09/08/2018	11:49	53 18.816	4 37.496	9.7	0.5	Unsuccessful (almost no penetration and then loss of stability - slope?)				
Vib 7	09/08/2018	12:05	53 18.818	4 37.517	9.1	0.5	Unsuccessful (almost no penetration and then loss of stability - slope?)				
Vib 7	09/08/2018	12:18	53 18.817	4 37.489	8.7	1.5	Core consists mostly of unconsolidated mud and water then onto hard bed				
	09/08/2018	12:30					Return to berth. Crew change				
	09:08/2018	14:30					Depart berth				
Vib 6	09/08/2018	14:50	53 18.801	4 37.124	6.2	0.0	Unsuccessful (no penetration)				
Vib 6	09/08/2018	15:12	53 18.796	4 37.128	6.2	1.0	Top of the vibrocore visible above water and it will not go in more than 1m				
Vib 6	09/08/2018	15:35	53 18.801	4 37.082	6.0	0.0	Vibrocore failure				
Vib 6	**09/08/2018**	**15:58**	**53 18.802**	**4 37.067**	**6.0**	**1.7**	**Getting to almost 2m depth then no more penetration. Sample retained as best available**	**Y**		**Y**	**x1**
Vib 5	09/08/2018	16:03	53 18.930	4 36.797	6.8	0.0	Unsuccessful (no penetration)				
Vib 5	09/08/2018	16:10	53 18.927	4 36.798	6.8	0.0	Frequency increased (no penetration)				
Vib 5	**09/08/2018**	**16:35**	**53 18.942**	**4 36.798**	**7.1**	**1.5**	**Stony layer present but sample retained as best available**	**Y**		**Y**	**x1**
Vib 1	09/08/2018	16:55	53 19.399	4 36.550	10.1	0.7	Minimal penetration				
Vib 1	09/08/2018	17:05	53 19.394	4 36.539	10.0	0.8	Minimal penetration				
Vib 1	**09/08/2018**	**17:30**	**53 19.413**	**4 36.607**	**10.3**	**1.0**	**Hitting stones but core retained as 1m penetration is best available**	**Y**		**Y**	**x1**
Vib 2	09/08/2018	17:41	53 19.248	4 36.673	10.1	0.0	Unsuccessful (no penetration and then loss of stability)				
Vib 2	**09/08/2018**	**17:51**	**53 19.252**	**4 36.670**	**10.0**	**1.0**	**Penetration difficult - hard at around 1m and then blown off station by wind**	**Y**		**Y**	
Vib 2	09/08/2018	18:00	53 19.261	4 36.665	10.2	0.5	Corer pulled over as vessel moves due to wind picking up. Station abandoned & previous core retained as best available				
Vib 3	**09/08/2018**	**18:19**	**53 19.123**	**4 36.818**	**9.7**	**2.7**	**Reasonable penetration. Core retained**	**Y**		**Y**	**x1**
	09/08/2018	18:30					Return to berth. End of survey day				
	10/08/2018	09:30					Depart berth				
Vib 7/8	10/08/2018	09:41	53 18.793	4 37.569	11.5	0.0	Unsuccessful (no penetration and then loss of stability - slope?)				
Vib 7/8	10/08/2018	09:55	53 18.781	4 37.564	11.6	0.8	Minimal penetration with solid clay at base				
Vib 4	**10/08/2018**	**10:20**	**53 19.041**	**4 37.036**	**10.5**	**3.0**	**Reasonable penetration. Core retained and move back to 7/8 for final attempt**	**Y**	**Y**	**Y**	**x2**
Vib 7/8	**10/08/2018**	**10:40**	**53 18.774**	**4 37.566**	**11.5**	**0.8**	**Minimal penetration with solid clay at base. Core retained as best available**	**Y**		**Y**	
	10/08/2018	11:00					Return to berth. End of survey				

3. INTERTIDAL HABITAT SURVEY

3.1 Intertidal Survey Methods

3.1.1 PHASE 1 WALKOVER SURVEY

In order to record ecological and physical characteristics of the intertidal zone within the reclamation areas, IECS staff undertook a Phase 1 walkover survey during the two hour period either side of low water (around a spring tide), in accordance with standard methodologies outlined in the Joint Nature Conservation Committee (JNCC) Marine Monitoring Handbook (2001)[1] within Procedural Guidance No 3-1 In situ intertidal biotope recording (Wyn and Brazier, 2001[2] and Wyn et al. 2000[3]), and The Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey (Wyn et al. 2006[4]).

Shore type, wave exposure, sediments/substrates present and descriptions of species/biotopes present were noted along with spatial relationships between these features with descriptions and photographs taken. Where present, topographic/morphological features of the sediment (e.g. ripples, standing water, creeks) and evidence of animal activity (casts, tubes, feeding pits, burrows, faecal mounds) were also recorded.

The survey was undertaken on the afternoon of the 13th June 2018 (low water 16:42, 0.7m) and the morning of the 14th June 2018 (low water 05:09, 0.6m).

3.1.2 INTERTIDAL CORING

During the Phase 1 intertidal walkover survey, core samples were taken from locations pre-determined by Royal HaskoningDHV (see Figure 3.1). Two replicate samples were taken at each location, one for macrofaunal analysis and one for particle size analysis (PSA). The cores were taken to a depth of approximately 15cm using a 0.01m² corer and transferred to appropriately labelled sample buckets and refrigerated over-night prior to transport back to the IECS laboratory where the core material for invertebrate taxonomic analysis was sieved through a 0.5 mm mesh will be carried out the next day and the sieve residue will be preserved using a borax buffered 4% formo-saline solution (containing Rose Bengal vital stain). PSA samples were frozen prior to analysis using a Malvern Laser Particle Size Analyser for the fine fractions and a certified sieve next for the coarser fraction. These data were subsequently merged.

The position of each sampling station was logged using hand-held DGPS and a visual description of the sample and the immediate area:

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[1] Davies, J., Baxter, J., Bradley, M., Connor, D., Khan, J., Murray, E., Sanderson, W., Turnbull, C. & Vincent, M. 2001. *Marine Monitoring Handbook*. JNCC.

[2] Wyn, G., & Brazier, P. 2001. *Procedural Guideline No. 3.1 In Situ Intertidal Biotope Recording*. In Davies et al. 2001.

[3] Wyn, G, Brazier, D P and McMath, A J. 2000. *CCW Handbook for Marine Intertidal Phase 1 Survey and Mapping.* CCW Marine Sciences Report: 00/06/01.

[4] Wyn G., Brazier P., Birch AB., Cooke A., Jones M., Lough N., McMath A. and Roberts S. 2006. *Handbook for Marine Intertidal Phase 1 Biotope Mapping Survey*. CCW, 114pp.

- photograph of the sample and the immediate surrounding area;
- presence / approximate abundance of epifauna (and, where possible, identification), degree of anoxia in the sediment and parameters outlined in 3.2.1.

3.1.3 BIOTOPE CHARACTERISATION

All biotopes or identifiable habitats present were initially mapped in the field with the aid of aerial images and a hand-held DGPS. Any other features of note within the intertidal zone were also noted as per the ITT, including:

- rock pools
- man-made structures and influences
- habitats/species of conservation importance.

On completion of the taxonomic analysis and in conjunction with the field notes, biotopes were then assigned to the areas, and these mapped.

It should be noted that it was not possible to access all of the intertidal areas to conduct *in situ* characterisation, due to port restrictions on access due to health and safety requirements (e.g. steep boulder protection walls and slip hazards on weed covered slipways.

The location of the intertidal sample stations are shown in Figure 3.1.

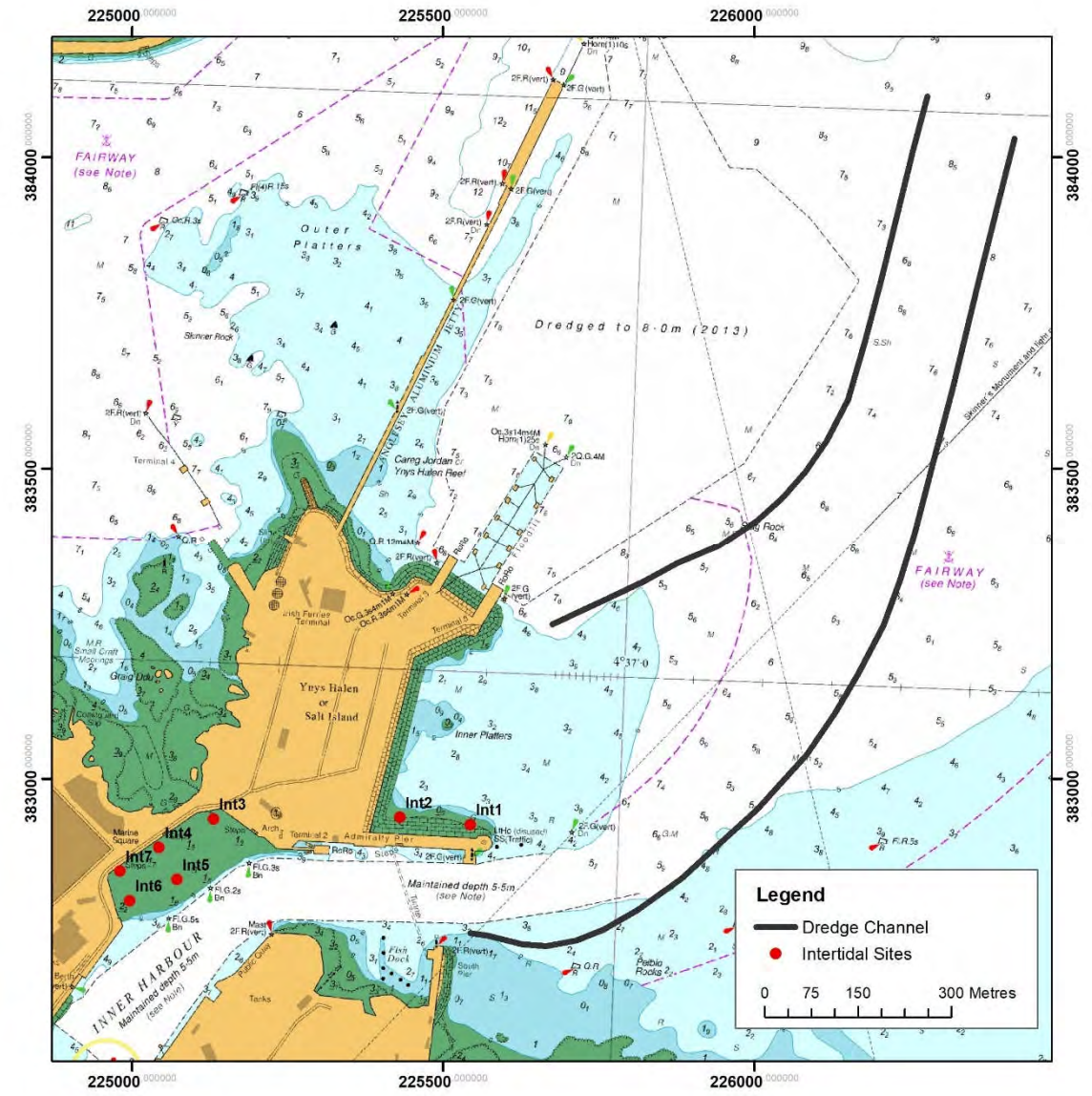


Figure 3.1: Intertidal coring station locations.

3.1.4 INTERTIDAL SAMPLE ANALYSIS

All IECS laboratory processes, including benthic invertebrate analysis and sediment analysis are undertaken in line with National Marine Biological Analytical Quality Control (NMBAQC) Scheme protocols (Worsfold *et al,* 2010[5], Cefas, 2009[6], EN ISO 2005[7]).

Faunal Extraction and Sorting

The 4% Formaldehyde was decanted from each sample through a 212µm sieve using appropriate exposure prevention controls as detailed in the Health & Safety documentation. Material retained on the sieve was then washed back into the container before being washed through a nest of 20cm diameter 5mm and 1mm mesh stainless steel sieves to remove excess fixative as well as fine mud and sand particles and partition the sample for ease of sorting.

The residue from each sieve was then gently washed into white trays and water added to the tray and the contents examined by eye using a 1.5x illuminated magnifier. Large specimens were removed and sorted into major phyla. The residue was then sorted using a dissection microscope to remove smaller specimens and ensure samples are processed to NMBAQC Scheme standards. The fauna derived were retained and stored by group in appropriately labelled containers, preserved using 70% IMS and passed on for identification.

Taxonomic Identification

Identification was carried out using Olympus SZ40 zoom microscopes with 10X and 20X eyepieces, giving a maximum magnification of up to 80X. An additional 2X objective was used to increase the potential magnification to 160X, where required. Olympus BX41 compound microscopes were used for further magnification, if necessary, up to 1000X.

Identification of infaunal samples was to the lowest possible taxonomic level (i.e. species) were possible. During identification, all individuals were initially separated into families, with part animals being assigned to families where possible. The macrofaunal animals were identified to species level using standard taxonomic keys, low and high power stereoscopic microscopes and dissection as necessary. Juvenile bivalves were opened using sodium hypochlorite. Incomplete animals without anterior ends were not recorded as individuals for the quantitative dataset. However, they were identified where possible and recorded as present. Similarly, motile and colonial sessile epibenthic taxa and meiofauna were recorded and included within the infaunal quantitative data set although these were excluded from the subsequent community analysis.

Regular cross reference identification was carried out by senior taxonomists as part of the standard IECS quality assurance (QA) procedures. Reporting nomenclature used Howson &

5 Worsfold, T. & Hill, D. 2010. *Guidelines for Processing Marine Macrobenthic Invertebrate Samples: a Processing Requirements Protocol*. Edited by M. O'Reilly. NMBAQC.

6 Cefas. 2012. *CSEMP Green Book. Appendices Version 15, 36pp. Appendix 10. Guidelines for the Analysis of Macrobenthos in Sediment Samples.* Cefas.

7 EN ISO. 2005. *International Standard 16665:2005. Water quality – Guidelines for Quantitative Sampling and Sample Processing of Marine Soft-bottom Macrofauna*. 35pp

Picton (1997[8]), the Marine Species of the British Isles and Adjacent Seas (MSBIAS - www.marinespecies.org/msbias/) and the World Register of Marine Species (WoRMS - www.marinespecies.org) where applicable.

Biomass

Biomass analysis was performed by the wet weight (tissue blotted) technique and carried out for individual species in each sample. Each taxon was placed on blotting paper to allow absorption of preservative into the blotting paper, the individuals were then placed on a zeroed microbalance for 30 seconds and the reading taken. The macrofaunal organisms were then placed back in their respective pots and stored. Biomass calculations included all identifiable fragments and were recorded to ± 0.0001g.

Infaunal Analysis Quality Control

Standard internal AQC measures were employed, with the first two samples processed by each benthic technician checked and the results documented. An additional 10% of all samples were then selected at random and subject to re-analysis. The results of the internal AQC measures have been documented and if required can be forwarded to the Client.

Particle Size Analysis

The particle size analysis was undertaken using a combination of dry sieving for the >1mm fraction and laser particle size analysis for the <1mm fraction using a Malvern Mastersizer 2000 (laser granulometer) and Hydro 2000 Mu accessory unit (dispersion unit). Prior to the analysis of each sample a photograph was taken with an internal label. Each bulk sample was then thoroughly mixed before extracting three representative sub samples for analysis using the Malvern laser particle size analyser for the fine fraction. The remaining part of the bulk sample was used to accurately assign coarse fraction data by manual sieving with the data generated from these methods of analysis merged and used to derive statistics such as:

- full particle size distribution
- mean and median grain size in phi and mm;
- bulk sediment classes (% silt, sand & gravel);
- skewness;
- kurtosis; and
- sorting coefficient.

[8] Howson, C.M. & Picton, B.E. 1997. *The Species Directory of the Marine Fauna and Flora of the British Isles and Surrounding Seas*. Ulster Museum and the Marine Conservation Society.

3.2 Intertidal Survey Results

3.2.1 Old Harbour (The Pill)

Intertidal core stations 3-7 were located within a sheltered south easterly facing area of mixed sediment semi-enclosed by the Old Harbour wall and the adjacent Salt Island Bridge, and area apparently referred to as 'The Pill'.

A brief description of the dominant taxa from the individual cores is provided below, with a more detailed list of species present and their abundance and biomass provided in Appendices 2 and 3 (under separate Excel workbook).

Information from these data have been used to derive biotopes and an indication of their distribution, these covered in Section 5 of this report.

Core Station 3

Muddy mixed sediment with standing water, sparse *Fucus vesiculosus* and *Semibalanus* on the larger cobbles, *Littorina littorea* present, and empty *Cerastoderma* shells within the sediment, a 3cm redox layer was noted (Plate 3.1).

Plate 3.1: Core station 3.

Core Station 4

Muddy mixed sediment with standing water and a diatom film, sparse *Fucus vesiculosus* and *Ulva lactuca* and *U. intestinalis, Littorina littorea* present and *Patella vulgata* on larger cobbles, empty *Cerastoderma* shells within the sediment, a 3cm redox layer was noted (Plate 3.2).

Plate 3.2: Core station 4.

Core Station 5

Muddy mixed sediment with standing water, sparse *Fucus vesiculosus* and *F. serratus, U. lactuca, U. intestinalis* and *Chondrus crispus*, empty *Cerastoderma* shells noted within the sediment, a 4cm redox layer (Plate 3.3).

Plate 3.3: Core station 5.

Core Station 6

Firm mixed sediment with standing water, *F. vesiculosus* and *C. crispus, L. littorea* and *C. edule* present, no redox layer was noted (Plate 3.4).

Plate 3.4: Core station 6.

Core Station 7

Muddy mixed sediment with standing water and diatom film, adjacent to drainage outfall. Sparse *F. vesiculosus, U. lactuca* and *U. intestinalis* common, *L. littorea* and *C. edule* present, redox layer 3cm (Plate 3.5).

Plate 3.5: Core station 7.

3.2.2 OLD JETTY/NEW SEA WALL

Intertidal core stations 1 & 2, were located on what was found to be a shallow inclined concrete seawall, and as such no cores could be taken from this location. The survey team hoped to access the adjacent low shore intertidal area to take sample cores but the Harbour Master was unable to permit surveyors on to this area due to the slippery nature of the algae covered concrete ramp.

As such a visual inspection was carried out from the top of the old jetty of the intertidal area below, and also of the newer rock armour seawall running towards up to ferry terminal north of the Old Jetty.

The Old Jetty

The top the old Jetty consisted of bare concrete and grass tufts below which was a parallel band of black tar lichen, *Verrucaria maura*. Below the band of *Verrucaria*, was a dense narrow zone of *Pelvetia canaliculata* grading down into a *F. spiralis* zone, and then into wider zone dominated by *Ascophyllum nodosum*, although with this being replaced by *F. vesiculosus* towards the eastern side of the site, together with an area of dense barnacle coverage. *F. serratus* was dominant in the lower shore elevation. The general assemblage and habitat banding is shown in Plates 3.6 & £.7.

Plate 3.6: The Old Jetty. Upper shore lichens grading into fucoids.

Plate 3.7: The Old Jetty – mid to low shore fucoid bands.

New Sea Wall

The newer rock armour sea wall running north from the Old Jetty to the Ferry Terminal exhibited a similar pattern of zonation as the jetty, although with a denser coverage of barnacles and sparser coverage of fucoids. *Laminaria* sp. was noted as present in this area into the subtidal fringe (Plates 3.8 & 3.9).

Plate 3.8: New Sea Wall showing general distribution of fucoid bands.

Plate 3.9: New Sea Wall showing detail of the distribution of fucoid bands.

4. SUBTIDAL HABITAT SURVEY

4.1 Subtidal Survey Methods

4.1.1 SUBTIDAL GRAB SURVEY

Royal HaskoningDHV identified 27 stations for grab sampling in the ITT, with a sample to be taken from each station, using a 0.1 m^2 Day grab, with a sub-sample being collected for particle size analysis using a cut-off 100 ml syringe.

IECS Standard Operating Procedures (SOP) for conducting benthic grab surveys are in line with industry guidelines (Davies et al., 2001; Ware & Kenny, 2011). A single grab sample was therefore taken for macrofaunal & sediment analysis at each station. Each station was located using the survey vessel's DGPS, but with hand-held back-up also carried. A day grab was deployed at each sample station. The position of the subtidal grab stations are shown in Figure 4.1.

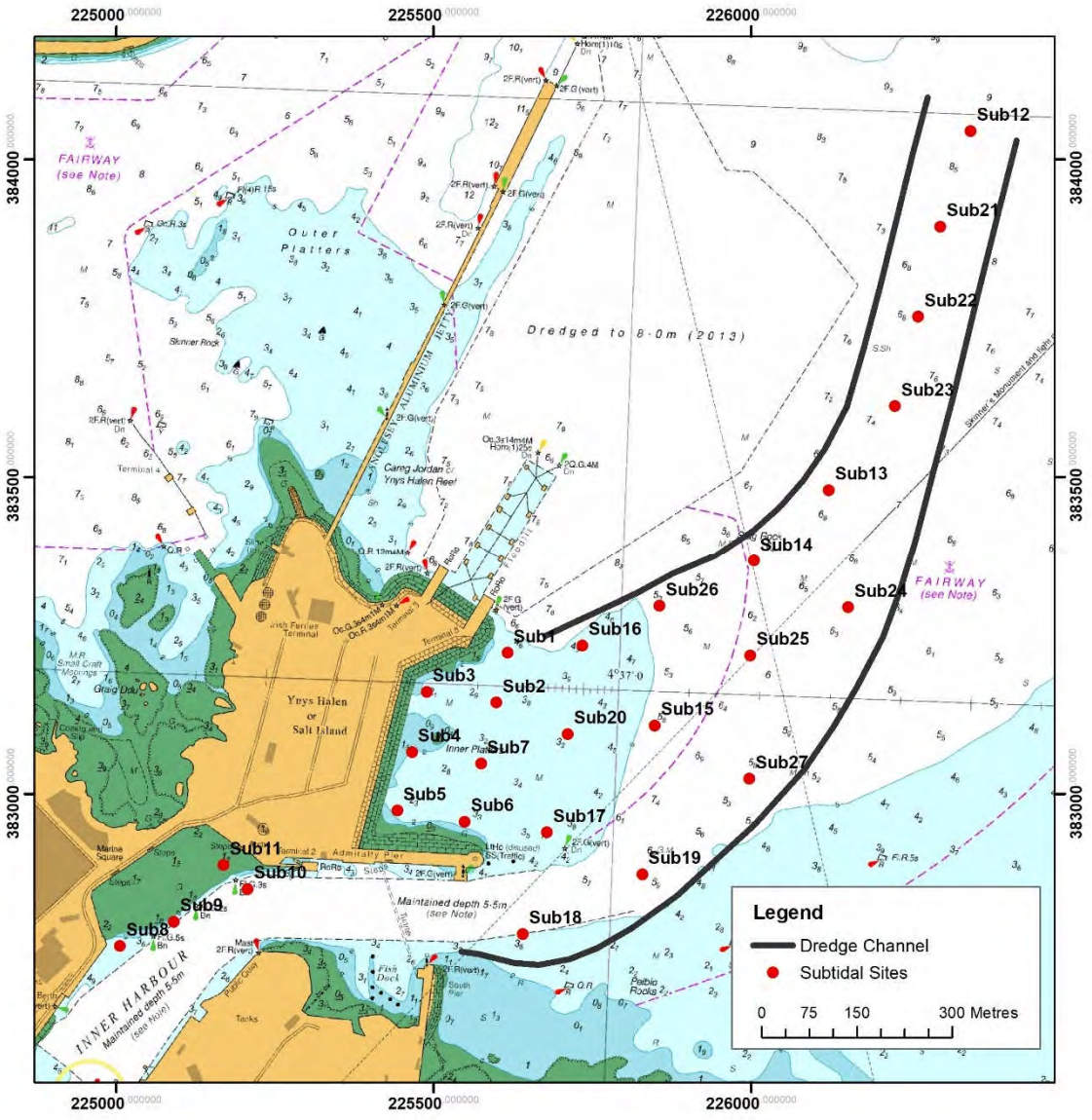


Figure 4.1: Subtidal benthic sampling station positions.

Following retrieval of the sample, a depth bite measurement was taken to ensure that the sample exceeded 10cm depth, with up to three attempts made to collect a viable sample, moving 10m from the original sample location after each attempt.

Following acceptance of the sample, a photograph was then taken of the material and a sub-sample of the undisturbed surface of the sediment taken, using a cut off 100mm syringe, this material then extruded and stored and labelled for subsequent particle size analysis (PSA).

The main sample was then released from the grab and washed in a hopper through a nest of 5mm to 0.5mm mesh sieves, with the sieve residue then retained. This residue was then gently back-washed into sealable containers and a borax buffered 4% formo-saline solution (containing Rose Bengal vital stain) added as a fixative. .

A full survey log was maintained throughout the survey detailing time of sampling, position (DGPS derived), station number, water depth, physical characteristics of the sample and digital image number (cross referencing (QA)).

4.1.2 SUBTIDAL SAMPLE ANALYSIS

Laboratory sample processing (invertebrate taxonomy and particle size analysis) follow the techniques described in Section 3.1.4.

4.2 Subtidal Survey Results

The subtidal samples were dominated by abundant small polychaetes, with some stations supporting large numbers of bivalves. Photographs of the individual grab samples from each station (grab and sieved residue) are provided in Plate 4.1 and show the soft sandy substratum and visual dominance of *Abra* and *Nucula* bivalves in many of the samples.

Aphelochaeta marioni, Chaetozone gibber, Euclymene oerstedii, Leitoscoloplos mammosus and *Tharyx* were numerous at some stations e.g. stations 6, 8, 11, 17and 19. In addition, *Capitella* was very abundant at station 5 with 1,138 individuals in the sample, although absent or near absent from other stations, this perhaps indicating some form of environmental stress at this location.

Other stations had a faunal assemblage dominated by bivalves, with *Nucula nitidosa* and *Abra alba* most numerous. *N. nitidosa* was present in most stations, with *N. nucleus* also present albeit in lower numbers and less regularly from the area. However, *A. alba* was the dominant bivalve at most locations, with stations 12, 13, 21, 22, 23, 25 and 27 supporting numbers in excess of 250 individuals per sample.

Of particular note, given their conservation status, two *Arctica islandica* were recovered at station 24. These were photographed and the specimens returned to the water prior to processing (Plate 4.2). The presence of 120 *Peringia ulvae* from station 8 indicates the proximity of the station to the intertidal rocky shore. Similarly, the record of 619 *Corophium volutator* from station 11 indicates its location on the intertidal fringe, the assemblage being very similar to that recorded from the adjacent intertidal core sample.

Subtidal sample diversity was generally high, and analysis addressing a range of indices are addressed in Section 5. Appendices 2 and 3 provide spreadsheets detailing species abundance and biomass for all stations (provided on separate CD).

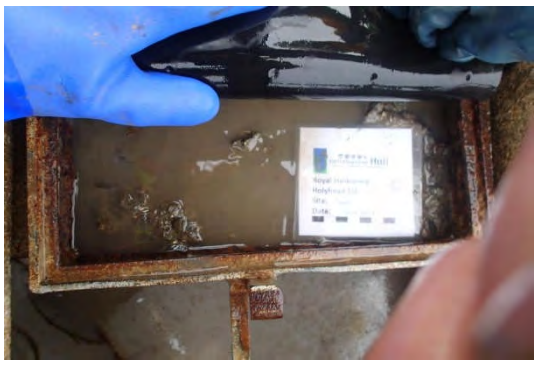
Stn	Grab Surface	Sieve Residue
1		
2		
3		
4		

Plate 4.1: Photographs (grab surface and sieve residue) from each subtidal sample station.

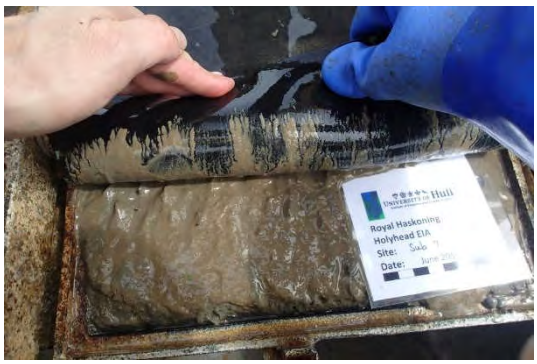
Stn	Grab Surface	Sieve Residue
5		
6		
7		
8		

Plate 1 (Cont.)

Stn	Grab Surface	Sieve Residue
9		
10		
11		
12		

Plate 1 (Cont.)

Stn	Grab Surface	Sieve Residue
13		
14		
15		
16		

Plate 1 (Cont.)

Stn	Grab Surface	Sieve Residue
17		
18		
19		
20		

Plate 1 (Cont.)

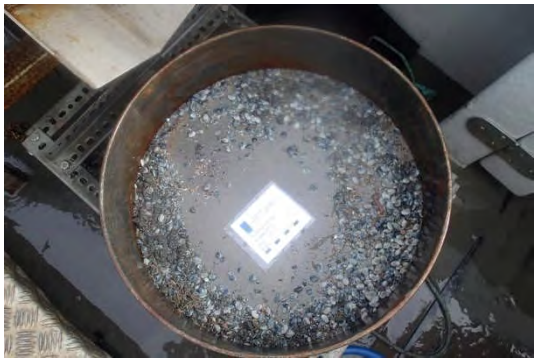
Stn	Grab Surface	Sieve Residue
21		
22		
23		
24		

Plate 1 (Cont.)

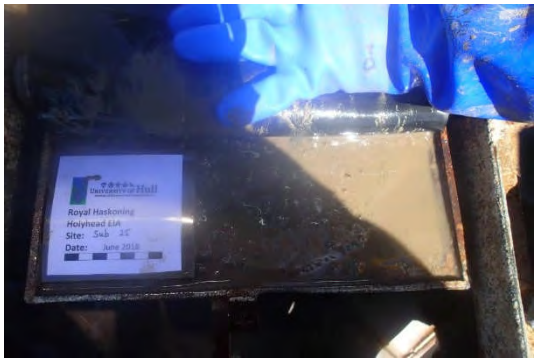
Stn	Grab Surface	Sieve Residue
25		
26		
27		

Plate 1 (Cont.)

Plate 4.2: *Arctica islandica* (recovered from station 24 and returned to the water).

5. COMMUNITY DESCIPTIONS

5.1 Statistical Analysis

Data analysis has followed standard procedures to derive univariate and multivariate parameters descriptive of habitat type and benthic community characteristics, using a combination of packages primarily including R and Primer v6.

5.1.1 METHODS

Data Standardisation

Species names were standardised according to WoRMS (2017) and mobile (swimming) and meiofaunal species and barnacles (ineffectively quantified by grab sampling) were removed from the data set. The data were analysed both including and excluding the juveniles. However, the abundance of the juveniles was very low and the species present were characteristic of the area. Their removal from the data set had no impact on the overall outcome (other than to minimally reduce the number of species and abundance). Therefore, the data presented here includes the juveniles. Similarly, the removal of meiofauna and barnacles had minimal impact on the overall outcome.

Univariate

Descriptive statistics applicable to sediment type were derived using GRADISTAT v8 (Blott & Pye, 2001[9]) and included mean and median grain size (φ and µm), sorting coefficient, skewness, kurtosis and bulk sediment classes (% silt, sand and gravel). These parameters were presented for individual stations and also summarised broad community types (Section 5.3). A summary is presented in the main report with the full output being presented in Appendix 1.

The total number of species (S), abundance (N), Pielou's evenness (J') and Shannon Wiener diversity (H'(log_2)) were calculated using Primer V6. These parameters were presented, together with total biomass (B), for individual stations, summarised for intertidal and subtidal areas, and also for broad community types.

Multivariate

Cluster analysis (with SIMPROF), based on Bray Curtis similarity, was used to identify broad community types. Data were square root transformed prior to analysis. The range of values in the data set indicated that a stronger transformation was not necessary although the effect of stronger transformations was investigated for completeness. SIMPER analysis was used to determine the variability within the identified community types and their characterising species.

9 Blott, S.J. & Pye, K. 2001. Gradistat: A Grain Size Distribution and Statistics Package for the Analysis of Unconsolidated Sediments. *Earth Surface Processes and Landforms*. **26**: 1237-1248

5.1.2 RESULTS

Sediment Parameters

The sediments in the area were largely composed of mud with varying proportions of sand and gravel (Figure 5.1a-c), and are classed as medium and coarse silts to fine sands in line with the Folk and Ward classification (Table 5.1). The sediments were generally classed as 'very poorly sorted' across the subtidal area and 'extremely poorly sorted' in the intertidal area, meaning that the sediments were composed of a range of particle sizes (Table 5.1). In the subtidal areas, the proportion of mud ranged from 51% (station 1) to 93% at station 4 and was greater than 85% across approximately half of the survey area. Sand content ranged from 7% (station 4) to 40% (station 19, but was greater than 15% at most stations and, generally, between 20 and 35% (Figure 5.1(b)). Gravel was only recorded at 7 stations and was generally low (less than 10%). Values ranged from 1% at station 14 to 27% at station 1 (Figure 5.1(c)), although this was an exceptionally high value in the context of the subtidal survey area as a whole. Median phi values ranged from 4.1 (corresponding to 58 µm) at station 1 to 6.96 (corresponding to 8 µm) at station 4 (Table 5.1).

The intertidal sediments were slightly coarser, with up to with 15-44% gravel content and 35-59% mud (Figure X(a-c)). Median phi values ranged from 0.5 (706 µm) at station 6 to 4.9 (34 µm) at station 4, although median particle diameter was less than 150 µm (2.7 φ) at all stations except station 6 (Table A). The intertidal sediments can be described as extremely poorly sorted very fine to medium sands.

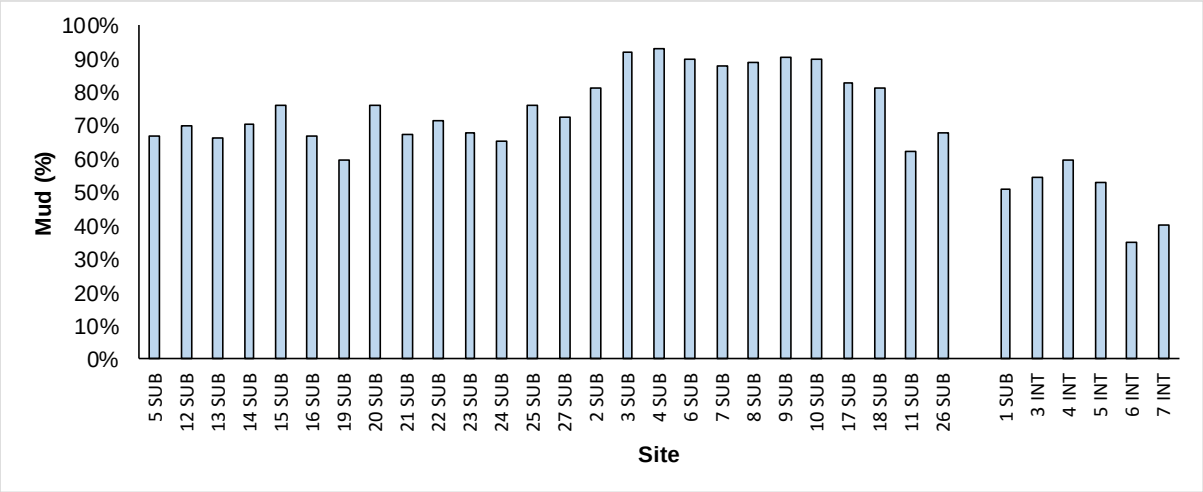


Figure 5.1(a): Sediment mud content at each station

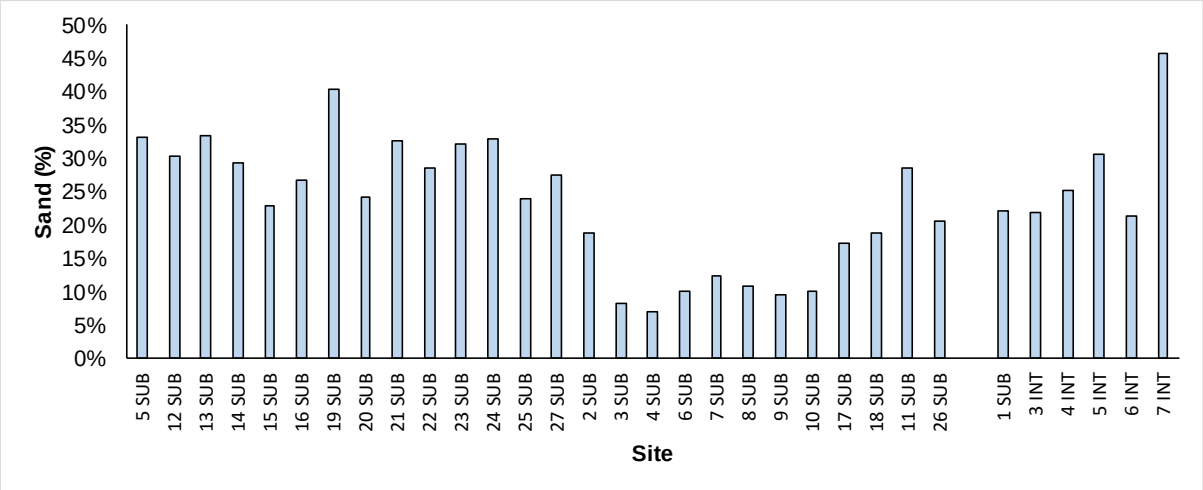


Figure 5.1(b): Sediment sand content at each station

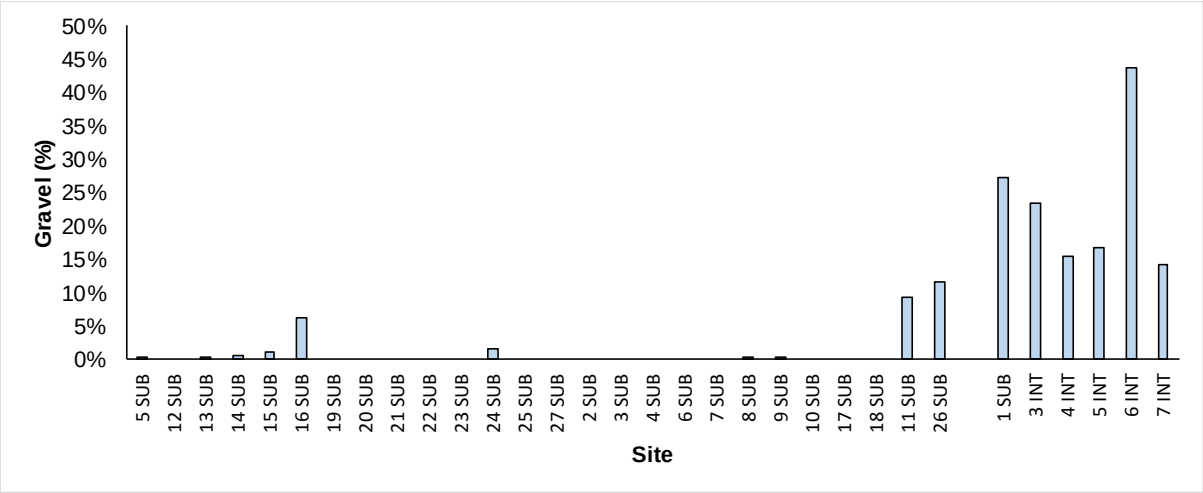


Figure 5.1(c): Sediment gravel content at each station

Table 5.1: Particle size and sediment type for each station. SIMPROF class relates to the multivariate analysis

Site	SIMPROF class	Mean µm	Median µm	Mean φ	Median φ	Folk & Ward Class. *	Sorting
1 SUB	A	110.5	58.4	3.2	4.1	Very Fine Sand	Extremely Poorly Sorted
2 SUB	D	13.5	12.1	6.2	6.4	Medium Silt	Very Poorly Sorted
3 SUB	K	9.4	8.5	6.7	6.9	Medium Silt	Poorly Sorted
4 SUB	K	8.8	8.0	6.8	7.0	Medium Silt	Poorly Sorted
5 SUB	H	26.0	23.6	5.3	5.4	Coarse Silt	Very Poorly Sorted
6 SUB	E	10.2	9.7	6.6	6.7	Medium Silt	Very Poorly Sorted
7 SUB	B	10.8	9.9	6.5	6.7	Medium Silt	Very Poorly Sorted
8 SUB	M	10.1	8.7	6.6	6.8	Medium Silt	Poorly Sorted
9 SUB	M	9.3	8.1	6.7	6.9	Medium Silt	Very Poorly Sorted
10 SUB	J	10.0	8.9	6.6	6.8	Medium Silt	Poorly Sorted
11 SUB	I	33.6	29.0	4.9	5.1	Very Coarse Silt	Very Poorly Sorted
12 SUB	C	19.5	23.8	5.7	5.4	Coarse Silt	Very Poorly Sorted
13 SUB	D	23.8	31.0	5.4	5.0	Coarse Silt	Very Poorly Sorted
14 SUB	D	20.6	22.0	5.6	5.5	Coarse Silt	Very Poorly Sorted
15 SUB	D	16.5	16.3	5.9	5.9	Coarse Silt	Very Poorly Sorted
16 SUB	D	24.0	22.7	5.4	5.5	Coarse Silt	Very Poorly Sorted
17 SUB	E	14.1	14.8	6.1	6.1	Medium Silt	Very Poorly Sorted
18 SUB	M	14.8	15.3	6.1	6.0	Medium Silt	Very Poorly Sorted
19 SUB	E	28.1	44.5	5.2	4.5	Coarse Silt	Very Poorly Sorted
20 SUB	D	16.0	16.5	6.0	5.9	Coarse Silt	Very Poorly Sorted
21 SUB	D	22.7	31.8	5.5	5.0	Coarse Silt	Very Poorly Sorted
22 SUB	D	20.3	27.0	5.6	5.2	Coarse Silt	Very Poorly Sorted
23 SUB	D	22.9	31.8	5.4	5.0	Coarse Silt	Very Poorly Sorted
24 SUB	D	24.6	34.8	5.3	4.8	Coarse Silt	Very Poorly Sorted
25 SUB	D	16.8	17.4	5.9	5.8	Coarse Silt	Very Poorly Sorted
26 SUB	E	32.7	17.9	4.9	5.8	Very Coarse Silt	Very Poorly Sorted
27 SUB	D	20.0	26.6	5.6	5.2	Coarse Silt	Very Poorly Sorted
3 INT	G	109.8	45.0	3.2	4.5	Very Fine Sand	Extremely Poorly Sorted
4 INT	G	64.8	34.4	3.9	4.9	Very Fine Sand	Extremely Poorly Sorted
5 INT	G	79.3	50.2	3.7	4.3	Very Fine Sand	Extremely Poorly Sorted
6 INT	G	458.1	705.5	1.1	0.5	Medium Sand	Extremely Poorly Sorted
7 INT	G	121.7	143.0	3.0	2.8	Very Fine Sand	Very Poorly Sorted

Univariate Analysis of the Biological Community

The total number of species recorded from intertidal stations ranged from 18 at station 6 to 27 at station 7 (Figure 5.2). Abundance (individuals / 0.1 m^2) ranged from 298 at station 3 to 665 at station 7 (Figure 5.3), whilst biomass ranged from 0.3 g/0.1 m^2 at station 3 to 3.2 g/0.1 m^2) at station 6 (Figure C). Pielou's evenness was 0.7-0.8 at all stations, indicating a reasonable distribution of the individuals between the species and a low degree of dominance and Shannon Wiener diversity ranged from 2.8 (station 6) to 3.7 (station 5) (Table 5.2).

Subtidal species richness (S) ranged from 28 (station 10) to 73 (station 1), with more than 40 species being recoded from the majority of stations (Figure 5.2). The maximum abundance was recorded from station 5 (2609 individuals / 0.1 m^2), with over 2000 individuals / 0.1 m^2 also being recorded from stations 6, 8 and 11. The minimum abundance of 345 individuals / 0.1 m^2 was recorded from station 1, with less than 1000 individuals/ 0.1 m^2 being recorded from around 50% of the stations (Figure 5.3). Biomass ranged from 1.42 g/0.1 m^2 (station 10)to 323 g/0.1 m^2 (station 24), although biomass was less than 70 g/0.1 m^2 at all other stations and was less than 40 g/0.1 m^2 at nearly 50% of the stations (Figure 5.4). Shannon Wiener diversity (H'(log_2)) ranged from 2.1 to 5.1 (Table 5.2) and was highest at stations with the lowest abundance and highest number of species (e.g. stations 1, 7 and 2). The lowest diversity was recorded from stations 10, 9, 18 and 8 (Table 5.2). This was reflected in the evenness values (J') which ranged from 0.4 at stations 9 and 10 to 0.8 at station 1 (Table 5.2).

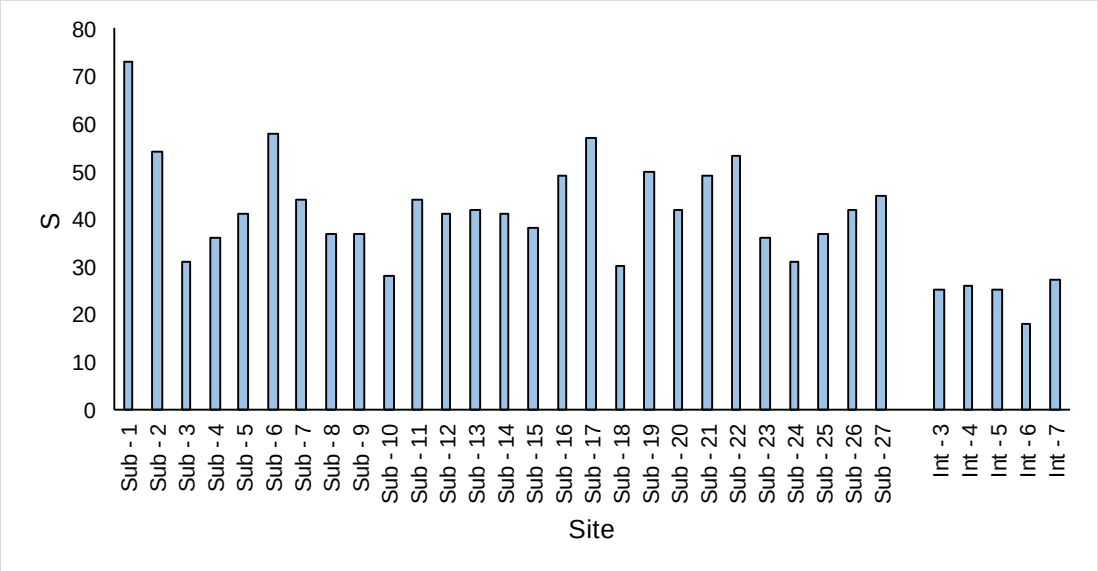


Figure 5.2: Number of species recorded at each station

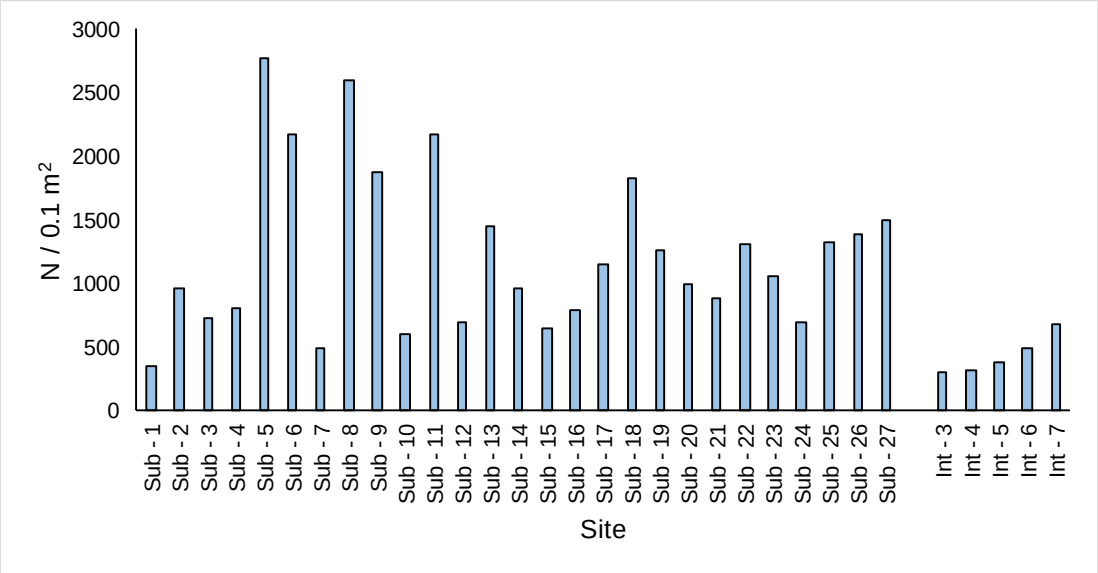


Figure 5.3: Total abundance / 0.1 m² recorded at each station

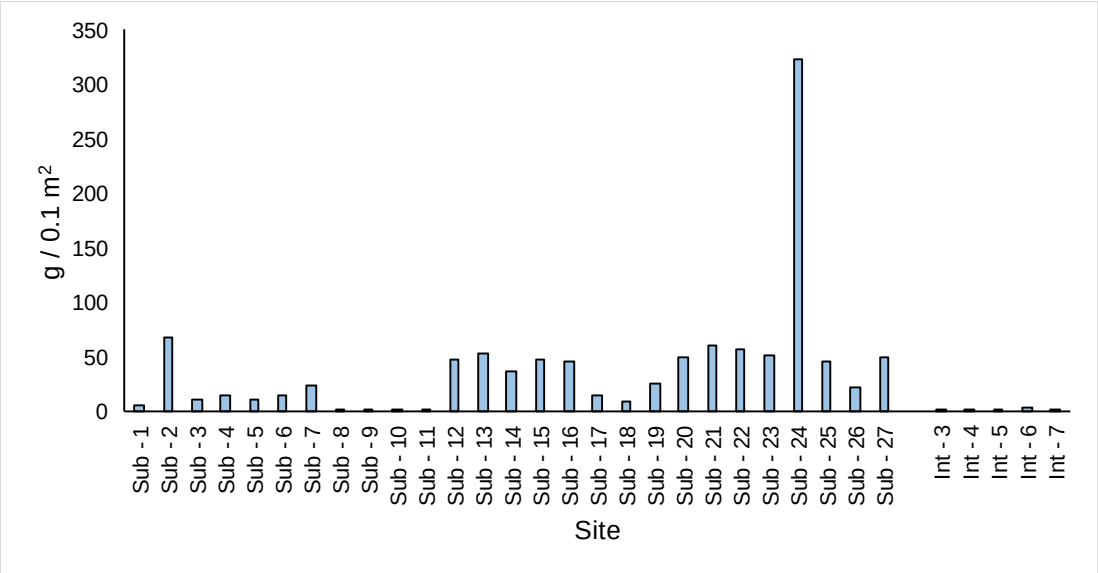


Figure 5.4. Total biomass (g /0.1 m² recorded at each station

Table 5.2: Shannon Wiener diversity (H'(log_2) and Pielou's evenness values for each station

Site	H'(log_2)	J'
Sub - 1	5.13	0.83
Sub - 2	3.98	0.69
Sub - 3	2.98	0.60
Sub - 4	2.89	0.56
Sub - 5	3.07	0.57
Sub - 6	2.80	0.48
Sub - 7	4.10	0.75
Sub - 8	2.65	0.51
Sub - 9	2.10	0.40
Sub - 10	2.08	0.43
Sub - 11	3.29	0.60
Sub - 12	3.37	0.63
Sub - 13	3.20	0.59
Sub - 14	3.70	0.69
Sub - 15	3.20	0.61
Sub - 16	3.83	0.68
Sub - 17	3.66	0.63
Sub - 18	2.60	0.53
Sub - 19	3.62	0.64
Sub - 20	3.33	0.62
Sub - 21	3.13	0.56
Sub - 22	3.61	0.63
Sub - 23	3.87	0.75
Sub - 24	3.24	0.65
Sub - 25	3.43	0.66
Sub - 26	3.83	0.71
Sub - 27	3.83	0.70
Int - 3	3.12	0.67
Int - 4	3.60	0.77
Int - 5	3.71	0.80
Int - 6	2.77	0.66
Int - 7	3.49	0.73

Multivariate Community Analysis

The intertidal community was characterised by species typical of mixed sediment shores with a high mud content. The community was dominated by terebellid (e.g. *Chaetozone gibber, Cirriformia tentaculata, Tharyx* and *Apheloochaeta marioni*) and Capitellid species (e.g. *Mediomastus fragilis, Heteromastus filiformis* and *Notomastus*) polychaetes with a number of Spionid species (*Polydora cornuta, Dipolydora quadrilobata*) (Table 5.3). Other species included the amphipod *Corophium volutator,* the gastropod *Peringia ulvae,* and the oligochaete *Tubificodes benedii.* Bivalves were almost entirely absent with *Abra alba* and *Nucula nitidosa* being recorded in very low (1-3 individuals) numbers at some, but not all, stations. The average similarity between the stations (in terms of the species present and their relative abundances) was 54% (Table 5.3), which is fairly typical for intertidal sediment, particularly where the sampling location is variable.

The subtidal community was slightly more variable (average similarity between stations of 43%) although the number of stations, spatial scale and, therefore, environmental variability was greater. The most abundant species were the bivalves *A, alba* and *N. nitidosa*, together with the polychaete *C. gibber, A. marioni, Leitoscoloplos mammosus* and *Euclymene oerstedii.* The bivalves *Thyasira flexuosa* and *Kurtiella bidentata* were also present and the diversity of polychaete species was greater than in the intertidal area.

Table 5.3: Community composition of intertidal and subtidal areas (as a whole), based on SIMPER analysis

Species (Intertidal)	Av.Abund	Cum.%
Mediomastus fragilis	5.78	11.93
Aphelochaeta marioni	5.57	22.71
Tubificoides benedii	5.93	32.6
Corophium volutator	5.92	41.1
Polydora cornuta	5.48	49.12
Tharyx Type A	4.14	56.68
Nematoda	6.97	63.97
Cirriformia tentaculata	3.37	69.75
Chaetozone gibber	2.47	74.1
Peringia ulvae	2.95	78.24
Manayunkia aestuarina	3.64	81.33
Dipolydora quadrilobata	2.26	84.17
Leitoscoloplos mammosus	2.27	86.89
Notomastus	2.15	89.55
Heteromastus filiformis	1.48	91.53
Average similarity: 54.33		

Species (Subtidal)	Av.Abund	Cum.%
Abra alba	10.68	12
Chaetozone gibber	10.96	22.75
Nucula nitidosa	6.34	30.82
Leitoscoloplos mammosus	5.99	36.91
Aphelochaeta marioni	9.29	42.46
Euclymene oerstedii	7.08	47.61
Euphilomedes interpuncta	6.16	52.04
Thyasira flexuosa	3.18	55.83
Nematoda	4.68	59.43
Tharyx Type A	5.26	62.71
Praxillella affinis	3.83	65.37
Amphiura filiformis	2.52	67.41
Notomastus	2.19	69.34
Levinsenia gracilis	2.28	71.23
Nephtys hombergii	1.7	73.08
Pholoe baltica	2.18	74.8
Eudorella truncatula	2.22	76.48
Kurtiella bidentata	1.92	77.95
Mediomastus fragilis	2.38	79.41
Exogone naidina	1.59	80.69
Average similarity: 43.36		

Cluster analysis with the SIMPROF test indicated the presence of 13 different community types (groups a-m), with nearly half of the stations being assigned to group d in the most seaward part of the dredged channel (Figures 5.5; 5.6). The stress value of 0.1 (Figure 5.6) indicates reasonable separation, which reduces only to 0.09 upon removal of the intertidal stations. Therefore, variation exists within the subtidal community, not just between the intertidal and the subtidal communities.

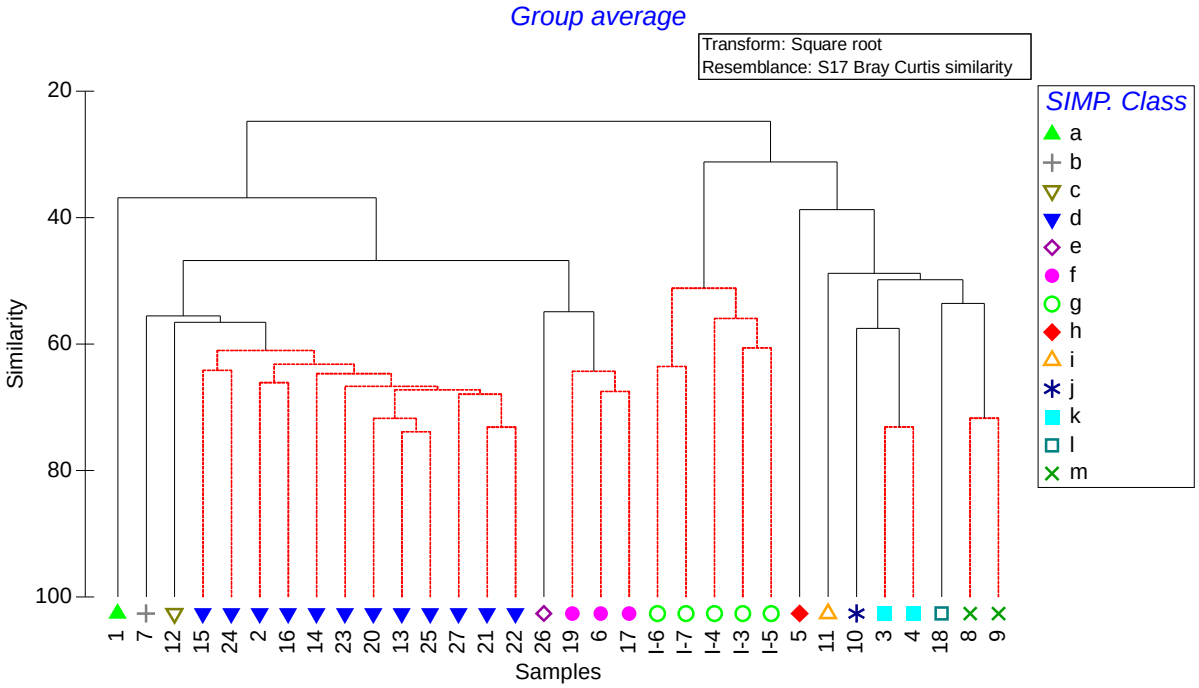


Figure 5.5: Community types defined by SIMPROF (based on √ transformed data). Samples labelled 'I' are intertidal

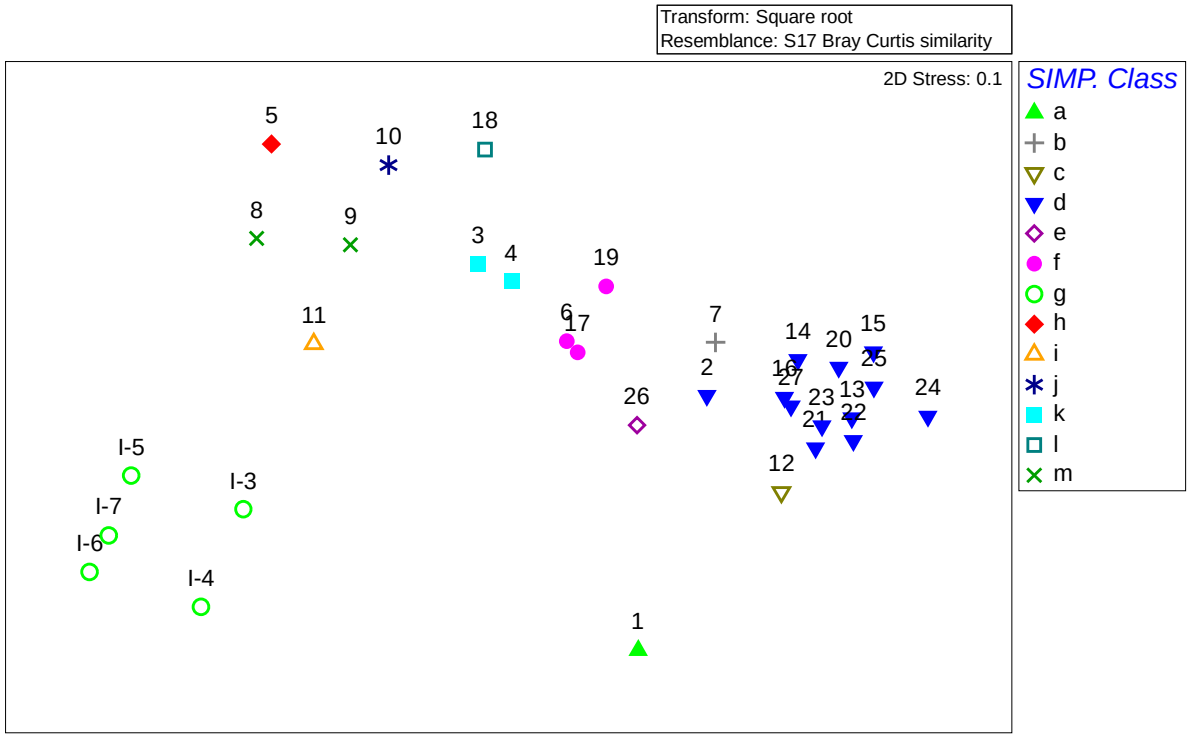


Figure 5.6: Community types defined by SIMPROF. Samples labelled 'I' are intertidal (group g)

Twelve of the 26 stations were assigned to group d (Figure 5.5; 5.6; Table 5.4(a)), all of which were located in the main dredge channel where the sediment was predominantly described as coarse silt. The community at these stations was characterised by the bivalves *A. alba*, *N. nitidosa* and *T. flexuosa* and the polychaetes *E. oerstedii, Praxillella affinis and C. gibber.*

Average biomass was 73.9 g/0.1m^2 and was the highest amongst the groups. Groups f, k and m were all characterised by the polychaetes *Aphelochaeta marioni* and *C. gibber*, accounting for up to 50 % of the similarity between the samples within each group. Other characterising species, common to all three groups, included *L. mammosus* and *Tharyx* Type A (Polychaeta) and the bivalve *N. nitidosa.* Whilst the species composition of these stations was broadly similar (in terms of the dominant species), the abundance and diversity varied between the stations, hence their separation. The average biomass for group m was notably low compared to the other groups. (Table 5.4(a)).

Eight of the stations could not be grouped and their community composition is presented in Table 5.4(b) based on proportional representation of the most abundant species. Station 1 (group a) was the most diverse with a total of 73 species, the most abundant being *Nucula nucleus, C. gibber, A. alba* and the polychaetes *D. caulleryi, M. fragilis, Levinsenia gracilis* and *A. marioni.* The sediments at this station were comparatively coarse with the highest gravel content being recorded at this station (Figure 5.1a-c; Table 5.1). Station 7 and 12 (groups b and c) were bivalve dominated with *A. alba* and *N. nitidosa* contributing up to 55% of the abundance (Table 5.4(b)). Stations 10 (group j) and 18 (group l) were heavily dominated by *C. gibber and A. marioni* and whilst Stations 5, 11 and 26 (groups h, i and e, respectively) were also characterised by these species, there was a greater dominance of other species such as *L. mammosus*, *Tharyx* Type A and *Capitella capitata* and *C. volutator*). These stations were all characterised by comparatively high abundance (Table 5.4(b)).

The intertidal community (group g; Table 5.4(a)) is described earlier in this section.

Table 5.4(a): Simprof classes and characterising species (based on square root transformed data), diversity and biomass (derived from raw data)

Group d	Av.Abund	Cum.%
Abra alba	16	18
Euclymene oerstedii	13	29
Nucula nitidosa	7	37
Praxillella affinis	7	43
Chaetozone gibber	7	48
Leitoscoloplos mammosus	5	53
Thyasira flexuosa	4	57
Amphiura filiformis	4	61
Pholoe baltica	4	64
Kurtiella bidentata	3	67
Average similarity	64.35	
Species	43	
H'(log2)	3.5	
N	1041	
B (g m^{-2})	73.9	

Group f	Av.Abund	Cum.%
Aphelochaeta marioni	24	17
Chaetozone gibber	14	29
Leitoscoloplos mammosus	10	38
Abra alba	8	44
Nucula nitidosa	6	48
Levinsenia gracilis	4	52
Eudorella truncatula	4	55
Notomastus	4	58
Tharyx Type A	4	61
Pariambus typicus	4	64
Thyasira flexuosa	3	66
Mediomastus fragilis	3	68
Average similarity	65.37	
Species	55	
H'(log2)	3.4	
N	1521	
B (g m^{-2})	18.6	

Group g	Av.Abund	Cum.%
Mediomastus fragilis	6	13
Aphelochaeta marioni	6	25
Tubificoides benedii	6	35
Corophium volutator	6	44
Polydora cornuta	5	53
Tharyx Type A	4	61
Cirriformia tentaculata	3	67
Chaetozone gibber	2	72
Peringia ulvae	3	77
Average similarity	55.13	
Species	24	
H'(log2)	3.3	
N	426	
B (g m^{-2})	1	

Group k	Av.Abund	Cum.%
Aphelochaeta marioni	18	22
Chaetozone gibber	11	36
Leitoscoloplos mammosus	8	47
Nucula nitidosa	8	56
Abra alba	6	63
Tharyx Type A	6	69
Thyasira flexuosa	4	74
Average similarity	74.28	
Species	34	
H'(log2)	2.9	
N	756	
B (g m^{-2})	12.6	

Group m	Av.Abund	Cum.%
Aphelochaeta marioni	29	26
Chaetozone gibber	24	48
Tharyx Type A	22	64
Ophryotrocha	6	68
Leitoscoloplos mammosus	4	71
Tubificoides benedii	4	74
Nucula nitidosa	3	77
Average similarity	71.38	
Species	37	
H'(log2)	2.4	
N	2237	
B (g m^{-2})	1.8	

Table 5.4(b): Simprof classes (single stations, based on √ transformed data) and characterising species, diversity and biomass (derived from raw data)

Group a (Sub 1)	A	Cum %
Nucula nucleus	46	14
Chaetozone gibber	44	28
Abra alba	17	33
Dipolydora caulleryi	16	38
Mediomastus fragilis	13	43
Levinsenia gracilis	9	45
Aphelochaeta marioni	9	48
Euclymene oerstedii	9	51
Nephtys kersivalensis	8	53
Tanaopsis graciloides	8	56
Species	73	
H'(log2)	5.13	
N	320	
B (g m^{-2})	4.97	

Group b (Sub 7)	A	Cum %
Abra alba	95	19
Nucula nitidosa	64	32
Nuculidae JUV.	54	43
Chaetozone gibber	43	52
Euclymene oerstedii	43	61
Species	44	
H'(log2)	4.1	
N	491	
B (g m^{-2})	22.9	

Group c (Sub 12)	A	Cum %
Abra alba	283	44
Nucula nitidosa	67	55
Tubificoides amplivasatus	48	62
Leitoscoloplos mammosus	44	69
Species	41	
H'(log2)	3.4	
N	1278	
B (g m^{-2})	46.7	

Group j (Sub 10)	A	Cum %
Actiniaria	256	43
Edwardsia claparedii	247	84
Species	28	
H'(log2)	2.1	
N	596	
B (g m^{-2})	1.4	

Group e (Sub 26)	A	Cum %
Leitoscoloplos mammosus	291	25
Chaetozone gibber	210	42
Tharyx Type A	104	51
Euclymene oerstedii	90	59
Abra alba	87	66
Species	42	
H'(log2)	3.8	
N	1179	
B (g m^{-2})	21.2	

Group h (Sub 5)	A	Cum %
Capitella	1138	44
Tharyx Type A	537	64
Tubificoides pseudogaster S	216	72
Chaetozone gibber	149	78
Aphelochaeta marioni	95	82
Species	41	
H'(log2)	3.1	
N	2609	
B (g m^{-2})	10	

Group l (Sub 11)	A	Cum %
Corophium volutator	619	29
Chaetozone gibber	361	45
Aphelochaeta marioni	358	62
Polydora cornuta	209	71
Species	44	
H'(log2)	3.3	
N	2167	
B (g m^{-2})	2.1	

Group l (Sub 18)	A	Cum %
Chaetozone gibber	938	51
Aphelochaeta marioni	326	69
Species	30	
H'(log2)	2.6	
N	1823	
B (g m^{-2})	8.2	

5.2 Intertidal Community Distribution and Biotope Analysis

5.2.1 Old Harbour (The Pill)

Intertidal core stations 3-7 were located within a sheltered south easterly facing area of mixed sediment semi-enclosed by the Old Harbour wall and the adjacent Salt Island Bridge, and area apparently referred to as 'The Pill'.

The area predominantly consisted of species rich mixed sediment biotope **LS.LMx.Mx.CirCer**, (Cirratulids and *Cerastoderma edule* in littoral mixed sediment). This biotope was dominated by cirratulid polychaetes and consisted of a species-rich intertidal muddy mixed sediment area dominated by high numbers of Cirratulid polychaetes. *Cerastoderma edule* was also noted in varying abundance as well as areas on *Cerastoderma* shell debris (Plates 5.1 & 5.2).

Plate 5.1: LS.LMx.Mx.CirCer

Plate 5.2: LS.LMx.Mx.CirCer

Slightly more cobbly mixed sediments adjacent to the harbour walls and firmer areas on the mudflat typically had a sparse covering of *Fucus vesiculosus* and occasionally *Ascophyllum nodosum* indicative of the biotope **LR.LLR.F.Fves.X** (Figure 5.7, Plate 5.3). This was superseded by the *Fucus serratus* equivalent biotope **LR.LLR.F.Fser.X** towards the lower shore (Figure 5.7, Plate 5.4).

Plate 5.3: LR.LLR.F.Fves.X

Plate 5.4: LR.LLR.F.Fser.X

A slender area of rock at the bottom of the shore covered in dense *Fucus serratus* together with *Mastocarpus stellatus* was indicative of the biotope **LR.LLR.F.Fser.FS** (Plate 5.5), above which was another area of the mixed sediment *F. serratus* biotope **LR.LLR.F.Fser.X**.

Plate 5.5: LR.LLR.F.Fser.FS

Plate 5.6: LR.FLR.Eph.X

At the western corner of the mudflat large amounts of *Ulva* sp. grew together with *F. vesiculosus* in the run-off adjacent from a drainage outfall (**LR.FLR.Eph.X**) (Plate 5.6), several similar pockets of *Ulva* sp. dominated sediment were noted within the area. The lower 50cm of the harbour wall was consistently covered in a dense covering of *F. vesiculosus* (**LR.LLR.F.Fves.FS**) (Figure 5.7, Plate 5.7) which graded into **LR.LLR.F.Fser.X** towards the lower shore (Figure 5.7).

Plate 5.7: LR.LLR.F.Fves.FS

Plate 5.8: LR.HLR.MusB.Sem.Sem

Above this biotope band was a 2-3m abundant covering of the barnacles *Semibalanus balanoides* and *Austrominius modestus*, the limpet *Patella vulgata* and *Littorina saxatilis* were common (**LR.HLR.MusB.Sem.Sem**) (Plate 5.8).

***Didemnum vexillum* was not noted on any structures during the survey of this area.**

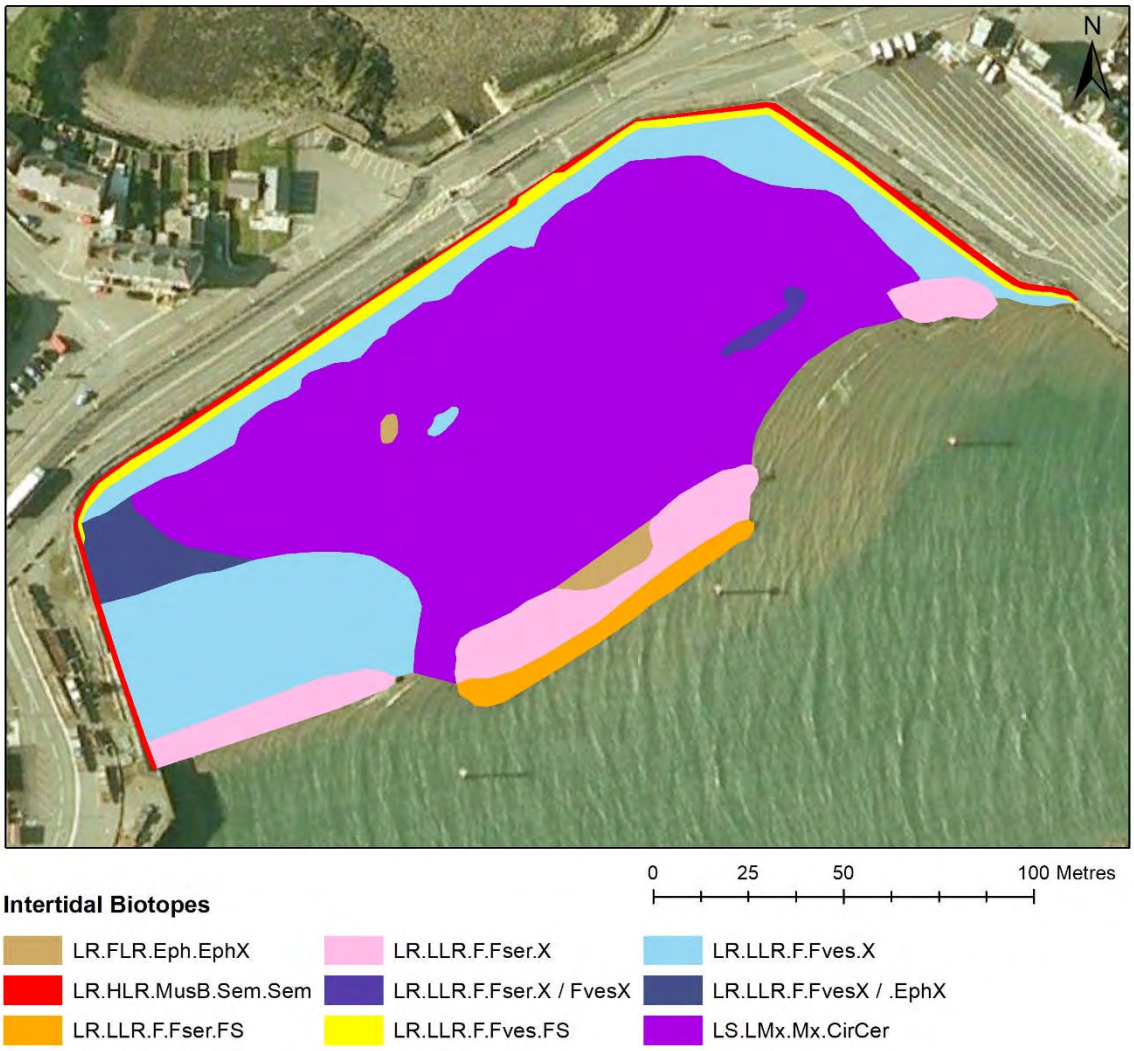


Figure 5.7: Distribution of biotopes in the Old Harbour survey area

5.2.2 OLD JETTY/NEW SEA WALL

As described earlier in this report, the sample locations for the cores were actually on a hard man-made substratum. Additional access to the adjacent, largely hard substratum was not possible due to the health & safety requirements of the port. As such, a visual assessment of the species present were undertaken and the following biotopes generated from this. The biotope distribution is shown in Figure 5.8.

The top the old Jetty featured a band of the black tar lichen (**LR.FLR.Lic.Ver.Ver**) (Plate 5.9), interspersed increasingly by ephemeral algae **LR.FLR.Eph.Ent** (Plate 5.10) towards the eastern end of the jetty.

Plate 5.9: LR.FLR.Lic.Ver.Ver

Plate 5.10: LR.FLR.Eph.Ent

Below this, a relatively consistent series of habitat bands were noted with reduction in elevation, grading from a narrow *Pelvetia* zone (**LR.LLR.F.Pel**) (Plate 5.11), into a dense band of fucoids consisting of **LR.LLR.F.Fspi.FS** (Plate 5.12) above **LR.LLR.F.Asc.FS** (Plate 5.13).

Plate 5.11: LR.LLR.F.Pel

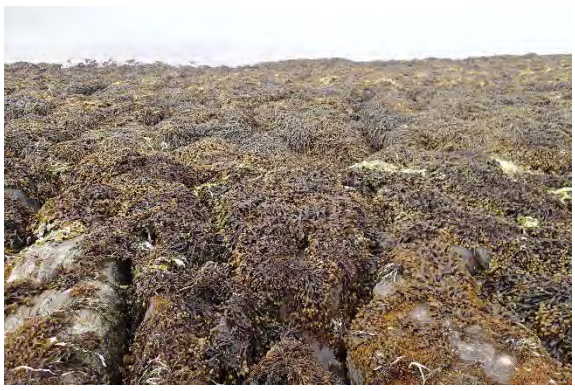


Plate 5.12: LR.LLR.F.Fspi.FS

The bands of both *F. spiralis* and *Ascophyllum nodosum* were observed to run along the length of the old jetty, although at the eastern end the presence of *Ascophyllum* was largely replaced by *Fucus vesiculosus* (**LR.LLR.F.Fves.FS**) (Plate 5.14).

Plate 5.13: LR.LLR.F.Asc.FS	**Plate 5.14: LR.LLR.F.Fves.FS**

Sandwiched between the fucoid dominated bands was an area of dense barnacles (**LR.MLR.BF.FvesB**) (Plate 5.15), with the **LR.LLR.F.Fspi.FS** above **LR.LLR.F.Asc.FS** biotopes grading into *Fucus serratus* biotope (**LR.LLR.F.Fser.FS**) towards the low shore.

Plate 5.15: LR.MLR.BF.FvesB	**Plate 5.16: General Zonation (New Sea Wall)**

The rock armour sea wall running north to the Ferry Terminal exhibited a similar zonation to that of the Old Jetty, although with a greater density of barnacles and a lower coverage by fucoids. Access was not permitted onto this area, and as such, no detailed photographs could be taken. However, zonation remained similar with tidal elevation to that investigated on the Old Jetty. The **LR.FLR.Lic.Ver.Ver** remained present but narrower than on the Old Jetty, this grading into a thin **LR.MLR.BF.PelB** which in turn graded into a broad band of **LR.MLR.BF.FspiB**. Below this was **LR.MLR.FvesB** grading to **LR.MLR.BF.Fser**. Figure 5.8 and Plate 5.16 show the main zonation bands.

***Didemnum vexillum* was not visible on any structures during the survey of this area.**

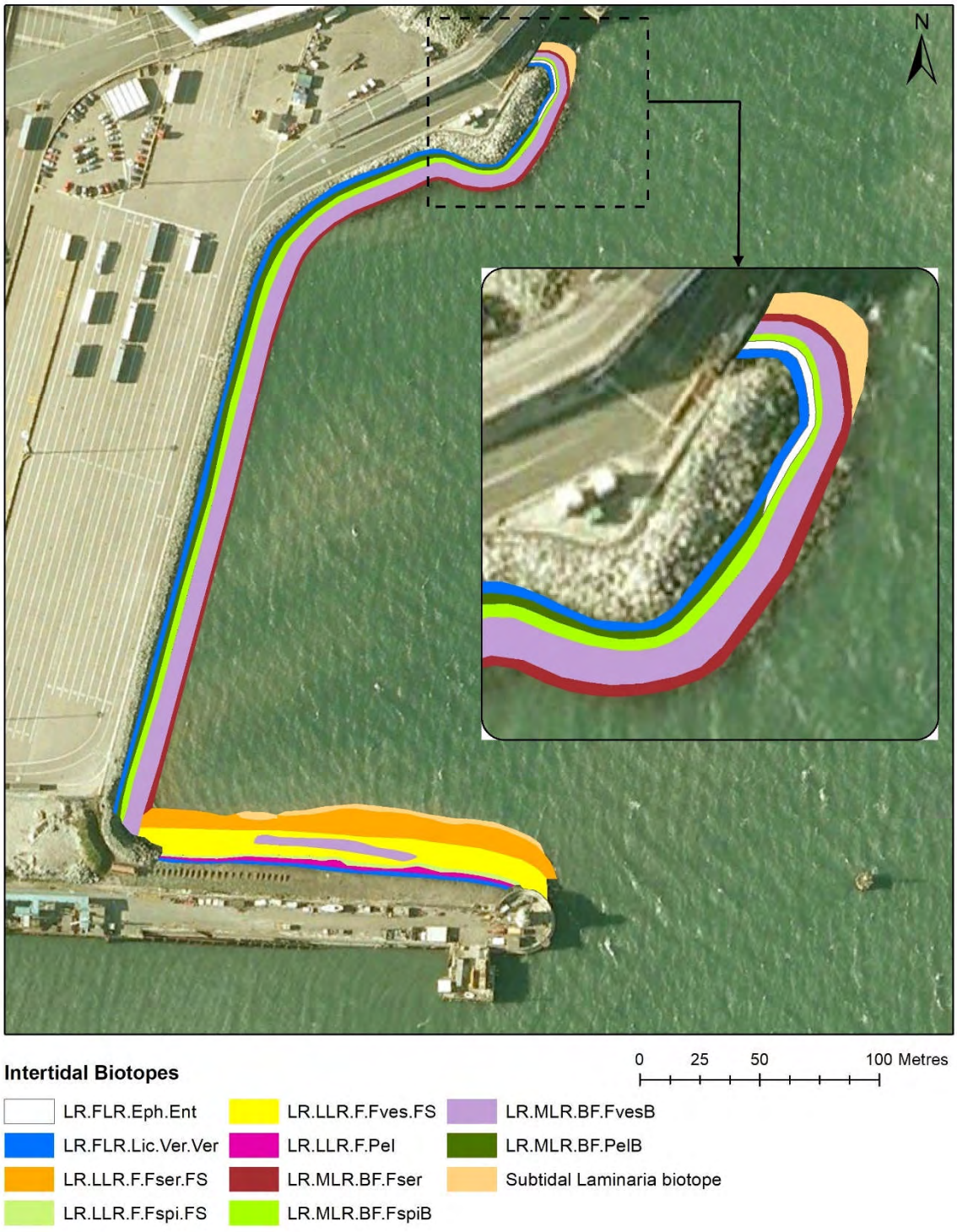


Figure 5.8: Distribution of biotopes in the Old Jetty/Sea Wall area

5.3 Subtidal Community Distribution and Biotope Analysis

Based on the information from Sections 4.2 and 5.1, the following subtidal biotopes have been assigned.

The survey stations located in the approaches tended to feature a soft sandy mud/muddy sand substratum dominated by bivalves and in particular *Abra alba*.

Closer on shore off the Old Jetty, New Sea Wall area, the habitat became muddier, probably as a result of increased shelter, and was dominated by *Nucula nitidosa*.

Station 5 was featured abundant Capitella and may reflect increased environmental stress either from fresh water discharge (several unknown source discharges were noted adjacent to this area), or nutrient enrichment, with fucoid debris also noted in this location.

Stations 8, 9 and 10, located immediately off The Pill were from a muddy substratum dominated by *Aphelochaeta marioni* and other cirratulids, with some components being very similar to the adjacent intertidal assemblage.

Station 1: SS.SMX.CMx.MysThyMx. *Mysella bidentata* and *Thyasira* spp. in circa-littoral muddy mixed sediment.

An area of muddy mixed sediment, with a faunal assemblage reminiscent of a shallow water variant of the mixed sediment biotope MysThyMx, although with a reasonably diverse assemblage of algae. Perhaps the muddy mixed sediment *Laminaria* biotope LsacR.Mu may grade into this (although little information on the infaunal assemblage is presented in the JNCC biotope description). The sampling position was adjacent to Laminaria beds.

Station 2: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 3: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

A more muddy substratum with *Abra alba* and *Nucula nitidosa* dominant but at lower abundances than some other sites.

Station 4: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

A more muddy substratum with *Abra alba* and *Nucula nitidosa* dominant but at lower abundances than some other sites.

Station 5: SS.SMu.SMuVS.CapTubi/SS.SSA.CMuSa.AalbNuc. *Capitella capitata* in enriched sublittoral variable salinity muddy sediments/*Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

Area of sandy mud with very high *Capitella* abundance, indicating a *Capitella* biotope, although possibly grading into a more diverse biotope such as AalbNuc. Presence of Capitella may indicate environmental stress (discharge?) or nutrient enrichment (decaying algae)?

Station 6: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

A more muddy substratum with *Abra alba* and *Nucula nitidosa* dominant but at lower abundances than some other sites.

Station 7: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 8: SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy. *Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud/*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud.

Muddy area dominated by *A. marioni* and other cirratulids. Assemblage resembles AphTub but grading into the more diverse MelMagThy biotope.

Station 9: SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy. *Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud/*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud.

Muddy area dominated by *A. marioni* and other cirratulids. Assemblage resembles AphTub but grading into the more diverse MelMagThy biotope.

Station 10: SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy. *Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud/*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral sandy mud.

Muddy area dominated by *A. marioni* and other cirratulids. Assemblage resembles AphTub but grading into the more diverse MelMagThy biotope.

Station 11: LS.LMx.Mx.CirCer. Cirratulids and *Cerastoderma edule* in littoral mixed sediment.

The sample position was on the edge of the intertidal zone, and the assemblage had high numbers of *C. volutator* and cirratulids. The faunal composition and sediment type very similar to adjacent intertidal core stations (CirCer).

Station 12: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 13: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 14: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 15: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 16: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 17: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

A more muddy substratum with *Abra alba* and *Nucula nitidosa* dominant but at lower abundances than some other sites.

Station 18: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

A more muddy substratum with *Abra alba* and *Nucula nitidosa* dominant but at lower abundances than some other sites.

Station 19: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 20: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 21: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 22: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 23: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 24: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 25: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 26: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

Station 27: SS.SSA.CMuSa.AalbNuc. *Abra alba* and *Nucula nitidosa* in circa-littoral muddy sand or slightly mixed sediment.

An area of sandy mud with very high abundances of the bivalves *Abra alba* and *Nucula nitidosa*, indicative of the biotope AalbNuc.

A detailed breakdown of the constituent parts for the biotopes from the subtidal survey is provided in Appendix 4.

6. DIDEMNUM VEXILLUM ASSESSMENT

6.1 Approach

The presence and location of *Didemnum vexillum* (Carpet Sea Squirt) was required to be noted, as part of the ITT. the species being considered an invasive non-native species that can encrust hard substratum and reproduce rapidly. It can potentially overgrow native encrusting species and biogenic communities e.g. shellfish and other sessile invertebrates. As such, it can have a considerable impact on native benthic communities as well as commercial seafood cultivation. Methods are therefore required to control its potential colonisation and minimise its spread.

The presence of the species is known from the Holyhead area and a series of locations to investigate the presence and status of the species were provided by Royal HaskoningDHV in the ITT and these are shown in Figure 6.1.

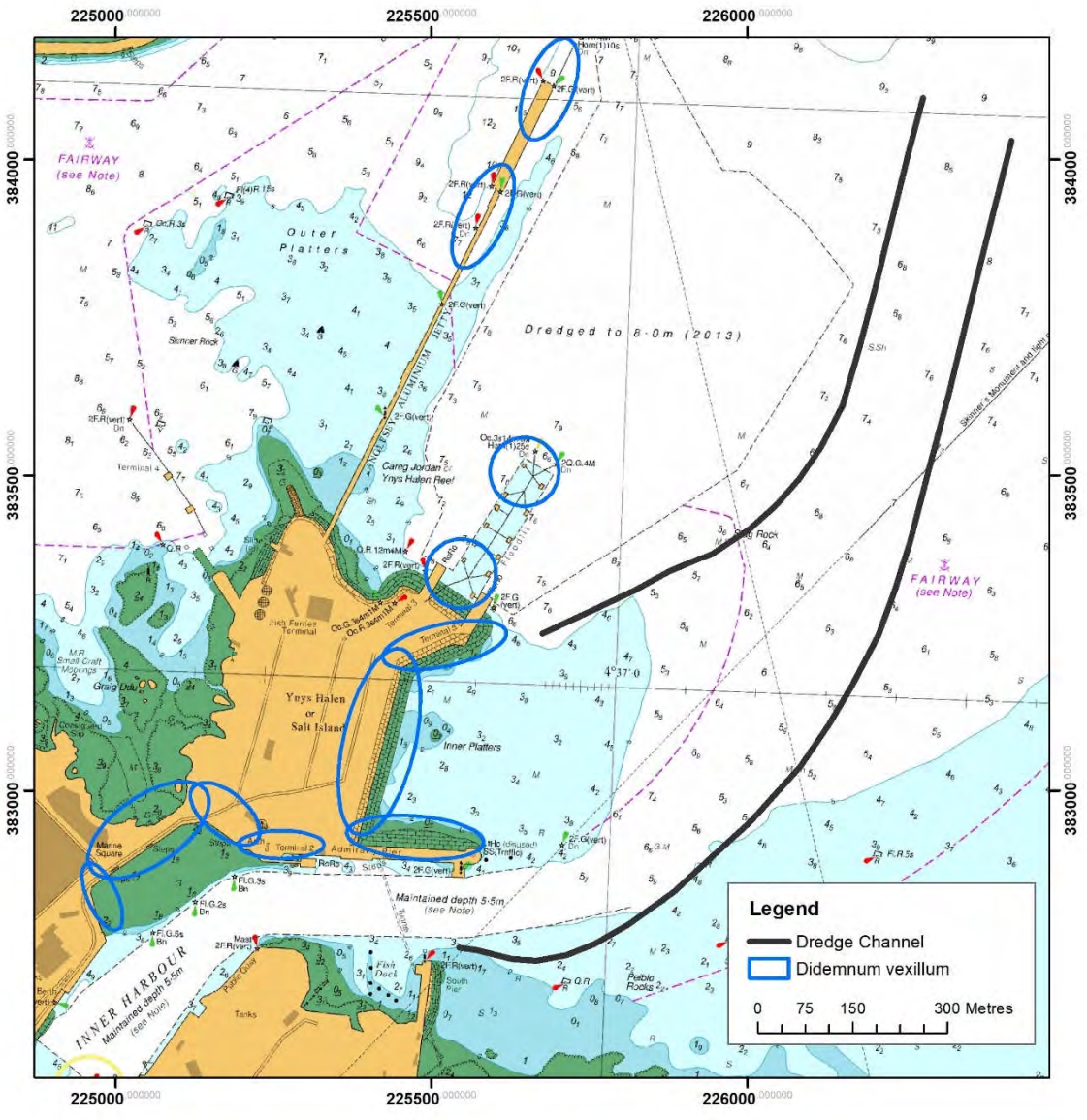


Figure 6.1: Areas of Didemnum vexillum investigation

In accordance with the ITT, the presence and status of *D. vexillum* was therefore carried out during both the intertidal Phase 1 walkover survey, and in the subtidal zone via a dedicated ROV survey of potential colonised structures.

To this end, a VideoRay Pro4 ROV was deployed to capture video footage of hard subtidal structures e.g. jetties, in order to identify encrusting communities where *Didemnum vexillum* may be present. The system employed included a rotating manipulator arm that could be used to take samples if necessary (Plates 6.1 & 6.2).

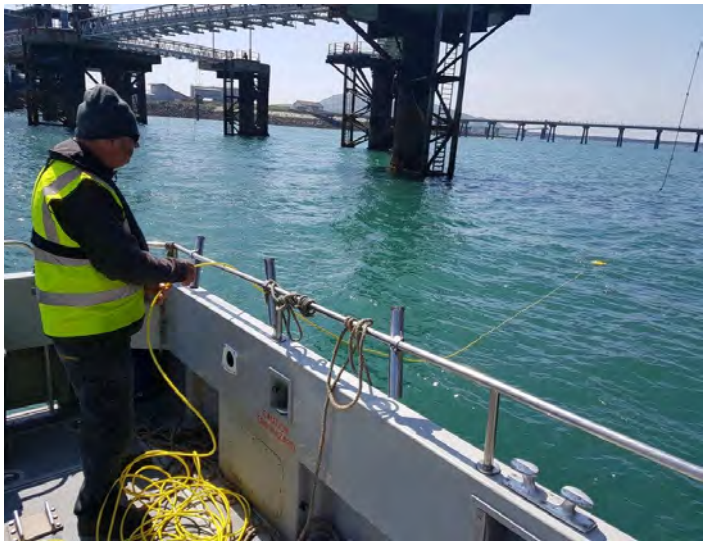


Plate 6.1 (left): VideoRay Pro4 with manipulator arm

Plate 6.2 (above): VideoRay Pro4 being deployed

During the video survey the images of the port structures were observed for the potential presence of *D. vexillum*. However, no potential presence was observed.

The video footage was stored digitally and then transferred to a central hard drive system with daily back-up when returned to the IECS premises.

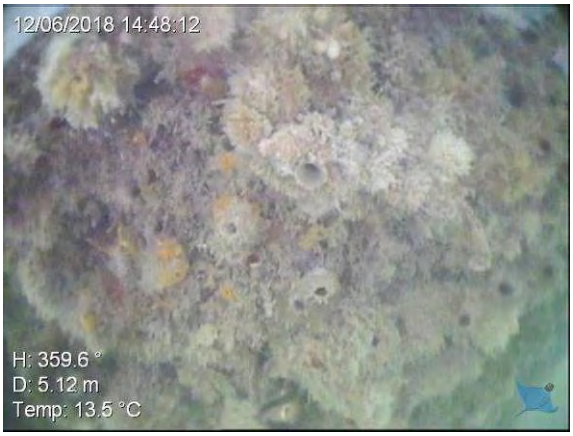
The footage was then transferred into a video editing package and assessed in real-time for any further evidence of occurrence. Representative video clips were then identified and these transferred to DVD.

6.2 Findings

A brief summary of the findings are provided in this document. A short stand-alone report with additional screen grabs and a description of the dominant fauna are provided in an accompanying video report (on DVD), which provides summary clips of each of the subtidal hard substratum survey areas.

Importantly, no evidence of *D. vexillum* was recorded from either the intertidal or subtidal surveys.

A selection of representative stills from the subtidal survey are provided here (Plates 6.3 to 6.7), but more detailed imagery and assemblage description is provided on the associated DVD.



Plates 6.3 to 6.7: Selected images from the subtidal *D. vexillum* survey. Note that no evidence of *D. vexillum* was observed either during the survey nor from subsequent analysis of the video footage.

APPENDICES

Appendix 1: Sediment properties.

	SIMPROF class	A	D	K	K	H	E	B	M	M	J	I
	Site	**1 SUB**	**2 SUB**	**3 SUB**	**4 SUB**	**5 SUB**	**6 SUB**	**7 SUB**	**8 SUB**	**9 SUB**	**10 SUB**	**11 SUB**
	TEXTURAL GROUP:	Gravelly Mud	Sandy Mud	Mud	Mud	Slightly Gravelly Sandy Mud	Sandy Mud	Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Mud	Sandy Mud	Gravelly Mud
	SEDIMENT NAME:	Coarse Gravelly Fine Silt	Very Fine Sandy Fine Silt	Fine Silt	Fine Silt	Slightly Fine Gravelly Fine Sandy Fine Silt	Very Fine Sandy Fine Silt	Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Fine Silt	Very Fine Sandy Fine Silt	Very Fine Gravelly Fine Silt
FOLK AND WARD METHOD (μm)	MEAN	110.5	13.50	9.381	8.801	25.97	10.17	10.83	10.11	9.305	9.991	33.61
	SORTING	25.68	4.701	3.788	3.680	6.095	4.134	4.288	3.991	4.069	3.918	10.24
	SKEWNESS	0.265	0.084	0.103	0.103	0.037	0.053	0.085	0.190	0.171	0.141	0.172
	KURTOSIS	0.684	0.823	0.922	0.934	0.696	0.854	0.857	1.022	0.997	0.955	0.952
FOLK AND WARD METHOD (ϕ)	MEAN	3.178	6.211	6.736	6.828	5.267	6.619	6.529	6.628	6.748	6.645	4.895
	SORTING	4.682	2.233	1.922	1.880	2.608	2.048	2.100	1.997	2.025	1.970	3.356
	SKEWNESS	-0.265	-0.084	-0.103	-0.103	-0.037	-0.053	-0.085	-0.190	-0.171	-0.141	-0.172
	KURTOSIS	0.684	0.823	0.922	0.934	0.696	0.854	0.857	1.022	0.997	0.955	0.952
FOLK AND WARD METHOD (Description)	MEAN:	Very Fine Sand	Medium Silt	Medium Silt	Medium Silt	Coarse Silt	Medium Silt	Medium Silt	Medium Silt	Medium Silt	Medium Silt	Very Coarse Silt
	SORTING:	Extremely Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Coarse Skew ed	Symmetrical	Coarse Skew ed	Coarse Skew ed	Symmetrical	Symmetrical	Symmetrical	Coarse Skew ed	Coarse Skew ed	Coarse Skew ed	Coarse Skew ed
	KURTOSIS:	Platykurtic	Platykurtic	Mesokurtic	Mesokurtic	Platykurtic	Platykurtic	Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic
	D50 (mm):	58.35	12.10	8.514	8.003	23.60	9.660	9.868	8.719	8.146	8.855	29.04
	D50 (f):	4.099	6.369	6.876	6.965	5.405	6.694	6.663	6.842	6.940	6.819	5.106
% Composition	% GRAVEL:	27.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.2%	0.4%	0.0%	9.2%
	% SAND:	22.0%	18.8%	8.2%	7.0%	33.2%	10.0%	12.4%	10.9%	9.5%	10.2%	28.5%
	% MUD:	50.8%	81.2%	91.8%	93.0%	66.6%	90.0%	87.6%	88.9%	90.1%	89.8%	62.3%

Appendix 1 (Cont.)

	SIMPROF class	C	D	D	D	D	E	M	E	D	D	D
	Site	12 SUB	13 SUB	14 SUB	15 SUB	16 SUB	17 SUB	18 SUB	19 SUB	20 SUB	21 SUB	22 SUB
	TEXTURAL GROUP:	Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Gravelly Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud
	SEDIMENT NAME:	Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Fine Gravelly Very Fine Sandy Fine Silt	Fine Gravelly Fine Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt
FOLK AND WARD METHOD (μm)	MEAN	19.46	23.81	20.61	16.51	24.01	14.11	14.75	28.08	16.00	22.70	20.31
	SORTING	4.684	5.324	5.267	4.839	8.769	4.373	4.520	4.768	4.870	4.711	4.586
	SKEWNESS	-0.192	-0.188	-0.042	0.004	0.155	-0.056	-0.029	-0.401	-0.048	-0.303	-0.262
	KURTOSIS	0.709	0.803	0.811	0.794	1.060	0.795	0.808	0.766	0.764	0.760	0.758
FOLK AND WARD METHOD (ϕ)	MEAN	5.683	5.392	5.601	5.920	5.380	6.147	6.083	5.154	5.965	5.461	5.622
	SORTING	2.228	2.412	2.397	2.275	3.132	2.129	2.176	2.253	2.284	2.236	2.197
	SKEWNESS	0.192	0.188	0.042	-0.004	-0.155	0.056	0.029	0.401	0.048	0.303	0.262
	KURTOSIS	0.709	0.803	0.811	0.794	1.060	0.795	0.808	0.766	0.764	0.760	0.758
FOLK AND WARD METHOD (Description)	MEAN:	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Medium Silt	Medium Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt
	SORTING:	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Fine Skewed	Fine Skewed	Symmetrical	Symmetrical	Coarse Skewed	Symmetrical	Symmetrical	Very Fine Skewed	Symmetrical	Very Fine Skewed	Fine Skewed
	KURTOSIS:	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Mesokurtic	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Platykurtic
	D50 (mm):	23.78	31.04	21.97	16.35	22.65	14.76	15.29	44.46	16.51	31.82	26.97
	D50 (f):	5.394	5.010	5.508	5.935	5.464	6.082	6.031	4.491	5.921	4.974	5.212
% Composition	% GRAVEL:	0.0%	0.4%	0.6%	1.0%	6.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	% SAND:	30.2%	33.3%	29.2%	22.9%	26.7%	17.2%	18.7%	40.2%	24.0%	32.6%	28.6%
	% MUD:	69.8%	66.3%	70.2%	76.1%	67.0%	82.8%	81.3%	59.8%	76.0%	67.4%	71.4%

Appendix 1 (Cont.)

	SIMPROF class	D	D	D	E	D		G	G	G	G	G
	Site	23 SUB	24 SUB	25 SUB	26 SUB	27 SUB		3 INT	4 INT	5 INT	6 INT	7 INT
	TEXTURAL GROUP:	Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud	Gravelly Mud	Sandy Mud		Gravelly Mud	Gravelly Mud	Gravelly Mud	Muddy Gravel	Gravelly Muddy Sand
	SEDIMENT NAME:	Very Fine Sandy Very Coarse Silt	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Gravelly Fine Silt	Very Fine Sandy Very Coarse Silt		Coarse Gravelly Coarse Silt	Coarse Gravelly Coarse Silt	Very Fine Gravelly Fine Silt	Fine Silty Coarse Gravel	Very Fine Gravelly Very Coarse Silty Fine Sand
FOLK AND WARD METHOD (μm)	MEAN	22.90	24.56	16.77	32.73	20.02		109.8	64.82	79.32	458.1	121.7
	SORTING	4.780	4.932	4.646	13.56	4.462		24.67	19.40	16.25	27.35	13.01
	SKEWNESS	-0.285	-0.281	-0.044	0.367	-0.263		0.339	0.341	0.213	-0.206	-0.064
	KURTOSIS	0.773	0.796	0.778	1.098	0.749		0.720	1.065	0.807	0.629	0.959
FOLK AND WARD METHOD (ϕ)	MEAN	5.448	5.347	5.898	4.933	5.642		3.187	3.947	3.656	1.126	3.039
	SORTING	2.257	2.302	2.216	3.761	2.158		4.625	4.278	4.022	4.774	3.701
	SKEWNESS	0.285	0.281	0.044	-0.367	0.263		-0.339	-0.341	-0.213	0.206	0.064
	KURTOSIS	0.773	0.796	0.778	1.098	0.749		0.720	1.065	0.807	0.629	0.959
FOLK AND WARD METHOD (Description)	MEAN:	Coarse Silt	Coarse Silt	Coarse Silt	Very Coarse Silt	Coarse Silt		Very Fine Sand	Very Fine Sand	Very Fine Sand	Medium Sand	Very Fine Sand
	SORTING:	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted		Extremely Poorly Sorted	Extremely Poorly Sorted	Extremely Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Fine Skewed	Fine Skewed	Symmetrical	Very Coarse Skewed	Fine Skewed		Very Coarse Skewed	Very Coarse Skewed	Coarse Skewed	Fine Skewed	Symmetrical
	KURTOSIS:	Platykurtic	Platykurtic	Platykurtic	Mesokurtic	Platykurtic		Platykurtic	Mesokurtic	Platykurtic	Very Platykurtic	Mesokurtic
	D50 (mm):	31.77	34.76	17.39	17.91	26.60		44.95	34.38	50.24	705.5	143.0
	D50 (f):	4.976	4.847	5.845	5.803	5.232		4.475	4.862	4.315	0.503	2.806
% Composition	% GRAVEL:	0.0%	1.6%	0.0%	11.7%	0.0%		23.5%	15.4%	16.7%	43.6%	14.2%
	% SAND:	32.1%	32.9%	23.8%	20.4%	27.4%		21.8%	25.2%	30.6%	21.3%	45.6%
	% MUD:	67.9%	65.4%	76.2%	67.9%	72.6%		54.7%	59.4%	52.7%	35.1%	40.1%

Appendix 2: Species abundance data (subtidal and intertidal).

See separate excel workbook

Appendix 3: Species biomass data (subtidal and intertidal).

See separate excel workbook

Appendix 4: Subtidal Biotope Descriptions.

	JNCC 04.06 Biotope Codes					
	Level 3		Level 4		Level 5	
Sample	Code	Description	Code	Description	Code	Description
Sub - 1	SS.SMX	Sublittoral mixed sediment	SS.SMX.CMx	Circalittoral mixed sediment	SS.SMX.CMx.MysThyMx	Mysella bidentata and Thyasira spp. in circalittoral muddy mixed sediment
Sub - 2	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 3	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 4	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 5	SS.SMU/SS.SSA	Sublittoral mud	SS.SMU.ISaMu/SS.SSA.CMuSa	Infralittoral sandy mud/Circalittoral muddy sand	SS.SMU.ISaMu.Cap/SS.SSA.CMuSa.AalbNuc	Capitella capitata in enriched sublittoral muddy sediments/Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed
Sub - 6	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 7	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc/	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 8	SS.SMU	Sublittoral mud	SS.SMU.SMuVS/SS.SMU.ISaMu	Sublittoral mud in variable salinity (estuaries)/Infralittoral sandy mud	SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy	Aphelochaeta marioni and Tubificoides spp. In variable salinity infralittoral mud/Melinna palmata with Magelona spp. and Thyasira spp. in infralittoral sandy mud
Sub - 9	SS.SMU	Sublittoral mud	SS.SMU.SMuVS/SS.SMU.ISaMu	Sublittoral mud in variable salinity (estuaries)/Infralittoral sandy mud	SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy	Aphelochaeta marioni and Tubificoides spp. In variable salinity infralittoral mud/Melinna palmata with Magelona spp. and Thyasira spp. in infralittoral sandy mud

Appendix 4 (Cont.)

Sub - 10	SS.SMU	Sublittoral mud	SS.SMU.SMuVS/SS.SMU.ISaMu	Sublittoral mud in variable salinity (estuaries)/Infralittoral sandy mud	SS.SMU.SMuVS.AphTubi/SS.SMU.ISaMu.MelMagThy	Aphelochaeta marioni and Tubificoides spp. In variable salinity infralittoral mud/Melinna palmata with Magelona spp. and Thyasira spp. in infralittoral sandy mud
Sub - 11	LS.LMx	Littoral mixed sediment	LS.LMx.Mx	Species-rich mixed sediment shores	LS.LMx.Mx.CirCer	Cirratulids and Cerastoderma edule in littoral mixed
Sub - 12	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 13	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 14	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 15	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 16	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 17	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 18	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 19	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 20	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment

Appendix 4 (Cont.)

Sub - 21	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 22	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 23	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 24	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 25	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 26	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment
Sub - 27	SS.SSA	Sublittoral sand	SS.SSA.CMuS	Circalittoral muddy sand	SS.SSA.CMuSa.AalbNuc	Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment

Appendix F

Subacoustech Underwater Noise Report

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Further underwater noise propagation modelling for works at Holyhead Harbour

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08/03/2019

Subacoustech Environmental Report No. P238R0302

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This report is a controlled document. The report documentation page lists the version number, record of changes, referencing information, abstract and other documentation details.

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1 Introduction

Subacoustech Environmental has been instructed by HaskoningDHV to undertake acoustic propagation modelling for dredging, drill piling, peckering and impact piling related to a port expansion project at Holyhead Port on Holy Island. The purpose of the modelling is to estimate the received sound pressure levels in the region, with particular concern for the impacts on marine mammals and fish.

This report has been prepared by Subacoustech Environmental Ltd for HaskoningDHV and presents the results and findings of the modelling assessment.

1.1 Noise sources

Works at the harbour are expected to include dredging, drill piling, impact piling and peckering. Dredging will include both trailing suction hopper dredging (TSHD) and cutter suction dredging (CSD). On the advice of HaskoningDHV it is expected that dredging and peckering may occur over a 24 hour period, drill piling over a 10.5 hour period and impact piling over a three hour period.

1.2 Survey area

Figure 1-1 shows the Holyhead Harbour area along with the location of proposed works and modelling locations highlighted. Dredging and peckering is to take place in the area enclosed in red (the dredge channel) whilst drill piling and impact piling is to occur in area A and area B.

The specific locations used for modelling are summarised below:

- Modelling of noise from dredging and peckering was undertaken, independently of each other, at the north east corner of the dredge channel at 53.325237°N, 4.609556°W.
- Modelling of noise from drill piling and impact piling was undertaken independently of each other within Area A at 53.31784°N, 4.618864°W.
- An additional scenario was modelled in which peckering, impact piling in area A, drill piling and impact piling in area B were all operating simultaneously. Modelling of noise from impact piling in area B was undertaken at 53.313717°N, 4.626708°W.

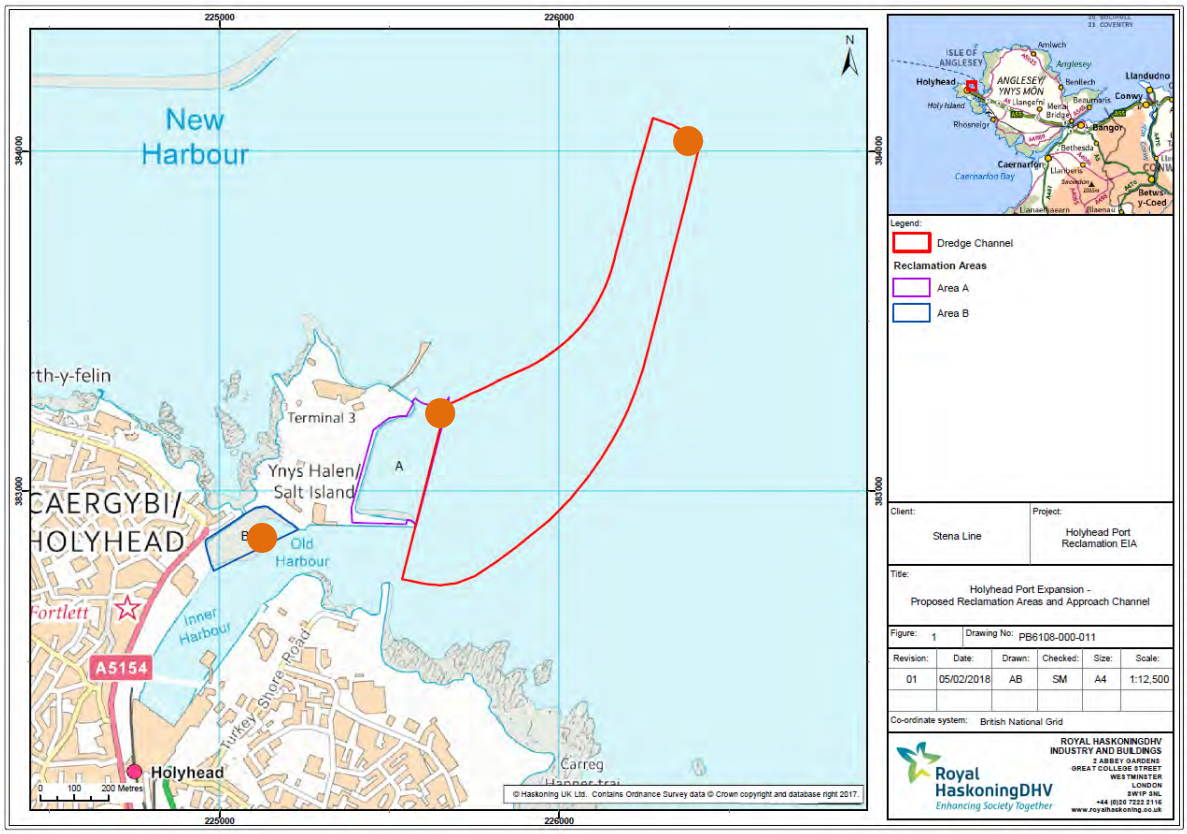

Figure 1-1 Proposed area of the works with modelling locations overlain, image provided by Royal HaskoningDHV

1.3 Assessment overview

This report presents a detailed assessment of the potential underwater noise from works at Holyhead Harbour and covers the following:

- Review of background information on the units for measuring and assessing underwater noise;
- Discussion of the approach, input parameters and assumptions for the noise modelling undertaken;
- Presentation of detailed subsea noise modelling using unweighted metrics and interpretation of the results using suitable noise metrics and criteria; and
- Summary and conclusions.

2 Measurement of underwater noise

Sound travels much faster in water (approximately 1,500 ms^{-1}) than in air (340 ms^{-1}). Since water is a relatively incompressible, dense medium, the pressures associated with underwater sound tend to be much higher than in air. As an example, background levels of sea noise of approximately 130 dB re 1 µPa for UK coastal waters are not uncommon (Nedwell *et al.* (2003 and 2007)).

2.1 Units of measurement

Sound measurements underwater are usually expressed using the decibel (dB) scale, which is a logarithmic measure of sound. A logarithmic scale is used because rather than equal increments of sound having an equal increase in effect, typically a constant ratio is required for this to be the case. That is, each doubling of sound level will cause a roughly equal increase in "loudness".

Any quantity expressed in this scale is termed a "level". If the unit is sound pressure, expressed on the dB scale, it will be termed a "Sound Pressure Level". The fundamental definition of the dB scale is given by:

$$Level = 10 \times \log_{10}\left(\frac{Q}{Q_{ref}}\right)$$

where Q is the quantity being expressed on the scale, and Q_{ref} is the reference quantity.

The dB scale represents a ratio and, for instance, 6 dB really means "twice as much as…" (such as a doubling of peak or RMS pressure, exposure etc). It is, therefore, used with a reference unit, which expresses the base from which the ratio is expressed. The reference quantity is conventionally smaller than the smallest value to be expressed on the scale, so that any level quoted is positive. For instance, a reference quantity of 20 µPa is used for sound in air, since this is the threshold of human hearing.

A refinement is that the scale, when used with sound pressure, is applied to the pressure squared rather than the pressure. If this were not the case, when the acoustic power level of a source rose by 10 dB the Sound Pressure Level would rise by 20 dB. So that variations in the units agree, the sound pressure must be specified in units of root mean square (RMS) pressure squared. This is equivalent to expressing the sound as:

$$Sound\ Pressure\ Level = 20 \times \log_{10}\left(\frac{P_{RMS}}{P_{ref}}\right)$$

For underwater sound, typically a unit of one micropascal (µPa) is used as the reference unit; a Pascal is equal to the pressure exerted by one Newton over one square metre; one micropascal equals one millionth of this.

2.2 Quantities of measurement

Sound may be expressed in many ways depending upon the type of noise, and the parameters of the noise that allow it to be evaluated in terms of a biological effect. These are described in more detail below.

2.2.1 Sound pressure level (SPL)

The Sound Pressure Level is normally used to characterise noise and vibration of a continuous nature such as drilling, boring, continuous wave sonar, or background sea and river noise levels. To calculate the SPL, the variation in sound pressure is measured over a specific time period to determine the Root Mean Square (RMS) level of the time varying sound. The SPL can therefore be considered a measure of the average unweighted level of sound over the measurement period.

Where an SPL is used to characterise transient pressure waves such as that from seismic airguns, underwater blasting or impact piling, it is critical that the period over which the RMS level is calculated is quoted. For instance, in the case of pile strike lasting, say, a tenth of a second, the mean taken over a tenth of a second will be ten times higher than the mean taken over one second. Often, transient sounds such as these are quantified using "peak" SPLs.

2.2.2 Peak sound pressure level (SPL_{peak})

Peak SPLs are often used to characterise sound transients from impulsive sources, such as percussive impact piling and seismic airgun sources. A peak SPL is calculated using the maximum variation of the pressure from positive to zero within the wave. This represents the maximum change in positive pressure (differential pressure from positive to zero) as the transient pressure wave propagates.

A further variation of this is the peak-to-peak SPL where the maximum variation of the pressure from positive to negative within the wave is considered. Where the wave is symmetrically distributed in positive and negative pressure, the peak-to-peak level will be twice the peak level, or 6 dB higher.

2.2.3 Sound exposure level (SEL)

When assessing the noise from transient sources such as blast waves, impact piling or seismic airgun noise, the issue of the period of the pressure wave is often addressed by measuring the total acoustic energy (energy flux density) of the wave. This form of analysis was used by Bebb and Wright (1953, 1954a, 1954b and 1955), and later by Rawlins (1987) to explain the apparent discrepancies in the biological effect of short and long-range blast waves on human divers. More recently, this form of analysis has been used to develop criteria for assessing the injury range from marina mammals and fish for various noise sources (NMFS (2018) and Popper *et al*. (2014)).

The Sound Exposure Level (SEL) sums the acoustic energy over a measurement period, and effectively takes account of both the SPL of the sound source and the duration the sound is present in the acoustic environment. Sound Exposure (SE) is defined by the equation:

$$SE = \int_0^T p^2(t)dt$$

where p is the acoustic pressure in Pascals, T is the duration of the sound in seconds, and t is the time in seconds. The Sound Exposure is a measure of the acoustic energy and, therefore, has units of Pascal squared seconds (Pa^2s).

To express the Sound Exposure on a logarithmic scale by means of a dB, it is compared with a reference acoustic energy level (${P^2}_{ref}$) and a reference time (T_{ref}). The SEL is then defined by:

$$SEL = 10 \times \log_{10}\left(\frac{\int_0^T p^2(t)dt}{{P^2}_{ref}T_{ref}}\right)$$

By selecting a common reference pressure P_{ref} of 1 µPa for assessments of underwater noise, the SEL and SPL can be compared using the expression:

$$SEL = SPL + 10 \times \log_{10} T$$

Where the SPL is a measure of the average level of the broadband noise, and the SEL sums the cumulative broadband noise energy.

This means that, for continuous sounds of less than one second, the SEL will be lower than the SPL. For periods greater than one second the SEL will be numerically greater than the SPL (i.e. for a sound of ten seconds duration, the SEL will be 10 dB higher than the SPL, for a sound of 100 seconds duration the SEL will be 20 dB higher than the SPL, and so on).

The SEL metric is often presented as a “single strike” SEL (SELss), which represents the SEL of a single impulse of a transient noise source, or as a cumulative SEL (SEL_{cum}), which represents a combined series of SELss noise levels, generally for impulsive sources that can operate over an extended period, such as piling.

Weighted metrics for marine mammals have been proposed by the National Marine Fisheries Service (NMFS) (2018). These assign a frequency response to groups of marine mammals and are discussed in detail in section 3.2.

3 Modelling methodology

3.1 Detailed modelling inputs

To estimate the likely noise levels from dredging, peckering, drill piling and impact piling operations, modelling has been carried out using an approach that is widely used and accepted by the acoustics community, in combination with publicly available environmental data and information provided by HaskoningDHV. The approach is described in more detail below.

Modelling of underwater noise is complex and can be approached in several different ways. Subacoustech have chosen to use a numerical approach that is based on two different solvers:

- A parabolic equation (PE) method for lower frequencies (12.5 Hz to 80 Hz); and
- A ray tracing method for higher frequencies (100 Hz to 100 kHz).

The PE method is widely used within the underwater acoustics community but has computational limitations at high frequencies. Ray tracing is more computationally efficient at higher frequencies but is not suited to low frequencies (Etter, 1991). This study utilises the dBSea implementation of these numerical solutions.

These solvers account for a wide array of input parameters, including bathymetry, sediment data, sound speed and source frequency content to ensure as detailed results as possible.

Modelling has been undertaken at three locations. Shown in Figure 1-1, dredging and peckering are modelled to take place in the north east corner of the dredge channel, impact piling and drill piling are modelled to take place in the north east corner of Area A and further impact piling is modelled to take place in Area B. Simultaneous modelling of multiple sources has also been undertaken to represent the worst case scenario: impact piling and drill piling are occurring in Area A, impact piling only is occurring in Area B and peckering is occurring in the dredge channel. These locations were selected as they are expected to provide the worst-case impact ranges for each activity due to their separation from land or situation in deeper water, which tends to result in greater underwater noise propagation ranges.

Where modelling of multiple sources has been undertaken, stated impact ranges use the impact piling at Area A as a central reference point.

3.1.1 Bathymetry

The bathymetry data used in the modelling was supplied by HaskoningDHV. A high tide of 5.66 m (Mean High Water Springs) has been used throughout the modelling as this represents a conservative approach with regards to noise propagation.

3.1.2 Seabed properties

Based on information provided by HaskoningDHV, the seabed properties used for the modelling were assumed to be predominantly sand underlain by clay. Geo-acoustic properties for the seabed were based on available data from Jensen *et al*. (2011) and are provided in Table 3-1.

Seabed type	Compressive sound speed in substrate (ms^{-1})	Density profile in substrate (kg/m^3)	Attenuation profile in substrate (dB/wavelength)
Sand	1650	1900	0.8
Clay	1500	1500	0.2

Table 3-1 Seabed geo-acoustic properties used for modelling

3.1.3 Source noise levels

The underwater noise levels present at each noise source are given in the following sections. The appropriate noise metric (generally SPL_{RMS}, SPL_{peak} or SELss) has been given in each case depending on the character of the particular noise source in question. Source noise levels are effectively the level of noise at 1 m from the source.

Very little information is publicly available in respect of underwater noise sources that would be relevant to this project, and so data has generally been drawn from measurements taken by Subacoustech of similar situations. Noise data have been modelled and presented below as ⅓ octave-band centre frequency levels.

3.1.3.1 Impact piling source levels

Specific plant details were unavailable at the time of modelling so the source levels for impact piling have been selected based on Subacoustech's extensive database of underwater noise sources. The source chosen for impact piling is an IHC S-280 hammer operating at 280 kJ driving a 610 mm pile. The ⅓ octave levels used for modelling are shown in Figure 3-1. For multiple pulse criteria it is assumed that piling will occur at a rate of one strike per second over a 3 hour period, operating without a soft start.

The unweighted source levels estimated for impact piling at Holyhead Harbour is:

- 210.1 dB re 1 µPa SPL_{peak}
- 185.1 dB re 1 µPa^{2}s SEL_{ss}

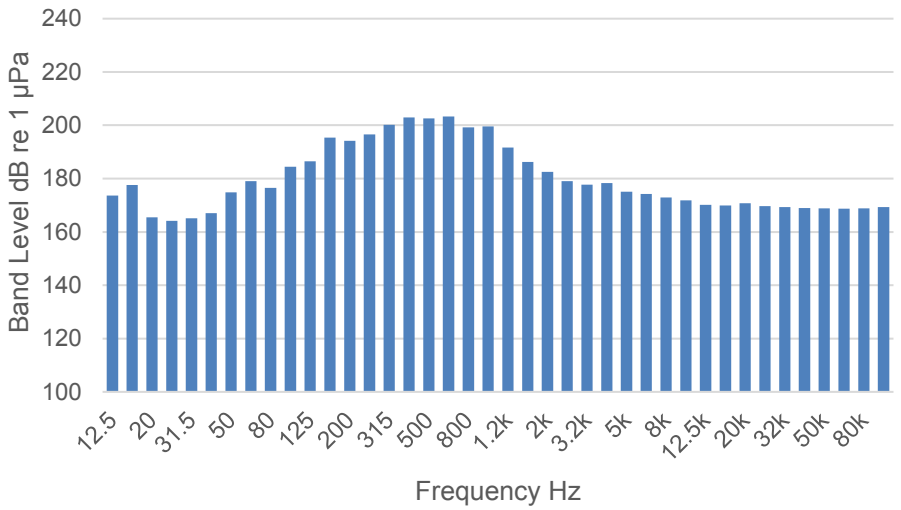

Figure 3-1 Source ⅓ octave band impact piling noise levels used for modelling

3.1.3.2 Peckering source levels

Specific plant details were unavailable at the time of modelling so the source levels for peckering have been selected from Subacoustech's database of underwater noise sources. The source chosen is a 4.2 tonne, 10.4 kJ hydraulic hammer. The ⅓ octave noise levels used for modelling are shown in

Figure 3-2. When calculating the SEL_{cum} impact of peckering, it is assumed that the noise is present over a continuous 24 hour period.

The unweighted SPL_{RMS} source level estimated for peckering at Holyhead Harbour is:

- 175.1 dB re 1 µPa SPL_{RMS}

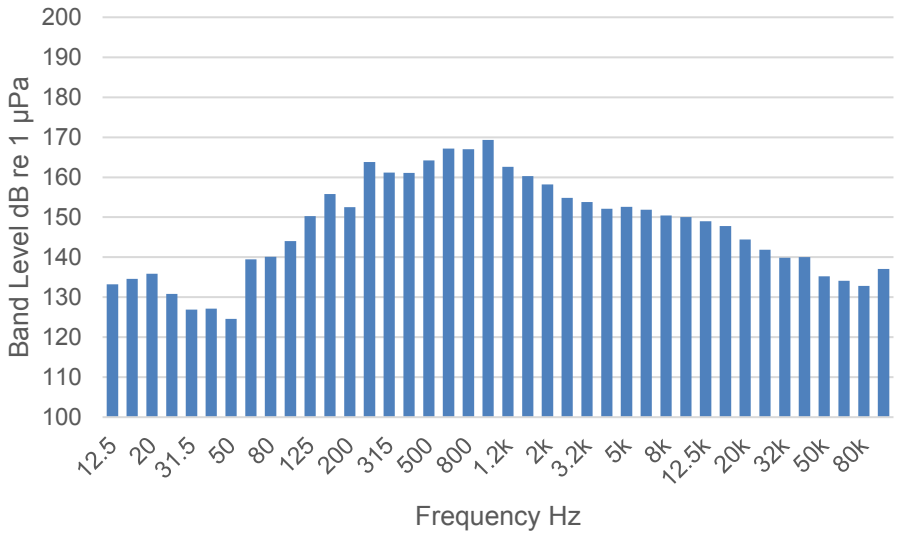

Figure 3-2 Source ⅓ octave band levels for peckering used for modelling

3.1.3.3 Dredger source levels

The proposed dredging operations at Holyhead Harbour include the operation of both TSHD and CSD dredgers. Specific plant details were unavailable at the time of modelling and so source levels have been selected from Subacoustech's database of underwater noise sources. The sources chosen are a CSD 112.6 m length, 24 m breadth dredge, cutting power 4000 kW and a TSHD of 173.15 m length, 32 m breadth and 3200 kW dredge pump power. The ⅓ octave levels used for modelling are shown in Figure 3-3. When calculating SEL_{cum} impact of dredging, it is assumed that the dredging noise is present over a continuous period of 24 hours. Although a dredger will be mobile in practice, for the purposes of modelling it is assumed that it will remain in a single location representative of the greatest likely noise propagation.

The unweighted SPL_{RMS} source levels estimated for dredging at Holyhead Harbour are:

- 178.7 dB re 1 µPa SPL_{RMS} (CSD)
- 175.6 dB re 1 µPa SPL_{RMS} (TSHD)

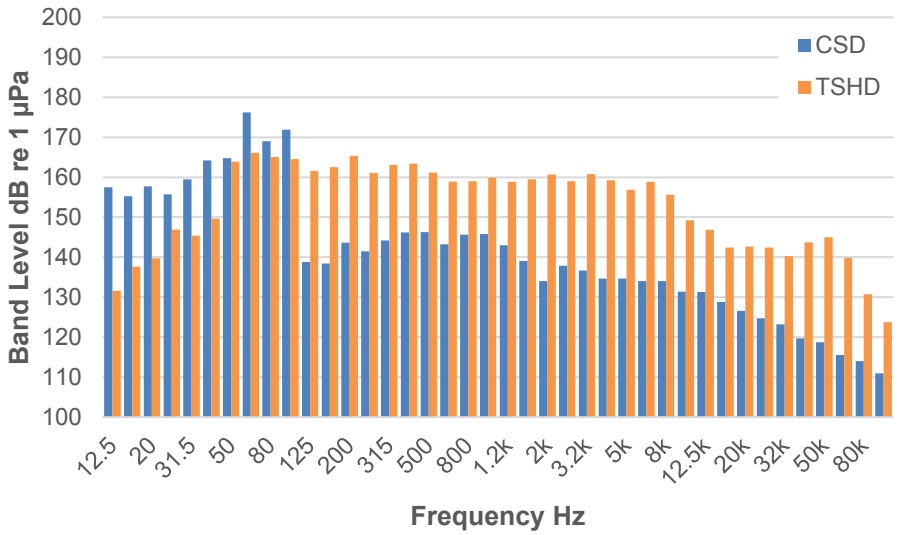

Figure 3-3 Source ⅓ octave band levels for dredgers used for modelling

3.1.3.4 Drill piling source levels

Specific plant details were unavailable at the time of modelling and so source levels have been selected from Subacoustech's database of underwater noise sources. The source chosen is an 80 kW, 15 tonne, 54 kNm @ 200 bar maximum torque drill. The ⅓ octave levels used for modelling are shown in Figure 3-4. When calculating SEL_{cum} impact of drill piling, it is assumed that the drill piling noise is present over a continuous period of 10.5 hours.

The unweighted SPL_{RMS} source level estimated for drill piling at Holyhead Harbour is:

- 163.6 dB re 1 µPa SPL_{RMS}

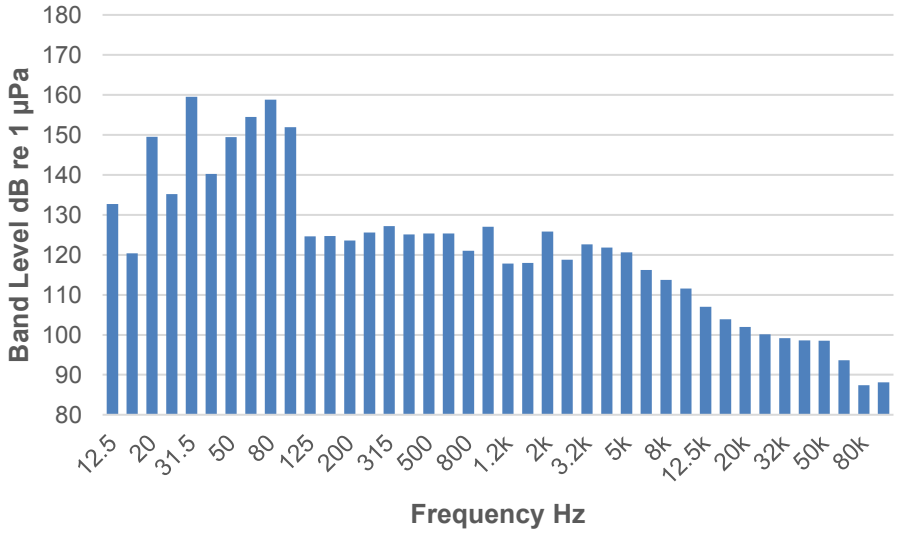

Figure 3-4 Source ⅓ octave band levels for drilling used for modelling

3.2 Assessment criteria

3.2.1 Background

Over the past 20 years it has become increasingly evident that noise from human activities in and around underwater environments can have an impact on the marine species in the area. The extent to which intense underwater sound might cause an adverse environmental impact in a species is dependent upon the incident sound level, sound frequency, duration of exposure and/or repetition rate of the sound wave (see for example Hastings and Popper, 2005). As a result, scientific interest in the hearing abilities of aquatic animal species has increased. These studies are primarily based on evidence from high level sources of underwater noise such as blasting or impact piling, as these sources are likely to have the greatest environmental impact and therefore the clearest observable effects.

The impacts of underwater sound can be broadly summarised into three categories:

- Physical traumatic injury and fatality;
- Auditory injury (either permanent or temporary); and
- Disturbance.

The following sections discuss the most up to date and authoritative criteria for assessing these impacts in key marine species. The metrics and criteria that have been used in this study to assess environmental effect come from the latest guidance from the U.S. National Marine and Fisheries Service (NMFS) concerning underwater noise and its effects on marine mammals (NMFS (2018)) and Popper *et al.* (2014) for the impacts of noise on species of fish.

3.2.2 Marine mammals

Since it was published, Southall *et al.* (2007) has been the source of the most widely used criteria to assess the effects of noise on marine mammals. NMFS (2018) was co-authored by many of the same academics from the Southall *et al* (2007) paper, and effectively updates it. In the updated guidelines, the frequency weightings have changed from those used by Southall *et al.* along with the criteria. The criteria have generally become more strict for most situations.

The NMFS (2018) guidance categorises marine mammals into groups based on their hearing sensitivities and applies filters to the noise to approximate the hearing response of the receptor. The hearing groups given in the NMFS (2018) are summarised in Table 3-2.

The auditory weighting functions for each hearing group are provided in Figure 3-5.

Hearing group	Example species	Generalised hearing range
Low Frequency (LF) Cetaceans	Baleen Whales	7 Hz to 35 kHz
Mid Frequency (MF) Cetaceans	Dolphins, Toothed Whales, Beaked Whales, Bottlenose Whales (including Bottlenose Dolphin)	150 Hz to 160 kHz
High Frequency (HF) Cetaceans	True Porpoises (including Harbour Porpoise)	275 Hz to 160 kHz
Phocid Pinnipeds (PW) (underwater)	True Seals (including Harbour Seal)	50 Hz to 86 kHz

Table 3-2 Marine mammal hearing groups (from NMFS, 2018)

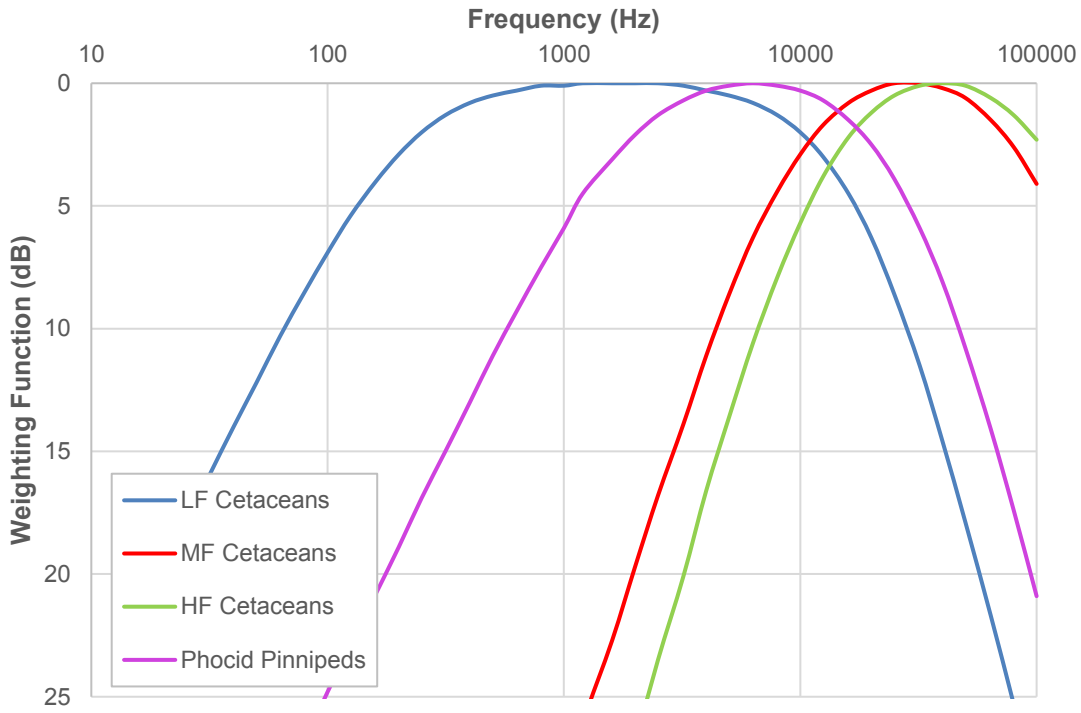

Figure 3-5 Auditory weighting functions for low frequency (LF) cetaceans, mid frequency (MF) cetaceans, high frequency (HF) cetaceans, phocid pinnipeds (PW) (underwater) (from NMFS, 2018)

NMFS (2018) presents unweighted peak criteria (SPL_{peak}) and cumulative, weighted sound exposure criteria (SEL_{cum}) for both permanent threshold shift (PTS) where unrecoverable hearing damage may occur and temporary threshold shift (TTS) where a temporary reduction in hearing sensitivity may occur in individual receptors. Table 3-3 and Table 3-4 summarise the NMFS (2018) criteria for onset of risk of PTS and TTS for each of the key marine mammal hearing groups for impulse and non-impulsive noise. These represent different sensitivities to noise when the source is impulsive or non-impulsive (i.e. more continuous in character). Both sets of criteria have been included, and the appropriate set should be used depending on the type of noise present: impact piling is considered impulsive, whereas drill piling, peckering and dredging are all effectively continuous (non-impulsive) noise sources. Where multiple sources are considered, the most onerous criteria (impulsive) should be used, although both sets have been included.

In the assessment of cumulative SEL values, both 'fleeing' and 'stationary' animal models have been used. It has been assumed that HF and MF cetaceans and PW pinnipeds will flee from the sound source at a speed of 1.5 ms^{-1} (Otani *et al.* (2000)) for the entire duration of the activity. LF cetaceans are assumed to flee from the sound source at 3.25 ms^{-1} (Blix and Folkow (1995)) for the entire duration of the activity. As the noise sources are close to land, the fleeing model predicts exposure based on the receptor fleeing in a straight line into open water.

Fish species are not assumed to flee. It is assumed that the receptor stays at the same position from a noise source for its entire duration without moving away, as a worst case.

Impulsive noise	PTS criteria		TTS criteria	
Hearing Group	SPL_{peak} (unweighted) dB re 1 µPa	SEL_{cum} (weighted) dB re 1 μPa^2s	SPL_{peak} (unweighted) dB re 1 µPa	SEL_{cum} (weighted) dB re 1 μPa^2s
LF Cetaceans	219	183	213	168
MF Cetaceans	230	185	224	170
HF Cetaceans	202	155	196	140
PW Pinnipeds	218	185	212	170

Table 3-3 Assessment criteria for marine mammals from NMFS (2018) for impulsive noise (impact piling)

Non-impulsive noise	PTS criteria	TTS criteria
Hearing Group	SEL_{cum} (weighted) dB re 1 μPa^2s	SEL_{cum} (weighted) dB re 1 μPa^2s
LF Cetaceans	199	179
MF Cetaceans	198	178
HF Cetaceans	173	153
PW Pinnipeds	201	181

Table 3-4 Assessment criteria for marine mammals from NMFS (2018) for non-impulsive noise (dredging, drill piling and peckering)

3.2.3 Weighted source levels

To undertake the modelling for the NMFS (2018) criteria with regards to the weighted criteria, the source levels at 1 metre were adjusted using the auditory weighting functions shown in

Weighting	Impact Piling single strike SEL source level	Peckering SEL source level	CSD SEL source level	TSHD SEL source level	Drill Piling SEL source level
Unweighted	185.1 dB re 1 μPa^2s	175.1 dB re 1 μPa^2s	178.7 dB re 1 μPa^2s	175.6 dB re 1 μPa^2s	163.6 dB re 1 μPa^2s
LF Cetaceans	184.3 dB re 1 μPa^2s	174.6 dB re 1 μPa^2s	169.4 dB re 1 μPa^2s	172.8 dB re 1 μPa^2s	153.0 dB re 1 μPa^2s
MF Cetaceans	156.5 dB re 1 μPa^2s	155.9 dB re 1 μPa^2s	137.8 dB re 1 μPa^2s	158.6 dB re 1 μPa^2s	118.9 dB re 1 μPa^2s
HF Cetaceans	154.4 dB re 1 μPa^2s	153.3 dB re 1 μPa^2s	135.3 dB re 1 μPa^2s	155.3 dB re 1 μPa^2s	114.9 dB re 1 μPa^2s
Phocid Pinnipeds	175.2 dB re 1 μPa^2s	168.4 dB re 1 μPa^2s	152.7 dB re 1 μPa^2s	168.1 dB re 1 μPa^2s	136.0 dB re 1 μPa^2s

Table 3-5Summary of NMFS (2018) weighted and unweighted source levels

Weighted Impact Piling source levels

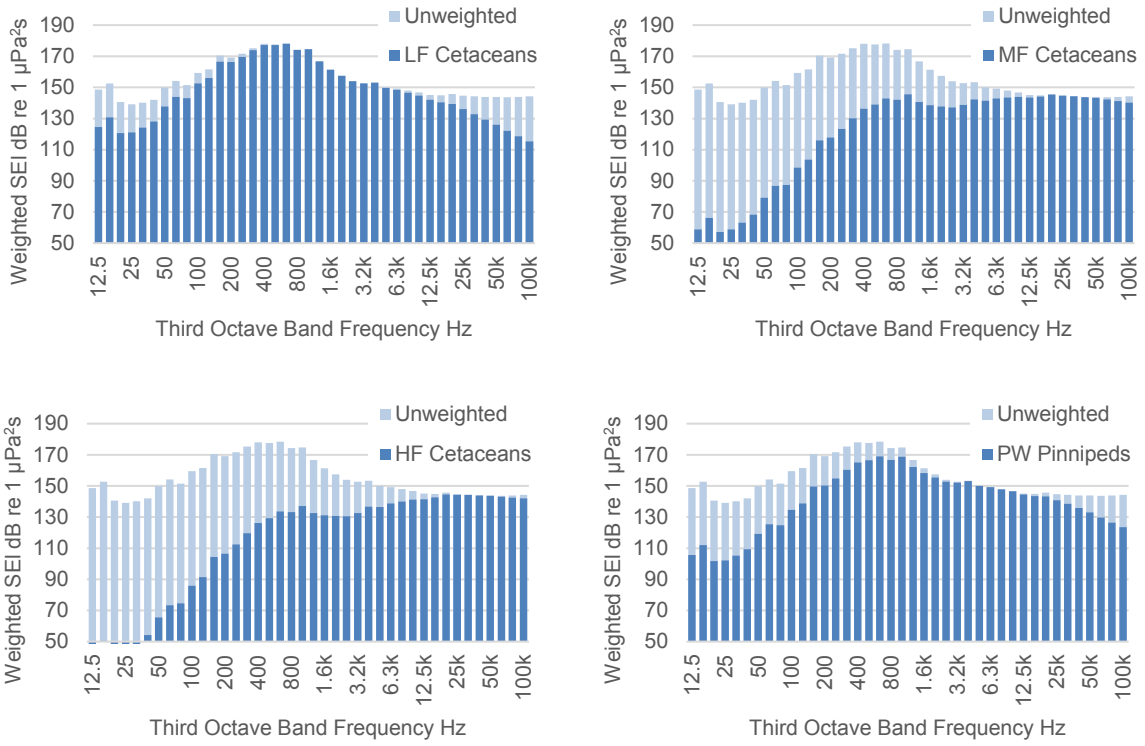

Figure 3-6 Unweighted and NMFS (2018) weighted source levels for Impact Piling

Weighted Peckering source levels

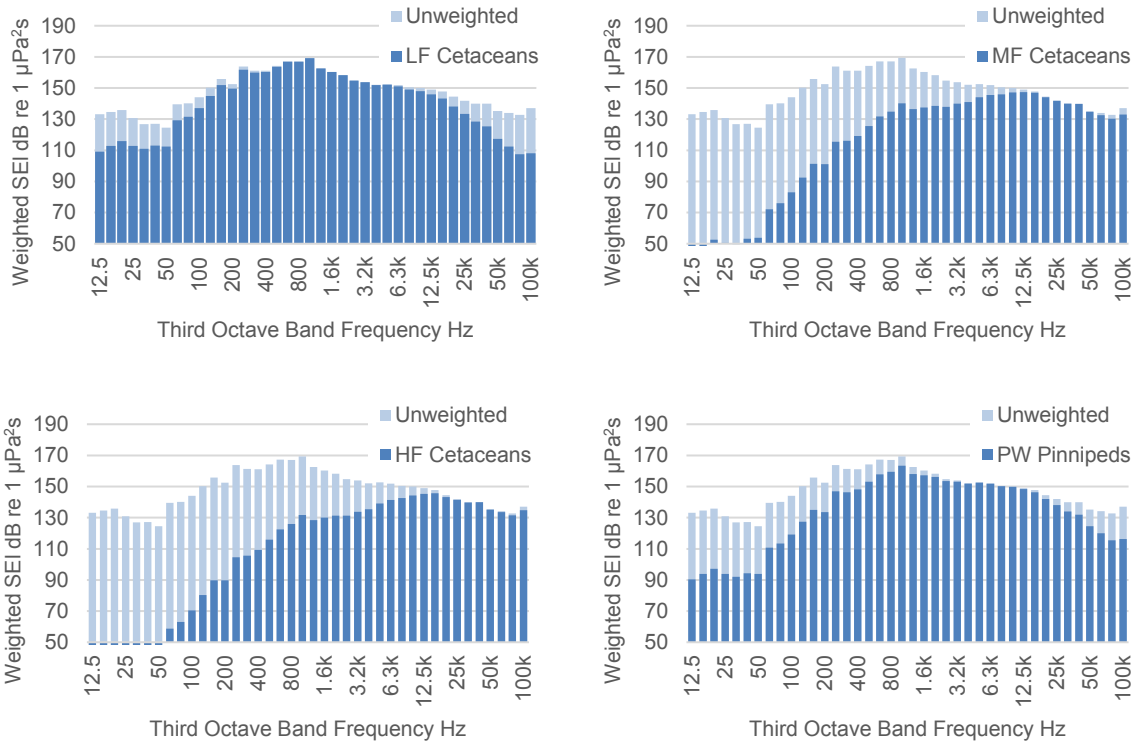

Figure 3-7 Unweighted and NMFS (2018) weighted source levels for Peckering

Weighted CSD source levels

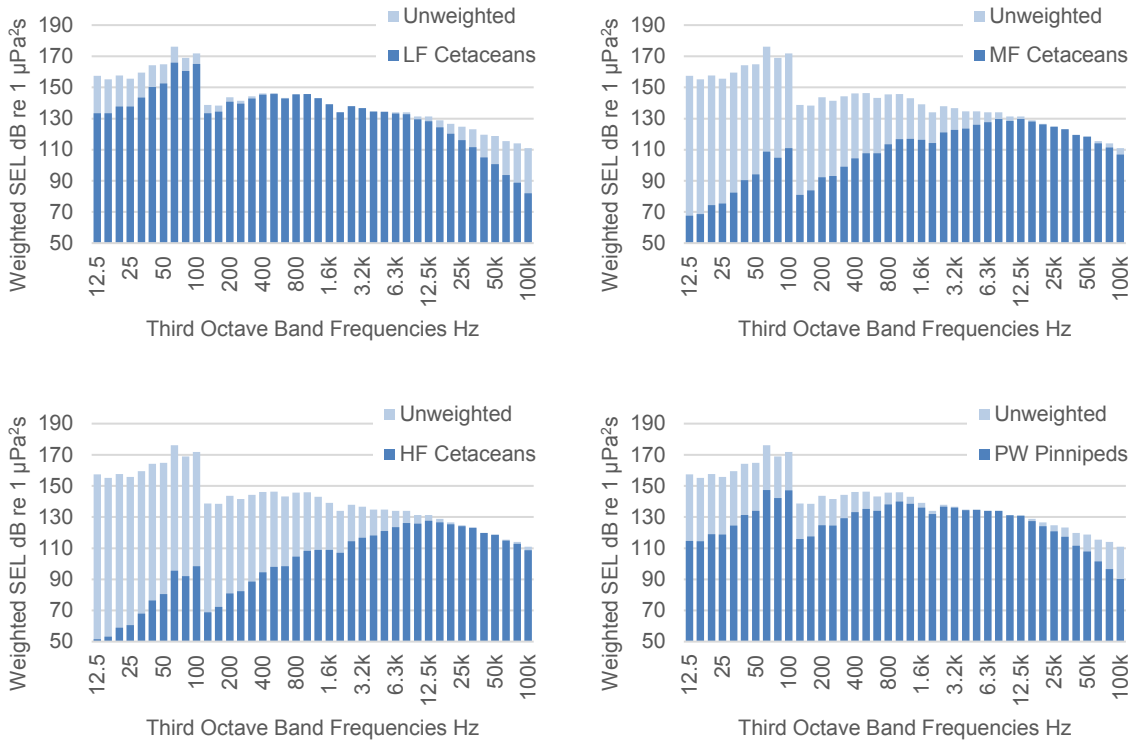

Figure 3-8 Unweighted and NMFS (2018) weighted source levels for CSD

Weighted TSHD source levels

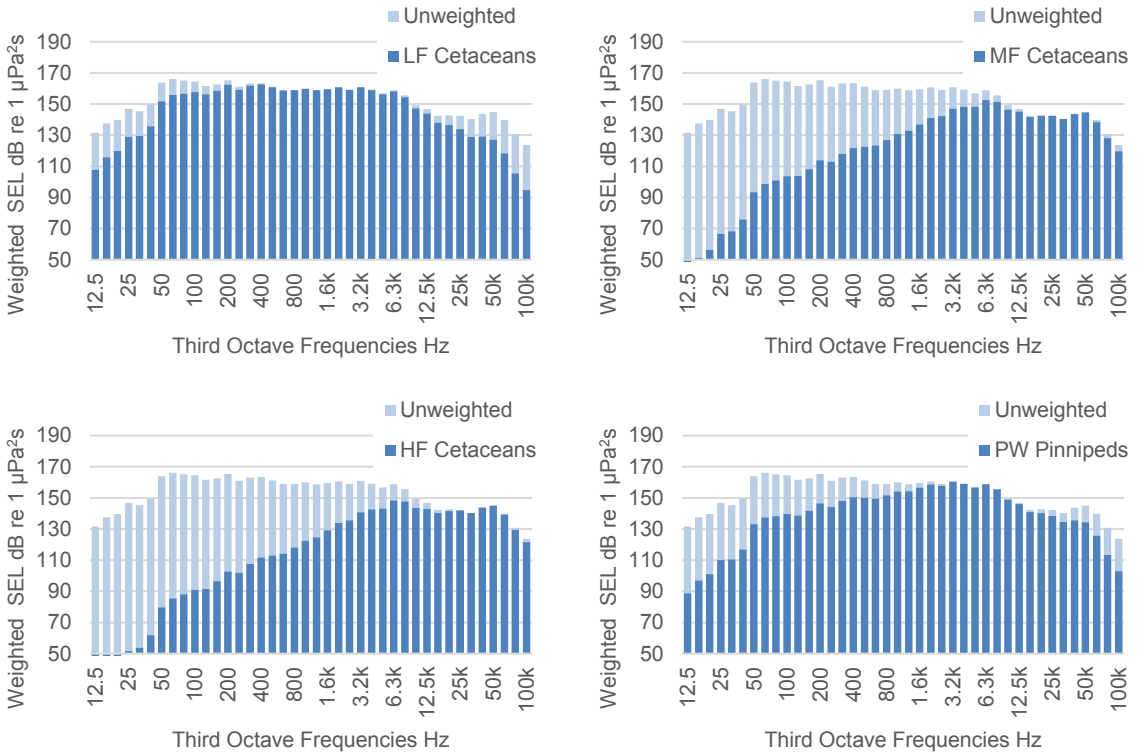

Figure 3-9 Unweighted and NMFS (2018) weighted source levels for TSHD

Weighted Drill Piling source levels

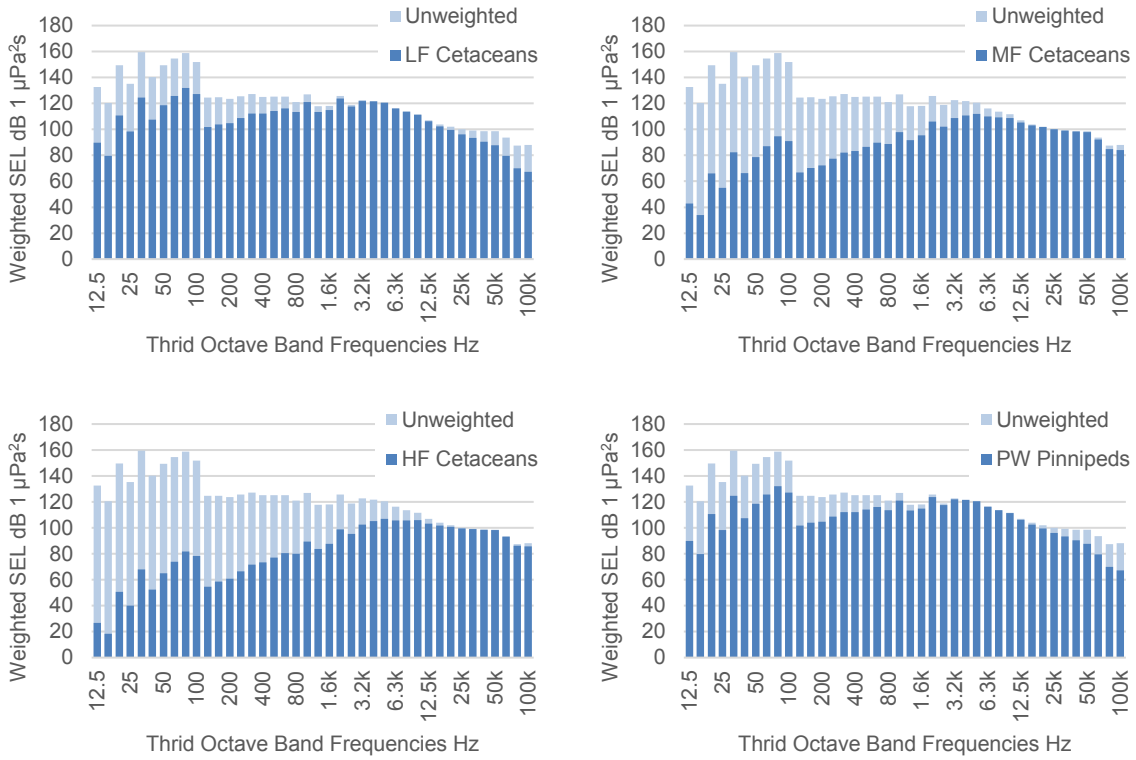

Figure 3-10 Unweighted and NMFS (2018) weighted source levels for Drill Piling

3.2.4 Fish

The effects of noise on fish have been assessed using criteria from Popper *et al*. (2014), which gives specific criteria for mortality and potential mortal injury, recoverable injury and TTS, masking and behaviour from various stimuli, including impact piling and continuous noises. Species of fish are grouped by whether or not they have a swim bladder and whether that swim bladder is involved in its hearing, as this affects its sensitivity to noise. The criteria are given as unweighted SPL_{peak}, RMS, and SEL_{cum} values and are summarised in Table 3-6 and Table 3-7.

Impact Piling	Mortality & potential mortal injury	Impairment	
Type of animal		Recoverable injury	TTS
Fish: no swim bladder	> 219 dB SEL_{cum} > 213 dB SPL_{peak}	> 216 dB SEL_{cum} > 213 dB SPL_{peak}	>> 186 dB SEL_{cum}
Fish: swim bladder not involved in hearing	210 dB SEL_{cum} > 207 dB SPL_{peak}	203 dB SEL_{cum} > 207 dB SPL_{peak}	> 186 dB SEL_{cum}
Fish: swim bladder involved in hearing	207 dB SEL_{cum} > 207 dB SPL_{peak}	203 dB SEL_{cum} > 207 dB SPL_{peak}	186 dB SEL_{cum}

Table 3-6 Assessment criteria for species of fish from Popper et al. (2014) for impact piling noise

Continuous noise	Mortality & potential mortal injury	Impairment	
Type of animal		Recoverable injury	TTS
Fish: no swim bladder	-	-	-
Fish: swim bladder not involved in hearing	-	-	-
Fish: swim bladder involved in hearing	-	170 dB RMS for 48 hours	158 dB RMS for 12 hours

Table 3-7 Assessment criteria for species of fish from Popper et al. (2014) for continuous noises

Where insufficient data is available (shown by a dash in the previous tables), qualitative criteria have been given, summarising the effect of the noise as having either a high, moderate or low effect on an individual in either the near-field (tens of metres), intermediate-field (hundreds of metres), or far-field (thousands of metres). This also includes information for masking and behavioural effect. These qualitative effects are reproduced in Table 3-8 to Table 3-9. In general, continuous-type noises are unlikely to reach levels at which there is a risk of injury to fish.

Impact Piling	Recoverable injury	TTS	Masking	Behaviour
Type of animal				
Fish: no swim bladder	-	-	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	-	-	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder involved in hearing	-	-	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate

Table 3-8 Summary of the qualitative effects on fish from impact piling noise from Popper et al. (2014) (N=Near-field, I=Intermediate-field, F=Far-field)

Continuous noise	Recoverable injury	TTS	Masking	Behaviour
Type of animal				
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involved in hearing	-	-	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Table 3-9 Summary of the qualitative effects on fish from continuous noises from Popper et al. (2014) (N=Near-field, I=Intermediate-field, F=Far-field)

4 Modelling results

4.1 Impact Piling

The SPL_{peak} noise level from impact piling using the parameters given in section 3.1 is presented in Figure 4-1. Piling was modelled in Area A. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7.

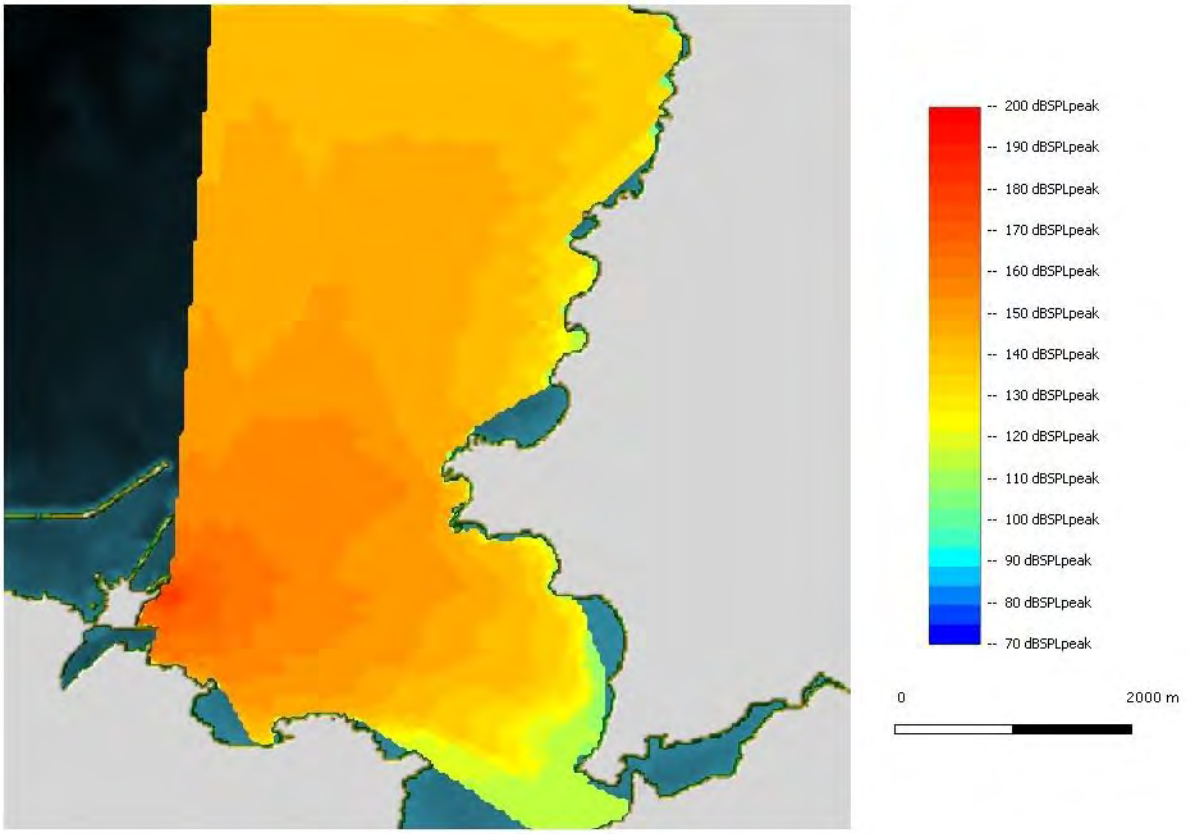

Figure 4-1 Underwater noise level distribution during impact piling, unweighted SPL_{peak}

4.2 Peckering

The SPL_{RMS} noise level from peckering is presented in Figure 4-2. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7.

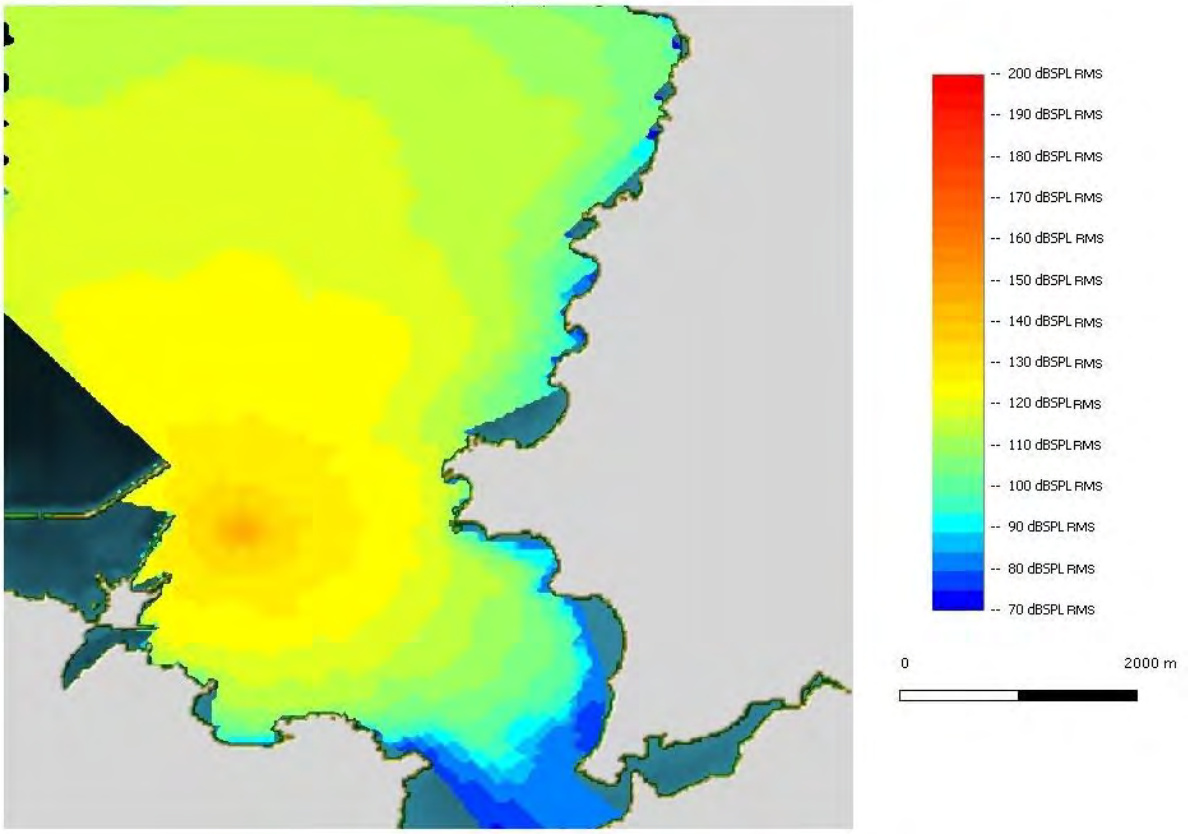

Figure 4-2 Underwater noise level distribution during peckering, unweighted SPL_{RMS}

4.3 Cutter Suction Dredging

The unweighted SPL_{RMS} noise level from the CSD is presented in Figure 4-3. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7.

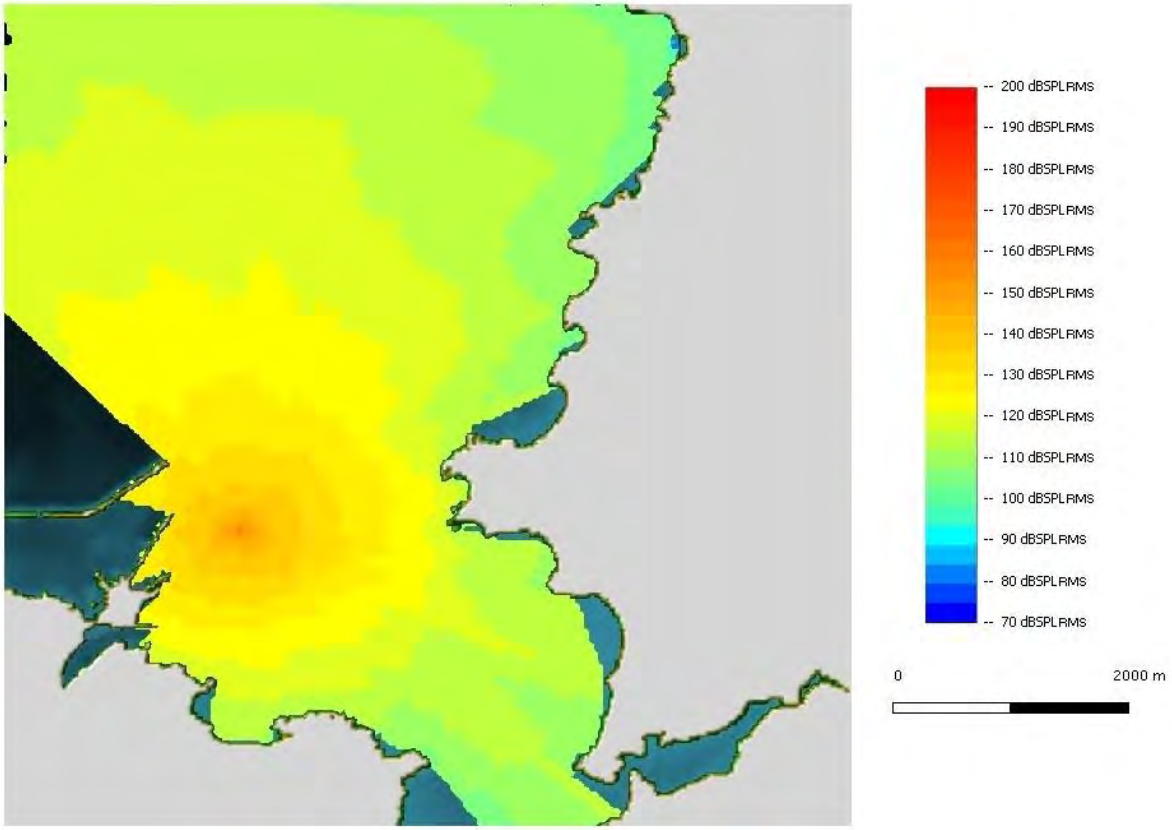

Figure 4-3 Underwater noise level distribution during Cutter Suction Dredger operation, unweighted SPL_{RMS}

4.4 Trailing Suction Hopper Dredging

The unweighted SPL_{RMS} noise level from the TSHD is presented in Figure 4-4. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7.

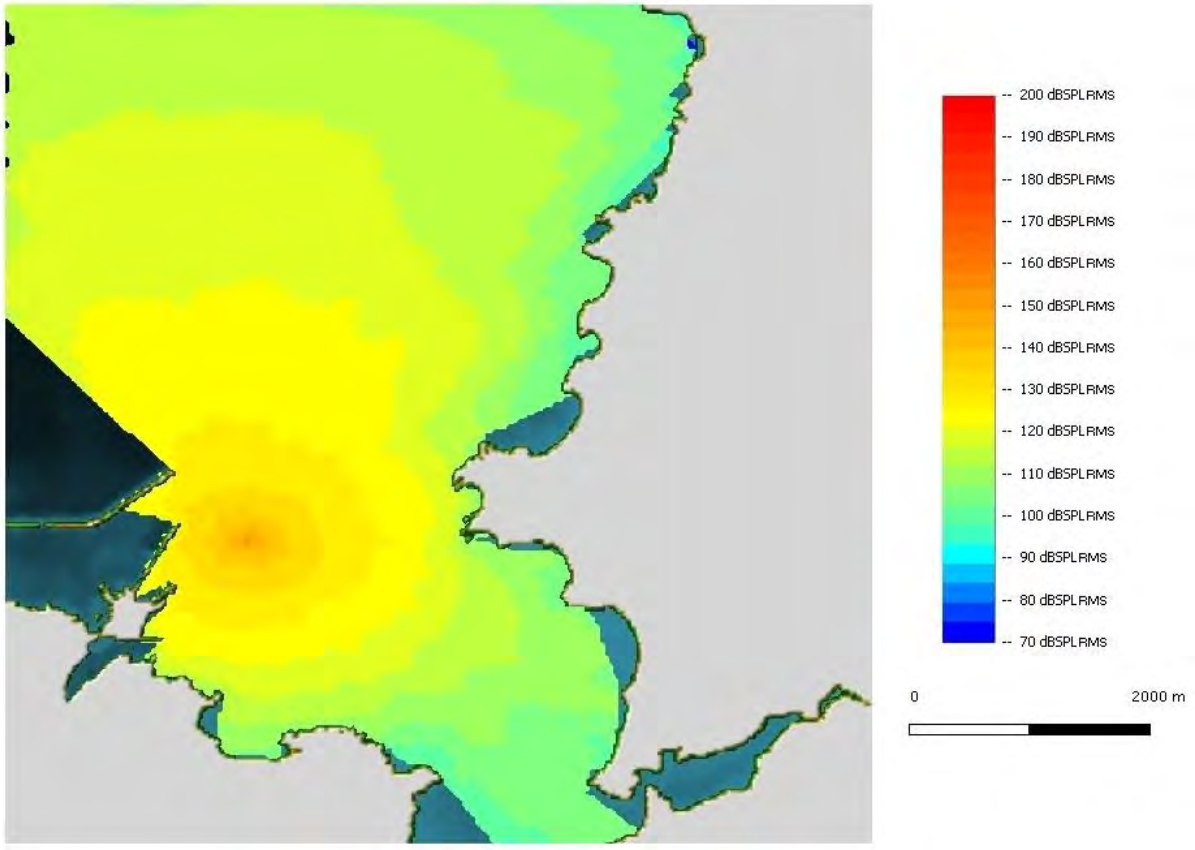

Figure 4-4 Underwater noise level distribution during Trailing Suction Hopper Dredger operation, unweighted SPL_{RMS}

4.5 Drill Piling

The unweighted SPL_{RMS} noise level form drill piling is presented in Figure 4-5. Drill piling was modelled in Area A. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7.

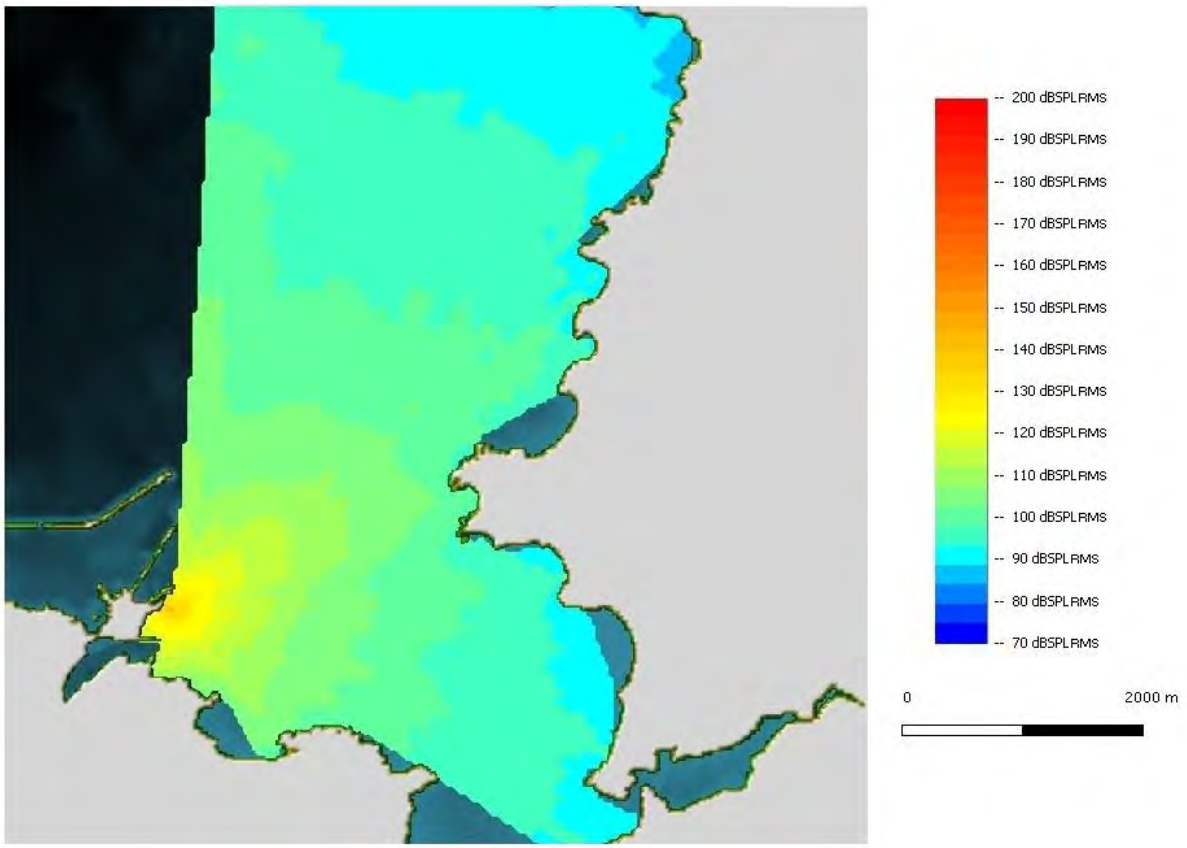

Figure 4-5 Underwater noise level distribution during drill piling, unweighted SPL_{RMS}

4.6 Multiple source scenario

The SPL_{peak} noise level from impact piling in two locations, in addition to drill piling and peckering, is presented in Figure 4-6. The modelling assumes that all four sources are operating simultaneously. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.2, with the ranges of impact given in the summary in section 4.7. Calculations of multiple pulse impacts consider the different operation period for each piece of equipment.

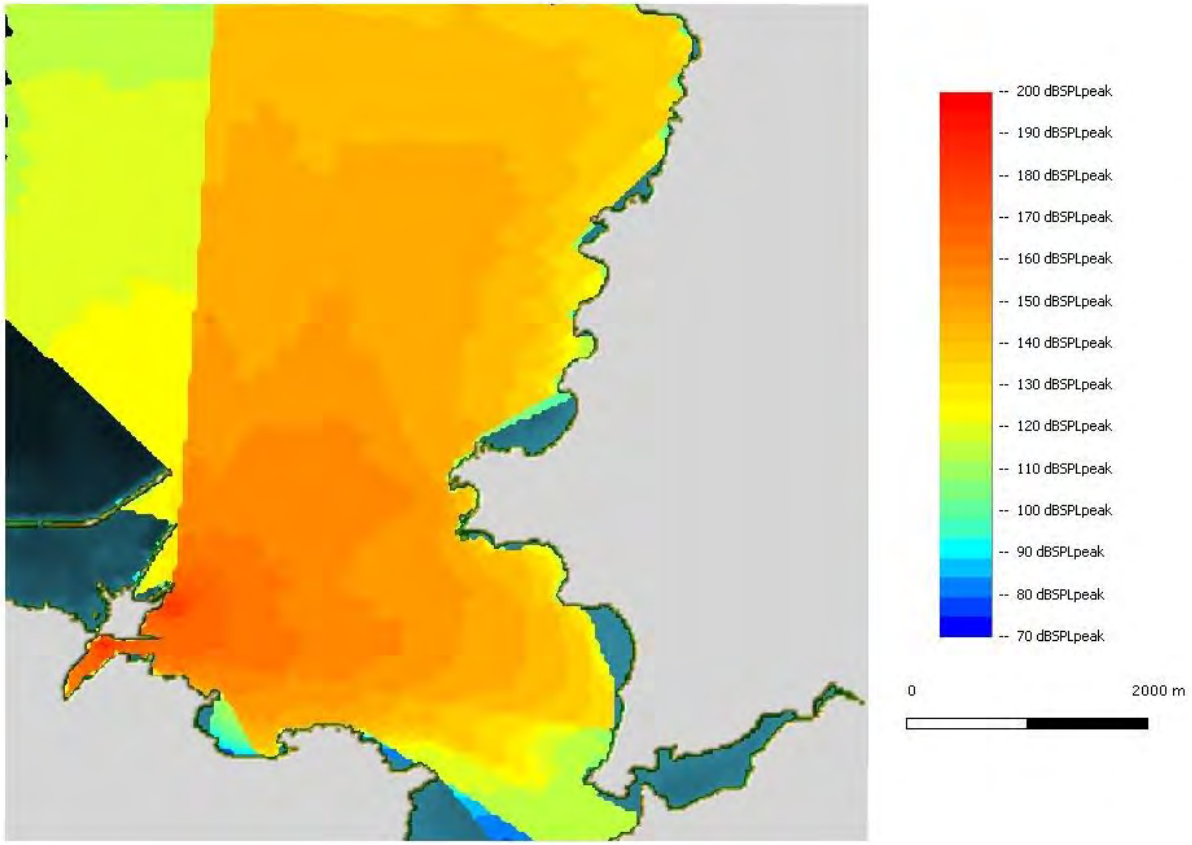

Figure 4-6 Underwater noise level distribution during the multiple source scenario: impact piling in two locations, drill piling and peckering, unweighted SPL_{peak}

4.7 Impact range summary

Table 4-1 to Table 4-4 present the SPL_{peak} and SEL_{cum} results for impulsive noise. The results to the non-impulsive criteria are given in Table 4-5 and Table 4-6. As discussed in section 3.2, the modelling results of SEL_{cum} NMFS (2018) criteria for marine mammals assume a fleeing receiver, results of SEL_{cum} Popper *et al.* (2014) criteria for fish assume a stationary receiver.

The results are based on the maximum predicted noise level in the water column. This approach is used as it is not possible to predict the depth of a receptor species at the time of a single noise event.

Impact ranges for the multiple source scenarios are based on the distance from the location of piling at Area A.

4.7.1 Impulsive noise injury criteria

Threshold	Criteria SPL_{peak} (unweighted)	Impact piling SPL_{peak} maximum range
LF Cetaceans PTS	219 dB re 1 µPa	< 10 m
MF Cetaceans PTS	230 dB re 1 µPa	< 10 m
HF Cetaceans PTS	202 dB re 1 µPa	< 10 m
PW Pinnipeds PTS	218 dB re 1 µPa	< 10 m
LF Cetaceans TTS	213 dB re 1 µPa	< 10 m
MF Cetaceans TTS	224 dB re 1 µPa	< 10 m
HF Cetaceans TTS	196 dB re 1 µPa	15 m
PW Pinnipeds TTS	212 dB re 1 µPa	< 10 m

Table 4-1 Maximum ranges to NMFS (2018) SPL_{peak} injury criteria for marine mammals

Threshold	Criteria SPL_{peak} (unweighted)	Impact piling SPL_{peak} maximum range
Fish (no swim bladder) injury	> 213 dB re 1 µPa	< 10 m
Fish (with swim bladder) injury	> 207 dB re 1 µPa	< 10 m

Table 4-2 Maximum ranges to Popper et al. (2014) SPL_{peak} injury criteria for species of fish

Threshold	Criteria SEL_{cum} (weighted)	Impact piling SEL_{cum} (3 hour) maximum range	Multiple source scenario SEL_{cum} (24 hour) maximum range
LF Cetaceans PTS	183 dB re 1 μPa^2s	< 10 m	< 10 m
MF Cetaceans PTS	185 dB re 1 μPa^2s	< 10 m	< 10 m
HF Cetaceans PTS	155 dB re 1 μPa^2s	40 m	30 m
PW Pinnipeds PTS	185 dB re 1 μPa^2s	< 10 m	< 10 m
LF Cetaceans TTS	168 dB re 1 μPa^2s	780 m	960 m
MF Cetaceans TTS	170 dB re 1 μPa^2s	< 10 m	< 10 m
HF Cetaceans TTS	140 dB re 1 μPa^2s	400 m	430 m
PW Pinnipeds TTS	170 dB re 1 μPa^2s	430 m	430 m

Table 4-3 Maximum ranges to NMFS (2018) weighted SEL_{cum} impulsive injury criteria for marine mammals

Threshold	Criteria SEL_{cum} (unweighted)	Impact piling SEL_{cum} (3 hour) maximum range	Multiple source scenario SEL_{cum} (24 hour) maximum range
Fish (no swim bladder) mortality and potential mortal injury	> 219 dB re 1 μPa^2s	< 10 m	< 10 m
Fish (no swim bladder) recoverable injury	> 216 dB re 1 μPa^2s	< 10 m	< 10 m
Fish (with swim bladder not involved in hearing) mortality and potential mortal injury	210 dB re 1 μPa^2s	20 m	20 m
Fish (with swim bladder involved in hearing) mortality and potential mortal injury	207 dB re 1 μPa^2s	40 m	40 m
Fish (with swim bladder) recoverable injury	203 dB re 1 μPa^2s	100 m	100 m
Fish TTS	186 dB re 1 μPa^2s	580 m	560 m

Table 4-4 Maximum ranges to Popper et al. (2014) unweighted SEL_{cum} impulsive injury criteria for species of fish

It is worth noting that the HF cetacean PTS impact range and the fish TTS impact range for multiple sources is slightly smaller than the impact range for piling alone. It is recognised that this must be erroneous, although the small difference means it is similar to a rounding error in the calculation and not significant. It may be caused in the model by interference between noise from the two piling sources. However, it is recommended that the greater of the predicted ranges are considered in the assessment.

4.7.2 Non-impulsive noise injury criteria

Threshold	Criteria SEL_{cum} (weighted)	CSD SEL_{cum} (24 hour) maximum range	TSHD SEL_{cum} (24 hour) maximum range	Drill Piling SEL_{cum} (10.5 hour) maximum range	Peckering SEL_{cum} (24 hour) maximum range	Multiple source scenario SEL_{cum} (24 hour) maximum range
LF Cetaceans PTS	199 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m
MF Cetaceans PTS	198 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m
HF Cetaceans PTS	173 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m
PW Pinnipeds PTS	201 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m
LF Cetaceans TTS	179 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	30 m
MF Cetaceans TTS	178 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m
HF Cetaceans TTS	153 dB re 1 μPa^2s	< 10 m	360 m	< 10 m	150 m	150 m
PW Pinnipeds TTS	181 dB re 1 μPa^2s	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m

Table 4-5 Maximum ranges to NMFS (2018) weighted SEL_{cum} non-impulsive injury criteria for marine mammals

Threshold	Criteria SPL_{RMS} (un-weighted)	CSD SPL_{RMS} maximum range	TSHD SPL_{RMS} maximum range	Drill Piling SPL_{RMS} maximum range	Peckering SPL_{RMS} maximum range	Multiple source scenario SPL_{RMS} maximum range
Fish (no swim bladder) injury	158 dB re 1 µPa (for 12 hours)	38 m	32 m	< 10 m	24 m	24 m
Fish (with swim bladder) injury	170 dB re 1 µPa (for 48 hours)	< 10 m	< 10 m	< 10 m	< 10 m	< 10 m

Table 4-6 Maximum ranges to Popper et al. (2014) unweighted SEL_{cum} non-impulsive injury criteria for species of fish assuming a stationary animal

5 Summary and conclusions

Subacoustech Environmental has undertaken a study of the impacts of underwater noise propagation for HaskoningDHV for works at Holyhead Harbour, which include impact piling, peckering, cutter suction dredging (CSD), trailing suction hopper dredging (TSHD) and drill piling. This includes the effects on marine mammals and fish.

The level of underwater noise from the proposed sources of construction activity at range has been estimated using a parabolic equation (PE) modelling method for lower frequencies and a ray tracing modelling solution at higher frequencies. The modelling considers a wide variety of input parameters specific to the situation, including source noise levels, frequency content, duty cycle, seabed properties and the sound speed profile in the water column. Full account is taken of the complex bathymetry in the area.

Modelling locations and operation parameters for each of the noise sources and the model set-up were chosen to give worst case impact ranges.

Noise levels have been assessed in terms of criteria provided by NMFS (2018) for marine mammals and Popper *et al*. (2014) for fish, using the relevant SPL_{peak}, SPL_{RMS} and SEL metrics. In the case of the NMFS (2018) criteria, the ⅓ octave band frequency spectrum of the source noise level has been adjusted according to the LF, MF, HF and PW frequency weightings stipulated in the guidelines.

The results show that impact piling over a three hour period will have the greatest impact of all the individual noise sources considered. A combination of two impact piling sources along with peckering and drill piling all occurring simultaneously will have little effect on the modelled impact ranges.

The largest impact range was calculated to be for LF Cetacean TTS during the multiple source scenario, where the criteria was exceeded at 960 m. This range is based on the receptor being at this distance from the activity at its commencement, then swimming away from the noise source towards open water.

The greatest impact range in respect of PTS onset was to HF cetaceans and was estimated to be 40 m. This is based on the same assumptions as the TTS modelling above. All other species groups would need to be much closer to the impact piling, drill piling, dredging and peckering to reach PTS onset.

In respect of fish species, the greatest impact range for TTS onset is modelled at 580 m during impact piling. This is for the most sensitive fish species group identified by Popper *et al*. (2014): fish with a swim bladder involved in hearing, and assumes that the fish do not swim away. There is a risk of recoverable injury to this most sensitive fish species group within approximately 100 m of the piling.

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P238R0301	-	27/02/2019	Issue to client
P238R0302	-	08/03/2019	Re-issue including fleeing animal SEL_{cum}

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G3	Archaeological Assessment of Extended Geophysical Survey
G4	Stage 2 Geoarchaeology Report (Vibrocores)
G5	Stage 1 Geoarchaeology Report (Boreholes)

G1 – Archaeological DBA

REPORT

Holyhead Port Expansion

Appendix G1 - Archaeological Desk Based Assessment

Client: Stena Line Ports Ltd.

Reference: I&BPB6108R007D0.1
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Date: 26/03/2019

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Executive Summary

Stena Line is proposing to expand Holyhead Port through the reclamation of two areas to provide new berths and associated landside areas for port-related use and to develop a new approach channel to 10m below Chart Datum (bCD).

This Archaeological Desk Based Assessment has been prepared to provide archaeological / historical baseline data to inform the Archaeology and Cultural Heritage chapter of the Environmental Statement, in support of the required consent applications. For the purposes of this Archaeological Desk Based Assessment, a Study Area was established comprising the proposed scheme footprint (encompassing both the approach channel and the two reclamation areas) plus a 1km buffer. This Archaeological Desk Based Assessment is regarded as a 'point in time' document and assessed the proposed scheme footprint based on that illustrated in Figure 1.2 of the Assessment Written Scheme of Investigation (Royal HaskoningDHV, 2018). Any updates to the proposed scheme footprint will be reflected and assessed within the Environmental Statement.

Data were acquired from a variety of sources, including the UK Hydrographic Office (via emapsite.com), Cadw, the Royal Commission on the Ancient and Historical Monuments of Wales (the National Monuments Record of Wales) and the Gwynedd Archaeological Trust - the Historic Environment Record PRN 666. A total 48 designated heritage assets were recorded within the Study Area, comprising one Scheduled Monument, 45 Listed Buildings and two Conservation Areas. A further 181 non-designated heritage assets were also identified within the Study Area, alongside an additional 20 recorded wrecks and obstructions within the marine and inter-tidal extent of the Study Area (comprising 18 charted wreck sites and two charted obstructions). The heritage importance of the known and potential heritage assets identified within the Study Area has been assessed as variable and ranges between low to high based on available data. Where uncertainty occurs, the precautionary approach is to assign high importance. This precautionary approach represents good practice in archaeological impact assessment and reduces the potential for impacts to be under-estimated.

A high-level assessment of the potential impacts of the proposed scheme upon heritage assets and their setting has identified a potential for both direct and indirect impacts to occur upon the archaeological and cultural heritage resource as a result of the proposed works. Direct (physical) impacts may occur as a result of intrusive groundworks associated with the proposed scheme. Indirect impacts may occur to marine heritage assets as a result of changes to the hydrodynamic and sedimentary regimes arising as a result of the proposed scheme. Indirect non-physical impacts also have the potential to occur upon the setting of designated and non-designated heritage assets, whether visually, or in the form of noise, dust and vibration, spatial associations and a consideration of historic relationships between places.

This document includes an initial heritage settings assessment, addressing Steps 1 and 2 of Cadw's *Setting of Historic Assets in Wales* (Cadw, 2017). In order to do so, as part of this assessment a two stage-filtering process has been applied to identify a selection of designated and non-designated heritage assets that warrant further consideration with respect to their setting within the Environmental Statement (thereby addressing Steps 3 and 4 of Cadw's guidance).

The potential for both direct and indirect impacts to occur as a result of the proposed scheme upon the archaeological and cultural heritage resource are further explored as part of the Environmental Statement, which includes an assessment of impact significance and explores the application of mitigation measures to be implemented to reduce, offset or remedy and potentially significant impacts from occurring in a manner that is considered to be appropriate and proportionate to the importance of the identified remains present and the scale of potential impacts.

1 Introduction

1.1 Background

Royal HaskoningDHV (RHDHV) was commissioned by Stena Line Ports Ltd. (henceforth referred to as Stena Line) to prepare an Archaeological Desk Based Assessment (ADBA) to inform an Environmental Statement (ES) for the proposed expansion of Holyhead Port as part of the Environmental Impact Assessment (EIA) process.

This ADBA should be regarded as a 'point-in-time' document based on an earlier iteration of the scheme footprint than that which is being assessed within the ES. The proposed scheme footprint assessed within this ADBA has been based on that illustrated in Figure 1.2 of the WSI (Royal HaskoningDHV, 2018). The footprint brought forward for assessment within the ES, and the study areas surround it, have since been refined.

Holyhead Port is located on Holy Island (Ynys Gybi) on the western side of the Isle of Anglesey (see **Figure 1.1**). The Port is a private port owned by Stena Line and forms the principal link for surface transport from north Wales and central and northern England to Ireland. Holyhead Port is the second busiest Ro-Ro ferry port in the UK although the Port is currently operating near full capacity and, surrounded by Holyhead Town, there is no space available in which the Port can expand to meet current and future demand of its operations. The Port also supports a flourishing cruise industry, with ships currently docking at the Orthios jetty which in the near future is anticipated to be required for ships supporting a proposed biomass project. As such, a new deep-water cruise berth is required. Stena Line is therefore proposing to expand the Port through the reclamation of two areas to provide new berths and associated landside areas for port-related use (see **Figure 1.1**).

1.2 Overview of the Proposed Scheme

The proposed scheme comprises the reclamation of two intertidal / subtidal areas (the Salt Island Expansion site and the Pelham Patch Development site) and the dredging of an approach channel (**Figure 1.1**). A total of 9 hectares of new quay storage and handling space will be created together with a 370m long deep-water berth and a 280m long berth. Further details outlining the proposed scheme can be found in **Section 2**.

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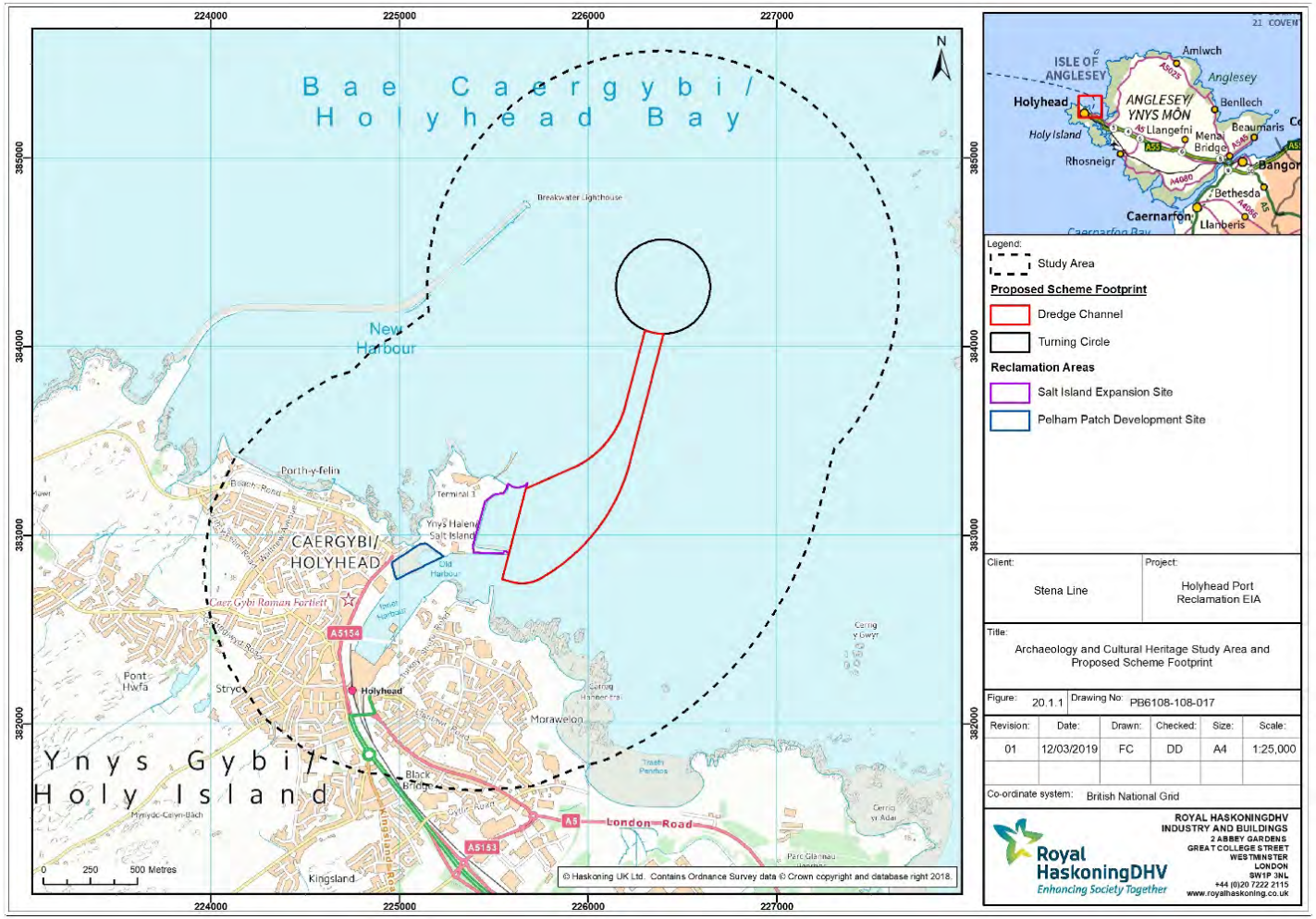

Figure 1.1 Archaeological and Cultural Heritage Study Area and Proposed Scheme Footprint

1.3 Purpose of this Document

This ADBA has been prepared in accordance with a scheme-specific Written Scheme of Investigation (WSI) which was prepared to set out the scope for the assessment of archaeology and the historic environment as part of the ES (Royal HaskoningDHV, 2018). The WSI incorporated details of the baseline assessment methodology, including settings assessment, the acquisition and assessment of baseline survey data and the impact assessment methodology. The methodologies presented therein have been applied during the compilation of this ADBA.

This ADBA represents the key source of information for the Archaeology and Cultural Heritage ES chapter and outlines, as far as is possible from existing information, the nature, extent and significance of the historic environment baseline within the proposed scheme footprint (the site) and its immediate surroundings. It also provides a high-level assessment of the potential impacts of the proposed scheme upon the historic environment. This ADBA has been prepared in a manner that is consistent with the Chartered Institute for Archaeologists' (CIfA) Standards and guidance for historic environment desk-based assessment and Code of Conduct (CIfA, 2014a and 2014b).

The specific aims of this ADBA are:

- To identify and describe the known and potential heritage assets within the site based on a review of existing information in order to provide an archaeological and historical baseline context within a defined Study Area (see **Section 3.1.1** below);
- To assess the significance (heritage importance) of the known and potential heritage assets and to provide a consideration of the contribution that setting has on the significance of each asset; and
- To identify the potential impacts of the proposed scheme upon heritage assets and their setting as part of a high-level assessment.

The information outlined in this document informs the ES, where it is considered alongside the archaeological assessment of geophysical and geotechnical survey data undertaken for the proposed scheme.

2 The Proposed Scheme

2.1 Salt Island Expansion

The expansion of Salt Island is proposed to serve as a new multi-purpose use area, including intermodal freight, Ro-Ro and Lo-Lo freight traffic, heavy and abnormal loads, as well as a new berth for cruise ships. This area would comprise:

- The reclamation of an area extending from the north- and south-east corners of Salt Island, forming approximately 65,750m^2 of new port land and requiring approximately 720,000m^3 of fill material. Fill material would comprise approximately 520,000m^3 of the dredged arisings from the proposed approach channel and 200,000m^3 would be imported;
- A 370m long berth, referred to as the Main Quay Wall;
- A 30m wall around the Lighthouse on Admiralty Pier, referred to as the Lighthouse Wall;
- A 100m wall that forms the northern extent of the reclaimed area, referred to as the North Wall;

- A 90m long wall extending from the north-eastern extent of the reclaimed area to shelter vessels at berth, referred to as the North Wave Wall;
- A reinforced concrete heavy lift pad; and
- Two hi-bay workshops, each with an associated office building.

2.2 Pelham Patch Development

The development of Pelham Patch is proposed to serve as a new multi-purpose berth and set-down area, as well as a potential security and customs facility. This area would comprise:

- The reclamation of an area between Marine Yard and Salt Island, forming approximately 24,250m^2 of new port land and requiring approximately 163,500m^3 of fill material. Fill material would comprise approximately 120,000m^3 of the dredged arisings from the proposed approach channel and 43,500m^3 would be imported;
- The construction of a 280m quay wall;
- Blocking up the culvert running under Salt Island Bridge;
- Re-alignment of the service road, which links Salt Island to Holy Island, away from residential and commercial properties; and,
- Replacement of the existing perimeter fencing with a more open design to reduce the enclosed character of the area and improve views across the Old Harbour.

2.3 Capital Dredge

The current bed levels within the dredge area range from approximately 3m bCD at the southern extent, to 10m bCD at the mouth of the proposed approach channel. The proposed approach channel would be dredged to a target depth of 10m bCD to provide sufficient water depth for deep-water vessels to access the new Salt Island berth. No dredging is required to provide access to the new berth at the Pelham Patch site as the current water depth (5.5m bCD) is sufficient for the shallower draft vessels that would use this berth; however, a small amount of dredging would be required in front of the proposed quay wall to reach the target depth of 5m bCD.

The capital dredge would remove approximately 1,900,000m^3 of material, the majority of which would arise from the development of the approach channel and a smaller amount from the reclamation areas. In addition, there is a need to import approximately 243,500m^3 of material to be used in the reclamation works. This material would be delivered to site by either by sea, in barges, or by road to Terminal 2 where the temporary site compound will be set up.

2.4 Potential Impacts upon Archaeology and Cultural Heritage

2.4.1 Direct impacts

Direct (physical) impacts may occur as a result of intrusive groundworks, and as such, would only occur during construction. No groundworks are anticipated to be required during the operational phase. Any activities involving intrusive groundworks could result in damage to, or total destruction of, archaeological material (if/where surviving) or the relationships between that material and the wider environment (stratigraphic context or setting). These relationships are often crucial to developing a full understanding of an asset.

The extent of any direct impact will depend on the presence, nature and depth of any such remains, in association with the depth of construction-related groundworks, as well as the specific elements, aspects or area of the asset subject to impact. The potential for direct impacts to occur upon the archaeological and cultural heritage resource are further explored as part of the ES.

2.4.2 Indirect impacts

Indirect impacts to marine heritage assets may occur as a result of changes to the hydrodynamic and sedimentary regimes arising as a result of the proposed scheme. Buried heritage assets that become exposed to marine processes, due to increased wave/tidal action for example, will deteriorate faster than those protected by sediment cover. Conversely, if increased sedimentation results in an exposed site becoming buried this may be considered a beneficial impact.

Indirect non-physical impacts also have the potential to occur upon the setting of designated and non-designated heritage assets, whether visually (e.g. as a result of the new port land and new quay walls), or in the form of noise, dust and vibration, spatial associations and a consideration of historic relationships between places. Indirect (non-physical) impacts upon the setting of heritage assets may therefore occur during the construction phase (albeit of a temporary and short-term nature) or during the operational phase due to the presence of the new multi-purpose port area and berthing facilities afforded by the development. The potential for indirect impacts to occur upon the archaeological and cultural heritage resource are further explored as part of the ES.

3 Methodology

3.1 Desk Based Assessment

3.1.1 Study area

Existing records of known heritage assets have been sought from a Study Area comprising the proposed scheme footprint[1] (encompassing both the dredge channel and the two reclamation areas) plus a 1km buffer (**Figure 1.1**). This area is considered sufficient to encapsulate heritage assets that may subject to impact, either directly (physically) or indirectly (non-physically), as a result of the proposed scheme.

3.1.2 Sources

The following sources were consulted to inform this ADBA:

- Data from the UK Hydrographic Office (UKHO) through emapsite.com regarding offshore sites (wrecks and obstructions);
- Data from Cadw[2] (the Welsh Government's Historic Environment Service) regarding Welsh designated sites: including World Heritage Sites (WHS), Scheduled Monuments (SMs), Listed Buildings (LB), Parks and Gardens (PG), Conservation Areas and Historic Landscape Areas;
- Data from the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) – the National Monuments Record of Wales (NMRW)[3] regarding onshore and offshore sites;

[1] The proposed scheme footprint assessed within this ADBA was based on that illustrated in Figure 1.2 of the WSI (Royal HaskoningDHV, 2018). The footprint brought forward for assessment within the ES has since been refined.
[2] Designated Historic Asset, The Welsh Historic Environment Service (Cadw), 20/07/18, licensed under the Open Government Licence http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/
[3] © Crown copyright: Royal Commission on the Ancient and Historical Monuments of Wales

- Data from Gwynedd Archaeological Trust (GAT) – the Historic Environment Record (HER) PRN 666;
- Data from the Natural Resources Wales (NRW) regarding data for Heritage Coasts, National Parks, Sites of Specific Interest (SSSI), Areas of Outstanding Natural Beauty (AONB) and LANDMAP;
- Documentary and internet sources including:
    - Regional, Local and Period Archaeological Studies and Journals;
    - Geological, palaeoenvironmental and historical literature relating to the development and land-use of the Study Area;
    - The Archaeology Data Service (ADS);
    - A Research Framework for the Archaeology of Wales (first published in 2008 – present: on-going); and
    - Previous archaeological studies in the area.
- Historic maps.

Sources with spatial data have been incorporated into a project geographic information system (GIS) so that they can be spatially analysed. The data have been grouped (to eliminate duplicate records), assigned an individual RHDHV ID number, where relevant for assessment, and compiled into project specific gazetteers (**Annex 1**).

3.2 Chronology

Archaeological material is generally studied within a framework of 'periods' or 'ages' that reflect the activities and cultural changes taking place over time. Dates are referred to as BC (before Christ), BP (before present) or AD (*Anno domini*) within the text. BP dates are used for periods of time older than *circa* 10,000 years ago whereas BC and AD refer to calibrated radiocarbon chronologies that can be considered equivalent to calendar years.

The known archaeological periods are broadly defined by the following date ranges:

- Palaeolithic: *c.* 960,000 BP – 8,500 BC
- Mesolithic: 8,500 – 4,000 BC
- Neolithic: 4,000 – 2,200 BC
- Bronze Age: 2,200 – 700 BC
- Iron Age: 700 BC – AD 43
- Romano-British: AD 43 – 410
- Early medieval (Saxon): AD 410 – 1066
- Medieval: AD 1066 – 1499
- Post-medieval: AD 1500 – 1799
- 19th Century: AD 1800 – 1899
- Modern: AD 1900 – present day

3.3 Heritage Settings Assessment Methodology

The heritage settings assessment has been undertaken in line with Cadw's *Setting of Historic Assets in Wales* (Cadw, 2017), which defines the setting of a historic asset as "*the surroundings in which it is understood, experienced and appreciated, embracing present and past relationships to the surrounding landscape*" (Cadw, 2017: 2). The setting of a historic asset can include physical elements of its surrounding, such as boundary walls, adjacent fields or functional and physical relationships with other historical assets or natural features. It can also include less tangible remains, such as function, sensory perceptions or historical, artistic, literary and scenic associations. Although views to and from a site are the most obvious factor relating to sensory perceptions, other sensory elements can also affect setting, such as noise, vibrations and smells. The importance of the setting of a heritage asset lies in what it contributes to the significance of a heritage asset.

The Cadw guidance recommends a stepped approach for assessing the implications of project proposals, as follows:

- Step 1: Identify the historic assets that might be affected by a proposed change or development;
- Step 2: Define and analyse the settings to understand how they contribute to the significance of the historic assets and, in particular, the ways in which the assets are understood, appreciated and experienced;
- Step 3: Evaluate the potential impact of a proposed change or development on that significance; and
- Step 4: If necessary, consider options to mitigate or improve the potential impact of a proposed change or development on that significance.

The heritage settings assessment as presented in this ADBA is intended to address Steps 1 and 2. This study seeks to identify areas and heritage assets which are considered likely to be sensitive to the proposed scheme with respect to their setting, so that they can be taken through for further assessment as part of the ES

The heritage settings assessment as presented in this ADBA initially focuses on the main, most highly designated, heritage assets within the Study Area. Select and applicable non-designated heritage assets have also been considered, although they have not generally been described in the same level of detail as other more highly designated assets. Heritage assets whose setting may be affected by the proposed scheme have been identified, mapped and, where warranted, subject to 'heritage-specific' site visits (see **Section 3.4** and **Section 6**) in order to establish a sufficiently early understanding of the designated and non-designated heritage assets which may be subject to impact and to enable any potential setting impacts of the proposed scheme to be adequately assessed in the Archaeology and Cultural Heritage Chapter of the ES (Steps 3 and 4).

3.4 Heritage Site Visit

A 'heritage specific' site visit was undertaken on the 14th and 15th November 2018 as part of the production of this ADBA in order to inform the assessment of the potential for indirect impacts to occur upon the setting of heritage assets within the wider vicinity of the proposed scheme. Those heritage assets targeted during the site visit were based on heritage assets / areas identified as warranting additional consideration during the ADBA (and to be progressed as part of the ES) on the basis that they are particularly sensitive, and / or have been identified as having heritage setting considerations and implications.

During the site visit identified features were photographed and plotted using a handheld tablet device, enabling observations to be recorded and spatial data to be captured. Site visit data were uploaded and assessed alongside the remaining source material (see **Section 6**). Selected photos from the site visit can be found in this report (see **Section 6**).

During the site visits, consideration was also given to identifying previously unrecorded heritage assets that may be subject to impact as a result of the proposed scheme. No additional heritage assets other than those already recorded by the various inventories were identified.

3.5 Impact Assessment Methodology

The assessment of the significance of any identified impact is largely a product of the heritage significance (importance) of an asset and the perceived magnitude of the effect on it, assessed and qualified by professional judgement.

An assessment of effects on an asset involves an understanding of the heritage significance of the asset and in the case of an effect on the setting of that asset, the contribution that the setting makes to the heritage importance (or heritage significance) of the asset. Policy sets out that the amount of information and analysis required should be proportionate to the potential impact that the proposal has on the significance of the archaeological remains and sufficient to determine the extent of this impact (The Planning Policy Wales, paragraph 6.5.6).

The initial indicative criteria for determining the heritage importance of any relevant heritage assets are described in **Table 3.1**.

The categories and definitions of heritage significance do not necessarily reflect a definitive level of importance of an asset. They are intended to provide a provisional guide to the assessment of perceived heritage importance, which is to be based upon professional judgement incorporating the evidential, archaeological, historical, aesthetic, architectural and communal heritage values of the asset or assets.

Establishing heritage importance (or likely heritage importance) of an asset or group of assets, and the related impact significance by considering the perceived magnitude of effect on the asset or assets, assists in the development of appropriate evaluation and mitigation approaches. It is important to note that the heritage significance of an asset can be amended or revised as more information comes to light.

Where uncertainty occurs, the precautionary approach is to assign high importance. This precautionary approach represents good practice in archaeological impact assessment and reduces the potential for impacts to be under-estimated.

Table 3.1 Indicative criteria for determining heritage importance

Heritage Significance (importance)	Definitions / Example Assets
Very High (perceived International Importance)	• Assets of acknowledged international importance (e.g. World Heritage Sites) • Assets of acknowledged international importance • Assets that can contribute significantly to acknowledged international research objectives
High (perceived National Importance)	• Assets of acknowledged national importance (e.g. Scheduled Monuments, Protected Wreck Sites and undesignated assets of the quality and importance to be designated under national and international legislation) • Conservation areas containing buildings with a high heritage importance • Assets of acknowledged national importance

Heritage Significance (importance)	Definitions / Example Assets
	• Assets that can contribute significantly to acknowledged national research objectives
Medium (perceived Regional Importance)	• Locally Listed buildings or structures • Designated special historic landscapes • Assets that contribute to regional research objectives • Assets with regional value, educational interest or cultural appreciation
Low (perceived Local Importance)	• Assets that contribute to local research objectives • Assets with local value, educational interest or cultural appreciation • Assets that may be heavily compromised by poor preservation and/or poor contextual associations
Very Low (Negligible)	• Assets with no significant value or archaeological / historical interest
Uncertain (unknown)	• The importance / existence / level of survival of the asset has not been ascertained (or fully ascertained/understood) from available evidence

It is important that there is a narrative behind the assessment for example as a modifier (qualifier) for the heritage significance assigned to an asset.

Although an objective of this ADBA is to identify the potential impacts of the proposed scheme upon heritage assets and their setting as part of a high-level assessment (see **Section 2.4**), it is not within the scope of this document to undertake a full impact assessment. The full impact assessment methodology adopted for the Holyhead Port Expansion project (including an assessment of the magnitude of effect (change) and the determination of the resultant impact significance) is presented within the ES.

3.6 Assumptions and Limitations

Data used to compile this report consists of secondary information derived from a variety of sources. The assumption is made that the secondary data, as well as that derived from other secondary sources, is reasonably accurate.

The records held by the sources used in this assessment are not a record of all surviving heritage assets, rather a record of the discovery of a range of archaeological and historical components of the historic environment associated with the Site and Study Area. The information held within these sources is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown.

3.7 Copyright

This report may contain material that is non-RHDHV or Stena Line copyright (e.g. Ordnance Survey, British Geological Survey, Crown Copyright), or the intellectual property of third parties, which is for non-public reproduction. Users remain bound by the conditions of the Copyright, Designs and Patents Act 1988 with regard to multiple copying and electronic dissemination of the report within the public realm.

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- at an appropriate time, Stena Line will submit the reports to the appropriate National repositories with full usage rights to make accessioned material publicly available as part of their normal functions.

4 Legislation, Policy and Guidance

4.1 Introduction

The Site is located within the Welsh Territorial Sea (up to 12 nautical miles (nm)) from the Welsh coast. The planning system in Wales operates at two principal levels; nationally through the Welsh Government and locally through local planning authorities. Cadw administers the responsibilities of the Ministers of the Welsh Government with regard to archaeological and built heritage matters, which extend offshore to the 12nm territorial limit. There are four regional archaeological trusts in Wales that have advisory roles to Cadw; for the Study Area this advice is provided by Gwynedd Archaeological Trust. The local planning authority for Holyhead is the Isle of Anglesey County Council.

The following section provides a summary of the planning and legislative framework which governs the treatment of the historic environment in the planning process.

4.2 Key Consenting Requirements

The key consents required for the proposed scheme are:

- A Harbour Revision Order (HRO) in accordance with Section 14 of the Harbours Act 1964; and
- Marine licences under Part 4 of the Marine and Coastal Access Act (MCAA) 2009 for works below the level of Mean High Water Spring (MHWS) tides (including deposits and removals) within the UK marine area.

It is anticipated that Listed Building Consent for works in relation to the Admiralty Pier (including sea wall between salt island bridge and George IV Arch) (RHDHV 25) will also be required. This requirement, and any required Conservation Area consent (in relation to the Holyhead Beach Conservation Area RHDHV 1, if required) will be a focus of consultation with the Local Planning Authority as the project progresses.

4.2.1 Marine and Coastal Access Act (2009) (as amended)

Part 4 of the Marine and Coastal Access Act provides a framework for the marine licensing system for those 'licensable marine activities' undertaken below the level of MHWS tides. The Natural Resources Wales (NRW) are the regulatory authority for marine licensing in Welsh inshore and offshore waters.

Under this legislation, marine development plans must be consistent with the Marine Policy Statement (MPS; HM Government, 2011) (see section 4.4.1).

4.2.2 Harbour Act 1964 (as amended)

Following the transfer of specific functions under the Harbours Act 1964 by virtue of the Wales Act 2017, the Welsh Ministers are responsible for making various types of harbour orders, including Section 14 HROs.

Section 14 of the HA 1964 allows for the Welsh Government to make a HRO "*in relation to a harbour which is being improved, maintained or managed by a harbour authority in the exercise and performance of statutory powers and duties…for achieving all or any of the objects specified in Schedule 2*".

Section 14 also requires an application to be made in writing to the MMO by "*the authority engaged in improving, maintaining or managing it or by a person appearing to him to have a substantial interest or body representative of persons appearing to him to have such an interest*".

4.3 Primary Legislation relating to the Historic Environment in Wales

4.3.1 Historic Environment (Wales) Act 2016

The Historic Environment (Wales) Act became law on the 21st March 2016. The Act forms part of an integrated suite of policy, advice and guidance that makes improvements to the existing systems for the protection and sustainable management of the Welsh historic environment in a manner that is in step with the modern conservation philosophy set out in the Conservation Principles for the Sustainable Management of the Historic Environment in Wales. To summarise, the Act was introduced with the intention of:

- Giving more effective protection to listed buildings and scheduled monuments;
- Enhancing existing mechanisms for the sustainable management of the historic environment; and
- Introducing greater transparency and accountability into decisions taken on the historic environment.

4.3.2 Planning (Wales) Act 2015

The Planning (Wales) Act 2015 was passed on the 6th July 2015. This makes provision for the preparation and revision of a new National Development Framework for Wales and the production of Strategic Development Plans. Although planning law only applies within the territory of local authorities, which generally extends only to the low water mark, Cadw is fully aware of the significance of seabed prehistory and submerged landscapes, and the importance of a seamless approach to protection.

4.3.3 Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 defines sustainable development as '*the process of improving the economic, social, environmental and cultural well-being of Wales*' with the promotion and protection of culture as part of one of its seven well-being goals.

4.3.4 Town and Country Planning Act 1990

The Town and Country Planning Act is an act of the United Kingdom Parliament that regulates the development of land and buildings in England and Wales. It is the principle instrument of town and country planning law, and sets out the requirements for local authorities to prepare development plans.

4.3.5 Planning (Listed Buildings and Conservation Areas) Act (1990)

Statutory protection for Listed Buildings and Conservation Areas, and their settings, is provided under the Planning (Listed Buildings and Conservation Areas) Act. A Listed Building is that which is seen to be of special architectural or historic interest, and a Conservation Area comprises an area of special architectural or historic interest, the character or appearance of which is desirable to preserve or enhance.

A Listed Building may not be demolished, altered or extended in any manner which would affect its character without Listed Building Consent being granted by either the relevant Local Planning Authority's Conservation Officer. There are three grades of listing (in descending order):

- Grade I: buildings of exceptional interest;

- Grade II*: particularly important buildings of more than special interest; and
- Grade II: buildings of special interest, warranting every effort to preserve them.

4.3.6 Ancient Monuments and Archaeological Areas Act 1979 (as amended)

Under the terms of the Act, an archaeological site or historic building of national importance can be designated as a Scheduled Monument and is registered with the Department of Culture, Media and Sport (DCMS). Any development that might physically affect a Scheduled Monument is subject to the granting of Scheduled Monument Consent. Historic England advises the government on individual cases for consent and offers advice on the management of Scheduled Monuments.

4.3.7 Protection of Wrecks Act 1973

Under Section One of the Protection of Wrecks Act, wrecks and wreckage of historical, archaeological or artistic importance can be protected by way of designation. It is an offence to carry out certain activities in a defined area surrounding a wreck that has been designated, unless a licence for those activities has been obtained. Section Two of the Act provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency through the Receiver of Wreck.

4.3.8 Protection of Military Remains Act 1986

Under the Protection of Military Remains Act (1986), all aircraft that have crashed in military service are automatically protected. Maritime vessels lost during military service are not automatically protected although the Military of Defence has powers to protect any vessel that was in military service when lost. The Military of Defence can designate ‘controlled sites’ around wrecks whose position is known and can designate named vessels as ‘protected places’ even if the position of the wreck is not known. It is not necessary to demonstrate the presence of human remains at either ‘controlled sites’ or ‘protected places’.

4.3.9 Merchant Shipping Act 1995

This Act sets out the procedures for determining the ownership of underwater finds that turn out to be ‘wreck’, defined as any flotsam, jetsam, derelict and lagan found in or on the shores of the sea or any tidal water. It includes ship, aircraft, hovercraft, parts of these, their cargo or equipment. If any such finds are brought ashore, the salvor is required to give notice to the Receiver of Wreck that he / she has found or taken possession of them and, as directed by the Receiver, either hold them pending the Receiver’s order or deliver them to the Receiver. The act is administered by the Maritime and Coastguard Agency.

4.4 Planning Policy

4.4.1 UK Marine Policy Statement

The UK Marine Policy Statement (MPS) (HM Government, 2011) provides the framework for preparing Marine Plans and taking decisions affecting the marine environment. The MPS sets out high level objectives for marine planning, which have directed development of the Plan at a local level. Marine Plans must be in accordance with other relevant national policy, including the Planning Policy Wales (The Welsh Government, 2016) and are intended to contribute to the achievement of sustainable development in the UK marine area. The Marine and Coastal Access Act 2009 requires all public authorities taking authorisation or enforcement decisions that affect or might affect the UK marine area to do so in accordance with the MPS unless relevant considerations indicate otherwise (HM Government, 2011). Section 2.6.6. of the MPS outlines the approach to be taken with regards to the Historic Environment.

4.4.2 Draft Welsh National Marine Plan

The Site is located within the inshore region of the Welsh National Marine Plan Area. At the time of compiling this document, the Welsh National Marine Plan was available in draft format. The draft Plan was subject to consultation between 7th December 2017 and the 29th March 2018. Since summer 2018 there has been a period of engagement with the stakeholder reference group on key themes arising from the consultation, with a number of elements of the plan being developed on until March 2019. Formal adoption of the plan by the Welsh Government Ministers and Secretary of State at the Department for Environment, Food and Rural Affairs is anticipated in late Spring 2019.

4.4.3 Planning Policy Wales

Planning Policy Wales (PPW), edition 9, was first published by the Welsh Government in March 2002 and most recently updated in November 2016. This document is the principal national guidance on the importance, management and safeguarding of the historic environment within the planning process in Wales and provides advice on all aspects of planning policy in Wales.

Chapter 6: Conserving the Historic Environment sets out the principal national guidance on the importance, management and safeguarding of heritage assets within the planning process. The aim of Chapter 6 is to ensure that Local Planning Authorities, developers and owners of heritage assets adopt a consistent and holistic approach to their conservation and to reduce complexity in planning policy relating to proposal that affect them.

To summarise, government guidance provides a framework that:

- recognises that heritage assets are a finite non-renewable source;
- requires an assessment and / or evaluation of the historic environment resource affected by the proposals and an impact assessment of the proposed development on the importance of the heritage assets;
- takes into account the desirability of preserving and enhancing the importance of heritage assets and their setting; and
- places weight on the conservation of designated heritage assets.

This guidance is supplemented by a series of Technical Advice Notes (TANs). TAN 24: The Historic Environment provides planning advice relevant to the historic environment on how the planning system considers the historic environment during development plan preparation and decision making on planning and listed building applications. The TAN provides guidance on how the following aspects of the historic environment should be considered:

- World Heritage Sites;
- Scheduled Monuments;
- Archaeological remains;
- Listed Buildings;
- Conservation Areas;
- Historic Parks and Gardens;
- Historic Landscapes; and
- Historic assets of special local interest.

4.4.4 Joint Local Development Plan (Anglesey and Gwynedd)

The Anglesey and Gwynedd Joint Local Development Plan 2011-2026 (IoACC and Gwynedd Council, 2017) was adopted on 31st July 2017 and represents a land use development strategy which concentrates on sustainable development. Amongst other aims, the Plan provides a development strategy which seeks to protect areas to ensure the maintenance and enrichment of the natural and built environment.

4.5 Guidance

Cadw have prepared and published a series of best-practice guidance documents intended to enhance the provisions of the Historic Environment (Wales) Act 2016 and recent planning policy and advice. Available best-practice guidance includes:

- Setting of Historic Assets in Wales (Cadw, 2017a)
- Heritage Impact Assessment in Wales (Cadw, 2017b);
- Managing Change in World Heritage Sites in Wales (Cadw, 2017c);
- Managing Change to Listed Buildings in Wales (Cadw, 2017d);
- Managing Change to Registered Historic Parks and Gardens in Wales (Cadw, 2017e);
- Managing Conservation Areas in Wales (Cadw, 2017f);
- Managing Historic Character in Wales (Cadw, 2017g);
- Managing Listed Buildings at Risk in Wales (Cadw, 2017h); and
- Managing Lists of Historic Assets of Special Local Interest in Wales (Cadw, 2017i).

5 Archaeological and Historical Baseline

5.1 Known Heritage Assets

5.1.1 Designated Heritage Assets

There are 48 designated heritage assets recorded within the Study Area (**Figure 5.1**), comprising:

- One Scheduled monument;
- 45 Listed Buildings; and
- Two Conservation Areas.

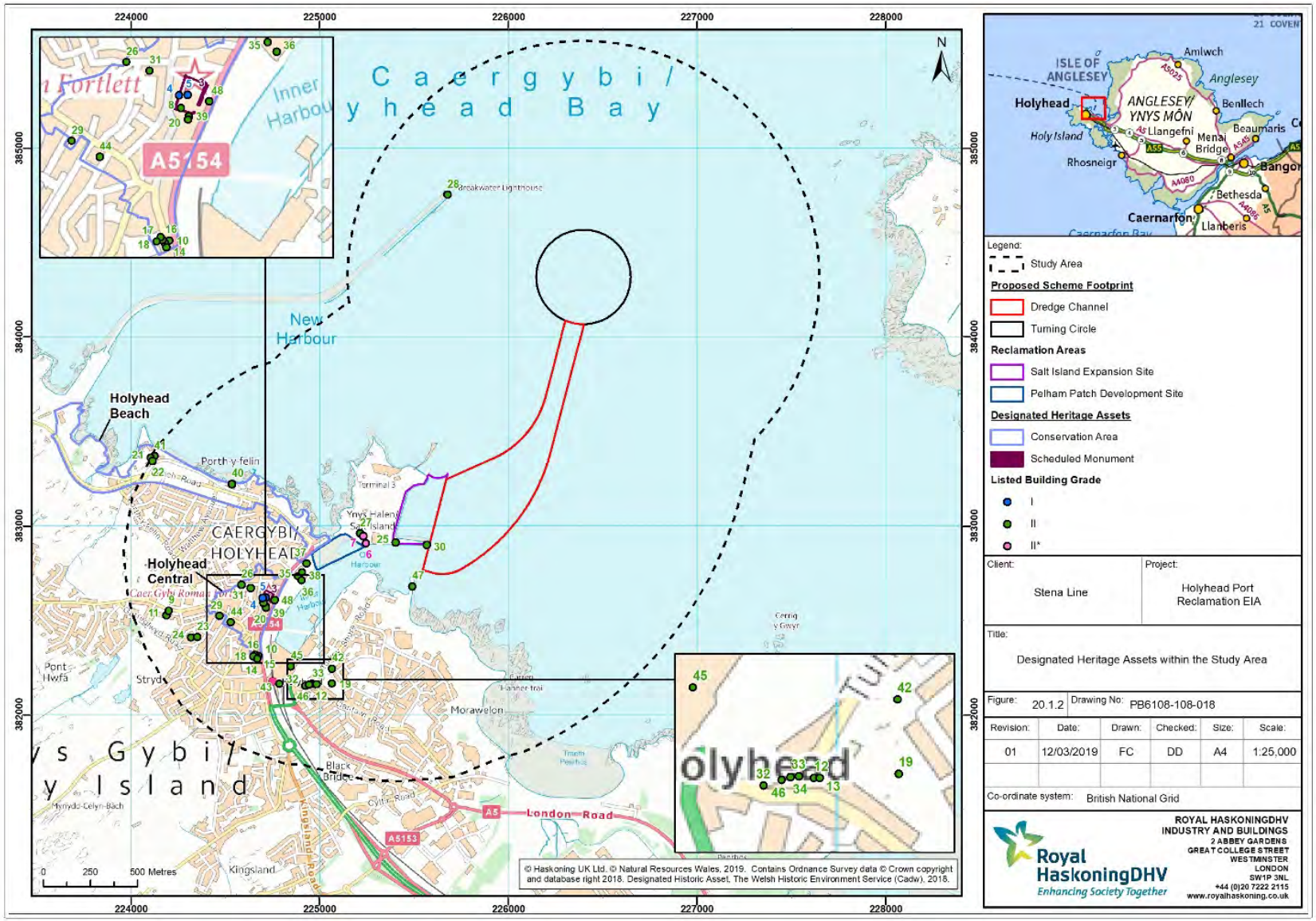

Figure 5.1 Designated Heritage Assets within the Study Area

The Scheduled Monument recorded within the Study Area is the remains of a Roman Fort (Caer Gybi, RHDHD 3), thought to have formed a small coastguard fort in the late Roman period. All that remains of the fort is a three-sided rectangular enclosure, within which lies St. Cybi's Church and churchyard. The wall is designated as a Grade I Listed Building (RHDHV 4). The fourth (eastern) side of the fort is formed by a steep cliff of rock, some 15ft high. No similar examples of three-sided landed places are known in Britain, although examples on the Rhine frontier are dated to the reign of Valentinian. Although no datable finds have been discovered in association with the fort, the style of position of Caer Gybi place it amongst coastal fortifications of the 3rd and 4th Centuries AD (Jarrett, 1969). Caer Gybi is located some 260m south-west of the Pelham Patch Development site, although the reclamation area is obscured by the presence of the marine workshops in the Pelham Quay area (see **Section 6** for further discussion).

The 45 Listed Buildings within the Study Area consist of two Grade I, two Grade II* and 41 Grade II Listed Buildings. The Grade I Listed Buildings comprise the Walls of Upper Churchyard, Market Square (RHDHV 4 – discussed above) and St. Cybi's Church (RHDHV 5). The present building of St. Cybi's Church mainly dates from the late 15th / early 16th centuries, although earlier 13th century masonry is incorporated in the chancel. St. Cybi's Church has been designated as a Grade I Listed Building on the basis that it is considered to represent an outstanding late medieval church in North Wales.

The Grade II* listed heritage assets recorded within the Study Area comprise the George IV Arch (RHDHV 6) and Harbour Office (RHDHV 7) on Salt Island. These assets are located within the security zone of the present Port of Holyhead. The George IV Arch was built between 1822 and 1824 by Thomas Harrison and commemorates George IV's landing at Holyhead on 7th August 1821 en route for Ireland. The monument is listed on the basis that it represents a fine Welsh example of a classical monument by a prominent architect. It also has group value, being part of a wider harbour improvement scheme by renowned engineer John Rennie in the 1820s, which included the Admiralty Pier (RHDHV 25), Harbour Office (RHDHV 7) and Customs House (RHDHV 27). The Harbour Office is located to the west of the George IV Arch and has been designated as a Grade II* Listed Building as a rare Welsh example of maritime architecture from Georgian period and as an integral part of this important harbour scheme designed by Rennie.

Grade II Listed Buildings within the Study Area are varied and include harbour and / or railway-related infrastructure, residential dwellings, places of worship, memorials / monuments, public buildings, schools and 20th Century military defences. Those with proximity to the proposed scheme include the Admiralty Pier (including the sea wall between Salt Island Bridge and the George IV Arch) (RHDHV 25), the Admiralty Pier lighthouse (RHDHV 30) and Customs House (RHDHV 27) on Salt Island, the lighthouse on Holyhead Breakwater (RHDHV 28), a number of marine service buildings (RHDHV 35-8) and South Pier (RHDHV 47) (to the south of Admiralty Pier).

On the basis of the potential vulnerability of the heritage assets summarised above as a result of the proposed scheme with regards to their setting, these assets are discussed in further detail in **Section 6**.

The Study Area also includes two Conservation Areas; the Holyhead Beach and Holyhead Central Conservation Areas (RHDHV 1 and 2, respectively). The Holyhead Beach Conservation area consists of a unique and varied character and history, including imposing buildings and rugged landscape to the west, vast public open space to the centre, and more urban 19th century development to the east. The Holyhead Central Conservation Area includes the area around the old Roman Fort of St Cybi as well as the core of the 19th Century expansion of the town, representative of a period of rapid expansion of the town in the mid 19th Century and has a uniformity and integrity of character and scale.

A gazetteer for all designated heritage assets within the Study Area is provided in **Annex 1**. Reference to select designated heritage assets is made in **Sections 5** and **6**, as and where relevant.

5.1.2 Non-designated Heritage Assets

5.1.2.1 Heritage Assets

There are 182 non-designated heritage assets within the onshore extent of the Study Area, recorded variously by the GAT HER and / or the NMRW (RHDHV 49-228, 249-250). These assets are detailed in Annex 1 and their location illustrated in **Figure 5.2**. The non-designated heritage assets within the onshore extent of the Study Area vary in nature, character and period and include (but are not confined to) find spots, burials, places of worship, roads, harbour and / or railway-related infrastructure and associated buildings, bridges, walls, residential dwellings, shops, banks, public buildings, schools and 20th century military defences. An additional record for a non-designated heritage asset (RHDHV 251) within the offshore extent of the Study Area is also recorded, comprising a findspot for items of wreck-related debris of modern date which were recovered and sold in 1948.

Reference to select non-designated heritage assets is made in **Sections 5** and **6**, as and where relevant. Although no non-designated heritage assets lie within the proposed scheme footprint, the potential for the setting of any such assets to be indirectly impacted by the proposed scheme is considered in **Section 6**.

5.1.2.2 Wrecks and Obstructions

There are 20 recorded wrecks and obstructions within the marine and intertidal extent of the Study Area, comprising 18 charted wreck sites and two charted obstructions [4](RHDHV 229-250). These assets are detailed in Annex 1 and their location illustrated in **Figure 5.3**.

Of the charted wreck sites within the Study Area, six are named, comprising:

- *Kirkmichael* (RHDHV 229), a British vessel lost in 1894;
- Ossea (RHDHV 230), a British vessel lost in 1894;
- *Rhyl* (RHDHV 231), a British vessel lost in 1900;
- *Saint Olaf* (RHDHV 232), a British steamship lost in 1900;
- *Bidsie and Bell* (RHDHV 233), a British sailing vessel lost in 1925; and
- HMS *Campina* (RHDHV 234), a British trawler lost in 1940.

[4] *Two additional charted obstructions were also recorded within the search area. These obstructions were described as 'underwater rock' and are not of archaeological interest. As such, they have been omitted from this study.*

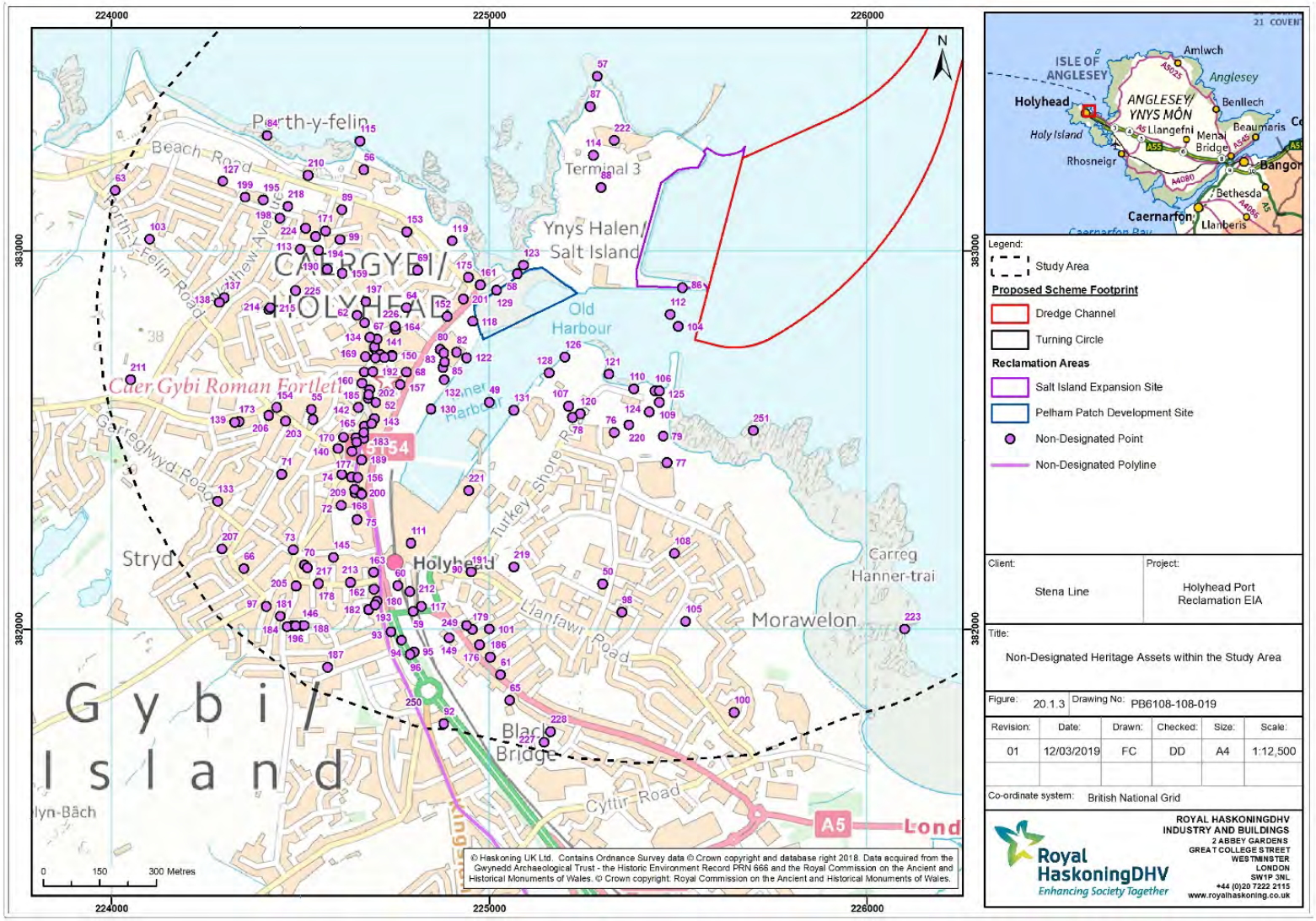

Figure 5.2 Non-designated Heritage Assets within the Study Area

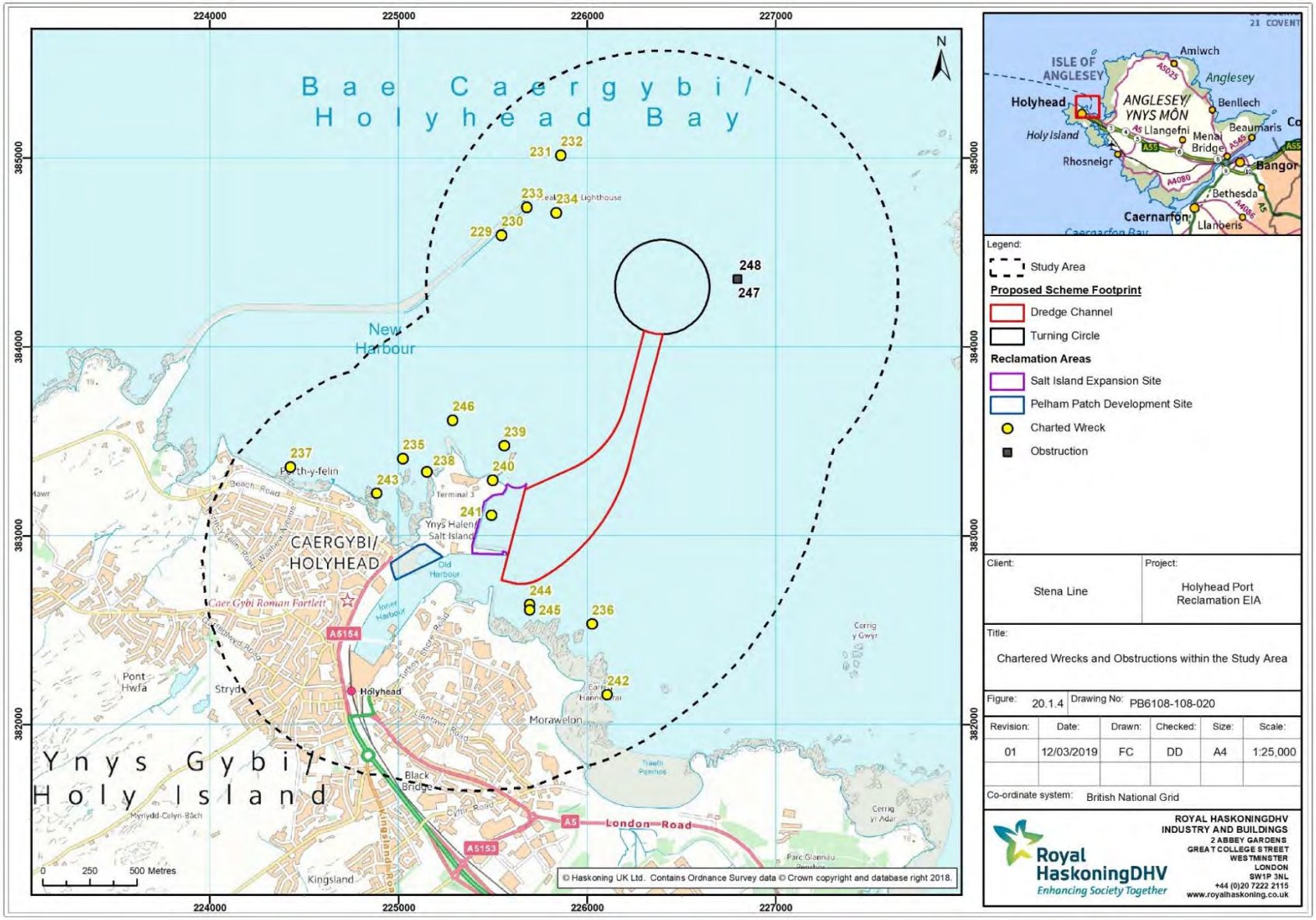

Figure 5.3 Charted Wrecks and Obstructions within the Study Area

Of the named wrecks listed above, only one is recorded as having a precisely known charted position (the HMS *Campina*, RHDHV 234), with the position of the remaining wrecks recorded as unreliable.

The remaining wreck sites charted within the Study Area are unknown wrecks (RHDHV 235-246). With the exception of RHDHV 235, which is recorded as a British hulk, no further information is recorded. All unknown wrecks are recorded as having a charted position of unreliable accuracy.

The two charted obstructions within the Study Area are both described as 'foul ground'. One obstruction is recorded as an anchor (RHDHV 247), the charted location of which is considered to be precisely known. The other charted obstruction (RHDHV 248) is of unknown origin.

Of the charted wrecks and obstructions summarised above, only one charted within the scheme footprint itself (RHDHV 241) and is located within the Salt Island Expansion site. All remaining wrecks and obstructions are beyond the parameters of the proposed scheme footprint.

Charted wreck and obstruction locations have been reviewed as part of an archaeological assessment of geophysical survey data undertaken for the project, the results of which are reported on as part of the ES.

5.2 Marine and Inter-Tidal Archaeological Potential

5.2.1 Introduction

Proposed groundworks anticipated as part of the scheme construction are confined to the reclamation areas and the approach channel dredge. On this basis, this summary of the potential for buried archaeological remains is considered only in relation to marine and intertidal heritage assets. This potential is assessed in relation to three key marine themes relevant to the marine and inter-tidal archaeological baseline:

- Seabed prehistory;
- Maritime archaeology; and
- Aviation archaeology.

5.2.2 Seabed prehistory

5.2.2.1 Location, topography and geology

The Site is located to the east / northeast (Salt Island Expansion site and dredge channel) and southwest (Pelham Patch Development site) of Salt Island; part of the Port of Holyhead. Holy Island (Ynys Gybi), is located off the western coast of Anglesey, to which currently it is joined by the Stanley Embankment and the Four Mile Bridge (Pont Rhyd y Bont). Holyhead is the principal town on Holy Island, which is itself located off the western coast of Anglesey, Wales. The topography of Salt Island is characterised by a central ridge, running northeast to southwest; a landform characteristic seen across much of Holy Island.

The bedrock geology of Salt Island is composed of Pre-Cambrian rocks, largely characterised by the Mona Complex. The bedrock of the Study Area is largely represented by the New Harbour Group of the Mona Complex, a sequence of metamorphosed sedimentary rock comprising sandstone (psammite) and green mica schists (Jackson *et al*., 1995, Mouchel Heritage, 2009). The bedrock is variously exposed at the surface in outcrops and overlain by a veneer of younger sediment (BGS, 1990). The oldest overlying sediment appears to be Quaternary in age, with the boundary between solid geology and overlying sediments representing a depositional hiatus.

Quaternary deposits typically represent a series of glacial and inter-glacial episodes and the accompanying rise and fall in relative sea level. In the Irish Sea, these deposits generally comprise glacial till separated by pro-glacial fluvial and glaciomarine deposits. BGS data indicates that superficial sediments at the northern extent of Salt Island comprise Devensian till. More recent pro-deltaic and marine deposits are mapped by the BGS as overlaying glacial till, pro-glacial fluvial and glaciomarine deposits within the Irish Sea.

5.2.2.2 Potential for prehistoric archaeological remains

The earliest evidence of hominid / human activity in the UK dates back some 970,000 years BP (Parfitt *et al*. 2005, Parfitt *et al*. 2010). The presence of hominid / early humans has been influenced by a series of marine transgressions and regressions that are associated with fluctuating glacial and interglacial conditions arising from changes in global climate during the Pre-Devensian period (970,000-110,000 BP) which have, over time, shaped the entire northwest European landscape. Due to the lowering of relative sea levels, corresponding to periods of marine regression, many areas which today are marine and intertidal / subtidal, within and surrounding the Study Area, would have been sub-aerially exposed and therefore suitable for human / hominid exploitation at various times in the past. The potential for hominid occupation and activity of Pre-Devensian date is indicated by a number of Palaeolithic cave sites in the wider region along the Welsh coast. The Pontnewydd Cave, Denbighshire (South Wales, *c.* 220km south-south-east of the Study Area) provides one such example, within which the oldest human remains known from Wales were discovered, dating back some 230,000 years[5].

Despite this potential, basal erosion occurring as a result of ice movement during the Devensian glaciation is likely to have stripped away the Pre-Devensian sediments in the area, removing much evidence for an earlier human presence in North West Wales to all but a few exceptional sites (IFA Wales, 2008). Available data suggests Pre-Devensian formations in the Study Area are confined to the Pre-Cambrian Mona Complex, which pre-dates the earliest evidence of hominid / human activity in Britain. This rock formation has no potential to contain *in situ* archaeological material. Although it may have provided surfaces upon which archaeological material was deposited, the destructive effects of the encroaching Devensian ice sheet will have likely re-deposited any archaeological material during the re-working of the landscape. Pre-Devensian finds, if present within the Study Area, are therefore most likely to occur in secondary contexts[6]. Although discoveries from secondary contexts are by their very nature, derived artefacts, they nonetheless have the potential to provide information on patterns of human land use and demography (Ashton and Lewis, 2002; Hosfield and Chambers, 2004).

The Devensian glaciation (110,000-13,500 BP) was the last glacial stage to occur before the present climatic amelioration. Although sea levels during the Last Glacial Maximum (LGM - 18,000 BP) were approximately 120m below present-day levels, with the southern edge of the ice sheet extending in a line from the Severn to the Wash (Flemming, 2002: 7), the Study Area would have been concealed by an ice sheet during this period and would have been uninhabitable for early human exploitation and activity. The Devensian ice sheet was drained by a number of fast flowing corridors of ice known as ice streams. The island of Anglesey is located close to the eastern margin of the Irish Sea Ice Stream (one of the largest ice streams in the British and Irish Ice Sheet). As such, the glacial landforms and sediments preserved on Anglesey are representative of these glacial and sedimentary processes that resulted in the major reconfiguration of the landscape that occurred beneath the Irish Sea Ice Stream during the Devensian glaciation. BGS data indicate the survival of numerous relict glacial features on the seabed within the Irish Sea (Jackson *et al.,* 1995). Devensian deposits within the Study Area comprise Devensian till at the northern extent of Salt Island. As this formation is a glacial deposit, it is not considered to be of archaeological potential.

[5] https://museum.wales/articles/2013-07-09/The-oldest-people-in-Wales---Neanderthal-teeth-from-Pontnewydd-Cave/
[6] *Artefacts discovered within their secondary contexts are those which have been derived or moved from their original positions by natural processes.*

The Devensian ice sheet began to retreat following the LGM and by 10,000 BP the climate began to ameliorate with the onset of the Holocene period. BGS data indicates the presence of periglacial outwash deposits within the wider environs of the Study Area, deposited close to the retreating ice sheet at a time when the environment is likely to have been too hostile for settlement by humans.

Following the retreat of the Devensian ice sheet, the Mesolithic period (8,500-4000 BC) in Britain saw a marked improvement in climate with the onset of the warmer Holocene interglacial. The Holocene marine transgression of the Mesolithic saw the coastline approaching that of today's (Shennan and Horton, 2002), with the Study Area likely to have been a largely terrestrial environmental with coastal proximity. The archaeological record indicates that coasts, estuaries and wetlands were regarded as key landscape elements during this period, with evidence indicating the presence of constructed settlements albeit of a non-permanent nature and hunter-gatherer lifestyle for Mesolithic groups. Any surviving sedimentary deposits from this period could potentially contain both *in situ* and derived artefacts from a time when these coastal and littoral landscapes, now submerged by the sea, were utilised intensively by human populations.

The earliest prehistoric archaeological sites within Anglesey date to the Mesolithic period. Archaeological evidence for Mesolithic activity primarily consists of lithic artefacts, although evidence for a wide range of material implements is present in the archaeological record. Notable finds of Mesolithic date have been discovered on Holy Island, including over a hundred flint and chert cores from among the later prehistoric round houses by South Stack *c.* 3.5km west of the Study Area (Lynch, 1991: 329). Mesolithic microliths were also found during the Parc Cybi excavations *c.* 0.7km south of the Study Area (Gwynedd Archaeological Trust, undated). Despite these lithic discoveries, neither site yielded remains considered to be indicative of an identifiable settlement site. A Mesolithic occupation deposit, comprising over 5,000 pieces of flint has been discovered in excavations at Trwyn Du, Anglesey (*c.* 16km south-west of the Study Area), with the assemblage identified as suggesting long-term though seasonal occupation of the site[7]. Evidence for Later Mesolithic occupation in the wider region has been discovered at Snail Cave; a prehistoric rock shelter site at Great Orme, Llandudno, *c.* 50km east of the Study Area[8].

The relative sea-level rise of the Holocene marine transgression would have resulted in a large extent of the Study Area being inundated to form a fully marine environment by the Neolithic period (*c.* 4,000 – 2,200 BC). As such, the potential exists for maritime related material dating to this period onwards within extents of the Study Area (discussed in **Section 5.2.3**).

5.2.3 Maritime Archaeology

5.2.3.1 Archaeological and Historic Background

Prehistoric and Roman

The rise in relative sea level and the gradual inundation of a large extent of the Study Area throughout the Mesolithic period saw the formation of the Holyhead coastline as forming a natural harbour, likely to have been utilised for maritime related activities. The potential therefore exists for maritime related material dating from this period onwards within the Study Area. Whilst there is limited archaeological evidence for Mesolithic maritime activities, discoveries of Mesolithic logboats (e.g. McGrail, 2001) demonstrate the ability for these early communities to build such watercraft. Although well beyond the parameters of the Study Area, discoveries elsewhere in the British Isles such as Star Carr in North Yorkshire represent the use of watercraft during this period, with the uncovering of a boat paddle amongst an assemblage of material discovered within waterlogged peat deposits considered to represent a substantial settlement site[9].

[7] http://www.dyfedarchaeology.org.uk/lostlandscapes/trwyndu.html
[8] http://www.heneb.co.uk/cadwprojs/cadwreview2011-12/snailcave11-12.html G. Smith
[9] https://www.archaeology.co.uk/articles/return-to-star-carr-discovering-the-true-size-of-a-mesolithic-settlement.htm

The archaeological record suggests a continued use of logboats in the Neolithic period. The movement of goods across the sea is also indirectly indicated, for example, by the circulation of polished stone axes between Britain and Ireland (Breen and Forsythe, 2004:32) and the adoption of agriculture which required the introduction of non-indigenous species of plants and animals for food (Murphy 2002: 49). Despite the inundation of large extents of the Study Area by the Neolithic period, Neolithic activity of a more terrestrial nature is likely to have occurred within the present day subtidal / intertidal areas (e.g. the Salt Island Expansion site and the Pelham Patch Development site). Archaeological assemblages dating to the Neolithic typically indicate a shift in settlement activities from the hunting and gathering lifestyles practised in the Mesolithic to increasingly sedentary agricultural settlement practised by Neolithic communities, although lifestyle practices are likely to have varied across regions, within some Neolithic groups continuing to maintain a significant degree of 'seasonary or transitory movement' (Hodgson & Brennand, 2006: 29). Areas providing access to coastal, wetland and dry land environments are likely to have allowed gathering and hunting to remain of primary economic importance well into the period after which domesticated crops and animals became available (Hodgson & Brennand 2006: 31). Neolithic activity settlement in the region is evidenced by two Neolithic tombs, at Trefignath (*c.* 1.1km south of the Study Area) and at Treaddur (*c.* 2.6km south of the Study Area) (Gwynedd Archaeological Trust, undated). Further sites include Bryn Celli Ddu[10], a Neolithic chambered tomb in Anglesey (*c.* 27km south-east of the Study Area) and the remains of a rectangular early Neolithic building excavated at Parc Cybi (*c.* 0.7km south of the Study Area), with evidence also suggesting extensive Neolithic activity that is likely to have continued into the mid and later Neolithic.

At a national scale, the onset of the Bronze Age (*c.* 2,200 – 700 BC) is marked by the introduction of bronze metalworking, changes in pottery styles, the increased occurrence of single burial traditions and changes in monumental building (Hodgson & Brennand, 2006: 29). A number of Bronze Age burial barrows are recorded within the wider environs of the Study Area, including two sited on the top of Holyhead Mountain (*c.* 1.5km west of the Study Area). Bronze Age settlement sites are rare, likely because the construction methods utilised by Bronze Age communities left little in the way of archaeological trace. As such, evidence for Bronze Age settlement activity relies on more ephemeral features such as burnt mounds and earth ovens (Gwynedd Archaeological Trust, 2011). Excavations at Parc Cybi (*c.* 0.7km south of the Study Area) have revealed a number of pits with charcoal, pottery fragments and midden material with evidence suggesting a flourishing population throughout the period, as well as a probable Bronze Age timber roundhouse, a possible multiple-cist barrow, the ring ditch of a barrow and a deep-ditched enclosure (Gwynedd Archaeological Trust, 2011). From a maritime perspective, the archaeological record indicates a continuation of seaborne contact during this period, resulting in an increase in marine traffic and a perceived preference for Bronze Age communities to settle in coastal areas (Murphy, 2002: 49). Direct evidence for maritime activity of this period is provided by the remains of Bronze Age sewn-plank boats, uncovered on the Severn Estuary foreshore (Murphy, 2002: 50). These boats were discovered near the coast or in intertidal environments, suggesting they could have been used along the coast and were likely capable of cross-channel journeys in favourable weather (Van de Noort, 2003: 406). Copper mining activities at Parys Mountain dates back as far as the Bronze Age, and it is possible that material excavated at the mine could have been transported by sea from the north Anglesey coast.

The Iron Age (*c.* 700 BC – AD 43) is characterised by the introduction of iron weapons and tools and settlement activity typically represented by nucleated settlements comprising round houses, sometimes associated with defended hillfort or promontory fort sites. An Iron Age settlement of stone roundhouses accompanied by several outlining roundhouses and other structures, as well as possibly contemporary field boundaries, was discovered during excavations at Parc Cybi (*c.* 0.7km south of the Study Area). Other notable features in the wider region include the hillforts of Caer y Twr (*c.* 1.8km west of the Study Area) and Dinas (*c.* 30km south-west of the Study Area) on Holyhead Mountain and on the south coast of Holy Island

[10] https://cadw.gov.wales/daysout/bryn-celli-ddu-burial-chamber/?lang=en

respectively, which are of probable Iron Age date (Gwynedd Archaeological Trust, undated). Settlement activity in the wider environs of the Study Area is also indicated by an extensive group of round houses with associated terraced fields and walled enclosures on the south-western slope of Holy Island and at Porth Dafarch (*c.* 2km south-west of the Study Area). A number of Iron Age coastal forts in Wales had easy approaches to the sea via sandy coves and beaches, and therefore may have been involved in maritime trade and / or fishing activities during this period (Murphy, 2002: 53). There were further developments in boat design during the Iron Age, with the introduction of the 'Romano-Celtic' boat, examples of which are known from Blackfriars in London (Marsden, 1994) and Barland Farm in the Severn Estuary (Bell and Neumann, 1997).

The impact of the Roman invasion of Anglesey in AD 60 and AD 78 is not easily identified through archaeological evidence (Gwynedd Archaeological Trust, 2011), although evidence to the south of the Study Area from Parc Cybi appears to suggest continuity of settlement but with a shift taking place in the pattern of settlement. A number of military and civilian sites along the Liverpool Bay coast indicate a flourishing trade and cultural contact during the Romano-British period (Murphy, 2002: 55). Coastal trade in the wider region is indicated by the discovery of coins on beaches around Glamorgan, south Wales (Murphy, 2002: 56). The discovery of a Romano-Celtic boat at Barland's Farm on the Severn Estuary provides direct evidence for the types of watercraft in use during this period (Bell and Neumann, 1997). Military occupation of the area was controlled from the Roman auxiliary fort of *Segontium*, Caernarfon on the eastern shore of the Menai Strait, opposite the Isle of Anglesey. Evidence of an extensive complex of rectangular buildings have been discovered at Tai Cochion, south-west Anglesey, associated with a road leading down to the shore, indicating the likely site of a ferry from the mainland (Hopewell and Edwards, 2017). A small compact group of Roman buildings was also excavated at Parc Cybi, with pottery finds at the site suggesting the complex dates to the 3rd and 4th Centuries (Kenney, 2009). During the later Romano-British period, a fort comprising a naval base was constructed at Holyhead in order to protect the island from Irish coastal raids (Hopewell, 2005; Murphy, 2002: 55; Wessex Archaeology, 2007).

Medieval

Archaeological evidence suggests a decline in population levels coinciding with the end of Roman military rule, with many of the round house settlements ceased in the 4th Century AD (Gwynedd Archaeological Trust, undated). Settlements dating to the 5th - 12th Centuries AD are still comparatively rare in Wales, although excavations at Rhuddgaer in south-west Anglesey have revealed an early medieval settlement with discoveries including several structures interpreted as an early medieval farming settlement and a series of field systems (Hopewell and Edwards, 2017). The presence of the Early Medieval cemetery at Parc Cybi indicates the presence of a resident population in the area to the south of the Study Area (Gwynedd Archaeological Trust, 2011). Excavations at Glyn, a couple of miles inland from Red Wharf Bay, Anglesey, have also revealed a settlement of pre-Viking and Viking date that developed into a strong trading or mercantile settlement (Murphy 2002: 58). Several cemeteries of early medieval date have been found on Holy Island and are testament to human activity in the area during this period (Gwynedd Archaeological Trust, undated). Further evidence is provided by the establishment of a clas church[11] within the Roman fort at Holyhead in the late 5th or 6th Century AD. Although archaeological evidence for Viking interaction in this period is scarce, documentary sources and Anglesey place-names provide some indication of Viking influence in the area and the clas church is recorded to have attracted the attention of the Vikings in 961 AD (Edwards, 1986).

Following the end of Viking activity in the 12th Century, Anglesey flourished and the Irish Sea is likely to have witnessed considerable maritime activity from this period. A number of important ports developed in Anglesey in the 13th Century. The number of vessels that passed through the Study Area are likely to have increased through this period, and there are a greater number of archaeological examples of shipwrecks

[11] *A monastic church staffed by canons or claswyr and ruled by an Abbot.*

around the Welsh coast of medieval date. One such example in the wider region includes the Magor Pill wreck on the Severn Levels (Nayling, 1998), dated to the 13th Century.

Post-medieval to Modern

Post-medieval (AD 1500 - 1799) Wales witnessed rapid expansion in settlements, harbours and industries alike and the transport of goods by sea increased. Holyhead is characterised by the development of the port as a point of departure for Ireland during this period. In the reign of Elizabeth I (1558-1603), Holyhead became the departure point for the Royal Mail to Ireland and during the Commonwealth (1649-1660), the town of Holyhead was garrisoned, with regular packet boats sailing to Ireland (Gwynedd Archaeological Trust, undated). Direct evidence for post-medieval maritime activity is provided by the Pwll Fanog slate wreck in the Menai Strait, dating to around the 14th to mid-16th Century and the Royal Yacht Mary which sunk in 1675 on the Skerries, off the north-west coast of Anglesey. The Royal Yacht Mary was built by the Dutch East India Company in 1660 and was given to King Charles II on his restoration.

In the second half of the 18th Century, mining on Parys Mountain began to take place on a much larger scale and was one of the largest copper mines in the world by the early 19th Century. Exports of coal, slate and granite fuelled the growth in industrialisation and the Irish Sea also saw a growth in the use of packet boats (designed for domestic mail, passenger and freight transportation) and ferries plying the waters of the Study Area. The Admiralty Pier, designed by John Rennie Senior in the 1820s, served to facilitate the Irish mail packet boats during this period. The Act of Union between Great Britain and Ireland in 1800 saw Holyhead develop as the principal port for Ireland. The Act of Union increased the need to make the journey between Great Britain and Ireland easier. Port facilities were updated by John Rennie and Thomas Telford as part of works to improve the route between Dublin and London in the 19th Century. Construction of the London to Holyhead road, designed by Telford in the 1820s, improved land transport links to Holyhead. The Stanley Embankment, also designed by Telford, further improved transport links. The embankment, which opened in 1823, carried the road over the Afon Lasinwen, the tidal strait between Holy Island and Anglesey. Further developments saw the opening of the Chester and Holyhead Railway in 1848 (Gwynedd Archaeological Trust, undated). The port itself was also developed and expanded, with the construction of the Holyhead 'Great Breakwater' between 1847 and 1873, to reduce the exposure of the port and to accommodate a larger number of vessels using Holyhead as a harbour of refuge. In 1876, it was noted that an average of 3,500 vessels per annum used the new harbour and facilities (Owens, 1987: 13 and 29). The 19th Century developments boosted the population and economy of Holyhead during this period. The population increased from 3,869 in 1841 to 8,863 in 1851 (figures from census returns, quoted in Hollands, 1973; Owens ,1987: 11-12).

Due to changes in trade and communication routes, Holyhead is considered to have lost its economic strength in the period of the two world wars. For the modern period, the greatest potential for shipping losses and wrecking events in the Study Area is associated with the two World Wars. Through its position on the route to both Ireland and the port of Liverpool, Holyhead was regarded as strategically important during WWII and became home to a large number of defensive works constructed in this period to resist the threat of invasion.

To the present day, Holyhead continues to operate as a major port. In the later 20th Century, the port of Holyhead was adapted to cater for the transport of larger ferries, facilitating travel by ferry to Dublin, Ireland. The wider landscape of Anglesey is dominated by the Anglesey Aluminium industrial complex, built in the late 1960s and was one of the largest suppliers of aluminium in the UK, though production stopped in 2008 (Gwynedd Archaeological Trust, undated).

5.2.3.2 Potential

Navigational Hazards

With the presence of drop-offs, reefs and pinnacles, many vessels have historically fallen victim to the waters off Anglesey. The NMRW records eight navigational aids and eight topographical seascape features as indicated on historic charts (**Annex 1**). These records serve to identify navigational hazards (and the need for navigational aids) within the Study Area which likely contributed to a number of vessel losses, many of which may remain unaccounted for. These records have retained their original identification assigned by the NMRW for ease of cross-referencing.

Recorded Losses

Data relating to Recorded Losses were extracted from the NMRW. Recorded Losses are records for ships that are known to have wrecked offshore, but for which the exact locations are not known. Recorded Losses are typically assigned to locations referred to as 'Named Locations', which are general locations for the loss of a vessel. For example, a Recorded Loss within this dataset may be based on the loss of a vessel in the 'Holyhead Outer Harbour', the 'Holyhead New Harbour' or the 'Holyhead Harbour'. The positional data of these records is unreliable and serve only to provide an indication on the types of vessels which passed through the area and the wrecking incidents that are known to have occurred in the general area. Whilst the remains of these vessels are expected to exist somewhere on the seafloor, their location is unknown. As such, they signify the potential marine resource.

There are 91 recorded losses within the Study Area, comprising one medieval loss, 82 post-medieval losses and eight modern losses. Details regarding Recorded Losses are presented in a gazetteer format in **Annex 1**. These records have retained their original identification assigned by the NMRW for ease of cross-referencing. The gazetteer does not include positional data due to the inaccuracies therein, although references to general location of loss are captured within the 'description field', where available. All Recorded Losses listed by the NRHE and HER within the wider search area are included within the gazetteer.

Overview of Potential

There is potential for the presence of archaeological material of a maritime nature spanning from the Mesolithic period to the present day within the Study Area. An overview of maritime archaeological potential is provided in **Table 5.1**.

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Table 5.1 Summary of maritime archaeological potential of the Study Area

Period	Key Themes	Summary of Potential
Prehistoric (*c.* 960,000 BP – AD 43)	Prehistoric maritime activities include coastal travel, fishing and the exploitation of other marine and coastal resources. The Holyhead coastline formed a natural harbour from the Mesolithic period onwards and was likely to have been utilised for maritime related activities during the prehistoric period. Later prehistoric maritime activities include overseas voyages to facilitate trade and the exploitation of deep water resources. Copper mining activities at Parys Mountain dates back as far as the Bronze Age, and it is possible that material excavated at the mine could have been transported by sea from the north Anglesey coast. In the late prehistoric period, a number of Iron Age coastal forts in Wales had easy approaches to the sea via sandy coves and beaches, and therefore may have been involved in maritime trade and / or fishing activities during this period (Murphy, 2002: 53). Vessels of this period include rafts, hide covered watercraft and log boats. Remains of later prehistoric watercraft may comprise larger boat types, including those representing new technologies such as the Bronze Age sewn plank boats which are associated with a growing scale of seafaring activities.	There is anticipated to be **low potential** for the survival of material associated with maritime activities pre-dating the Post-medieval period within the Study Area. Discoveries of this date and type are rare in the archaeological record. The remains of marine heritage assets pre-dating the 16th century, where identified in the archaeological record within marine and inter-tidal contexts, are found to be fragile and are vulnerable to the manner in which they were deposited in the marine environment and the depositional environment in which they are present. Whether a heritage asset lies on or within seabed sediments, the effects of sediment transport and the biological processes of deterioration with either open seawater or buried environments all play a role in the survival of archaeological remains within a marine / inter-tidal environment. The survival of remains of this nature is therefore dependent on the presence of a depositional context which provides a combination of environmental factors favourable for the preservation of organic material. Environmental conditions which promote the survivability of the remains of watercraft, boats or ships of this date is exceptional, with examples of such craft seldom found to be well preserved within marine and inter-tidal contexts. Remains of this date, if present may lie within or on Holocene Seabed Sediments (characterised in the Study Area as an inter-tidal / marine deposit, comprising soft clay, silt and sand).
Romano-British (AD 43 – 410)	Material of Romano-British date may be associated with the expansion and diversification of trade with the Continent. A number of military and civilian sites along the Liverpool Bay coast indicate a flourishing trade and cultural contact during the Romano-British period (Murphy, 2002: 55). The Roman fort of Caer Gybi, considered to represent a land place and coastal fortification signifies the potential for maritime material of this date to exist within the Study Area. Watercraft of this period may be in the form of the 'Romano-Celtic' shipbuilding tradition, often considered to represent a fusion of Roman and northern European methods.	
Early medieval (Saxon) (AD 410 – 1066)	Material associated with coastal and seafaring activity in the early medieval period may be associated with the renewed expansion of trade routes and Germanic and Norse invasion and migration. Evidence indicates a strong trading or mercantile settlement in the wider Anglesey region during this period (Murphy, 2002: 58). Vessels of this period may be representative of new shipbuilding traditions such as the clinker technique.	
Medieval (AD 1066 – 1499)	Low potential for material associated with medieval maritime activity, including that associated with increasing trade between the UK and Europe, the development of established ports around the Welsh coast. Vessels of this period are representative of a shipbuilding industry which encompassed a wide range of vessel types (comprising both larger ships and vernacular boats). Such wrecks may also be representative of new technologies (e.g. the use of flush-laid strakes in construction), developments in propulsion, development of reliable navigation techniques and the use of ordnance.	

Period	Key Themes	Summary of Potential
Post-medieval (AD 1500 – 1799)	Maritime heritage assets of Post-medieval may include wrecks, maritime-related debris or features relating to port-side development. Wrecks of this date may be representative of continuing technological advances in the construction, fitting and arming of ships, and in navigation, sailing and steering techniques. Wales witnessed rapid expansion in settlements, harbours and industries alike during the post-medieval period and the transport of goods by sea increased. It was during this period that. Wrecks of this date may be associated with continuing local trade, marine exploitation and the rapid expansion in industry. Holyhead became the departure point for the Royal Mail to Ireland during this period. The remains of vessels associated with wider themes may also be present (e.g. the expansion of transoceanic communications and the opening up of the New World or the establishment of the Royal Navy during the Tudor period and the increasing scale of battles at sea). Vessels of this period continue to variously represent both the clinker techniques and construction utilising the flush-laid strakes technique.	There is anticipated to be **low-moderate potential** for the survival of material associated with maritime activities dating to the Post-medieval period within the Study Area. Although the remains of boats and ships dating to this period are also rare (and where encountered, can be expected to be of special interest (Wessex Archaeology, 2013)), the rapid expansion of Holyhead and the growth in the transportation of goods by sea during this period signifies an intensification in the number of vessels expected to have passed through the Study Area thereby increasing the opportunity for wrecking incidents to have occurred. However, the preservation of any such remains is dependent on the variable environmental factors outlined above, with the likelihood of survivability considered to be low. Remains of this date, if present may lie within or on Holocene Seabed Sediments (characterised in the Study Area as an inter-tidal / marine deposit, comprising soft clay, silt and sand).
19th century (AD 1800 – 1899)	Maritime heritage assets of 19th Century date may comprise shipwrecks and maritime-related debris, particularly in relation to port-side development and expansion. Wrecks of this date may be associated with the introduction of iron and later steel in shipbuilding techniques. Such vessels may also be representative of other fundamental changes associated with the industrial revolution, particularly with regards to propulsion and the emergence of steam propulsion and the increasing use of paddle and screw propelled vessels. The port of Holyhead was developed and expanded during this period as part of the harbour improvement scheme, following an Act of Parliament in 1810 which included a requirement to improve the harbour. These improvements resulted in a larger number of vessels using Holyhead as a harbour and its facilities (Owens, 1987). Wrecks of this period may be associated with transport to Ireland, large-scale trade, the fishing industry or coastal maritime activity including marine exploitation. Shipwrecks of this period may demonstrate a diverse array of vernacular boat types evolved for use in specific environments.	There is anticipated to be **moderate to high potential** for the survival of material associated with maritime activities dating to the 19th century within the Study Area. There are many more examples of the remains of boats and ships of 19th century date in the archaeological record, with many examples identified in marine contexts. Amongst recorded known wrecks, there is a clear bias towards the remains of vessels dating from the 19th century onwards. This is due to the increasing use of iron and later steel in shipbuilding which not only has a higher survival rate in comparison to organic material such as wood, but is also more easily identified on the seafloor as a result of hydrographic surveys. In addition, from the mid-18th century onwards, there was a more centralised record for shipping losses (e.g. the Lloyds of London list of shipping casualties) which saw the compilation of a register of vessels lost, including information on the location of loss. The survivability of vessels of this date within a marine context will depend on the construction material of the vessel alongside the environmental context in which it is deposited and the cause of loss. In general terms, a metallic-hulled vessel is likely to survive to a greater degree than a wooden-hulled counterpart, although the degree to which any remains lie intact replies on a number of variable factors.

Period	Key Themes	Summary of Potential
		Remains of this date, if present may lie within or on Holocene Seabed Sediments (characterised in the Study Area as an inter-tidal / marine deposit, comprising soft clay, silt and sand).
Modern (AD 1900 – present day)	For the modern period, the greatest potential for shipping losses and wrecking events in the Study Area is associated with the two World Wars. Through its position on the route to both Ireland and the port of Liverpool, Holyhead was regarded as strategically important during WWII. There is thus potential for the discovery of shipwrecks associated with the two world wars including both naval vessels and merchant ships. Wrecks of this period may also be associated with the increased shipping responding to the demand to fulfil military requirements. A large number of vessels dating to this period were lost as a result of enemy action. In the post-war years, there is potential for wrecks associated with a wide range of maritime activities, including military, commerce, fishing and leisure. Although ships and boats of this period are more numerous, loses decline due to increased safety coupled with the absence of any major hostilities. Vessels dating to this period may have been lost as a result of any number of reasons, including human error, adverse weather conditions, collision with other vessels or navigational hazards or mechanical faults.	There is anticipated to be **moderate to high potential** for the survival of material associated with maritime activities of modern date within the Study Area. The highest volumes of known boats and ships date to the two World Wars, with comparatively fewer numbers lost during the inter-war years and during the post-war years. As above, the survivability of vessels of this date within a marine context will depend on the construction material of the vessel alongside the environmental context in which it is deposited and the cause of loss. The loss of many vessels as a result of the hostilities of the World Wars (e.g. mines, torpedoes, bombs and gun fire) mean that the remains of many vessels of this date lie widely dispersed. These factors aside, in general terms, a metallic-hulled vessel is likely to survive to a greater degree than a wooden-hulled counterpart, although the degree to which any remains lie intact replies on a number of variable factors. Remains of this date, if present may lie within or on Holocene Seabed Sediments (characterised in the Study Area as an inter-tidal / marine deposit, comprising soft clay, silt and sand).

5.2.4 Aviation Archaeology

5.2.4.1 Archaeological and Historic Background

The early 20th Century was characterised by the relatively rapid development of aviation technology. Early aircraft were constructed of canvas covered wooden frames and were extremely fragile. However, the regular use of aircraft over the battlefields of the Western Front by the end of WWI, however, prompted the mass-production of fixed wing aircraft in large numbers, spurring technological advances in aircraft design.

Aviation activity in the wider environs of the Study Area pre-dating WWII is represented by the establishment of the Royal Naval Air Service (RNAS) Llangefni Airship Station in Mona, a hamlet in the centre of Anglesey. The station, which was active between 1915 and 1919, was constructed as an Admiralty initiative to provide a deterrent to enemy submarines operating in the Irish Sea. It was responsible for deploying airships with the purpose of patrolling a large area of sea extending from Anglesey to Morecambe Bay in the east and to Dublin in the west. Air activity is therefore known to have occurred in the skies in the general vicinity of the Study Area during this period. Although the number of aircraft losses within this area of the Irish Sea can't be quantified based on available data, it is possible that of those aircraft that plied the skies above Anglesey, some may have been lost at sea. At least 28 fixed wing aircraft and 15 airships are recorded to have been lost by the German Imperial Air Service and Navy during raids on the UK mainland during WWI (Wessex Archaeology, 2009: 65) and at least 34 aircraft from the British Home Defence Squadrons are also recorded to have been lost during this period (Holyoak, 2002: 659).

During the Inter-war period, civil aviation increased significantly with overseas services established to a number of destinations worldwide (Wessex Archaeology, 2009: 16). Twenty civil aircraft losses are recorded by the Department of Transport's Air Accident Investigation Branch (AAIB) to have occurred at sea between 1920 and 1939, though this is not regarded as being a comprehensive record (Wessex Archaeology, 2009: 65). From 1935, Britain witness a period of re-armament and expansion, testified by the construction of 89 new airfields during this period. RAF Penrhos, located some 48km south of the Study Area, dates to this period of expansion. RAF Penrhos was operational prior to the outbreak of WWII from 1937 until 1946, and provided armament training, air observer, bomber and gunnery schools.

Airpower became increasingly important at a strategic and operational level during WWII, and the increased use of aircraft fuelled the development of high-powered monoplanes of aluminium (Wessex Archaeology 2009: 65). Thousands of RAF aircrew, many from Commonwealth and other countries, trained at airfields in the north Wales region, which provided all stages of the training, making the region as a whole a very significant location for the provision of training during this period[12]. A significant number of aircraft losses are known to have occurred during WWII, with an average of five aircraft estimated to have crashed every day between 1939 and 1945 somewhere in the British Isles (Bédoyère, 2001: 8). Aviation activity dating to WWII in the wider region of the Study Area is likely to have occurred in relation to RAF Mona which was used as a training base during this period. Air activity is also likely to have occurred in relation to RAF Valley (formerly RAF Rhosneigr) which opened in Anglesey in February 1941. RAF Valley facilitated flying convoy patrols over the Irish Sea, and several enemy aircraft are recorded to have been claimed as a result of these patrols[13]. A number of Air / Sea Rescue operations are also documented to have taken place during this period[14].

Air activity across the Irish Sea after WWII is likely to have included the transport of many United States Army Airforce which were transferred from Europe to the Far Eastern theatre in the war against Japan. In the late 1940s, RAF Valley became a permanent RAF station with official status as a Master Diversion

[12] http://www. heneb.co.uk/cadwprojs/cadwreview2011-12/militaryairfields2011-12.html
[13] http://www.raf.mod.uk/rafvalley/aboutus /stationhistory.cfm
[14] http://www.raf.mod.uk/rafvalley/aboutus/stationhistory.cfm

airfield. Amongst its other operations, RAF Valley provided a base for the Mountain Rescue Team which was formed in 1943 to help crashed aircraft and stranded climbers on the Welsh hills[15].

Post-war developments in aircraft technology saw the development and refinement of the jet engine. The jet aircraft was much faster than its propeller-powered predecessors and was able to attain a greater altitude, providing maximum efficiency over long distances (Jarrett, 2000). The first jet-propelled aircraft was based at RAF Valley in 1949.

With the growth of commercial aviation in the post-war years, flight soon became an available means of travel within and around the UK. However, despite the volume of aviation activity in the skies over the UK, there have been very few major losses. The Air Accidents Investigations Branch (AAIB) lists 120 civil aircraft losses at sea around the UK between 1946 and 1994, most of which comprise light aircraft or in more recent years, helicopters associated with the North Sea oil and gas industry (Wessex Archaeology, 2009:68). The majority of military aircraft losses in the post-war years due to training accidents (Wessex Archaeology, 2009: 66). Aircraft training is known to have occurred from RAF Valley from the 1950s, whereby Naval pilots were trained to fly jet aircraft (http://www.raf.mod.uk/rafvalley/aboutus/stationhistory.cfm). The Station continued in its role as a Flying Training School and base for Search and Rescue operations until the late 1970s. As a Master Diversion Airfield, RAF Valley and its relief landing ground at Mona received many aircraft as a result of bad weather or unserviceability, placing it amongst the busiest airfields in the UK in 1980 (http://www.raf.mod.uk/rafvalley/aboutus/stationhistory.cfm). As such, there is likely to have been a considerable amount of aircraft activity over the Irish Sea during the modern period. Modern aircraft activity over the Irish Sea also comprised passenger transport, with a service provided between Anglesey Airport and Cardiff airport, twice daily.

5.2.4.2 Potential

Recorded Losses

There is one recorded aircraft loss within the Study Area. The aircraft reportedly lost in the vicinity of the Study Area is that of a Saro London II K6927 aircraft (506968). This London II aircraft was flying from Oban to Calshott, when a deterioration in weather caused the pilot to head to the Holyhead Harbour to find an appropriate place to land. Whilst making an attempt to land the aircraft, the starboard wind tip float touched the water, causing it to crash and sink ten minutes later, with the starboard wings torn off and the hull split open. The crew reportedly survived and were picked up by the harbour motor boat.

The Military Aircraft Crash Site scoping project, undertake by GAT, identified a total of 175 crash sites recorded in Gwynedd (http://www.heneb.co.uk/cadwprojs/cadwreview2011-12/militarycrash2011-12.html), the distribution of which appears to be confined to onshore contexts. This is representative of the density of military aircraft activity in the wider region and further signifies the potential for currently unrecorded aircraft remains to exist within offshore contexts.

Overview of Potential

Although there are no known aircraft crash sites within the Study Area, there is potential for the discovery of previously unknown aircraft material. An overview of aviation archaeological potential is presented in **Table 5.2**.

[15] *http://www.raf.mod.uk/rafvalley/aboutus/stationhistory.cfm*

Table 5.2 Summary of aviation archaeological potential of the Study Area

Period	Key Themes and Summary of Potential
Pre-1939	**Low potential** for material associated with the early development of aircraft. Aircraft of this period may represent early construction techniques (e.g. those constructed of canvas covered wooden frames) or may be associated with the mass-production of fixed wing aircraft in large numbers during WWI. Potential may be associated with patrolling activities undertaken from the Llangefni Airship Station in Mona during WWI.
	Low potential for material associated with the development of civil aviation during the 1920s and 1930s, associated with the expansion of civilian flight from the UK to a number of European and worldwide destinations. Aircraft losses in the Inter war years may have occurred in relation to training operations undertaken from RAF Penrhos.
1939 - 1945	**Moderate to high potential** for WWII aviation remains, particularly in association with the flying convoy patrols of RAF Valley and training operations from RAF Mona. Aircraft of this period are likely to be representative of technological innovations propelled by the necessities of war which extended the reliability and range of aircraft.
Post-1945	**Moderate potential** for aviation remains associated with military activities dominated by the Cold War, the evolution of commercial travel and recreational flying and the intensification of offshore industry (including helicopter remains). Aircraft of this period may be representative of advances in aerospace engineering and the development of the jet engine. Losses in the area may have occurred as a result of training activities or search and rescue operations known to have taken place at RAF Valley during this period.

5.3 Previous Investigations

Numerous investigations of an archaeological and cultural heritage nature are recorded to have taken place within the Study Area. The GAT HER documents 52 event records within the Study Area, summarised in **Table 5.3**. Further details can be found in **Annex 1**. Where relevant and available, the results of previous investigations are included within and referred to in **Section 5.2**.

Table 5.3 Summary of Previous Investigations

Investigation Type	Number of Events	RHDHV IDs	Summary
Building Survey	8	E1-E8	Various building surveys carried out between 2012-2017 in Holyhead in advance of proposed development works (E1, E2 and E4), property renovations/conversions/remedial works (E3, E5 and E6), to inform future conservation plans (E7) and as part of project appraisal reports for a flood risk management appraisal (E8).
Desk-based Assessment	10	E9-E18	Various desk-based assessments undertaken between 1992-2016 for the Holyhead / Anglesey area in advance of proposed development works (E11-E14 and E18) and improvement / regeneration / renewal schemes (E9, E15-E17).
Evaluation	2	E19-E20	Archaeological field evaluations undertaken in Holyhead in 2016 advance of a proposed housing development (E19) and in 2004 at the Hibernia Row Pumping Station (E20).
Excavation	1	E21	An archaeological excavation undertaken at Caer Gybi, Holyhead in 1952 (E21).
Field Observation	1	E22	The Gwynedd Archaeological Trust's Historic Churches Project; site visits undertaken 1996-8 (E22).
Field Survey	1	E23	A coastal erosion survey for the coastline of Anglesey undertaken in 1997 (E23).
Field Visit	5	E24-E28	Field visits undertaken between 1986 and 2006 to the Roman wall surrounding St Cybi's churchyard as part of scheduled ancient monument monitoring (E24-E28).
Heritage Assessment	2	E29-E30	Two studies focusing on First World War Sites in north-west Wales, undertaken 2016-7 (E29-E30).

Investigation Type	Number of Events	RHDHV IDs	Summary
Historic Area Assessment	1	E31	Assessment of the Historic Landscape Character of the north-western half of Holy Island, undertaken in 2012 in advance of proposed development (E31).
Landscape Characterisation	1	E32	LANDMAP aspect area assessment undertaken in 2000 (E32).
Monument Management	1	E33	Holyhead Harbour draft conservation plan (E33), undertaken in 2003.
Photographic record / survey	4	E34-E37	Various photographic records undertaken between 2003-4 prior to demolition(E34) and development works (E35-E36). Also the photographic survey of the grade I listed St Cybi Church, Holyhead (E37) undertaken in 2017.
Project	3	E38-E40	Various thematic/regional projects undertaken between 2002 and 2011, relating to medieval mills on Anglesey (E38), settlement from the Late Bronze Age to the early medieval period in north-west Wales (E39) and an assessment of medieval / post-medieval ecclesiastical sites in north-west wales (E40).
Project record	4	E41-E44	Various project records for thematic studies undertaken between 2002 and 2005, relating to prehistoric funerary and ritual sites in West Gwynedd/Anglesey (E41-E42), intertidal peat in north Wales (E43) and deserted ecclesiastical sites in north-west Wales (E44).
Watching Brief	8	E45-E52	Various archaeological watching briefs undertaken in Holyhead between 1992 and 2017. The watching briefs took place in advance of improvement / replacement works (E45-E46, E48 and E52), extension works (E47) and proposed development works (E49 and E51) as well as in relation to an internal wall in St Cybi's Church, Holyhead (E50).
Total	**52**		

5.4 Cartographic Sources

A historic map regression has been undertaken with a focus on the proposed development footprint and the immediate surrounding area. The map regression exercise shows development in the area to be largely dominated by harbour related infrastructure and associated activity with population expansion

The earliest map consulted was the Anglesey Ordnance Survey (OS) Town Plan of 1888. This OS mapped showed the Pelham Patch Development site as a sub / inter-tidal area, flanked by a jetty ('Fish Jetty') to the south, with a number of cranes and a hydraulic capstan also mapped. To the area west of the Pelham Patch Development site is the Marine Yard, which is mapped as including a timber yard. Many of the buildings recorded within the Marine Yard still stand in the present day (RHDHV 35-38, RHDHV 80-82, refer to Annex 1).

The 1888 OS map depicts small branch lines running to the south and north of the Marine Yard, with the southern line ending in the timber yard and the northern line extending to run across the Salt Island Bridge, alongside the Old Harbour Pier. The line is shown as forking to follow the line of Admiralty Pier to the east and the Salt Island Cottages to the north.

The Inner Harbour is flanked on its eastern and western edge by a mix of workshops and goods sheds, railway lines and associated platforms. Two graving docks are mapped, featuring on the eastern edge of the Inner Harbour and to the south of the Old Harbour, the latter of which is adjacent to a dock yard. Further eastwards, the South Pier is mapped, which is orientated in a north-south direction, from the coastline opposite Admiralty Pier and the Old Harbour Lighthouse.

To the north-west of Salt Island Bridge, the land is largely occupied by terraced housing in the north of Holyhead, with other notable features including the Forge Hill Foundary and the Marine Hotel. This area of dense occupation extends to the south-west (and beyond), with notable features including a town hall, school, bank, market hall and post office. A number of street names depicted on the 1888 OS map are still present today, including (but not confined to) North West Street, George Street, Armenia Street and Water Street. In some instances (e.g. George Street), although they retain their original name, the streets do not always align with their modern-day mapped location. Housing in the north Holyhead area is shown as being largely contained by a large street running in a curved north-westerly direction from Cross Street to Newry-Fawr Street. Although not named on the map, the street aligns with present-day Vicarage Lane. Housing to the north of this street and south of the present-day Prince of Wales Road (depicted on the map but unnamed) is confined to a row of houses either side of Newry-Fawr Street, the Sailors Home and the Coastguard Station. Buildings to the north of the street in the location of present day Prince of Wales Road comprise Beach Yard and New Harbour View. The former Beach Yard is home to the present-day Holyhead Marine Services and Boatyard. To the west of Beach Yard, a lifeboat house is mapped in the 1888 OS map (used in the present day as a restaurant).

The 1888 OS map shows only the southern extent of Salt Island to be subject to development, occupied by harbour related infrastructure (comprising the Harbour Office and Custom House, both of which are still present, with few surviving original features), the Salt Island Cottages and a Dock Yard. Other buildings mapped on the southern extent of Salt Island include Eden House and Admiralty House. To the north of the Salt Island Dock Yard are two hospitals; depicted as the Stanley Sailor's Hospital and the Fever Hospital. These hospitals have since been demolished, with the area occupied by the present day ferry terminal. To the west of Salt Island, within the sub-tidal zone, are two slips, a watch house, a boat house and a bathing place. Mapped features in the northern extent of Salt Island during this period are confined to a disused battery, depicted on the 1889-1890 OS County Series mapping for Anglesey. The Holyhead Breakwater, extending from Soldier's Point to an area north of Salt Island, is visible in the 1889-1890 map, with the Breakwater Lighthouse mapped at its north-eastern most extent. The stone embankment was built in three stages between 1847 to 1873 in response to a growth in shipping in Holyhead.

In the 1888 OS map, the Salt Island Expansion site is shown to be a largely marine environment. To the south of the Salt Island Expansion site, Admiralty Pier is mapped as extending eastwards from the south-eastern corner of Salt Island, with the George IV Arch (still present) mapped at its western extent and the Old Harbour Lighthouse at its eastern extent. Further eastwards of the Old Harbour Lighthouse, a jetty (the 'Mailboat Jetty') is shown, a feature which is no longer present today. The western coast of Salt Island as depicted on the 1888 OS map remains largely unchanged in the present day. The eastern coast has been extended, with much of the former sub and inter-tidal area reclaimed to house the present-day ferry port.

The 1900 OS County Series map for Anglesey shows little notable change in the features and land use discussed above. Notable changes since the 1888 map include the presence of a Meteorological Office at the north of Salt Island and a mapped bathing place in the sub-tidal area to the east of Salt Island. A further change of interest is the change in name of the Admiralty Pier, which is referred to as 'Mail Pier', a name which also appears in the later 1924 OS County Series mapping for Anglesey.

The 1924 OS County Series mapping for Anglesey shows a continued presence of many of the features outlined above, although an expansion in population is signified by a growth in the number of dwellings mapped. Notable changes in comparison to earlier maps include the relocation of the Meteorological Office further southwards on Salt Island and the appearance of the Anemometer Huts, in the former location of the Meteorological Office at the northern extent of Salt Island. The former Fever Hospital, previously north of the Salt Island Dock Yard, is no longer mapped individually, and appears to comprise part of the Stanley Sailor's Hospital by this time. The former 'Fish Jetty', extending to the south of the Pelham Patch

Development site (south-west of Salt Island Bridge) is also no longer present. New features of interest by this date include a football ground, mapped on the south-eastern side of the Inner Harbour. Holyhead football club is thought to have been established in the later 1800s and is further representative of the population growth in the area.

The OS County Series 1938-53 map for Anglesey shows a number of changes to earlier maps for the area. Although Admiralty Pier continues to be shown as 'Mail Pier', the former Mail Jetty, previously mapped as extending eastwards from the Old Harbour Lighthouse, is no longer present. However, the beacon which featured on the end of the former jetty appears to have been retained and is mapped. To the north-west of Old Harbour Pier, the street extending in a north-westerly direction towards Beach Road (aligning with the present-day Prince of Wales Road) is for the first time, named as Ffordd Mor. On Salt Island, a lifeboat station is mapped to the north-west of the island.

In the 1968-9 OS Plan, the former Admiralty Pier is renamed once again, shown as 'Car Ferry Pier', indicative of its change in use by this period. A car ferry terminal is also shown to the south-west of the George IV Arch on this map. The road, formerly referred to as Ffordd Mor, is by this period, shown by its present-day name; the Prince of Wales Road, with the land to the immediate south-west (to the north-east of Vicarage Lane) showing signs of development expansion, with several new dwellings mapped. Conversely, many of the former dwellings to the north-east of North West Road (on Stanley Row and Horthsach Row) are no longer present. The railway lines which formerly extended across Salt Island Bridge to Salt Island are no longer mapped, with the terminus now appearing to the east of Cross Street in Holyhead. To the south / south-east of the Old and Inner Harbour, the former graving docks are labelled as dry Dock No. 1 and Dry Dock No. 2. A cement works is mapped for the first time during this period, to the south of Old Harbour (west of South Pier).

In the 1971-1979 OS Plan, a notable change is the presence of the Salt Island breakwater, extending in a north-north-easterly direction from the north of the island. Admiralty Pier continues to be shown as Car Ferry Pier during this period. The beacon to the east of the pier is no longer mapped. The football ground to the south-east of the Inner Harbour is also no longer present and is instead occupied by a freightliner depot.

5.5 Historic Landscape Character

The Study Area is located within an area that has not yet been subject to a Historic Landscape Characterisation. The Study Area is, however, located within the LANDMAP Aspect Area for Holyhead (Aspect Area Code YNSMNHL030), the boundary of which has been drawn to coincide with the extent of the principal settlement and associated port infrastructure. The Holyhead Aspect Area is classified as a built environment dominated by nucleated settlement, with other historic landscape patterns also identified; characterised by irregular fieldscapes, reclaimed land, non-nucleated settlement, processing / manufacturing and communications.

Archaeological interest in Holyhead is indicated by buried-dry, relict-stone monuments, buildings and structures, documentary evidence, industrial archaeology and associations. Although the post-medieval period dominates the archaeological record for Holyhead, other periods are well represented in the area, including prehistoric, Roman, industrial (post-medieval / 19th century) and the modern period.

The LANDMAP assessment characterised a remarkable feature of the present Holyhead townscape as '*its blend of 18th-19th century and the stridently new*' which it describes as being '*true of the town itself, of the railway station and of the harbour. The two periods do not always sit well together in visual terms*'.

The overall historic evaluation of Holyhead is that it is an outstanding area of national value, '*as an historic port landscape associated with John Rennie and Thomas Telford and the route between Dublin and London*

and as an historic urban area with Roman antecedents'. The visual relationship of the town, church, railway, port and historic landscape elements further justify this evaluation. The condition of Holyhead as an Aspect Area is described as '*fair*', with much of the town looking the same despite various regeneration proposals and initiatives. This is largely due to an increased understanding of the historic port environment, with '*structures safeguarded as a consequence*'.

The survival of historical features within Holyhead is regarded by LANDMAP as outstanding, with heritage assets from the Roman period onwards, comprising many historical structures within the town, railway and port. The area is one of outstanding rarity, with the breakwater regarded as being one of very few similar structures in the UK.

As part of the LANDMAP assessment, management recommendations relevant to future development within the Holyhead Aspect Area were determined. The principle recommendation was that development should be based on the '*appropriate amelioration of the historic environment in a way that respect's the town's historic character*'.

5.6 Historic Seascape Character

Seascape can be defined as 'an area of sea, coastline and land, as perceived by people, whose character results from the actions and interactions of land and sea, by natural and/or human factors' (Briggs and White, 2009). The importance of Welsh seascapes and their sensitivity, particularly towards marine development, is well recognised. The Anglesey Area of Natural Beauty Management Plan 2015-2020 (IACC, 2015) identifies the importance of seascapes as a highly valued part of the Welsh scenery that are some of the last 'wild' landscape areas and support a wealth of natural heritage.

The *Sensitivity of Welsh Seascapes to Offshore Developments* project (Briggs and White, 2009) characterised seascapes around Wales (focusing on the visual or scenic aspects of the coastline within geological, land use, historic and cultural contexts), with a view to facilitating the decision-making process surrounding development proposals, protection and conservation. This was further built upon as part of the National Seascapes Assessment for Wales, commissioned by the NRW on behalf of the Welsh Government to inform the development of the Welsh National Marine Plan. The National Seascapes Assessment for Wales identified 29 national Marine Character Areas (MCAs), with key characteristics of each MCA described as individual MCA profiles.

The Study Area is within MCA 7 Holyhead Bay and the Skerries. MCA 7 is regarded as an area of cultural contrasts, with some remote coastlines (e.g. Carmel Head) to the bustling harbour and marine at Holyhead. The MCA is recognised as a key historic gateway and trading route between the UK and Ireland, with ferry services retaining important links across the Irish Sea to Ireland. The lighthouse of Admiralty Pier is a notable historic landmark within this MCA, reinforcing Holyhead's maritime history and a representative day marker in the area.

Due to the strategic position of the bay, its challenging marine environment and the natural resources it offers, a diverse range of coastal and marine activities have shaped the seascape over the centuries, with the marina supporting several sea-based recreational activities, such as sailing, boating, sea canoeing / kayaking, diving, surfing, fishing and tourist boat trips. The National Seascapes Assessment for Wales recognises that, combined with linked modern developments and shoreline facilities, the marina generates a significant influence on the local seascape, prominent in views from the sea when entering the harbour.

The Anglesey Seascape Character Assessment (Fiona Fyfe Associates *et al*., 2013) further divides the area into Seascape Character Types (SCTs) that are areas of recognisable character that occur across the

assessment area, and Seascape Character Areas (SCAs) that are geographically distinct areas with a unique sense of place, and comprise different combinations of SCTs (*ibid*.).

The seascape relevant to the proposed scheme is SCA 11 Holyhead, which is summarised as follows:

This SCA is characterised by its relatively high level of development (in the Holyhead and Valley areas) and the influence of Holyhead Port. It has many centuries of maritime history, the earliest evidence of which is a Roman fort. Today, views of the port are dominated by the long breakwaters, large ships (including the Dublin and Dun Laoghaire ferries), cranes, walkways, and many colours and sizes of smaller craft. It is a settled and busy environment, and at night its coloured lights become apparent. Holyhead mountain rises above the town, forming a backdrop and setting. Its rocky profile and wild, heather-covered appearance contrasts with the built structures of the town and port below. The chimney of the aluminium smelter is a prominent local landmark (Fiona Fyfe Associates *et al*., 2013).

Key characteristics relevant to the historic seascape character of the area can be summarised as follows:

- Numerous onshore historic and cultural features reflecting the area's long history of transport, defence and trade. The chimney of the aluminium works is a prominent local landmark;
- Offshore historic and cultural features associated with development of the port, harbour and marina, including breakwaters, lighthouses, beacons and other infrastructure; and
- Seascape setting strongly influenced by harbour infrastructure (breakwaters, navigation lights etc) and shipping. Skerries visible in the distance on northern horizon.

Changes occurring in the area with the potential to affect the special quality of archaeology and history (including historic parks and gardens) were identified, comprising:

- Natural processes / climate change;
- Visitor pressure;
- Marine use - commercial and fishing;
- Development pressure/ transport routes; and
- Land management changes.

In summary, the ongoing development of Holyhead Port and expansion of the town was recognised as being a fundamental force for change in the SCA. However, although the character of the historic harbour and associated buildings and transport routes were recognised as a factor which makes the Holyhead SCA more sensitive, this is counteracted by the presence of existing development and port infrastructure, including the breakwaters.

6 Settings Assessment

6.1 Approach

As set out in section 3.3 above, the settings assessment presented in this ADBA addresses Steps 1 and 2 of Cadw's guidance on the Setting of Historic Assets in Wales (Cadw, 2017), as follows:

- Step 1: Identify the historic assets that might be affected by a proposed change or development.

- Step 2: Define and analyse the settings to understand how they contribute to the significance of the historic assets and, in particular, the ways in which the assets are understood, appreciated and experienced.

In order to identify the heritage assets with potential to be affected by the proposed development, baseline data for heritage assets within the Study Area was subject to a two-stage filtering process to produce a short-list of assets considered to warrant further consideration in the ES (i.e. to address Steps 3 and 4 of Cadw's guidance).

The first filter identifies parts of the Study Area in which material changes to the setting of heritage assets may occur due to the presence of the proposed scheme. Having established which areas of the Study Area are vulnerable to change, those heritage assets whose setting might be affected by the proposed scheme can be taken forward for further consideration. An initial draft Zone of Theoretical Visibility (ZTV)[16] produced as part of the landscape and visual assessment was reviewed against baseline data to identify assets with likely visibility of the proposed scheme (see **Figure 6.1**). The ZTV was based on the proposed main shed building ridgelines on the Salt Island Expansion site at 11.5m and on the Pelham Patch Development site at 12m high above a finished floor level of 6.95aOD. The Digital Terrain Model used in the ZTV analysis includes building and woodland heights modelled at 10m above ground level. The proposed permanent visible structures will be limited to a series of sheds (approximately 12m above ground level), cranes and lighting masts, which are not anticipated to be significant in more distant views. Given the height and nature of the development, it is therefore assumed that significant visual impacts, should they occur, would likely do so within very close range of the development (anticipated to be less than 500m). There is unlikely to be anything of note from a visual perspective beyond 1km. Heritage assets beyond these parameters were nonetheless scoped into the assessment where considered sensitive to the proposed scheme (e.g. due to their siting and height) due to potential visibility of the proposed scheme.

The second filter addresses all heritage assets considered to be potentially sensitive to the proposed scheme arising as a result of a material change to their setting. This step identifies the contribution setting makes to the significance of the heritage assets in question, which subsequently informs consideration of whether there is potential for material harm to occur as a result of the proposed scheme. Data was based on existing records as held by Cadw, the GAT HER and the NMRW and was further informed by heritage-specific site visits to better understand the contribution that setting makes to the heritage assets in question. A number of key and highly designated heritage assets were also subject to a landscape and visual site visit in order for the views from the heritage assets towards the proposed scheme to be visually represented as part of the assessment.

[16] *The initial draft ZTV (dated 16-08-2018) was produced by Estell Warren Landscape Architecture prior to the finalisation of the refined Project Description. Updated landscape and visual assessment tool-kits, based on the finalised scheme design, will be subject to further scrutiny and consideration as part of the ES.*

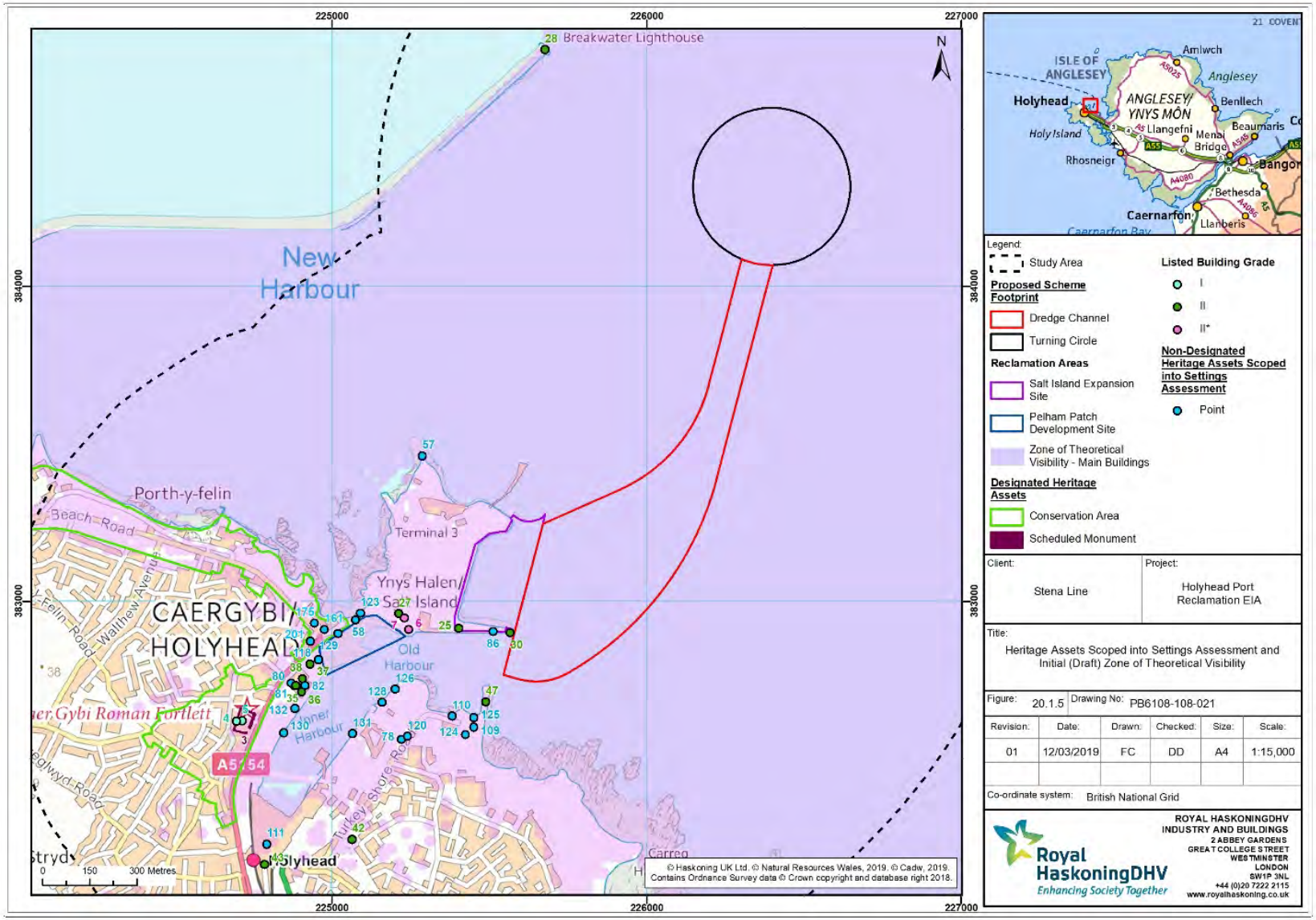

Figure 6.1 Heritage Assets Scoped into Settings Assessment and Initial (Draft) Zone of Theoretical Visibility

6.2 Heritage assets scoped into the settings assessment

6.2.1 Designated heritage assets

Based on the application of the first filter outlined above (i.e. consideration of the ZTV against known baseline data), a total of 15 designated heritage assets are considered to be subject to a potential change in their settings as a result of the proposed scheme. These are summarised in **Table 6.1**, grouped accordingly to a particular location or theme (Groups 1-6) and discussed in further detail below.

Table 6.1 Designated heritage assets subject to a potential change in their settings as a result of the proposed scheme

RHDHV ID	Name	Designation Status
1	Holyhead Beach	Conservation Area
2	Holyhead Central	Conservation Area
3	Roman Fort (Caer Gybi)	Scheduled Monument
4	Walls of Upper Churchyard, Market Square	Grade I Listed Building
5	St. Cybi's Church	Grade I Listed Building
6	George IV Arch, Salt Island	Grade II* Listed Building
7	Harbour Office, Salt Island	Grade II* Listed Building
25	Admiralty Pier (including sea wall between salt island bridge and George IV Arch), Salt Island	Grade II Listed Building
27	Customs house, Salt Island	Grade II Listed Building
28	Lighthouse on Holyhead Breakwater	Grade II Listed Building
30	Lighthouse on Admiralty Pier	Grade II Listed Building
35	Fitting, Boiler and Smithy Shops, at Marine Yard, Holyhead Docks, Victoria Road (SE Side)	Grade II Listed Building
36	Office and Stores Building, Victoria Road (SE Side)	Grade II Listed Building
37	Sailmakers, seamstresses and polishers workshops, Victoria Road (SE side)	Grade II Listed Building
38	Stores, Old Boiler Shop and Sawmill Buildings at Marine Yard, Victoria Road (SE Side)	Grade II Listed Building
42	Skinner Monument, Turkey Shore Road (SE Side)	Grade II Listed Building
43	Clock Turret in Station Approach, London Road	Grade II Listed Building
47	South Pier, Turkey Shore Road	Grade II Listed Building

6.2.2 Non-designated heritage assets

Based on the application of the first filter outlined above (i.e. consideration of the ZTV against known baseline data), a total of 24 non-designated heritage assets have been identified within locations where there is potential for a change in setting due to the proposed scheme, as summarised in **Table 6.2** below. These are also grouped by theme or location (Groups 1-6) alongside the designated heritage assets and discussed in further detail below.

Table 6.2 Non-Designated heritage assets subject to a potential change in their settings as a result of the proposed scheme

RHDHV ID	Name	Period
57	Breakwater, Salt Island	Post-medieval
58	Bridge, Salt Island	Post-medieval
78	Accumulator House, Holyhead	Post-medieval
80	Foundry, Holyhead Harbour Marine Workshops	Post-medieval
81	Erecting Shop, Holyhead Harbour Marine Workshops	Post-medieval
82	Engine House, Holyhead Harbour Marine Workshops	Post-medieval
86	Storehouse, Admiralty Pier	Post-medieval
109	Graving Dock, Holyhead Harbour	Post-medieval
110	Harbour, W of South Pier	Post-medieval
111	Inner Harbour Walls	Post-medieval
118	Pelham Quay	Post-medieval
120	Turkeyshore Road	Post-medieval
123	Viaduct, Remains of, N of Salt Island Bridge	Post-medieval
124	Curtain Wall, Telford's Dock	Post-medieval
125	Dock Wall, W of South Pier	Post-medieval
126	Public Quay and Quay Walls, Parry's Island	Post-medieval
128	Quay Walls, Parry's Island	Post-medieval
129	Quay Wall, S of Salt Island	Post-medieval
130	Quayside, S of Pelham Quay	Post-medieval
131	Quayside, S of Parry's Island	Post-medieval
132	Wall, Marine Yard	Post-medieval
161	Fair View, Holyhead	19th Century
175	North West Street, Holyhead	19th Century
201	Hibernia Terrace, Holyhead	19th Century

Within the scoping opinion it was considered that the proposed scheme has the potential to result in a significant adverse impact upon the Telford Graving Dock (RHDHV 108); a non-designated heritage asset considered to represent a monument of national importance. The Scoping Opinion was prepared at such a time that a reclamation area was under consideration to the west of South Pier. This reclamation area has not been brought forward for consideration into the ES. Due to the refinement of the proposed scheme (with only two reclamation areas now under consideration), the heritage site visits and ZTVs generated for the project indicate that the remaining two reclamation areas are unlikely to be visible from the Telford Graving Dock. As such, this asset is not included within the settings assessment.

6.2.3 Heritage site visit results and assessment of setting

6.2.3.1 Group 1

- Roman Fort (Caer Gybi) (RHDHV 3)
- Walls of Upper Churchyard, Market Square (RHDHV 4)

- St. Cybi's Church (RHDHV 5)
- Holyhead Central Conservation Area (RHDHV 2)

Figure 6.2 View towards the proposed scheme (north-east) from the grounds of St. Cybi's Church (RHDHV 5)

These heritage assets are located within close proximity to one another. The remains of the Roman Fort are subject to statutory protection as a Scheduled monument, with the walls also subject to Grade I listing as an outstanding structure from the late Roman period. As a coastal fort, the remains of Caer Gybi have an intrinsic relationship with the sea. The location of the fort allowed for far reaching views across Holyhead port and the surrounding waters, so that hostile vessels approaching the land could be identified. On this basis, the setting of the asset undoubtedly contributes towards its heritage significance.

St Cybi's Church is located within the walls of the Roman fort in a position overlooking the inner harbour. The church has been designated as an outstanding late medieval church in North Wales. For the most part the architectural qualities of the church are predominantly considered to contribute towards its significance, as is its group value with Caer Gybi. The setting of the church in relation to Caer Gybi thereby contributes towards its heritage significance.

The Holyhead Central Conservation Area was originally concentrated around the old Roman Fort of St Cybi, although the area was extended to include the core of the 19th century expansion of the town. The majority of the area was developed in a period of rapid expansion of the town in the mid 19th Century and has a uniformity and integrity of character and scale. Whilst several of the buildings are individually listed it is the

overall streetscape that makes the major contribution to the qualities of the area and therefore is considered worthy of protection and enhancement.

The heritage site visit confirmed the majority of the Holyhead Central Conservation Area to be masked from the port itself and any associated development. Although centred around the Roman Fort, the area has a strong 19th Century character, which is in part detracted from due to the presence of modern development in the area. Although the setting of the Conservation Area undoubtedly contributes towards its significance, the setting is considered to be fairly well contained within the existing development of the town itself. Despite this, the setting of the Conservation Area is considered to include a number of fine views, deemed worthy of protection. Of those views identified, one noteworthy outward view is that of St. Cybi's churchyard, across Victoria Road to the infrastructure of the port and the Inner Harbour beyond. As important views within the Conservation Area are considered to be important to the overall character of the area, it therefore follows that any changes to this view, however small, warrant further consideration.

The proposed scheme may alter the setting of the heritage assets outlined above, subsequently potentially affecting the appreciation of their heritage significance. On this basis, the heritage assets listed above merit further consideration within the ES.

6.2.3.2 Group 2

- George IV Arch (RHDHV 6)
- Harbour Office (RHDHV 7)
- Admiralty Pier (including sea wall between salt island bridge and George IV Arch) (RHDHV 25)
- Customs House (RHDHV 27)
- Lighthouse on Admiralty Pier (RHDHV 30)
- Storehouse, Admiralty Pier (RHDHV 86)

Figure 6.3 View eastwards, showing the George IV Arch (RHDHV 6) in the foreground towards the Admiralty Pier (RHDHV 25), showing the Lighthouse on Admiralty Pier (RHDHV 30) in the distance.

The heritage assets categorised as 'Group 2' were each constructed in response to the 1810 Act of Parliament which included the much-needed improvement to the harbour at Holyhead. In the early 19th century, Holyhead become established as the principal port for communication with Ireland and was the station for the Post Office steam packets. The harbour improvement scheme (with the exception of the George IV Arch designed by Thomas Harrison) was designed by renowned engineer John Rennie, who specialised in the design of bridges and harbours.

As individual heritage assets, the immediate setting of the heritage assets outlined above are considered to be fairly tight and localised, with a number of factors distracting from an appreciation of their setting in the form of port noise and traffic. The significance of these heritage assets is however, in part, contributed by their integral group value as part of this important 1820s harbour scheme. The heritage site visit confirmed the presence of good visual links between these assets, allowing their age, association and historical character within the current port setting to be well appreciated. In the current port scheme design, the site visit did however identify that these visual links are frequently blocked by the high concentration of HGVs in the port vicinity. Modern development within the port of unsympathetic design (particularly the former passenger terminal / waiting area which exists as a corrugated building at the beginning of the Admiralty Pier) further restricts these interlinking views, thereby challenging an appreciation of the significance of these assets within the current baseline environment.

Figure 6.4 View from the of the Harbour Office (RHDHV 7), looking eastwards towards the Lighthouse on Admiralty Pier (RHDHV 30)

Figure 6.5 View to the north-west, showing the George IV Arch (RHDHV 6)

Due to the siting and visual relationship between these assets, it is considered that their setting is a notable contributing factor towards their significance. Given their location, the proposed scheme will form a notable part of the setting of the assets identified above. This is particularly the case with the Admiralty Pier (RHDHV 25), the setting of which will be significantly altered by the proposed reclamation of the Salt Island Expansion site which will results in the asset no longer forming a pier-like structure. Similarly, the setting of the Admiralty Pier Lighthouse (RHDHV 30) will no longer feature as an isolated feature on the end of the pier, which will instead be incorporated into the wider port landscape as a result of the neighbouring reclamation area.

Figure 6.6 View from the George IV Arch (RHDHV 6), NNE towards the Harbour Office (RHDHV 7) and Customs House (RHDHV 27)

Figure 6.7 View of the Admiralty Pier (RHDHV 25) and lighthouse (RHDHV 30) looking east

On this basis, the heritage assets listed above merit further consideration within the ES. It is, however, noteworthy that the heritage significance of some of the assets listed above is not only confined their group value and setting but is also contributed to by other factors that are integral and individual to the assets in question.

6.2.3.3 Group 3

- South Pier, Turkey Shore Road (RHDHV 47)
- Graving Dock, Holyhead Harbour (RHDHV 109)
- Harbour, West of South Pier (RHDHV 110)
- Curtain Wall, Telford's Dock (RHDHV 124)
- Dock Wall, West of South Pier (RHDHV 125)
- Accumulator House (RHDHV 78)
- Turkeyshore Road (RHDHV 120)
- Public Quay and Quay Walls, Parry's Island (RHDHV 126)
- Quay Walls, Parry's Island (RHDHV 128)
- Quayside, South of Parry's Island (RHDHV 131)

These heritage assets are located on or within the vicinity of the shoreline opposite to (south / south-west of) the Admiralty Pier (RHDHV 25). Of the assets listed above, only one is currently designated (South Pier RHDHV 47). The South Pier is a masonry pier which projects *c.* 100m northwards from the shoreline opposite the Admiralty Pier (see **Annex 2**, Panorama 2). It has been designated as both an integral part of the 19th Century harbour scheme designed by Rennie and also due to its group value in association with the Admiralty Pier. The location of the pier and associated non-designated heritage assets was visited as part of the heritage site visits.

Figure 6.8 View north-east, from the end of South Pier (RHDHV 47) towards the Admiralty Pier (RHDHV 25) and lighthouse (RHDHV 30)

Figure 6.9 Views from the Harbour, West of South Pier (RHDHV 110) looking north towards Salt Island

The setting of the South Pier was recognised as being characterised as a relatively quiet area, affording good views of the Admiralty Pier. The non-designated harbour to the west of South Pier (RHDHV 110) was similarly tranquil, used in the present day by small fishing boats. Given the views of Admiralty Pier from these locations, the setting of these assets may be altered by the proposed scheme. They are therefore considered to warrant further consideration in the ES.

The Graving Dock (RHDHV 109) was identified as no longer extant, fenced off and full of debris. The Curtain Wall (RHDHV 124) was confirmed as still visible, although it is largely masked by surrounding modern development. Access was not possible to the location of the Accumulator House (RHDHV 78), which appears to be largely concealed by rubble and debris. The setting of these heritage assets is not considered to contribute towards their significance. They are therefore not taken forward for further consideration in the ES.

The Public Quay (RHDHV 126) (including associated assets RHDHV 128 and 131) is currently in use by fishing boats. The quay is adjacent to a long stay car park with far reaching views towards Salt Island possible. The proposed scheme will alter the setting of the quay with the construction and operation of the Pelham Patch Development site. However, the setting of the quay is not considered to contribute towards its significance in any notable way. As such, the proposed scheme is not anticipated to harm the significance of these assets. They are therefore not taken forward for further consideration in the ES.

The immediate setting of Turkeyshore Road (RHDHV 120) is well contained, with the road being largely enclosed by the port boundary wall. The proposed scheme is not anticipated to alter the setting of the road. It is therefore not taken forward for further consideration in the ES.

6.2.3.4 Group 4

- Fitting, Boiler and Smithy Shops, at Marine Yard, Holyhead Docks, Victoria Road (RHDHV 35)
- Office and Stores Building, Victoria Road (RHDHV 36)
- Sailmakers, seamstresses and polishers workshops, Victoria Road (RHDHV 37)
- Stores, Old Boiler Shop and Sawmill Buildings at Marine Yard, Victoria Road (RHDHV 38)
- Foundry, Holyhead Harbour Marine Workshops (RHDHV 80)
- Erecting Shop, Holyhead Harbour Marine Workshops (RHDHV 81)
- Engine House, Holyhead Harbour Marine Workshops (RHDHV 82)
- Wall, Marine Yard, Holyhead (RHDHV 132)
- Pelham Quay, Holyhead Harbour (RHDHV 118)
- Quayside, South of Pelham Quay (RHDHV 130)
- Quay Wall, South of Salt Island (RHDHV 129)

The heritage assets categorised as ‘Group 4’ represent part of a large quayside development comprising a group of marine workshop buildings built in the 19th Century. The heritage significance of these assets is in part, contributed by their siting and group value as a (probably) unique group of purpose-built marine service buildings at a major British ferry port. As such, it is considered that their setting is a notable contributing factor towards their significance.

Figure 6.10 View northwards towards the marine workshops

The heritage site visit confirmed these heritage assets (where extant) to be refurbished to a high standard, with the buildings used in the present day as offices and marine services. As a group of assets, the marine yard workshops were recognised as having a strong presence within their surroundings with a strong sense of 19th Century industry, with their current setting enabling their age, association and historical character to be well appreciated despite modern port activity, traffic and parking (particularly with regards to port-related HGV movements) (see **Annex 2**, Panorama 1). Intervisibility from these heritage assets to those identified within Group 2 was possible, again reinforcing this important link associated with the 19th century development of the port and their group value.

Figure 6.11 View from the marine yard (north-east of the marine workshops), looking north-east across proposed Pelham Patch Development site, towards Salt Island

Figure 6.12 Views of the marine yard looking north

The setting of these assets is considered to contribute towards their significance. Given their location, the proposed scheme has the potential to alter the setting of these assets. On this basis, the heritage assets listed above merit further consideration within the ES.

6.2.3.5 Group 5

- Lighthouse on Holyhead Breakwater (RHDHV 28)
- Breakwater, Salt Island (RHDHV 57)
- Skinner Monument, Turkey Shore Road (RHDHV 42)
- Clock Turret in Station Approach, London Road (RHDHV 42)
- Inner Harbour Walls (RHDHV 111)

The heritage assets categorised as ‘Group 5’ have been grouped not due to their location or character, but as key prominent heritage assets within the area.

The lighthouse on Holyhead Breakwater (RHDHV 28) is located some 1.5km north of the Salt Island Expansion site. Despite this distance, the ZTV indicates a potential for visibility of the proposed scheme from this location (see **Annex 2**, Panorama 3). The Holyhead Breakwater lighthouse was designated on the basis that it forms an important component of the engineering works of the Holyhead Breakwater, and a very good example of a harbour light retaining its original character.

The heritage site visit recognised the Breakwater lighthouse as forming an important historic landmark within the area, along with the non-designated breakwater itself. Although it was not easily accessible, it was noted that the lighthouse could be appreciated from the Holyhead Beach Conservation Area and from various locations across the port itself. The setting of the lighthouse contributes to its heritage significance being located as it is in a prominent position at the end of the breakwater. However, given the distant views from the lighthouse and the breakwater to the proposed scheme, it is considered that although the setting of these assets may be subject to minor alteration, the presence of the scheme itself will not constitute material harm to the setting or the appreciation of the assets. Moreover, significant views of the lighthouse which are considered to contribute most notably to the setting of the asset are those from sea towards the lighthouse itself, which was designed to be seen from offshore, by ships, boats and vessels entering, leaving or passing by the port. These heritage assets are therefore not taken forward for further consideration in the ES.

The Skinner Monument (RHDHV 42) was built in 1834 to commemorate Captain John MacGregor Skinner, a commander of the Holyhead mail packet who drowned in a storm in 1832. The obelisk is located on a rock outcrop overlooking the harbour.

Figure 6.13 Skinner Monument (RHDHV 42)

The heritage site visit recognised this heritage asset as an impressive monument in the area, affording panoramic views of Holyhead including those assets located within the port itself (Group 2) (see **Annex 2**, Panorama 4). Similarly, the monument itself is visible from the majority of heritage assets visited around Holyhead as part of the settings assessment. Despite these far-reaching views, the immediate setting of the monument is tightly contained, with residential housing located directly adjacent to it. Access to the

monument is off Turkeyshore Road, although the footpath is poorly maintained and rarely used. A public information board allows an understanding of the monument's purpose.

Figure 6.14 Views looking north towards the harbour from Skinner Monument (RHDHV 42)

Given that this heritage asset was sited purposefully to overlook the harbour, its setting is considered to contribute towards its significance. As the proposed scheme has the potential to alter this setting, it merits further consideration within the ES

The clock turret in Station Approach (RHDHV 42) was unveiled on the 17th June 1878 by Albert Edward, Prince of Wales to mark completion of old harbour extension. The turret formerly stood some 50m to the north between the former Station Hotel and the dockside.

The heritage site visit to the clock turret identified the asset to be located in the centre of the Stena Line office car park. Views towards the port were not possible from the location of this asset. As such, the proposed scheme is not considered to alter the setting of the asset, with no potential impact upon its significance. This heritage asset is therefore not taken forward for further consideration in the ES.

Figure 6.15 The clock turret in Station Approach (RHDHV 42)

The inner harbour walls (RHDHV 111) is a non-designated heritage asset. The site visit confirmed no views to the port from the location of the inner harbour walls and thereby no potential for the proposed scheme to alter its setting. This heritage asset is therefore not taken forward for further consideration in the ES.

The Breakwater, Salt Island (RHDHV 57) (and any remains thereof) was not accessible during the site visit. However, due to the original siting of this asset, views towards the direction of the Salt Island Expansion area are predominantly occupied by the existing ferry port. As such, the setting of this asset is considered unlikely to be altered in such a way so as to harm the asset or an appreciation of its significance. This heritage asset is therefore not taken forward for further consideration in the ES.

6.2.3.6 Group 6

- Bridge, Salt Island (RHDHV 58)
- Viaduct, Remains of, North of Salt Island Bridge (RHDHV 123)
- North West Street, Holyhead (RHDHV 175)
- Hibernia Terrace, Holyhead (RHDHV 201)
- Fair View, Holyhead (RHDHV 161)
- Holyhead Beach Conservation Area (RHDHV 1)

As part of Rennie's original plan, a swing bridge was designed to connect Salt Island to Holyhead. The swing bridge is not extant, with the present day bridge comprising a single span concrete modern bridge. The bridge and the viaduct were viewed as part of the settings assessment site visit. Although the immediate setting of these assets will alter with the presence of reclamation of the Pelham Patch Development site, given that this area is largely subsumed by modern development, the setting of these assets is not considered to the vulnerable to the proposed scheme in a manner that may constitute harm to their significance. These heritage assets are therefore not taken forward for further consideration in the ES.

Figure 6.16 Views north-east towards Marine Square

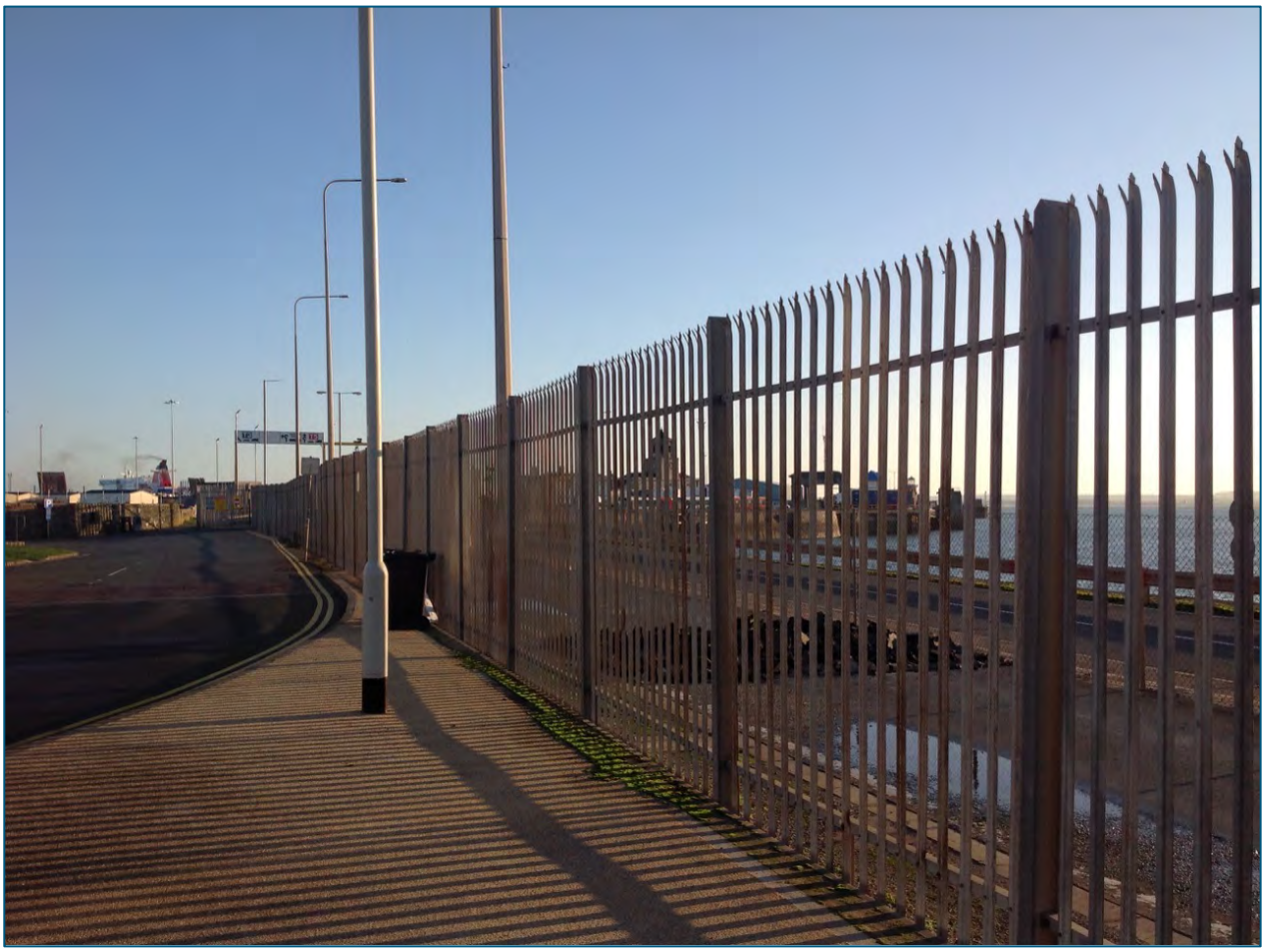

Figure 6.17 View looking north-east down Victoria Road, with Marine Square to the left (not visible) and the current service lane and security fencing to the right (against which the Pelham Patch Development area is proposed)

Views of the proposed scheme will be possible from Hibernia Terrace, Fair View and North West Street (see **Annex 2**, Panorama 5). The immediate setting of these roads and the buildings within them is tightly confined to their grouping, with further views afforded to various heritage designated assets within the port itself. Although the setting of these assets will be altered by the proposed scheme, this setting it not considered to contribute to the appreciation of the significance of these assets to any notable degree. As such, the proposed scheme is not considered to constitute harm to the individual heritage significance of these assets, and they are therefore not taken forward individually for further consideration in the ES. Any changes to the views from these locations are considered as representing a landscape and visual amenity issue rather than a heritage consideration. However, the contribution of the terraces (which form 18th Century Marine Square) to the overall character of the area are captured with respect to consideration of the Holyhead Beach Conservation Area (RHDHV 1) which is taken forward for further consideration in the ES (see discussion below).

The Holyhead Beach Conservation Area covers the area from Salt Island Bridge, with its southern boundary running westwards for approximately a mile until it reaches Soldier's Point before turning back eastwards. The Conservation Area has been designated on the basis that it encapsulates a unique character and history of the imposing buildings and rugged landscape to the west, the vast public open space to the centre, and the more urban 19th Century development to the east. All aspects of the conservation area are considered worthy of protection and enhancement.

The Conservation Area is sub-divided into sub-areas within the Conservation Area character appraisal. Sub-area three is to the east and is the most relevant with respect to the proposed scheme. Sub-Area 3 is predominantly urban in character and appearances (in contrast to the remainder of the Conservation area), with terraces of two and three-storey buildings, a number of which forming the hard landscapes 18th century Marine Square. It is noted in the character appraisal that any proposal should take into consideration the existing; character, setting, views and style.

The heritage site visit confirmed there to be no significant views towards the port from the majority of the Holyhead Beach Conservation Area (Sub-Areas 1, 2 and large extents of Sub-Area 3). The beach area retains a quiet, tranquil Victorian seaside feel, which is not anticipated to be challenged by the proposed scheme. Current light fittings are sympathetic in design, furthering this feel. The area also affords a nice view to the Holyhead Breakwater and lighthouse.

However, of the important views both from and towards the Conservation area, one is regarded as being on the easterly edge of the Conservation area, by Marine Square towards the Inner Harbour. Current views from this location are towards the Victoria Road, which is bordered by a metal fence, beyond which is the service road which provides access to Salt Island and ultimately the sub-tidal Pelham Patch Development site. As such, the reclamation of the Pelham Patch Development site will undoubtedly alter these views, which are considered noteworthy with respect to the Conservation area, the Holyhead Beach Conservation Area (RHDHV 1) is therefore taken forward for further consideration in the ES.

7 Summary of Heritage Assets and their Heritage Importance

7.1 Onshore Heritage Assets

7.1.1 Designated Heritage Assets

The 48 designated heritage assets within the onshore extent of the Study Area. Of those assets considered, 47 are of perceived National importance and are thereby considered to be of high heritage importance, in line with criteria outlined in **Table 3.1**. The Admiralty Pier (RHDHV 25) has been identified as being of international significance as the most intact and architecturally and historically interesting parts of the early 19th Century harbour and is therefore considered of very high heritage importance in line with criteria outlined in **Table 3.1**.

7.1.2 Non-designated Heritage Assets

The majority of non-designated heritage assets recorded within the Study Area are of perceived local importance and are therefore considered as heritage assets of low heritage importance. Exceptions to this are heritage assets representative of port facilities and associated infrastructure that relate to the harbour improvement scheme in the 19th Century. The harbour improvements by Rennie and Telford were initiated to improve the route between Dublin and London in the 19th Century and can therefore be of perceived regional and perhaps even National importance on the basis of their group value, thereby equating to a medium to high heritage importance, in line with criteria outlined in **Table 3.1**. Heritage assets of relevance include the former Salt Island swing bridge (RHDHV 58), the former site of the Black Bridge (RHDHV 59) and the Black Bridge (RHDHV 60), the Telford Graving Dock Engine House (RHDHV 79), the LNWR Graving Dock (RHDHV 107), the Telford Graving Dock (RHDHV 108), the Graving Dock, Holyhead Harbour (RHDHV 109), the Storehouse, Admiralty Pier (RHDHV 86) and the curtain wall around Telford's dock (RHDHV 124).

7.2 Marine and Intertidal Heritage Assets

7.2.1 Wrecks and Obstructions

The full character and extent of the archaeological remains of the six named wrecks within the Study Area (RHDHV 229-234) is unknown. However, based on available data, they appear to represent assets of perceived local importance and are thereby assigned a low heritage importance, in line with criteria outlined in **Table 3.1**. The charted obstruction recorded as an anchor (RHDHV 247) is also considered to be of low heritage significance. All remaining charted wrecks and obstructions within the Study Area are currently unidentified and / or of unknown origin. On this basis, they are considered to have an uncertain heritage significance. Where uncertainty occurs, the precautionary approach is to assign high importance as part of the EIA process. This precautionary approach represents good practice in archaeological impact assessment and reduces the potential for impacts to be under-estimated.

The heritage importance of an asset can be amended or revised as more information comes to light. The charted wreck and obstruction locations have been reviewed as part of an archaeological assessment of geophysical survey data undertaken for the project, the results of which are reported on as part of the ES. The corroboration of the charted data and geophysical survey data may, therefore, supersede the heritage significance assigned above in the ES.

7.3 Potential Heritage Assets

For the purposes of assessment, the importance of potential discoveries has been defined as high importance for *in situ* sites and finds and medium importance for isolated finds within secondary contexts. However, each individual discovery would be considered independently and any requirements for further data gathering or analysis would be considered on a case-by-case basis according to the importance of the discovery.

7.3.1 Summary of Heritage Importance

The heritage significance (importance) of the heritage assets are summarised in **Table 7.1**.

Table 7.1 Summary of heritage significance

Asset Type	Definition		Importance
Onshore heritage assets	Admiralty Pier (RHDHV 25)		Very High
	Remaining designated heritage assets		High
	Non-designated heritage assets	Assets representative of port facilities and associated infrastructure that relate to the harbour improvement scheme in the 19th Century: former Salt Island swing bridge (RHDHV 58), the former site of the Black Bridge (RHDHV 59) and the Black Bridge (RHDHV 60), the Telford Graving Dock Engine House (RHDHV 79), the LNWR Graving Dock (RHDHV 107), the Telford Graving Dock (RHDHV 108), the Graving Dock, Holyhead Harbour (RHDHV 109), the storehouse, Admiralty Pier (RHDHV 86) and the curtain wall around Telford's dock (RHDHV 124).	Medium - High
		Remaining non-designated heritage assets of perceived local importance	Low
	Potential in situ heritage assets	Primary context features and associated artefacts	High
	Potential derived finds	Isolated discoveries of archaeological material discovered within secondary contexts	Medium

Asset Type	Definition		Importance
Potential *in situ* prehistoric sites	Primary context features and associated artefacts and their physical setting (if/where present)		High
	Known submerged prehistoric sites and landscape features with the demonstrable potential to include artefactual material		High
Potential submerged landscape features	Other known submerged palaeolandscape features and deposits likely to date to periods of prehistoric archaeological interest with the potential to contain in situ material		High
Potential derived Prehistoric finds	Isolated discoveries of prehistoric archaeological material discovered within secondary contexts		Medium
Potential palaeoenvironmental evidence	Isolated examples of palaeoenvironmental material		Low
	Palaeoenvironmental material associated with specific palaeolandscape features or archaeological material		High
Known maritime heritage assets	Charted named wrecks: *Kirkmichael* (RHDHV 229), *Ossea* (RHDHV 230), *Rhyl* (RHDHV 231), *Saint Olaf* (RHDHV 232), *Bidsie and Bell* (RHDHV 233) and HMS *Campina* (RHDHV 234).		Low
	Charted un-named wrecks: RHDHV 235-246		High
	Charted obstructions	Anchor: RHDHV 247	Low
		Obstruction of unknown origin: RHDHV 248	High
Potential wrecks	Wrecks within the study area that are yet to be discovered		High
Potential derived maritime finds	Isolated artefacts lost from a boat or ship or moved from a wreck site		Medium
Potential aircraft	Aircraft within the study area that are yet to be discovered		High
Potential derived aviation finds	Isolated artefacts lost from an aircraft or moved from a crash site		Medium
Potential *in situ* Intertidal / subtidal assets	In situ features which may related to former port-side development and infrastructure		High
Potential derived intertidal finds	Isolated artefacts and findspots dating to all periods which are located within the intertidal zone.		Medium

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Annex 1: Gazetteers

Designated Heritage Assets within the Study Area

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
1	Holyhead Beach, Conservation Area	Multiperiod	Conservation Area			N/A	This area is full of naval tradition which pre-dates the Breakwater buildings that were built during the 19th century. The Breakwater buildings changed the character of the area. One of the area's most notable aspects is Holyhead Mountain. Most of Newry Beach evolved from agricultural land to an enclosed working area established during the construction period of the Great Breakwater. Later after completion of the Breakwater the central area was transformed by the construction of a two tier promenade and landscaping to create a vast green public open space that even today is used for functions. The unique character and history of the imposing buildings and rugged landscape to the west, the vast public open space to the centre, and the more urban 19th century development to the east are all considered worthy of protection and enhancement.		62450
2	Holyhead Central, Conservation Area	Multiperiod	Conservation Area			N/A	Holyhead Central Conservation area was originally designated on 24 June 1971 and concentrated around the old Roman Fort of St Cybi. The area was extended in July 1991 to include the core of the 19th century expansion of the town. The majority of the area was developed in a period of rapid expansion of the town in the mid 19th century and has a uniformity and integrity of character and scale. Whilst several of the buildings are individually listed it is the overall streetscape that makes the major contribution to the qualities of the area and therefore is considered worthy of protection and enhancement.		62453
3	Roman Fort, Remains of, Holyhead	Roman	Scheduled Monument	224710	382620	N/A	Roman wall surrounding St Cybi's Churchyard.	AN031	1762

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
4	WALLS OF UPPER CHURCHYARD, MARKET SQUARE	Roman	Listed Building	224697	382619	I	Between Stanley Street and Victoria Road enclosing St Gybi's Church, and Capel-y-Bedd, entered by gateway from Market Square. Late Roman small coastguard fort. Probably originally consisted of rectangular enclosure with tower at each corner, and, at lower level to E, flanking walls perhaps to quay. Former Roman E wall rebuilt in Medieval period, and again in C19, when lower churchyard was created. Some rebuilding of upper part of NE tower (itself medieval rebuild), possible C17. SE tower rebuilt C19. Scheduled Ancient Monument: A 31. Listed Grade I as outstanding structure from late Roman period. Group value with Parish Church and Capel y Bedd.	5415	66350
5	ST CYBI'S CHURCH	Medieval	Listed Building	224714	382620	I	St Cybi's Church overlooks the inner harbour. The church is entered by an archway from Market Square. It was traditionally founded by St Cybi within the walls of a fort of the late Roman period. The present building dates mainly from late C15/early C16 rebuilding. Late C15 chancel incorporates C13 masonry; transepts (circa 1480), N aisle (circa 1500), S aisle and porch with stair turret (circa 1520). C17 tower. Early C19 vestry to N of tower. Restoration of 1877-1879 by Sir Gilbert Scott. South (Stanley) chapel of 1896-97. Listed Grade I as an outstanding late medieval church in North Wales. Group value with Capel y Bedd and Upper Churchyard walls.	5413	1763
6	GEORGE IV ARCH, SALT ISLAND	Post-medieval	Listed Building	225244	382909	II*	Situated within the security zone of the Port of Holyhead, to the east of the Harbour Office and Customs House and facing the end of the Admiralty Pier. Built 1822-24 by Thomas Harrison (1744-1829), architect of Chester. Commemorates George IV's landing at Holyhead on 7th August 1821 en route for Ireland; the royal yacht was delayed by bad weather and eventually the King had to travel on the new post-office steam packet, a decision that earned him popularity. Public subscription paid for this monument and it was inserted into the 1821 scheme designed by the renowned engineer John Rennie; this resulted from an Act of Parliament to improve the harbour and it included Admiralty Pier, Harbour Office and Customs House. In 1821 Harrison apparently told C R	5773	11823

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
							Cockerell that he had first proposed an Egyptian design which he felt was "better conceived". Group value with Admiralty Pier and listed buildings thereon. Graded II* as fine Welsh example of a classical monument by this prominent architect, and as part of important 1820's harbour group.		
7	HARBOUR OFFICE, SALT ISLAND	Post-medieval	Listed Building	225229	382947	II*	Situated within the security zone of the Port of Holyhead, facing south across the inner harbour that is now the ferry terminal. Adjacent to Customs House. Built 1821 probably to the design of John Rennie, the widely renowned engineer who specialised in the design of bridges and harbours. Modern alterations and large extension to rear. In 1810 an Act of Parliament was passed which included much needed improvement to the harbour at Holyhead which had by that time become established as the principal port for communication with Ireland, in particular it was the station for the Post Office steam packets. This work involved the construction of the Admiralty Pier and lighthouse to the east of Salt Island and included the George IV Arch, Harbour-Master's Offices and Customs House. Group value with the Admiralty Pier and listed buildings thereon. Graded II* as rare example in Wales of maritime architecture from Georgian period and as an integral part of this important harbour scheme designed by Rennie.	5772	11612
8	CAPEL Y BEDD, MARKET SQUARE	Medieval	Listed Building	224701	382590	II	In churchyard overlooking inner harbour, entered by archway from Market Square. To S of St Gybi's Church near archway to churchyard. Nave of C14 church converted to school in 1748. Also known as Capel. Llan-y-Gwyddel, and Old Vestry. Group value with Parish Church and Upper Churchyard walls.	5414	1764
9	Boundary Wall to Cybi Building, Holyhead High School	Post-medieval	Listed Building	224199	382550	II	Defines the boundary of the school grounds to South Stack Road and to the west, and encloses the former head-masters house (Gwynant) to the east. Listed for group value as an integral part of the design of the school.	87588	68948
10	CENOTAPH, VICTORIA ROAD (W SIDE)	Post-medieval	Listed Building	224677	382309	II	Opposite Victoria Terrace. War memorial in Cornish granite. Unveiled 15 September 1923; by L F Roslyn, following style of	14749	66368

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
							Lutyens' Whitehall Cenotaph but with addition of bronze reliefs.		
11	Cybi Building, Holyhead High School	Post-medieval	Listed Building	224185	382524	II	North-west of the town centre, opposite the main buildings of Ysgol Uwchradd Caergybi. Built 1904 as part of Holyhead's new county school. An early example of a county school, following the 1902 Education Act, which transferred responsibility for educational provision from School Boards to County Councils. The building was used within Anglesey's new comprehensive system from 1954 as an integral part of the comprehensive school in Holyhead. Latterly used as the sixth form centre for the school, but closed in 2006. Listed as a good example of an Edwardian county school, with a clearly articulated plan, and good architectural detail.	87587	68949
12	NO 1 TANALLTRAN COTTAGES	Post-medieval	Listed Building	224975	382160	II	To E of Plas Alltran (see Turkey Shore Road). Pair of cottages. Circa 1891 built to order of Jane Henrietta Adeane (1842-1926) as part of same development as Plas Alltran. Group value.	5726	66359
13	NO 2 TANALLTRAN COTTAGES	Post-medieval	Listed Building	224981	382160	II	To E of Plas Alltran (see Turkey Shore Road). Pair of cottages. Circa 1891 built to order of Jane Henrietta Adeane (1842-1926) as part of same development as Plas Alltran. Group value.	14734	66362
14	NO 2, VICTORIA TERRACE, VICTORIA TERRACE	Post-medieval	Listed Building	224669	382296	II	At junction of Victoria Road and Market Street. Terrace of houses converted from part of former Eagle and Child Hotel (built circa 1770) which was renamed Royal Hotel after visit of George IV in 1821. When Station Hotel opened (1880), Royal Hotel became houses. Formerly consisted of advanced seven window three-storey pedimented central block flanked by, to L, two storey, two window block and service buildings; and to R, long two storey wing.	5724	66360
15	NO 3, VICTORIA TERRACE, VICTORIA TERRACE	Post-medieval	Listed Building	224665	382305	II	At junction of Victoria Road and Market Street. Terrace of houses converted from part of former Eagle and Child Hotel (built circa 1770) which was renamed Royal Hotel after visit of George IV in 1821. When Station Hotel opened (1880), Royal Hotel became houses. Formerly consisted of advanced seven	14751	66358

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
							window three-storey pedimented central block flanked by, to L, two storey, two window block and service buildings; and to R, long two storey wing.		
16	NO 4, VICTORIA TERRACE, VICTORIA TERRACE	Post-medieval	Listed Building	224661	382311	II	At junction of Victoria Road and Market Street. Terrace of houses converted from part of former Eagle and Child Hotel (built circa 1770) which was renamed Royal Hotel after visit of George IV in 1821. When Station Hotel opened (1880), Royal Hotel became houses. Formerly consisted of advanced seven window three-storey pedimented central block flanked by, to L, two storey, two window block and service buildings; and to R, long two storey wing.	14752	66349
17	NO 5, VICTORIA TERRACE, VICTORIA TERRACE	Post-medieval	Listed Building	224658	382315	II	At junction of Victoria Road and Market Street. Terrace of houses converted from part of former Eagle and Child Hotel (built circa 1770) which was renamed Royal Hotel after visit of George IV in 1821. When Station Hotel opened (1880), Royal Hotel became houses. Formerly consisted of advanced seven window three-storey pedimented central block flanked by, to L, two storey, two window block and service buildings; and to R, long two storey wing.	14753	66372
18	NO 6, VICTORIA TERRACE, VICTORIA TERRACE	Post-medieval	Listed Building	224648	382309	II	At junction of Victoria Road and Market Street. Terrace of houses converted from part of former Eagle and Child Hotel (built circa 1770) which was renamed Royal Hotel after visit of George IV in 1821. When Station Hotel opened (1880), Royal Hotel became houses. Formerly consisted of advanced seven window three-storey pedimented central block flanked by, to L, two storey, two window block and service buildings; and to R, long two storey wing.	14754	66370
19	PILLBOX NEAR SKINNER'S MONUMENT, TURKEY SHORE ROAD (SE SIDE)	Post-medieval	Listed Building	225065	382164	II	On high ground 80m to S of Skinner Monument. Second World War pillbox fortification; part of circa 1940 defences of port of Holyhead. Included as unusual Welsh example of this fortification type, to a design believed to have been used only on Anglesey.	14741	66366

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
20	THE CAPTAINS TABLE, MARKET SQUARE	Post-medieval	Listed Building	224714	382565	II	At SE corner of Churchyard, adjacent to entrance arches, with rear facing over Holyhead inner harbour. Group value with Parish Church, Capel y Bedd and Churchyard walls.	14727	66357
21	TRINITY YARD LARGE WORKSHOP, BEACH ROAD (N SIDE)	Post-medieval	Listed Building	224104	383360	II	Below Beach Road near sailing club; in walled enclosure. Part of depot built by Trinity House circa 1870 for maintenance of coastal lights. Listed for special interest within a scarce group of nautical workshops. Group value with adjacent listed buildings in enclosure.	14731	68946
22	TRINITY YARD SMALL WORKSHOP, BEACH ROAD (N SIDE)	Post-medieval	Listed Building	224111	383345	II	Below Beach road bear sailing club; in walled enclosure. Aligned SW-NE, to rear of large workshop, at right angles. Part of depot built by Trinity House circa 1870 for maintenance of coastal lights. Listed for special interest within a scarce group of nautical workshops. Group value with adjacent listed buildings in enclosures.	14732	68947
23	TY'N PARC, MILL BANK	Post-medieval	Listed Building	224348	382410	II	Early C19 house enlarged early C20 as part of Bon Sauveur Convent. Convent founded 1907, house substantially enlarged to rear 1919/1924. Included for group value with neighbouring Ucheldre Centre.	14728	66365
24	UCHELDRE CENTRE (FORMER BON SAUVEUR CONVENT CHAPEL), MILL BANK	Post-medieval	Listed Building	224318	382408	II	Formerly chapel of former Bon Sauveur convent. Romanesque style; 1934-37 by Professor R M Butler, architect, of Dublin. Former attached early C20 school closed and demolished 1980's. Under conversion to community centre at time of inspection. Group value with Ty'n Parc.	5741	66351
25	ADMIRALTY PIER (INCLUDING SEA WALL BETWEEN SALT ISLAND BRIDGE AND GEORGE IV ARCH), SALT ISLAND	Post-medieval	Listed Building	225402	382913	II	At NE end of Victoria Road, projecting E into harbour. In 1810 an Act of Parliament was passed which included much needed improvement to the harbour at Holyhead which had by that time become established as the principal port for communication with Ireland, in particular it was the station for the Post Office steam packets. This work involved the construction of the Admiralty Pier and lighthouse to the east of Salt Island and Harbour-Master's Offices and Customs House, with later addition of the George IV Arch. Listed as an integral part of this important harbour scheme designed by Rennie. Group value.	14757	11831

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
26	CAERNARFON CASTLE PUBLIC HOUSE, SUMMER HILL	Post-medieval	Listed Building	224584	382689	II	At top of Summer Hill facing down towards Stanley Street. Early C19 public house. Previous building on site associated with William Morris, naturalist, antiquarian, collector of Welsh verse, customs officer at Holyhead, one of the celebrated Morris Brothers of C18 Wales. Included as early C19 building in location closing top of Summer Hill.	14736	59418
27	CUSTOMS HOUSE, SALT ISLAND	Post-medieval	Listed Building	225212	382960	II	Situated within the security zone of the Port of Holyhead, facing south across the inner harbour that is now the ferry terminal. Adjacent to Harbour Office. Built 1821 probably to the design of John Rennie, the widely renowned engineer who specialised in the design of bridges and harbours. Modern alterations and large extension to rear. In 1810 an Act of Parliament was passed which included much needed improvement to the harbour at Holyhead which had by that time become established as the principal port for communication with Ireland, in particular it was the station for the Post Office steam packets. This work involved the construction of the Admiralty Pier and lighthouse to the east of Salt Island and included the George IV Arch, Harbour-Master's Offices and Customs House. Group value with the Admiralty Pier and listed buildings thereon. Listed as an integral part of this important harbour scheme designed by Rennie.	5771	11610
28	Lighthouse on Holyhead Breakwater	Post-medieval	Listed Building	225676	384753	II	Set on ovoid platform forming the outer end of the long breakwater stretching into Holyhead Bay. The precise date of the lighthouse is unknown, though a publication of 1871 suggests that it was built in 1850. If so, it may have been designed by J.M.Rendell who was the engineer who prepared the plans for the breakwater in 1845. However it has also been attributed to John Hawkshaw, the superintending engineer who completed the breakwater between 1857 and 1873. An important component of the engineering works of the Holyhead Breakwater, and a very good example of an harbour light retaining its original character.	5744	11822

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
29	HYFRYDLE CHAPEL (INCLUDING FORECOURT GATES AND RAILINGS), THOMAS STREET (SW SIDE)	Post-medieval	Listed Building	224468	382522	II	In prominent position near top of Thomas Street, on corner of Ucheldre Avenue. Behind forecourt with stone piers and iron gates and railings (from Blackbridge Foundry, Holyhead) dated 1888. Large chapel of 1886-88; builder William Williams and Son, of Tan Yr Efail, cost £3,511. Included for contribution to townscape in conservation area, and impressive interior. Group value.	14738	8147
30	Lighthouse on Admiralty Pier	Post-medieval	Listed Building	225566	382898	II	At the E end of Admiralty Pier. Built 1821, by John Rennie (1761-1821), prominent engineer. In 1810 an Act of Parliament was passed which included much-needed improvement to the harbour at Holyhead which had by that time become established as the principal port of communication with Ireland; in particular it was the station for the Post Office steam packets. This work involved the construction of the Admiralty Pier and lighthouse to the east of Salt Island, and Harbour Master's Offices and Customs House, with the later addition of the George IV Arch. Listed as an integral part of the important harbour scheme designed by Rennie, and as a good and well-preserved example of an early C19 harbour light.	14758	2513
31	MARKET HALL, STANLEY STREET (W SIDE)	Post-medieval	Listed Building	224633	382671	II	In town centre on sloping site. Set back and above the street behind single storey shops; side and rear elevations to Summer Hill and Trearddur Square. Dated 1855, designed by J Edwards Thomas (?), Builder - see inscribed surround to clock face. Commissioned by Hon W O Stanley of Penrhos to succeed the old Market Cross. The access off Stanley Street was remodelled in 1906. Listed for its importance to Holyhead and as a prominent mid C19 town centre building with a well preserved facade.	5763	11613
32	PLAS ALLTRAN, TURKEY SHORE ROAD (SE SIDE)	Post-medieval	Listed Building	224922	382152	II	On acutely angled corner site between Turkey Shore Road and Llanfawr Road. Late C19 doctor's house and surgery built to order of Jane Henrietta Adeane (1842-1926) for her medical practitioner, Dr Russell. Group value.	5727	11151

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
33	STABLE BLOCK TO PLAS ALLTRAN	Post-medieval	Listed Building	224959	382162	II	To E of Nos 1 & 2 Turkey Shore Road. Circa 1891 built to order of Jane Henrietta Adeane (1842-1926) as part of same development as Plas Alltran. Included for group value with adjacent parts of Plas Alltran development.	5728	12528
34	1,TURKEY SHORE ROAD, Holyhead, GWYNEDD	Post-medieval	Listed Building	224950	382161	II	To E of Plas Alltran. Pair of semi-detached cottages. Circa 1891, built to order of Jane Henrietta Adeane (1842-1926) as part of same development as Plas Alltran. Group value.	5729	59010
35	FITTING, BOILER AND SMITHY SHOPS, AT MARINE YARD, HOLYHEAD DOCKS, VICTORIA ROAD (SE SIDE)	Post-medieval	Listed Building	224884	382732	II	Opposite Water Street. Irregular group of 3 parallel ranges to rear (NW) of office and stores building, the Smithy overlooks Victoria Road. Part of a large group of marine workshop buildings, Fitting Shop may incorporate part of pre-1850 building on site, and was rebuilt circa 1880, at same time as Smithy Shops (which included Coppersmiths', Brass Foundry, and Iron Foundry). Boiler Shop (or Erecting Shop) was contrived between these circa 1890. Listed as part of a (probably) unique group of purpose-built marine service buildings at a major British ferry port. Group value.	5734	33997
36	OFFICE AND STORES BUILDING, VICTORIA ROAD (SE SIDE)	Post-medieval	Listed Building	224903	382711	II	Part of a large group of marine workshop buildings opposite Water Street, this block behind Fitting, Boiler, and Smithy Shops facing harbour. 1880-90, extended after 1916. Listed as part of a (probably) unique group of purpose-built marine service buildings at a major British ferry port.	5735	11826
37	SAILMAKERS, SEAMSTRESSES AND POLISHERS WORKSHOPS VICTORIA ROAD (SE SIDE)	Post-medieval	Listed Building	224930	382800	II	Opposite Cross Street. Part of a large group of marine workshop buildings, this block before 1900. Listed as part of a (probably) unique group of purpose-built marine service buildings at a major British ferry port. Group value.	5736	11829
38	STORES,OLD BOILER SHOP AND SAWMILL BUILDINGS AT MARINE YARD, VICTORIA ROAD (SE SIDE)	Post-medieval	Listed Building	224905	382754	II	Opposite Water Street. Part of a large group of marine workshop buildings, built between 1858 and 1880. Listed as part of a (probably) unique group of purpose-built marine service buildings at a major British ferry port. Group value.	5737	11824
39	STANLEY HOUSE, MARKET SQUARE	Post-medieval	Listed Building	224716	382574	II	At SE corner of Churchyard, adjacent to entrance arches, with rear facing over Holyhead inner harbour. Former house, now	14726	11614

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
							divided, early C19, with rear rebuilt in late C19. Group value with Parish Church, Capel y Bedd and Churchyard walls.		
40	ZODIAC RESTAURANT, BEACH ROAD (N SIDE)	Post-medieval	Listed Building	224533	383222	II	On rocks below Beach Road NE of junction with Walthew Avenue. Former lifeboat house, circa 1850s, now converted to restaurant. Believed to be the oldest surviving lifeboat house in Wales.	14729	19165
41	TRINITY HOUSE OFFICE, BEACH ROAD (N SIDE)	Post-medieval	Listed Building	224122	383369	II	Below Beach Road near sailing club; in walled enclosure. Part of depot built by Trinity House circa 1870 for maintenance of coastal lights. Listed for special interest within a scarce group of nautical workshops. Group value with adjacent listed buildings in enclosure.	14730	34002
42	SKINNER MONUMENT, TURKEY SHORE ROAD (SE SIDE)	Post-medieval	Listed Building	225063	382243	II	Overlooking harbour on rocky outcrop; reached via steps on Turkey Shore Road. 1834; obelisk commemorating Captain John MacGregor Skinner RN, commander of Holyhead mail packet, drowned in storm 13 October 1832.	5417	12656
43	CLOCK TURRET IN STATION APPROACH, LONDON ROAD	Post-medieval	Listed Building	224785	382162	II	In forecourt of entrance to Holyhead station and ferry terminal, reached via incline from main bridge over railway. Iron clock turret unveiled 17 June 1878 by Albert Edward, Prince of Wales to mark completion of old harbour extension; formerly stood approx 50m to N between former Station Hotel and dockside.	14735	21164
44	TABERNACL CHAPEL, THOMAS STREET (SW SIDE)	Post-medieval	Listed Building	224527	382488	II	On corner with Baptist Street. Chapel of 1913. Builder William Williams and Son, of Tan Yr Efail. Included for contribution to townscape in conservation area, and well designed interior. Group value.	14737	17176
45	TRAIN SHED AT HOLYHEAD STATION, TURKEY SHORE ROAD	Post-medieval	Listed Building	224847	382256	II	On E side of inner angle of Holyhead inner harbour. Development of station and hotel by LNWR 1876 to 1880 consisted of hotel at apex of inner harbour flanked by arrival (E) and departure (W) platforms. Covered by sheds with Euston type roofs. Hotel closed 1950's demolished with W platform circa 1979, leaving this former arrivals platform. W part of site subsequently redeveloped. Included for hisoric importance as remaining part of the major rebuilding of	14739	21165

RHDHV ID	Name	Period	Status	Eastings	Northings	Grade	Summary Description	NMRW Ref No.	GAT HER PRN
							Holyhead Station. Believed to be the longest station train shed in Wales.		
46	2,TURKEY SHORE ROAD, Holyhead, GWYNEDD	Post-medieval	Listed Building	224941	382158	II	To E of Plas Alltran. Pair of semi-detached cottages. Circa 1891, built to order of Jane Henrietta Adeane (1842-1926) as part of same development as Plas Alltran. Group value.	14740	59010
47	SOUTH PIER, TURKEY SHORE ROAD	Post-medieval	Listed Building	225489	382680	II	To S of Admiralty Pier; reached via Turkey Shore Road. 1820-21, by John Rennie (1761-1821), prominent engineer. In 1810 an Act of Parliament was passed which included much needed improvement to the harbour at Holyhead which had by that time become established as the principal port for communication with Ireland, in particular it was the station for the Post Office steam packets. This work involved the construction of the Admiralty Pier and lighthouse to the east of Salt Island and Harbour-Master's Offices and Customs House, with later addition of the George IV Arch. The former dry dock to SW of South Pier was possibly the first in Wales. Listed as an integral part of this important harbour scheme designed by Rennie. Group value with Admiralty Pier.	14742	34003
48	LOWER CHURCHYARD WALLS AND GATEWAY, VICTORIAL ROAD (W SIDE)	Post-medieval	Listed Building	224760	382606	II	Below St Cybi's Church, parallel to road enclosing lower level of churchyard. Wall probably first built early C19 when lower churchyard formed; gateway dated 1926. Included for group value with walls to upper churchyard.	14750	66352

Non-designated Heritage Assets within the Study Area

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
49	Findspot	Antler	Antler Dredged from Holyhead Harbour, Holyhead	Prehistoric	SH25008260	16579	
50	Burial Chamber, Site of, Morawellan	Chambered Tomb	Recorded as cromlech OS 6 inch 1926. Recorded as destroyed - 1868. Field investigation, site developed and no trace of burial chamber. <3> Known only from a C19th reference. The area is now occupied by houses	Neolithic	SH25308212	2510	
250	Roman Road	Roman road	Former location of a Roman road.	Roman	SH40387341	17843	
51	Early Christian Burials Beneath Eglwys y Bedd, Holyhead	Burials	Early Christian Burials Beneath Eglwys y Bedd, Holyhead	Early medieval	SH24708260	6894	
52	Findspot	Coin	Mercian coin of c.790 AD supposedly found within Caer Gybi.	Early medieval	SH24708260	1547	
53	Monastery, Site of, Caer Gybi	Monastery (documentary sources)	A dark age monastery existed at Holyhead founded by St. Cybi (c.540) who is said to have been given the Roman fort later known as Caer Gybi. In 961 it was plundered by the vikings. By 1291 it had become a college of 3 prebends, said to have been founded in the early c.12th. It was suppressed c.1547. No remains survive.	Early medieval	SH24708260	1828	
54	Road, Possible Site of	Medieval road	A 6.6m long area of bedrock was identified, sealed by a possible metalled surface lying directly on the bedrock (Plate 01). The metalled surface may have been fragmented bedrock, but the stones forming the surface appeared to lie quite flat and level, giving the appearance of a metalled surface. This could be the remnant of a Medieval, or earlier, road surface.	Medieval	SH2466882520	61481	
55	Allotments, Site of	Allotments	Allotment gardens shown on the third edition OS map. A watching brief on land at the Old Scout's Hall revealed evidence for the allotments, namely the condition of the soil and the presence of late 19th and 20th century pottery.	Post-medieval	SH2452982581	61482	416178
56	Boat Yard, Newry Beach, Holy Island	Boat Yard	Established c.1890 at the east end of Newry Beach. Still in use as a boat yard	Post-medieval	SH2466883215	34022	
57	Breakwater, Salt Island	Breakwater	This breakwater from the north end of Salt Island was part of Rendel's original plan, which included a much shorter west breakwater, and	Post-medieval	SH2528683462	34019	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
			eastern one, and a pier for the packet boats from Newry beach. The railway was laid to Salt Island.				
58	Bridge, Salt Island	Bridge	A swing bridge joining Salt Island to Holy Island formed part of Rennie's original plans, though nothing existed before then. The bridge is now a single span opening with a riveted iron girder on its north side, through the stone causeway.	Post-medieval	SH2507482940	34008	
59	Black Bridge, London Road	Bridge	Black bridge carries the London Road (the A5) over the main line railway. The existing structure dates in part from the 19th century, although map evidence points to the existence of a river bridge in the vicinity at least from the mid-18th century.	Post-medieval	SH2479882047	59477	
60	Black Bridge, Site of	Bridge, no longer extant	The first bridge to cross the river which flows south out of Holyhead Harbour (Afon y Drip) had been constructed by 1802 (M2) and is called Black Bridge on the Parliamentary map of 1810 showing Rennie's proposed works (M4).	Post-medieval	SH2475882116	34009	
61	Noddfa Chapel, London Road	Building	Chapel	Post-medieval	SH25038188	7656	8656
62	Tabernacle Newydd	Building	Non-conformist Chapel	Post-medieval	SH24658283	7658	8658
63	Porth-y-felin	Building	Non-conformist Chapel	Post-medieval	SH24018316	7665	
64	Armenia Chapel	Building	Non-conformist Chapel	Post-medieval	SH24788285	7667	8667
65	Disgwylfa Chapel, London Road	Building	Non-conformist Chapel	Post-medieval	SH2505481812	7671	8671
66	Millbank Chapel	Building	Non-conformist Chapel	Post-medieval	SH24358216	7672	8672
67	English Presbyterian Chapel	Building	Non-conformist Chapel	Post-medieval	SH24678281	7674	8674
68	Bethel Chapel	Building	Non-conformist Chapel	Post-medieval	SH24788268	7678	8678
69	Chapel, Cross Street, Holyhead	Building	Non-conformist Chapel	Post-medieval	SH24818295	7679	8679
70	English Methodist Chapel	Building	Non-conformist Chapel	Post-medieval	SH24518217	8148	11871

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
71	Baptist Chapel	Building	Non-conformist Chapel	Post-medieval	SH24458241	8149	8664
72	St Mary's Church	Building	Chapel	Post-medieval	SH2460782327	8150	11873
73	Chapel, Holyhead	Building	Non-conformist Chapel	Post-medieval	SH24488221	8152	11871
74	Chapel, Mount Pleasant, Holyhead	Building	Non-conformist Chapel	Post-medieval	SH24618241	8154	8655
75	Outbuildings, Site of, Rear of Victorian Chambers	Building	Post-medieval outbuilding	Post-medieval	SH24658229	12542	31103
76	Tyddyn Lantern	Building	This is a building shown on a map of 1817 (Penrhos II 778). Its name would suggest it originally housed a light for guiding ships, and it has been stated that 'a lantern placed in the window (of tyddyn lantern) was the earliest harbour guide'	Post-medieval	SH25338252	16079	
77	Llain Garregoes,	Building	A rectangular structure is marked on the tithe map of Holyhead to the east of tyddyn lantern, and given the name Llain Garregoes. It is not clear from the map evidence if it was a domestic or agricultural building. Nothing is now visible on the ground.	Post-medieval	SH25478244	16080	
78	Accumulator House, Holyhead	Building	The engine house which powered the LNWR graving dock gates and pumps. Built in the 1860's when the east side of the harbour was being infilled and straightened by the railway company (Davidson 2002). Built 1874-6 for pumping out the dry dock.	Post-medieval	SH25228256	16082	
79	Engine House, Telford Graving Dock	Building	The engine house which powered the 1825-6 graving dock gates and pumps. The building is now derelict, but contains many features of interest including mountings and various fixings relating to the steam engine, now reputedly in the science museum.	Post-medieval	SH25468251	16085	
80	Foundry, Holyhead Harbour Marine Workshops	Building	Shown on LNWR plan of 1874. Currently used as a fabricator's workshop. One of a row of parallel buildings at the Yard, formed by the foundry, erecting shop, fitting shop and office building, the foundry is the northernmost structure.	Post-medieval	SH24878274	33996	
81	Erecting Shop, Holyhead Harbour Marine Workshops	Building	This building has been created by filling in the space between the foundry (PRN 33996) and fitting shop (PRN 11825), and roofing over it. The roof level has been raised by erecting brick walls on top of the two longitudinal walls of the foundry.	Post-medieval	SH24888273	33998	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
82	Engine House, Holyhead Harbour Marine Workshops	Building	A small brick built engine house, designed to hold a small engine to power the shearlegs at the dock side. The house remains, with a duct to carry the cable out towards the dock. The building is built at a skewed angle to the other buildings.	Post-medieval	SH2491382732	33999	
83	Packet Yard, Former Site Of,	Building	The former site of the Marine Yard, called 'Builders Yard' on Rendel's 1850 map (M30) which shows two buildings. It has been improved by 1857 by squaring off the east edge on the harbourside, constructing a wood jetty for packets to berth.	Post-medieval	SH2488282706	34010	
84	Beaching Ground	Building	Shown as such on Calver's map of 1857. This was deliberately formed by tipping small stone which was waste from the breakwater operations, as no suitable beaching ground existed. (Donald Insall Associates Ltd., 2003).	Post-medieval	SH2441283305	34011	
85	Oil Store, Holyhead Harbour Marine Workshops	Building	A small rectangular building, described as a 'Paint Shop' on the 1883 plan, though had become an oil store by 1923, and the paint store lay to the north, in line with the fitting shop. Nothing now remains, but in 1986 the National Monuments Record	Post-medieval	SH2487782691	34012	
86	Storehouse, Admiralty Pier	Building	A series of rooms built into the parapet of the Admiralty Pier. Designed by Hawkshaw and built c.1860 (WCD 293). Most are now blocked, though all are clearly marked on the 1923 map, with their functions described.	Post-medieval	SH2551182903	34013	
87	Lifeboat House, Salt Island	Building	A lifeboat house, now disused and due for demolition, it was used for much of the 20th century to house the main and inshore lifeboat.	Post-medieval	SH2526783382	34031	308398
88	Stanley Sailors Hospital	Building	The hospital was established in 1871 on Salt Island, Holyhead, for the use of sailors but was used during the First World War as a military hospital. In 1916, hospital was extended to provide extra accommodation during the War.	Post-medieval	SH2529583168	58710	
89	Stanley Sailor's Home, Newry	Building	Building on Prince of Wales Road has a 1857 date stone and provided refuge for shipwrecked sailors. The Home is usually considered to be the site of the Beach Auxiliary VAD Hospital in the First World War.	Post-medieval	SH2461083109	58712	
90	Nos. 1 to 3 Llanfawr Road	Building	Cottage	Post-medieval	SH2495282151	59009	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
91	Nos. 91 to 95 Market Street	Building	Built between 1769 and 1802 and the building range was built as a single block of up to four houses. It is believed that the properties were originally intended to be for domestic use and later became used for retail.	Post-medieval	SH2466282357	59419	
92	Cattle Sheds, Yard and Pens, Remains of	Building	The site comprises a number of related structures, including rows of derelict concrete livestock/cattle pens probably dating to the 1940s or 1950s situated on a stone platform with glazed brick coping, and once served by a siding.	Post-medieval	SH24888175	59472	
93	Gas Works, Remains of	Building	The remains of the former gas works, now the site of the Fairfield garage, are located on the east side of Kingsland Road just south of the junction with London Road. The works are shown on a map of 1865 (GAS Llangefni WCD/43) and on the Ordnance Survey	Post-medieval	SH2474081993	59473	33590
94	Carriage Shed (1 of 2)	Building	The area contains two large carriage sheds with a derelict gas works situated between. The western of the two sheds is a long, slightly curving structure, constructed of rubble with entrances in each gable end.	Post-medieval	SH2476781971	59474	
95	Carriage Shed (2 of 2)	Building	The area contains two large carriage sheds with a derelict gas works situated between. The eastern carriage shed is rectangular and open ended with planked upper gables; constructed of brick, pitched slate roof.	Post-medieval	SH2480081940	59475	
96	Gas Works, Remains of	Building	The area contains two large carriage sheds with a derelict gas works situated between. The former gas works is separated from the stone-built carriage shed by a long, narrow yard. The building is a gabled structure of red brick with a corrugated asbestos roof	Post-medieval	SH2479181933	59476	
97	Plas Hyfryd Terrace	Building	A 19th century terrace of houses, which is shown on the 1st edition Ordnance Survey map of 1889.	Post-medieval	SH24418206	61523	
98	Llys y Gwynt, Llanfawr Close	Building	"The house is shown on the 25 inch maps from 1887 with a garden with greenhouses to the SE and a more open area bounded by trees to the NE. The house was used as a hospital for wounded servicemen during the First World War"	Post-medieval	SH2535082045	62296	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
99	Vicarage	Building	During the First World War wife of the vicar, Rev. Edwin Jones, ran the Red Cross Workroom no 4795 in the Vicarage with a team of volunteers making supplies for the VAD. Now converted to government building.	Post-medieval	SH2460483030	62320	
100	Plas Llanfaw	Building	In the early 20th century the large house was occupied by Miss Jane Henrietta Adeane, she was closely associated with the Stanley Sailors' Hospital and was its commandant during its use as a military hospital in the First World War.	Post-medieval	SH2564881780	62414	
101	Pier Watch House	Building	No other data	Post-medieval	SH2582		41263
102	Boston House, Boston Street	Building	Shop	Post-medieval	SH2469982718		416023
103	Coastguard Station	Building	Coastguard Station noted on historic maps	Post-medieval	SH2410183031		519007
104	Holyhead Harbour; Holyhead Docks, Holyhead	Complex	NMR record for Holyhead docks as a whole.	Post-medieval	SH255828		41260
105	Ellin Stanley's Cross	Cross	A cross erected in honour of Ellin Stanley following her death in 1871.	Post-medieval	SH25528202	16637	
106	Dock, Old Harbour	Dock	Small open dock, appeared on an historic chart	Post-medieval	SH2543882630		519107
107	LNWR Graving Dock	Dry dock	Graving dock built in the 1870's when the east side of the harbour was being infilled and straightened by the LNWR railway company. It is now filled in, but the top course of the masonry is still visible (Davidson 2002). Built c. 1874 - 6	Post-medieval	SH25218259	16083	
108	Telford Graving Dock	Dry dock	Graving dock designed by Telford and built in 1825-6. It is now filled in, but parts of the edging stones are still visible in places	Post-medieval	SH25498220	16084	
109	Graving Dock, Holyhead Harbour	Dry dock	A dry dock which formed part of Rennie's original design, though was not constructed until 1825-6, and therefore the final designs are probably by Telford. The lock gates, machinery and crane were provided by William Hazeldine.	Post-medieval	SH25458260	34004	
110	Harbour, W of South Pier	Habour	A small harbour lying between Parry's Island and the 1823 - 4 graving dock. It is shown on Beechey's plan of 1839. The surviving west wall probably belongs to the original structure, though it is of a quite different build to the large limestone blocks used elsewhere, so is unlikely to have formed part of Telford's design	Post-medieval	SH2538282635	34015	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
111	Inner Harbour Walls	Habour Wall	The harbour walls built 1877-80 as part of the LNWR improvements. Their line has been lost elsewhere, but here it is well preserved. Built from large limestone blocks. A section part way down the north side collapsed in the 1970's because of water pressure.	Post-medieval	SH2479382228	34027	
112	New Jetty, Holyhead Old Harbour	Jetty	L-shaped jetty, visible on charts of 1850	Post-medieval	SH2547882832		519108
113	Evans Staff	Navigation Aid	A flagstaff is depicted and annotated 'Evans Staff' on an historic chart. The area is now housing.	Post-medieval	SH2450083005		519051
114	Fog Signal Gun, Salt Island	Navigation Aid	Small rectangular building is shown on an historic charts with the annotation 'Fog Signal Gun'. However, modern aerial photography reveals that the site is now likely to be under the tarmac of the ferry terminal	Post-medieval	SH2527583253		519068
115	Mackenzie Landing, Newry Beach, Holy Island	Pier	Built 1892. Long pier with right angle end and steps to water. Named after a superintendent of the Marine Yard.	Post-medieval	SH2465783290	34023	
116	73 to 75 Market Street	Post-medieval Shop	Built between 1841 and 1850 as a purpose retail unit with accommodation above. One notable occupant was Richard Mon Williams, Derwydd Gweinyddol (Presiding Druid) of the Ynys Mon Eisteddfod committee in 1920	Post-medieval	SH2465282401	60867	
117	Holyhead Harbour: Hydraulic Tower	Pump	No other data	Post-medieval	SH24828206		41262
118	Pelham Quay	Quay	This quay was established early on for the custom house of c.1800, though was later improved, and is first seen most clearly on the map of 1826 - 32 (M7). It was named after Thomas Pelham, 2nd Earl of Chichester, who was Chief Secretary to Ireland	Post-medieval	SH2495682814	34014	
119	Quarry Railway, Site of	Railway	The harbour at Holyhead was improved to extend its capacity to serve the expected demands of the new London to Holyhead rail link, which was opened in 1849 with the completion of the Britannia Bridge across the Menai Straits. Work began in 1848.	Post-medieval	SH24908302	19677	
120	Turkeyshore Road	Road	Turkeyshore road, leading from the black bridge past Alltran and on to Ynys Rug or Parry's Island would appear to have been built during the	Post-medieval	SH25248257	16078	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
			early 19th century, probably to reach the graving dock and south pier installed by Telford after 1810.				
121	Sewer Pipe, W of South Pier	Sewer	Main waste pipe from the port and hotel. Probably inserted c.1880 - clearly marked on 1883 map (M23) as 6ft culvert, running from hotel. Probably still in situ.	Post-medieval	SH2531782674	34021	
122	Sheer Legs, Marine Yard	Sheer Legs	A set of large sheers lay on the quayside, driven by engine shed (PRN 33999). Nothing now remains, but they were still present in the 1970's.	Post-medieval	SH2494082718	34032	
123	Viaduct, Remains of, N of Salt Island Bridge	Viaduct	Stone walling north of the bridge to Salt Island preserves the abutment of the 7ft gauge tramway (PRN 34024) to Salt Island which cut across the shore at this point, supported on timber piles.	Post-medieval	SH2509082962	34035	
124	Curtain Wall, Telford's Dock	Wall	Curtain wall around Telford's dock; stone built, part of original design, 4m high.	Post-medieval	SH2542482575	34005	
125	Dock Wall, W of South Pier	Wall	A well-made wall of limestone blocks, this forms the edge of the present dock, with later masonry blocks across the entrance to the former dock. Steps lead down to the water's edge and there are large mooring rings fastened to the masonry.	Post-medieval	SH25458263	34006	
126	Public Quay and Quay Walls, Parry's Island	Wall	This long side of Parry's Island was used as a quay certainly from the 1820's, and quite possibly before then, being close to where the packet boats moored. It is described as a 'public quay' following the construction of the new SE side of the harbour	Post-medieval	SH25208272	34007	
127	Boundary Wall, Holy Island	Wall	Boundary of Admiralty lands. A stone boundary wall running parallel to Newry Road, and then as the boundary to the Salt Island tramway at the west end. Still largely extant. Built 1849-50.	Post-medieval	SH2429483184	34020	
128	Quay Walls, Parry's Island	Wall	The quay wall built either side of the graving dock, and including the public quay, built 1876-80 by LNWR. Rail still runs along the quay north of the graving dock.	Post-medieval	SH2515882678	34028	
129	Quay Wall, S of Salt Island	Wall	Well preserved section of harbour wall south of the bridge to Salt Island and around the inner harbour to Pelham Quay. Appears to be part of the early 1810-24 works as it is clearly shown on M7 (1826-32). Two sets of steps down to water.	Post-medieval	SH2501982897	34030	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
130	Quayside, S of Pelham Quay	Wall	The length immediately south of the quay, fronting the Marine Yard, has been rebuilt. A short length (approx. 50m) remains in situ, with part of the cattle path visible, and steps down to the water. Built late 1870's.	Post-medieval	SH2484682582	34033	
131	Quayside, S of Parry's Island	Wall	Good remaining stretch of walling up to ferry birth. Culvert outlet from graving dock pump house is clearly visible in dock wall.	Post-medieval	SH2506582579	34034	
132	Wall, Marine Yard	Wall	A short length of walling, with a door through it, survives on what is now a parking area south of Marine Yard. Probably part of the former goods shed or a building associated with it.	Post-medieval	SH2488182660	34036	
133	Melin Ucheldre, Former Site of	Windmill	Windmill shown on the 1st and 2nd edition OS maps.	Post-medieval	SH2428082338	36155	
249	Black Bridge, Holyhead	Building	Non-conformist chapel.	Post-medieval	SH24948201	7662	8662
134	Empire Cinema, Stanley Street	Building	The Empire Cinema was originally built as a private house Newry House, which was later subdivided into homes and offices which were let to professional men and their families. Part of the structure was converted for use as a theatre in the early 20th Century and by the 1920's was in use as a theatre and cinema. At around this time the facade was modified and the distinctive curved frontage added.	Post-medieval/Modern	SH2468482772	59422	
135	Nos. 11 to 13 Stanley Street	Building	Nos. 11 to 13 Stanley Street were built around 1779 and are contemporary with other properties recorded as the Stanley Lane Houses. The uniformity of this block is due to the conditions for construction as specified by Lord Stanley.	Post-medieval/Modern	SH2468182620	59421	
136	No. 44 Market Street, Holyhead	Building	No. 44 Market Street was likely to have been built prior to 1769 and is therefore one of the oldest surviving buildings on the street. Was known as The King's Head Hotel. As with the town itself the King's Head declined during the 1920's/1930's and is believed to have been converted for use as a shop prior to 1938.	Post-medieval/Modern	SH2463682470	59431	
137	67-69 Walthew Avenue, Holyhead	Building	Terraced House	19th Century	SH2429982876		415900
138	71-73 Walthew Avenue, Holyhead	Building	Terraced House	19th Century	SH2428582864		415901

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
139	10-14 Alderley Terrace, Holyhead	Building	Terraced Housing	19th Century	SH2432682547		415997
140	12-14 Thomas Street, Holyhead	Building	Terraced Housing	19th Century	SH2459982477		416007
141	42 Stanley Street, Holyhead	Building	Terraced House	19th Century	SH2470382767		416013
142	Hsbc Bank, Market Square	Building	Bank (Financial)	19th Century	SH2465382587		416078
143	George Hotel, Market Street, Holyhead	Building	Hotel	19th Century	SH2469582557		416079
144	3-6 Market Street, Holyhead	Building	Shopping Parade	19th Century	SH2468882543		416080
145	33-37 Stationroad, Holyhead	Building	Terraced Housing	19th Century	SH2458782190		416090
146	Moreton Road, Holyhead	Building	Terraced Housing	19th Century	SH2450482009		416126
147	41-43 Moreton Road, Holyhead	Building	Terraced Housing	19th Century	SH2447782009		416128
148	3 Kingsland Road, Holyhead	Building	Cafe	19th Century	SH2469482106		416131
149	2-18 London Road, Holyhead	Building	Terraced Housing	19th Century	SH2489381977		416145
150	Post Office, Boston Street, Holyhead	Building	Post Office	19th Century	SH2474282724		416152
151	Albert Vaults, Stanley Street, Holyhead	Building	Public House	19th Century	SH2469682742		416153
152	The South Stack, Victoria Road, Holyhead	Building	Public House	19th Century	SH2488882827		416159
153	Vicarage Lane / Maes Y Mor, Holyhead	Building	Housing Estate	19th Century	SH2478183051		416165

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
154	Cambria Inn, Holyhead	Building	Public House	19th Century	SH2443782586		415994
155	Lloyds Bank, Boston Street, Holyhead	Building	Bank (Financial)	19th Century	SH2471182726		416071
156	71-77 Market Street, Holyhead	Building	Shopping Precinct	19th Century	SH2465282401		416088
157	(1-4)Lands End, Victoria Road, Holyhead	Building	Terraced Housing	19th Century	SH2476482647		416160
158	87-85 Newry Street, Holyhead	Building	Terraced Housing	19th Century	SH2454083038		415987
159	56 Newry Street, Holyhead	Building	Terraced House	19th Century	SH2461182941		415990
160	Churchill House, Stanley Street, Holyhead;Holyhead Conservative Club	Building	Political Club, Shop, Shopping Arcade	19th Century	SH2466382650		416075
161	Fair View, Holyhead	Building	Terraced Housing	19th Century	SH2497682910		416019
162	4 Kingsland Road, Holyhead	Building	Shop	19th Century	SH2469482106		416132
163	Dublin Packet, Holyhead	Building	Hotel, Public House	19th Century	SH2469382150		416121
164	9 St Cybi Street, Holyhead	Building	Terraced House	19th Century	SH2475182792		416012
165	Cavendish House, 12-16 Market Street, Holyhead	Building	Shopping Parade	19th Century	SH2466982537		416081
166	30-38 Stanley Street, Holyhead	Building	Shopping Precinct	19th Century	SH2469682747		416015
167	(1-2) Stanley Street, Holyhead	Building	Shop	19th Century	SH2466982680		416154
168	82-102 Market Street, Holyhead	Building	Shopping Precinct	19th Century	SH2464582360		416087
169	Magistrates Court, Stanley Street, Holyhead	Building	Magistrates Court	19th Century	SH2467282721		416022

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
170	6-8 William Street, Holyhead	Building	Terraced Housing	19th Century	SH2461482507		416006
171	2 Newry Fawr, Holyhead	Building	Terraced House	19th Century	SH2456683053		415986
172	Post Office, Boston Street, Holyhead	Building	Post Office	19th Century	SH2474282722		416073
173	10 Alderley Terrace, Holyhead	Building	Terraced Housing	19th Century	SH2433782549		415998
174	30 Market Street, Holyhead	Building	Shop	19th Century	SH2464782506		416083
175	North West Street, Holyhead	Building	Terraced Housing	19th Century	SH2494482930		416016
176	Cecil Street, Holyhead	Building	Terraced Housing	19th Century	SH2497481959		416147
177	Ty Cyfle, Market Street, Holyhead	Building	Shop	19th Century	SH2463582402		416085
178	Holborn Road, Holyhead	Building	Terraced Housing	19th Century	SH2454782121		416122
179	Wian Street, Holyhead	Building	Terraced Housing	19th Century	SH2495581999		416146
180	9 Rhos-Y-Gaer Avenuie	Building	Shop	19th Century	SH2470382074		416133
181	46-36 Maeshyfryd Road, Holyhead	Building	Terraced Housing	19th Century	SH2444782034		416124
182	National School, Rhos-Y-Gaer Venue, Holyhead	Building	School	19th Century	SH2468182052		416135
183	Boots Pharmacy, 27-29 Market Street, Holyhead	Building	Shop	19th Century	SH2466882504		416082
184	45-74 Moreton Road, Holyhead	Building	Terraced Housing	19th Century	SH2446582006		416125
185	5-7 Stanley Street, Holyhead	Building	Shop	19th Century	SH2467982611		416077

Royal HaskoningDHV

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
186	Gilbert Street, Holyhead	Building	Terraced Housing	19th Century	SH2500281926		416148
187	5-7 Moreton Road, Holyhead	Building	Terraced Housing	19th Century	SH2457281900		416130
188	29-31 Moreton Street, Holyhead	Building	Terraced Housing	19th Century	SH2450982010		416129
189	55 Market Street, Holyhead	Building	Shop	19th Century	SH2466282448		416156
190	65- 67 Newry Street, Holyhead	Building	Terraced Housing	19th Century	SH2457182952		415989
191	(1-3) Llanfawr Road	Building	Housing Estate	19th Century	SH2495282151		416174
192	22-26 Stanley Street, Holyhead	Building	Bank (Financial), Shop	19th Century	SH2469182681		416074
193	National Schoolhouse, Rhos-Y-Gaer Avenue, Holyhead	Building	House	19th Century	SH2469782065		416134
194	79-85 Newry Street, Holyhead	Building	Terraced Housing	19th Century	SH2454783001		415988
195	6 Walthew Lane, Holyhead	Building	Terraced House	19th Century	SH2440183135		415893
196	39-37 Moreton Road, Holyhead	Building	Terraced Housing	19th Century	SH2448782009		416127
197	Town Hall, Newry Street, Holyhead	Building	Town Hall	19th Century	SH2467382866		416008
198	1 Walthew Avenue, 1 St David'S Road, Holyhead	Building	Terraced House	19th Century	SH2444683087		415894
199	Tanrallt, Seabourne Road, Holyhead	Building	House	19th Century	SH2435383142		415890
200	89-95 Market Street, Holyhead	Building	Shopping Precinct	19th Century	SH2465882361		416089

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
201	Hibernia Terrace, Holyhead	Building	Cafe, Public House	19th Century	SH2493182873		416020
202	9-24 Stanley Street, Holyhead	Building	Shopping Parade	19th Century	SH2468382633		416076
203	British Stores, Ucheldre Avenue, Holyhead	Building	Shop	19th Century	SH2446082551		416000
204	London House, 9-11 Boston Street, Holyhead	Building	Shop	19th Century	SH2472282719		416072
205	Maeshyfryd Road, Holyhead	Building	Terraced Housing	19th Century	SH2448882114		416123
206	Rhoslan, British School, British Terrace, Holyhead	Building	National School	19th Century	SH2441682565		415995
207	Mill Bank Terrace, Holyhead	Building	Terraced Housing	19th Century	SH2429282212		416164
208	30-42 Market Street, Holyhead	Building	Shopping Parade	19th Century	SH2464982494		416084
209	74-102 Market Street, Holyhead	Building	Shopping Precinct	19th Century	SH2464482369		416086
210	Air Raid Shelter, Holyhead Maritime Museum	Air Raid Shelter	Air Raid Shelter, WW2	Modern	SH24528320	19171	
211	Allotments, Holyhead Park	Allotments	During the First World War Holyhead Park was taken over by the Local Authority and divided into plots for allotments. The Park was only newly created as it does not appear on the 1900 25 inch map. In 1917 the Park was given by Mr William Thomas, a Liverp	Modern	SH24058266	62334	
212	Arches, London Road Bridge	Arch	The drive leading down to the station is supported by a row of stone arches, presumably dating to the time of building the original station hotel (now demolished), and now used for storage. A similar arch remains under the west end of the London Road Bri	Modern	SH24798210	21163	

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
213	Assembly Rooms, Holborn Road	Building	The building is shown on the 1924 25 inch map but not on the 1900 map. It has now been demolished and houses occupy part of the site. The Assembly Rooms were used as a VAD hospital for injured soldiers during the First World War. This was the first such	Modern	SH2463282124	58713	
214	Baker Street Baptist Mission Room, Baker Street	Building	The North Wales Express (20th April 1900, p5) reports that the English Baptist Church has erected a new mission hall in Baker Street. This hall is marked as "mission room" on the 1924 25 inch map. This map shows the hall closer to the houses than in re	Modern	SH2441682845	60179	8660
215	Marconi Wireless Station	Building	Holyhead had one of the first fully operational Marconi wireless stations, which were commissioned by the British Admiralty as coastal stations to communicate with shipping. These were constructed in 1901.	Modern	SH24428285	60187	
216	Old Scouts' Hall, Site of	Building	The Old Scouts' Hall, which formerly occupied the site, was built in the mid-20th century. Demolished.	Modern	SH2453382555	61483	
217	English Wesleyan Chapel Schoolroom, Lhassa Street, Holyhead	Building	Schoolroom to English Wesleyan Chapel. It is assumed that the schoolroom was the building shown on the 1924 25 inch map on the eastern end of the chapel. Neither building was shown on the 1900 map.	Modern	SH2451882162	62329	
218	Beach Auxiliary Hospital	Building	A Sailors' Home run by the British and Foreign Sailors' Society and was loaned to the Holyhead VAD for conversion into a hospital to take wounded soldiers in the First World War. This hospital is listed in the Red Cross list of auxiliary hospitals as "Beach Auxiliary Hospital, Holyhead". The hospital could accommodate 80 patients and 3 wards were paid for by Sir RJ Thomas, MP	Modern	SH2446783118	62669	
219	Pill Box, Morawelon	Building	Pillbox	Modern	SH2506582164		270476
220	Rest Camp	Camp	From March 1918 there was a Rest Camp at Holyhead, which could cater for 1000 people and about 73,000 men passed through the camp between March 1918 and October 1919, including Sinn Fein prisoners	Modern	SH25378254	62338	
221	Harbour Ferry Terminal	Terminal Building	Modern Ferry Terminal, built 1990.	Modern	SH2494582366		402393
222	Salt Island Ferry Terminal Complex	Terminal Building	Modern Ferry Terminal	Modern	SH2533083292		403731

RHDHV ID	Name	Type	Description	Period	NGR	GAT HER PRN	NMRW Ref No.
223	Pill Box (Variant)	Building	Square structure fortified with concrete and embrasures to resemble a pillbox and faced in local stone. One of a number of structures built around Holyhead for its defence. All have been referred as 'Welsh mini-castles'.	Multi-period	SH261820		270514
224	10-12 Bryngoleu north Avenue	Building	House	Multi-period	SH2451383061		415984
225	Landscape, Holyhead Settlement, Anglesey	Settlement	Large port, origins in Roman period & end for importance in dark ages as ecclesiastical centre. Modern town developed from late 18th & thriving 20th century port of embarkation for Ireland. Road and rail terminus.	Multi-period	SH2448782895	17116	
226	Ffynnon Gybi, Site of	Well	St. Cybi's well (site of). A healing well at Caer Gybi was once covered by a building. No trace.	Unknown	SH24758280	1767	
227	Possible Field Boundary	Boundary Ditch	A narrow (0.3m wide) linear feature, orientated northeast - southwest, that cut through the underlying natural clay was identified within 5m of the southwest limit of Trench 5. This may have been boundary for an allotment or a field.	Unknown	SH2514581701	68742	
228	Remains of Stone Wall	Wall	The northeastern end of the trench may have clipped the edge of a springhead that was noted on the First and Second Edition Ordnance Survey Maps (Figure 02 and 03). This was indicated on the ground by a concentration of sub-rounded stones below the topsoil.	Unknown	SH2516281729	68741	
251	Findspot possible representing site of a wreck	Findspot	Findspot for a brass stern tube; brass propeller measuring 18in x 16in pitch marked 1331235; and an anchor with 20 fathoms (36m) of 1/4in chain cable. The items were recovered in July 1948 and presumed to belong to the Admiralty. They were sold on 11 December 1948.	Modern	SH2569982525		240180

Recorded wrecks and obstructions within the Study Area

RHDHV ID	Summary	Name	Nationality	Description	Longitude (WGS84)	Latitude (WGS84)	Source ID
229	Wreck, Dangerous wreck	*Kirkmichael*	GB	The *Kirkmichael* was a steel-hulled barque built by W Doxford & Sons, Sunderland, in 1882. Technical and configuration specifications are given as 61.6m length, 10.1m beam and 6.1m draught with a tonnage of 933. At time of loss 22 December 1894, the vessel was owned by A J Steel & Son, Liverpool, and was on passage from Glasgow and Liverpool to Melbourne under the command of master T Jones. Having lost most of her canvass, the barque was attempting to make a run for the harbour under bare poles. The barque was driven against the outer wall of the breakwater. The Holyhead lifeboat was launched at 10.30am, but the lifeboat was swamped. Six of the lifeboat's oars were washed away forcing it to return. The rocket lifesaving crew mean crawled along the breakwater and managed to get a line onto the stern of the barque by which 11 men were taken off. The 1st and 2nd mate had taken to the rigging, one fell to his death and the other died of exposure. The ship's steward remained onboard to be taken off in the morning when the weather had abated. The wreckage is reported to lie in 10-12m of water, along the outer side of the breakwater 330m from the lighthouse, close the wreck of the *Osseo* (RHDHV 230). The full character and extent of archaeological remains is presently unknown.	-4.6212	53.3294	UKHO 7253
230	Wreck, Dangerous wreck	*Osseo*	GB	The *Osseo* was a metal-hulled vessel (records for this exact material composition differ, with references suggesting that the hull of the vessel was either iron or steel). The barque built by C J Bigger at Londonderry, in 1889. Technical and configuration specifications are given as 74.7m in length, 11.3m in beam, 6.7m in draught with a tonnage of 1463. The vessel is recorded as having one deck and one bulkhead. At time of loss on 30 December 1894, the vessel was owned by B H McCorkell, Londonderry, and was under the command of master R Boggs. The vessel was carrying a cargo of nitrate from Taltal, Chile, to Ardrossan, when it was caught in a northwesterly force 9 gale. Heading for the shelter of Holyhead, the barque ran onto the breakwater and was lost with all 26 crewmembers. The wreck is reported to lie flat on the seabed in close proximity to the *Kirkmichael* (see RHDHV 229). The full character and extent of the archaeological remains is presently unknown.	-4.6212	53.3294	UKHO 7453

RHDHV ID	Summary	Name	Nationality	Description	Longitude (WGS84)	Latitude (WGS84)	Source ID
231	Wreck, Dangerous wreck	*Rhyl*	GB	The Rhyl is recorded to have been 73.2m in length, with a beam of 10.1m and a draught of 5.8m. The Rhyl sunk on 24 July 1900.	-4.6167	53.3333	UKHO 7260
232	Wreck, Dangerous wreck	*Saint Olaf*	GB	The Saint Olaf is recorded to have been 54.3m in length, with a beam of 8.2m, a draught of 4m and a tonnage of 568. The British steam ship sank on 18 December 1900.	-4.6167	53.3333	UKHO 7264
233	Wreck, Dangerous wreck	*Bidsie and Bell*	GB	A record for a British sailing vessel which sunk on the 14 January 1925. The vessel is recorded to have been 42m in length, with a beam of 8.7m, a draught of 4.6m and a tonnage of 371.	-4.6192	53.3308	UKHO 7256
234	Wreck, Dangerous wreck	HMS *Campina*	GB	The HMS *Campina* was a 290ton steam trawler with a length of 43.3m, a beam of 7m and a draught of 4m. It was hired as an armed patrol vessel in September 1939 and then purchased in June 1940. The trawler detonated a mine on 22 July 1940 a few yards from the Holyhead New Harbour lighthouse. The trawler sank with the loss of 11 crewmembers. The initial loss location was given as bearing 088 degrees, 1 cable from the outer breakwater lighthouse. The wrecks location was subsequently confirmed as 53 19N, 04 36 37W (Notice to Mariners 2278/40 and 2279/40) and a buoy placed bearing 083 degrees, 100 yards from the wreck. The buoy was repositioned to bearing 60 degrees, 100 yards from the wreck in early December 1940. The buoy had been removed by mid August 1942. The wreck was examined and swept in August 1968 Considerable steel wreckage is reported to remain *in situ* covered in kelp. The wreck stands up to 4m high in places.	-4.6169	53.3306	UKHO 7255
235	Wreck, Dangerous wreck		GB	Recorded as a hulk and classified as a 'dead' wreck. No further information recorded.	-4.6283	53.3186	UKHO 7237
236	Wreck, Dangerous wreck			No further information recorded.	-4.6128	53.3111	UKHO 7219
237	Wreck, Dangerous wreck			No further information recorded.	-4.6373	53.3180	UKHO 7236

RHDHV ID	Summary	Name	Nationality	Description	Longitude (WGS84)	Latitude (WGS84)	Source ID
238	Wreck, Dangerous wreck			No further information recorded.	-4.6264	53.3180	UKHO 7235
239	Wreck, Dangerous wreck			Recorded as a 'dead' wreck. No further information recorded.	-4.6203	53.3194	UKHO 7239
240	Wreck, Dangerous wreck			Recorded as a 'dead' wreck. No further information recorded.	-4.6212	53.3178	UKHO 7233
241	Wreck, Dangerous wreck			Recorded as a 'dead' wreck. No further information recorded.	-4.6212	53.3161	UKHO 7227
242	Wreck, Dangerous wreck			No further information recorded.	-4.6114	53.3078	UKHO 7217
243	Wreck, Dangerous wreck			No further information recorded.	-4.6303	53.3169	UKHO 7230
244	Wreck, Dangerous wreck			No further information recorded.	-4.6178	53.3119	UKHO 7222
245	Wreck, Dangerous wreck			No further information recorded.	-4.6178	53.3117	UKHO 7221
246	Wreck, Dangerous wreck			Recorded as a 'dead' wreck. No further information recorded.	-4.6245	53.3205	UKHO 7241
247	Obstruction, Foul ground			Anchor.	-4.6023	53.3278	UKHO 7251
248	Obstruction, Foul ground			No further information recorded.	-4.6022	53.3277	N/A (MTF_OBSTRUCTIONS.190503)

Royal HaskoningDHV

Anchorages, Navigational Aids and Navigational Hazards

NPRN	Type	Description	NGR
519154	ANCHORAGE	One of three anchorage areas in the lee of Salt Island shown on an historic chart (se also NPRNs 519152-3). This one being opposite the main quay.	SH2514482689
519151	ANCHORAGE	An anchorage is shown on an historic chart.	SH2712883649
519153	ANCHORAGE	One of three anchorage areas in the lee of Salt Island shown on an historic chart (see NPRN 519152 and 519154). This one being within the present day entrance to the harbour.	SH2543282775
519155	ANCHORAGE	The inner roadstead for Holyhead Old Harbour, as shown on an historic chart.	SH2646382956
519152	ANCHORAGE	One of three anchorage areas in the lee of Salt Island shown on an historic chart (see NPRN 519153-4). This one being inside the Pibeo Rocks. The area has been reclaimed with the harbour wall having been extended outwards and is now in industrial use.	SH2528582568
519080	NAVIGATION AID	A post with a round ball on top is shown on an historic chart.	SH2501583077
519049	NAVIGATION AID	A buoy is shown on an historic chart to the east of the northern arm of the old harbour entrance.	SH2584482879
519050	NAVIGATION AID	A 'Buoy with bell' is shown on historic charts.	SH2532883962
519084	NAVIGATION AID	A buoy is shown marking the rocky outcrop of Skinners Rock (see NPRN 519083).	SH2528283663
519082	NAVIGATION AID	A post is shown on an historic chart marking a small rocky outcrop.	SH2416083446
519088	NAVIGATION AID	A post is shown on an historic chart marking a small rocky outcrop.	SH2582582698
519105	NAVIGATION AID	One of a pair of buoys used for warping vessels (hauling on a line attached to buoy, typically against the wind or in a dead calm, thus pulling the vessel in that direction). This one is shown on an historic chart outside the harbour arms closely associated with the chain crossing the harbour mouth.	SH2567282692
519106	NAVIGATION AID	One of a pair of buoys used for warping vessels (hauling on a line attached to buoy, typically against the wind or in a dead calm, thus pulling the vessel in that direction) (see NPRN 519105). This one is shown on an historic chart inside the harbour arms.	SH2552782712
240150	SEASCAPE	The function of this record is solely for information retrieval purposes only. It has been generated to represent the centre of a diffuse geographical area which has the potential to include a great many wrecks and downed aircraft as suggested by repeated references to the area within documentary sources.	SH2693484006
240432	SEASCAPE	The function of this record is solely for information retrieval purposes only. It has been generated to represent the centre of a diffuse geographical area which has the potential to include a great many wrecks and downed aircraft as suggested by repeated references to the area within documentary sources.	SH2488883691

NPRN	Type	Description	NGR
240426	SEASCAPE	The function of this record is solely for information retrieval purposes only. It has been generated to represent the centre of a diffuse geographical area which has the potential to include a great many wrecks and downed aircraft as suggested by repeated references to the area within documentary sources.	SH2568882760
518593	SEASCAPE	A smal rokcy pinnacle to the north of the inner harbour arm is shown on an historic chart.	SH2549783075
519094	SEASCAPE	Two small rocky pinnacles named after the shipwreck of HMS NIMROD (see NPRN 271855).	SH2639882408
519006	SEASCAPE	The black buoy warning of the western extremity of the reef is shown on a historic chart with the annotation 'Bell' (see NPRN 519004)	SH2669085062
519083	SEASCAPE	A small reef, closely associated with the Outer Platters and once marked with a buoy (see NPRN 519084).	SH2530883701
519004	SEASCAPE	The rocky ledge extending out from the headland is shown on historic charts dating back to 1842 marked by a buoy (see NPRN 519006)	SH2716385130
519085	SEASCAPE	A small isolated rocky pinnacle.	SH2606683149
519087	SEASCAPE	Three small rocky pinnacles are shown on the southern side of the entrance to the harbour, marked with a buoy (see NPRN 519088).	SH2582382639
519069	SEASCAPE	A reef, once marked with a buoy (see NPRN 519050).	SH2506583807
519086	DEFENCE, MARITIME	A large chain, possibly used to prevent enemy ships from entering or for warping, is marked on an historic chart crossing the entrance to Holyhead Old Harbour.	SH2569682785

Recorded Losses

NPRN	Name	Period	Description
240277	UNNAMED WRECK	Medieval	The Calendar of Close Rolls notes the receiving of a petition from the wife of Simon de Faversham of Dublin, Juliana, with regard to a ship belonging to her husband which 'took a great treasure of the fifteenth of Ireland pertaining to the King'. The ship was wrecked at a place called St Helen's Bay (Ynys Halen/Salt Island?) in Anglesey on the 1 November 1295 (All Saint's Day in the 23rd year of his reign). Simon de Faversham and his three sons were lost in the wrecking incident. On 15 July 1298, John Havering, Justice of North Wales, was ordered to make an inquisition as to what happened to the treasure, the goods, chattels and the remains of vessel so that that goods might be returned to the King and to Juliana de Faversham.
240116	BRIDGET	Post Medieval	The BRIDGET was a wooden schooner belonging to the port of Dungarvon. At time of loss, the vessel was owned by carrying a cargo of wooden from Dungarvon to Barrow. At 11am on ? 1860, the schooner was observed to part its cables and drifted onto the end of the outer breakwater. The Holyhead lifeboat, THOMAS FIELDEN, was launched. However, it being highwater, the crew were able to jump to safety onto the breakwater itself. The schooner soon after drifted off to sea and foundered.
240121	UNKNOWN GALLIOT	Post Medieval	"A report printed in Lloyds List on 26 January 1802 noted that a Prussian galliot carrying a cargo of gin had been wrecked near Holyhead."
240122	PRIDE OF THE DEE	Post Medieval	The PRIDE OF THE DEE was a wooden schooner which was caught in a north-northwesterly gale in Holyhead roads on 20 January 1891. The schooner's four crewmembers were taken off by the Holyhead lifeboat, JOSEPH WHITWORTH. The PRIDE OF THE DEE was subsequently lost between the Holyhead breakwater and Clipperau rocks.
240123	ISABELLA	Post Medieval	The ISABELLA was a wooden schooner which was caught in a north-northwesterly gale in Holyhead roads on 20 January 1891. The schooner's three crewmembers were taken off by the Holyhead lifeboat, JOSEPH WHITWORTH. The ISABELLA was subsequently lost between the Holyhead breakwater and Clipperau rocks.
240124	MAGGIE BROCKLEBANK	Post Medieval	The MAGGIE BROCKLEBANK was a wooden schooner which was caught in a north-northwesterly gale in Holyhead roads on 20 January 1891. The schooner's crew were taken off by the Holyhead lifeboat, JOSEPH WHITWORTH. The MAGGIE BROCKLEBANK was subsequently lost between the Holyhead breakwater and Clipperau rocks.
240126	DOROTHY AND MARY	Post Medieval	The DOROTHY AND MARY was a 72ton wooden schooner belonging to David Jones of Porthmadog. The schooner was carrying a cargo of coal from Newcastle to Dublin on 11 December 1883, when it was caught in a west-northwesterly hurricane. The schooner had anchored off the Clipperau buoy but by 8.30pm was dragging its anchors. The Holyhead lifeboat THOMAS FIELDEN managed to get additional crewmembers onboard, but returned at 3am to take the four crewmembers off. The schooner was subsequently wrecked off the Clipperau buoy.
240128	UNNAMED WRECK	Post Medieval	At 2.20am on 18 November 1893, distress signals were seen flying from a large brigantine in the outer roads. The Holyhead lifeboat THOMAS FIELDEN launched into the north-northwesterly gale but was unable to get along side in the heavy seas. The brigantine was subsequently wrecked 3/4 mile from the old lighthouse.
240177	MARQUIS OF WELLINGTON	Post Medieval	The MARQUIS OF WELLINGTON was a wooden smack bound from Liverpool to Belfast under the command of master Irvin. On 28 October 1843, it was caught in a northerly gale and forced into Holyhead Bay. The smack anchored came to anchor outside the harbour. The lifeboat launched and managed to rescued the crew of 3. The smack's anchor cables soon parted and it was driven ashore.

NPRN	Name	Period	Description
240415	CLERMONT	Post Medieval	No further details.
240417	UNNAMED FULL-RIGGED SHIP	Post Medieval	This UNNAMED FULL-RIGGED SHIP, along with 2 brigs, was reported to have missed the Holyhead harbour entrance and have been smashed to pieces. The incident was seen from Penrhos Mansion.
240418	UNNAMED BRIG	Post Medieval	The UNNAMED BRIG, along with another brig and a three masted ship, was reported to have missed the Holyhead harbour entrance and have been smashed to pieces. The incident was seen from Penrhos Mansion.
240419	UNNAMED BRIG	Post Medieval	The UNNAMED BRIG, along with another brig and a three masted ship, was reported to have missed the Holyhead harbour entrance and have been smashed to pieces.
240425	HARLEQUIN	Post Medieval	The HARLEQUIN was a wooden sailing vessel whose crew was rescued by the Holyhead Lifeboat and shore-based lifesaving apparatus on 28 April 1829.
240427	FAME	Post Medieval	The FAME was a wooden sailing vessel whose crew was rescued by the Holyhead Lifeboat and shore-based lifesaving apparatus on 28 April 1829.
240428	PLUTARCH	Post Medieval	The PLUTARCH was a wooden sailing vessel belonging to the port of New Orleans. The vessel was wrecked to the west of Holyhead town on 10 September 1835. The Holyhead lifeboat rescued the crew of eleven.
240431	UNNAMED WRECK	Post Medieval	A newspaper reporter noted other casualties of the Royal Charter Gale from onboard Brunel's GREAT EASTERN in Holyhead harbour. While the GREAT EASTERN battled to maintain station, anchors out and steaming into the wind, a large vessel was sunk and another four were swept into the shallows where they were rolled about in the surf and soon disintegrated.
240434	EDITH	Post Medieval	The EDITH was a paddle-steamer belonging to the London and North Western Railway. On 8 September 1875 the EDITH collided with another London and North Western Railway paddle-steamer, DUCHESS OF SUTHERLAND. The EDITH sank inside the New Harbour and was not raised for two years. In December 1878 it was returned to service with screw propulsion.
240435	MERLIN	Post Medieval	The MERLIN was a schooner registered at Llanelli. On 17 October 1875, the schooner collided with the London and North Western Railway paddle-steamer, EARL SPENCER near the holyhead breakwater.
240437	HORATIO	Post Medieval	The HORATIO was a cargo vessel. On 1 February 1884 it was on passage from Barrow to Calais, and was taken in tow in an attempt to run the ship ashore between the Old Harbour and the Inner Harbour. The steamer sank across the entrance to the Inner Harbour.
240438	WOODBINE	Post Medieval	The WOODBINE was a schooner on passage from Charlestown to Fleetwood. On the night 1 February 1884 the WOODBINE was sheltering in Holyhead New Harbour when its anchor cable parted and the schooner was driven ashore.
240439	GRIGAN	Post Medieval	The GRIGAN was a barque. On 1 February 1884 the GRIGAN was on passage to Perambuco when it was wrecked on the Peibo rocks. The captain and four crewmemebers of Littlehampton brig ROBERT AND MARY attempted to take a boat out to the GRIGAN. The boat was run down by the London and North Western Railway Steamer ALEXANDRA and the captain, Britt, was killed under the paddle wheels. The other crewmembers of the ROBERT AND MARY were saved.

NPRN	Name	Period	Description
240604	ALICE	Post Medieval	The ALICE was a wooden schooner, belonging to the port of Liverpool, which was wrecked in Holyhead harbour on 7 October 1850.
240938	BUNBURY	Post Medieval	"The BUNBURY was a wooden brigantine built at Prince Edward Island in 1834. Technical and configuration specifications are given as 136tons; 72ft 4in length x 19ft 2in breadth x 12ft 6in depth; rigged with a standing bowsprit; square sterned, carvel built, with female bust figurehead. The brigantine was registered at Cardiff on 4 August 1841 by its owner James Howell, victualler, of Cardiff (56 shares) and his spinster daughter Jane Howell (8 shares). Whilst in Howell's ownership, the brigantine had six different masters ending with William Rogers from November 1843. The ship's registry was closed in June 1846 with the note that it had stranded at Holyhead."
240963	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
240964	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
240965	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
240966	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
240967	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
240970	UNNAMED WRECK	Post Medieval	Wreckage was reported at this location in 1976. The full character and extent of any archaeological remains is presently unknown.
271479	MARY	Post Medieval	The MARY was a wooden sailing vessel on passage from Milford Haven to Preston. The report printed in Lloyds List on 10 March 1780 noted the master's name as Richards and that the vessel had been wrecked at Holyhead on 25 February 1780. The master was the only survivor of all the ship's crewmembers.
271482	ELLEN	Post Medieval	The ELLEN was a wooden sailing vessel on passage from Limerick to London which stranded near Holyhead. The report printed in Lloyds List on 19 February 1796 notes the master's name as Kavanugh and that the cargo was being unloaded.
271782	NANCY	Post Medieval	The NANCY was a wooden sailing vessel on passage from Wicklow to Liverpool when it was lost near Holyhead on 2 November 1833.
271786	MARY-ANN	Post Medieval	The MARY-ANN was a wooden sailing vessel on passage from the West Indies to Dublin. The report printed in Lloyds List on 6 December 1763 noted that the master's name was Johnston and that the vessel was ashore at Holyhead.
271790	NEPTUNE	Post Medieval	The NEPTUNE was a wooden sailing vessel on passage from New England to Liverpool in early October 1789. The reported printed in Lloyds List on 13 October 1789 notes that the master's name was Daniel and that the vessel was ashore at Holyhead.

NPRN	Name	Period	Description
271792	FAME	Post Medieval	The FAME was a wooden sailing vessel which was on passage from Barcelona to Liverpool. The report printed in Lloyds List on 22 December 1789 noted the master's name as Johnson and that the vessel was onshore near Holyhead.
271804	HMS FOX	Post Medieval	The FOX was an English Royal Navy 6th rate Ship of the Line. This ship was built in 1705, captured from the French in May 1705 by HM TRYTON and taken into Royal Navy service. The technical and configuration specifications are given as 273bm, 93 ft length x 26 ft breadth, armed with 24 carriage mounted cannon. At the time of loss, 28 August 1706, the vessel was under the command of Captain Henry Rocke. The FOX tried to anchor off Holyhead in a gale, but one anchor chain broke and the cable of another parted, causing her to be driven ashore and wrecked with a heavy loss of life.
271812	BOSCAWEN	Post Medieval	The BOSCAWEN was a wooden sailing vessel which was on passage from Liverpool to Africa in early July 1763. The report printed in Lloyds List on 26 July 1763 noted that the vessel was lost at Holyhead and that all the crew had perished.
271814	JESSE	Post Medieval	The JESSE was a wooden sailing vessel on passage from Africa and St Kitts to Liverpool under the command of master Briggs. The report printed in Lloyds List on 11 November 1767 notes that the vessel had been caught in a hard gale and blown ashore between two rocks on the southeast side of Holyhead. The ship was wrecked but the crew were saved.
271817	NANCY	Post Medieval	The NANCY was a wooden sailing vessel which was on passage from Liverpool to Africa. The report printed in Lloyds List on 20 February 1770 gave the master's name as Williams and noted that the vessel was onshore at Holyhead and bilged. The cargo was recovered.
271827	MALLY	Post Medieval	The MALLY was a wooden sailing vessel on passage from Youghal to Liverpool. The report printed in Lloyds List on 29 April 1788 noted that the vessel had been attempting to enter Holyhead harbour when it was wrecked on 3 April 1788. The report gave the master's name as M'Kirdy. The crew were all saved.
271846	FRIENDSHIP	Post Medieval	The FRIENDSHIP was a wooden sailing vessel on passage from Dublin to Bordeaux. The report printed in Lloyds List on 31 October 1775 notes the master's name as Mullay and that the vessel was totally lost at Holyhead.
271855	HMS NIMROD	Post Medieval	The damaged hull was reported to have been refloated, hence archaeological remains associated with the loss of this vessel are not confirmed as present at this location. The NIMROD is described as a Royal Naval brig sloop and was built by Bailey at Ipswich in 1812 . Technical and configuration specifications are given as 384 builder's mark tonnage; 18 guns and complement of 115. At time of loss, the vessel was under the command of Commander Samuel Sparshottt. The NIMROD has left Cork on the 13 January 1827 and encountered rising seas and a gale as it entered the Irish Sea. As a precaution, the topgallant-masts and spars were struck and sail shortened. At 10.30 am, a heavy sea carried away her port bulwarks along with her quarter-boat and water spilled down the main hatchway flooding the lower deck. The vessel recovered and pumping commenced, whilst the wreckage was cleared, the Captain altered course so that the ship ran before the wind. The gale increased blowing away several sails, until the only sail remaining was the fore trysail. The land ahead was identified as Anglesey, and the captain attempted to run for Holyhead, anchoring off the harbour at 7 pm with her best and small bower anchors laid out on 14 January 1827. All her topmasts and yards were struck, but two hours later the shank of the best bower anchor broke and the NIMROD began to drag. Her sheet anchor was let go but the ship drove onto a ridge of rocks where the rudder was unshipped and holes were made in the hull. The rocks has subsequently been given the ship's name. Attempts were made to fire a line from the shore using Manby's apparatus, but these attempts failed. A line was taken out when the wind dropped and the NIMROD's crew were subsequently saved. The NIMROD subsequently fell over on Penrhos Beach. The larboard side was found to be bilged and the keel gone. The wreck was refloated in the February and brought into dry dock at Holyhead, where it was sold for £510 to Rolland Robert & Company, of Holyhead.

NPRN	Name	Period	Description
271905	HENRY	Post Medieval	The HENRY was a 174nt wooden brig belonging to the port of Whitehaven. At time of loss 3 January 1854, the vessel was owned by Simon & Co (the master being I Simon) and was on passage from Cardiff to Liverpool. The report printed in Lloyds List on 6 January 1854 noted that the brig had gone ashore near the breakwater of the new harbour and been totally wrecked. The gale causing the loss had reached storm force 9 at its height.
271911	ALMA	Post Medieval	The ALMA was a 42nt wooden smack built 1856 at Aberystwyth and registered at the port. At time of loss 14 September 1861, the vessel was owned by Jones and Co (the master being R Jones). The smack was at anchor in Holyhead outer roads sheltering during a south-westerly force 6 when it was in collision. The smack subsequently foundered with the loss of two lives.
271923	DEVONIA	Post Medieval	The DEVONIA was a wooden schooner built in 1836. At time of loss, the vessel was carrying a cargo of copper concentrate (ore?) from Liverpool to Swansea. The schooner was caught in a north north-easterly hurricane force gale and was blown onto the eastern end of the Holyhead breakwater on 19 February 1868 as it was trying to reach shelter. The five crewmembers were also lost.
271957	WILLIAM POOLE	Post Medieval	The WILLIAM POOLE was a wooden schooner registered at Liverpool. At time of loss on 18 October 1854, the vessel was on passage from Liverpool to Dublin. The schooner was caught in a north-easterly gale force 10 and was blown against the outer breakwater. All hands were lost.
271958	ALBION	Post Medieval	The ALBION was a wooden schooner carrying coal from Liverpool to Porthmadog under the command of master Thomas. On 18 October 1854, the schooner was attempting to reach the shelter of the New Harbour at Holyhead during an east-north-easterly gale. The schooner ran onto the piles for the breakwater at the entrance and became a total wreck. Capstan bars and several news hatches were subsequently picked up inside the breakwater. Two crewmembers were drowned.
271975	WESTBOURNE	Post Medieval	The WESTBOURNE was a wooden brig built at Cork in 1852. Technical and configuration specifications are given as 193gt, 150nt; 102ft 3in length x 20ft 6in breadth x 12ft depth; sheathed in felt and yellow metal, partly fastened with iron bolts. At time of loss on 3 December 1863, the vessel was owned by Carmichael and registered at Liverpool and under the command of master McNaught. The brig was on passage from Liverpool to Belize but had taken shelter in Holyhead during severe north-north-westerly gale (force 12). The WESTBOURNE was at anchor, when it was run down by the sailing vessel CONFIANCE. The brig began to founder. The 9 crewmembers took to the ship's boat, which immediately capsized and all were drowned.
271984	SCOTLAND	Post Medieval	The SCOTLAND was a wooden schooner built by Rankin at Dumbarton in 1861. Technical and configuration specifications are given as 66.65gt, 67nt; 67ft 9in length x 18ft 4in breadth x 8ft 7in depth; 1 deck, 2 mast, rigging schooner, stern square, built carvel, head semi (?) woman, framework wood, fastened with iron bolts; official number 29190, signal LDNW. At time of loss on 2 December 1867, the vessel was owned by John Parry of Northop, Flint, master mariner, and registered at Chester (7 in 1862). The schooner was carrying a cargo of iron ore from Barrow-in-Furness to Briton Ferry when it was caught in a northerly force 10 gale. The schooner was blown against the Holyhead breakwater and wrecked. Two crewmembers lost their lives.
271988	CRONJE	Post Medieval	The CRONJE was a small wooden fishing vessel or lugger owned by T Jones of Holyhead. The lugger was putting to sea in a southerly force 7 gale on 18 January 1901 when it foundered, 0.25 miles ESE of the Holyhead breakwater lighthouse.
272000	JOFUR	Post Medieval	The JOFUR was a wooden brig built by Jens Tellefsen at Grimstad in 1872. Technical and configuration specifications are given as 210gt, 202nt; 98ft 8in length x 24ft 8in breadth x 12ft 8in depth; 1 deck. At time of loss on 18 November 1893, the vessel was owned by B C Floresnaess of Lillesand and under the command of master N P Floresnaess. The brig was carrying a cargo of timber from Brevik, Norway, to Connah's Quay, when it was caught in a north-north-easterly hurricane (force 12) and blown onshore at Salt Island.

NPRN	Name	Period	Description
272015	ELLEN	Post Medieval	The ELLEN is recorded as being a ketch. However, it seem likely that it may have been a ketch-rigged Weaver flat, the ELLEN having been built in 1837 at Winsford on the River Weaver. Typically flats were 60-65ft length and 15ft beam. The ELLEN's tonnage is given as 53nt. The vessel was carrying 100tons of fire clay from Holyhead to Liverpool. On 2 December 1876, the ELLEN was at anchor inside the New Harbour with the mate and one other man onboard. The vessel sprang a leak during a south-south-easterly force 7. The crew abandoned ship and refused to return despite the urging of the master. All three are reported to have stood on the beach and watched the ELLEN founder.
272022	VOLUNTEER	Post Medieval	Archaeological remains associated with the loss of this vessel are not confirmed as present at this location. It is likely that the schooner was raised and repaired, as the schooner's entry in the Port of Padstow Shipping Register suggests that the schooner was re-registered at Beaumaris in 1879. The VOLUNTEER was a wooden schooner built by Scott, Dumbarton, in 1861. Technical and configuration specifications are given as 83nt; 65ft 5in length x 19ft 3in breadth x 10ft 1in depth. The schooner was sold to Warwick R. Guy and James Bate at Port Isaac in 1865 and registered at Padstow. At time of loss, the schooner was carrying a cargo of coal from Liverpool to Plymouth and was caught in a southerly gale force 10. The schooner was thrown onto its beam ends in a heavy squall and soon foundered off the lighthouse on Holyhead breakwater with the loss of all three crewmembers.
272056	ROYALIST	Post Medieval	The ROYALIST was a wooden schooner built at Littlehampton in 1850. Technical and configuration specifications are given as 135gt, 123nt; 88ft 2in length x 21ft 4in breadth x 11ft 4in depth, partly fastened with iron bolts. At time of loss on 8 October 1896, the vessel was owned by J Ennor of Newquay and under the command of J Chapel. The schooner was carrying a cargo of coal from Runcorn to Fowey and had run for the shelter of Holyhead to escape a south-south-westerly force 10 gale. The schooner was in collision with the Liverpool registered steam tug BRITISH KING in Holyhead Outer Roads. The ROYALIST subsequently foundered with the loss of three crewmembers.
272069	SUNSHINE	Post Medieval	The SUNSHINE was a 3nt wooden lugger owned by R Jones of Holyhead (sources also suggest that the vessel may have been working as a pilot vessel). At time of loss on 10 October 1891, the SUNSHINE was under the command of L Jones. The lugger was in collision with the French registered brig HENRY EVELINA and subsequently foundered 0.5miles off the Holyhead breakwater lighthouse.
272079	DEVONPORT	Post Medieval	The DEVONPORT was a wooden schooner built by Clibbert in 1853 at Appledore. Technical and configuration specifications are given as 147gt, 134nt; 89ft 7in length x 21ft breadth x 12ft 4in depth. At time of loss on 25 September 1897, the vessel was owned by J Samuel of Calstock and carrying coal from Runcorn to Plymouth under the command of master P C Samuel. The schooner was caught in a northerly force 10 gale and was in collision with the Plymouth registered schooner UNDAUNTED.
272097	GLADYS	Post Medieval	The GLADYS was a wooden sailing vessel, owned by H Owen, Holyhead. The vessel was at moorings near the Holyhead breakwater when it was caught by a southerly gale force 8 and foundered on 26 February 1905. The master, H Evans, and four crewmembers were also lost.
272112	SEAGULL	Post Medieval	A wreck was reported at this location in 1976. The SEAGULL was a 9nt wooden cutter which had been at anchor in the New Harbour on 2 October 1912. The cutter broke free from its moorings in heavy weather and went ashore to become a total wreck near the Coastguard Station.
272134	BIDSIE AND BELL	Post Medieval	The BIDSIE AND BELL was a wooden schooner (or brigantine, sources differ) built by Gowen at Berwick-upon-Tweed in 1873. Technical and configuration specifications are given as 371gr, 188nt; 137ft 8in length x 28ft 7in breadth x 15ft 1in depth. At time of loss, the vessel was owned by J Fisher & Sons and on passage from Garston to Bideford. The schooner ran onto Holyhead breakwater on 14 January 1925. The wreck was marked with a buoy (Notice to Mariners 389/25) until it was removed in mid September 1925 (Notice to Mariners 1518/25)
272139	HMS MANX LAD	Post Medieval	The MANX LAD was a wooden fishing vessel built at Sandhaven in 1937. Technical and configuration specifications are given as 24gt, 9nt; 44ft 3in length x 14ft 3in breadth x 6ft 4in depth; screw propulsion powered by a fuel oil engine (motor). The vessel was owned by Isle of Man Fisheries Ltd at

NPRN	Name	Period	Description
			Peel and was registered at that port. However, in July 1940, the fishing vessel had been hired by the Admiralty for use as a minesweeper. The MANX LAD detonated a German mine on 16 August 1940 as it went to the aid of the MEATH (see NPRN 272189) and sank near the entrance to the Holyhead New Harbour.
272155	PEARL	Post Medieval	The PEARL was a wooden brigantine built at Hillsborough River, Prince Edward Island, in 1852. Technical and configuration specifications are given as 118gt, 106nt; 83ft length x 21ft 7in x 10ft 9in depth. The PEARL was registered at Prince Edward Island in 1852 by Joseph Bartlett, a farmer/planter of Brigus, Conception Bay, New Foundland. The brigantine's registry was transferred to Fowey in 1862 when it was sold to Joseph Steel, the owner and master at time of loss. The PEARL was carrying a cargo of salt for Mr Hayes of Runcorn to Christie and Ranson of Ipswich. It had put into Holyhead on 27 November 1863 due to contrary winds. On 3 December 1863, the winds increased to a northwesterly hurricane. The PEARL was riding out the storm in the New Harbour with both anchors deployed when, at 6am, it was fouled by a Maltese barque. The PEARL's anchor cables parted and the master ran the brigantine ashore to save both vessel and crew. At noon, on the flood tide, the PEARL refloated apparently not much damaged and ran for the Old Harbour to get alongside the quayside. The master brought the PEARL inside the wooden jetty. However, as no ropes could be got ashore and with no anchors the vessel was washed back out of the harbour and soon went on the rocks. A shore boat manned by 5 local men put out and brought the crew of the PEARL safely onshore. The brigantine had been insured for the value of £700.
272156	HELEN CAMPBELL	Post Medieval	The HELEN CAMPBELL was a 275nt wooden barque built in 1860 by Hawkinson of Weymouth, Nova Scotia. At the time of loss, 3 December 1863, the vessel was owned by C Campbell junior of Weymouth, Nova Scotia and captained by William O'Brien. The Holyhead Bay Board of Trade Wreck Return reports The HELEN CAMPBELL 'Sailed from Dundalk on 02.12 at 1 pm, but at 7 a.m. the following day, the wind now NW and blowing a hurricane, she entered Holyhead Bay under close-reefed fore-topsail only, the remainder of her canvas having been blown away, as well as her main yard and all attached sail. In running before the gale into the harbour her wheel-chains gave way, and unable to repair them was forced to anchor when nearly abreast of the lightship. Here the crew cut away the foremast, but one chain of 45 fathoms parted and she drove on the rocks near Tremadog, on the east side of Holyhead Harbour. With great difficulty a line was rigged to the shore and assisted by people on the beach, the crew succeeded in reaching safety, but all were completely exhausted. The master was of the opinion that the loss on the said ship amounted to £3,000, but nothing on the cargo, and he was unaware as to the amount of insurance carried'.
272162	DEVONSHIRE	Post Medieval	The DEVONSHIRE was a wooden sailing vessel carrying cattle from Dublin to Liverpool. The report from Holyhead printed in Lloyds List on 16 October 1827 noted the master's name as Adamson. It also stated the vessel had been caught in heavy squalls whilst running for the entrance of the old harbour. The DEVONSHIRE had been driven onto rock to leeward and was likely to become a total wreck. The crew had been saved and most of the cattle had been got ashore.
272186	AERIAL	Post Medieval	The AERIAL was a 79nt wooden schooner, built in 1848 in Newport, Monmouthshire and registered in Caernarfon. At the time of loss, 3 December 1863, the vessel was owned by Mr Hughes of Porthmadog and captained by Henry Owen. The AERIAL left Belfast at 8 am on 2 December and was caught in a hurricane 8 miles northwest of Holyhead, at 6 am on 3 December. The vessel was forced to head for Holyhead and entered Holyhead Bay at 12.30 pm, setting anchor inside of the lightship. At 10.15 am the bower chain broke and the AERIAL was dragged onto Peniel beach, where it lost its keel and filled with water. No lives were lost as the crew saved themselves in their own boat.
272194	PILOT BOAT NO 5	Post Medieval	The PILOT BOAT NO 5 was a wooden sailing pilot cutter owned by W Owens of Holyhead. The pilot cutter was at anchor in Holyhead Outer Roads on 5 August 1893 was in collision with the Liverpool registered steam tug SEA KING. The cutter subsequently foundered.
272202	INDUSTRIE	Post Medieval	The INDUSTRIE was a 130ton wooden brigantine built in 1834 and belonging to the port of Ostend. At time of loss, the vessel was carrying a cargo of salt from Liverpool to Ostend under the command of master Willibred Jannssens. The rock salt was being shipped by Blackburn & Company of

NPRN	Name	Period	Description
			Liverpool, consigned to Mr. Duclos-Assandre, of Ostend. The brigantine had left Liverpool on 11 November 1863 at 1pm. Contrary winds forced the INDUSTRIE to put into Holyhead Refuge Harbour on 21 November, but the brigantine set out again on the 30 November. Due to the bad weather, the master put back into Holyhead on 1 December, using both anchors to anchor in the roadstead. On Thursday 3 December, at 5.30 pm with the wind blowing a full gale from the north-northwest, a drifting barque got foul of the INDUSTRIE's moorings, and the INDUSTRIE was compelled to slip both anchors to avoid collision. The crew endeavoured to reach the Old Harbour under sail, but the brigantine drove onto the rocks to the east side of the South Pierhead. After the brigantine had been ashore for two hours, the Master and crew abandoned the vessel in their own boat, afraid that the vessel would go to pieces in the night. After finding lodgings, the Master, Mate and cook returned to the beach to watch the vessel and at 2 am saw a boat alongside. They also launched a boat and went out to the brigantine, where they found several people on board, who claimed they had come to get her off the rocks, but were actually engaged in plunder. The value of the vessel was estimated at £100.
272222	SACHEM	Post Medieval	The SACHEM was a wooden sailing vessel on passage from Virginia to Dublin under the command of master Stover. The vessel was wrecked near Holyhead according to a report printed in Lloyds List on 26 January 1802.
272239	FANNY TRUSS	Post Medieval	The FANNY TRUSS was a wooden schooner by Mulvey & Co at Chester in 1848. Technical and configuration specifications are given as: 56.17gt, 48.73rt; 63.7ft length x 16.9ft breadth x 7.6ft depth in hold; 1 deck, 2 masts, rigging schooner, stern round, built carvel, framework wood; official number 3148. The schooner was registered at Chester (10 in 1876, previously 11 in 1856 at Chester) and was owned at time of loss by Ellis Hughes of Connah's Quay, master mariner. The master on charge of the vessel was S Harding. The schooner caught fire in Holyhead harbour on 10 November 1883. The fire was fanned by a north-westerly force 8 gale and, as a consequence, the vessel was completely destroyed.
272266	JANE	Post Medieval	The JANE was a wooden sailing vessel belonging to Workington. The report printed in Lloyds List on 15 November 1816 noted that vessel had been driven ashore at Holyhead.
272285	JOHN	Post Medieval	The JOHN was a wooden schooner registered in the United Kingdom. At the time of loss, 5 February 1824, the vessel was sailing from Cork to Liverpool under the command of Captain Dunbar. The JOHN was driven upon the rocks in a 'tremendous squall', about a mile leeward of Holyhead. The master, mate and four other seamen were hauled ashore with ropes, but eleven passengers and two crew members drowned.
272286	FAVORITE	Post Medieval	The FAVORITE was a wooden schooner registered in Liverpool. At the time of loss, 10 February 1824, the vessel was sailing from Liverpool to Africa under the command of Captain Cummins. The FAVORITE was driven ashore leeward of Holyhead. The large part of her cargo was landed in good order but the vessel bilged and was wrecked. No loss of life was reported.
272315	JAMES	Post Medieval	The JAMES was a wooden sailing vessel on passage from Liverpool to Limerick under the command of master Bowden. On 24 April 1822, the vessel ran onto rocks at the entrance to Holyhead Harbour and was bilged.
272319	LADY HUGHES	Post Medieval	The LADY HUGHES was a wooden sailing vessel which was run down by the schooner GRACE as it entered Holyhead harbour during the night of 29 September 1823. The master's name is given as Ellis. The crew were saved when the LADY HUGHES subsequently sank.
272340	ABBEY	Post Medieval	The ABBEY was a wooden sailing vessel. At time of loss on 30 August 1819, it was carrying a cargo of china clay from Charleston, Devon, to Liverpool under the command of master Cowling. The vessel is reported to have run onto the back slope of the pier at Holyhead and to have been bilged.
272358	CHALES	Post Medieval	The CHALES was a wooden schooner which was carrying a mixed cargo including cheese and iron, plus passengers from Bristol to Glasgow. The report from Liverpool printed in Lloyds List noted the master's name as Humphries and stated that the schooner had been blown onshore at

NPRN	Name	Period	Description
			Holyhead during a severe gale over the night of 15-16 October 1814. The schooner was reported to be full of water and that most of the cargo would be saved. Unfortunately, one female passenger had been drowned in the incident.
272381	VENUS	Post Medieval	The VENUS was a wooden sailing vessel on passage from Liverpool to Sligo in early March 1806. The report printed in Lloyds List on 18 March 1806 noted the master's name as Cumming and that vessel had been wrecked at Holyhead. The crew had been saved and part of the cargo had been recovered.
272389	BRIDGEWATER	Post Medieval	A report printed in Lloyds List on 17 November 1807 noted that vessel BRIDGEWATER, under the command of master Edwards, had been wrecked at Holyhead.
507206	CORAL	Post Medieval	The CORAL was a wooden schooner belonging to the port of Amlwch. In late September/early October 1856, the schooner was carrying a cargo of coal. During the night, it was driven from its anchorage in Holyhead harbour by a northwesterly gale and onto rocks near Porth maen-amarch. The schooner went to pieces before morning. The crew of five persons saved themselves. The lower half of the schooner later floated ashore and it was reported that 'divers have been employed in securing the chains, anchors and other such portions'.
524842	ROSEINA	Post Medieval	The ROSEINA was a wooden schooner built at Porthmadoc in 1851. Technical and configuration specifications are given as 86.17gt, 69.89rt; 62.7ft leength x 18.6ft breqdth x 10.5ft depth in hold; 1 deck, 2 masts, schooner rigged with a standing bowsprit, square sterned, carvel built, has a woman'd bust figurehead, framework and planking are of wood. The schooner was transferred from Caernarfon to the Port of Aberystwyth Shipping register (17 in 1855) on sale to a consortium comprising Anne Daniel of Borth, widow (8 shares); Abraham Jones of Dolybont, tanner (8 shares); Enoch Watkin Jones of Brynllys, farmer, (8 shares); Richard James of Bynells, gentlemen (12 shares); representatives of the late Thomas Daniel, master mariner, deceased (8 shares); John Roberts of Ffestiniog (4 shares); and Morgan Jones of Porthmadoc, shipbuilder (4 shares). The schooner's register entry (17 in 1855) is closed with the annotation 'vessel totally wrecked at Holyhead 18 November 1893'.
524907	LEITH PACKET	Post Medieval	The LEITH PACKET was a wooden sloop built at Berwick-upon-Tweed in 1814. Technical and configuration specifications are given as 49 tons burthen; 49.5ft length x 14.5ft breadth x 9ft depth in hold; 1 deck, 1 masts, Sloop rigged with a running bowsprit, square sterned, carvel built. The sloop had been placed on the Port of Pwllheli Shipping Register in January 1849 by its new owners, after the death of John Marshall, master mariner, of Berwick-upon-Tweed, and his wife Eleanor. John Marshall's partners, Alexander Smith, ship owner and general agent, and Charles Dent, shipowner and coal merchant, passed sahres to Richard Davies of Bodraen and David Davies of Nevin, both mariners. The sloop's register entry is closed with the annotation 'Vessel and certificate lost 12 December 1869 at Holyhead'.
525222	MARY ANN	Post Medieval	The MARY ANN was a wooden schooner built at Barmouth in 1842 (possibly by Griffith Thomas, a shareholder in 1859). Technical and configuration specifications are given as 72.97gt; 56.6ft length x 19ft breadth x 9.95ft depth in hold; 1 deck, 2 masts, rigging schooner, stern square, build carvel, head female bust, framework wood; official number 17145. At time of loss, the vessel was owned by Evan Pierce of Porthmadoc, master mariner, although subject to a mortgage of £40 at 5 percent interest secured from William Jones of Porthmadoc, sallmaker. The MARY ANN's Port of Caernarvon Shipping Register entry (32 in 1859) is closed with the annotation 'Vessel ran into and sunk in Holyhead Harbour 29 January 1882'.
525558	SARAH	Post Medieval	The SARAH was a wooden flat built by James Dodsford at Winsford in 1824. Technical and configuration specifications are given as 48 2998/3500 tons burthen; 63.6ft length x 13.2ft breadth x 5.9ft depth of hold; 1 deck, 1 mast, flat, square sterned, carvel built. At time of loss, the vessel was owned by Edmund Sharpe of Lnacaster, architect, and teh master was William Wignall. The flat's port of Preston Shipping Register entry is closed with the annotation ' Lost near Holyhead July 21 1841 also Registration and licence'.

NPRN	Name	Period	Description
272123	CARRIE BELL	Modern	The CARRIE BELL was a wooden schooner built by Simpson at Glasson Dock in 1842. Technical and configuration specifications are given as 136gt, 98nt; 95ft 3in length x 21ft 4in breadth x 11ft 3in depth; 1 deck, 3 masts; fastened with iron bolts. At time of loss on 25 November 1917, the vessel was owned by J Barrow of Lancaster and was carrying a cargo of china clay from Padstow to Preston under the command of W Maker. The schooner sank 0.75miles southeast of the Holyhead breakwater lighthouse.
272128	ELWOOD	Modern	The ELLWOOD was a wooden schooner built by Archibald McLaren at Montague, Prince Edward Island, in 1877. Technical and configuration specifications are given as 109gt, 91nt; 83ft length x 23ft breadth x 10ft depth; 2 masts. After building, the schooner was transferred to the port of Waterford. At time of loss on 28 February 1918, the vessel was owned by S E Pim of Wicklow and registered at Dublin. It was carrying a cargo of timber from Wicklow to Garston under the command of master J Ward. The schooner ran onto Salt Island, Holyhead.
272147	BEN-LEE	Modern	The BEN-LEE was a steel-hulled, full-rigged ship built by Barclay, Curle & Co Ltd in 1893. Technical and configuration specifications are given as 2341gt, 2204nt; 284ft 5in x 42ft 2in x 24ft 5in; 3 masts, 1 deck, 1 bulkhead, passenger deck 38ft, forecastle 34ft. At time of loss on 29 January 1916, the vessel was owned by J & J Rae & Co , Liverpool , and was under the command of master E R Brown. The BEN-LEE was outward bound to Santos and then onto Sydney, Australia. It was in collision with the American steamship PHILADELPHIA and foundered in the Holyhead Outer Roads.
272160	RIVAL	Modern	The RIVAL was a 78nt, wooden schooner built in 1862 and belonging to the port of Plymouth, Devon. At time of loss on 16 January 1912, the vessel was carrying a cargo of china clay from Pentewan, Cornwall, to Runcorn. The schooner was in collision with the Stockton-upon-Tees registered steamship SCARSDALE and subsequently foundered near the new harbour. One crewmember was also lost in the incident.
272198	VARONS	Modern	The VARONS was a wooden schooner of Latvian registry built by I Puhling (the owner at time of loss) at Oppiesgriew in 1920. Technical and configuration specifications are given as 216gt, 182nt; 105ft length x 26ft 9in breadth x 12ft 5in depth. On 6 March 1931, the vessel was under the command of its long time master Inenburg and was on passage to Teignmouth. The vessel ran onto Salt Island Point.
240968	UNKNOWN COAL HULK	Modern	A coal hulk was reported to have sunk at this location on 12 January 1922. Dispersals operations had been completed by 22 December 1922, when the wreck's warning buoy was removed (Notice to Mariners 9/22 and 95/23). In June 1957, HMS COOK reported no trace could be found and suggested that it was likely that any surviving remains had sunk into the mud.
272093	AMERICAN	Modern	The AMERICAN was a 50nt dumb wooden lighter being towed from Barrow-in-Furness to Southampton. At time of loss on 3 November 1900, the lighter was owned by J Carid & Co, London. It was overwhelmed and sank in the outer roads of Holyhead harbour.
272204	BUSHMILLS	Modern	The BUSHMILLS was a steel-hulled steamship built by E Withy & Co at West Hartlepool in 1890. Technical and configuration specifications are given as 2479gt,1582nt; 300ft x 38ftt 5in x 20ft 6in; 1 deck; 5 bulkheads, passenger deck 33ft, quarterdeck 90ft; screw propulsion powered by twin boilers linked to a triple expansion engine producing 217hp; machinery by Central Marine Eng Co Ltd., West Hartlepool. At time of loss 11 January 1911, the vessel was owned by J Weatherill and registered in Dublin. It was on passage from Liverpool to Cardiff. It was abandoned in Holyhead Roads and drifted onto the Nimrod Rock.
506968	SARO LONDON II K6927	Modern	This London was delivered to 204 Sqn on 8 June 1936. It was returned to Saunders Roe for conversion on 17 February 1937 before being taken by 204 Sqn when it left for Australian tour 2 December 1937. On 15 December 1937, the engine cut out and it was ditched into the sea 52 miles off Akyab, Burma. It was towed to SS JALAGOPAL, but was damaged in collision with the towing ship. It was then assigned to 201 Sqn on 1 October 1939 and 240 Sqn on 11 November 1939. On 5 February 1940, it was being flown by P/O Willis and P/O H A B Porteous from Oban to Calshott. The weather deteriorated and the pilot decided to head for Holyhead Harbour. Visibility was down to about 200 yards or less and he had difficulty in

NPRN	Name	Period	Description
			deciding where to land. Whilst flying at 50ft over the harbour, he saw another London II at moorings which flashed at him to indicate its position. P/O Porteous decided to land alongside, but whilst making the very low, right-hand turn, the starboard wing tip float touched the water and the machine crashed, sinking 10 minutes later. The starboard wings had been torn off and the hull split open. The crew were not seriously hurt and were picked up by the harbour motor boat. The final annotations on the aircraft's service history state that it was struck off charge, damaged beyond repair, after total flying hours 432.35.

Events

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E1	Land at Tyddyn Bach, South Stack Road, Holyhead	44263	Castlering Archaeology	Building Survey	2012	Building survey carried out by Castlering Archaeology in advance of a proposed housing development on land at Tyddyn Bach, Holyhead.
E2	Caernarfon Castle Public House, Holyhead	44523	C.R Archaeology	Building Survey	2013	Building survey carried out by CR Archaeology of Caernarfon Castle Public House, Holyhead, prior to development as part of the Holyhead Townscape Heritage Initiative.
E3	91-95 Market Street, Holyhead	44526	C.R Archaeology	Building Survey	2013	Building survey and desk based assessment carried out by CR Archaeology of 91-95 Market Street, Holyhead, to inform a proposed programme of remedial works at the site.
E4	11-13 Stanley Street, Holyhead	44528	C.R Archaeology	Building Survey	2013	Building survey carried out by CR Archaeology of 11-13 Stanley Street, Holyhead, in advance of proposed development.
E5	Empire Cinema, Stanley Street, Holyhead	44529	C.R Archaeology	Building Survey	2013	Building survey carried out by CR Archaeology of Empire Cinema, Stanley Street, Holyhead, in advance of proposed renovations.
E6	Site of the Former Kwik Save, 44 Market Street, Holyhead	44535	C.R Archaeology	Building Survey	2013	Building survey and desk based assessment carried out by CR Archaeology of 44 Market Street, Holyhead, during the conversion of the property into multiple dwellings.
E7	73-75 Market Street, Holyhead	44618	C.R Archaeology	Building Survey	2015	Building survey and desk based assessment carried out by CR Archaeology of 73-75 Market Street, Holyhead, to inform future conservation plans.
E8	Holyhead Breakwater : Level 4 Building Record	44988	Gwynedd Archaeological Trust	Building Survey	2017	Gwynedd Archaeological Trust was commissioned by Royal HaskoningDHV to carry out a historic building appraisal and record of Holyhead Breakwater, Ynys MÃ´n. Holyhead Breakwater comprises a 2.4km long stone-built structure designed to provide maritime shelter at the Port of Holyhead, as well as protection from coastal erosion. The breakwater was built between 1848 and 1873 and is a Grade II* listed structure. In addition to the pier, which forms the main structure, the breakwater also includes a pier end three-storey lighthouse, built in 1873, a large stone quay from which the breakwater extends, built in 1847, and a late 19th century small stone building located at the end of the quay. The Level 4 building record provides a comprehensive analytical record and draws on the full range of primary and secondary sources of information about the breakwater and discusses its significance in terms of architectural, social, national and economic history. In particular, this includes its relationship with similar 19th century breakwaters and the impact on Holyhead socially and economically during construction and use. The construction of the Holyhead Breakwater reflects governmental interest in the question of harbours of refuge, reflected in the work of a Royal Commission which in 1847 discussed the need for a harbour of refuge at Holyhead to protect shipping on its way to or from Liverpool as well as the safeguarding of the Holyhead packet boats,

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
						similar to that employed at Portland for Channel shipping. The Breakwater was also of international significance as technology and equipment were exported to overseas breakwater developments, including the breakwater at Ponta Delgada in the Azores. The building of the breakwater had a great effect on the town itself. The population increased from 3,869 in 1841 to 8,863 in 1851. The larger population was particularly drawn to Holyhead after 1845 when preparatory work was started on the Great Breakwater. There was also much other work available from a host of employers, which resulted in a move from rural Anglesey as men left farms and smaller communities for Holyhead with its offer of more profitable work. The effect of these developments was, however, to result in the port becoming something of a through port moving goods and people from England to Ireland, with more limited benefit for the town of Holyhead itself. The port and railway did however continue to provide significant employment in the town.
E9	A5 Improvements, Holyhead	40167	Gwynedd Archaeological Trust	Desk-based Assessment	1993	Desk based assessment carried out by Gwynedd Archaeological Trust in advance of improvements to the Holyhead section of the A5 trunk road, Anglesey.
E10	RCAHM Chapel Survey	40251	Gwynedd Archaeological Trust	Desk-based Assessment	1994	
E11	Dolgarrog - Eglwysbach Pipelines	40342	Gwynedd Archaeological Trust	Desk-based Assessment	1995	Desk based assessment and field survey carried out by Gwynedd Archaeological Trust in advance of the proposed construction of four water pipelines in the Conwy Valley.
E12	A55 Bryngwran to Holyhead West Section	40353	Gwynedd Archaeological Trust	Desk-based Assessment	1996	Desk based assessment carried out by Gwynedd Archaeological Trust in advance of the proposed construction of a section of the A55 road, Anglesey, between Ty Mawr farm and north of the London road Junction, Holyhead.
E13	Holyhead WTW Improvements: Urban	40605	Gwynedd Archaeological Trust	Desk-based Assessment	2002	Gwynedd Archaeological Trust were asked by Symonds Group Ltd to undertake archaeological assessment in advance of a new pipeline between the Waste Water Treatment works at Penrhos, Holyhead and Holyhead Harbour.
E14	Land at Tyddyn Bach South Stack Road, Holyhead	44014	Castlering Archaeology	Desk-based Assessment	2006	Desk based assessment and field visit carried out by Castlering Archaeology in advance of proposed development on land at Tyddyn Bach, Holyhead.
E15	A5 Anglesey Improvements Stage 2: A5114 Nant Turnpike to West of Bryngwran	44366	Gwynedd Archaeological Trust	Desk-based Assessment	1993	Desk based assessment carried out by Gwynedd Archaeological Trust of a section of road in advance of proposed improvements to the A5 trunk road across Anglesey.

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E16	Market Hall, Stanley Street, Holyhead	44530	C.R Archaeology	Desk-based Assessment	2013	Desk based assessment carried out by CR Archaeology of Market Hall, Holyhead, as part of proposed regeneration works in the area.
E17	Holyhead to Cwm Reservoir. Archaeological Assessment.	44925	Gwynedd Archaeological Trust	Desk-based Assessment	2016	Gwynedd Archaeological Trust was commissioned by Black & Veatch to carry out an archaeological assessment in December 2015-February 2016 in advance of a proposed water main renewal scheme west of Holyhead, Anglesey. The landscape around the proposed Holyhead pipeline route was noted to be rich in archaeological remains from the early prehistoric through to post-medieval times. Recommendations included an archaeological watching brief and controlled stripping for different sections of the route.
E18	Holyhead Waterfront, Holyhead, Anglesey. Archaeology and Cultural Heritage Desk Based Assessment.	45284	Cambrian Archaeological Projects	Desk-based Assessment	2010	Cambrian Archaeological Projects undertook in 2010, an Archaeological and Cultural Heritage Desk Based Assessment as part of an Environmental Impact Assessment for the proposed development of a new marina and associated facilities in Holyhead Harbour. The study highlighted the area is rich in archaeological and historical remains, and 12 proposed landscape character areas were identified.
E19	London Road, Holyhead, Archaeological Evaluation	45067	Gwynedd Archaeological Trust	Evaluation	2017	Gwynedd Archaeological Trust was contracted by BC Services Ltd to undertake an archaeological evaluation in advance of a proposed housing development off London Road, Holyhead, Anglesey. The archaeological evaluation involved monitoring the removal of Japanese Knotweed and the excavation of five trenches across the northern half of the site. Limited archaeological remains in the form of remnants of a stone field boundary wall alongside a spring depicted on Ordnance Survey Maps were identified during the evaluation. It also revealed that the area within the proposed development boundary has been heavily disturbed through the removal of topsoil and modern services, such as, a large sewer main that extends across the length of the site (Reilly & Smith 2017).
E20	Hibernia Row Pumping Station, Holyhead: Archaeological Field Evaluation	54767	Gwynedd Archaeological Trust	Evaluation	2004	
E21	Excavations at Caer Gybi, Holyhead 1952	42160	Ministry of Works	Excavation	1952	
E22	GAT Historic Churches Project	43449	Gwynedd Archaeological Trust	Field Observation	1998	

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E23	Coastal Erosion Survey: Anglesey	40362	Gwynedd Archaeological Trust	Field Survey	1997	Desk based assessment and field survey carried out by Gwynedd Archaeological Trust to assess and map the scale of erosion of the coastline of Anglesey.
E24	Field Monument Warden Site Visit: Roman Wall Surrounding St Cybi's Churchyard	42161	Cadw	Field Visit	1994	Field visit made by Cadw to Roman Wall Surrounding St Cybi's Churchyard as part of scheduled ancient monument monitoring.
E25	Field Monument Warden Site Visit: Roman Wall Surrounding St Cybi's Churchyard	44735	Cadw	Field Visit	1986	Field visit made by Cadw to Roman Wall Surrounding St Cybi's Churchyard as part of scheduled ancient monument monitoring.
E26	Field Monument Warden Site Visit: Roman Wall Surrounding St Cybi's Churchyard	44736	Cadw	Field Visit	1997	Field visit made by Cadw to Roman Wall Surrounding St Cybi's Churchyard as part of scheduled ancient monument monitoring.
E27	Field Monument Warden Site Visit: Roman Wall Surrounding St Cybi's Churchyard	44737	Cadw	Field Visit	2005	Field visit made by Cadw to Roman Wall Surrounding St Cybi's Churchyard as part of scheduled ancient monument monitoring.
E28	Field Monument Warden Site Visit: Roman Wall Surrounding St Cybi's Churchyard	44738	Cadw	Field Visit	2006	Field visit made by Cadw to Roman Wall Surrounding St Cybi's Churchyard as part of scheduled ancient monument monitoring.
E29	First World War Military Sites: Manufacturing and Research and Development. Part 1: Report and Gazetteer	44890	Gwynedd Archaeological Trust	Heritage Assessment	2016	This report describes the results of a study, funded by Cadw, of First World War sites in north-west Wales coming under the theme of manufacturing and research and development. It focuses on the early use of aircraft in war in north-west Wales, both airships and aeroplanes, and the major advances in long wave telegraphy that were developed in the area. Munitions manufacturing and more general manufacturing during the war are also covered with specific sites identified. Over all 14 main sites and 108 features within these have been identified and included in the gazetteer (appendix III). Further work on the prisoner of war camp at Frongoch, Bala has also been included in this years project and artefacts made by the prisoners were recorded. All the sites are included in an Access database to assist inclusion into the HER, and there is an accompanying MapInfo table of polygons defining the limits of those sites where these could be identified. The history and background of these sites is considered and their current condition was checked and recorded. Issues relating to scheduling these sites and specific sites proposed for scheduling are included in the confidential part 2 of this report.

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E30	First World War Military Sites: Infrastructure and Support. Report and Gazetteer	44893	Gwynedd Archaeological Trust	Heritage Assessment	2017	This report describes the results of a study, carried out by Gwynedd Archaeological Trust and grant aided by Cadw, of First World War sites in north-west Wales coming under the theme of infrastructure and support. It focuses particularly on the military and auxiliary hospitals in the area but also looks at a range of activities that local people in north-west Wales undertook to help the war effort. This includes efforts to increase in food production and forestry, the work of local societies and the use of existing buildings to accommodate soldiers during training and Belgian refugees. Over all 93 sites have been identified and included in the gazetteer (appendix I). All the sites are included in an Access database to assist inclusion into the HER, and there is an accompanying MapInfo table of polygons. The history and background of these sites are considered and their current condition was checked and recorded at a basic level. The work for this project was undertaken in the financial year 2016-17.
E31	Penrhos Leisure Village, Holyhead, Anglesey	44658	Gwynedd Archaeological Trust	Historic Area Assessment	2012	Gwynedd Archaeological Trust was asked by How Planning, on behalf of Land and Lakes Ltd, to undertake a detailed assessment of the historic landscape character of the north-western half of Holy Island, Anglesey, in advance of proposed development.
E32	LANDMAP Ynys Mon History Aspect	43618	Gwynedd Archaeological Trust	Landscape Characterisation	2000	
E33	Holyhead Harbour Draft Conservation Plan	41476	Donald Insall Associates Ltd.	Monument Management	2003	
E34	Prn 17176 Photographic Record	43622	W M Design	Photographic record	2003	Photographic record made prior to demolition
E35	Prn 19165 Photographic Record	43659	Not detailed (Roberts, E.)	Photographic record	2004	Photographic record made prior to development works
E36	Prn 19171 Photographic Record	43660	Not detailed (Roberts, E.)	Photographic record	2004	Photographic record made prior to development works
E37	St Cybi's Church, Holyhead, Anglesey: Recording of the Southern Clerestory Windows	44849	Gwynedd Archaeological Trust	Photographic Survey	2017	Photographic survey of the 13th century St Cybi Church, Holyhead, a Medieval Grade I Listed Building.
E38	The Medieval Mills of Anglesey: Archaeological Threat Related Assessment	44297	Gwynedd Archaeological Trust	Project	2002	Cadw funded project carried out by Gwynedd Archaeological Trust to identify Medieval mills on Anglesey, to asses their status and condition, and to make appropriate management recommendations.

RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E39	Early Celtic Societies in North Wales	44557	Bangor University	Project	2010	Desk based research project undertaken by Waddington, K. in collaboration with Bangor University and Karl, R. as an expansion of the 'Welsh Roundhouse Project. The project assessed evidence for settlement from the Late Bronze Age to the early medieval period (late 2nd millennium BC- early 2nd millennium AD) in north-west Wales and examined the long-term processes of social change and settlement practices. Drew on previous work by Ghey.E., Johnston. R., Edwards. E. and Pope, R. and a number of Gwynedd Archaeological Trust projects, in particular 'G1770 Defended enclosures survey and 'G1104 Hut circle settlement survey. Funded by the University of Wales Publications and Collaborative Research Committee (the successor to the former Board of Celtic Studies).
E40	Cadw Scheduling Enhancement: Holy Wells	45033	Gwynedd Archaeological Trust	Project	2011	This project has been grant aided by CADW, and undertaken by Gwynedd Archaeological Trust in 2011, and forms part of a wider scheduling enhancement project which aims to assess all monuments of Medieval and Post-Medieval date. This report forms one of four projects being undertaken within 2010-11 to examine all ecclesiastical remains from the relevant period. The projects have been undertaken with the primary aim of providing consistent and accurate information to allow the creation of a database of Medieval ecclesiastical sites in Northwest Wales, so that sites considered to be of national importance can be identified.
E41	Prehistoric Funerary and Ritual Monument Survey: West Gwynedd/Anglesey	40526	Gwynedd Archaeological Trust	Project record	2003	
E42	Pan-wales Prehistoric Funerary and Ritual Sites Survey: Trial Data Synthesis	40527	Gwynedd Archaeological Trust	Project record	2005	
E43	North Wales Intertidal Peat Survey 2001-2002	40567	Gwynedd Archaeological Trust	Project record	2002	
E44	Deserted Ecclesiastical Sites in North-west Wales: a Threat-related Archaeological Assessment	40569	Gwynedd Archaeological Trust	Project record	2004	
E45	Investigations at Caer Gybi Holyhead Environmental Improvement Scheme Phase	40095	Gwynedd Archaeological Trust	Watching Brief	1992	Watching brief carried out by Gwynedd Archaeological Trust during works relating to the Welsh Development Agency Town Improvement scheme at Caer Gybi, Holyhead.

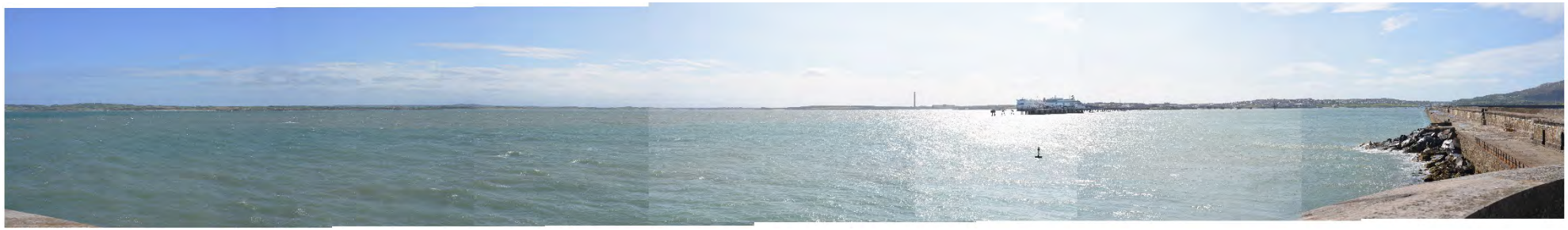
RHDHV ID	Name	PRN	Organisation	Type	Year	Summary
E46	Investigations at Holyhead St. Cybi Environmental Improvement	40096	Gwynedd Archaeological Trust	Watching Brief	1992	Watching brief carried out by Gwynedd Archaeological Trust during works relating to the Welsh Development Agency Town Improvement scheme at Caer Gybi, Holyhead.
E47	9 Stanley Street, Holyhead	40320	Gwynedd Archaeological Trust	Watching Brief	1995	Watching brief carried out by Gwynedd Archaeological Trust during the construction of an extension to council offices at Stanley Street, Holyhead.
E48	Market Street, Holyhead, Drainage Scheme	44668	Gwynedd Archaeological Trust	Watching Brief	2015	Gwynedd Archaeological Trust was commissioned by Cyngor Sir Ynys Môn in 2015 to undertake a partial watching brief during works associated with a water drainage scheme and street improvements at Market Street, Holyhead. Two areas containing a metalled surface were identified and have been tentatively interpreted as a Medieval or earlier road surface.
E49	Old Scouts' Hall, Holyhead	44671	Gwynedd Archaeological Trust	Watching Brief	2015	Gwynedd Archaeological Trust was commissioned by BC Services (Anglesey) Ltd in 2015 to undertake a watching brief during works associated with the construction of a new building on the site of the Old Scouts' Hall, Holyhead. Evidence of the demolished former scouts' hall was revealed, as well as earlier allotment gardens marked at this location on historic OS mapping.
E50	St. Cybi's Church, Holyhead. Internal West Wall of Nave: Archaeological Watching Brief and Survey	44850	Gwynedd Archaeological Trust	Watching brief	2017	
E51	Land off South Stacks Road, Holyhead, Anglesey	45065	Castlering Archaeology	Watching Brief	2017	Castlering Archaeology was commissioned by Anwyl Homes in 2016-17 to conduct a watching brief during ground intrusive works as part of the construction phase of the residential development on c.3.6 hectares of land off South Stacks Road, Holyhead, Anglesey. The site comprises former agricultural land that surrounded three former farmsteads – Tyddyn Bach, Tyddyn y Feiler and Tydfil. The watching brief forms Phase 3 of a programme of archaeological work undertaken prior to and following planning permission granted for the development. The watching brief during ground intrusive works was conducted intermittently between October 2016 and May 2017. Despite the potential archaeological interest of the site and the extent of the groundworks, no significant archaeology was revealed.
E52	Holyhead to Cwm Reservoir. Archaeological Mitigation: Interim Report	45225	Gwynedd Archaeological Trust	Watching Brief	2016	Gwynedd Archaeological Trust was asked by Morrison Utility in 2016 to undertake a controlled strip and watching brief during ground works for a replacement water main, West of Holyhead. The work revealed mostly post-medieval features yet a prehistoric burnt mound was also uncovered.

Royal HaskoningDHV

Annex 2: Panoramas

Panorama 1: Looking west towards Pelham Quay *(image courtesy of Estell Warren)*

Panorama 2: Looking north from South Pier, towards Admiralty Pier *(image courtesy of Estell Warren)*



Panorama 3: Looking south from near the lighthouse on Holyhead Breakwater (image courtesy of Estell Warren)

Panorama 4: Looking north from Skinners Monument, near properties at Harbour View (image courtesy of Estell Warren)

Panorama 5: Looking south east from properties at Fair View, near the Isle of Anglesey Coastal Path (path follows the Prince of Wales Road, right of photograph) (image courtesy of Estell Warren)

G2 – Archaeological Assessment of Geophysical Survey

Holyhead Port Expansion

Archaeological Assessment of Marine Geophysical Data

Ref: 203703.01
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wessexarchaeology

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Summary

Wessex Archaeology was commissioned by Royal HaskoningDHV to assess data acquired from Holyhead Port in advance of a proposed expansion scheme. The proposed development involves the reclamation of two areas, one around the Old Harbour area of Holyhead Port (the Pelham Patch Development) and one to the east of the existing Irish Ferries terminal (the Salt Island Expansion site), and the dredging of a new approach channel.

The study area comprises the extents of the proposed dredge footprint, which extends from the mouth of the Old Harbour to approximately 1.8 km out into the Fairway to the east of Salt Island (Ynys Halen).

This report consists of an assessment of marine geophysical survey data comprising sub-bottom profiler (SBP), sidescan sonar (SSS), magnetometer and multibeam echosounder (MBES) datasets, acquired by Titan Environmental Surveys Ltd. during two separate surveys in 2018. The aim of this assessment is to identify any anomalies of archaeological potential within the study area, in order to further inform the planning process ahead of the proposed development scheme.

A previous assessment for the proposed expansion scheme was carried out by Wessex Archaeology for Titan in 2018, based on the original survey data acquired in May 2018. This current assessment supersedes the previous report, and also includes an assessment of the data acquired from the survey extension area in December 2018.

No palaeolandscape features of archaeological potential were identified during assessment of the sub-bottom profiler data.

A total of 13 seabed anomalies of archaeological potential were identified within the proposed dredge footprint, all of which were assigned an A2 archaeological rating (Uncertain origin of possible archaeological interest). The most significant of these is 7003, the remains of the Mail Jetty of Admiralty Pier, which may be of local historic interest. Six of the identified anomalies were magnetic only, indicating buried ferrous debris. These may be of archaeological potential, or be modern debris associated with Holyhead Port.

No potential wreck sites were identified, and no recorded wrecks or obstructions are present within the proposed dredge footprint.

Additional anomalies were identified within the survey data but outside of the proposed dredge footprint. These are outlined in a separate summary report (document ref. 203703.2).

It is recommended that if any objects of possible archaeological interest are recovered during the proposed development, they should be reported through an agreed protocol. This will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures.

Acknowledgements

This assessment was commissioned by Royal HaskoningDHV. Wessex Archaeology would like to acknowledge the assistance of Sarah Marjoram of Royal HaskoningDHV throughout the project.

The survey data were acquired by Titan Environmental Surveys Ltd., and Wessex Archaeology would like to acknowledge the assistance of Edd Wilkes and Vince Grove of Titan during the original data assessment.

Holyhead Port Expansion

Archaeological assessment of marine geophysical data

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Royal HaskoningDHV to assess geophysical survey data acquired from Holyhead Port in advance of a proposed expansion scheme. The proposed development involves the reclamation of two areas, one around the Old Harbour area of Holyhead Port (the Pelham Patch Development) and one to the east of the existing Irish Ferries terminal (the Salt Island Expansion site), and the dredging of a new approach channel.

1.1.2 The study area comprises the extents of the proposed dredge footprint, which extends from the mouth of the Old Harbour to approximately 1.8 km out into the Fairway to the east of Salt Island (Ynys Halen) (Fig. 1).

1.1.3 This report consists of an assessment of marine geophysical survey data comprising sub-bottom profiler (SBP), sidescan sonar (SSS), magnetometer and multibeam echosounder (MBES) data sets, acquired by Titan Environmental Surveys Ltd. (Titan) during two separate surveys in May and December 2018.

1.1.4 A previous assessment for the proposed expansion scheme was carried out by Wessex Archaeology for Titan in 2018, based on the original survey data acquired in May 2018 (Wessex Archaeology 2018). This current assessment supersedes the previous report, and also includes an assessment of the data acquired from the survey extension area in December 2018 (Fig. 1).

1.1.5 The geophysical data coverage achieved from both previous surveys covers a larger area than the proposed dredge footprint (Fig. 1). This report presents the results from within the dredge footprint area only; a separate summary report (Wessex Archaeology 2019) summarising any identified anomalies outside of the dredge footprint has been produced to accompany this document.

1.2 Aims and objectives

1.2.1 The aim of this assessment is to identify any anomalies of archaeological potential within the proposed dredge footprint, in order to further inform the planning process ahead of the proposed development scheme. This is to be achieved through the following objectives:

- identify any buried palaeolandscape features of possible archaeological potential;
- confirm the presence of known or previously located marine sites of archaeological potential, and comment on their apparent character;
- identify, locate and characterise hitherto unrecorded marine sites of archaeological potential; and

- provide recommendations for archaeological mitigation.

1.3 Co-ordinate system

1.3.1 The survey data were acquired in British National Grid (BNG) projected coordinates, and the results within this report are presented using the same coordinate system.

2 METHODOLOGY

2.1 Data sources

2.1.1 A number of data sources were consulted during this assessment, including:

- Geophysical survey data (SSS, MBES, SBP and magnetometer), acquired by Titan in May and December 2018, and the accompanying survey report (Titan 2019);
- Wreck and obstruction data provided by the United Kingdom Hydrographic Office (UKHO);
- Desk-based assessment and method statement associated with the proposed development and survey (Royal HaskoningDHV 2018a, 2018b); and
- Past reports and historic borehole records from previous developments in the area (Fugro-McClelland 1993, Fugro 2002).

2.2 Geophysical data – technical specifications

2.2.1 Geophysical data were acquired by Titan between 12 and 19 May 2018 for the original survey, and between 10 and 12 December 2018 for the extension area survey, both undertaken on board the survey vessel MV *Titan Surveyor*. Main lines were generally run NNE-SSW at a spacing of 30 m, with perpendicular cross lines run every 200 m. Additional lines within the harbour area were run along the length of the harbour, at a spacing of 30 m. Further details on the equipment used are provided in Table 1:

Table 1 Summary of survey equipment

Survey Company	Survey Vessel	Data Type	Equipment	Data Format
Titan (May 2018)	*Titan Surveyor*	SBP	Innomar SES-2000 parametric SBP Applied Acoustics surface towed boomer	*.sgy* *.seg*
		MBES	Geoacosutics Geoswath 4 (250 kHz)	*.xyz*
		SSS	Edgetech FS4200 (100 / 600 kHz, 50 m range)	*.xtf*
		Magnetometer	Geometrics G-882	*.csv*
		Positioning	Trimble HYDROpro	N/A
Titan (Dec 2018)	*Titan Surveyor*	SBP	Applied Acoustics surface towed boomer	*.seg*
		MBES	Reson Seabat T-20P Dual Head (400 kHz)	*.txt*
		SSS	Edgetech FS4200 (100 / 600 kHz, 50 m range)	*.xtf* *.jsf*
		Magnetometer	Geometrics G-882	*.csv*
		Positioning	Trimble HYDROpro	N/A

2.3 Geophysical data – processing

2.3.1 A number of datasets were assessed over the study area; each dataset was processed separately using the following software (Table 2):

Table 2 Software used for geophysical assessment

Dataset	Processing Software	Interpretation and rationalisation
SBP	CodaOctopus Survey Engine v5.5	ArcMap v10.5
MBES	QPS Fledermaus v7.8	
SSS	CodaOctopus Survey Engine v5.5	
Magnetometer	MagPick v3.25	

2.3.2 The SBP and MBES data were used as the primary datasets for the palaeographic assessment and the SSS, MBES and magnetometer datasets were used for the seabed features assessment. 100% of all data sets were assessed.

2.3.3 The SBP data were processed using CodaOctopus Survey Engine Seismic+ software. This software allows the data to be visualised with user selected filters and gain settings in order to optimise the appearance of the data for interpretation. The software then allows an interpretation to be applied to the data by identifying and selecting sedimentary boundaries and shallow geological features that might be of archaeological interest.

2.3.4 The SBP data were interpreted with a two-way travel time (TWTT) along the z-axis. In order to convert from TWTT to depth, the velocity of the seismic waves was estimated to be 1,600 ms^{-1}. This is a standard estimate for shallow, unconsolidated sediments.

2.3.5 The SBP data can also be used to record small reflectors which appear to be buried material such as a wreck site covered by sediment. The position and dimensions of any such objects are noted in a gazetteer and an image of each anomaly acquired. It should be noted that anomalies of this type are rare, as the sensors must pass directly over such an object in order to produce an anomaly.

2.3.6 The MBES data were analysed to identify any unusual seabed structures that could be shipwrecks or other anthropogenic debris. The data were provided as 1.0 m gridded files and were analysed using QPS Fledermaus software, which enables a 3-D visualisation of the acquired data and geo-picking of seabed anomalies. The MBES data were also used in the palaeogeographic assessment.

2.3.7 The high frequency *.xtf* SSS data files were processed using CodaOctopus Survey Engine Sidescan+ software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were interpreted for any objects of possible anthropogenic origin. This involves creating a database of anomalies within Coda by tagging individual features of possible archaeological potential, recording their positions and dimensions, and acquiring an image of each anomaly for future reference.

2.3.8 A mosaic of the SSS data is produced during this process to assess the quality of the sonar towfish positioning. This process allows the position of anomalies to be checked between different survey lines and for the positioning to be further refined if necessary.

2.3.9 The form, size and/or extent of an anomaly is a guide to its potential to be an anthropogenic feature and therefore of archaeological interest. A single small but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor

anomalies may define the edges of a buried but intact feature, or it may be all that remains as a result of past impacts from, for example, dredging or fishing.

2.3.10 The magnetometer data were processed using Geometrics MagPick software in order to identify any discrete magnetic contacts which could represent buried metallic debris or structures such as wrecks.

2.3.11 The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map. The data were first smoothed to try and eliminate any spiking. A trend was then fitted to the resulting data, and the trend values subtracted from the smoothed values. This was carried out in an attempt to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged based on the grid and individual profile lines. Images are taken in a similar process to that of the SSS data.

2.4 Geophysical data – data quality

2.4.1 Once processed, the geophysical data sets were individually assessed for quality and their suitability for archaeological purposes, and rated using the following criteria (Table 3):

Table 3 Criteria for assigning data quality rating

Data quality	Description
Good	Data which are clear and unaffected or only slightly affected by weather conditions, sea state, background noise or data artefacts. Seabed datasets are suitable for the interpretation of upstanding and partially buried wrecks, debris fields, and small individual anomalies. The structure of wrecks is clear, allowing assessments on wreck condition to be made. Subtle reflectors are clear within SBP data. These data provide the highest probability that anomalies of archaeological potential will be identified.
Average	Data which are moderately affected by weather conditions, sea state and noise. Seabed datasets are suitable for the identification of upstanding and partially buried wrecks, the larger elements of debris fields and dispersed sites, and larger individual anomalies. Dispersed and/or partially buried wrecks may be difficult to identify. Interpretation of continuous reflectors in SBP data is problematic. These data are not considered to be detrimentally affected to a significant degree.
Below Average	Data which are affected by weather conditions, sea state and noise to a significant degree. Seabed datasets are suitable for the identification of relatively intact, upstanding wrecks and large individual anomalies. Dispersed and/or partially buried wrecks, or small isolated anomalies may not be clearly resolved. Small palaeogeographic features, or internal structure may not be resolved in SBP data.
Variable	This category contains datasets where the individual lines range in quality. Confidence of interpretation is subsequently likely to vary within the study area.

2.4.2 Two different SBP systems (surface towed boomer and parametric SBP) were used by Titan. The quality of the boomer data has been rated as ‘Good’ using the above criteria, with good penetration into the shallow geology and reflectors clearly visible.

2.4.3 The parametric SBP data were rated as ‘Average’ using the above criteria. The data were generally good, but the relatively hard geology of the study area restricted penetration, and very few shallow reflectors were visible. This dataset was not considered suitable for archaeological assessment within this study area, and so only the boomer data were used to undertake the assessment.

2.4.4 The MBES data were rated as 'Good' using the above criteria. The data quality and resolution of 1 m was found to be of a good standard and suitable for archaeological assessment of objects and debris over 1 m in size.

2.4.5 The SSS data have been rated as 'Good' using the above criteria table, with small anomalies generally clearly visible throughout most of the dataset. Some noise and snatching were visible within some of the data lines, particularly those run within the harbour area, but this did not detrimentally affect the data to a significant degree.

2.4.6 The magnetometer data have been rated as 'Average' using the above criteria table, with small anomalies generally clearly visible. However, lines run in proximity to harbour infrastructure resulted in large background signals which may mask the presence of smaller anomalies.

2.5 Geophysical data – anomaly grouping and discrimination

2.5.1 The previous section describes the initial interpretation of all available geophysical datasets, which were conducted independently of one another. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different datasets and apparently overstating the number of archaeological features in the study area.

2.5.2 To address this fact the anomalies were grouped together; allowing one ID number to be assigned to a single object for which there may be, for example, a UKHO record and multiple SSS anomalies.

2.5.3 Once all the geophysical anomalies and desk-based information have been grouped, a discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. These flags are ascribed as follows (Table 4):

Table 4 Criteria discriminating relevance of identified features to proposed scheme

Overview classification	Discrimination	Criteria	Data type
Archaeological	P1	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material	SBP, MBES
Archaeological	P2	Feature of possible archaeological interest	SBP, MBES
Archaeological	A1	Anthropogenic origin of archaeological interest	MBES, SSS, Mag.
Archaeological	A2	Uncertain origin of possible archaeological interest	MBES, SSS, Mag.
Archaeological	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly	MBES, SSS, Mag.

2.5.4 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all features of potential archaeological interest to be highlighted, while retaining all the information produced during the course of the geophysical interpretation and desk-based assessment for further evaluation should more information become available.

3 PALAEOGEOGRAPHIC ASSESSMENT

3.1 Geological baseline and archaeological potential

3.1.1 Holy Island (Ynys Gybi) and most of Anglesey (Ynys Môn) are composed of superficial drift overlying Precambrian geology, most notably the Mona Complex. The on-shore area is characterised by outcrops of the Precambrian New Harbour Group, which comprises interbedded mica shists and psammites (British Geological Survey (BGS) 2018), along with scattered igneous intrusions.

3.1.2 The recent geological history of the UK is directly linked to glacial / interglacial cycles experienced during the Pleistocene (2.5 million – 10 ka), which resulted in large areas of the surrounding continental shelf being periodically exposed as a terrestrial environment. This is represented in the geological record, with distinct terrestrial landscape features being present across what is now the seabed, interspersed with deposits of marine and glacially derived sediments.

3.1.3 Previous borehole surveys from the vicinity of the study area have recovered evidence of these repeated glacial cycles, in the form of glacial till overlying the Precambrian bedrock (Fugro-McClelland 1993, Fugro 2002). It is likely that these are equivalent to the Devensian tills of the Cardigan Bay Formation, as identified further offshore (Jackson *et al.* 1995).

3.1.4 Due to these repeated glacial cycles, the corresponding rises and falls in eustatic sea level, and major reconfigurations of the landscape during the last million years, the archaeological record of the UK is phased between periods of occupation and long periods of hiatus, when environmental conditions or high sea levels restricted access to Britain.

3.1.5 Although now fully submerged, the proposed development area was a terrestrial environment during much of prehistory. No prehistoric sites or finds are known from within the study area, although the potential remains for preserved Palaeolithic and Mesolithic land surfaces to be present below the modern superficial marine and intertidal sediments.

3.1.6 Sea level curve data estimates that the survey area would have become fully inundated during the Mesolithic period (c. 10,000 – 4,000 BC) (Shennan and Horton 2002), and so any archaeological material present in the region since this date is likely to be directly related to sea-faring and the growth of settlement at and around Holyhead.

3.2 Palaeogeographic assessment results

3.2.1 The identified geology within the study area has been divided into 4 phases, as described below and illustrated in Figure 2:

Table 5 Shallow stratigraphy of the study area

Unit	Unit Name	Geophysical Characteristics (1)	Sediment Type (2)	Archaeological Potential
4	Holocene Seabed Sediments	Acoustically layered unit of varying thickness, contains gas in some areas.	Intertidal/marine deposit, soft clay, silt and sand.	Considered of low potential in itself, but possibly can cover archaeological material.

Unit	Unit Name	Geophysical Characteristics [1]	Sediment Type [2]	Archaeological Potential
3	Devensian Upper Till	Observed cutting into Unit 2 in some parts of the study area, relatively acoustically unstructured with some internal reflectors.	Stiff gravelly clay.	Low archaeological potential.
2	Devensian Lower Till	Observed across much of the study area, generally acoustically chaotic with some areas of possible layering.	Stiff gravelly clay and clayey, schist gravel. Possible lodgement till.	Low archaeological potential.
1	Precambrian Bedrock	Observed across the entire study area, relatively homogenous unit with some internal reflectors.	Metamorphic mica schist and psammite bedrock.	No archaeological potential, although upper boundary may have formed a land surface.

[1] Based on geophysical data

[2] Based on previous borehole data, Jackson *et al.* 1995, and BGS 2018

3.2.2 Unit 1 represents the Precambrian bedrock, recorded to comprise mica shists and psammites of the New Harbour Group. This unit was identified at relatively shallow depth throughout the study area. As Precambrian bedrock, the unit itself is not considered to be of archaeological potential. However, the upper boundary may at one time have provided a land surface upon which archaeological material may have been deposited.

3.2.3 Unit 2 and Unit 3 are present across much of the study area, directly overlying Unit 1. Both units are interpreted as representing glacial till from the Devensian Cardigan Bay Formation, but have been separated into two distinct units (an upper and lower till) based on the geophysical data. It is possible that Unit 2 represents a lodgement till, and Unit 3 a subsequent ablation till, although this is not certain. As glacial till deposits, Unit 2 and Unit 3 are not considered to be of archaeological potential.

3.2.4 Unit 4 overlies Unit 2 and Unit 3 and in some places Unit 1, and represents the modern marine/intertidal sediment. The unit varies in thickness from a relatively thin veneer further out along the fairway, to a few metres thick in sheltered areas (e.g. immediately to the east of Salt Island), to absent where it has been removed by dredging of the harbour navigation channel. In areas where Unit 4 is relatively thick, accumulations of shallow gas have been observed.

3.2.5 As a modern seabed sediment, Unit 4 is not considered to be of archaeological potential in itself. However, it has to potential to cover debris of archaeological potential in areas where it is relatively undisturbed.

3.2.6 No palaeogeographic features of archaeological potential were identified within the study area.

4 SEABED FEATURES ASSESSMENT

4.1 Introduction

4.1.1 The geophysical data were assessed to identify features of archaeological potential relating to maritime and aviation activity.

4.1.2 Evidence shows that Holy Island has been continuously settled from the Neolithic up until the present day, with Holyhead harbour being a centre for both trade and military activity at various periods within this time.

4.1.3 This indicates any archaeological material present within the study area could be from a wide range of periods, although no sites from any periods have been previously identified within the study area.

4.2 Seabed features assessment results

4.2.1 The results of this assessment are collated in gazetteer format detailed in Appendix 1, and the distribution of identified anomalies illustrated in Figure 3.

4.2.2 A total of 13 features have been identified as being of possible archaeological potential within the proposed dredge footprint, and are discriminated as shown in Table 6. No previously recorded wrecks or obstructions are present within the proposed dredge footprint.

Table 6 Anomalies of archaeological potential within the proposed dredge footprint

Archaeological discrimination	Quantity	Interpretation
A1	0	Anthropogenic origin of archaeological interest
A2	13	Uncertain origin of possible archaeological interest
A3	0	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	13	

4.2.3 Furthermore, these anomalies can be classified by probable type, which can further aid in assigning archaeological potential and importance (Table 7).

Table 7 Types of anomaly identified

Anomaly classification	Definition	Number of anomalies
Debris field	A discrete area containing numerous individual debris items that are potentially anthropogenic, and can include dispersed wreck sites for which no coherent structure remains	3
Debris	Distinct objects on the seabed, generally exhibiting height or with evidence of structure, that are potentially anthropogenic in origin	3
Dark reflector	Individual objects or areas of high reflectivity, displaying some anthropogenic characteristics. Precise nature is uncertain	1
Magnetic	No associated seabed surface expression, and have the potential to represent possible buried ferrous debris or buried wreck sites	6
Total		**13**

4.2.4 Additional anomalies to those outlined above have been identified within the survey data, but outside the proposed dredge footprint. These are not discussed in detail here, but are summarised in an additional report (Wessex Archaeology 2019).

4.2.5 Three of the identified anomalies have been classified as debris fields. The largest, **7003**, is an area measuring approximately 162.0 x 18.5 m extending ENE between the eastern end of Admiralty Pier and the existing channel marker beacon (Fig. 3).

4.2.6 This debris field comprises numerous irregular dark reflectors, including linear features and alignments of point reflectors, most of which have small shadows indicating height above the seabed of up to 1.2 m. The feature was also clearly identified within the MBES data, as a linear area of debris (Fig. 4).

4.2.7 This is interpreted as the remains of the old Mail Jetty, originally constructed at this location in the mid-18th Century, and then demolished in the mid-20th century (Royal HaskoningDHV 2018a). Although this debris field is the remains of a previously demolished structure, the remains may be of local historic interest, and the rest Admiralty Pier itself is a Grade II listed structure.

4.2.8 Debris field **7016** is situated towards the northern edge of the proposed dredge footprint, and is a dispersed scatter of irregular dark reflectors, including linear features, measuring 56.3 x 31.3 m. A number of the features have small shadows, indicating heights above seabed of up to 0.3 m. A magnetic anomaly measuring 59 nT in amplitude has been tentatively associated with this debris field, suggesting some features may be ferrous in composition.

4.2.9 Debris field **7009** is a much smaller feature, measuring 5.0 x 2.7 m, and contains at least three small distinct objects with height above seabed up to 0.3 m. No magnetic anomaly has been associated with this feature, and so any debris is likely to be non-ferrous.

4.2.10 Three anomalies (**7012**, **7013** and **7015**) have been interpreted as individual pieces of debris, which range in size from 1.4 x 0.2 x 0.5 m (**7012**) to 4.2 x 2.9 x 0.0 m (**7015**). Anomaly **7015** is associated with a 25 nT magnetic anomaly and so may be ferrous in composition. Anomalies **7012** and **7013** have not been associated with a magnetic anomaly, suggesting they are non-ferrous in nature, although the appearance of **7013** suggests it may be a small anchor.

4.2.11 Other individual items of debris were identified within the data, but due to their nature and location (often either adjacent to the jetty walls or within the dredged channel), they were interpreted as modern features.

4.2.12 One anomaly (**7014**) has been classified as a dark reflector. This measures 2.5 x 1.3 x 0.0 m in size, and could represent either a piece of debris or a natural feature. The anomaly has not been associated with a magnetic anomaly, so any debris at this location is likely to be non-ferrous.

4.2.13 A total of six anomalies (**7002**, **7004**, **7005**, **7006**, **7007**, and **7035**) are magnetic only, without any corresponding SSS or MBES contacts. These range in amplitude from 26 nT (**7007**) to 135 nT (**7006**), and potentially represent ferrous material buried within the seabed sediment. This buried material could be of archaeological potential, or it could be modern debris relating to activity at Holyhead port.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1.1 Assessment of the SBP data and historic boreholes indicates the geology of the study area comprises Precambrian bedrock, Devensian till, and modern marine/intertidal sediment. No palaeogeographic features of archaeological potential have been identified.

5.1.2 A total of 13 seabed anomalies of archaeological potential were identified within the study area, all of which were assigned an A2 archaeological rating (Table 4). The most significant of these is **7003**, the remains of the Mail Jetty of Admiralty Pier, which may be of local historic interest.

5.1.3 No potential wreck sites were identified, and no recorded wrecks or obstructions are present within the study area.

5.1.4 It is recommended that if any objects of possible archaeological interest are recovered during the proposed development, they should be reported through an agreed protocol. This will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures.

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Wessex Archaeology 2019 *Holyhead Port Expansion – Archaeological Assessment Summary Report*. Salisbury, unpubl rep, ref: 203703.2

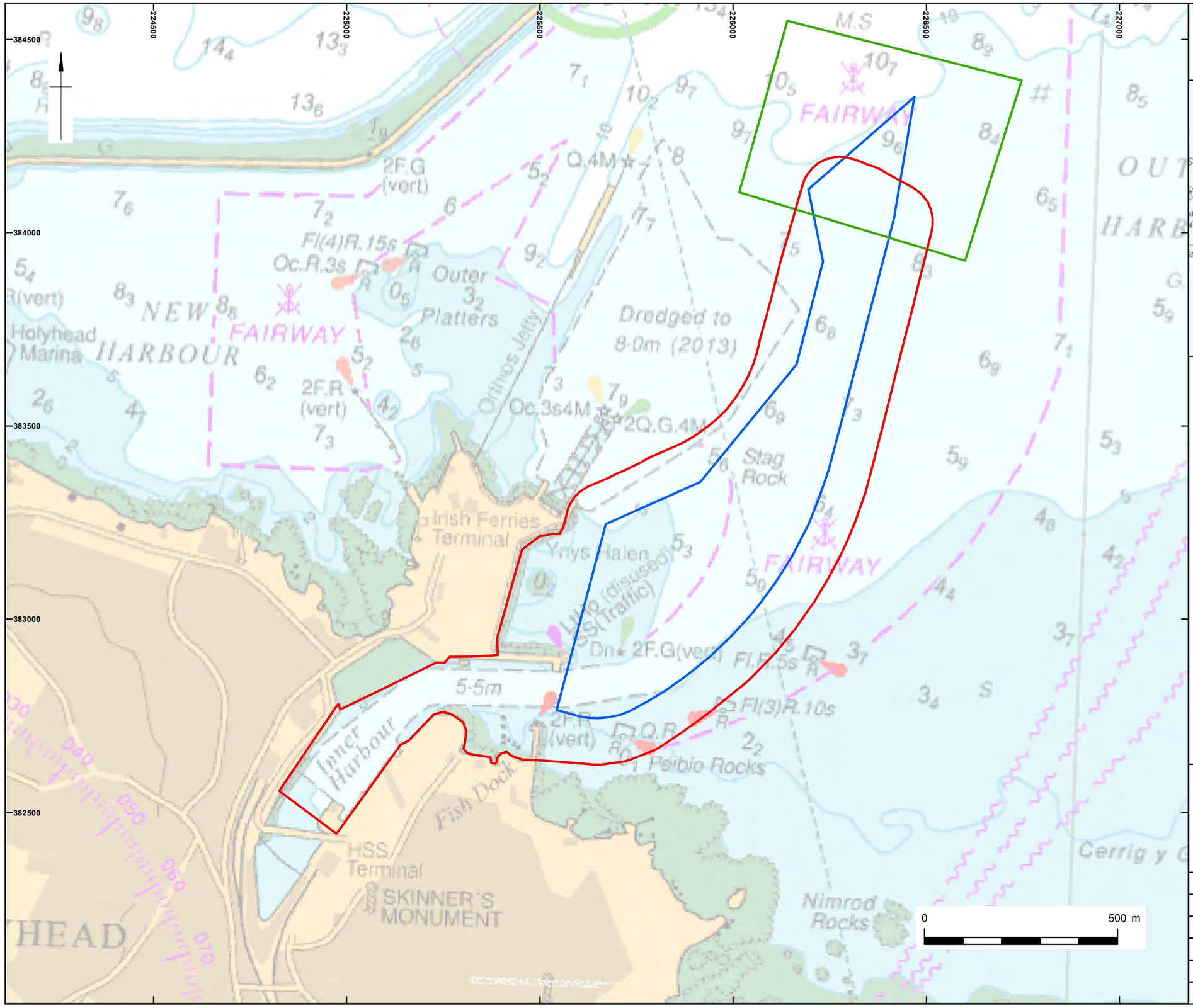
APPENDICES

Appendix 1 Seabed features of archaeological potential

ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7014	Dark Reflector	226228	384048	A2	2.6	1.3	0.0	-	Elongate dark reflector without shadow or associated magnetic anomaly. Located in an area of seabed disturbance. Could be non-ferrous debris or a natural feature.
7012	Debris	226210	383574	A2	1.4	0.2	0.5	-	Elongate dark reflector with distinct shadow, but without an associated magnetic anomaly. Possible non-ferrous debris.
7013	Debris	226316	383892	A2	2.7	1.4	2.0	-	Distinct, elongate dark reflector with irregular shadow, but without an associated magnetic anomaly. Possible debris, potentially a small anchor.
7015	Debris	226238	384070	A2	4.2	2.9	0.0	25	Poorly defined, T-shaped dark reflector without shadow but with a distinct associated magnetic anomaly. Possible partially buried ferrous debris. Identified as a dark reflector during previous assessment, but updated to reflect the new data.
7003	Debris Field	225636	382901	A2	162.0	18.5	1.2	-	Distinct debris field extending from the end of Admiralty Pier to a beacon approximately 130 m out into the water. Identified within both the SSS and MBES data sets. The debris comprises numerous irregular dark reflectors with small shadows, including a number of linear features, and rows of small dark reflectors with shadows. Probably the remains of the Mail Jetty extension to the pier, originally constructed in the mid-18th century and demolished in the mid-19th century. Potentially of local historic interest.
7009	Debris Field	226045	383429	A2	5.0	2.7	0.3	-	Small area containing three distinct objects, one of which has a distinct shadow. No associated magnetic anomaly. Possible partially buried, non-ferrous debris.

ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7016	Debris Field	226210	384122	A2	56.3	31.3	0.3	59	Area of irregular and curvilinear dark reflectors with small shadows, centred on a larger feature identified as a small mound in the MBES data. Tentatively associated with a magnetic anomaly, suggesting the presence of ferrous objects. Identified during both phases of assessment, and probably a scattered debris field. Located on the edge of the proposed dredge area, with objects situated both inside and outside the boundary. Position and dimensions updated from previous assessment to reflect new data.
7002	Magnetic	225740	382777	A2	-	-	-	35	Distinct magnetic anomaly identified on more than one survey line, but without an associated SSS or MBES contact. Located outside of the previously dredged area. Possible piece of buried ferrous debris.
7004	Magnetic	225768	383012	A2	-	-	-	54	Distinct magnetic anomaly, only identified on one survey line, but without an associated SSS or MBES contact. Located outside of the previously dredged area. Possible piece of buried ferrous debris.
7005	Magnetic	226055	383227	A2	-	-	-	44	Distinct magnetic anomaly identified on more than one survey line, but without an associated SSS or MBES contact. Possible piece of buried ferrous debris.
7006	Magnetic	225980	383228	A2	-	-	-	135	Large, distinct magnetic anomaly identified on more than one survey line, but without an associated SSS or MBES contact. Possible piece of buried ferrous debris.
7007	Magnetic	225900	383287	A2	-	-	-	26	Relatively small but distinct magnetic anomaly, but without an associated SSS or MBES contact. Possible piece of buried ferrous debris.
7035	Magnetic	226391	384164	A2	-	-	-	82	Possible magnetic dipole without associated SSS or MBES contact. Located in an area of natural background variation and possibly natural or a data spike, but could represent buried ferrous debris.

1. Co-ordinates are in British National Grid
2. Positional accuracy estimated ±5 m



Original Survey Area – May 2018

Survey Extension Area – December 2018

Proposed Dredge Footprint

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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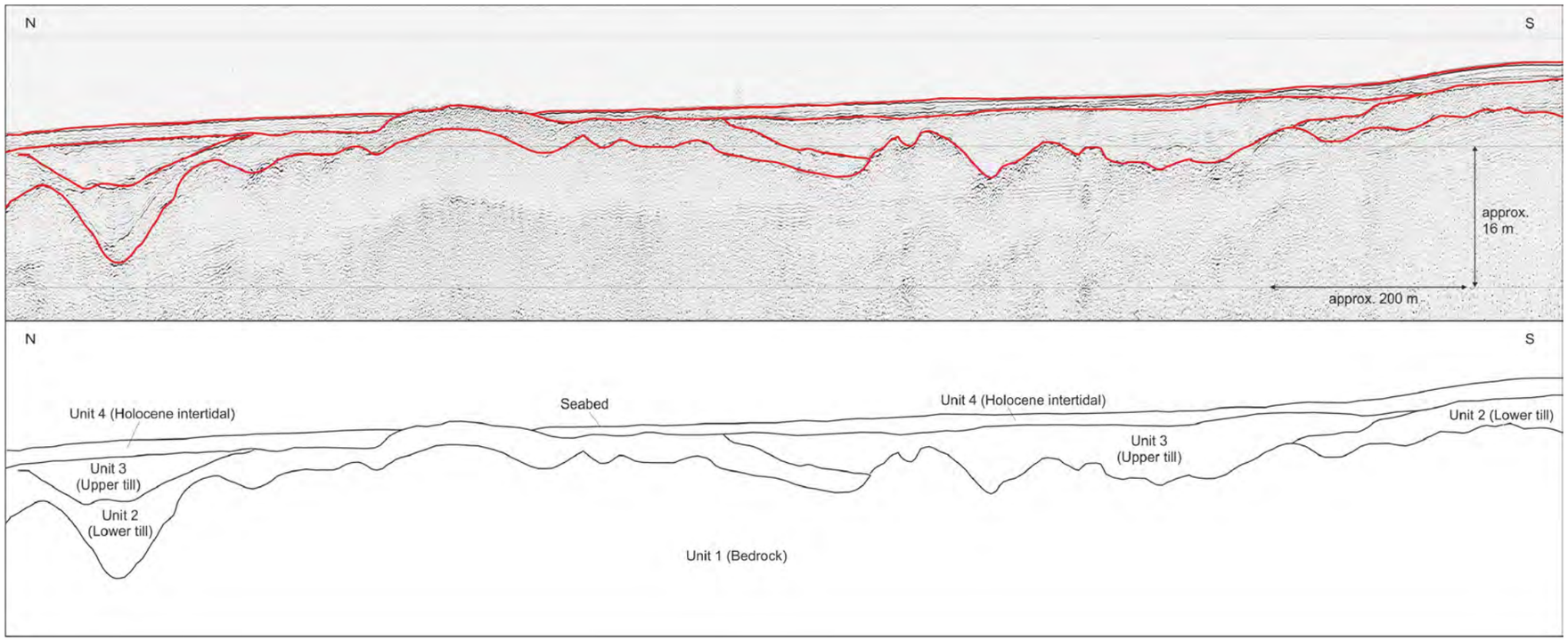
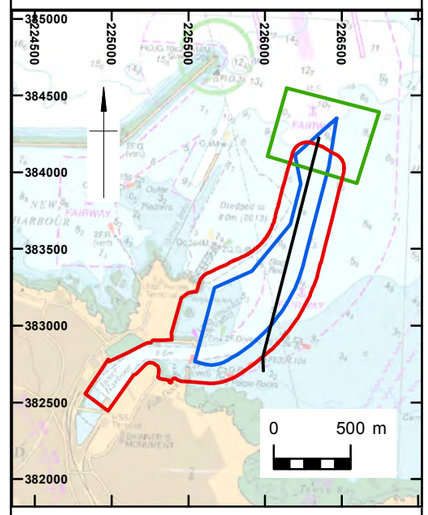
Study area location

Figure 1





Original Survey Area – May 2018

Survey Extension Area – December 2018

Proposed Dredge Footprint

Transect location

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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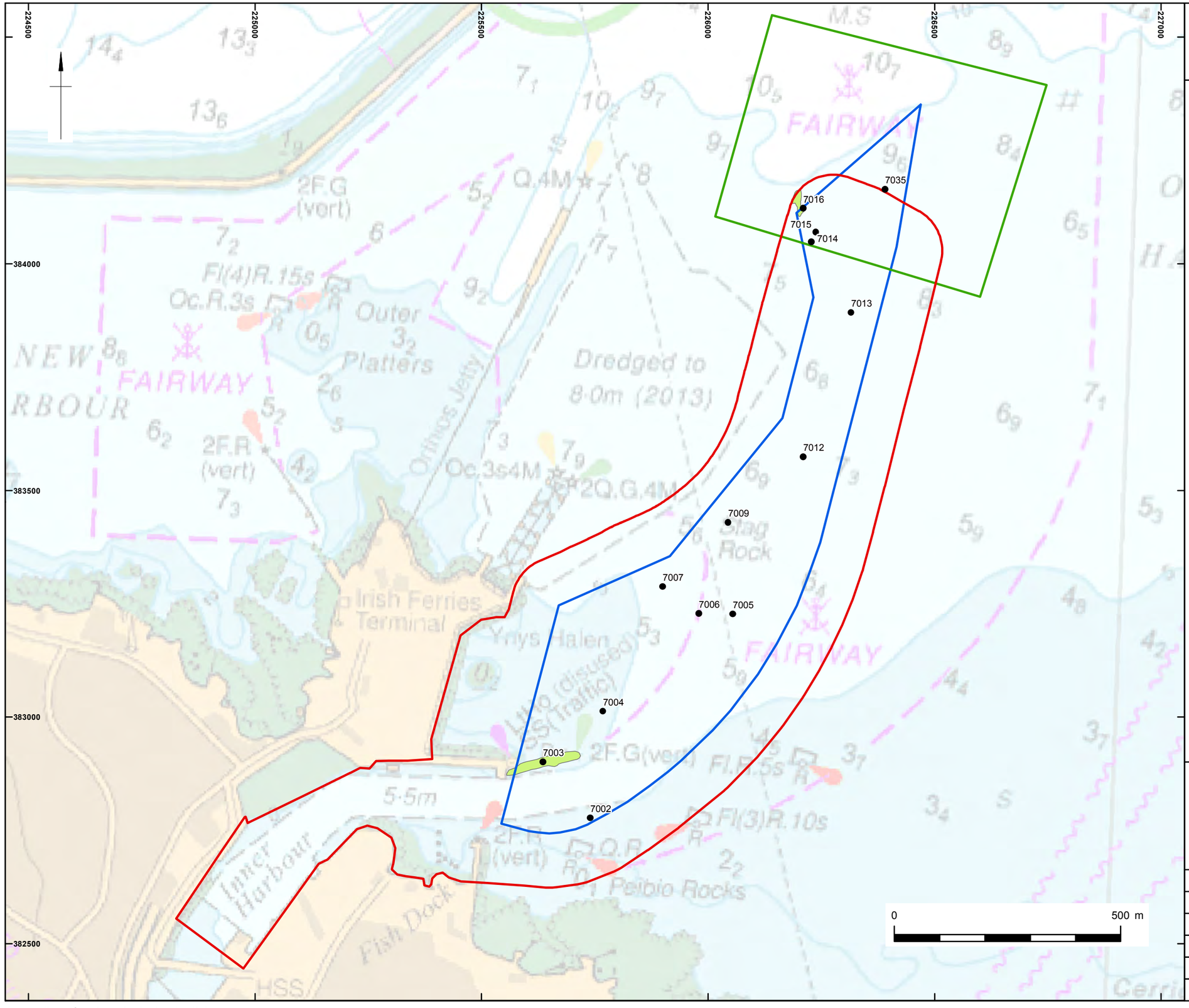
Boomer data example

Figure 2



Original Survey Area – May 2018

Survey Extension Area – December 2018

Proposed Dredge Footprint

A2 anomaly (uncertain origin or possible archaeological interest)

Debris field boundaries

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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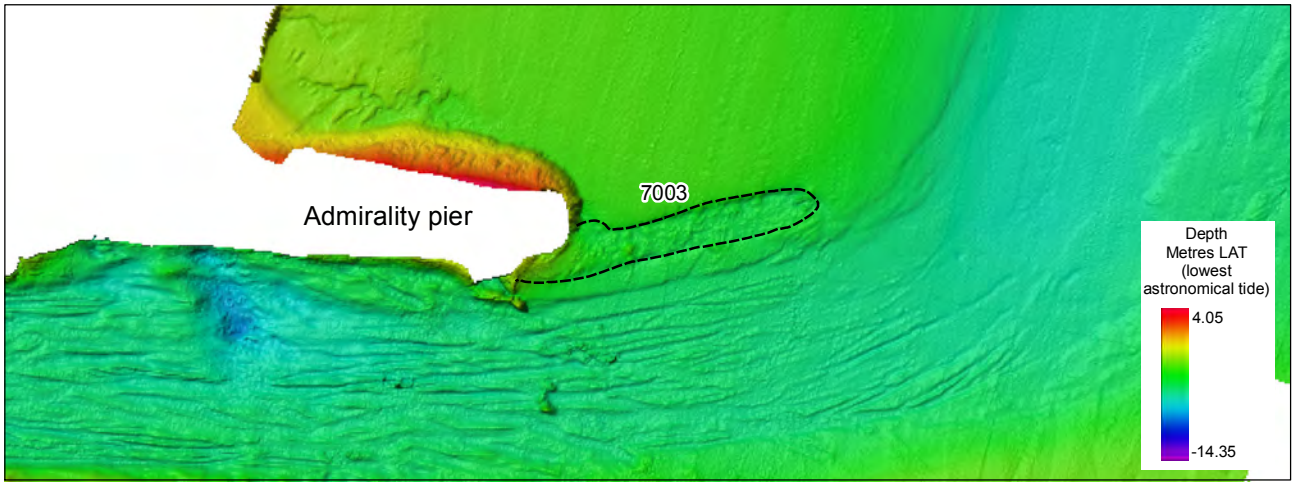
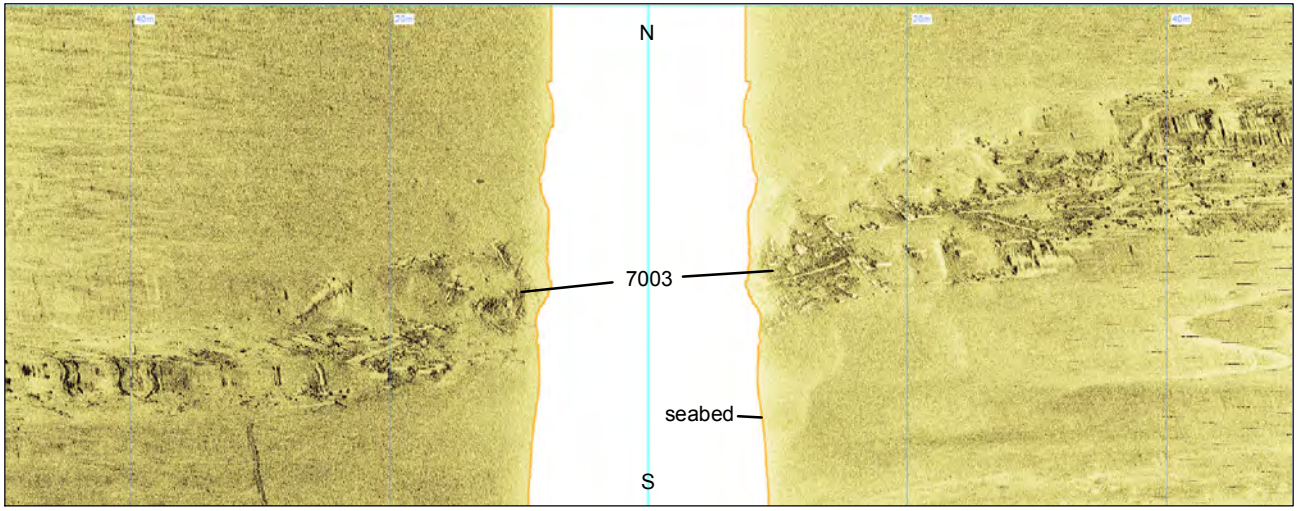
Anomalies of archaeological potential

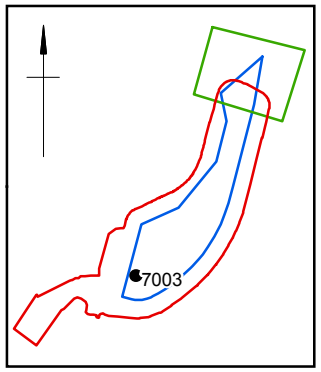
Figure 3



MBES data, viewing north, x2 vertical exaggeration



SSS waterfall image



Original Survey Area – May 2018

Proposed Dredge Footprint

Survey Extension Area – December 2018

A2 anomaly (uncertain origin or possible archaeological interest)

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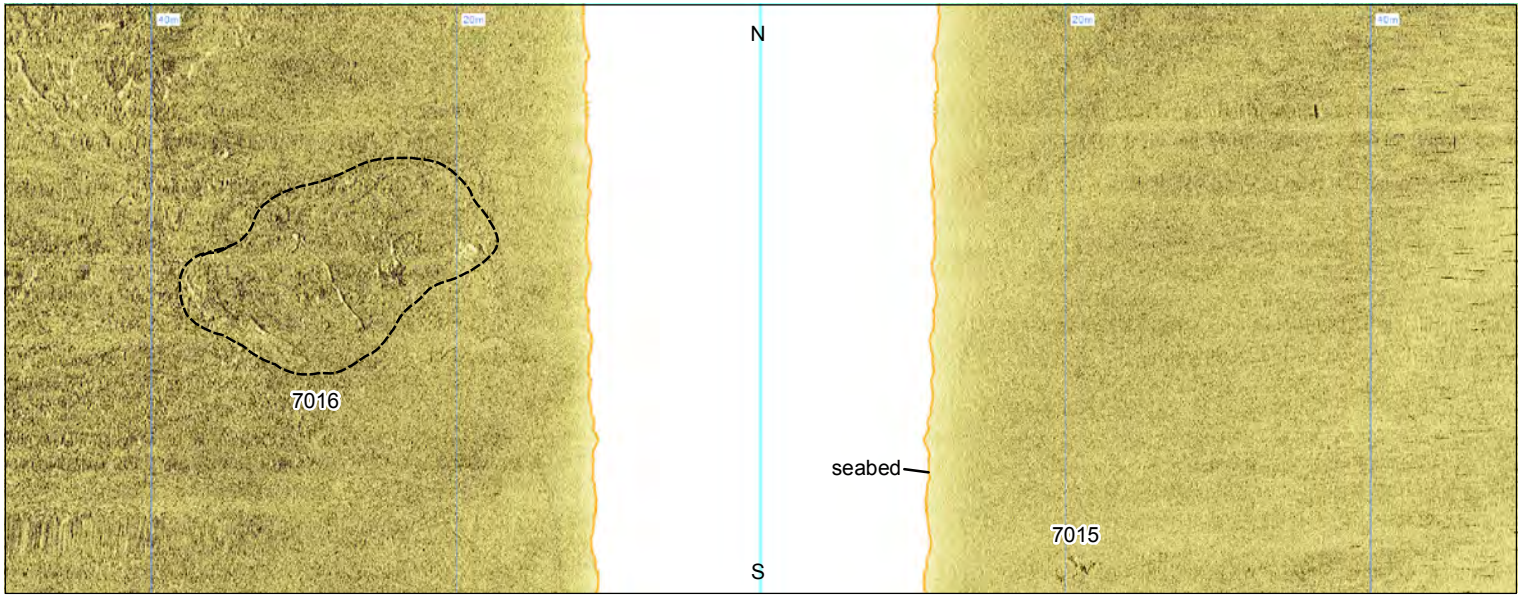
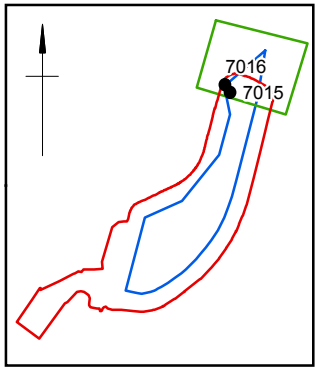
Data example – 7003

Figure 4



SSS waterfall image



Original Survey Area – May 2018

Survey Extension Area – December 2018

Proposed Dredge Footprint

A2 anomaly (uncertain origin or possible archaeological interest)

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Data example – 7015 & 7016

Figure 5

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G3 - Archaeological Assessment of Extended Geophysical Survey

Report Title: Holyhead Port Expansion – Archaeological Assessment Summary Report **Report number:** 203703.2		
Area: Holyhead Port	**Area definition:** Area within survey area coverage, but outside proposed dredge footprint. Only anomalies within the defined area are reported.	**Associated Wessex Archaeology Report Ref:** 203703.1
Data reviewed: sidescan sonar, multibeam echosounder, magnetometer, sub-bottom profiler	**Data definitions:** see Definition of Terms document	**Co-ordinate system:** British National Grid

Interpretation Results:

A total of 24 anomalies were identified within the survey area coverage, but outside the proposed dredge footprint.

- a total of 0 were assigned an A1 archaeological discrimination;
- a total of 24 were assigned an A2 archaeological discrimination;
- a total of 0 were assigned an A3 archaeological discrimination.

The A2 features are a combination of individual items of debris (including possible anchors and buoy sinkers), lengths of rope or chain, dark reflectors, and isolated magnetic anomalies (suggesting buried ferrous debris).

Due to their position on the approach to a port, the identified anomalies could represent features of archaeological interest or modern debris. However, this cannot be confirmed without further investigation.

Recommended Mitigation:

No Archaeological Exclusion Zones are recommended for any of the identified anomalies.

Features assigned A2 archaeological discrimination rating: avoidance of these features is recommended where possible if they are proposed to be directly impacted by development in the future. Further investigation of anomalies to be impacted may be required.

It is recommended that if any objects of possible archaeological interest are recovered during the proposed development, that they should be reported using an agreed protocol. This will establish whether the recovered objects are of archaeological interest and recommend appropriate mitigation measures.

Accompanying files:

203703_Holyhead_Additional_Areas_Seabed_PhaseIII_BNG_20190424.shp
203703_Holyhead_Additional_Areas_Linears_BNG_20190424.shp
Marine_Geo_Definition_of_Terms_V1_20181113.pdf

Quality Assurance:

Version & Issue Date	Status	Author	Approval
V1 25/04/2019	Draft	DSH	SHLA

Appendix I: Seabed Features of Archaeological Potential

ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7000	Debris	225577	382662	A2	1.9	1.5	0.6	-	Distinct, square dark reflector with shadow, associated with a small mound in the MBES data. No associated magnetic anomaly. Possible non-ferrous debris, potentially modern but located outside of the main harbour and dredge area.
7001	Rope/Chain	225600	382639	A2	0.1	24.5	0.0	-	Poorly defined, curvilinear dark reflector without shadow. Possible length of rope or chain, possibly associated with an anchor identified to the south outside of the study area.
7008	Dark Reflector	225679	383259	A2	2.8	1.3	0.9	-	Distinct dark reflector with shadow, possibly two immediately adjacent features, but without an associated magnetic anomaly. Could be non-ferrous debris or a natural feature.
7010	Magnetic	226267	383378	A2	-	-	-	49	Distinct magnetic anomaly identified on more than one survey line, but without an associated SSS or MBES contact. Possible piece of buried ferrous debris.
7011	Magnetic	226343	383456	A2	-	-	-	16	Relatively small but distinct magnetic anomaly, without an associated SSS or MBES contact. Could be buried ferrous debris or a natural feature.
7017	Debris	226295	384466	A2	4.8	2.7	1.0	-	Irregular dark reflector with irregular shadow and surrounding seabed disturbance, identified as a small mount in the MBES data. Associated with length of rope/chain **7018**. No associated magnetic anomaly, but possibly an anchor.
7018	Rope/Chain	226299	384459	A2	17.2	0.6	0.1	-	Curvilinear dark reflector with small shadow, appears to be attached to possible anchor **7017** at one end. No associated magnetic anomaly. Possible length of rope or chain.
7019	Debris	226294	384450	A2	9.7	2.7	0.3	-	Irregular, elongate dark reflector with irregular shadow and surrounding seabed disturbance, identified as a small mount in the MBES data. Potentially associated with anchor **7017**, but this cannot be confirmed without further investigation. No associated magnetic anomaly, but potentially partially buried debris.

ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7020	Dark Reflector	226204	384414	A2	3.4	1.5	0.4	-	Irregular dark reflector with irregular shadow, situated within a generally featureless area of the seabed. Associated with a small distinct mound in the MBES data. No associated magnetic anomaly, and could be non-ferrous debris or a natural feature.
7021	Magnetic	226342	384378	A2	-	-	-	162	Distinct negative magnetic monopole without any associated SSS or MBES contacts. Possible piece of buried ferrous debris.
7022	Debris	226403	384357	A2	1.5	0.4	0.0	-	Poorly defined, rectangular dark reflector, possibly with a shadow but is too small to measure. No associated magnetic anomaly. Associated with possible rope/chain **7023**, and could be an anchor or mooring block.
7023	Rope/Chain	226395	384360	A2	17.6	1.1	0.0	-	Poorly defined curvilinear dark reflector without shadow, attached to debris **7022** at one end. Possible length of rope or chain.
7024	Magnetic	226440	384418	A2	-	-	-	47	Distinct magnetic dipole located within an area of high background variation. No associated SSS or MBES contact. Possible piece of buried ferrous debris.
7025	Rope/Chain	226102	384291	A2	52.0	0.2	0.0	-	Distinct, curvilinear dark reflector with possible small shadow, but too small to measure. No associated magnetic anomaly. Possible length of rope or chain.
7026	Debris	226211	384260	A2	2.2	1.4	2.1	-	Distinct, irregular dark reflector with large shadow, but without an associated magnetic anomaly. Possible debris, potentially an anchor.
7027	Magnetic	226347	384255	A2	-	-	-	194	Distinct magnetic dipole without any associated SSS or MBES contacts. Possible significant piece of buried ferrous debris.
7028	Magnetic	226086	384226	A2	-	-	-	71	Distinct but irregular magnetic dipole without associated SSS or MBES contact. Possible buried ferrous debris.
7029	Debris	226037	384171	A2	1.5	0.9	0.3	38	Distinct, rounded dark reflector with shadow, possibly hollow. Associated with a distinct magnetic anomaly. Probably piece of debris, possibly a buoy sinker or tyre, but this cannot be confirmed without further investigation.

ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Magnetic Amplitude (nT)	Notes
7030	Debris	226118	384195	A2	3.3	1.6	0.3	-	Distinct, rounded dark reflector with shadow, possibly hollow. No associated magnetic anomaly. Probably piece of debris, possibly a buoy sinker or tyre, but this cannot be confirmed without further investigation.
7031	Debris	226150	384168	A2	3.0	0.3	0.1	-	Short, linear dark reflector with small shadow but without an associated magnetic anomaly. Possible non-ferrous linear debris.
7032	Dark Reflector	226177	384149	A2	1.8	0.8	0.5	-	Distinct dark reflector with distinct shadow, but without an associated magnetic anomaly. Possible natural feature, but located close to debris field **7016** and may be related debris.
7033	Debris	226234	384166	A2	10.7	0.2	0.1	-	Curvilinear dark reflector with small shadow, but without an associated magnetic anomaly. Possible non-ferrous linear debris.
7034	Magnetic	226123	384099	A2	-	-	-	280	Distinct negative magnetic monopole without any associated SSS or MBES contacts. Possible significant piece of buried ferrous debris.
7036	Rope/Chain	226493	384145	A2	24.3	0.2	0.0	-	Curvilinear dark reflector without shadow or associated magnetic anomaly, possible length of rope or chain.

1. Co-ordinates are in British National Grid
2. Positional accuracy estimated ±5 m

G4 – Stage 2 Geoarchaeology Report (Vibrocores)

Holyhead Port Expansion

Stage 2 Marine Geoarchaeological Assessment

Ref: 203701.01
June 2019

wessexarchaeology

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Document Information

Document title	Holyhead Port Expansion
Document subtitle	Stage 2 Marine Geoarchaeological Assessment
Document reference	203701.01
Client name	Royal HaskoningDHV
Address	Peterbourough Rightwell House Bretton Peterbourough Cambridgeshire PE3 8DW
On behalf of	Stena Line Ports Ltd.
Site location	Port of Holyhead
County	Angelsey
WA project name	Holyhead Port Expansion MGA
WA project code(s)	203701 (203700)
Date of fieldwork	29/10/2018 to 30/10/2018
Fieldwork directed by	Claire Mellett
Project management by	Dave Norcott
Document compiled by	Claire Mellett
Contributions from	-
Graphics by	Ken Lymer

Quality Assurance

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Summary

Wessex Archaeology was commissioned by Royal HaskoningDHV on behalf of Stena Line Ports Ltd. to assess geotechnical data acquired from Holyhead Port, Anglesey, in advance of a proposed port expansion scheme that includes reclamation of two areas (the Pelham Patch Development and the Salt Island Expansion site) and dredging of a new approach channel.

This report outlines the results of a Stage 2 geoarchaeological assessment of five vibrocores recovered from the proposed scheme. The aim of this assessment is to determine the type, sequence and depositional history of the deposits within the site in relation to archaeological potential. The results are considered alongside a previous geophysical assessment (Wessex Archaeology 2019).

Deposits recovered in all five vibrocores comprise very dark grey, soft, clayey sandy silt with frequent shell fragments and whole shells. Sub-angular fragments of black, iron stained slag was recovered in VC05 and a strong odour of hydrocarbons was recorded in VC05 and VC06, both indicating modern (>AD 1800) industrial activity. The sediments are interpreted as modern seabed sediments deposited in a tidally influenced marine environment (Unit 4) and have low geoarchaeological potential.

The results of the geoarchaeological assessment agree with interpretations of geophysical data. Notably, shallow gas was identified in geophysical data within seabed sediments (Unit 4). This was also observed in vibrocores as while splitting open cores, the deposits expanded in length and width, this is typical of gas rich soft sediments.

There is no evidence of palaeolandscape features within the proposed scheme and no deposits of geoarchaeological interest were recovered in vibrocores. Therefore, the potential for prehistoric archaeology is considered low. Any archaeological material in the study area is more likely related to sea-faring activity and the growth of settlement and industries in and around Holyhead.

Based on the results of Stage 2 geoarchaeological recording, deposits within the prosed scheme have low geoarchaeological potential and no further palaeoenvironmental assessment or deposit modelling is recommended.

Acknowledgements

This work was commissioned by Royal HaskoningDHV, on behalf of Stena Line Ports Ltd. Sarah Marjoram and Diana Donohue of Royal HaskoningDHV are thanked for their assistance with the preparation of this report.

Geoarchaeological recording and report compilation was undertaken by Dr. Claire Mellett. Illustrations were prepared by Ken Lymer. Quality control was provided by Dr. Alex Brown, and the project was managed for Wessex Archaeology by David Norcott.

Holyhead Port Expansion

Stage 2 Marine Geoarchaeological Assessment

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Royal HaskoningDHV on behalf of Stena Line Ports Ltd. to assess geotechnical data acquired from Holyhead Port, Anglesey, in advance of a proposed port expansion scheme.

1.1.2 The study area lies in the nearshore directly off the coast of Anglesey in North Wales, and extends from Holyhead Port Inner Harbour, through the Old Harbour, to approximately 1.5 km out into the Fairway to the east of Salt Island (Ynys Halen) (**Figure 1**).

1.1.3 The proposed development involves dredging of a new approach channel along with the reclamation of two areas (the Pelham Patch Development and the Salt Island Expansion site) (**Figure 1**).

1.2 Summary of previous marine archaeological works

1.2.1 An assessment of marine geophysical survey data comprising sub-bottom profiler, sidescan sonar, magnetometer and multibeam echosounder, was previously undertaken (Wessex Archaeology 2019) with the aim of identifying palaeolandscape features of possible archaeological interest.

1.2.2 No palaeolandscape features were identified within the study area.

1.3 Scope of work

1.3.1 To help frame geoarchaeological investigations of this nature, Wessex Archaeology has developed a five-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The stages are summarised below (**Table 1**).

1.3.2 This report summarises the results of Stage 2 geoarchaeological recording of five geotechnical vibrocores. Typically, Stage 2 recording would follow an initial Stage 1 review of geotechnical logs. However, as no geotechnical logs were available for the vibrocores, the geoarchaeological assessment commences at Stage 2.

Table 1 Stages of geoarchaeological assessment and recording

Stage	Method	Description
1	Review	A desk-based archaeological review of the borehole, vibrocore and CPT logs generated by geotechnical contractors. Aims to establish the likely presence of horizons of archaeological interest and broadly characterise them, as a basis for deciding whether and what Stage 2 archaeological recording is required. The Stage 1 report will state the scale of Stage 2 work proposed.

Stage	Method	Description
2	Geoarchaeological Recording	Archaeological recording of selected retained or new core samples will be undertaken. This will entail the splitting of the cores, with each core being cleaned and recorded. The Stage 2 report will state the results of the archaeological recording and will indicate whether any Stage 3 work is warranted.
3	Sampling and Assessment	Dependent upon the results of Stage 2, sub-sampling and palaeoenvironmental assessment (pollen, diatoms and foraminifera) may be required. Subsamples will be taken if required. Assessment will comprise laboratory analysis of the samples to a level sufficient to enable the value of the palaeoenvironmental material surviving within the cores to be identified. Subsamples will also be taken and/or retained at this stage in case scientific dating is required during Stage 4. Some scientific dating (e.g. radiocarbon or Optically Stimulated Luminescence (OSL)) may be undertaken at this stage to provide chronological context. The Stage 3 report will set out the results of each laboratory assessment together with an outline of the archaeological implications of the combined results, and will indicate whether any Stage 4 work is warranted.
4	Analysis and Dating	Full analysis of pollen, diatoms and/or foraminifera assessed during Stage 3 will be undertaken. Typically, Stage 4 will be supported by scientific dating (e.g. radiocarbon or OSL) of suitable subsamples. Stage 4 will result in an account of the successive environments within the coring area, a model of environmental change over time, and an outline of the archaeological implications of the analysis.
5	Final Report	If required Stage 5 will comprise the production of a final report of the results of the previous phases of work for publication in an appropriate journal. This report will be compiled after the final phase of archaeological work, whichever phase that is.

2 AIMS AND OBJECTIVES

2.1.1 The principle aim of the Stage 2 geoarchaeological recording is to assess the archaeological potential of deposits recovered in vibrocores collected in support of the proposed expansion of Holyhead Port.

2.1.2 This will be achieved with the following objectives;

- Log and record deposits within vibrocores;
- Interpret the probable environments represented;
- Determine the importance of the deposits, with regard to their archaeological and palaeoenvironmental potential;
- Make recommendations for dating and palaeoenvironmental assessment as appropriate, with reference to key research questions and regional/national period specific and maritime research agendas.

2.1.3 This is to be undertaken in accordance with the Written Scheme of Investigation (Royal HaskoningDHV 2018b) and previous geophysical works associated with the proposed scheme (Wessex Archaeology 2019).

3 GEOARCHAEOLOGICAL BACKGROUND

3.1.1 Geoarchaeological assessments are typically undertaken with reference to geological periods (e.g. Quaternary), epochs (e.g. Pleistocene) and sub-epochs (e.g. Devensian) that reflect major climate, sea-level or environmental changes. Here we adopt British nomenclature and dates are given as ka (thousands of years before present) and Ma (millions of years before present).

3.1.2 Holy Island (Ynys Gybi) and most of Anglesey (Ynys Môn) are composed of Pleistocene and Holocene sediments overlying Precambrian geology, most notably the Mona Complex (British Geological Survey (BGS) 2018). The solid geology of the onshore area is characterised by outcrops of the Precambrian New Harbour Group, which comprises interbedded mica shists and psammites, along with scattered igneous intrusions. This is overlain by diamicton (till) deposited during the last ice age (Devensian) with coastal and estuarine deposits fringing the present-day coast. Directly off the coast of Holyhead the seabed sediments comprise sandy gravel with finer grained silts and clays expected in the nearshore (BGS 2018). The thickness of Pleistocene sediments in the nearshore area is not expected to exceed 5 m (Mellett *et al.* 2015).

3.1.3 The recent geological history of the UK is directly linked to glacial/interglacial cycles experienced during the Pleistocene (2.5 Ma – 11.7 ka). Anglesey and the adjacent Irish Sea are areas that were repeatedly overridden by ice during glacial periods with the most recent glaciation, the Devensian, having the greatest impact on the Pleistocene geology of the region. Previous borehole surveys from the vicinity of the study area have recovered evidence of these repeated glacial cycles, in the form of glacial diamict overlying Precambrian bedrock (Fugro-McClelland 1993, Fugro 2002). The archaeological potential of these glacial sediments is considered low.

3.1.4 At the end of the last ice age, ice sheets retreated from the area approximately 22 ka (Chiverrell et al. 2013; 2018) and it has long been debated as to whether this deglaciation occurred in a terrestrial or marine environment (McCarroll, 2001; Scourse and Furze, 2001). If it was in a terrestrial environment, this means the seabed would have been subaerially exposed and suitable for occupation and thus have potential to preserve archaeological material or palaeolandscapes. However, there is increasing evidence to suggest deglaciation offshore of Anglesey occurred in a marine setting (Van Landeghem et al 2009, Van Landeghem and Chiverrell 2011). In this scenario, the seabed would not have been subaerially exposed at the end of Devensian making the potential for prehistoric archaeology low.

3.1.5 While the debate is ongoing, we recognise there is potential that the study area was subaerially exposed during the period between when ice sheets retreated (~22 ka) and sea levels rose to their present-day position (~8 ka) (Shennan and Horton 2002).

3.1.6 However, there is no evidence of palaeolandscape features in the study area based on an assessment of geophysical data (Wessex Archaeology 2019). Furthermore, no prehistoric sites or finds are known from within the study area. Any archaeological material in the study area is more likely related to sea-faring activity and the growth of settlement and industries in and around Holyhead.

3.1.7 The stratigraphy of the study area has been divided into four key units based on an assessment of geophysical data (Wessex Archaeology 2019) and the British Geological Survey (Jackson *et al.* 1995; Mellett *et al.* 2015), as outlined below (**Table 2**).

Table 2 Shallow stratigraphy of the study area

Unit	Unit Name	Geophysical Characteristics (1)	Sediment Type (2)	Archaeological Potential
4	Holocene Seabed Sediments	Acoustically layered unit of varying thickness, contains gas in some areas.	Intertidal/marine deposit, soft clay, silt and sand.	Considered of low potential in itself, but possibly can cover archaeological material.
3	Devensian Upper Till (Cardigan Bay Formation/Irish Sea Till)	Observed cutting into Unit 2 in some parts of the study area, relatively acoustically unstructured with some internal reflectors.	Stiff gravelly clay.	Low archaeological potential.
2	Devensian Lower Till (Cardigan Bay Formation/Irish Sea Till)	Observed across much of the study area, generally acoustically chaotic with some areas of possible layering.	Stiff gravelly clay and clayey, schist gravel.	Low archaeological potential.
1	Precambrian Bedrock	Observed across the entire study area, relatively homogenous unit with some internal reflectors.	Metamorphic mica schist and psammite bedrock.	No archaeological potential, although upper boundary may have formed a land surface.

(1) Based on geophysical data

(2) Based on previous borehole data, Jackson *et al.* 1995, and BGS 2018

4 METHODOLOGY

4.1 Co-ordinate system

4.1.1 Results are presented as British National Grid (BNG) projected coordinates.

4.2 Geotechnical coring strategy

4.2.1 Geotechnical samples were recovered using a vibrocorer providing a near-continuous record of the deposits within the shallow subsurface.

4.2.2 A total of seven vibrocores were recovered to a maximum depth of 3 m below seafloor (mbsf) (**Figure 2**) (**Appendix 1**). Upon recovery, samples (~25 cm) from the top and bottom of the vibrocores were removed for environmental testing. Due to low recovery, no material remained from VC02 and VC07/08 after environmental sampling.

4.2.3 A total of five vibrocores (VC01, VC03, VC04, VC05 and VC06) were sent to Wessex Archaeology for geoarchaeological recording.

4.3 Geoarchaeological recording

4.3.1 Vibrocore sections were split lengthways and the surface of the deposits cleaned to reveal any structures or features. Each section was photographed and described by a suitably trained geoarchaeologist following Hodgson (1997) and COWRIE (2007), to include information such as:

- Depth;
- Texture;
- Composition;
- Colour;
- Inclusions;
- Structure (bedding etc.); and,
- Contacts between deposits (where visible).

4.3.2 Interpretations were made regarding the probable depositional environments and formation processes of the sampled deposits. Depths are given in metres down core. This data is presented in **Appendix 2**. Core photographs are presented in **Appendix 3**.

4.3.3 Deposits recovered in vibrocores were interpreted in terms of their geoarchaeological potential. Of greatest geoarchaeological potential are sediments from former terrestrial depositional environments, as well as certain features or inclusions of possible archaeological and palaeoenvironmental interest, specifically:

- Peat layers;
- Deposits containing other organic material such as wood fragments, roots, dark organic staining etc.;
- Clay or silt deposits, especially those containing laminated features such as lacustrine varves or tidal rhythmites;
- Inorganic fossils (such as molluscs);
- Concentrations of charcoal;
- Individual artefacts such as pieces of flint or pottery (though finding these within core samples is rare); and,
- Any other feature thought to indicate a terrestrial depositional environment.

5 RESULTS

5.1.1 The results of the Stage 2 geoarchaeological recording are discussed below, with full vibrocore descriptions presented in **Appendix 2**. The results are considered alongside the geophysical data (Wessex Archaeology 2019) in order to aid assessment. Every attempt has been made to assign deposits to the stratigraphic units detailed in **Table 2**. Any uncertainty as to the date and/or taphonomy of deposits serves as an opportunity to propose further works.

5.1.2 Five vibrocores were subject to Stage 2 geoarchaeological recording with the aim of determining the type, sequence and depositional history of deposits in relation to archaeological potential.

5.1.3 The predominant deposit recovered in each vibrocore comprised a very dark grey, soft, clayey sandy silt with frequent shell fragments and whole shells. This deposit is interpreted to have been deposited in a marine environment (**Appendix 2**).

5.1.4 Subtle variations in sand and silt content were observed. In VC04 frequent laminations were recorded from 1.74 m to 2.48 m, and in VC03, interbedded sand and silt deposits were recorded. This likely indicates a tidal influence on deposition.

5.1.5 In VC05, a clayey silty gravelly deposit was recorded between 0.60 m and 0.80 m. A sub-sample of gravel was extracted and washed to allow identification of the clasts. The gravel comprises sub-angular fragments of black, iron stained slag resulting from industrial activity.

5.1.6 When removing the caps from the cores, the deposits expanded by 1-2 cm spilling out of the end of the cores. This expansion is typically observed in gas rich sediments. This expansion was also observed when the cores were split open making them difficult to reseal.

5.1.7 The deposits recovered in all five vibrocores correspond to Unit 4 (**Table 2**) and agree with the interpretation of geophysical data.

6 DISCUSSION

6.1.1 Vibrocores collected in support of the proposed Holyhead Port Expansion project recovered sediments deposited in a tidally influenced marine environment (Unit 4). The presence of industrial slag and possible hydrocarbons suggests these deposits are modern (>AD 1800) and therefore have low archaeological potential.

6.1.2 Interpretation of geophysical data recorded the presence of gas within Unit 4 and while opening vibrocores, the deposits expanded in length which is typical of gas rich soft sediment. Gas is often associated with decomposition of organic material and can be indicative of peat deposits. However, in this case the gas is more likely a result of biochemical reactions within the fine-grained deposits.

6.1.3 Glacial deposits from Unit 3 and Unit 2 were not recovered in vibrocores. This may be due to the stiff nature of glacial diamict which makes it difficult to recover using a vibrocorer.

6.1.4 The greatest potential for palaeolandscape development and prehistoric activity within the study area is during the period between when the ice sheets retreated (~22 ka) and sea levels rose to their present-day position (~8 ka). This period would correspond to the contact between glacial deposits (Unit 2 and 3) and overlying modern seabed sediments (Unit 4). However, there is no evidence of buried palaeolandscapes according to both geophysical (Wessex Archaeology 2019) and geoarchaeological assessments.

7 RECCOMENDATIONS

7.1.1 Deposits recovered in vibrocores from Holyhead Port are interpreted to be modern seabed sediments deposited in a tidally influenced marine environment and thus have low geoarchaeological potential.

7.1.2 Given the shallow depth of vibrocores (<3 m) and that deposits recovered relate to modern seabed sediments with low geoarchaeological potential, deposit modelling is not recommended as it will not enhance the understanding of site stratigraphy.

7.1.3 The potential and requirement for Stage 3 palaeoenvironmental assessment on geotechnical vibrocore samples is considered low and there are no further recommendations.

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APPENDICES

Appendix 1 – list of vibrocores

VC	X	Y	Depth from (m)	Depth to (m)
VC01	226180	383943	0.00	0.56
VC03	225927	383414	0.00	2.08
VC04	225679	383271	0.00	2.48
VC05	225936	383078	0.00	0.99
VC06	225628	382829	0.00	1.08

Appendix 2 – vibrocore descriptions

VC	Depth from (m)	Depth to (m)	Description	Depositional Environment	Unit
VC01	0.00	0.56	Gley 1 4/1 Dark greenish grey soft slightly sandy clayey silt with frequent shells (intact and fragments). Expands.	Intertidal/Marine	4

VC	Depth from (m)	Depth to (m)	Description	Depositional Environment	Unit
VC03	0.00	0.73	Gley 1 3/ Very dark grey clayey silty fine sand with occasional beds (<20 cm) of sandy clayey silt. Intact and fragments of shell throughout.	Intertidal/Marine	4
	0.73	1.23	Gley 1 3/ Very dark grey slightly sandy clayey silts with frequent shell fragments	Intertidal/Marine	4
	1.23	1.51	Gley 1 3/ Very dark grey clayey silty fine sand with frequent shell fragments	Intertidal/Marine	4
	1.51	2.08	Gley 1 3/ Very dark grey slightly sandy clayey silts with frequent shell fragments	Intertidal/Marine	4

VC	Depth from (m)	Depth to (m)	Description	Depositional Environment	Unit
VC04	0	1.74	Gley 1 3/ Very dark grey slightly sandy clayey silt with frequent shell fragments. Becoming more sandy from 0.54 m	Intertidal/Marine	4
	1.74	2.48	Gley 1 3/ Very dark grey soft clayey silt with frequent laminations of medium sand and occasional shell fragments	Intertidal/Marine	4

VC	Depth from (m)	Depth to (m)	Description	Depositional Environment	Unit
VC05	0.00	0.60	Gley 1 3/ Very dark grey soft slightly sandy clayey silt with occasional sand sized fragments of shell.	Intertidal/Marine	4
	0.60	0.80	Gley 1 3/ Very dark grey clayey silty sandy gravel with frequent shell fragments. Gravel is sub angular to sub rounded and comprises black slag with orange staining (Iron?)	Made ground	
	0.80	0.99	Gley 1 3/ Very dark grey silty fine sand with frequent sand sized shell fragments	Intertidal/Marine	4

VC	Depth from (m)	Depth to (m)	Description	Depositional Environment	Unit
VC06	0.00	1.18	Gley 1 3/ Very dark grey soft clayey silt with occasional pockets of fine sand.	Intertidal/Marine	4

Appendix 3 – core photographs

203701
Holyhead Port Expansion MGA
VC03
0.00 - 2.08m
Top
30/10/2018

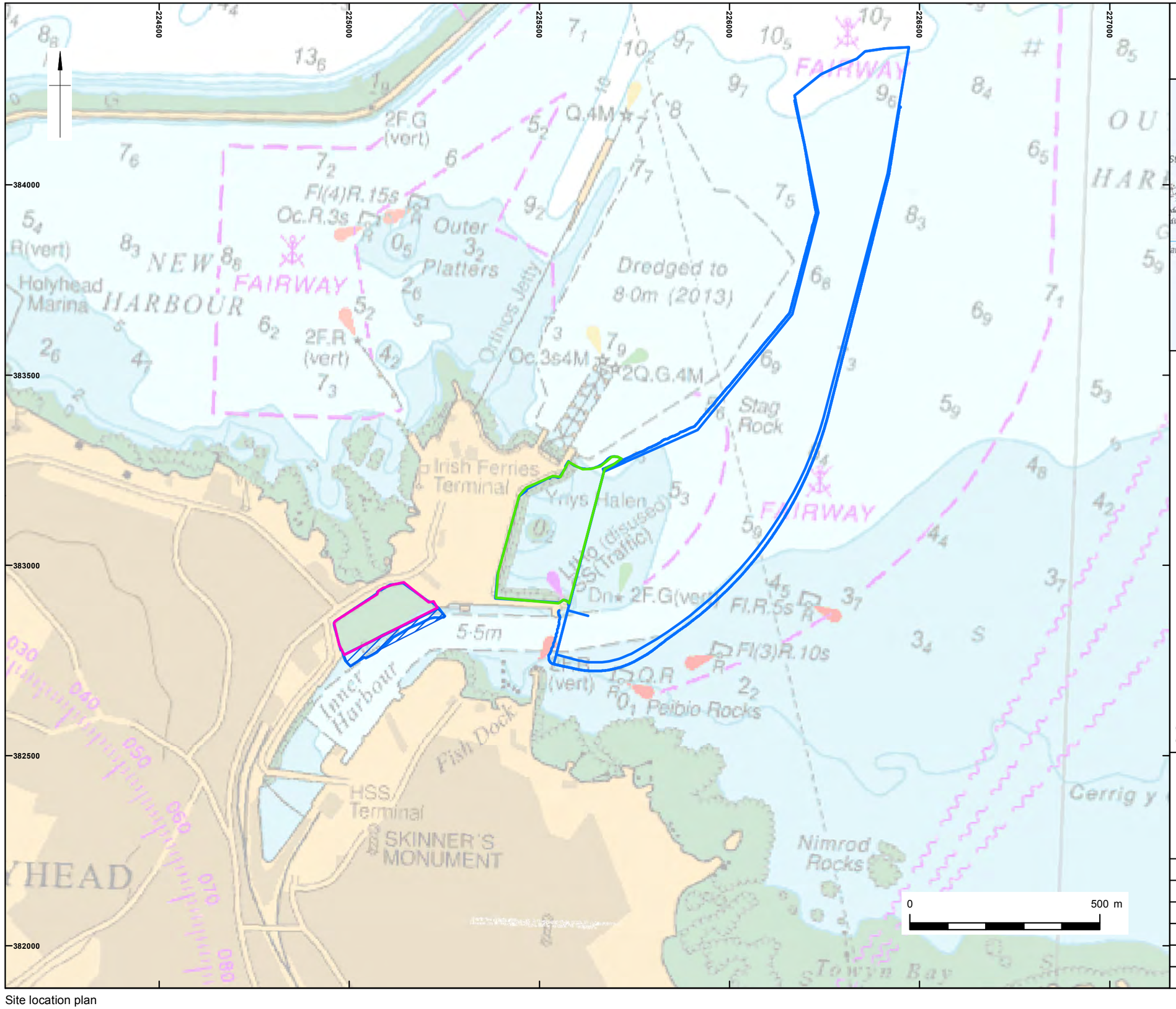
203701
Holyhead Port Expansion MGA
VC04
0.00 - 1.04m
Top
30/10/2018

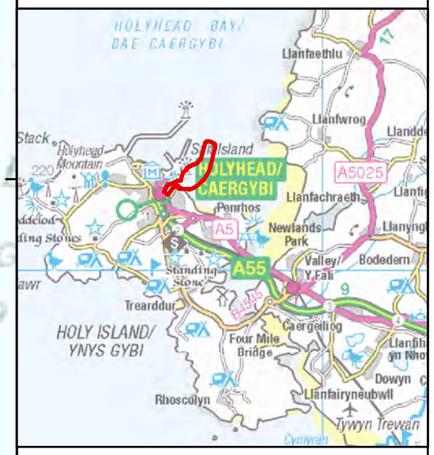
203701
Holyhead Port Expansion MGA
VC04
1.04 - 1.75m
Top
30/10/2018

203701
Holyhead Port Expansion MGA
VC04
2.00 - 3.00m
← Top
30/10/2018
wessex archaeology

203701
Holyhead Port Expansion MGA
VC05
0.00 - 1.00m
← Top
30/10/2018
wessex archaeology

203701
Holyhead Port Expansion MGA
VC06
0.00 – 1.18 m
TOP
30/10/2018





- Salt Island Expansion site
- Pelham Patch Development
- Dredge Preparation Area
- Dredge Channel

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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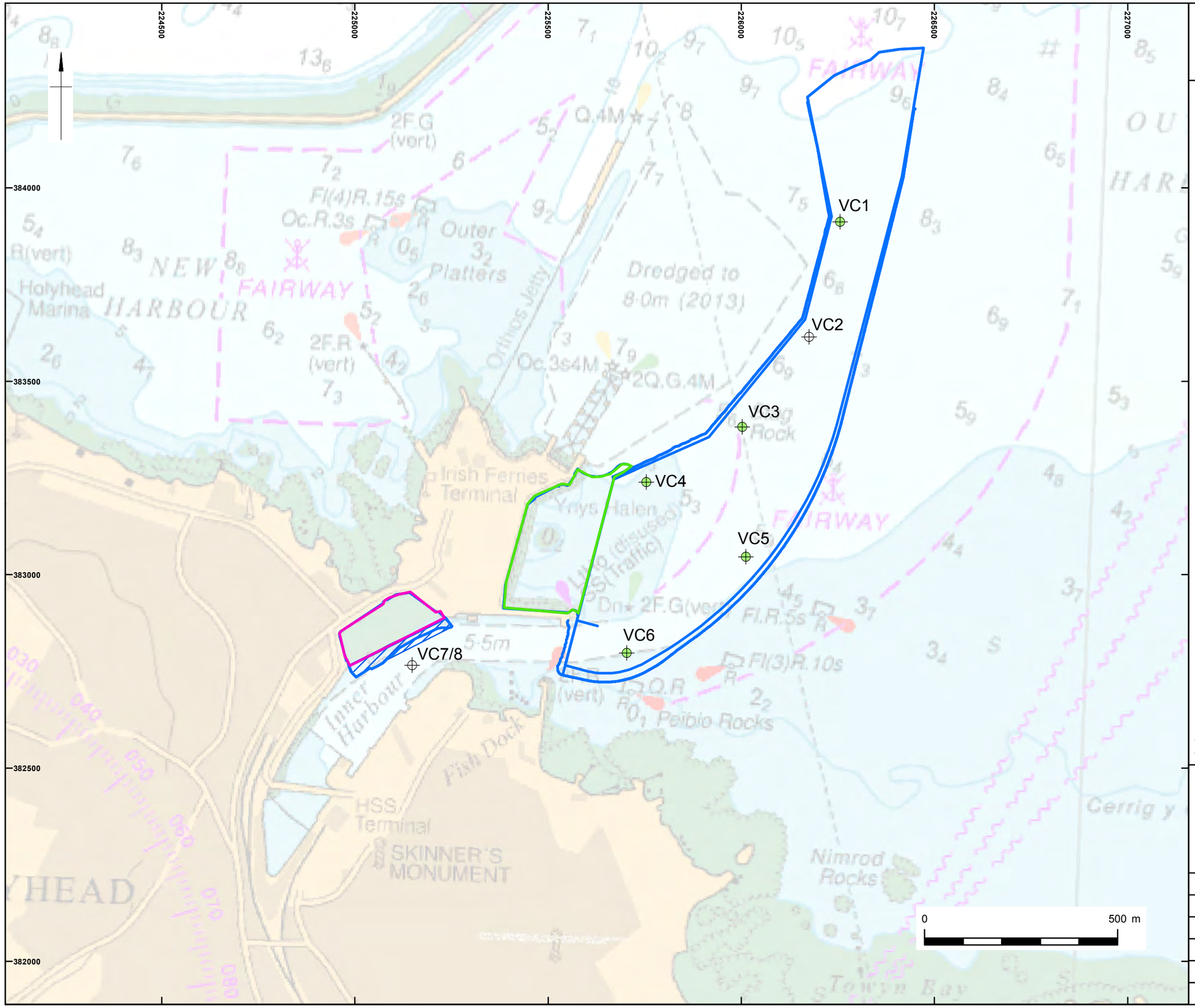
Site location plan

Figure 1



BH priority

- Low
- No sample
- Dredge Channel
- Salt Island Expansion site
- Pelham Patch Development
- Dredge Preparation Area

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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Vibrocore locations and geoarchaeological significance

Figure 2

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G5 – Stage 1 Geoarchaeology Report (Boreholes)

Holyhead Port Expansion

Stage 1 Marine Geoarchaeological Review

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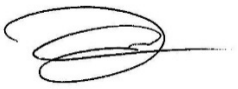
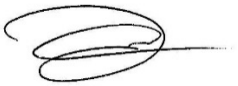
V1	External draft for client comments	CLM	DRN 
V2 18/06/2019	Revised after client comments	CLM	DRN 

DATA LICENCES

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Summary

Wessex Archaeology was commissioned by Royal HaskoningDHV on behalf of Stena Line Ports Ltd. to review geotechnical borehole logs acquired from Holyhead Port, Anglesey, in advance of a proposed port expansion scheme that includes reclamation of two areas (the Pelham Patch Development and the Salt Island Expansion site) and dredging of a new approach channel.

This report outlines the results of a Stage 1 review of thirteen geotechnical borehole logs recovered from the proposed scheme. The aim of this review is to determine the type, sequence and depositional history of the deposits within the site in relation to archaeological potential. The results are considered alongside a previous geophysical assessment (Wessex Archaeology 2019a).

Note, the boreholes reviewed in this report are from a different survey to the vibrocores previously assessed and reported on by Wessex Archaeology (2018b).

The results of from the geotechnical borehole review are broadly consistent with the expected stratigraphy of the site. Bedrock (psammite) is overlain by glacial deposits comprising firm to stiff, sandy gravelly clay interpreted as till and sandy silty gravel deposits. Locally (BH-02, DC-02 and DC-03) these deposits have been reworked by marine processes to form gravelly sand. Glacial derived deposits have low geoarchaeological potential as they date to time periods when the area would have been unsuitable for occupation.

In BH-03 and BH-07, clay comprising rootlets, partially decomposed plant material and, peat and wood fragments was recorded overlying glacial deposits. These are interpreted as alluvium and are of geoarchaeological interest as they show evidence of past terrestrial environments and have the potential to preserve palaeoenvironmental material. These deposits have been assigned medium geoarchaeological potential.

The uppermost deposits comprise soft sandy clay with varying amounts of shell fragments interpreted to represent seabed sediments. These deposits are of low geoarchaeological potential as they reflect deposition in a modern marine environment.

In the case of undisturbed samples being available, the deposits in BH-03 and BH-07 would be candidates for more detailed geoarchaeological recording (Stage 2). However, a review of geotechnical logs shows sub-samples from these deposits are disturbed.

Based on the results of this Stage 1 marine geoarchaeological review, eleven boreholes comprise deposits with low geoarchaeological potential. Two boreholes (BH-03 and BH-07) recovered alluvium deposits with medium geoarchaeological potential. However, no further work is recommended as the nature of available samples is not suitable for Stage 2 geoarchaeological recording.

Acknowledgements

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Geoarchaeological recording and report compilation was undertaken by Claire Mellett. Illustrations were prepared by Ken Lymer. Quality control was provided by David Norcott, and the project was managed for Wessex Archaeology by David Norcott.

Holyhead Port Expansion

Stage 1 Marine Geoarchaeological Review

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Royal HaskoningDHV on behalf of Stena Line Ports Ltd., to assess geotechnical data acquired from Holyhead Port, Anglesey, in advance of a proposed port expansion scheme.

1.1.2 The study area lies in the nearshore directly off the coast of Anglesey in North Wales, and extends from Holyhead Port Inner Harbour, through the Old Harbour, to approximately 1.5 km out into the Fairway to the east of Salt Island (Ynys Halen) (**Figure 1**).

1.1.3 The proposed development involves dredging of a new approach channel along with the reclamation of two areas (the Pelham Patch Development and the Salt Island Expansion site) (**Figure 1**).

1.2 Summary of previous marine archaeological works

1.2.1 An assessment of marine geophysical survey data comprising sub-bottom profiler, sidescan sonar, magnetometer and multibeam echosounder, was previously undertaken (Wessex Archaeology 2019a) with the aim of identifying palaeolandscape features of possible archaeological interest. No palaeolandscape features were identified within the study area.

1.2.2 Subsequently, a geoarchaeological assessment of five vibrocores was undertaken (Wessex Archaeology 2019b). Deposits in all cores comprised very dark grey, soft, clayey sandy silt with frequent shell and occasional inclusions of slag, indicating deposition in a marine environment influenced by industrial activity. These deposits have low geoarchaeological potential and no further palaeoenvironmental assessment or deposit modelling was recommended.

1.3 Scope of work

1.3.1 To help frame geoarchaeological investigations of this nature, WA has developed a five-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The stages are summarised below (**Table 1**).

Table 1 Stages of geoarchaeological assessment and recording

Stage	Method	Description
1	Review	A desk-based archaeological review of the borehole, vibrocore and CPT logs generated by geotechnical contractors. Aims to establish the likely presence of horizons of archaeological interest and broadly characterise them, as a basis for deciding whether and what Stage 2 archaeological recording is required. The Stage 1 report will state the scale of Stage 2 work proposed.

Stage	Method	Description
2	Geoarchaeological Recording	Archaeological recording of selected retained or new core samples will be undertaken. This will entail the splitting of the cores, with each core being cleaned and recorded. The Stage 2 report will state the results of the archaeological recording and will indicate whether any Stage 3 work is warranted.
3	Sampling and Assessment	Dependent upon the results of Stage 2, sub-sampling and palaeoenvironmental assessment (pollen, diatoms and foraminifera) may be required. Subsamples will be taken if required. Assessment will comprise laboratory analysis of the samples to a level sufficient to enable the value of the palaeoenvironmental material surviving within the cores to be identified. Subsamples will also be taken and/or retained at this stage in case scientific dating is required during Stage 4. Some scientific dating (e.g. radiocarbon or Optically Stimulated Luminescence (OSL)) may be undertaken at this stage to provide chronological context. The Stage 3 report will set out the results of each laboratory assessment together with an outline of the archaeological implications of the combined results, and will indicate whether any Stage 4 work is warranted.
4	Analysis and Dating	Full analysis of pollen, diatoms and/or foraminifera assessed during Stage 3 will be undertaken. Typically, Stage 4 will be supported by scientific dating (e.g. radiocarbon or OSL) of suitable subsamples. Stage 4 will result in an account of the successive environments within the coring area, a model of environmental change over time, and an outline of the archaeological implications of the analysis.
5	Final Report	If required Stage 5 will comprise the production of a final report of the results of the previous phases of work for publication in an appropriate journal. This report will be compiled after the final phase of archaeological work, whichever phase that is.

2 AIMS AND OBJECTIVES

2.1.1 The principle aim of the Stage 1 geoarchaeological review is to assess the archaeological potential of deposits recovered in boreholes collected in support of the proposed expansion of Holyhead Port.

2.1.2 This will be achieved with the following objectives;

- Review geotechnical borehole logs to identify deposits of potential archaeological interest, assigning high, medium and low status accordingly, and;
- Make recommendations for Stage 2 geoarchaeological recording, where necessary.

3 GEOARCHAEOLOGICAL BACKGROUND

3.1.1 Geoarchaeological assessments are typically undertaken with reference to geological periods (e.g. Quaternary), epochs (e.g. Pleistocene) and sub-epochs (e.g. Devensian) that reflect major climate, sea-level or environmental changes. Here we adopt British nomenclature and dates are given as ka (thousands of years before present) and Ma (millions of years before present).

3.1.2 Holy Island (Ynys Gybi) and most of Anglesey (Ynys Môn) are composed of Pleistocene and Holocene sediments overlying Precambrian geology, most notably the Mona Complex (British Geological Survey (BGS) 2018). The solid geology of the onshore area is characterised by outcrops of the Precambrian New Harbour Group, which comprises interbedded mica shists and psammites, along with scattered igneous intrusions. This is overlain by diamicton (till) deposited during the last ice age (Devensian) with coastal and estuarine deposits fringing the present-day coast. Directly off the coast of Holyhead the seabed sediments comprise sandy gravel with finer grained silts and clays expected in the nearshore (BGS 2018). The thickness of Pleistocene sediments in the nearshore area is not expected to exceed 5 m (Mellett et al. 2015).

3.1.3 The recent geological history of the UK is directly linked to glacial/interglacial cycles experienced during the Pleistocene (2.5 Ma – 11.7 ka). Anglesey and the adjacent Irish Sea are areas that were repeatedly overridden by ice during glacial periods with the most recent glaciation, the Devensian, having the greatest impact on the Pleistocene geology of the region. Previous borehole surveys from the vicinity of the study area have recovered evidence of these repeated glacial cycles, in the form of glacial diamict overlying Precambrian bedrock (Fugro 2002). The archaeological potential of these glacial sediments is considered low.

3.1.4 At the end of the last ice age, ice sheets retreated from the area approximately 22 ka (Chiverrell et al. 2013; 2018) and it has long been debated as to whether this deglaciation occurred in a terrestrial or marine environment (McCarroll, 2001; Scourse and Furze, 2001). If it was in a terrestrial environment, this means the seabed would have been subaerially exposed and suitable for occupation and thus have potential to preserve archaeological material or palaeolandscapes. However, there is increasing evidence to suggest deglaciation offshore of Anglesey occurred in a marine setting (Van Landeghem *et al.* 2009, Van Landeghem and Chiverrell 2011). In this scenario, the seabed would not have been subaerially exposed at the end of Devensian making the potential for prehistoric archaeology low.

3.1.5 While the debate is ongoing, we recognise there is potential that the study area was subaerially exposed during the period between when ice sheets retreated (~22 ka) and sea levels rose to their present-day position (~8 ka) (Shennan and Horton 2002).

3.1.6 However, there is no evidence of palaeolandscape features in the study area based on an assessment of geophysical data (Wessex Archaeology 2019a). Furthermore, no prehistoric sites or finds are known from within the study area. Any archaeological material in the study area is more likely related to sea-faring activity and the growth of settlement and industries in and around Holyhead.

3.1.7 The stratigraphy of the study area has been divided into four key units based on an assessment of geophysical data (Wessex Archaeology 2019a) and the British Geological Survey (Jackson et al. 1995; Mellett et al. 2015), as outlined below (**Table 2**).

Table 2 Shallow stratigraphy of the study area

Unit	Unit Name	Geophysical Characteristics [1]	Sediment Type [2]	Archaeological Potential
4	Holocene Seabed Sediments	Acoustically layered unit of varying thickness, contains gas in some areas.	Intertidal/marine deposit, soft clay, silt and sand.	Considered of low potential in itself, but possibly can cover archaeological material.
3	Devensian Upper Till (Cardigan Bay Formation/Irish Sea Till)	Observed cutting into Unit 2 in some parts of the study area, relatively acoustically unstructured with some internal reflectors.	Stiff gravelly clay.	Low archaeological potential.
2	Devensian Lower Till (Cardigan Bay Formation/Irish Sea Till)	Observed across much of the study area, generally acoustically chaotic with some areas of possible layering.	Stiff gravelly clay and clayey, schist gravel.	Low archaeological potential.
1	Precambrian Bedrock	Observed across the entire study area, relatively homogenous unit with some internal reflectors.	Metamorphic mica schist and psammite bedrock.	No archaeological potential, although upper boundary may have formed a land surface.

[1] Based on geophysical data

[2] Based on previous borehole data, Jackson *et al.* 1995, and BGS 2018

4 METHODOLOGY

4.1 Co-ordinate system

4.1.1 Results are presented as WGS84 UTM 30N projected coordinates.

4.2 Geotechnical coring strategy

4.2.1 A total of thirteen boreholes were drilled to a maximum depth of 32.20 meters below sea floor (mbsf) using a combination of cable percussion and rotary coring methods from a jack-up barge during June and July 2018.

4.2.2 Cable percussion methods were used to advance through the superficial deposits. At each major change in lithology a disturbed sample was taken and stored in a bag or tub for geotechnical or environmental testing.

4.2.3 Geotechnical logs are presented in **Appendix 1**.

4.3 Review of geotechnical logs

4.3.1 Each of the thirteen borehole geotechnical logs was reviewed by a geoarchaeologist in order to identify deposits of potential archaeological interest. Vibrocores were assigned either a high, medium or low status based on their perceived geoarchaeological significance as itemised in **Appendix 2** and shown on **Figure 2**.

5 RESULTS

5.1.1 A total of thirteen borehole geotechnical logs were reviewed as part of the Stage 1 works, with the aim of identifying deposits of potential geoarchaeological significance. Outline descriptions based on geotechnical logs are presented in **Appendix 2**, accompanied by an initial interpretation of the deposits.

5.1.2 Bedrock (Unit 1) was recovered in nine of the thirteen boreholes (**Appendix 2**). Bedrock in the area comprises psammite which is a metamorphosed sandstone. Bedrock lies at depths between 0 mbsf (BH-06) and 10.60 mbsf (BH-01).

5.1.3 Overlying bedrock, firm to stiff, sandy gravelly clay was recovered in nine boreholes (BH-01, BH-02, BH-03, BH-04, BH-07, BH-01, DC-02, DC-03 and DC-04). These deposits are interpreted as glacial in origin (till) based on their high strength and heterogeneous nature. It is not possible to determine if they correspond to Unit 2 or Unit 3, as defined in **Table 2**, based on geotechnical logs alone. For the purpose of this Stage 1 review, they are simply referred to as glacial deposits.

5.1.4 In BH-01, a dense, sandy silty gravel (2 m thick) was recorded below the glacial till, and in BH-04 a deposit of silty gravel (0.5 m thick) was recorded within the till. These deposits are also interpreted to be of glacial origin due to their relationship with the till. They potentially correspond to Unit 2 (**Table 2**) as Cardigan Bay Formation/Irish Sea Till is recorded to comprise a clayey gravel component (Jackson et al. 1995).

5.1.5 Overlying glacial till in BH-02, DC-02 and DC-03, are gravelly sand and sandy gravel deposits. These may be glacial in origin but may also reflect reworking of the till by modern marine processes as they are recorded directly below seabed sediments in these boreholes.

5.1.6 In BH-03, between 2.00 mbsf and 4.00 mbsf, organic clay with wood fragments and pockets of peat was recovered. Similarly, in BH-07 a clay deposit comprising rootlets and partially decomposed plant matter was recovered between 1.10 mbsf and 3.95 mbsf. These deposits are interpreted as alluvium and possibly show evidence of past terrestrial environment.

5.1.7 The uppermost deposits recovered in all but two of the boreholes comprise soft sandy clay with varying amounts of shell fragments. These deposits are interpreted to represent modern seabed sediments (Unit 4). In BH-01 and BH-02, these deposits are described as possibly organic and in BH-02, fragments of metal are recovered indicating industrial activity.

5.1.8 In DC-02 and BH-09, seabed sediments are locally coarser grained sandy gravel.

6 DISCUSSION

6.1.1 The results of from the geotechnical borehole review are broadly consistent with the expected stratigraphy of the site (**Table 2**) with the exception of two boreholes (BH-03 and BH-07) where alluvium comprising organic material was recorded.

6.1.2 Of the superficial deposits recovered in boreholes, glacial sediments are considered to have low archaeological potential as they correspond to time periods when the area would not have been suitable for occupation. Furthermore, preservation of palaeoenvironmental material in these glacial derived deposits is expected to be low making them unsuitable for further geoarchaeological works.

6.1.3 Seabed sediments are also interpreted to have low geoarchaeological potential as they were deposited by modern marine processes and show evidence of industrial activity.

6.1.4 The most geoarchaeologically significant deposits are alluvium recovered in BH-03 and BH-07 which lie within the Salt Island Expansion site (**Figure 2**).

6.1.5 Alluvium is a term used to describe a deposit laid down by flowing water, typically in a river or estuarine environment. Therefore, these deposits may have been deposited in a terrestrial environment which was later inundated by post-glacial sea-level rise.

6.1.6 The presence of rootlets, organic material and fragments of peat suggests there is potential for these deposits to preserve palaeoenvironmental material. However, these organics appear to be reworked rather than in situ.

6.1.7 The alluvial deposits have been classified as having medium geoarchaeological potential.

7 RECCOMENDATIONS

7.1.1 A Stage 1 review of geotechnical borehole logs acquired in support of the proposed Holyhead Port Expansion project identified two boreholes comprising deposits of medium geoarchaeological potential (BH-03 and BH-07).

7.1.2 In the case of undisturbed samples being available, the deposits in BH-03 and BH-07 would be candidates for more detailed geoarchaeological recording (Stage 2). However, a review of geotechnical logs shows sub-samples from these deposits are disturbed bulks and therefore unsuitable for further work.

7.1.3 The remaining eleven boreholes (BH-01, BH02, BH04, BH05, BH-06, BH-08, BH09, DC-01, DC-02, DC-03 and DC-04) have low geoarchaeological potential.

7.1.4 No further geoarchaeological work is recommended.

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APPENDICES

Appendix 1 – borehole logs

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-01**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	4.72	
Coordinates (m)	E225663.35 N383227.30	Ground Elevation (m Datum)	-4.72	Sheet 1 of 4
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	D	1							Very soft dark grey to black sandy CLAY with occasional shell fragments (<2 x 2mm). Sand is fine to coarse. Possibly slightly organic.			
0.00 - 0.50	D	2										
1.00 - 1.10	D	4						1				
1.00 - 1.10	D	5										
1.00 - 1.50	B	6										
1.00	BVane)		3 kPa (*1 kPa*)									
1.50 - 2.50	P	7	mm							(3.10)		
2.40	BVane)		6 kPa (*2 kPa*)					2				
2.50 - 3.00	B	10										
2.50 - 3.00	D	8										
2.50 - 3.00	D	9										
3.10 - 3.50	B	13						3				
3.10 - 3.50	D	11							Stiff, brown mottled grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of psammite and basalt.	3.10	-7.82	
3.10 - 3.50	D	12										
3.50 - 3.95	D	14										
3.50 - 4.50	B	15										
3.50 - 3.95	SPT		N = 18 (S)									
3.50	Pen		175 kPa									
4.00 - 4.50	D	16						4				
4.50 - 4.95	D	17										
4.50 - 5.00	D	18							Below 4.50m; medium cobble content. Cobbles (<120mm x 80mm) are subangular to rounded .			
4.50 - 5.00	D	19								(3.40)		
4.50 - 5.50	B	20										
4.50 - 4.95	SPT		N = 19 (S)					5				
4.50	Pen		150 kPa									
5.50 - 5.95	D	21							Below 5.50m; high cobble content.			
5.50 - 6.00	D	22										
5.50 - 6.50	B	23										
5.50 - 5.95	SPT		N = 16 (S)					6				
6.50 - 6.95	D	24								6.50	-11.22	
6.50 - 7.00	D	25							Firm greyish brown sandy silty CLAY. Sand is fine and medium.			
6.50 - 7.50	B	26										
6.50 - 6.95	SPT		N = 18 (S)					7				
7.50 - 7.95	UT	27	35/450 mm									
7.50 - 8.50	B	29							Below 7.50m; rare subangular and subrounded fine to medium gravel of psammite and basalt.	(2.10)		
7.95 - 8.10	D	28										
8.00	BVane)		6 kPa (*2 kPa*)					8				
8.50 - 8.95	D	30										
8.50 - 8.95	SPT		N = 39 (S)							8.60	-13.32	
8.60 - 9.00	D	31							Dense grey very sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular to rounded fine to coarse of psammite and basalt.			
8.60 - 9.00	D	32										
8.60 - 9.50	B	33						9				
9.50 - 10.50	B	35										
9.50 - 9.95	D	34							Below 9.50m; becomes silty.	(2.00)		
9.50 - 9.95	SPT		N = 41 (S)									
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-01**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	4.72		
Coordinates (m)	E225663.35 N383227.30	Ground Elevation (m Datum)	-4.72	Sheet 2 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
10.50 - 10.67	D	36										
10.50 - 10.66	SPT		50/15 mm (S)							10.60	-15.32	
									Extremely weak light greenish grey PSAMMITE. Slightly to moderately weathered. Recovered as slightly sandy very silty angular fine and medium gravel.	(0.10)	-15.42	
10.87 - 11.06	C	37								10.70		
10.70 - 11.70				100	97	84		11	Strong, locally very strong, narrowly foliated to medium bedded, greenish grey, fine to medium grained PSAMMITE with occasional thin foliations to medium beds of schistose pelite and occasional quartz veins (<30mm thick). Fresh.			
11.70 - 11.87	C	38							Between 11.41m and 11.61m; weak to medium strong, zone of tight folding of rock fabric.			
11.70 - 12.70				100	99	72		12	Between 11.93m and 12.12m; medium strong.			
10.70 - 14.14							10					
12.50 - 12.69	C	39										
12.70 - 13.40				100	97	74		13	Between 13.11m and 13.42m; medium strong.			
13.40 - 13.65	C	40										
13.40 - 14.00				100	100	90						
14.14 - 14.40	C	41						14				
15.11 - 15.39	C	42						15				
14.00 - 17.00				100	99	92						
14.14 - 17.19							5		Between 15.55m and 15.74m; medium strong			
15.85 - 16.13	C	43						16				
16.79 - 17.00	C	44						17				
17.00 - 18.50				100	100	61						
17.82 - 17.95	C	45					12					
17.19 - 18.70								18				
18.73 - 19.12	C	46										
18.50 - 20.00				100	97	69		19	Between 19.22m and 19.44m; medium band of medium strong schistose pelite.			
									Between 19.67m and 21.12m; medium strong schistose pelite.			

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-01**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	4.72		
Coordinates (m)	E225663.35 N383227.30	Ground Elevation (m Datum)	-4.72	Sheet 3 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.34 - 20.52	C	47							Between 19.84m and 20.00m; abundant quartz veining/ mineralisation (70mm thick).			
20.72	HPD	1										
20.00 - 21.50				100	90	73			Between 20.57m and 20.85m; medium strong schistose pelite.			
21.06 - 21.50	C	48						21	Between 21.06m and 21.52m; abundant quartz veins/ mineralisation, predominantly subvertical.	(21.30)		
21.50 - 23.00				100	90	75		22	Between 21.58m and 22.00m; medium strong to strong schistose pelite. Between 21.76m and 21.88m; quartz vein (<120mm thick).			
22.27 - 22.57	C	49										
22.57 - 22.78	C	50										
18.70 - 27.50							9	23				
23.28 - 23.56	C	51										
23.00 - 24.50				100	100	77		24				
24.56 - 25.01	C	52										
24.50 - 26.00				100	100	83		25				
25.68 - 26.00	C	53										
26.39 - 26.49	C	54						26				
26.00 - 27.50				100	100	48		27				
27.76 - 27.86	C	55										
27.50 - 29.00				100	100	85		28				
28.66 - 28.85	C	56										
29.38 - 29.71	C	57						29	Between 28.83m and 29.05m; medium band of medium strong schistose pelite.			
27.50 - 31.90												
29.00 - 30.50				100	100	100	5					

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-01**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	4.72	
Coordinates (m)	E225663.35 N383227.30	Ground Elevation (m Datum)	-4.72	Sheet 4 of 4
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
30.66 - 30.77	C	58						31				
30.50 - 32.00				100	100	74						
31.57 - 31.69	C	59						32	Between 31.90m and 32.00m; assessed zone of core loss End of Borehole at 32.00 m	32.00	-36.72	
								33				
								34				
								35				
								36				
								37				
								38				
								39				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-01**
Fugro Reference	G180016U	Water Depth (m Datum)	4.72	
Coordinates (m)	E225663.35 N383227.30	Ground Elevation (m Datum)	-4.72	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	10.70	CP	10/07/2018	10/07/2018	ARAN120A/ Comacchio 1200			CR	KR/LR	
10.70	32.00	RC	10/07/2018	11/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
10/07/2018	13:15:00	0.00	0.00	
10/07/2018	20:20:00	10.70	10.70	
10/07/2018	21:20:00	10.70	10.70	
11/07/2018	06:40:00	32.00	32.00	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
10.70	178	10.50	178
32.00	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
10.70	11.70	Water	0		00:11
11.70	12.70	Water	0		00:18
12.70	13.40	Water	0		00:27
13.40	14.00	Water	0		00:14
14.00	17.00	Water	0		01:28
17.00	18.50	Water	0		02:00
18.50	20.00	Water	0		00:31
20.00	21.50	Water	0		00:24
21.50	23.00	Water	0		00:25
23.00	24.50	Water	0		00:09
24.50	26.00	Water	0		00:26
26.00	27.50	Water	0		00:12
27.50	29.00	Water	0		00:27
29.00	30.50	Water	0		00:14
30.50	32.00	Water	0		00:24

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
10.70	11.70	102
11.70	12.70	102
12.70	13.40	102
13.40	14.00	102
14.00	17.00	102
17.00	18.50	102
18.50	20.00	102
20.00	21.50	102
21.50	23.00	102
23.00	24.50	102
24.50	26.00	102
26.00	27.50	102
27.50	29.00	102
29.00	30.50	102
30.50	32.00	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 12.20m; deck level = 7.48m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB

Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS — Print Date: 14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-02**
Fugro Reference	G180016U	Water Depth (m Datum)	3.60	
Coordinates (m)	E225639.27 N383128.33	Ground Elevation (m Datum)	-3.60	Sheet 1 of 4
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	D	1							Very soft and soft dark grey slightly sandy slightly organic CLAY. Sand is mainly fine. With frequent shell fragments (<8 x 4mm) and rare angular and subangular fine to coarse gravel of basalt.			
0.00 - 0.50	D	2										
0.50	HVane		2 kPa (*2 kPa*)									
1.00 - 1.10	D	4						1				
1.00 - 1.10	D	5										
1.00 - 1.50	B	6										
1.50 - 2.50	P	7	mm									
1.50	HVane		5 kPa (*2 kPa*)							(3.50)		
2.00	D	11						2				
2.00 - 2.50	D	8										
2.00 - 2.50	D	9										
3.00 - 3.50	B	14						3				
3.50	D	13							Very soft and soft grey mottled brown slightly gravelly slightly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse of basalt and psammite and occasional metal fragments (<50 x 10 x 10mm). (Possibly reworked material?) Below 3.50m; rare shell fragments.	3.50	-7.10	
3.50 - 3.90	B	15								(0.40)		
3.50 - 3.90	D	16								3.90	-7.50	
3.50 - 3.90	D	17								(0.10)	-7.60	
3.50	HVane		4 kPa (*2 kPa*)					4		4.00		
3.90 - 4.00	D	18							Grey, slightly sandy clayey angular to subrounded, fine to coarse GRAVEL of psammite and basalt.			
4.00 - 4.50	D	19										
4.00 - 4.50	D	20										
4.00 - 4.45	SPT		N = 14 (S)									
4.50 - 4.95	UT	21							Firm and stiff, grey mottled brown, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular and subrounded, fine to coarse of psammite and basalt. At 4.50m; low cobble content, cobbles are rounded of basalt (<110 x 60mm). Below 5.00m; occasional thin beds of sandy gravel.			
4.95 - 5.10	D	22						5		(2.30)		
5.00 - 5.50	B	23										
5.50	D	24										
5.50 - 5.95	D	25										
5.50 - 5.95	SPT		N = 17 (S)									
6.30 - 6.50	D	26						6		6.30	-9.90	
6.30 - 6.50	D	27								(0.30)		
6.50 - 6.57	D	28							Extremely weak to weak, grey PSAMMITE. Slightly to moderately weathered. Recovered as angular fragments (<6mm).	6.60	-10.20	
6.50 - 6.87	SPT		50/245 mm (S)				NR					
6.60 - 6.70												
6.71 - 7.01	C	29		86	59	43		7	Medium strong and strong, locally very strong, narrowly foliated to medium bedded greenish grey fine to medium grained PSAMMITE. Slightly weathered. with occasional narrow foliations to thin beds of schistose pelite and occasional quartz veins (<30mm thick). Discontinuities. Set #1 - foliation fractures, closely to medium spaced locally extremely to very closely spaced, subhorizontal (<10 deg) and inclined (20 – 40 deg), undulating and planar, smooth, tight and very tight, clean, locally with silt/ clay veneer, locally stained. Set #2 - foliation fractures, medium to widely spaced locally extremely closely spaced, inclined (55 – 70 deg), undulating, smooth, open and partly open infilled with sandy silt/ clay veneer, locally stained. Set #3 - joints, medium to widely spaced locally very closely to closely spaced, inclined (10 – 45 deg), undulating and stepped, rough, tight and very tight, predominantly clean, locally with silt/clay veneer, locally stained. Set #4 - joints, spacing not determined, inclined (60 – 90 deg), undulating and stepped, rough locally smooth, tight to open, locally moderately wide, stained, and infilled with lithorelicts and clay. Between 7.09m and 7.55m; medium strong.			
6.60 - 7.30												
7.93 - 8.16	C	30										
7.30 - 8.80				100	97	93		8				
8.65 - 9.13	C	31										
8.80 - 9.30				100	100	100		9				
9.30 - 10.30				100	100	100						

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-02**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.60		
Coordinates (m)	E225639.27 N383128.33	Ground Elevation (m Datum)	-3.60	Sheet 2 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
10.10 - 10.42	C	32										
10.30 - 11.00				100	100	100						
11.05 - 11.20	C	33						11				
6.70 - 15.68							6		Between 11.07m and 11.71m; swarm of quartz veins (<20mm thick) with pelite and psammite inclusions (<30x20mm).			
11.00 - 11.80				100	93	93						
12.06 - 12.22	C	44						12				
11.80 - 14.80				100	100	96		13				
13.45 - 13.86	C	45										
14.48 - 14.80	C	46						14				
15.20 - 15.39	C	47						15				
14.80 - 16.30				100	76	35						
15.68 - 16.74							21	16				
16.74 - 17.10	C	48							Between 16.40m and 16.49m ; non intact, drilling induced. Recovered as angular fragments ()<60mm). Between 16.67m and 18.02m; medium strong to strong schistose pelite.			
16.30 - 17.80				100	94	50		17				
17.10	HPD	1										
17.56 - 17.65	C	49										
18.41 - 18.57	C	50					12	18				
16.74 - 20.16				100	100	45						
17.80 - 19.30								19				
19.77 - 20.12	C	51							Between 19.38m and 20.94m; medium strong schistose pelite.	(25.60)		
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

FUGRO	Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-02**
	Client	Stena Line Ports Limited			
	Fugro Reference	G180016U	Water Depth (m Datum)	3.60	
	Coordinates (m)	E225639.27 N383128.33	Ground Elevation (m Datum)	-3.60	Sheet 3 of 4
	Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
19.30 - 20.80				100	87	57						
20.16 - 20.94												
21.13 - 21.33	C	52						21				
20.80 - 22.30				100	95	55						
22.30 - 22.44	C	53						22				
22.30 - 23.80				100	98	59		23	Between 23.03m and 23.54m; swarm of quartz veins (<40mm thick) with pelite and psammite inclusions (<70 x 15mm).			
23.40 - 23.55	C	54										
24.54 - 24.78	C	55		100	87	61		24				
23.80 - 25.30								25	Between 24.87m and 25.01m; quartz with psammite inclusions (<30 x 25mm).			
25.95 - 26.15	C	56						26				
25.30 - 26.80				100	94	48			Between 26.10m and 26.30m; medium strong, locally weak, extremely closely fractured.			
20.94 - 31.81							10					
27.04 - 27.22	C	57						27				
26.80 - 28.30				100	95	35						
28.09 - 28.30	C	58						28				
28.30 - 29.80				100	75	43		29	Between 28.82m and 29.45m; medium strong to strong schistose pelite. At 29.01m; quartz vein (0.50m thick) inclined (15 deg). Between 29.07m and 29.10m; non intact recovered as angular fragments (<60mm).			
29.10 - 29.22	C	59										
									Between 29.80m and 29.87m; swarm of quartz veins with			

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-02**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.60		
Coordinates (m)	E225639.27 N383128.33	Ground Elevation (m Datum)	-3.60	Sheet 4 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
30.04 - 30.31	C	60							pelite inclusions (<60x15mm).			
29.80 - 30.70				100	97	44						
30.80 - 30.96	C	61						31				
30.70 - 32.20				100	66	33						
31.81 - 32.20								32	Between 31.83m and 32.02m; weak to medium strong, non intact, recovered as sandy angular fine to coarse gravel with red surface staining locally.			
									End of Borehole at 32.20 m	32.30	-35.90	
								33				
								34				
								35				
								36				
								37				
								38				
								39				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-02**
Fugro Reference	G180016U	Water Depth (m Datum)	3.60	
Coordinates (m)	E225639.27 N383128.33	Ground Elevation (m Datum)	-3.60	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	6.60	CP	11/07/2018	12/07/2018	ARAN120A/ Comacchio 1200			JL/CR	KR/LR	
6.60	32.20	RC	12/07/2018	12/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
11/07/2018	18:00:00	0.00	0.00	
12/07/2018	02:05:00	6.60	6.50	
12/07/2018	15:20:00	6.60	6.50	
12/07/2018	21:00:00	32.20	32.20	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
6.60	178	6.50	178
32.20	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
6.60	7.30	Water	0		00:09
7.30	8.80	Water	0		00:26
8.80	9.30	Water	0		00:12
9.30	10.30	Water	0		00:27
10.30	11.00	Water	0		00:14
11.00	14.80	Water	0		00:24
14.80	16.30	Water	0		00:40
16.30	17.80	Water	0		00:30
17.80	19.30	Water	0		00:18
19.30	20.80	Water	0		00:18
20.80	22.30	Water	0		00:16
22.30	23.80	Water	0		00:16
23.80	25.30	Water	0		00:18
25.30	26.80	Water	0		00:16
26.80	28.30	Water	0		00:16
28.30	29.80	Water	0		00:19
29.80	30.70	Water	0		00:45
30.70	32.20	Water	0		00:25
					00:23

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
6.60	7.30	102
7.30	8.80	102
8.80	9.30	102
9.30	10.30	102
10.30	11.00	102
11.00	11.80	102
11.80	14.80	102
14.80	16.30	102
16.30	17.80	102
17.80	19.30	102
19.30	20.80	102
20.80	22.30	102
22.30	23.80	102
23.80	25.30	102
25.30	26.80	102
26.80	28.30	102
28.30	29.80	102
29.80	30.70	102
30.70	32.20	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 11.30m; deck level = 7.70m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

FUGRO	Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-03**
	Client	Stena Line Ports Limited			
	Fugro Reference	G180016U	Water Depth (m Datum)	3.30	
	Coordinates (m)	E225617.31 N383038.50	Ground Elevation (m Datum)	-3.30	Sheet 1 of 4
	Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	D	1							Very soft locally soft dark grey to black slightly sandy CLAY with rare shell fragments (<2 x 2mm). Possibly slightly organic. Sand is mainly fine.			
0.00 - 0.50	D	2										
0.50	HVane		2 kPa (*1 kPa*)									
1.00 - 1.10	D	4						1		(2.00)		
1.00 - 1.10	D	5										
1.00 - 1.50	B	6										
1.50 - 2.50	P	7	mm									
2.00 - 2.50	D	8						2		2.00	-5.30	
2.00 - 2.50	D	9							Firm, dark grey to black slightly gravelly, slightly sandy sliightly organic CLAY with frequent fragments of partially decomposed wood (<50 x 10mm). Gravel is angular and subangular, fine to coarse of psammite. Sand is fine to coarse.			
2.00 - 3.00	B	10								(1.10)		
3.00 - 3.45	D	11						3				
3.00 - 3.50	D	12								3.10	-6.40	
3.00 - 3.50	D	13							Soft grey organic CLAY with frequent fragments of partially decomposed organic matter (<50 x 10mm) and occasional pockets (<30 x 20mm) of dark brown fibrous peat.			
3.00 - 4.00	B	14								(0.90)		
3.00 - 3.45	SPT		0/450 (S)									
4.00 - 4.30	UT	15						4		4.00	-7.30	
4.00 - 4.50	B	18							Stiff brown mottled grey, slightly sandy gravelly CLAY with low to medium cobble content. Sand is fine to coarse. Gravel is angular to rounded, fine to coarse of psammite, quartz and basalt. Cobbles (<120 x 70mm) are angular to rounded of psammite and basalt.			
4.00 - 4.50	D	16										
4.00 - 4.50	D	17										
4.50 - 4.95	D	19										
4.50 - 5.50	B	20										
4.50 - 4.95	SPT		N = 28 (S)									
5.00 - 5.50	D	21						5		(2.00)		
5.50 - 5.85	D	22										
5.50 - 6.00	B	23										
5.50 - 5.85	SPT		50/200 mm (S)									
5.50	Pen		142 kPa									
6.00 - 6.15							NI	6		6.00	-9.30	
6.15 - 6.41							50		Medium strong and strong, greenish grey fine and medium grained schistose PSAMMITE. Slightly weathered. With occasional narrow foliations to thin bands of weak to medium strong schistose, pelite and occasional quartz veins (<40mm). Discontinuities. Set #1 - foliation fractures, closely to medium spaced, subhorizontal (<10 deg) and inclined (20 – 65 deg), undulating, smooth, tight and very tight, clean, locally with clay veneer, locally stained. Set #2 - joints, extremely closely to closely spaced, inclined (5 – 25 deg), stepped, rough, tight, stained. Set #3 - joints, extremely closelyu to closely spaced, inclined (75 – 85 deg), undulating and planar, rough, tight, stained.			
6.00 - 6.90				100	59	27						
6.48 - 6.64	C	24										
6.41 - 8.40							11	7				
7.61 - 7.72	C	25		100	55	39				(3.24)		
6.90 - 8.40												
8.40 - 8.75							NR	8	Between 6.00m and 6.15m; non intact, recovered as fragments (<20mm), possibly extremely closely fractured. Between 6.32m and 6.41m; non intact, probably drilling induced, recovered as fragments (<60mm). Between 7.16m and 7.62m; medium strong schistose pelite. Between 8.40m and 8.75m; assessed zone of core loss. Between 8.85m and 9.20m; non intact, drilling induced recovered as angular, medium to coarse gravel-sized fragments. Possibly extremely closely fractured in-situ.			
8.75 - 8.85							50					
8.85 - 9.24							NI	9				
8.40 - 9.90				77	30	0				9.24	-12.54	
9.48 - 9.55	C	26							Medium strong, locally weak or moderately weak, narrowly foliated, greenish grey fine grained schistose PELITE. Slightly weathered. With occasional narrow foliations and thin bands of medium strong to strong psammite. Discontinuities.			
9.24 - 10.60							8					

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-03**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.30		
Coordinates (m)	E225617.31 N383038.50	Ground Elevation (m Datum)	-3.30	Sheet 2 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
10.20 - 10.37	C	27							Set #1 - foliation fractures, extremely closely to closely spaced in widely spaced groups, subhorizontal (<15 deg) and inclined (50 - 55 deg), planar and undulating, rough and smooth, tight, with silt/clay veneer. Set #2 - joints, very closely to closely spaced, subhorizontal (<10 deg) and inclined (15 – 20 deg), undulating and stepped, smooth and rough, tight, predominantly clean, locally stained, locally wide and infilled with lithorelicts and clay (<20mm). Set #3 - joints, very closely to medium spaced, inclined (35 – 65 deg), undulating and stepped, rough locally smooth, tight, with silt veneer.			
9.90 - 11.40				100	68	59						
10.60 - 11.10							14			(3.26)		
11.09 - 11.40	C	28						11				
									Between 9.57m and 9.82m; fault inclined (70 deg) infilled with fault gouge comprising very clayey lithorelicts (<20mm)			
								12	Between 9.90m and 9.97m; non intact, probably drilling induced, recovered as fragments (<60mm).			
11.40 - 12.90				100	91	79						
12.37	C	29								12.50	-15.80	
									Medium strong and strong, locally moderately weak and weak, narrowly foliated to very thinly bedded greenish grey fine to medium grained schistose PSAMMITE. Fresh and slightly weathered. With occasional narrow foliations to medium bands of medium strong schistose pelite and occasional quartz veins. Discontinuities. Set #1 - foliation fractures, extremely closely to closely becoming medium spaced, subhorizontal (<10 deg) and inclined (20 – 75 deg), undulating, smooth and rough, tight, clean. Set #2 - joints, very closely to closely becoming medium to widely spaced, inclined (10 – 45 deg), undulating and stepped, rough, tight and very tight, stained locally clean. Set #3 - joints. As Set #2 inclined (50 - 85 deg).			
								13				
11.10 - 15.65							8					
13.40 - 13.73	C	30										
								14				
12.90 - 15.90				95	91	55						
14.52 - 14.73	C	31							Between 13.67m and 14.00m; slightly weathered, medium strong, greenish grey schistose pelite. Between 14.50m and 14.75m; slightly weathered, medium strong, greenish grey schistose pelite.			
								15				
15.20 - 15.44	C	32							At 15.20m; very weak.			
15.65 - 15.80							NR		Between 15.65m and 15.80m; assessed zone of core loss.			
15.90 - 16.30				100	85	25		16				
16.30 - 16.52	C	33							Between 16.03m and 61.06m; non intact, probably drilling induced, recovered as fragments (<60mm). Between 16.12m and 17.86m; frequent thin to medium bands of medium strong schistose pelite.			
16.30 - 17.40				100	100	69						
								17				
15.80 - 18.60							12					
17.23 - 17.40	C	34										
17.47 - 17.62	C	35										
								18	Between 17.96m and 18.23m; swarm of quartz veins (<40mm thick) with inclusions of psammite.			
17.40 - 18.90				100	97	53						
18.68 - 18.90	C	36										
								19				
19.30 - 19.81	C	37										
18.90 - 20.40				100	100	100						
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-03**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.30		
Coordinates (m)	E225617.31 N383038.50	Ground Elevation (m Datum)	-3.30	Sheet 3 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.20	HPD	1										
20.40 - 20.61	C	38					6					
18.60 - 22.35												
21.13 - 21.64	C	39		100	100	99		21				
20.40 - 21.90										(18.60)		
								22	Between 22.15m and 23.44m; tightly folded.			
22.38 - 22.79	C	40										
21.90 - 23.40				100	100	96		23				
23.40 - 24.00	C	41										
23.40 - 24.90				100	100	100		24				
24.64 - 24.84	C	42										
								25				
24.90 - 26.40				100	100	100			Between 25.65m and 26.60m; tightly folded.			
25.92 - 26.40	C	43						26				
22.35 - 31.10							3					
26.77 - 27.15	C	44						27	Between 26.90m and 27.60m; tightly folded.			
26.40 - 27.90				100	99	89						
27.63 - 27.90	C	45										
								28	Between 26.90m and 28.09m; quartz with inclusions of psammite (<30x15mm).			
28.40 - 28.66	C	46										
27.90 - 29.40				100	100	92		29				
29.40 - 30.20				100	100	100						
29.82 - 30.20	C	47										

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Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-03**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.30		
Coordinates (m)	E225617.31 N383038.50	Ground Elevation (m Datum)	-3.30	Sheet 4 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
30.20 - 31.10				100	100	96		31	End of Borehole at 31.10 m	31.10	-34.40	
								32				
								33				
								34				
								35				
								36				
								37				
								38				
								39				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-03**
Fugro Reference	G180016U	Water Depth (m Datum)	3.30	
Coordinates (m)	E225617.31 N383038.50	Ground Elevation (m Datum)	-3.30	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	6.00	CP	09/07/2018	09/07/2018	ARAN120A/ Comacchio 1200			CR	KR	
6.00	31.10	RC	09/07/2018	10/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
09/07/2018	09:30:00	0.00	0.00	
09/07/2018	11:45:00	6.00	5.50	
09/07/2018	12:05:00	6.00	5.50	
10/07/2018	05:40:00	31.10	31.10	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
6.00	178	5.50	178
31.10	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
6.00	6.90	Water	0		00:10
6.90	8.40	Water	0		00:14
8.40	9.90	Water	0		00:17
9.90	11.40	Water	0		00:18
11.40	12.90	Water	0		00:14
12.90	15.90	Water	0		01:05
15.90	16.30	Water	0		00:26
16.30	17.40	Water	0		00:34
17.40	18.90	Water	0		00:33
18.90	20.40	Water	0		00:34
20.40	21.90	Water	0		00:26
21.90	23.40	Water	0		00:26
23.40	24.90	Water	0		00:25
24.90	26.40	Water	0		00:42
26.40	27.90	Water	0		00:26
27.90	30.20	Water	0		00:38
30.20	31.10	Water	0		00:24
					00:27

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
6.00	6.90	102
6.90	8.40	102
8.40	9.90	102
9.90	11.40	102
11.40	12.90	102
12.90	15.90	102
15.90	16.30	102
16.30	17.40	102
17.40	18.90	102
18.90	20.40	102
20.40	21.90	102
21.90	23.40	102
23.40	24.90	102
24.90	26.40	102
26.40	27.90	102
27.90	29.40	102
30.20	31.10	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 10.20m; deck level = 6.90m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-04**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	3.46	
Coordinates (m)	E225590.93 N382932.46	Ground Elevation (m Datum)	-3.46	Sheet 1 of 4
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	D	1							Very soft and soft dark grey, slightly sandy becoming sandy with depth CLAY, possibly slightly organic with rare becoming frequent shell fragments (<3mm). Sand is fine and medium.			
0.00 - 0.50	D	2										
0.50	HVane		6 kPa (*4 kPa*)									
1.00 - 1.10	D	4						1		(2.00)		
1.00 - 1.10	D	5										
1.00 - 1.50	B	6										
1.50 - 2.50	P	7	mm									
2.00 - 2.50	D	8						2		2.00	-5.46	
2.00 - 2.50	D	9							Soft grey, slightly sandy CLAY with rare shell fragments (<6 x 4mm). Sand is fine.			
2.50	HVane		17 kPa (*9 kPa*)							(1.30)		
3.00 - 3.10	D	11						3				
3.30 - 3.50	D	12								3.30	-6.76	
3.30 - 3.50	D	13							Firm and stiff grey, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded, fine to coarse of psammite and basalt.	(0.20)		
3.50 - 3.95	D	14								3.50	-6.96	
3.50 - 4.00	B	15								(0.50)		
3.50 - 3.95	SPT		N = 24 (S)						Medium dense, grey, very sandy silty GRAVEL. Sand is fine to coarse, gravel is angular to sub rounded, fine to coarse of basalt, psammite and quartz.			
4.00 - 4.50	B	18						4		4.00	-7.46	
4.00 - 4.50	D	16							Stiff becoming locally firm with depth, brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded, fine to coarse of basalt, psammite and quartz. Becomes less sandy and gravelly with depth.			
4.00 - 4.50	D	17										
4.50 - 4.95	UT	19										
4.50	Pen		175 kPa									
4.95 - 5.00	D	20						5				
4.95	Pen		146 kPa									
5.00 - 5.50	B	22										
5.00 - 5.50	D	21										
5.50 - 5.95	D	23										
5.50 - 6.50	B	24										
5.50 - 5.95	SPT		N = 20 (S)							(3.65)		
6.50 - 6.95	UT	25						6				
6.50 - 7.50	B	27										
6.50	Pen		83 kPa									
6.95 - 7.00	D	26										
6.95	Pen		63 kPa					7				
7.50 - 7.95	D	28										
7.50 - 7.95	SPT		N = 40 (S)							7.65	-11.11	
7.65 - 8.00	B	30							Weak, greenish grey schistose PSAMMITE, moderately weathered. Recovered as very clayey sandy angular fine to coarse gravel and cobble sized fragments (<120 x 80mm).	(0.35)		
7.65 - 8.00	D	29										
8.00 - 8.10							NR	8		8.00	-11.46	
8.10 - 8.43							NI		Medium strong and strong, locally moderately weak and weak, becoming strong to very strong with depth, narrowly foliated to very thickly bedded greenish grey fine grained schistose PSAMMITE. Slightly weathered. With extremely to closely spaced narrow foliations to very thin beds of medium strong greenish grey pelite. Occasional randomly orientated quartz veins (<10mm thick).Discontinuities. Set #1 - foliation fractures, very closely to closely spaced locally medium spaced, subhorizontal, inclined (5 – 70 deg), undulating, smooth, tight and very tight, clean, locally with silt/clay veneer and stained. Set #2 - joints, extremely closely and closely spaced			
8.00 - 9.10				100	38	22						
8.71	C	31						9				
9.30 - 9.40	C	32										
9.10 - 10.60				100	95	64						

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Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-04**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.46		
Coordinates (m)	E225590.93 N382932.46	Ground Elevation (m Datum)	-3.46	Sheet 2 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
10.01 - 10.28	C	33							locally medium spaced, inclined (10 – 30 deg), stepped, rough, tight, predominantly clean, locally with silt/clay veneer, locally stained. Set #3- joints, medium spaced, inclined (50 – 80 deg), stepped, rough, tight to open, locally stained. Between 8.00m and 8.10m; assessed zone of core loss. Between 8.10m and 8.43m; non intact, probably drilling induced, recovered as fragments (<20mm). Between 9.23m and 9.28m; non intact, probably drilling induced, recovered as fragments (<60mm). Below 11.06m; becoming strong to very strong.			
8.43 - 12.93							13					
								11		(6.00)		
11.18 - 11.55	C	34										
10.60 - 12.10				100	99	82						
								12				
12.95 - 13.59	C	35										
12.10 - 14.30				100	99	67		13				
12.93 - 14.00							3					
								14		14.00	-17.46	
10.10 - 19.00				100	97	63			Medium strong, locally strong, narrowly foliated greenish grey and light greenish grey PELITE Slightly weathered. With occasional quartz veins (<25mm thick), concordant with foliation. Discontinuities. Set #1 - foliation fractures, closely to medium spaced locally extremely to very closely spaced, subhorizontal (<10 deg) and inclined (20 - 50 deg), undulating and planar, smooth, tight, clean, locally with silt/clay veneer. Set #2 - joints, medium spaced, inclined (40 – 80 deg), stepped, rough, tight, stained. Between 14.70m and 15.70m; occasional quartz veins. Between 15.51m and 15.53m; non intact, probably drilling induced, recovered as fragments (<20mm).			
14.69 - 14.75	C	36		100	98	61						
14.30 - 15.10												
14.00 - 15.84							14					
								15		(3.30)		
15.84 - 16.50	C	37		100	100	65						
15.10 - 16.60												
15.84 - 16.50							2					
								16				
16.66	HPD	1										
16.50 - 17.30				100	93	68	14					
16.60 - 17.35								17				
										17.30	-20.76	
17.35 - 17.59	C	38							Strong to locally very strong, narrowly foliated to very closely bedded greenish grey fine to medium grained schistose PSAMMITE. Slightly weathered. With extremely closely to very closely spaced narrow foliations and very thin bands of medium strong to strong greenish grey to greenish green pelite. Occasional to locally abundant quartz veining and mineralization, predominantly <10mm thick and concordant with foliation. Discontinuities. Set #1 - foliation fractures, closely to medium spaced locally extremely to very closely spaced, subhorizontal (<10 deg) and inclined (20 – 70 deg), undulating and planar, smooth and rough, tight, clean, locally with silt/clay veneer, locally stained. Set #2 - joints, extremely closely to closely spaced, locally medium, subhorizontal (<10 deg) and inclined (20 – 35 deg), stepped, rough, tight, predominantly clean. Set #3 - joints, spacing not determined, inclined (50 – 90 deg), undulating and planar, rough locally smooth,			
17.35 - 18.10				100	100	77						
								18				
17.30 - 19.00							10					
18.27 - 18.40	C	39										
18.73 - 18.86	C	40										
								19				
19.00 - 19.80							23					
19.00 - 20.00				100	89	22						
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-04**
Fugro Reference	G180016U	Water Depth (m Datum)	3.46	
Coordinates (m)	E225590.93 N382932.46	Ground Elevation (m Datum)	-3.46	Sheet 3 of 4
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.12 - 20.25	C	41							tight, locally stained.			
20.00 - 20.50				100	94	50			Between 19.76m and 19.89m; swarm of quartz veins (<40mm thick) with inclusions of schistose pelite (<30x10mm).			
20.33 - 20.42	C	42							Between 20.45m and 20.71m; swarm of quartz veins (<20mm thick) with inclusions of schistose pelite (<50 x 10mm).			
20.50 - 21.10				100	93	42			Between 20.64m and 20.66m; non intact, probably drilling induced, recovered as fragments (<20mm).			
								21				
21.23 - 21.37	C	43										
19.80 - 23.50							8					
21.10 - 22.60				100	98	48						
								22				
22.20 - 22.36	C	44							Between 22.49m and 22.52m; non intact, probably drilling induced, recovered as fragments (<20mm).			
22.60 - 23.35				100	100	88						
23.00 - 23.20	C	45						23	Between 22.90m and 23.50m; quartz with psammite and pelite inclusions (<70 x 30mm).			
23.35 - 24.10				100	87	45						
								24				
24.18 - 24.66	C	46								(14.70)		
24.10 - 25.60				100	100	81						
23.50 - 26.60							6	25				
25.44 - 25.60	C	47										
26.03 - 26.40	C	48						26				
25.60 - 26.70				100	100	59						
								27				
27.20 - 27.39	C	49										
26.70 - 28.20				100	89	75			Between 27.60m and 27.61m; non intact, probably drilling induced, recovered as fragments (<20mm).			
								28				
26.60 - 29.73							12		Between 28.29m and 28.49m; probable fault, inclined 70 deg infilled <20mm with probably fault gouge composed of angular fine gravel sized fragments of psammite, pelite of quartz in a matrix of yellowish-brown mineralization, possibly limonite.			
28.65 - 28.74	C	50										
28.20 - 29.70				100	90	59						
								29				
29.20 - 29.55	C	51										
									Between 29.85m and 30.65m; foliation is sub vertical,			

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Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-04**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.46		
Coordinates (m)	E225590.93 N382932.46	Ground Elevation (m Datum)	-3.46	Sheet 4 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
30.13 - 30.66	C	52							abundant quartz veining <(80mm thick) concordant with foliation planes.			
29.70 - 31.20				100	99	95						
29.73 - 31.85							5	31				
31.56 - 31.85 31.20 - 32.00	C	53		81	81	50						
31.85 - 32.00							NR	32	Between 31.85m and 32..00m; assessed zone of core loss.	32.00	-35.46	
									End of Borehole at 32.00 m			
								33				
								34				
								35				
								36				
								37				
								38				
								39				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-04**
Fugro Reference	G180016U	Water Depth (m Datum)	3.46	
Coordinates (m)	E225590.93 N382932.46	Ground Elevation (m Datum)	-3.46	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	8.00	CP	13/07/2018	13/07/2018	ARAN120A/ Comacchio 1200			CR	KR	
8.00	32.00	RC	13/07/2018	14/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
13/07/2018	13:15:00	0.00	0.00	
13/07/2018	17:15:00	8.00	8.00	
13/07/2018	18:30:00	8.00	8.00	
14/07/2018	10:00:00	32.00	32.00	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
8.00	178	8.00	178
32.00	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
8.00	9.10	Water	0		00:10
9.10	10.60	Water	0		00:20
10.60	12.10	Water	0		00:15
12.10	14.30	Water	0		00:55
14.30	15.10	Water	0		00:10
15.10	16.60	Water	0		00:06
16.60	17.35	Water	0		00:13
17.35	18.10	Water	0		00:10
18.10	19.00	Water	0		00:08
19.00	20.00	Water	0		00:11
20.00	20.50	Water	0		00:08
20.50	21.10	Water	0		00:05
21.10	22.60	Water	0		00:06
22.60	23.35	Water	0		00:14
23.35	24.10	Water	0		00:08
24.10	25.60	Water	0		00:08
25.60	26.70	Water	0		00:14
26.70	28.20	Water	0		00:10
28.20	29.70	Water	0		00:14
29.70	31.20	Water	0		00:21
31.20	32.00	Water	0		00:12

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
8.00	9.10	102
9.10	10.60	102
10.10	19.00	102
10.60	12.10	102
12.10	14.30	102
14.30	15.10	102
15.10	16.60	102
16.60	17.35	102
17.35	18.10	102
17.35	18.10	102
19.00	20.00	102
20.00	20.50	102
20.50	21.10	102
21.10	22.60	102
22.60	23.35	102
23.35	24.10	102
24.10	25.60	102
25.60	26.70	102
26.70	28.20	102
28.20	29.70	102
29.70	31.20	102
31.20	32.00	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 11.00m; deck level = 7.54m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB

Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS — Print Date: 14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-05**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	2.70		
Coordinates (m)	E225560.20 N383186.37	Ground Elevation (m Datum)	-2.70	Sheet 1 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.50 - 1.00	B	1							Very soft grey slightly sandy locally slightly gravelly clay. With rare shell fragments (<15 x 20 mm). Sand is fine to coarse, gravel is angular to rounded, fine and medium of schist, quartz and basalt.			
0.50 - 1.00	D	33										
1.00	D	2						1				
1.50	D	4										
1.50 - 2.00	B	5										
1.50 - 2.00	D	34								(3.55)		
1.50	HVane		8 kPa (*2 kPa*)									
2.00	D	6						2				
2.00 - 3.00	B	9										
2.00 - 3.00	D	35										
2.00 - 3.00	P	7	mm									
3.00	D	8						3				
3.50	D	11										
3.50	D	36					NI		Weak to medium strong, greyish green PSAMMITE. Recovered as angular, fine and medium gravel.	3.55 (0.05)	-6.25 -6.30	
3.55 - 3.60	D	12		100	50	0				3.60		
3.60 - 3.80							20					
3.60 - 4.00							NI	4	Medium strong and strong, locally moderately weak, narrowly foliated to thinly bedded greenish grey PSAMMITE. Slightly weathered. With occasional thin laminations to thin beds of weak to medium strong greenish grey schistose phyllitic pelite with frequent quartz veins (<40 mm thick) predominantly inclined (10-30 deg, occasionally 40-50 deg and 70-90 deg). Discontinuities. Set #1 - foliation fractures, extremely closely to medium spaced, subhorizontal (<10 deg) and inclined (20 – 40 deg), undulating and planar, locally stepped, smooth and rough, tight, clean, locally with silt/clay veneer, locally stained, rarely infilled with clay (<2mm). Set #2 - joints, very closely to widely spaced, inclined (12 – 45 deg), undulating and stepped, smooth and rough, tight, stained, locally infilled with clay (<2mm). Set #3 - joints, medium to widely spaced, inclined (65 – 90 deg), undulating and planar, rough, tight, stained, locally infilled with clay (<1mm).			
3.80 - 4.00												
4.00 - 4.10												
4.18 - 4.27	C	13										
4.00 - 5.10				100	53	0						
5.10 - 5.20	C	14						5				
4.10 - 6.95							19					
5.76 - 5.90	C	15										
5.10 - 6.60				100	65	18		6				
6.60 - 6.76	C	16										
6.60 - 7.90				100	42	22		7				
6.95 - 7.90												
8.15 - 8.28	C	17						8				
7.90 - 9.40				100	90	43						
9.05	C	18						9				
7.90 - 10.86							13					
9.94 - 10.15	C	19										

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-05**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	2.70		
Coordinates (m)	E225560.20 N383186.37	Ground Elevation (m Datum)	-2.70	Sheet 2 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
9.40 - 10.90				100	99	43			Between 10.28m and 10.40m; quartz. Between 10.47m and 10.68m; quartz with psammite inclusions (<70 x 20mm). Between 10.68m and 10.70m; non intact, probably drilling induced, recovered as fragments (<60mm).			
								11				
11.49 - 11.88	C	20										
10.90 - 12.40				100	97	52						
								12				
12.64 - 12.91	C	21										
								13				
12.40 - 13.90				100	100	71			Between 13.04m and 13.38m; medium strong schistose pelite.	(19.30)		
								14				
14.30 - 14.47	C	22										
13.90 - 15.40				100	100	60						
								15				
15.51 - 15.71	C	23										
								16				
15.40 - 16.90				100	100	60						
16.16 - 16.43	C	24					11		Between 16.43m and 16.69m; medium strong schistose pelite.			
10.86 - 21.79												
17.00 - 17.32	C	25						17				
16.90 - 18.40				100	99	63						
								18	Between 17.84m and 18.02m; possible fault, inclined (60 deg), wide, unfilled with silty angular gravel sized clasts, locally with quartz mineralization.			
18.18 - 18.34	C	26										
									Between 18.62m and 18.96m; medium strong schistose pelite.			
								19				
19.10 - 19.25	C	27		100	90	39						
18.40 - 19.90									Between 19.45m and 19.48m; non intact, probably drilling induced, recovered as fragments (<60mm). Between 19.52m and 19.62m; quartz with phyllitic schistose pelite inclusions (<40 x 30mm).			

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-05**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	2.70		
Coordinates (m)	E225560.20 N383186.37	Ground Elevation (m Datum)	-2.70	Sheet 3 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.06 - 20.25	C	28							Between 19.70m and 19.77m; quartz with psammite inclusions (<40 x 15mm).			
19.90 - 21.40				100	92	54						
20.82 - 21.01	C	29						21	Between 20.95m and 21.30m; zone of tight folding (wavelength 150mm; Amplitude 80mm).			
21.24 - 21.40	C	30										
21.48 - 21.79	C	31										
22.15 - 22.27	C	32		100	92	42		22				
21.40 - 22.90							12					
21.79 - 22.90									Between 22.58m and 22.61m; non intact, probably drilling induced, recovered as fragments (<60mm).			
								23	End of Borehole at 22.90 m	22.90	-25.60	
								24				
								25				
								26				
								27				
								28				
								29				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-05**
Fugro Reference	G180016U	Water Depth (m Datum)	2.70	
Coordinates (m)	E225560.20 N383186.37	Ground Elevation (m Datum)	-2.70	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	3.60	CP	30/06/2018	30/06/2018	ARAN120A/ Comacchio 1200			JL	KR/LR	
3.60	22.90	RC	30/06/2018	30/06/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
30/06/2018	01:30:00	0.00	0.00	
30/06/2018	03:45:00	3.60	3.60	
30/06/2018	05:20:00	3.60	3.60	
30/06/2018	13:05:00	22.90	22.90	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
3.60	178	3.60	178
22.90	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
3.60	4.00	Water	0		00:05
4.00	5.10	Water	0		00:16
5.10	6.60	Water	0		00:20
6.60	7.90	Water	0		00:15
7.90	9.40	Water	0		00:15
9.40	10.90	Water	0		00:17
10.90	12.40	Water	0		00:16
12.40	13.90	Water	0		00:14
13.90	15.40	Water	0		00:17
15.40	16.90	Water	0		00:17
16.90	18.40	Water	0		00:15
18.40	19.90	Water	0		00:12
19.90	21.40	Water	0		00:21
21.40	22.90	Water	0		00:23

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
3.60	4.00	102
4.00	5.10	102
5.10	6.60	102
6.60	7.90	102
7.90	9.40	102
9.40	10.90	102
10.90	12.40	102
12.40	13.90	102
13.90	15.40	102
15.40	16.90	102
16.90	18.40	102
18.40	19.90	102
19.90	21.40	102
21.40	22.90	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 10.50m; deck level = 7.80m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-06**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	1.00		
Coordinates (m)	E225527.60 N383101.60	Ground Elevation (m Datum)	-1.00	Sheet 1 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
									Open hole. [NO RECOVERY]	(0.30)		
										0.30	-1.30	
0.30 - 1.50 0.98 - 1.29	C	1		100	98	70		1	Strong, locally moderately weak and medium strong narrowly foliated to thinly bedded greenish grey PSAMMITE. Slightly weathered. With very closely and medium locally widely spaced narrow foliations and thin beds of medium strong greenish grey phyllitic schistose pelite and very closely to medium locally extremely widely spaced quartz veins (<60mm thick). Discontinuities. Set #1 - foliation fractures, extremely to very closely spaced, locally medium to widely spaced, subhorizontal (<10 deg) and inclined (20 – 50 deg), undulating, smooth, tight and very tight, clean, locally with silt/clay veneer, locally stained. Set #2 - joints, very closely to closely spaced, in widely to vary widely spaced clusters, subhorizontal (<10 deg) inclined (20 – 30 deg), stepped, rough, tight. Set #3 - joints, extremely closely to closely spaced in widely to very widely spaced clusters, inclined (60 - 85 deg), undulating locally planar or stepped, rough, tight, often stained. Set #4 - joints, very closely spaced in medium to very widely spaced clusters, inclined (35 – 55 deg), stepped, rough, tight, stained.			
1.50 - 1.80	C	2										
1.50 - 3.00 2.31 - 2.59 0.30 - 4.35	C	3		100	99	81	5	2				
3.14 - 3.48	C	4						3				
3.00 - 4.50				100	99	81			Between 1.70m to 2.05m; phyllitic schistose pelite with quartz inclusions (<40 x 10mm). Between 2.18m to 2.72m; zone of tight folding (wavelength 40-100mm, amplitude <50mm). Between 2.95m to 3.62m; phyllitic schistose pelite within fold (wavelength ~`1000mm and amplitude ~600mm).			
4.16 - 4.37	C	5						4				
4.35 - 6.00 5.19 - 5.40 4.50 - 6.00	C	6		100	100	64	9	5				
6.53 - 6.77	C	7						6	Between 6.04m to 6.23m; quartz with psammitic and phyllitic schistose inclusions (<60 x 30mm) locally with unknown black mineralisation.			
6.00 - 7.50				100	100	85			Between 6.63m to 6.82m; swarm of extremely to very closely spaced quartz veins (<15mm thick).			
7.27 - 7.50	C	8						7	Between 7.19m to 7.38m; locally with thin foliations of moderately strong pelite.			
6.00 - 9.00							8					
7.95 - 8.12	C	9						8				
7.50 - 9.00				100	100	64						
8.84 - 9.00	C	10						9	Between 8.74m to 8.84m; quartz with psammite inclusions (<40 x 20mm).			
9.60 - 10.10 9.00 - 10.50	C	11		100	100	84			Between 9.40m to 9.80m; abundant veins (<80mm x 80mm) and inclusions of quartz. Between 9.80m to 10.15m; quartz with inclusions (<50 x			

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-06**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	1.00		
Coordinates (m)	E225527.60 N383101.60	Ground Elevation (m Datum)	-1.00	Sheet 2 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
									30mm) of psammite and phyllitic schistose pelite.			
9.00 - 11.80							5					
10.85 - 11.05	C	12							Between 10.50m to 11.20m; medium strong phyllitic schistose pelite with inclusions and thin foliations to very thin bands of quartz and psammite. Tightly folded (wavelength <1000mm amplitude >1200mm).			
10.50 - 12.00				100	100	80		11				
11.63 - 11.86	C	13										
								12		(23.70)		
12.00 - 13.50				100	95	57						
12.85 - 12.90	C	14										
11.80 - 14.20							10	13				
13.05 - 13.36	C	15										
								14				
13.50 - 15.00				100	69	52			Between 14.20m to 14.74m; zone of increased fracture intensity.			
14.20 - 14.80							17					
								15				
15.20 - 15.73	C	16							Between 15.25m to 15.75m; quartz with inclusions of medium strong schistose pelite and very strong psammite.			
15.00 - 16.50				100	100	85		16				
									Between 16.25m to 16.71m; strong schistose pelite.			
16.55 - 16.71	C	17										
14.80 - 19.30							5	17				
16.50 - 18.00				100	100	81						
17.43 - 17.78	C	18										
								18				
18.52 - 18.83	C	19										
18.00 - 19.50				100	100	87		19				
19.58 - 19.75	C	20										
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-06**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	1.00		
Coordinates (m)	E225527.60 N383101.60	Ground Elevation (m Datum)	-1.00	Sheet 3 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.11 - 20.51 19.50 - 21.00	C	21		100	99	77			Between 20.04m and 20.19m; probable fault inclined (56 deg), undulating, rough, infilled (4mm), with annealed rock, stained.			
								21				
19.30 - 24.00 21.00 - 22.50 21.80 - 22.07	C	22		100	100	76	6		Between 21.20m to 21.45m; strong schistose pelite.			
								22				
								23				
22.50 - 24.00 23.41 - 23.71	C	23		100	95	80						
								24	End of Borehole at 24.00 m	24.00	-25.00	
								25				
								26				
								27				
								28				
								29				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-06**
Fugro Reference	G180016U	Water Depth (m Datum)	1.00	
Coordinates (m)	E225527.60 N383101.60	Ground Elevation (m Datum)	-1.00	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	24.00	RC	30/06/2018	01/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	LR/KR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
30/06/2018	23:20:00	0.00	0.00	
01/07/2018	13:30:00	24.00	24.00	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
24.00	146	0.30	178

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
0.30	1.50	Water	0		00:32
1.50	3.00	Water	0		00:27
3.00	4.50	Water	0		00:23
4.50	6.00	Water	0		00:22
6.00	7.50	Water	0		00:23
7.50	9.00	Water	0		00:30
9.00	10.50	Water	0		00:43
10.50	12.00	Water	0		00:16
12.00	13.50	Water	0		00:14
13.50	15.00	Water	0		00:12
15.00	16.50	Water	0		00:12
16.50	18.00	Water	0		00:18
18.00	19.50	Water	0		00:21
19.50	21.00	Water	0		00:18
21.00	22.50	Water	0		00:16
22.50	24.00	Water	0		00:16

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
0.30	1.50	102
1.50	3.00	102
3.00	4.50	102
4.50	6.00	102
6.00	7.50	102
7.50	9.00	102
9.00	10.50	102
10.50	12.00	102
12.00	13.50	102
13.50	15.00	102
15.00	16.50	102
16.50	18.00	102
18.00	19.50	102
19.50	21.00	102
21.00	22.50	102
22.50	24.00	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 8.20m; deck level = 7.20m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB

Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS — Print Date: 14/11/2018

FUGRO	Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-07**
	Client	Stena Line Ports Limited			
	Fugro Reference	G180016U	Water Depth (m Datum)	2.30	
	Coordinates (m)	E225495.37 N383009.30	Ground Elevation (m Datum)	-2.30	Sheet 1 of 3
	Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	B	2							Very soft dark grey slightly sandy CLAY with rare shell fragments. Sand is fine and medium.			
0.00 - 0.50	D	1										
0.00 - 0.50	D	3								(0.80)		
0.80 - 1.00	B	5								0.80	-3.10	
0.80 - 1.00	D	4							Dark grey very clayey GRAVEL. Gravel is angular to rounded fine to coarse of psammite and basalt.	(0.30)		
0.80 - 1.00	D	6						1		1.10	-3.40	
1.00 - 1.45	D	7							Very soft dark grey to black sandy organic CLAY with rare shell fragments (<2 x 3mm) and rare organic fibres (<1mm). Sand is fine and medium.			
1.00 - 1.45	SPT		0/450 (S)									
1.70 - 2.00	B	9							Between 1.70m to 2.00m; dark grey clayey angular to rounded gravel of psammite and basalt.	(1.25)		
1.70 - 2.00	D	10										
1.70 - 2.00	D	8						2	Between 2.00m to 2.35m; frequent shell fragments.			
2.00 - 2.60	D	11										
2.00 - 2.45	SPT		0/450 (S)									
2.35 - 2.60	D	12							Soft to firm brown organic CLAY with frequent black root traces (<3mm) and partially decomposed plant matter (<2 x 8mm).	2.35	-4.65	
2.60 - 3.00	D	13										
2.60 - 3.00	D	15										
2.60 - 3.50	B	14						3	Below 3.00m; becoming firm and slightly gravelly.	(1.60)		
3.50 - 3.95	UT	16	50/450 mm									
3.50	Pen		126 kPa									
3.80 - 4.10	D	18										
3.95 - 4.10	D	17								3.95	-6.25	
3.95	Pen		200 kPa					4	Firm brownish grey mottled grey and black slightly gravelly sandy SILT. Sand is predominantly fine. Gravel is angular fine to coarse of psammite.	(0.15)	-6.40	
										4.10		
										(0.30)		
4.40 - 4.65							NR		Weak to medium strong dark greenish grey PSAMMITE. Recovered as angular to subangular fine to coarse gravel.	4.40	-6.70	
4.65 - 4.72							NI			(0.25)		
4.74 - 4.93	C	20		79	54	26			[NO RECOVERY]	4.65	-6.95	
4.40 - 5.10								5	Medium strong locally strong narrowly foliated to thinly laminated greenish grey PSAMMITE. Slightly weathered. with very closely to medium spaced thin foliations and thin beds of phyllitic schistose pelite and very closely spaced quartz veins (<30mm thick). Discontinuities. Set #1 - foliation fractures, extremely closely to very closely spaced locally medium spaced, subhorizontal (<10 deg) and inclined (20 – 90 deg), undulating and stepped, locally planar, smooth locally rough, tight, locally with silt/clay veneer, stained. Set #2 - joints, medium to widely spaced locally very closely to closely spaced in medium to widely spaced clusters, subhorizontal (<10 deg) inclined (20 – 45 deg), undulating and stepped, smooth and rough, tight, stained locally with silt/clay veneer or infilled with clay (<1mm). Set #3 - joints, medium to widely spaced, inclined (50 – 85 deg), undulating and stepped, rough locally smooth, tight and very tight, stained.			
5.38 - 5.74	C	21		100	57	14						
5.10 - 5.80												
6.09 - 6.19	C	22		100	60	13		6				
5.80 - 6.60												
6.79 - 6.88	C	23		100	94	42						
6.60 - 7.10								7				
7.10 - 7.19	C	24										
7.10 - 8.10				100	100	40						
7.83 - 8.00	C	25							Between 4.65m and 4.72m; non intact, probably drilling induced, recovered as fragments (<60mm). Between 4.74m to 4.93m; strong. Between 5.10m and 5.20m; non intact, probably drilling induced, recovered as fragments (<20mm). Between 5.20m to 5.85m; phyllitic schistose pelite with occasional psammite inclusions (<20 to 60mm). Between 5.80m and 5.85m; non intact, probably drilling induced, recovered as fragments (<60mm).			
8.10 - 8.80				100	100	0		8				
8.62 - 8.80	C	26										
9.37 - 9.55	C	27						9	Between 8.72m to 9.14m; phyllitic schistose pelite with occasional psammite and quartz inclusions (<30 x 80mm).			
8.80 - 10.30				100	87	27						
4.72 - 14.80							16					

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Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-07**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	2.30		
Coordinates (m)	E225495.37 N383009.30	Ground Elevation (m Datum)	-2.30	Sheet 2 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
10.32 - 10.40	C	28										
10.30 - 10.85				100	60	0			Between 10.42m to 10.61m; zone of increased fracture intensity. Between 10.54m and 10.58m; non intact, probably drilling induced, recovered as fragments (<20mm). Between 10.85m to 11.36m; zone of tight folding (wavelength 20-180mm amplitude <70mm).			
10.85 - 11.00	C	29						11				
10.85 - 11.80				100	82	17						
12.05 - 12.10	C	30						12				
11.80 - 13.30				100	81	7						
								13	Between 13.02m and 13.30m; non intact, probably drilling induced, recovered as fragments (<60mm).			
13.34 - 13.40	C	31							Between 13.40m and 13.502m; non intact, probably drilling induced, recovered as fragments (<60mm).			
13.30 - 13.90				100	83	0				(18.15)		
14.08 - 14.19	C	32						14				
13.90 - 14.80				100	78	28			Between 14.48m and 14.68; non intact, probably drilling induced, recovered as stained fragments (<60mm).			
14.80 - 15.00							NR		Between 14.80m to 15.40m; assessed zone of core loss.			
15.07 - 15.17	C	33						15				
14.80 - 16.30				85	85	9	19					
15.00 - 16.20												
16.10 - 16.20	C	34						16				
16.20 - 16.70							50					
16.78 - 17.08	C	35										
16.30 - 17.60				87	61	33	9	17				
16.70 - 17.40												
17.40 - 17.60							NR		Between 17.40m to 17.60m; assessed zone of core loss.			
18.07 - 18.26	C	36						18				
17.60 - 19.10				100	100	29						
17.60 - 20.98							13	19				
19.32 - 19.43	C	37										
19.10 - 20.60				100	93	7						

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-07**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	2.30		
Coordinates (m)	E225495.37 N383009.30	Ground Elevation (m Datum)	-2.30	Sheet 3 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
20.30 - 20.43	C	38						21	Between 20.20m and 20.26m; non intact, probably drilling induced, recovered as fragments (<60mm). Between 20.39m to 20.60m; quartz with psammite and pelite inclusions (<20 x 60mm).			
20.60 - 21.30				100	49	16						
20.98 - 21.18									Between 20.98m to 21.18m; non intact possibly drilling induced. Recovered as silty sandy angular fine to coarse gravel sized fragments with occasional black and brown staining on surfaces. Between 21.25m to 21.30m; non intact possibly drilling induced. Recovered as gravelly sandy silt. Gravel sized fragments are extremely weak to very weak pelite. Possible fracture infill.			
21.18 - 21.25							14					
21.25 - 21.30							NI					
21.40 - 21.59	C	39										
21.30 - 22.75				97	73	23	12	22				
21.30 - 22.80												
22.40 - 22.75	C	40										
22.75 - 22.80							NR		End of Borehole at 22.80 m	22.80	-25.10	
								23				
								24				
								25				
								26				
								27				
								28				
								29				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-07**
Fugro Reference	G180016U	Water Depth (m Datum)	2.30	
Coordinates (m)	E225495.37 N383009.30	Ground Elevation (m Datum)	-2.30	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	4.40	CP	01/07/2018	01/07/2018	ARAN120A/ Comacchio 1200			CR	KR/LR	
4.40	22.80	RC	01/07/2018	02/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
01/07/2018	17:10:00	0.00	0.00	
01/07/2018	18:25:00	4.40	3.50	
01/07/2018	20:50:00	4.40	3.50	
02/07/2018	11:15:00	22.80	22.80	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
4.40	178	3.50	178
22.80	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
4.40	5.10	Water	0		00:08
5.10	5.80	Water	0		00:15
5.80	6.60	Water	0		00:22
6.60	7.10	Water	0		00:12
7.10	8.10	Water	0		00:32
8.10	8.80	Water	0		00:16
8.80	10.30	Water	0		00:34
10.30	10.95	Water	0		00:22
10.95	11.80	Water	0		00:13
11.80	13.30	Water	0		00:33
13.30	14.80	Water	0		00:10
14.80	16.30	Water	0		00:16
16.30	17.60	Water	0		00:14
17.60	19.10	Water	0		00:16
19.10	20.60	Water	0		00:20
20.60	21.30	Water	0		00:27
21.30	22.80	Water	0		00:22
					00:23

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
4.40	5.10	102
5.10	5.80	102
5.80	6.60	102
6.60	7.10	102
7.10	8.10	102
8.10	8.80	102
8.80	10.30	102
10.30	10.85	102
10.85	11.80	102
11.80	13.30	102
13.30	13.90	102
13.90	14.80	102
14.80	16.30	102
16.30	17.60	102
17.60	19.10	102
19.10	20.60	102
20.60	21.30	102
21.30	22.80	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 9.80m; deck level = 7.50m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

FUGRO	Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-08**
	Client	Stena Line Ports Limited			
	Fugro Reference	G180016U	Water Depth (m Datum)	3.62	
	Coordinates (m)	E225199.32 N382871.56	Ground Elevation (m Datum)	-3.62	Sheet 1 of 4
	Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	D	1						0	Very soft dark grey becoming black with depth slightly sandy, slightly gravelly CLAY. Sand is fine and medium. Gravel is angular to rounded, fine to coarse of psammite and basalt.			
0.00 - 0.50	D	2										
0.50	HVane		3 kPa (*2 kPa*)									
1.00 - 1.10	D	4						1		(2.30)		
1.00 - 1.10	D	5										
1.00 - 1.50	B	6										
1.50 - 2.30	B	8							Below 1.50m; locally grades into very sandy clayey gravel.			
1.50 - 2.30	P	7	mm					2				
										2.30	-5.92	
2.30 - 2.58							NI		Medium strong, locally strong, very strong or moderately weak, narrowly foliated to thinly bedded dark greenish grey PSAMMITE. Slightly weathered. With closely to medium spaced, locally widely spaced narrow foliations and very thin beds of phyllitic schistose pelite. Widely to very widely spaced swarms of extremely closely to closely spaced quartz veins (<40mm thick). Discontinuities. Set #1 - foliation fractures, very closely to medium spaced locally widely spaced, subhorizontal (<10 deg) and inclined (20 – 35 deg), undulating and stepped, smooth and rough, tight, stained, locally with silt/clay veneer, or infilled with clay. Set #2 - foliation fractures, medium to widely spaced locally closely spaced, inclined (45 – 65 deg), undulating, smooth and rough, very tight and tight, locally partly open, infilled with sandy silt/clay veneer, locally stained. Set #3 - joints, closely to medium spaced locally very closely or widely spaced, inclined (10 – 60 deg), undulating, stepped and planar, rough and smooth, very tight to partly open, stained with silt/clay veneer, locally infilled with clay/silt. Set #4 - joints, very widely spaced, inclined (70 – 85 deg), undulating, planar and stepped, rough locally smooth, very tight to moderately open, locally moderately wide, stained, locally with clay/silt veneer of infilled with sandy silt.			
2.62 - 2.76	C	9					15					
2.58 - 2.76												
2.30 - 3.40				100	16	16						
2.76 - 3.20								3				
3.20 - 3.76				100	0	0	NI					
3.40 - 3.60												
3.60 - 3.80				100	15	0						
3.96 - 4.24	C	10						4				
3.80 - 4.90				100	81	43						
4.77 - 4.90	C	11										
3.76 - 6.46							12	5				
4.90 - 5.90				100	97	66						
5.55 - 5.77	C	12										
5.90 - 6.40				100	100	100		6				
6.71 - 7.03	C	13										
6.40 - 9.40				100	96	81		7				
8.05 - 8.25	C	14						8				
8.78 - 9.06	C	15						9				
9.88 - 10.21	C	16								(15.26)		

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

FUGRO	Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-08**
	Client	Stena Line Ports Limited			
	Fugro Reference	G180016U	Water Depth (m Datum)	3.62	
	Coordinates (m)	E225199.32 N382871.56	Ground Elevation (m Datum)	-3.62	Sheet 2 of 4
	Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
9.40 - 10.90				100	78	54						
6.46 - 15.55							6	11				
11.32	HPD	1							Between 11.06m and 11.14m; non-intact, partially drilling induced. Recovered as angular to sub-rounded fine to coarse gravel. Locally with yellowish brown staining. Possibly extremely to very closely fractured.			
11.56 - 11.77 10.90 - 12.40	C	17		100	84	57						
12.20 - 12.40	C	18						12	Between 12.01m and 12.03m; non intact, probably drilling induced, recovered as fragments (<20mm).			
13.37 - 13.59	C	19						13				
12.40 - 15.40				100	100	88		14				
14.82 - 15.08	C	20						15				
									Between 15.15m and 15.95m; foliation folds over and becomes subvertical in orientation.			
15.40 - 16.10				100	50	50						
15.85 - 15.98	C	21						16	Between 16.00m and 16.35; non intact, probably drilling induced, recovered as stained fragments (<60mm).			
16.35 - 16.49	C	22										
16.10 - 16.90 15.55 - 17.56				100	0	0	10					
17.32	HPD	2						17				
17.56 - 18.02 16.90 - 18.40	C	23		100	83	80			Medium strong and strong becoming very strong with depth, dark greenish grey narrowly foliated to medium banded PSAMMITE. Slightly weathered. With widely to very widely spaced swarms of extremely to closely spaced quartz veins (<20mm thick). Discontinuities. Set #1 - foliation fractures, medium to widely spaced locally closely spaced, subhorizontal (<10 deg) and inclined (20 – 60 deg), undulating and stepped, smooth locally rough, tight and very tight, clean, locally with silt/clay veneer, locally stained. Set #2 - joints, medium to widely spaced locally extremely closely spaced, inclined (55 – 70 deg), undulating, smooth, very tight, with silt/ clay veneer, stained.	17.56	-21.18	
18.44 - 18.75	C	24						18				
19.85 - 20.25 18.40 - 21.40	C	25		100	100	100		19				
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-08**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.62		
Coordinates (m)	E225199.32 N382871.56	Ground Elevation (m Datum)	-3.62	Sheet 3 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
21.07 - 21.40	C	26						21				
21.40 - 22.90				100	100	100		22				
22.30 - 22.65	C	27										
22.90 - 23.32	C	28						23				
23.42	HPD	3										
22.90 - 24.40				100	100	100						
17.56 - 30.40							1	24		(12.84)		
24.14	C	29										
24.40 - 25.90				100	100	99		25				
25.65 - 25.90	C	30										
25.90 - 27.40				100	100	100		26				
27.17 - 27.40	C	31						27				
28.03 - 28.40	C	32						28				
27.40 - 28.90				100	100	100						
28.90 - 29.14	C	33						29				
28.90 - 30.40				100	100	100						
									Continued next page			

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-08**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	3.62		
Coordinates (m)	E225199.32 N382871.56	Ground Elevation (m Datum)	-3.62	Sheet 4 of 4	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
									End of Borehole at 30.40 m	30.40	-34.02	
								31				
								32				
								33				
								34				
								35				
								36				
								37				
								38				
								39				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-08**
Fugro Reference	G180016U	Water Depth (m Datum)	3.62	
Coordinates (m)	E225199.32 N382871.56	Ground Elevation (m Datum)	-3.62	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	2.30	CP	04/07/2018	04/07/2018	ARAN120A/ Comacchio 1200			CR	KR	
2.30	30.40	RC	04/07/2018	06/07/2018	ARAN120A/ Comacchio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD	JL/CR	KL/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
04/07/2018	16:00:00	0.00	0.00	
04/07/2018	16:30:00	2.30	2.30	
04/07/2018	17:35:00	2.30	2.30	
06/07/2018	00:15:00	30.40	30.40	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
2.30	178	1.50	178
30.40	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
2.30	3.40	Water	0		00:20
3.40	3.60	Water	0		00:12
3.60	3.80	Water	0		00:02
3.80	4.90	Water	0		00:10
4.90	5.90	Water	0		00:15
5.90	6.40	Water	0		00:10
6.40	9.40	Water	0		01:26
9.40	10.90	Water	0		00:34
10.90	12.40	Water	0		00:29
12.40	15.40	Water	0		01:08
15.40	16.10	Water	0		00:25
16.10	16.90	Water	0		00:20
16.90	18.40	Water	0		00:29
18.40	21.40	Water	0		00:55
21.40	22.90	Water	0		00:23
22.90	24.40	Water	0		00:25
24.40	25.90	Water	0		00:38
25.90	27.40	Water	0		00:36
27.40	28.90	Water	0		00:49
28.90	29.40	Water	0		00:32
29.40	30.40	Water	0		

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
2.30	3.40	102
3.40	3.60	102
3.60	3.80	102
3.80	4.90	102
4.90	5.90	102
5.90	6.40	102
6.40	9.40	102
9.40	10.90	102
10.90	12.40	102
12.40	15.40	102
15.40	16.10	102
16.10	16.90	102
16.90	18.40	102
18.40	21.40	102
21.40	22.90	102
22.90	24.40	102
24.40	25.90	102
25.90	27.40	102
27.40	28.90	102
28.90	30.40	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 10.70m; deck level = 7.80m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **BH-09**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	-0.79	
Coordinates (m)	E225047.17 N382795.02	Ground Elevation (m Datum)	0.79	Sheet 1 of 3
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Depth (m)	Sampling and In Situ Testing: Type	No.	Test Results	Core Recovery: TCR (%)	SCR (%)	RQD (%)	FI (-)	Strata Details: Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	B	1							Dark grey to black sandy GRAVEL with rare shell fragments (<30 x 30mm). Sand is fine to coarse. Gravel is angular to subrounded. Fine to coarse of psammite, quartz and basalt.	(1.00)		
0.00 - 0.50	D	2										
0.00 - 0.50	D	3										
0.50 - 1.00	B	4										
0.50 - 1.00	D	5										
1.00 - 1.50	B	7						1	Medium dense and dense greyish brown slightly silty very sandy GRAVEL. Sand is fine to coarse. Gravel is angular and subangular fine and medium of psammite and quartz.	1.00	-0.21	
1.00 - 1.50	D	6							Below 1.50m; becoming very silty, sandy.	(1.50)		
1.00 - 1.50	D	8										
1.00 - 1.45	SPT		N = 22 (S)									
1.50 - 2.00	B	9										
2.00 - 2.45	D	10						2				
2.00 - 2.50	D	11										
2.00 - 2.45	SPT		N = 31 (S)									
2.50 - 3.00	B	12							Greyish brown silty SAND AND GRAVEL. Sand is fine to coarse. Gravel is angular and subangular fine to coarse of psammite and quartz.	2.50 (0.75)	-1.71	
3.00 - 3.40	B	14						3				
3.00 - 3.40	D	13										
3.00 - 3.45	SPT		N = 63 (S)							3.25 (0.15)	-2.46 -2.61	
3.40 - 3.70							NI		Extremely weak brownish grey PSAMMITE. Partially to moderately weathered Recovered as very weak angular fine to medium gravel size lithorelicts in a silt matrix of disintegrated psammite.	3.40		
3.40 - 4.40				100	24	14						
4.07 - 4.24	C	15						4	Weak to medium strong thinly foliated to very thinly bedded greenish grey schistose PSAMMITE. Partially weathered; reddish brown staining fracture infill and locally reduced strength to very weak adjacent to fracture surfaces.			
3.70 - 5.50							22		Between 3.40m and 3.50m; non intact. Recovered as angular medium and coarse gravel sized fragments with reddish-brown stained surfaces. Possibly extremely closely fractured.			
4.40 - 5.20				100	54	0						
5.11 - 5.20	C	16						5	Between 3.40m and 3.70m; non intact. Recovered as angular medium and coarse gravel sized fragments with reddish-brown stained surfaces.			
5.50 - 6.05												
5.20 - 6.70				100	32	1		6				
6.32 - 6.50	C	17										
6.05 - 6.95							23					
7.20 - 7.40	C	18						7				
6.70 - 8.20				100	1	0						
6.95 - 8.30												
8.40 - 8.70	C	19						8				
8.20 - 9.70				100	55	25		9				
9.20 - 9.28	C	20										

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-09**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	-0.79		
Coordinates (m)	E225047.17 N382795.02	Ground Elevation (m Datum)	0.79	Sheet 2 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
8.30 - 12.47 9.70 - 11.20				100	73	43	13					
10.80 - 11.06	C	21						11				
11.20 - 12.70 12.04 - 12.17	C	22		100	33	5		12				
12.47 - 12.70							25					
12.70 - 13.00									Between 12.70m and 13.00m; assessed zone of core loss.			
13.00 - 13.35	D	23						13				
13.00 - 13.35							NI		Between 13.00m and 13.35m; non intact. Recovered as angular fine to coarse clayey gravel sized fragments with red stained surfaces. Including 1 no, pocket (<100x60x50mm) of firm grey gravelly clay. Possible infill from wide fracture.			
13.35 - 13.80 12.70 - 14.20	C	24		85	75	60						
14.40 - 14.60	C	25						14				
14.20 - 15.70				100	60	12		15				
15.25 - 15.30	C	26										
13.35 - 17.62												
15.70 - 16.40				100	54	0		16				
									Between 16.30m and 16.40m; non intact. Recovered as clayey fine to medium gravel. Locally extremely weak possibly partially weathered locally moderately weathered.	(25.80)		
16.40 - 17.20				100	54	18						
17.03 - 17.20	C	27						17				
17.26 - 17.45	C	28										
17.20 - 18.70				100	57	15		18	Between 17.91m and 18.17m; intensely fractured.			
18.37 - 18.47	C	29										
17.62 - 20.33								19	Between 18.79m and 20.2m; intensely fractured, numerous incipient fractures.			
18.70 - 20.20 19.52 - 19.68	C	30		100	36	11						
									Between 19.74m and 19.79m; non intact. Recovered as angular fine to coarse gravel sized fragments with			

Continued next page

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**BH-09**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	-0.79		
Coordinates (m)	E225047.17 N382795.02	Ground Elevation (m Datum)	0.79	Sheet 3 of 3	
Hole Type	Cable Percussion and Rotary Coring			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details					
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
									reddish brown stained surfaces.			
20.20 - 21.70				100	61	0	15	21				
20.33 - 21.70												
21.15 - 21.19	C	31										
21.19 - 21.42	C	32										
									Between 21.70m and 22.04m; non intact. Recovered as angular fine to coarse clayey gravel sized fragments with reddish brown stained surfaces. Partially to moderately weathered possibly very closely fractured.			
22.29 - 22.44	C	33						22				
21.70 - 23.30				100	58	16	25					
21.70 - 23.30												
								23				
23.30 - 23.49	C	34										
23.99 - 24.08	C	35		100	61	25		24				
23.30 - 24.70												
24.84 - 24.95	C	36						25				
25.44 - 25.80	C	37		100	51	23						
24.70 - 26.20												
23.30 - 28.81							15	26				
26.50 - 26.69	C	38										
26.20 - 27.70				100	62	15		27				
27.55 - 27.70	C	39										
								28				
27.70 - 29.20				100	41	17			Between 28.40m and 28.74m; intensely fractured, extremely closely spaced incipient fractures.			
28.84 - 28.93	C	40										
28.81 - 29.20							25	29				
									End of Borehole at 29.20 m	29.20	-28.41	

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**BH-09**
Fugro Reference	G180016U	Water Depth (m Datum)	-0.79	
Coordinates (m)	E225047.17 N382795.02	Ground Elevation (m Datum)	0.79	Sheet 1 of 1
Hole Type	Cable Percussion and Rotary Coring			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	3.40	CP	08/07/2018	08/07/2018	ARAN 120A/ Commachio 1200			CR	KR/LR	
3.40	29.20	RC	08/07/2018	08/07/2018	ARAN 120A/ Commachio 1200	Terracore S-Geobor	146mm Series 7 IMPREG & 146 10 cut PCD		KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
08/07/2018	06:30:00	0.00	0.00	
08/07/2018	18:45:00	29.20	3.40	

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
3.40	178	3.40	178
29.20	146		

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)
3.40	4.40	Water	0		00:10
4.40	5.20	Water	0		00:08
5.20	6.70	Water	0		00:14
6.70	8.20	Water	0		00:14
8.20	9.70	Water	0		00:13
9.70	11.20	Water	0		00:12
11.20	12.70	Water	0		00:45
12.70	14.20	Water	0		00:10
14.20	15.70	Water	0		00:15
15.70	16.40	Water	0		00:18
16.40	17.20	Water	0		00:10
17.20	18.70	Water	0		00:16
18.70	20.20	Water	0		00:23
20.20	21.70	Water	0		00:17
21.70	23.20	Water	0		00:17
23.20	24.70	Water	0		00:16
24.70	26.20	Water	0		00:16
26.20	27.70	Water	0		00:16
27.70	29.20	Water	0		00:14

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)
3.40	4.40	102
4.40	5.20	102
5.20	6.70	102
6.70	8.20	102
8.20	9.70	102
9.70	11.20	102
11.20	12.70	102
12.70	14.20	102
14.20	15.70	102
15.70	16.40	102
16.40	17.20	102
17.20	18.70	102
18.70	20.20	102
20.20	21.70	102
21.70	23.30	102
23.30	24.70	102
24.70	26.20	102
26.20	27.70	102
27.70	29.20	102

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 5.90m; deck level = 6.69m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB

Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS — Print Date: 14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**DC-01**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	8.60		
Coordinates (m)	E226343.31 N384039.03	Ground Elevation (m Datum)	-8.60	Sheet 1 of 1	
Hole Type	Not Recognised			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	B	2							Very soft grey slightly sandy CLAY with frequent shells and shell fragments. Sand is fine.			
0.00 - 0.50	D	1										
										(1.70)		
1.00 - 1.50	B	5						1				
1.00 - 1.50	D	4										
1.50 - 1.70	P	6	mm									
1.70 - 2.00	B	7							Below 1.60m; becoming firm sandy and slightly gravely. with abundant shells. Gravel is subrounded and rounded fine of basalt.	1.70	-10.30	
2.00 - 2.45	D	8						2	Dense grey SAND with frequent shell fragments (<4mm) locally very gravely at top.			
2.00 - 2.45	SPT		N = 41 (S)						Between 1.70m to 2.00m; very gravelly; gravel is angular to rounded fine to coarse of mixed lithologies including microgabbro and quartz. Shells are (<20 x 20mm).	(1.00)		
2.70 - 3.00	D	9							Firm grey slightly sandy CLAY with rare pockets of (<40 x 20mm) of black organic clay. Sand is fine.	2.70	-11.30	
3.00 - 3.45	UT	10	450					3				
										(0.90)		
3.45 - 3.60	D	11										
3.45	HVane		15 kPa (*5 kPa*)						End of Borehole at 3.60 m	3.60	-12.20	
3.45	HVane		16 kPa (*6 kPa*)									
3.45	HVane		18 kPa (*6 kPa*)					4				
								5				
								6				
								7				
								8				
								9				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**DC-01**
Fugro Reference	G180016U	Water Depth (m Datum)	8.60	
Coordinates (m)	E226343.31 N384039.03	Ground Elevation (m Datum)	-8.60	Sheet 1 of 1
Hole Type	Cable Percussion			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	3.60	CP	28/06/2018	28/06/2018	ARAN120A/ Comacchio 1200			CR	KR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
28/06/2018	15:10:00	0.00	0.00	
28/06/2018	17:40:00	3.60	3.60	

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
3.60	178	3.60	178

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 12.00m; deck level = 3.40m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**DC-02**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	7.74		
Coordinates (m)	E226229.93 N383609.68	Ground Elevation (m Datum)	-7.74	Sheet 1 of 1	
Hole Type	Not Recognised			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.50 - 1.00	B	1							Dark grey slightly sandy clayey GRAVEL with some shell fragments and occasional pockets of soft clay. Gravel is angular and subangular fine to coarse of slag, coal and basalt.	(1.00)		
1.00	D	2						1	Medium dense dark grey silty gravelly SAND. With occasional shell fragments and occasional thick laminae of very soft sandy clay. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of schist, psammite and basalt.	1.00	-8.74	
1.00 - 1.45	D	3							Between 1.50m to 2.00m; with low cobble content. Cobbles are subangular and subrounded of quartz and schist (<60mm x 80mm x 90mm).	(1.20)		
1.00 - 1.50	B	4										
1.00 - 1.45	SPT		N = 16 (S)									
1.50 - 2.00	B	5										
2.00	D	6						2				
2.00 - 2.20	D	7										
2.20 - 2.45	D	8							Stiff light brownish grey slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine and medium of schist, psammite, basalt and quartz.	2.20	-9.94	
2.20 - 2.65	SPT		N = 50 (S)						Below 2.70m; becoming very stiff light bluish grey slightly gravelly.			
2.70 - 3.25	UT	9	77/100 mm					3				
3.25 - 3.40	D	10										
3.25	Pen		225 kPa									
3.25	Pen		225 kPa						Between 3.50m to 4.50m; with occasional bands of slightly gravelly silty fine to coarse sand.	(2.60)		
3.25	Pen		225 kPa									
3.50 - 3.95	D	11										
3.50 - 4.50	B	12										
3.50 - 3.95	SPT		N = 31 (S)					4				
4.50	D	13										
									End of Borehole at 4.80 m	4.80	-12.54	
								5				
								6				
								7				
								8				
								9				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **DC-02**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	7.74	
Coordinates (m)	E226229.93 N383609.68	Ground Elevation (m Datum)	-7.74	Sheet 1 of 1
Hole Type	Cable Percussion			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	4.80	CP	28/06/2018	29/06/2018	ARAN120A/ Comaccho 1200			JL	LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
28/06/2018	23:05:00	0.00	0.00	
29/06/2018	03:30:00	4.80	4.50	

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
4.80	178	4.50	178

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 14.00m; deck level = 6.56m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**DC-03**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	6.30		
Coordinates (m)	E226039.25 N383260.54	Ground Elevation (m Datum)	-6.30	Sheet 1 of 1	
Hole Type	Not Recognised			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	B	2							Very soft grey slightly sandy becoming sandy with depth CLAY with rare shell fragments (<15 x 10mm). Sand is fine.			
0.00 - 0.50	D	1										
0.50 - 1.00	B	4							Below 0.50m; Becomes sandy with frequent shell fragments (<30 x 20mm) are frequent. Sand is fine.	(1.10)		
0.80 - 1.00	D	5										
1.00	HVane		6 kPa (*5 kPa*)					1		1.10	-7.40	
1.10 - 1.50	B	6							Medium dense grey very gravelly SAND locally grading to SAND and GRAVEL with frequently locally abundant shell fragments (<30 x 20mm). Sand is fine to coarse. Gravel is angular to rounded fine to coarse of mixed lithologies including psammite, basalt and quartz.	(1.00)		
1.50 - 1.95	D	7										
1.50 - 2.00	B	8										
1.50 - 1.95	SPT		N = 14 (S)									
								2		2.10	-8.40	
2.10 - 2.20	D	9							Stiff becoming firm with depth brownish grey slightly sandy slightly gravelly CLAY locally with thin laminae and dustings of brown silt. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of basalt and psammite.			
2.10 - 2.50	B	10										
2.10	Pen		112 kPa									
2.10	Pen		75 kPa									
2.10	Pen		88 kPa									
2.50 - 2.95	D	11										
2.50 - 2.95	SPT		N = 19 (S)									
2.50	Pen		138 kPa					3				
2.50	Pen		138 kPa									
2.50	Pen		212 kPa									
3.00 - 3.50	B	12										
3.40 - 3.50	D	13										
3.40	Pen		100 kPa									
3.40	Pen		125 kPa									
3.40	Pen		138 kPa									
3.50 - 3.95	UT	14										
3.50	Pen		62 kPa					4	Below 4.00m; Becomes firm.	(3.90)		
3.50	Pen		62 kPa									
3.50	Pen		62 kPa									
3.95 - 4.00	D	15										
3.95	Pen		62 kPa									
3.95	Pen		62 kPa									
3.95	Pen		62 kPa									
4.00 - 4.50	B	16										
4.50 - 4.95	D	17						5				
4.50 - 4.95	SPT		N = 15 (S)									
5.00 - 5.50	B	18										
5.50 - 5.95	UT	19										
5.50	Pen		25 kPa									
5.50	Pen		25 kPa									
5.50	Pen		25 kPa									
5.95 - 6.00	D	20						6	End of Borehole at 6.00 m	6.00	-12.30	
5.95	Pen		25 kPa									
5.95	Pen		25 kPa									
5.95	Pen		25 kPa									
								7				
								8				
								9				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID
Client	Stena Line Ports Limited			**DC-03**
Fugro Reference	G180016U	Water Depth (m Datum)	6.30	
Coordinates (m)	E226039.25 N383260.54	Ground Elevation (m Datum)	-6.30	Sheet 1 of 1
Hole Type	Cable Percussion			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	6.00	CP	28/06/2018	28/06/2018	ARAN120A/ Comacchio 1200			CR	KR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
28/06/2018	10:15:00	0.00	0.00	
28/06/2018	12:50:00	6.00	5.50	

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
6.00	178	5.50	178

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 12.60m; deck level = 6.30m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB
Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS				Print Date	14/11/2018

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID	**DC-04**
Client	Stena Line Ports Limited				
Fugro Reference	G180016U	Water Depth (m Datum)	4.88		
Coordinates (m)	E225821.54 N383200.86	Ground Elevation (m Datum)	-4.88	Sheet 1 of 1	
Hole Type	Not Recognised			Status	Draft

Depth (m)	Sampling and In Situ Testing			Core Recovery				Strata Details				
	Type	No.	Test Results	TCR (%)	SCR (%)	RQD (%)	FI (-)	Depth (m)	Strata Descriptions	Depth (Thickness) (m)	Level (m Datum)	Legend
0.00 - 0.50	B	2							Very soft grey slightly sandy CLAY with rare shell fragments (<15 x 10mm). Sand is fine and medium.			
0.00 - 0.50	D	1										
0.50 - 1.50	B	5										
0.80 - 1.00	D	4										
1.00	HVane		3 kPa (*3 kPa*)					1				
										(3.60)		
								2				
2.35	HVane		10 kPa (*2 kPa*)									
2.35	HVane		8 kPa (*2 kPa*)						Between 2.50m and 3.00m; slightly gravelly. Gravel is angular to rounded fine to coarse of slag, psammite and basalt.			
2.35	HVane		9 kPa (*3 kPa*)									
2.50 - 3.00	B	7						3				
2.50 - 3.00	D	8										
3.40 - 3.50	D	10										
3.50	HVane		5 kPa (*2 kPa*)									
									Stiff brownish grey slightly sandy slightly gravelly CLAY with occasional fine laminae of brown silt.	3.60	-8.48	
3.60 - 4.00	B	11										
3.60 - 4.00	D	12										
4.00 - 4.45	UT	13	50/500 mm					4				
4.00	Pen		150 kPa									
4.00	Pen		150 kPa									
4.00	Pen		175 kPa									
4.45 - 4.50	D	14										
4.45	Pen		188 kPa									
4.45	Pen		212 kPa									
4.45	Pen		212 kPa									
4.50 - 5.00	B	15						5				
5.00 - 5.45	D	16							Below 5.00m; locally yellowish brown.			
5.00 - 5.45	SPT		N = 18 (S)							(3.50)		
5.50 - 6.00	D	17										
6.00 - 6.45	UT	18	26/450 mm					6				
6.00	Pen		38 kPa						Below 6.00m; becoming soft to firm.			
6.00	Pen		38 kPa									
6.00	Pen		38 kPa									
6.45 - 6.50	D	19										
6.45	Pen		13 kPa									
6.45	Pen		25 kPa									
6.45	Pen		25 kPa									
6.50 - 7.00	B	20						7				
7.00 - 7.10	D	21							End of Borehole at 7.10 m	7.10	-11.98	
								8				
								9				

Notes

- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

Contract Name	Holyhead Port Expansion - Ground Investigation			Location ID **DC-04**
Client	Stena Line Ports Limited			
Fugro Reference	G180016U	Water Depth (m Datum)	4.88	
Coordinates (m)	E225821.54 N383200.86	Ground Elevation (m Datum)	-4.88	Sheet 1 of 1
Hole Type	Cable Percussion			Status: Draft

Equipment

Depth From (m)	Depth To (m)	Hole Type	Date From	Date To	Equipment	Core Barrel	Core Bit	Drilling Crew	Logged By	Remarks
0.00	7.10	CP	28/06/2018	29/06/2018	ARAN 120A/ Comacchio 1200			JL/CR	KR/LR	

Progress

Date (dd/mm/yyyy)	Time (hh:mm:ss)	Hole Depth (m)	Casing Depth (m)	Weather
28/06/2018	16:45:00	0.00	0.00	
29/06/2018	21:45:00	7.10	7.10	

Rotary Details

Depth From (m)	Depth To (m)	Flush Type	Flush Return (%)	Flush Colour	Run Time (hh:mm)

Core Details

Depth From (m)	Depth To (m)	Diameter (mm)

Hole and Casing

Depth To (m)	Hole Diameter (mm)	Depth To (m)	Casing Diameter (mm)
7.10	178	7.10	178

Chiselling / Slow Progress

Depth From (m)	Depth To (m)	Duration (hh:mm)	Tool/Remark

General Remarks

The borehole was carried out over water from jack-up platform Aran 120A. Deck to mudline = 9.60m; deck level = 4.72m CD. Water level was maintained at or above seabed level. All depths and depth related remarks refer to depths below seabed level. Groundwater not observed as borehole conducted in marine environment.

Notes

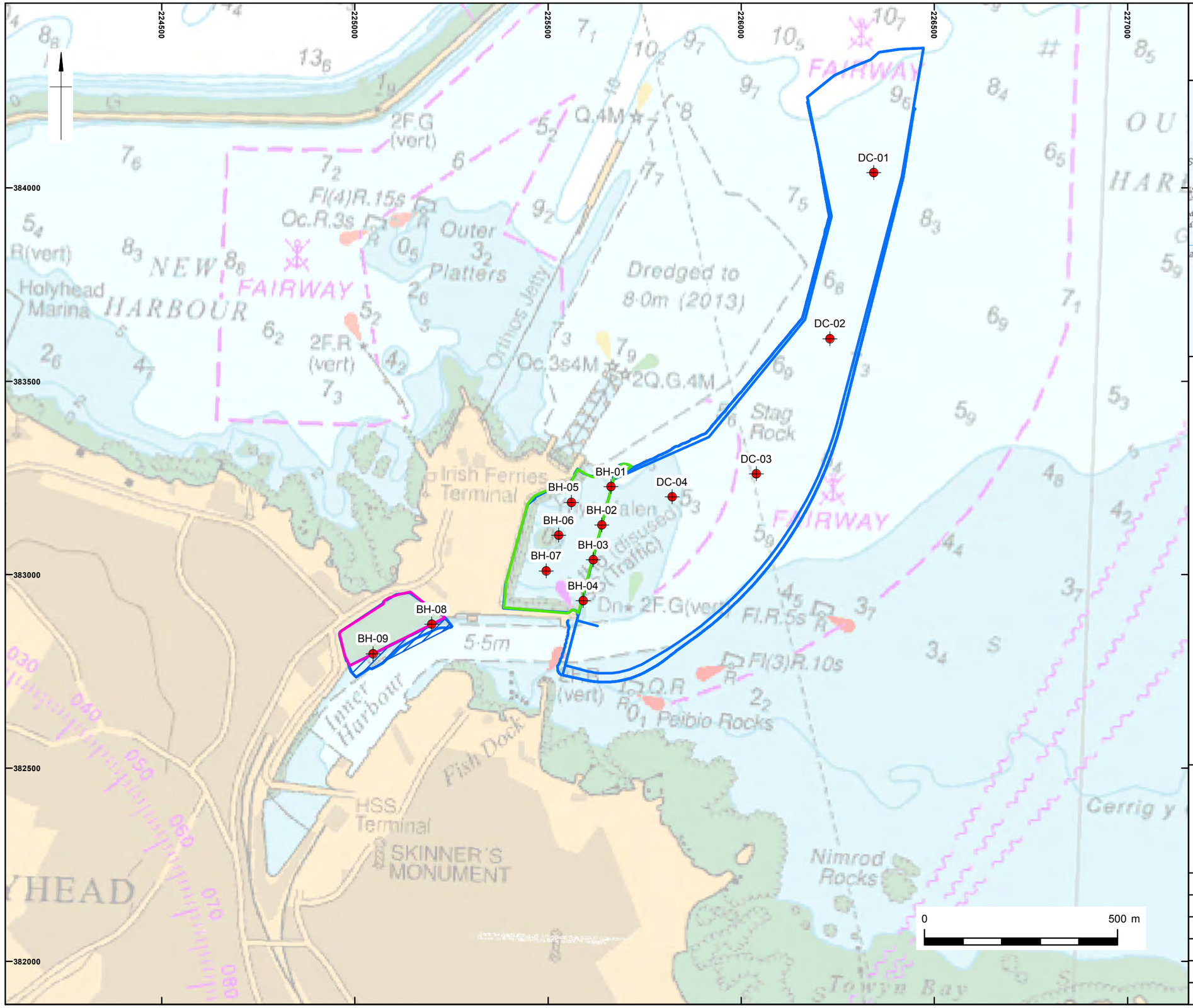
- Abbreviations and results data defined on 'Notes on Exploratory Position Records'

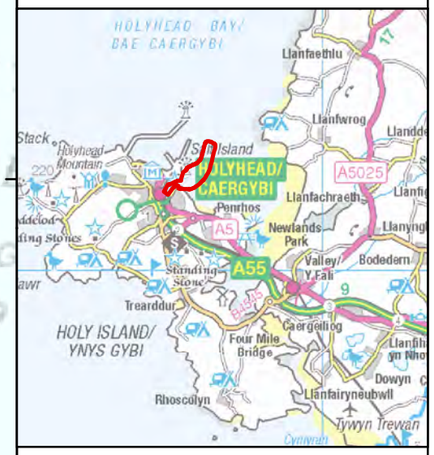
Checked By	NHA	Elevation Datum	Chart Datum	Grid Coordinate System	OSGB

Template: FGSL/HBSI/FGSL Nearshore BH Summary.hbt/Config Fugro Rev5/03/10/2018/TS — Print Date: 14/11/2018

Appendix 2 – geoarchaeological borehole review

id	Description	Potential
BH-01	Soft sandy clay with shell, possibly organic (3.10 m) (seabed sediments) stiff sandy gravelly clay (6.50 m) (?) firm sandy silty clay (8.60 m) (glacial) dense sandy silty gravel (10.60 m) (glacial) Psammite (32.00 m) (bedrock)	Low
BH-02	Soft sandy clay with shell, slightly organic (3.50 m) (seabed sediments) soft gravelly sandy clay with metal fragments (3.90 m) (seabed sediments) sandy clayey gravel (4.00 m) (glacial) firm and stiff sandy gravelly clay (6.30 m) (glacial) Psammite (32.30 m) (bedrock)	Low
BH-03	Soft sandy clay with rare shell fragmnts, possibly organic (2.00 m) (seabed sediments) firm gravelly sandy clay, slightly organic with wood fragments (3.10 m) (alluvium?) soft organic clay with pockets of peat (4.00 m) (alluvium?) stiff sandy gravely clay (6.00 m) (glacial) Psammite (31.10 m) (bedrock)	Medium
BH-04	Soft sandy clay with rare shell, possibly organic (2.00 m) (seabed sediments) soft sandy clay with rare shell (3.30 m) (seabed sediments) firm and stiff sandy gravelly clay (3.50 m) (glacial) silty gravel (4.00 m) (glacial) stiff sandy gravelly clay (7.65 m) (glacial) Psammite (32.00 m) (bedrock)	Low
BH-05	Soft sandy gravelly clay with rare shell (3.55 m) (seabed sediments) Psammite (22.90 m) (bedrock)	Low
BH-06	Psammite (24.00 m) (bedrock)	Low
BH-07	Soft sandy clay with rare shell (0.80 m) (seabed sediments) clayey gravel (1.10 m) (?) soft sandy clay, possibly organic (2.35 m) (alluvium?) soft organic clay with frequent rootlets and partially decomposed plant matter (3.95 m) (alluvium?) firm gravelly sandy silt (4.10 m) (glacial) Psammite (22.80 m) (bedrock)	Medium
BH-08	Soft sandy gravelly clay (2.30 m) (seabed sediments) Psammite (30.40 m) (bedrock)	Low
BH-09	Silty sandy gravel (2.50 m) (?) sand and gravel (3.25 m) (?) Psammite (29.20 m) (bedrock)	Low
DC-01	Soft sandy clay with frequent shell (1.70 m) (seabed sediments) sand with frequent shell (2.70 m) (seabed sediments) firm clay with rare pockets of organic clay (3.60 m) (glacial)	Low
DC-02	Sandy clayey gravel (1.00 m) (?) silty gravelly sand (2.20 m) (?) stiff sandy gravelly clay (4.80 m) (glacial)	Low
DC-03	Soft sandy clay with rare shell (1.10 m) (seabed sediments) gravelly sand (2.10 m) (?) stiff gravely clay (6.00 m) (glacial)	Low
DC-04	Soft sandy clay with rare shell (3.60 m) (seabed sediments) stiff sandy gravelly clay (7.10 m) (glacial)	Low





Salt Isalnd Expansion site

Pelham Patch Development

Dredge Channel

BH_locations

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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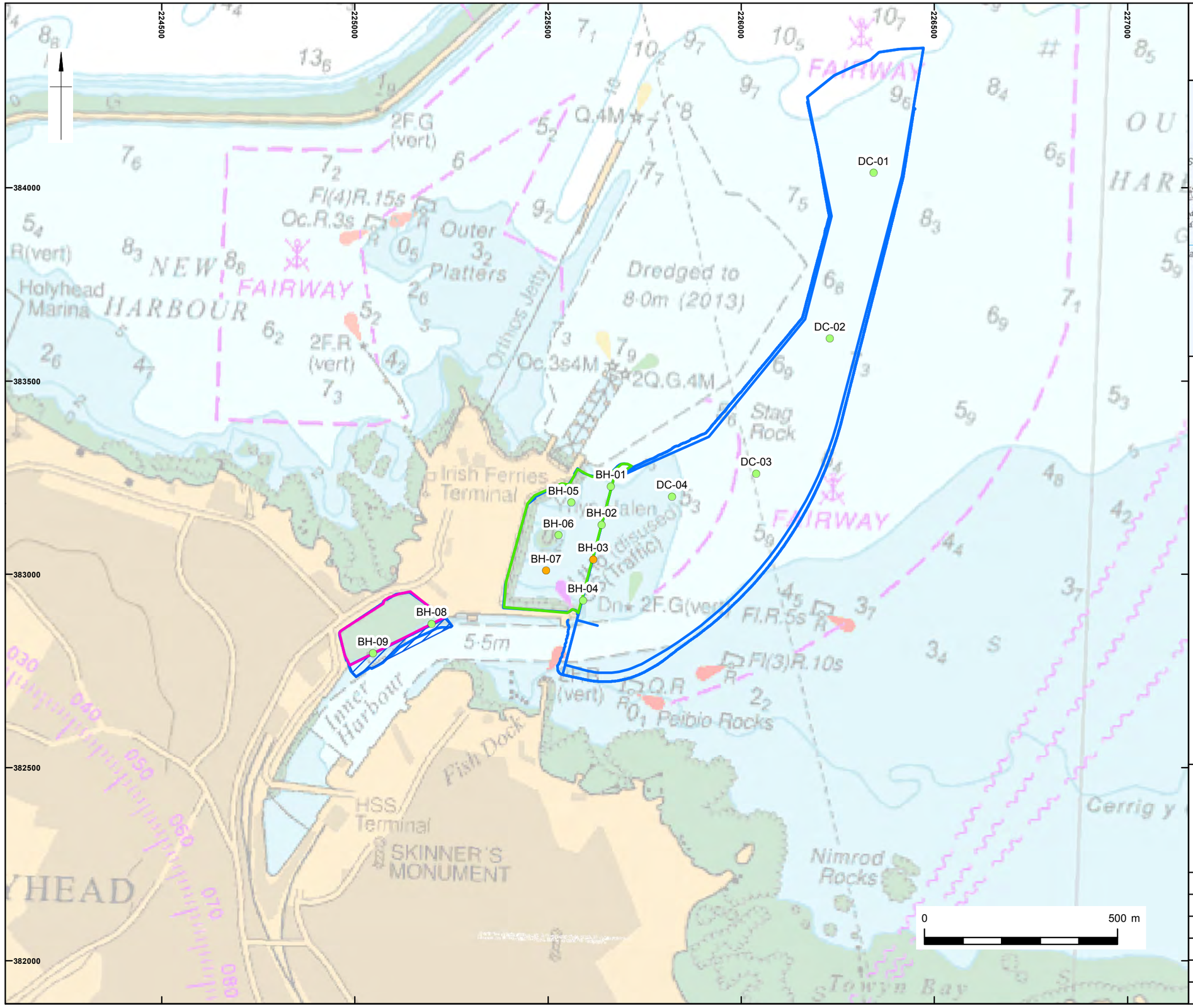
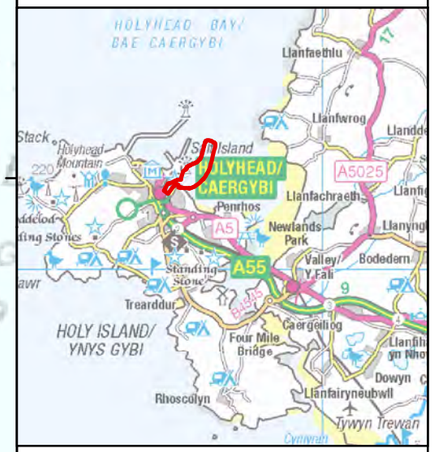
Site and borehole locations

Figure 1





Salt Island Expansion site

Pelham Patch Development

Area Dredge Channel

Priority

- Low
- Medium

Coordinate system:
OSGB36 (OSTN02/OSGM02)

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	\FigsMXD\\stage 1\2018_12_05

Borehole locations and geoarchaeological potential

Figure 2

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Appendix H

Visual Assessment

HOLYHEAD PORT EXPANSION

Visual Assessment

Estell Warren

Landscape Architecture

+

HOLYHEAD PORT EXPANSION

Project No. 2366

Visual Assessment

Version: 02

Date: 25 March 2019

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APPENDICES

Appendix 1 LVIA Methodology
Appendix 2 Representative Viewpoint Analysis Tables
Appendix 3 Glossary of Terms
Appendix 4 Consultee Correspondence

1 INTRODUCTION

1.1 Estell Warren Ltd was appointed by Royal HaskoningDHV in July 2018 to undertake a visual assessment of the proposed Holyhead Port Expansion, located on Holy Island to the west of the Isle of Anglesey. The site and study area adopted for the assessment are shown on **Figure 2366.01 Site Location & Study Area**.

1.2 The scope of the report has been guided by the Scoping Opinion provided by Natural Resources Wales (NRW) in July 2017 (section '*20. Landscape / Seascape and Visual Setting'*). NRW Advisory considered that the potential for '*significant effects upon the character of the seascapes experienced from the Area of Outstanding Natural Beauty to be limited*'. NRW agreed with the proposed approach to the Environmental Impact Assessment '*to assess the scheme's potential impact on the area's visual setting and not undertake a full LVIA*' (Landscape and Visual Impact Assessment).

1.3 Accordingly, this report considers the visual setting within the study area and the potential visual effects of the proposed scheme using a series of 'representative viewpoints'. Methodology is outlined in following sections. The report is structured as follows:

- Legislative and policy context
- Methodology
- Baseline description
- Proposed mitigation measures built into the Scheme
- Assessment of effects
- Compliance with planning policy
- Summary and conclusions

2 LEGISLATIVE AND POLICY CONTEXT

National Policy and Guidance

Planning Policy Wales (PPW, Edition 9 – November 2016)

2.1 Planning Policy Wales sets out the land use planning policies of the Welsh Government and is supplemented by a series of Technical Advice Notices. PPW describes how the land use planning system fulfils government objectives. National policy may remain relevant at a local level or may be interpreted at a local level in development plans.

Statutory Designations

The Anglesey Area of Outstanding Natural Beauty (AONB)

2.2 The primary objective of a statutory AONB designation is to conserve and enhance the areas' natural beauty; it affords the highest level of protection to a landscape. The coastal zone of Anglesey was designated to protect the aesthetic appeal and variety of the island's coastal landscape and habitats from inappropriate development. The AONB is primarily a coastal designation but also encompasses inland areas that form the backdrop to the coast. The extent of the Anglesey AONB within the study area is illustrated on ***Figure 2366.04 Visual Receptors***.

Local Policy

2.3 The development plan for Anglesey is set out in the *Anglesey and Gwynedd Joint Local Development Plan 2011 – 2026* (Written Statement 31 July 2017).

2.4 The development plan is based on a series of strategic objectives that determine strategic and detailed policies.

2.5 Policy PCYFF 4: Design and Landscaping seeks to integrate proposals into their surroundings. A (landscape) scheme should…*'Demonstrate how the proposed development has given due consideration to the Landscape Character Area Assessment or Seascape Assessment….and…demonstrate how the proposed development respects and protects local and strategic views*'.

2.6 Policy AMG 3: Protecting and Enhancing Features and Qualities that are Distinctive to the Local Landscape Character, states '*a proposal will be granted provided it doesn't have significant adverse impact upon features and qualities which are unique to the local landscape in terms of visual…aspects*'. Measures should be taken to ensure that the development does not:

- *'1. Cause significant adverse impact to the character of the built or natural landscape;*
- *2. Fail to harmonise with, or enhance the landform and landscape;*
- *3. Lose or fails to incorporate traditional features, patterns, structures and layout of settlements and landscape of both the built and natural environment.'*

2.7 *Particular emphasis will be given to the landscape identified by the Landscape Character Areas as being of high and outstanding quality…consideration will also be given to development that directly affect the landscape character and setting of the AONBs*…

2.8 Policy AMG 4: Coastal Protection states that a proposal on the coast must not '…*cause unacceptable harm to:…The built environment, or the landscape, or seascape character'… Priority is given to locations with close visual connection to current buildings or existing structures*…'

LandMap

2.9 The Natural Resources Wales LandMap database is a tool set to help sustainable decision making and natural resources planning. It provides a record and evaluation of landscape character, qualities and influences on the landscape. There are five datasets that provide a landscape 'baseline' for Wales. The dataset 'Visual and Sensory' maps landscape characteristics and qualities as perceived through our senses; primarily visually. The datasets combine and help define Landscape Character Areas. The 'Visual and Sensory' dataset is of most relevance to this report. Recorded information includes visual characteristics and scenic quality within each defined area.

2.10 The NRW Visual and Sensory Aspect Areas (within the study area) are illustrated on **Figure 2366.05**, with the relevant areas codified and listed in the key.

3 METHODOLOGY

3.1 The methodology used for this assessment is an abridged version of a full Landscape and Visual Impact Assessment. The report focuses on the existing, baseline visual aspects of the study area and the predicted visual effects of the proposed scheme. Assessment of existing landscape character and potential effects upon landscape (and seascape) character are not addressed in this report.

3.2 The methodology for this report is based on the general recommendations set out in Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, LI & IEMA, 2013. The guidelines are not prescriptive and set out a general approach that should be tailored to the specific circumstances of the project that is being assessed. The visual assessment is based on the methodology set out in **Appendix 1,** omitting sections relating to landscape assessment. A glossary of terms is included in **Appendix 3**. Briefly, the assessment process comprises the following stages:

- Establishment of the baseline visual conditions within the study area, including reference to any existing studies that may be available;
- Identification of potential visual receptors and assessment of their sensitivity to change;
- Commentary (and specific assessment where appropriate) of the effects of the proposed scheme on receptors at the construction stage; and,
- Assessment of the visual effects of the proposed scheme after completion.

3.3 Visual effects relate to the effect on views and visual amenity experienced by various receptors including residents, users of public rights of way, road users and recreational users. Views from conservation areas, listed buildings and scheduled monuments are also considered where these features include recognised viewpoints, e.g. used by tourists or other receptors. It should be noted that the assessment may address effects upon recognised views from cultural heritage resources but effects on 'setting' are not considered in this assessment (refer to the Cultural Heritage reporting).

3.4 The relative sensitivity of visual receptors is combined with the predicted magnitude of change to identify the *significance of effects*; expressed as major, moderate, minor or negligible and indicated as being either adverse or beneficial. Table 1 provides the assessment matrix used to determine the significance of landscape and visual effects.

Table 1. Assessment matrix for determining the significance of visual effects

Assessment Matrix			
	Sensitivity of receptor		
Magnitude of change	Low	Medium	High
High	Moderate effect	Moderate major effect	Major effect
Medium high	Minor moderate effect	Moderate effect	Moderate major effect
Medium	Minor effect	Minor moderate effect	Moderate effect
Low medium	Minor negligible effect	Minor effect	Minor moderate effect
Low	Negligible effect	Minor negligible effect	Minor effect
Negligible	Negligible effect	Negligible effect	Minor negligible effect

3.5 Effects are identified as being either reversible or irreversible and the duration of effects is also considered. Effects are described as being either beneficial or adverse depending on whether they are considered to have a positive or negative effect upon views.

3.6 Impact assessment and project development is an iterative process, with the overall aim of avoiding environmental impacts or reducing identified impacts to acceptable levels.

3.7 The extent of the study area adopted for this assessment has been derived from a combination of desktop study, site investigation and use of Zone of Theoretical Visibility (ZTV) analysis. Given the nature of the proposed development and characteristics of the study area, significant visual effects would not be expected beyond a 2km zone from the scheme boundary. However, high sensitivity receptors within 4km of the site boundary (within the ZTV) have also been identified and considered in this assessment.

3.8 ZTV analysis has been undertaken using the following parameters:

- OS Terrain 5 and 50 data has been used to form the topographical basis of the model;
- Significant areas of existing mature woodland and buildings have been incorporated into the terrain model. Both are set to 10m above ground level;
- ZTV software has been set to take account of Earth curvature;
- A maximum building development ridge height of 12m has been assumed within the Salt Island Expansion and maximum development height of 5.3m within Pelham Patch Development; and,
- Viewer height within the model has been set to 1.7m eye level.

3.9 The significance of predicted visual effects is considered within the assessment. Predicted visual effects have been assessed based on a series of 'representative viewpoints' (**Appendix 2** and **Figures 2366.02 Aerial Photograph & Photograph Locations** and **Figures 2366.07 to 09 Representative Viewpoints**). These have

been selected to represent the experience of different types of visual receptor, including users of public rights of way, residential properties, transport routes, heritage and recreational sites. Selected viewpoints may include specific locations that are popular vantage points or tourist destinations. The number and location of representative viewpoints were agreed with the Isle of Anglesey County Council and NRW (refer to **Appendix 4** for relevant correspondence).

3.10 Visual effects identified as being ***moderate***, ***moderate major*** and ***major*** are considered to be 'significant' in terms of EIA and should be noted and taken into account during the decision-making process.

Assumptions and Limitations

3.11 ZTV mapping uses Ordnance Survey Terrain 5 data as the basis for the Digital Terrain Model (DTM). The data is based on a grid of heights set at 5m intervals. It is considered to be a mid-resolution DTM product, suitable for use over wide study areas.

3.12 Woodland and other significant areas of vegetation are incorporated into the DTM using online aerial mapping and site observation. Buildings are incorporated into the DTM model using digital OS data. Heights used for both vegetation and building modelling are generic heights that are considered to be conservative estimates. ZTV mapping cannot incorporate the myriad of varying features and heights of those features. Mapping is assumed to present a 'worst case' scenario and is used as a guide only for site based survey to enable the selection of representative viewpoint locations and determine the possible extent of landscape areas affected.

3.13 ZTV mapping is based on analysis points set to the tops of tallest proposed structures. Mapping does not therefore differentiate between the full extent of a proposed building being visible or only the very top section being visible.

3.14 Site assessment is undertaken by a qualified landscape architect using publicly accessible viewpoints. Assessment of residential property and other non-accessible receptors is estimated based on effects identified from the closest publicly accessible areas.

3.15 The assessment of visual effects is based on views from ground floor areas, including gardens for residential property.

Data Sources

3.16 The assessment was undertaken with reference to a number of sources, as detailed in Table 2.

Table 2: Key Information Sources

Data Source	**Reference**
Landscape Institute & Institute of Environmental Management and Assessment.	Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (2013)
Ordnance Survey	Ordnance Survey 1-25000 digital and raster mapping
Ordnance Survey	Terrain 5 Digital Terrain Model data
Isle of Anglesey County Council / Gwynedd Council	Anglesey and Gwynedd Joint Local Development Plan 2011-2026
NRW	LANDMAP, Visual & Sensory, 2016

4 BASELINE DESCRIPTION

4.1 This section of the assessment describes the baseline visual condition for the site and its surroundings, against which the potential impacts of the proposed development can be identified. Baseline conditions are considered under the following sub-headings:

- Existing physical characteristics of the site and immediate site boundaries;
- Surrounding visual context, planning context; and,
- Visual analysis of factors which influence both the character and availability of views to the site (e.g. visual detractors, local horizons etc.).

The Existing Site and its Surroundings

Existing Site

4.2 The site primarily comprises of two separate intertidal / subtidal sea areas:

- Salt Island Expansion; the reclamation of approximately 6.6ha of intertidal / subtidal sea areas adjacent to the eastern boundary of Salt Island. The proposed flat landmass would be formed behind a new quay wall.
- Pelham Patch Development; the reclamation approximately 2.4ha of intertidal / subtidal sea areas within Holyhead Old Harbour, between Marine Yard and Salt Island. The proposed flat landmass would be formed behind a new quay wall.

General Context and Site Surroundings

4.3 Refer to **Figure 2366.01 Site Location and Study Area** for site location and extent of LVIA study area and **Figure 2366.02 Aerial Photograph & Photograph Locations** for aerial photographic coverage of the study area.

4.4 Holyhead Port lies at the centre of Holyhead town on the northern shore of Holy Island. The town has the largest population within the Isle of Anglesey county. Holy Island is separated from Anglesey by a narrow channel with road connections via Four Mile Bridge and trunk road and rail links via the Stanley Embankment.

4.5 The proposed sites are located within Holyhead Port, a busy shipping port serviced by major road and rail links. The port is the primary transport link between central and northern England and Ireland. As the UK's second busiest roll on roll off ferry port there are high volumes of private and commercial vehicular movements to and from the ferry terminals. Large ferries and larger cruise ships are a constant feature in views from the town and surroundings. Docking ferries generate sporadic streams of large container / haulage lorries, coaches, cars and vans that exit from the south of the port onto the busy A5 London Road and A55 dual carriageway. Frequent train movements to and from Holyhead Railway Station generate pedestrian activity between the station, ferry terminal and Holyhead town; mostly via the iconic Celtic Gateway footbridge.

4.6 The Inner Harbour forms the southern, inland area of Holyhead Port and is flanked by West Dock and East Dock. A port service lane links East Dock to West Dock (via a road bridge that crosses Inner Harbour) and then on to Salt Island to the north. Old Harbour is located to the north of Inner Harbour. The proposed Pelham Patch Development site is located on the western margin of Old Harbour. The port service lane runs within the western and northern boundaries of the site. A tall, steel palisade security fence runs along the northern site boundary and separates secure port areas from the public A5154 Prince of Wales Road and access road to Fair View. To the west of the site are large workshops and warehouse buildings at Marine Yard. To the north is Marine Square with bars, a café and residential property. There is a short terrace of properties off Fair View and a pumping station to the east of Marine Square. The north eastern boundary to Pelham Patch Development is formed by Salt Island, part of the Outer Harbour. Land immediately to the west of Pelham Patch forms part of the Holyhead Beach Conservation Area.

4.7 The proposed Salt Island Expansion site is located on the eastern shoreline of the Salt Island. The expansive, flat area of mostly manmade land provides access to ferry terminals 3,4 and 5. Terminals 3 and 5 are located to the north of the site and to the west is an extensive vehicular holding area. The southern boundary to the site is formed by Admiralty Pier and access to Terminal 2 roll on roll off berth located on the northern edge of Old Harbour.

Topography

4.8 Refer to **Figure 2366.03 Topography**.

4.9 Holy Island is similar to the Isle of Anglesey in being a relatively low-lying land mass.

4.10 The island consists of low, undulating landforms, with characteristic and frequent rocky outcrops and knolls. From marginal sea level land within the island typical reaches between 10 meters Above Ordnance Datum (mAOD) to 35mAOD. Topography rises towards the north west of the island, culminating in the rocky topped Holyhead Mountain. The mountain is the highest feature on Holy Island (and the Isle of Anglesey as a whole) and it forms an important and highly distinct backdrop to most views.

4.11 Holyhead Port is defined by gently rising ground within the town. To the west of the port land rises gently to between 30 to 38mAOD. To the east of the town land rises to approximately 20 to 25mAOD. Skinners Monument stands on a small rocky outcrop at 25mAOD with land falling sharply away towards the port in the west.

4.12 Existing quaysides in proximity to the proposed development sites are at approximately 8mAOD.

Settlements, industry, commerce and leisure

4.13 The primary settlement is Holyhead town with secondary settlements at Pont Hwfa and Llaingoch extending west towards Holyhead Mountain and Kingsland extending inland to the south.

4.14 Holyhead Port is strongly defined by relatively dense settlement patterns in the surrounding town which has emerged through the development of the port as a commercial hub and latterly as a leisure and tourism gateway to and from Ireland. The port character is strongly industrial and dominated by large ferry terminal buildings and the railway stations. Areas of hardstanding dominate and provide landing areas and vehicular holding areas to ferry terminals. Fish Dock to the north of East Dock is often a berth for commercial fishing vessels. Salt Island is partly reclaimed from the sea and extends the port facilities seawards into Holyhead Bay. Beyond Salt Island Holyhead Breakwater extends nearly 3 kilometres (km) into the bay and stands approximately 12m above high tide on its seaward side. It provides a sheltered 'roadstead' to the harbour area. The breakwater is a major visual feature seen from the town and coastal margins. The square based black and white lighthouse at the end of the breakwater is a local landmark.

4.15 Whilst relatively modern buildings and structures dominate the port area there are a number of features of cultural heritage interest. These include listed buildings at Marine Yard including workshops, offices, smithy's and store buildings. The stone Admiralty Pier to the south of Salt Island, Customs House, Harbour Office and George IV Arch are also listed structures as is the lighthouse on the eastern end of the pier which forms a local landmark.

4.16 Land based industry is focused on land to the east of Holyhead town and includes the large Penrhos / Holyhead Retail Park. To the east of Holy Island is the extensive former Anglesey Aluminium works, which ceased production in 2009. The stack to the former works is a significant feature in the skyline.

4.17 Holy Island is a significant tourist destination with activities largely focused on its coastline, beaches and bays. There are numerous caravan and static home sites on the coastal margins Holy Island. Holiday cottages and farm cottages are prevalent across the study area.

4.18 Penrhos Beach is located to the east Holyhead town and partly lies with the Isle of Anglesey AONB. East of this lies Penrhos Coastal Park.

4.19 The shoreline to the west of Holyhead Port is part of the Holyhead Beach Conservation Area. Holyhead Marina and lifeboat station are located to the west of the area and there are extensive areas of recreational mown grass in the central area.

4.20 Holyhead Breakwater Country park is located approximately 2km to the west of the port. It is on the site of a former quarry that supplied materials for construction of the breakwater in the mid-19th century. Holyhead Golf Course lies to the south of the town.

Communications and infrastructure

4.21 The main communication routes from Anglesey terminate at Holyhead. The A55 North Wales Expressway is the primary vehicular route within the study area and provides a direct dual carriageway link to Holyhead via north Wales and northern England. The road follows the main railway line to the town. The A55 road runs alongside the older A5 route that ultimately provides a link to London.

4.22 To the south of Holyhead the B4545 road provides a link across Holy Island to Trearddur on the western coastline. A number of minor roads radiate out from Holyhead in a south westerly direction towards the coast.

Land cover and land use

4.23 The predominant land use within the study area is pasture farmland, heavily interspersed with rocky outcrops and gorse scrub. There are wetter marshy areas in shallow valley clefts between low rocky hills. Fields are defined by walls or hedges.

4.24 Significant woodland areas are limited to Penrhos Coastal Park and plantation areas around the former Anglesey Aluminium works and south of the A55 road.

Public rights of way and access

4.25 Refer to **Figure 2366.04 Visual Receptors**.

4.26 There are a number of short sections of public rights of way along the coastline in proximity to Holyhead. Paths become more extensive and unbroken along coastal margins outside of the town and inland. There is a relatively dense network of paths to the west of Holyhead and north of Llaingoch that extend across the foothills and peaks of Holyhead Mountain. Elevated paths obtain extensive panoramic views.

4.27 Of particular note is the long distance footpath, the Isle of Anglesey Coastal Path. The path circumnavigates all of Anglesey and Holy Island, with the official start point at Holyhead. The path passes coastal margins to the north of Holyhead via existing tracks, public rights of way or minor roads. It skirts around Holyhead Port, passing alongside the northern boundary to the proposed Pelham Patch Development site via the A5154 road. The path extends around Holyhead Bay and the western shore of Anglesey to the east of the study area.

4.28 There are areas of Open Country to the west of Holyhead.

Designated landscape

4.29 The primary landscape related designation is the Isle of Anglesey AONB. Coastal margins within the study area (outside of Holyhead town) are designated as AONB.

Visual analysis

4.30 Refer to **Appendix 2** and **Figures 2366.02 Aerial Photograph & Photograph Locations and Figures 2366.07 to 09 Representative Viewpoints**.

Views towards the site

4.31 The juxtaposition of Holyhead Port, in the heart of Holyhead Town, limits close range views towards proposed development areas. The town rises gently on low lying topography surrounding the port. Views from within the town towards proposed site areas are typically screened by intervening buildings and structures; potential views are limited to the outer curtilages of the town that enclose the port area.

4.32 Views are further limited by large buildings within or in close proximity to the port. These include the substantial railway station buildings, ferry terminal buildings and various ancillary structures and workshops, including those within Marine Yard. The elevated A5 road crossing of the railway to the south of the port restricts local views. A tall, random rubble stone wall defines the port curtilage and is significant in often screening close range, ground level views to the port area. Roadside views towards the port from Turkey Shore Road to the east and from the A5154 Victoria Road to the west are effectively screened by the wall. Scrub and emerging vegetation within disused railway land alongside West Dock further filters and limits certain views.

4.33 Views from high sensitivity receptors in close range to proposed sites are limited to a small number of properties and receptors to the west of Old Harbour and certain elevated receptors to the east of Inner Harbour.

4.34 Properties at Fair View and those fronting onto Marine Square, orientate towards the northern boundary of the Pelham Patch Development site. Existing views are across the A5154 road and access road to Fair View. A tall steel palisade security fence forms the secure boundary to the port land and partially filters views into the Old Harbour area. The fence is highly intrusive in the view. Vehicular movements, including large lorries and coaches can be seen immediately within the fenced port boundary. Similar views are obtained from the Isle of Anglesey Coastal Path where it passes the site boundary following the A5154 road corridor.

4.35 Receptors in proximity to Marine Square lie within the eastern extent of the Holyhead Beach Conservation Area. Building facades and public realm features within this area make a positive contribution to the local scene. The Conservation Area appraisal also identifies certain outward views as an important quality of the area, describing them as '*particularly noteworthy*'; one such view is from *'..the easterly edge* (of the Conservation Area*), by Marine Square, towards the Inner Harbour*'. The view is however, significantly compromised by the intervening security fence described above.

4.36 Properties along Harbour View are located to the east of Inner Harbour on the edge of sharply ascending topography. As such they obtain an elevated and relatively open view to the west across the port area. Properties to the west of Holyhead, facing onto the port, form a middle distance horizon. Holyhead Mountain rises clearly into the skyline on the far horizon and is a focal point of the view. The foreground view is dominated by large ferry terminal buildings, the railway station and other workshop, ancillary structures, hardstanding and parking areas. Vehicular movements from Salt Island and the other ferry terminals are prominent, particularly during peak disembarkation periods. Ferry movements to and from terminals are a particular feature in views.

4.37 Skinners Monument is a prominent local feature in proximity to properties at Harbour View. Similar, open, elevated views are possible towards proposed development sites.

4.38 More distant views are possible towards proposed site areas, including vantage points within the Anglesey AONB.

4.39 Properties at Peibio Close obtain oblique views towards Salt Island, approximately 550m to the north west. The Isle of Anglesey Coastal Path passes to the north of these properties crossing areas of open, rough grassland. Views from receptors at this location are open and expansive, with the focus across Holyhead Bay and headland areas on Anglesey to the east. Container / haulage lorries, silos, lighting masts and the roll-on roll-off (ro-ro) vehicular ramps are prominent features on Salt Island, as are ferry movements to and from terminals. Admiralty Pier, Holyhead Breakwater and associated lighthouses are features in the view.

4.40 The coastline to the east of Holyhead allows views towards Salt Island. The closest available view within the Anglesey AONB is from Penrhos Beach, at approximately 1.3km distance. The Isle of Anglesey Coastal Path passes the shoreward side of the beach. Holyhead Breakwater can be seen extending across the horizon. Silos and ro-ro vehicular ramps are prominent on Salt Island. The focus of the view is across Holyhead Bay and Anglesey coastline. Holyhead Mountain is also a primary feature in the view, seen in the west above the middle distant horizon of Holyhead Town. Views south are towards vegetated embankments alongside the A5 London Road; the former Anglesey Aluminium works chimney stack is a dominant feature in the skyline.

4.41 Long distant views from across the wider study area are also available. These include coastline views across Holyhead Bay from the Isle of Anglesey in the east, part of Anglesey AONB. The Isle of Anglesey Coastal Path follows the coastline with open, expansive views across the bay.

4.42 To the west of the study area rising ground at Holyhead Mountain affords distant and expansive panoramic views across Holyhead and Holyhead Bay, with open views to the western Anglesey coastline. The dramatic form of Holyhead Breakwater, reaching out across the bay, is a primary element in views. Salt Island is visible, with docked or moving ferries the most prominent associated feature. The mountain terrain forms part of Anglesey AONB.

4.43 A defining feature of existing visual character is the constant activity and movement of vessels and other craft. Ferries and larger cruise ships are highly prominent moving to and from terminals. When docked, they can dominate the skyline and screen certain views. Smaller vessels, including fishing trawlers and yachts within New Harbour, further enhance the vibrant and ever-changing port character.

Visual detractors

4.44 Holyhead town and port are busy working environments that require large scale infrastructure and built facilities. Visual character of the town and surroundings is varied, with attractive features and views often offset by functional features.

4.45 In the wider study area, there are notable visual detractors:

- Industrial and retail areas to the east of Holyhead. The area of land between the A5 and A55 road corridors includes various retail and industrial buildings, including the substantial former Anglesey Aluminium works. The site includes very large buildings and a chimney stack that is visible for many miles across the landscape.
- Busy road corridors leading into Holyhead and road junction to the south of the port.

4.46 Within proximity to the proposed development sites there are local visual detractors.

- Fish Dock, areas to north of the ferry terminal on East Dock to South Pier. The area includes derelict ground, storage silos, poor boundary treatments, with general waste, litter and scrap materials. There are poor quality workshop sheds and lighting masts that punctuate the skyline. The area generally has a sense of neglect.
- On Salt Island three storage silos and the raised ro-ro vehicular ramps are often prominent in views. Stationary or moving container lorries are often brightly coloured and a source of visual discordance.

5 PROPOSED DEVELOPMENT AND MITIGATION MEASURES

Proposed Development

5.1 The development comprises of two reclamation areas; Salt Island Expansion and Pelham Patch Development. Reclamation of the existing intertidal sea areas would be formed using dredged and imported materials. Both sites require the construction of quay walls. The Pelham Patch Development includes and the realignment of the existing port service lane. The development requires dredging of the approach channel to the port.

5.2 The proposed Salt Island Expansion would provide a new deep water berth and additional ro-ro standage. Two High Bay Warehouses (approx. 12m to ridge) would be constructed on the northern and southern site areas. Two ship to shore cranes would be located on the site. The area would require 10nr lighting masts (approx. 20m high) that match existing masts on the island.

5.3 The Pelham Patch Development would provide an additional multi purpose berth, container and vehicular standing area. There are no proposed buildings within the area.

6 VISUAL EFFECTS

6.1 This section describes the significance of visual effects on baseline conditions during construction and operational stages of the proposed development. The significance of effects is determined by professional judgement, based on the sensitivity of the receptor, combined with the magnitude of the effect.

6.2 The ZTV of the proposed development is shown on **Figure 2366.06 Zone of Theoretical Visibility**. The ZTV provides a broad picture of the predicted theoretical extent of visibility of the development within the study area. The ZTV does not, however, take into account minor variations in landform, vegetation cover or buildings, all of which can affect the degree to which a development is visible or perceived within the landscape or a specific view.

6.3 The potential visual effects of the proposed development have been assessed from a series of *representative viewpoints* located within the ZTV (see **Appendix 2** and **Figure 2366.04 Visual Receptors**). Visual effects at construction stage and operational stage are considered. The assessment findings from these viewpoints have been used to identify effects on specific receptors and to form a basis for making professional judgement on the potential effects on other receptors in similar geographical locations to the relevant representative viewpoint.

6.4 The following is a summary of visual effects based on the representative viewpoint assessment.

Effects on Visual Receptors

Sensitivity

6.5 The sensitivity to change of visual receptors is dependent on the nature of the receptor and the activity they are undertaking. The sensitivity of visual receptors used in this assessment is set out in **Appendix 1**. Representative view tables for the proposed scheme are provided in **Appendix 2**.

Effects upon views from designated landscape

6.6 The study area includes the Isle of Anglesey AONB; primarily a coastal designation but encompassing inland areas that form the backdrop to the coast. This assessment includes specific representative viewpoints that demonstrate potential visual effects from within the AONB. Viewpoints include those from Holyhead Mountain (view 6, elevated vantage point and important recreational area), Penhros Beach (view 7, closest proximity to the development from within the AONB) and Penrhyn (view 8, Anglesey coastal view and important recreational footpath route). Views obtained from each location are varied in extent and character. Refer to **Figures 2366.08 Representative Viewpoints**, Sheets 2 and 3.

6.7 In all cases the proposed development, during both construction and operational stages, will be seen in context of existing, similar port development and infrastructure. In views from lower lying coastal margins the proposed development would barely be perceptible; seen as a very narrow margin of land against a backdrop of dense urban and infrastructure features. In elevated views from Holyhead Mountain the development forms a relatively small component in the extensive panoramic view. The location of the port expansion; to the east of Salt Island and the Old Harbour, results in intervening built features mostly screening the development to views from the west.

6.8 There will be no significant effects to views obtained from within the AONB towards the proposed development. Effects upon receptors within the AONB are predicted to be ***minor negligible adverse***.

Construction Stage Visual Effects

6.9 Construction stage activity is predicted to be the most visually disruptive phase of the proposed development. Effects would be temporary and short term only.

6.10 Site compounds, storage and batching areas would be located on Admiralty Pier. A possible laydown area may be located near to Terminal 1 on the Inner Harbour. Construction related activity would include use of tall plant / lifting cranes, haulage vehicles, dredging and importation of materials by sea going vessels. Flashing amber vehicular warning lights would be a potential visual distraction. There would be the requirement for temporary lighting.

6.11 Site activity during construction would be varied. Works, vehicular movements and on-site activity would constantly change in position and intensity. Tall plant and crane would shift position as development progresses, presenting a constantly changing feature in local views.

6.12 In all representative views considered in the LVIA, proposed construction works would be seen in context of existing busy port activity, vehicular movements, shipping activity and the myriad of buildings, portside and infrastructure facilities. Construction activity would not significantly contrast or conflict with existing visual character. In more distant views, works would be seen against a backdrop of urban, industrial or port features.

6.13 A significant adverse effect identified would be to views from properties and public open space at Fair View, to the west of Pelham Patch. Site compounds, storage and batching areas on Admiralty Pier and the laydown area near Terminal 1 would be visible. Close range views of tall plant, haulage vehicles and other activity during Pelham Patch Development works would be highly intrusive in the local view, with combinations of work activity intensifying visual intrusion at certain periods. Construction stage effects from receptors at Fair View are predicted to be ***moderate adverse***; a 'worst case' effect at peak working stages and intensity of activity.

6.14 No other significant visual effects have been identified during construction stages.

Operational Stage Visual Effects

6.15 Computer generated photomontage views have been prepared from selected viewpoints to illustrate the appearance of the operational scheme. Refer to **Figures 2366.10** (Photomontage View 1 from properties at Peibio Close), **2366.11** (Photomontage View 2 from Skinners Monument and **2366.12** (Photomontage View 3 from properties at Fair View).

6.16 No significant visual effects have been identified during operational stages. In all cases the proposed development would be seen in context of existing, similar port development and infrastructure.

6.17 In views from the Anglesey Coastal Path to the south east of the site proposed and existing features would appear contiguous. The coastal viewpoint is at low level and proposed ground planes would appear as a thin sliver of land across the view. There would be a low degree of contrast in the view with proposed and existing features appearing to visually integrate. Tall lighting masts on Salt Island Expansion would be seen in context of existing lighting. Existing detractors within the view would further reduce the overall magnitude of effect experienced by receptors. Effects are predicted to be ***minor adverse***.

6.18 In contrast, views from Skinners Monument and properties to the south east of the Inner Harbour are elevated, with views across harbour and port facilities. The scene below is dominated by large ferry terminal buildings, the railway station and other ancillary buildings and structures. There is associated vehicular movement, noise and activity. Existing port features are prominent and proposed features would appear similar in character, visually integrating and incurring a low degree of contrast in the view. Effects are predicted to be ***minor adverse***.

6.19 Close range views from Fair View, immediately to the west of Pelham Patch Development is across the A5154 road and access road to Fair View. The proposed ground plane would partially screen views to open sea areas in the Old Harbour. The scheme would include the replacement of the existing security fence along the northern site boundary with a chain link fence; the fence would be less dominant in the view and allow more open views across the boundary towards the Old Harbour. The proposed access road alignment would also be located within the site and at greater distance from the receptor location, slightly reducing the existing close range effects of traffic movements.

6.20 Proposed siting of storage containers would be seen against a backdrop of industrial units and residential properties on rising ground to the south. Standing vehicles may interrupt filtered views (through boundary fencing) to the harbour although this would be temporary and vary as vehicles come and go.

6.21 The proposed Pelham Patch Development would be seen in context of existing port and harbour features. There would be limited change in the character of the existing view. Proposed and existing features would visually integrate and there would be a low degree of contrast in the view. Effects from receptors at Fair View and environs are predicted to be ***minor adverse***.

6.22 The proposed development would allow large cruise ships to dock in slightly closer proximity to receptors located alongside the port and coastal margins. Vessels would be seen berthed alongside the Pelham Patch quayside. The presence of docked vessels is temporary and ever changing. Cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of visual receptors.

7 COMPLIANCE WITH PLANNING POLICY

7.1 The proposed development is assessed against relevant planning policy and guidance identified in section 2 of this chapter in **Table 3** below.

Table 3. Compliance with Planning Policy

Policy/ guidance	**Compliance commentary**
Anglesey and Gwynedd Joint Local Development Plan 2011 – 2026 (Written Statement 31 July 2017).	
Policy PCYFF 4: Design and Landscaping	This report addresses potential *visual effects* of the proposed development, as guided by the NRW Scoping Opinion (12 July 2017). The proposed development would not include a landscape scheme comprising of plant material; planting would neither be practical or appropriate to existing character. Consideration from the outset has been given to development layout, building massing and external colouring. Materials, finishes and surface treatments would be functional and in keeping with existing features. Proposed fencing along the southern boundary of the Pelham Patch Development site would be less visually intrusive than existing fencing.
Policy AMG 3: Protecting and Enhancing Features and Qualities that are Distinctive to the Local Landscape Character	This report has identified that there would be no significant visual effects arising from the proposed development. Proposed development would be appropriate to existing visual character of the port and environs. The development would be contiguous with comparable features and as such, proposed and existing features would appear to visually integrate and harmonise. The would be no significant effects to visual receptors within the Isle of Anglesey AONB.
Policy AMG 4: Coastal Protection	The proposed development is located within / adjacent to the existing port. There would be no significant visual effects arising from the proposed development.

7.2 Overall, the proposed development is considered to comply with policies relating to visual amenity.

8 SUMMARY AND CONCLUSIONS

8.1 The report identifies visual effects associated with the development of the proposed Salt Island Expansion and Pelham Patch Development, part of the Holyhead Port Expansion scheme.

8.1 The proposed sites are located within Holyhead Port which is serviced by major road and rail links. Ferries and larger cruise ships are a constant feature in views from the town and surrounding study area. Existing port character is strongly functional, dominated by large ferry terminal buildings and the railway station. There are high volumes of lorry and other vehicular movements through the port, particularly during peak disembarkation periods. Ferry movements to and from terminals and vessels at berth are prominent and characterful features in existing views.

8.2 There are a number of high sensitivity receptors within the study area. Inland areas encompassing Holyhead Town are an AONB. The Isle of Anglesey Coastal Path follows the coastline around Holyhead Bay and there are residential properties and areas of open space within close proximity of the port.

8.3 Predicted visual effects have been assessed using a series of representative viewpoints. Selected locations include views from within the Isle of Anglesey AONB, the coastal footpath, from residential property and other high sensitivity receptors. Close range views from high sensitivity receptors are limited to relatively few residential and other users immediately to the west of Pelham Patch Development and to the south across the inner harbour. Effects have been assessed during the construction and operational stages of the proposed development.

8.4 The LVIA identifies a significant adverse visual effect to properties and public space at Fair vVew during construction stages only. Close range views to construction works and associated activity at Pelham Patch Development site are predicted to incur ***moderate adverse*** visual effects during peak phases of activity. Construction activity would be short term and temporary. No other significant visual effects have been identified during construction.

8.5 No significant visual effects resulting from the proposed operational stages of the development have been identified. In close range views, existing port facilities, infrastructure, vessel and vehicular activity often dominate the scene. Proposed features would be seen in context of existing facilities and would incur a low magnitude of change in views, with development and activity visually integrating with existing features. Predicted visual effects to close range receptors would be ***minor adverse*** during operational stages.

8.6 In more distant coastal views (including locations within the Isle of Anglesey AONB) the Pelham Patch Development site is often screened or partially screened by intervening features. In low level views the proposed ground plane of the Salt Island Expansion would be seen as a thin sliver of land across the view with proposed features appearing contiguous with existing harbour wall / sea defence structures and barely perceptible. The proposed High Bay Warehouses would be seen against a backdrop of existing buildings, structures and lorries and containers. Predicted visual effects from coastal receptors would be ***minor adverse*** during operational stages.

8.7 In elevated, distant views from Holyhead Mountain the existing port, town and breakwater are clearly visible. Only a very small section of the proposed eastern Salt Island Expansion area would be seen with possible glimpsed views upper sections of High Bay Warehouses. In context of the wider, panoramic view proposed features would not be significant. Predicted visual effects from receptors at Holyhead Mountain would be ***minor negligible adverse*** during operational stages.

Figures

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KEY

SITE BOUNDARY
A - Salt Island Expansion
B - Pelham Patch Development

1km — 1Km OFFSETS FROM SITE BOUNDARY

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Enhancing Society Together

Estell Warren
Landscape Architecture

PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
SITE LOCATION AND STUDY AREA

SCALE	FIGURE	REVISION
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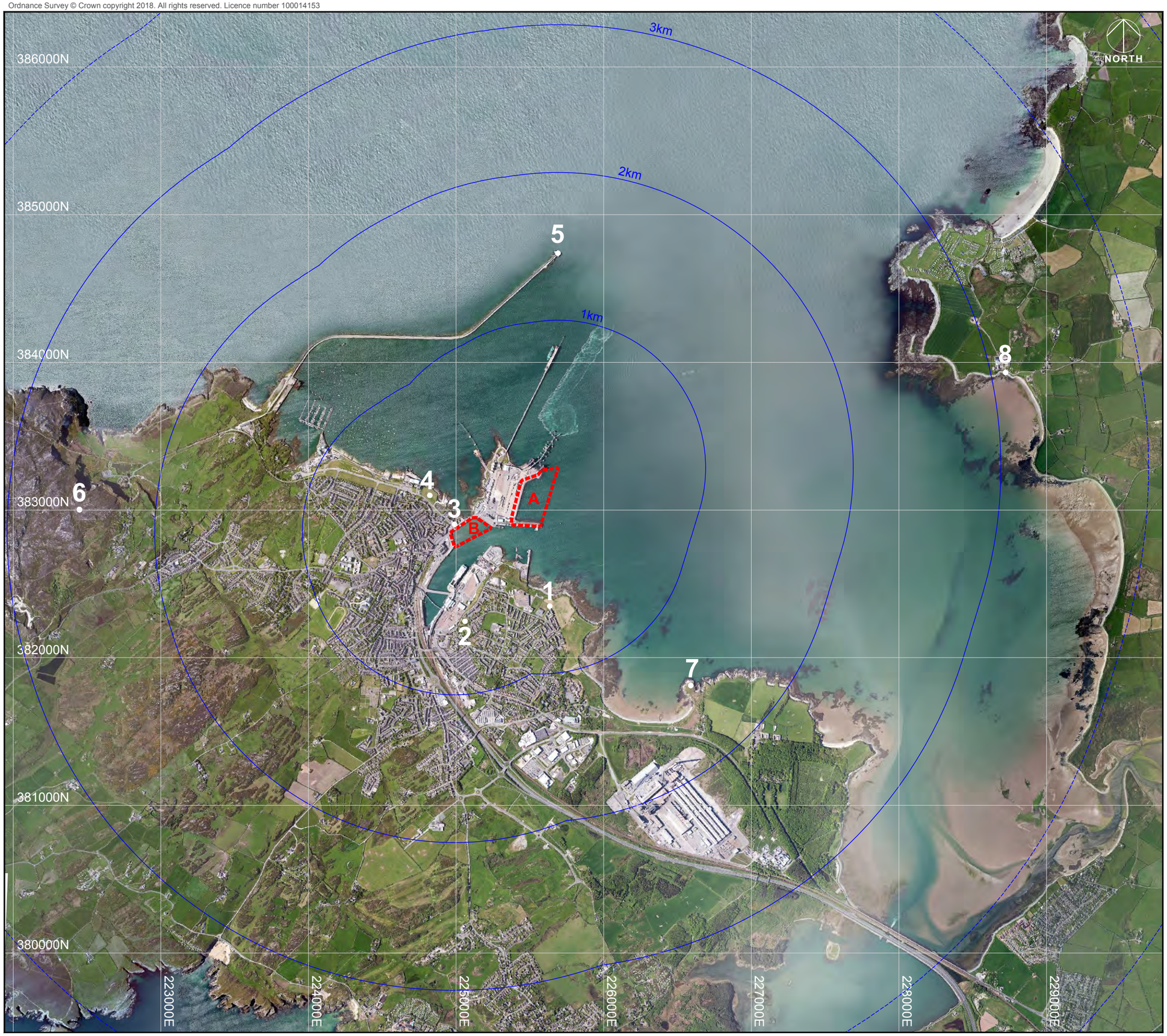

KEY

SITE BOUNDARY
A - Salt Island Expansion
B - Pelham Patch Development

1km OFFSETS FROM SITE BOUNDARY

REPRESENTATIVE VIEWPOINT LOCATION
(Refer to Figures 2366.07 to 09 for existing photograph views to site)

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Landscape Architecture

PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
AERIAL PHOTOGRAPH & PHOTOGRAPH LOCATIONS

SCALE	FIGURE	REVISION
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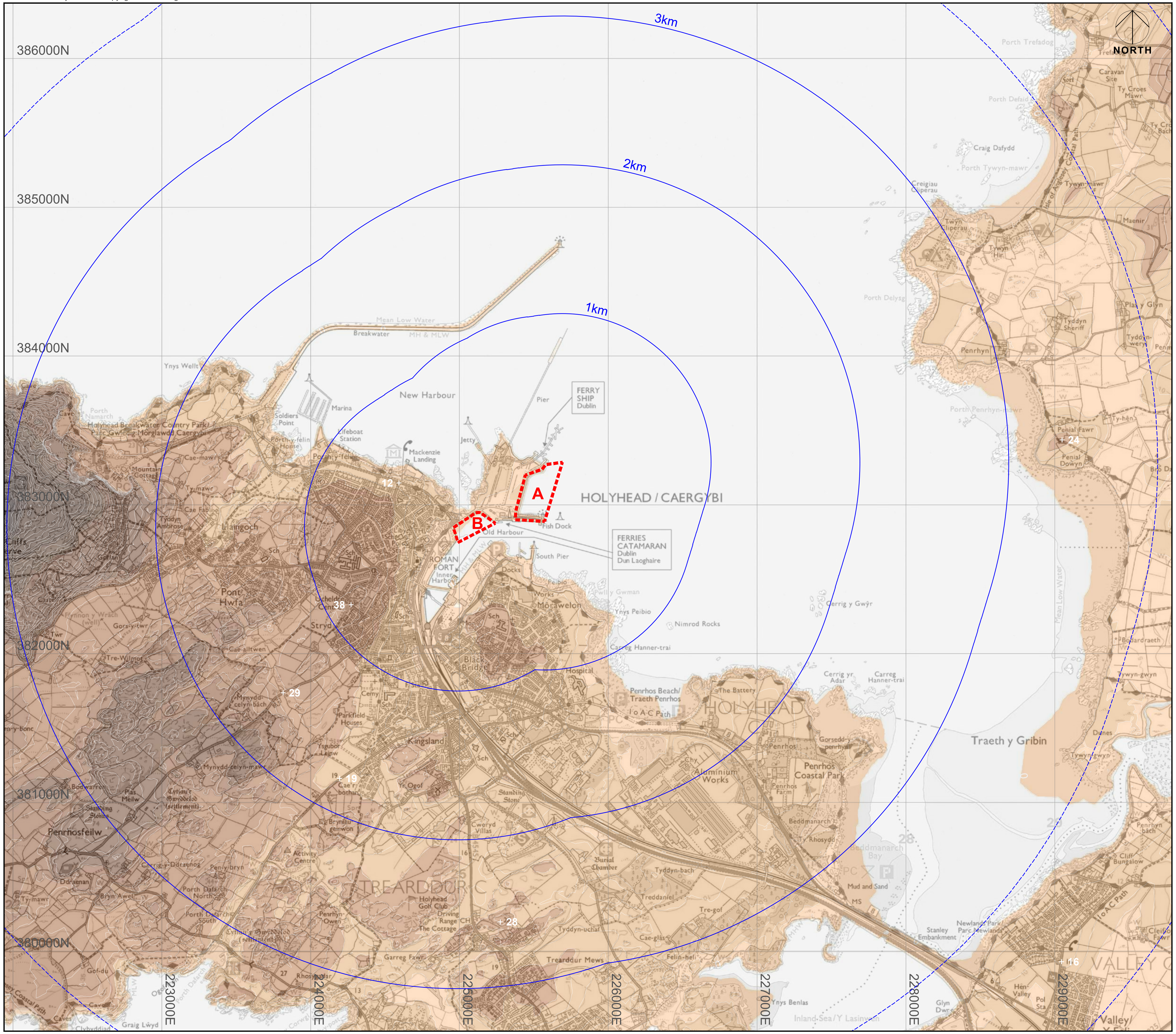

KEY

SITE BOUNDARY
A - Salt Island Expansion
B - Pelham Patch Development

1km — 1Km OFFSETS FROM SITE BOUNDARY

- 0-5m Above Ordnance Datum (mAOD)
- 5-10 mAOD
- 10-20 mAOD
- 20-30 mAOD
- 30-40 mAOD
- 40-50 mAOD
- 50-100 mAOD
- 100-120 mAOD
- 120-160 mAOD
- 160-180 mAOD
- 180-220 mAOD
- 220-240 mAOD

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PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
TOPOGRAPHY

SCALE	FIGURE	REVISION
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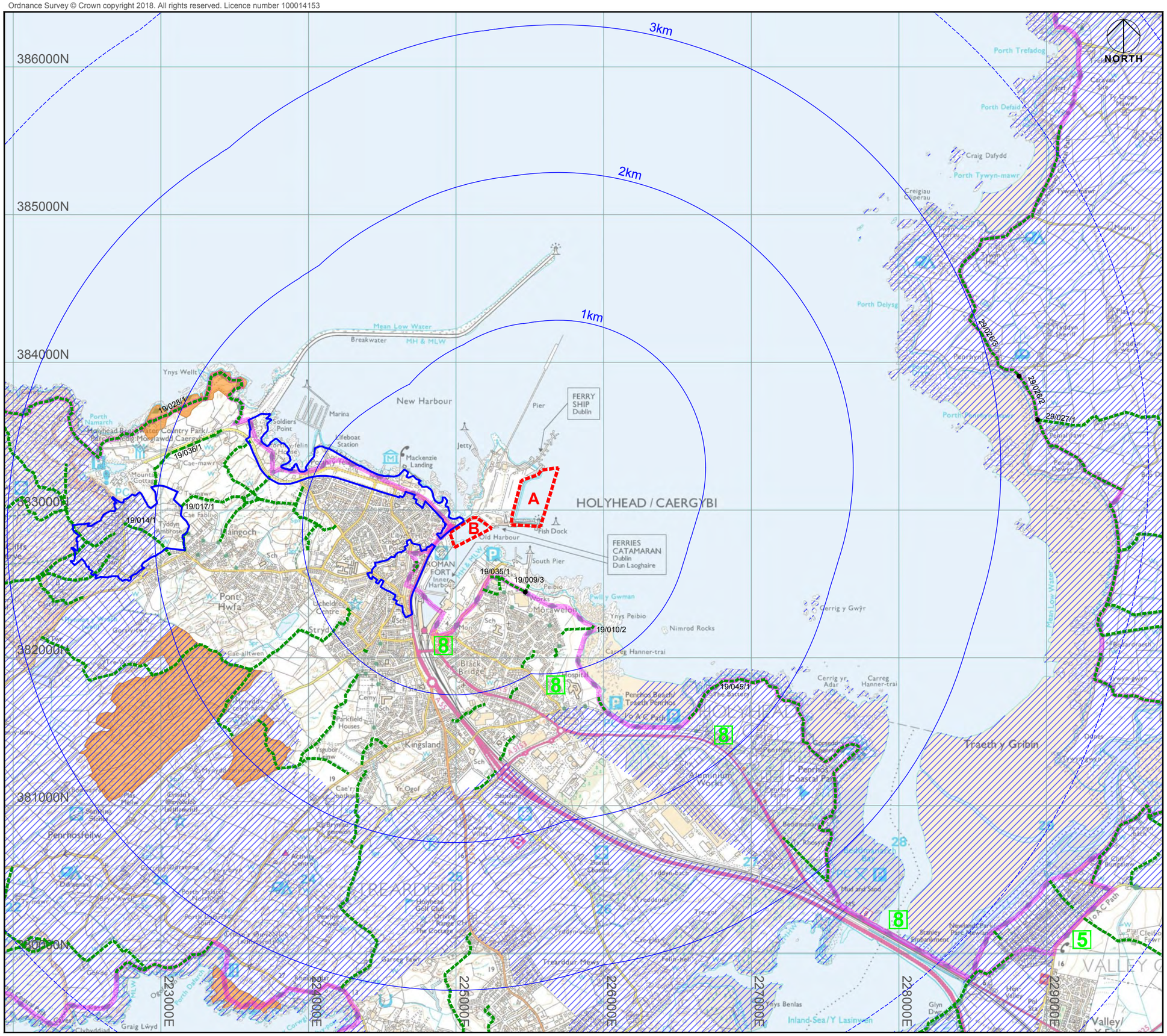

KEY

- SITE BOUNDARY
  A - Salt Island Expansion
  B - Pelham Patch Development
- 1Km OFFSETS FROM SITE BOUNDARY
- CONSERVATION AREA
- ANGLESEY AREA OF OUTSTANDING NATURAL BEAUTY
- OPEN COUNTRY
- BRIDLEWAY WITH REFERENCE NUMBER
- FOOTPATHS WITH REFERENCE NUMBER
- REFERENCE NUMBER CHANGE POINT
- LONG DISTANCE ROUTE: ISLE OF ANGLESEY COASTAL PATH
- SUSTRANS NCN: ROUTE 8 (LON LAS CYMRU) ROUTE 5 (NORTH WALES COASTAL ROUTE)
- MOTORWAY
- 'A' ROAD
- 'B' ROAD
- MINOR ROAD
- RAILWAY

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PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
VISUAL RECEPTORS

SCALE	FIGURE	REVISION
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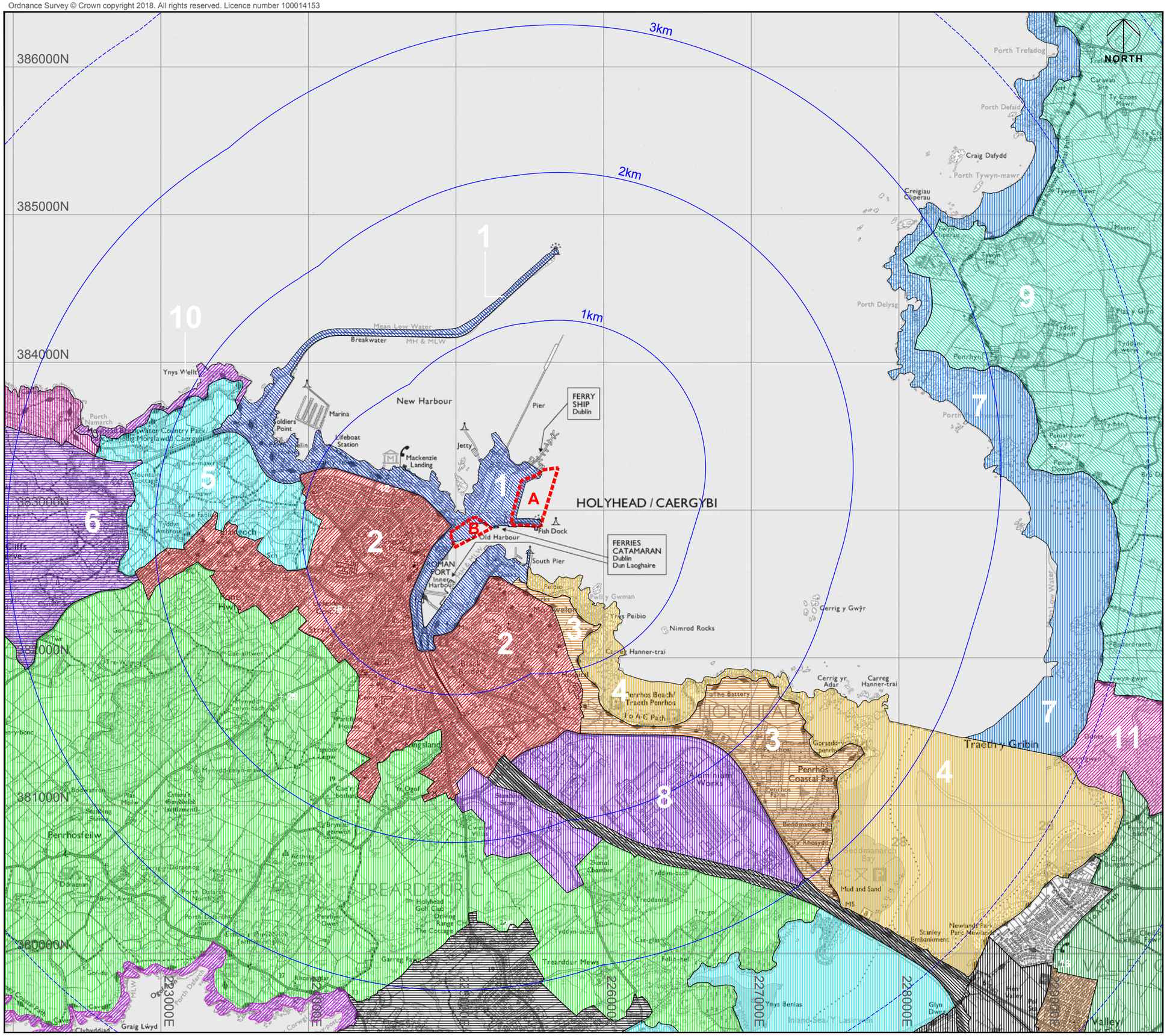

KEY

SITE BOUNDARY
A - Salt Island Expansion
B - Pelham Patch Development

1km OFFSETS FROM SITE BOUNDARY

VISUAL AND SENSORY ASPECT AREAS

1. Holyhead Harbour
2. Holyhead
3. Penrhos Coastal Park
4. Penrhos Beach
5. Holy Island
6. Holyhead Mountain
7. Northwest Coast
8. Penrhos
9. North-west Drumlins
10. Holy Island Coast
11. Alaw Estuary

Notes:

Information derived from '*LandMap*', Natural Resources Wales, 2016

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Landscape Architecture

PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
VISUAL & SENSORY ASPECT AREAS

SCALE	FIGURE	REVISION
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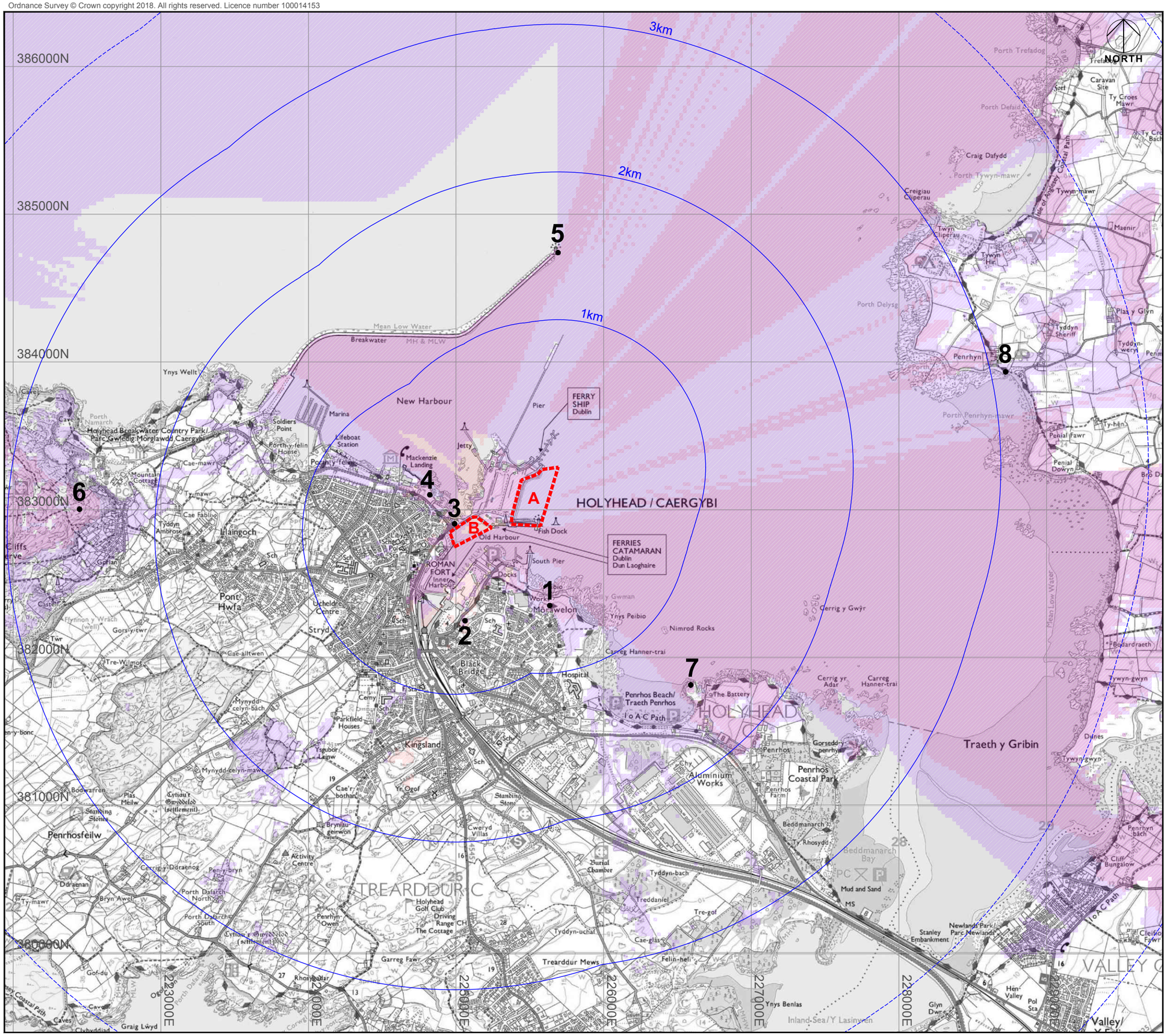

KEY

- SITE BOUNDARY
  A - Salt Island Expansion
  B - Pelham Patch Development
- 1km — 1Km OFFSETS FROM SITE BOUNDARY
- ZONE OF THEORETICAL VISIBILITY - Salt Island Expansion ZTV
- ZONE OF THEORETICAL VISIBILITY - Pelham Patch Reclamation ZTV
- ZONE OF THEORETICAL VISIBILITY - Salt Island and Pelham Patch ZTV
- 9 — REPRESENTATIVE VIEWPOINT LOCATION (Refer to Figures 2366.07 to 09 for existing photograph views to site)

Notes:

ZTV analysis:

- ZTV analysis points for Salt Island Expansion based on proposed High Bay Warehouse ridgeline heights of 12m on FFL of 5.5mAOD and ground plane points of 5.5mAOD.
- ZTV analysis points for Pelham Patch Reclamation based on proposed container storage heights (two stacked) at 10.3mAOD and ground plane of 5.0mAOD.
- Existing buildings and selected woodland areas are included in the Digital Terrain Model - building and woodland heights modelled in the DTM are at 10m above ground level.
- Observers eye level 1.7m.
- Extent of ZTV limited to 5km distance from analysis points
- Analysis adjusted for earth curvature / refraction

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PROJECT
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

FIGURE
ZONE OF THEORETICAL VISIBILITY

SCALE	FIGURE	REVISION
1:25,000 @ A3	2366.06	01

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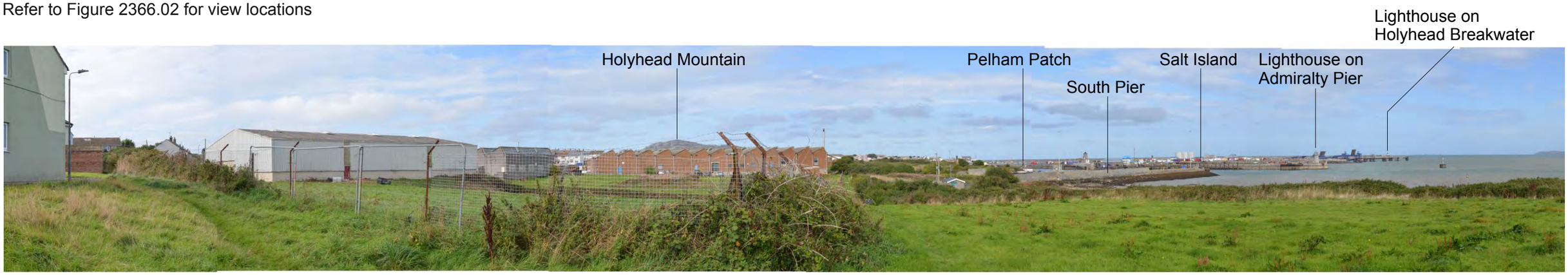
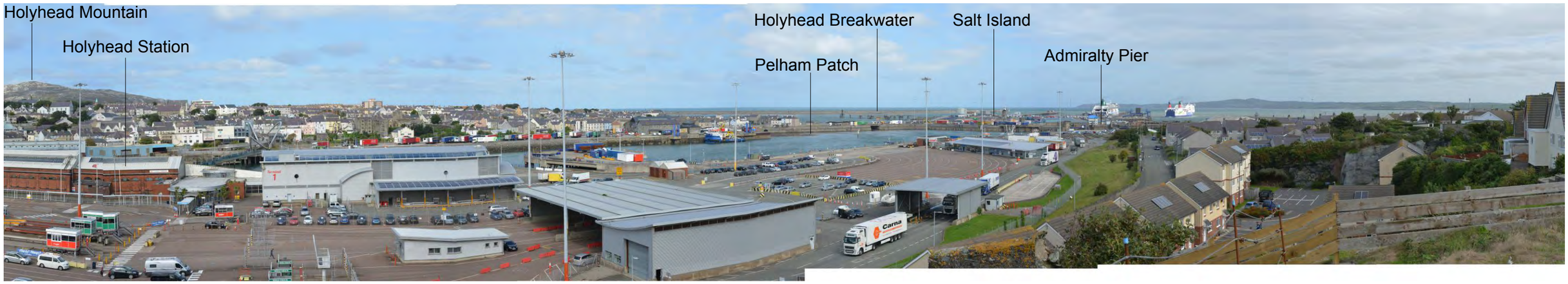
Refer to Figure 2366.02 for view locations



View 1: Looking north west from the Isle of Anglesey Coastal Path, near properties at Peibio Close
(E225635, N382349, 12mAOD, 301^{0}, 540m from site boundary)



View 2: Looking north from Skinners Monument, near properties at Harbour View
(E225061, N382247, 25mAOD, 21^{0}, 505m from site boundary)

View 3: Looking south east from properties at Fair View, near the Isle of Anglesey Coastal Path (path follows the Prince of Wales Road, right of photograph)
(E224990, N382903, 4mAOD, 147^{0}, 30m from site boundary)

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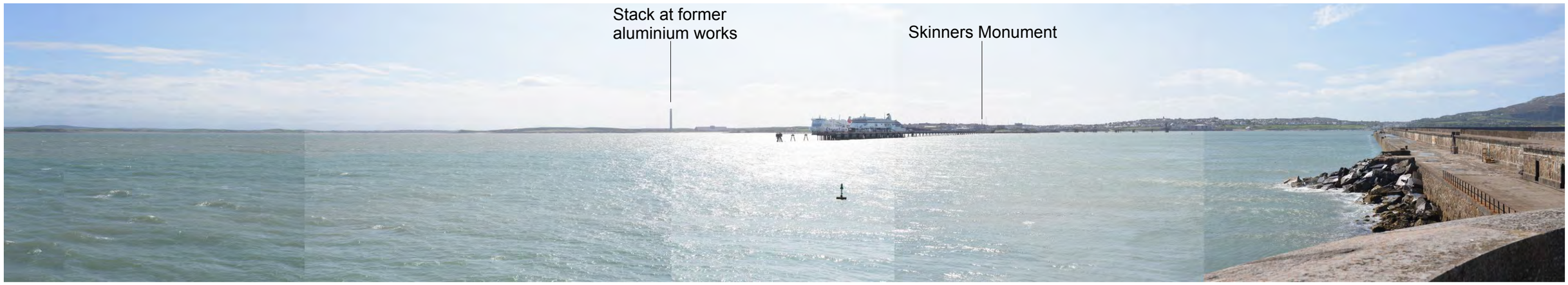
Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT

Drawing Title
REPRESENTATIVE VIEWPOINTS (Sheet 1 of 3)

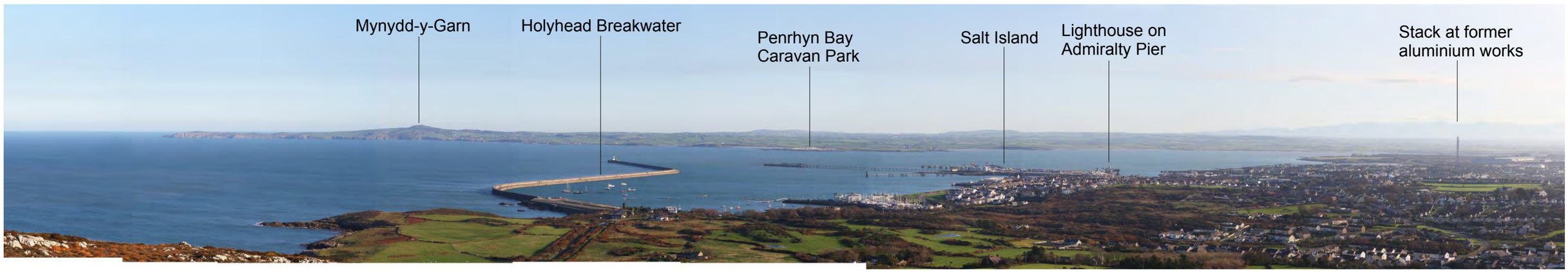
Figure:
2366.07

Refer to Figure 2366.02 for view locations

View 4: Looking east from playing fields off Prince of Wales Road
(E224822, N383099, 9mAOD, 118^{0}, 287m from site boundary)



View 5: Looking south from near the lighthouse on Holyhead Breakwater
(E225691, N384739, 8mAOD, 193^{0}, 1.45km from site boundary)



View 6: Looking east from Holyhead Mountain (Anglesey AONB)
(E222449, N383002, 130mAOD, 90^{0}, 2.5km from site boundary)

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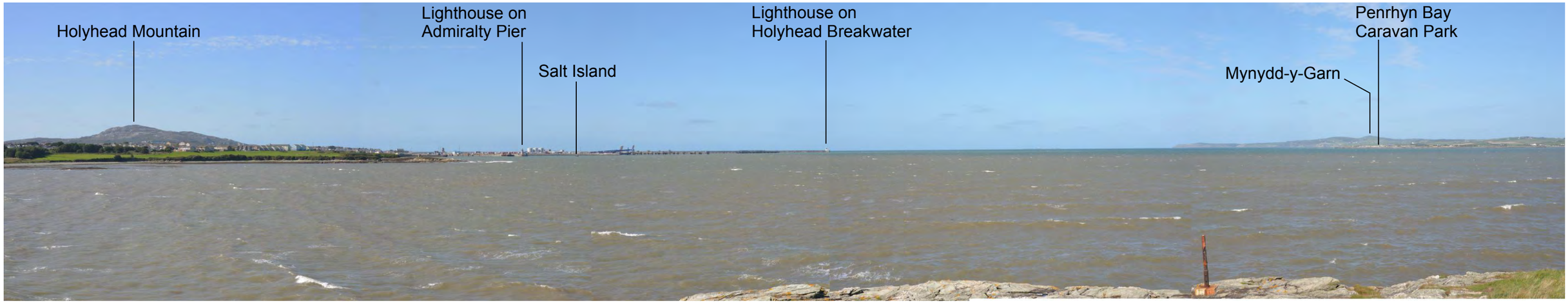
Project
HOLYHEAD PORT EXPANSION VISUAL ASSESSMENT

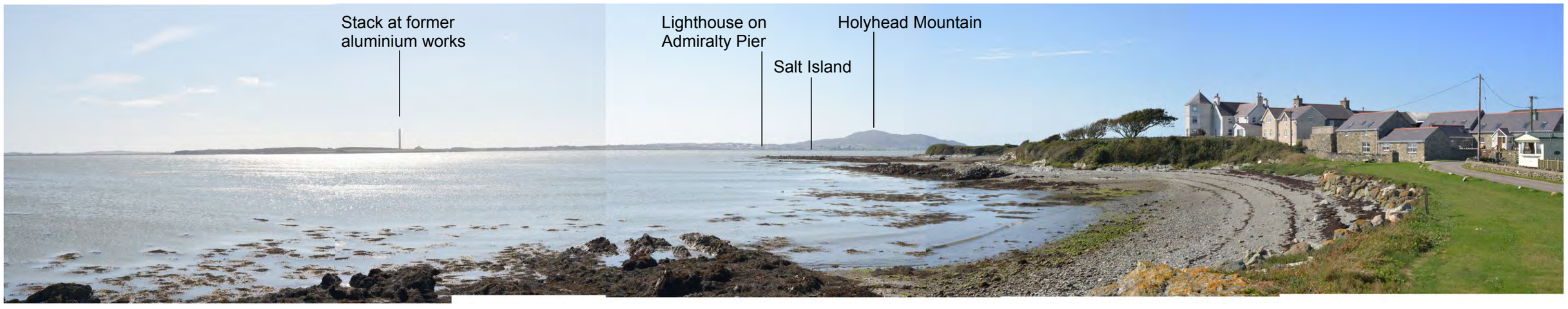
Drawing Title
REPRESENTATIVE VIEWPOINTS (Sheet 2 of 3)

Figure:
2366.08

Refer to Figure 2366.02 for view locations



View 7: Looking north west from Penrhos Beach (Anglesey AONB), on headland near the Isle of Anglesey Coastal Path (E226590, N381812, 11mAOD, 317**º**, 1.5km from site boundary)



View 8: Looking west from the Isle of Anglesey Coastal Path (Anglesey AONB), near properties and holiday chalets at Penrhyn (E228723, N383931, 4mAOD, 254**º**, 3.1km from site boundary)

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Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT

Drawing Title
REPRESENTATIVE VIEWPOINTS (Sheet 3 of 3)

Figure:
2366.09

Viewpoint 1: Looking north west from the Isle of Anglesey Coastal Path, near properties at Peibio Close

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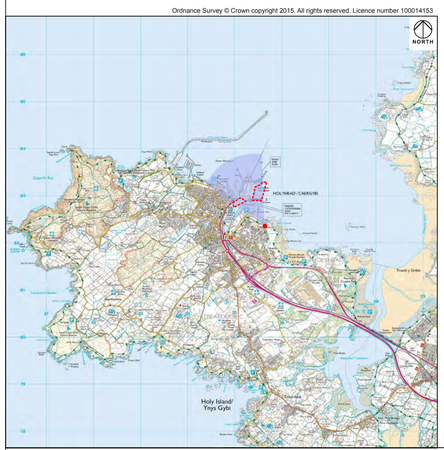

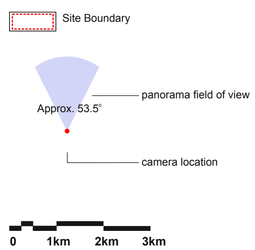

View 01
Existing View

Notes
·Print at A1
·View flat at a comfortable arm's length

Grid reference: E225635, N382349
Elevation: 12m AOD
Direction of centre of view: 301°
Field of view: 53.5° (HFOV), 18.2° (VFOV)
Distance to site boundary: 540m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 11.00, 03/09/2018
Weather conditions: High cloud, clear visibility

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Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 01
VIEW 1 FROM PROPERTIES AT PEIBIO CLOSE
Date: **MARCH 2019**
Figure: **2366.10 (sheet 1 of 2)**

Viewpoint 1: Photomontage view of the proposed Salt Island Expansion and Pelham Patch Development

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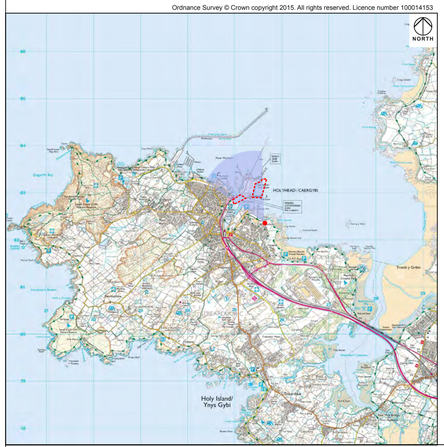

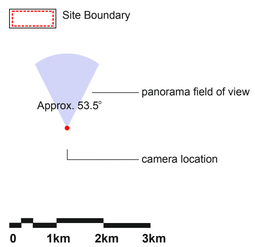

View 01
Year 1 View

Notes
·Print at A1
·View flat at a comfortable arm's length
·The above panoramic image has been digitally merged together from multiple photographs

Grid reference: E225635, N382349
Elevation: 12m AOD
Direction of centre of view: 301°
Field of view: 53.5° (HFOV), 18.2° (VFOV)
Distance to site boundary: 540m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 11.00, 03/09/2018
Weather conditions: High cloud, clear visibility

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Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 01
VIEW 1 FROM PROPERTIES AT PEIBIO CLOSE
Date: **MARCH 2019**
Figure: **2366.10 (sheet 2 of 2)**

Viewpoint 2: Looking north from Skinners Monument, near properties at Harbour View

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Site Boundary

Approx. 53.5°

panorama field of view

camera location

0 1km 2km 3km

View 02
Existing View

Notes
·Print at A1
·View flat at a comfortable arm's length

Grid reference: E225061, N382247
Elevation: 25m AOD
Direction of centre of view: 21°
Field of view: 53.5° (HFOV), 18.2° (VFOV)
Distance to site boundary: 505m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 11.45, 03/09/2018
Weather conditions: High cloud, clear visibility

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Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 02
VIEW 2 FROM SKINNERS MONUMENT
Date: **MARCH 2019**
Figure: **2366.11 (sheet 1 of 2)**

Viewpoint 2: Photomontage view of the proposed Salt Island Expansion and Pelham Patch Development

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Site Boundary

panorama field of view

Approx. 53.5°

camera location

0 1km 2km 3km

View 02
Year 1 View

Notes
- Print at A1
- View flat at a comfortable arm's length
- The above panoramic image has been digitally merged together from multiple photographs

Grid reference: E225061, N382247
Elevation: 25m AOD
Direction of centre of view: 21°
Field of view: 53.5° (HFOV), 18.2° (VFOV)
Distance to site boundary: 505m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 11.45, 03/09/2018
Weather conditions: High cloud, clear visibility

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Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 02
VIEW 2 FROM SKINNERS MONUMENT
Date: **MARCH 2019**
Figure: **2366.11 (sheet 2 of 2)**

Viewpoint 3: Looking south east from properties at Fair View, near the Isle of Anglesey Coastal Path

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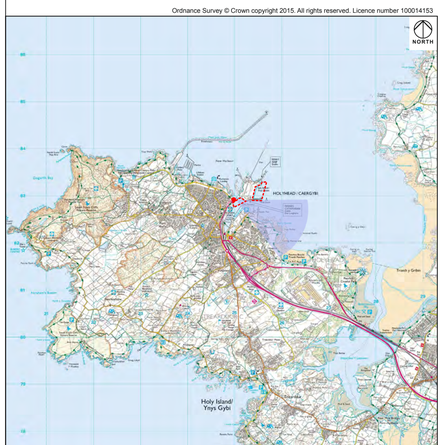

Site Boundary

Approx. 53.5°

panorama field of view

camera location

0 1km 2km 3km

View 03
Existing View

Notes
·Print at A1
·View flat at a comfortable arm's length

Grid reference: E224990, N382903
Elevation: 4m AOD
Direction of centre of view: 147°
Field of view: 53.5°(HFOV), 18.2°(VFOV)
Distance to site boundary: 30m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 12.02, 03/09/2018
Weather conditions: High cloud, clear visibility

Estell Warren
Landscape Architecture

Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 03
VIEW 03 FROM PROPERTIES AT FAIR VIEW
Date: **MARCH 2019**
Figure: **2366.11 (sheet 1 of 2)**

Viewpoint 3: Photomontage view of the proposed Pelham Patch Development

Note:
Proposed features shown at Pelham Patch Development are overlain onto the existing photograph view and not fully merged.

The existing fence shown in the foreground will be replaced with a proposed chain link fence.

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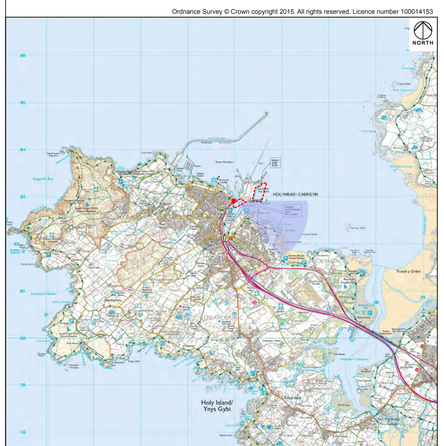
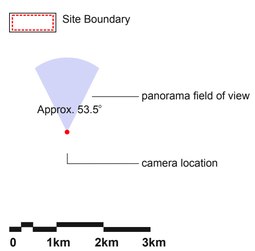




View 03
Year 1 View

Notes
·Print at A1
·View flat at a comfortable arm's length
·The above panoramic image has been digitally merged together from multiple photographs

Grid reference: E224990, N382903
Elevation: 4m AOD
Direction of centre of view: 147°
Field of view: 53.5°(HFOV), 18.2°(VFOV)
Distance to site boundary: 30m

Camera body: Nikon D600
Lens: 50mm prime
Camera height above ground level: 1.7m
Time and date of photo: 12.02, 03/09/2018
Weather conditions: High cloud, clear visibility

Estell Warren
Landscape Architecture

Project
HOLYHEAD PORT EXPANSION
VISUAL ASSESSMENT
Drawing Title
PHOTOMONTAGE 03
VIEW 03 FROM PROPERTIES AT FAIR VIEW
Date: **MARCH 2019**
Figure: **2366.11 (sheet 2 of 2)**

Appendix 1

LVIA Methodology

1. INTRODUCTION

The purpose of the landscape and visual assessment (LVIA) process is to identify the potential effects of a proposed development on the landscape and visual amenity resource of the area in which the development is located.

LVIA is either carried out formally as part of the Environmental Impact Assessment (EIA) process or informally as a contribution to an 'appraisal' or general understanding of the environmental effects of a development. In both cases the general principles and approach remain the same but the 'appraisal' approach may be simplified.

The key purpose of EIA Directives and legislation is to ensure that *likely significant effects* on the environment are taken into account during the development control process. This methodology has been prepared to identify *likely significant landscape and visual effects* to inform the EIA and decision-making process, but also to identify lesser effects, to help provide a rounded picture of the effect a development proposal may have on its landscape and visual context.

2. GUIDANCE AND APPROACH

This assessment methodology has been developed from the general guidance given in the Guidelines for Landscape and Visual Impact Assessment (GLVIA), Third Edition Landscape Institute & Institute of Environmental Management and Assessment 2013.

It should be noted that GLVIA3 does not provide a prescriptive LVIA methodology and relies on practitioners to develop their own specific methodologies based on the characteristics of the development proposal at hand and the landscape in which it is located, combined with professional judgement and experience. This methodology sets out the general approach to the LVIA process adopted by Estell Warren Ltd. Project specific methodology (as described in section 7 below) is to be defined based on the nature of the development, the characteristics of the landscape setting and the outcome of discussions with the planning authority and interested parties.

EIA Regulations[1] specify that an assessment of likely significant effects should cover certain aspects of a proposed development, these are set out in Table 1 below and cross referenced to the LVIA process for clarity:

[1] Schedule 4, Part 1 of The Town and Country Planning (Environmental Impact Assessment) Regulations 2011

Table 1: Relationship between EIA Regulations and LVIA Process	
EIA Aspects	**Interpretation of EIA Aspects Within LVIA Process / Reporting**
Direct effects	Direct physical effects of a proposal should be described in the LVIA, including quantities where appropriate (for example, loss of Xha broadleaved woodland).
Indirect and secondary effects	Indirect effects include perceptual and visual effects on landscape character and visual effects on specific receptors. Secondary effects may include further LVIA effects arising from related development, which may be remote from the development site itself (for example, borrow pits, requirement for additional permanent power supplies, off site drainage improvements).
Cumulative effects	The LVIA process should identify, in consultation with the planning authority, whether cumulative effects are likely to arise or not, based on the nature of the development proposal and its context. If potential for cumulative LVIA effects exists the assessment should address this issue.
Whether effects are likely to be short, medium or long term	The LVIA process should identify effects during various stages of a project including the construction stage and/or phased implementation.
Whether effects are temporary or permanent	In relation to the above, the LVIA process should identify whether effects are temporary or permanent (eg are they reversible or irreversible). For certain developments LVIA effects at decommissioning stage should also be assessed.
Whether effects are positive or negative	This is interpreted as either a *beneficial* (positive) or *adverse* (negative) effect in LVIA terms.

3. OVERVIEW OF ASSESSMENT PROCESS

The assessment process comprises:

- Establishment of the *landscape* baseline condition through identification of physical and perceptual landscape characteristics within the site and the surrounding study area (in the form of landscape character assessment) and identification of landscape designations or special interests (including related planning policies);

- Establishment of the *visual* baseline condition through identification and analysis of the existing visual resource that may be affected including the extent and nature of principle views to the proposed development from visual receptors in the study area;

- Identification of landscape and visual receptors to be assessed and assignation of their sensitivity to change;

- Assessment of the occurrence, magnitude and significance of the effects of the proposed development on landscape and visual receptors;

- Iterative development of design changes and/or mitigation measures to avoid, reduce or offset identified adverse effects;

- Re-assessment of effects, on the assumption of established mitigation measures being in place, to identify any residual environmental effects.

Two categories of effects are considered:

- Landscape effects relate to changes in the physical fabric, and/or character of the landscape. Landscape effects may include direct impact upon specific physical landscape elements (for example loss of distinctive topography, woodland or hedgerows) or effects on wider landscape character (for example available views of the development, lighting or sound effects, which may affect how the wider landscape is perceived). Effects on areas of designated landscape (for example National Parks) are also included in this category;

- Visual effects relate to changes that would occur in the composition of view character as a result of implementing a development. View receptors include residents, users of public rights of way, of roads and of recreational facilities. Effects in views from cultural heritage features (for example World Heritage Sites, Registered Parks and Gardens, Scheduled Monuments, other sites of archaeological interest, Listed Buildings and Conservation Areas) may also considered within this category where they are known to be of tourist or community importance.

The key part of the assessment process is the identification of the *significance* of landscape and visual effects. In identifying *significance* a number of factors are considered, including the *sensitivity* of the affected landscape or visual receptor to change, the *magnitude* of the effect and whether effects are beneficial or adverse.

The relative *sensitivity* to change of the landscape and visual resource may vary, for example; a small-scale rural landscape with historic features may be more sensitive to change than an area of undulating topography with enlarged field patterns or an urban fringe landscape which has been modified by man-made detractors. Residents and users of public rights of way would normally be considered more sensitive to change than drivers, given the relative speed at which the observer moves and the transitory nature of views from roads.

The magnitude of an effect depends on the degree to which physical landscape change, landscape character change or change in view character would occur as a result of the development being implemented.

The *duration* and *reversibility* of effects is also taken into account.

For physical landscape features the assessment of magnitude takes into account whether the change is considered to be irreversible or reversible over the short (0-5 years), medium (5-15 years) or long term (15 years plus). For example, removal of ancient semi-natural woodland may be considered irreversible whereas removal of recently planted woodland may be reversible over the short to medium term.

For landscape character and visual receptors the duration and reversibility of a development is identified and noted separately, with the assessment setting out different magnitude (and significance) results for different distinct periods or stages of a development. For example, the effects of a mineral extraction development would be assessed separately for the operational and post operational stages, to allow a clear understanding of the different changes on the landscape or within views over time, including the effects that may be associated with landscape mitigation measures. Timescales for identified LVIA effects should correspond with those set out in the ES for the development as a whole.

4. EXTENT OF THE STUDY AREA

The extent of study area used for the LVIA process should be based on the type of development being proposed and the likelihood of potential significant effects at distance. This may be defined by standoffs from the development site boundary (for example 1 - 3km distances for minerals or built development projects, or a 5km+ distance for overhead transmission line or wind farm development, depending on location), through establishing the extent of landscape character areas directly or indirectly affected by a proposal, or through the use of Zone of Theoretical Visibility (ZTV) mapping (see further below). Whichever approach is adopted, the extent of study area should be agreed with the planning authority at the outset of the assessment process.

5. REPRESENTATIVE VIEWPOINTS

GLVIA3 (at paragraphs 6.16 to 6.24) discusses the use of representative viewpoints as part of the LVIA process and identifies that theses should be selected through discussion with the competent authority and other interested parties. Selection should also be informed by desk research, ZTV analysis and fieldwork with the aim of picking up viewpoint locations '*reasonable and necessary to cover the likely significant effects*' (paragraph 6.21). Also, when selecting viewpoints, '*emphasis must always be on proportionality in relation to the scale and nature of the development proposal and its likely significant effects*,' (paragraph 6.21).

6. ZONE OF THEORETICAL VISIBILITY

ZTV mapping is a digital process which is used to generate a theoretical visual envelope arising from a development, or part of a development, based on a digital terrain model (DTM). This approach generates a 'worst case' potential extent of visual influence that could arise from a proposal on the basis that the DTM does not take into account intervening built form, woody vegetation or minor topographical features, which would otherwise combine in the real world to control the availability of views towards a site. In addition to showing where a development may be visible from, the process is also useful in showing where it is not visible from, enabling assessment focus to be directed to areas with the highest potential for visual or landscape character effects. The technique is of most relevance in open upland landscapes, where intervening features are generally absent. Where woodland blocks are present within a study area these may be modelled into the DTM although it should be recognised that ascribed woodland heights will be estimated.

ZTV mapping may be used to identify the different and / or overlapping visual influences that could arise from different components of a development, from different stages of a development or from cumulative effects associated with other development in the same area.

Estell Warren use LSS Terrain Modelling software for the preparation of ZTV maps and set the observer eye height to 1.7m above ground level. Large scale DTMs are prepared from a combination of Ordnance Survey Terrain 5 and Terrain 50 data as follows:

- 0-3km from site boundary – Terrain 5 data;
- 3km+ from site boundary – Terrain 50 data.

The above approach is used to provide a greater level of terrain accuracy close to a site whilst working within the computational limits of the software. The model is set to take account of earth curvature. Development model points (from which the ZTV is generated) should be set to the worst case height and extent positions with single or multi-point modelling being used depending on the scale of the development.

ZTV mapping may be used to identify the simple zone of theoretical visibility or may be used to identify how much of an observer's horizontal or vertical field of view would potentially be occupied by a development proposal. Similarly, a count of objects or assessment of the extent of visibility of different parts of a development component may be analysed. In all of these cases specific ZTV analysis methodology should be agreed with the planning authority.

7. PROJECT-SPECIFIC METHODOLOGY

Certain aspects of LVIA methodology should be defined for each project, based on the characteristics of the proposed development and its landscape setting. They should be agreed with the planning authority and / or key stakeholders as part of the assessment process:

- Extent of the study area;
- Representative viewpoint locations;
- Determination of landscape sensitivity;
- Determination of visual receptor sensitivity (where different to the general sensitivity ranking identified in this methodology);
- Use of ZTV mapping (to determine whether basic ZTV mapping or specialised mapping should be used and whether different ZTV should be prepared for different development components or stages of the project);
- Identification of the potential for cumulative effects and agree the extent of other development to be considered in the assessment;
- Agreement of photomontage view positions and development stages to be modelled and illustrated;
- Agreement of average vegetation growth rates to be used in photomontage views and for the purposes of assessing the effectiveness of mitigation measures over time.

8. ASSESSMENT LIMITATIONS

Site assessment is undertaken by a qualified landscape architect using publicly accessible viewpoints. Assessment of residential property and other non-accessible receptors is estimated based on effects identified from the closest publicly accessible areas.

The assessment of visual effects is based on views from ground floor areas, including gardens for residential property.

Visual containment and screening provided by vegetation cover does not remain constant throughout the year. The assessment of effects is based on an estimate of worst case winter views, where deciduous woody species have lost their leaves and a filtering branch structure remains. Where possible, depending on assessment timescale, a combination of in-leaf and out of leaf photographs will be taken and included within the LVIA report.

Assessment of Landscape Effects

The GLVIA state (at paragraph 5.1):

An assessment of landscape effects deals with the effects of change and development on landscape as a resource. The concern here is with how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. (LI & IEMA, 2013)

The landscape baseline should be established using existing Landscape Character Assessment (LCA) studies (where available, of relevant scale and up to date) or additional/ new LCA should be undertaken in accordance with current guidelines to establish Landscape Character Areas within the study area. Where existing LCA information is to be used a judgement should be made as to accuracy and suitability for the purposes of LVIA; for example, are key characteristics representative of what is seen on the ground? Are character area boundaries accurate and consistent?

Landscape receptors may include Landscape Character Areas, specific Landscape Types within the Character Areas, and international, national or locally designated areas and features (for example National Parks, Areas of Outstanding Natural Beauty, Special Landscape Areas and Areas of High/ Great Landscape Value). The GLVIA identifies that within the overall framework of LCA and landscape designations more specific landscape receptors, or components, may be identified such as *overall character and key characteristics, individual elements or features, and specific aesthetic or perceptual aspects*. A key part of the LVIA process is to establish which range of landscape receptors are likely to be affected by a proposed development before taking them forward for assessment.

The *sensitivity* of identified landscape receptors can be derived from a judgement of the *value* attached to a landscape and its *susceptibility* to the specific change associated with the type of development being assessed (see GLVIA Figure 5.1 and paragraphs 5.39 to 5.47). It should be noted that the sensitivity of a landscape receptor to the type of development being assessed may be different to the inherent sensitivity that may be identified in general LCA or other sensitivity studies.

Determination of Landscape Receptor Value

As noted at paragraph 5.45 of the GLVIA the value of landscape receptors will, to a degree, reflect landscape designations, but may be moderated by consideration of the range of factors set out in Box 5.1 of the GLVIA. In the same vein a non-designated landscape may be given a higher value based on consideration of the Box 5.1 factors.

The following approach is used to identify landscape value:

- Identify any designations assigned to the landscape and give an initial value according to the level of designation;
- Moderate the initial value based on an assessment of criteria given in Box 5.1 to give a final value.

Table 2 sets out typical criteria for assessing landscape value:

Table 2: Assessment of Landscape Receptor Value		
Low	**Medium**	**High**
Non-designated landscapes.	Locally designated landscapes.	Internationally and nationally designated landscapes and landscape features.
Consideration of other value criteria (assessed on a project by project basis with examples given below)		
Condition/ quality		
A landscape with no or few areas intact and/or in poor condition.	A landscape with some areas that are intact and/or in reasonable condition.	A landscape with most areas intact and/or in good condition.
Scenic quality		
A landscape of little or no aesthetic appeal.	A landscape of some aesthetic appeal.	A landscape of high aesthetic appeal.
Rarity and representativeness		
A landscape which does not contain rare landscape types or features.	A landscape which contains distinct but not rare landscape types or features.	A landscape which contains one or more rare landscape types or features.
Conservation interests		
A landscape with no or limited cultural and/or nature conservation content.	A landscape with some cultural and/or nature conservation content.	A landscape with rich cultural and/or nature conservation content.
Recreation value		
A landscape with no or limited contribution to recreational experience.	A landscape which provides some contribution to recreational experience.	A distinct landscape which forms a strong contribution to recreational experience.
Perceptual aspects		
A landscape with prominent detractors, probably part of the key characteristics.	A landscape with detractors that also retains some perceptual values.	A wild, tranquil or unspoilt landscape without noticeable detractors.
Cultural associations		
A landscape without recorded associations.	A landscape with some and/or moderately valued associations.	A landscape of rich and/or highly valued associations.
Overall judgement of landscape value		
Low value – receptor poorly reflects high and medium value criteria above.	**Medium value** – receptor moderately reflects high and medium value criteria above.	**High value** – receptor strongly reflects high and medium value criteria above.

Value judgements will be recorded for each landscape receptor using the above format.

Determination of susceptibility

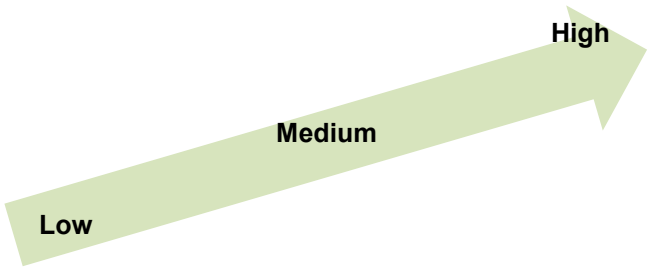
The susceptibility of a landscape receptor to change is assessed based on the broad criteria below in combination with consideration of the nature of the development proposal. Table 3 is shown as an example, criteria may change depending on project type. Susceptibility assessment will distinguish between receptors which are expected to be directly (eg physically) or indirectly (eg visually, aurally) affected, to ensure that the final judgement on sensitivity reflects the likely effects of a scheme rather than overall landscape sensitivity to change.

Table 3: Assessment of Landscape Receptor Susceptibility		
Less susceptible to change	***Moderately susceptible to change***	***Highly susceptible to change***
Pattern, complexity and physical susceptibility to change		
A simple, monotonous and/or degraded landscape with common/ indistinct features and minimal variation in landscape pattern.	A landscape with mostly intact pattern and/or with a degree of complexity and with features mostly in reasonable condition.	A strongly patterned/ textured or a simple but distinctive landscape and/or with high value features and essentially intact.
Visual susceptibility to change		
A very enclosed landscape which contains or strongly filters views, with an absence of visual landmarks and a lack of intervisibility with designated landscapes.	A partially enclosed landscape with some visual containment and filtering, possible limited intervisibility with visual landmarks and designated landscapes.	An open or exposed landscape with extensive intervisibility and no or very limited visual filtering or enclosure. Prominent visual landmarks may be present, and intervisibility with designated landscapes may occur.
Experiential susceptibility		
A landscape with prominent visual and/or aural intrusion and close relationship with large scale built development/ infrastructure. A landscape which contains many light sources and essentially suffers from light pollution.	A partially tranquil landscape with limited visual and/or aural intrusion, some relationship with built development/ infrastructure may be present. A landscape which contains some light sources.	A very tranquil, wild or remote landscape with little or no sense of visual or aural intrusion. A landscape which contains very few light sources and provides dark skies.

Sensitivity

The general relationship between value, susceptibility and sensitivity is shown in Table 4.

Table 4: Assessment of Landscape Sensitivity	**Susceptibility of landscape receptor**		
	Low	Medium	High
Receptor value High			
Medium			
Low			



Determination of sensitivity is based on professional judgement, however, high value/ high susceptibility receptors are likely to be highly sensitive to change, with lower value and/or low susceptibility receptors being likely to be of low sensitivity to change. A three point scale is used to define landscape receptor sensitivity:

- High
- Medium
- Low

Magnitude

The magnitude of change arising from a development on landscape receptors is identified using professional judgement based on the broad criteria in Table 5.

Table 5: Assessment of Magnitude of Change for Landscape Receptors	
Magnitude	**Typical Criteria for Landscape Receptors**
High	Major removal or addition of landscape features or removal of localised but unusual or distinctive landscape features and/or addition of new conspicuous features and elements which may alter the character of the landscape (with uncharacteristic features being negative and characteristic features being positive). Physical loss of landscape features that are not replaceable or are replaceable only in the long term.
Medium	Moderate removal or addition of landscape features and/or addition of new noticeable features and elements which would be clearly visible but would not alter the overall character of the landscape (with uncharacteristic features being negative and characteristic features being positive). Physical loss of landscape features that are replaceable in the medium term.
Low	Minor removal or addition of landscape features and/or addition of new discrete features and elements which would be perceptible within but would not alter the overall character of the landscape (with uncharacteristic features being negative and characteristic features being positive). Physical loss of landscape features that are readily replaceable in the short term.
Negligible	Barely perceptible removal or addition of landscape features would occur and the development would be barely perceptible in visual/ character terms.

Where magnitude of change is considered to fall between high, medium and low categories, intermediate categories of *low medium* and *medium high* will be introduced.

Beneficial or Adverse Change

Magnitude is also assessed as being either a beneficial or adverse change where:

- For beneficial change the proposed development, or part of it, would appear in keeping with existing landscape character and would make a positive visual and/or physical contribution to key characteristics. Removal of uncharacteristic features would also be a beneficial change;

- For adverse change the proposed development, or part of it, would be perceived as an alien or intrusive component in the context of existing landscape character and would have a negative visual and/ or physical effect on key characteristics.

Perceptual Effects

Certain landscape characteristics may relate to perceptual qualities, for example tranquillity, wildness, sounds, human activities or the presence and movement of wildlife.

Where appropriate, an assessment of effects on perceptual landscape qualities should be undertaken. Available quantitative evidence from other EIA disciplines for example noise, lighting, transport or ecology assessments, may be used to help inform an understanding of the degree of potential change to perceptual qualities. It should be recognised, however, that LVIA commentary on effects on perceptual characteristics is likely to remain subjective.

10. ASSESSMENT OF VISUAL EFFECTS

For *visual receptors* the criteria adopted for classification of sensitivity and magnitude are as follows:

Sensitivity

A visual receptor is a human user of the landscape. The practice has adopted the principle that the sensitivity for each type of visual receptor is inherent to the nature of the activity they are undertaking rather than the view itself. For example, all users of public rights of way are considered highly sensitive to a change in view, whether using a well-loved urban edge footpath or a remote mountain pass in a National Park. Judgements relating to the 'value' of a view may be taken into account in the assessment of magnitude of change rather than assessment of sensitivity.

Exceptions to the above principle include road users. Drivers on faster roads (eg 'A' and 'B' class roads and motorways) are considered to be of lower sensitivity than those using minor country lanes, where the purpose of the journey may include an element of appreciating the surroundings, rather than simply moving from A to B.

Effects in views from cultural heritage sites are included where appropriate, for example when they are known to be used by tourists, form part of the overall tourist experience (for example where they are a noticeable contributor to the key characteristics of a place) or where they form a local community feature. Effects on the setting of cultural heritage features are not included in this assessment and would be covered separately under the Cultural Heritage section of the ES where appropriate.

Table 6: Visual Receptor Sensitivity	
Sensitivity	**Typical Criteria for Visual Receptors**
High	Users of residential properties, public rights of way, named viewpoints and scenic roads or railways. Users of passive recreational areas. Users of cultural heritage features including World Heritage Sites, Registered Parks and Gardens, Scheduled Monuments, Listed Buildings and Conservation Areas where they are known to be tourist destinations or places used by local communities.
Medium	Users of offices, play areas, sporting and outdoor active recreational facilities and rural roads.
Low	Users of industrial and employment areas, users of main roads, motorways and rail network.

Magnitude

The magnitude of a visual effect will be dependent upon a number of factors; the character and extent of the existing view, the distance from receptor to development, changes in the view composition and proportion of the view affected by the proposed development. Identification of magnitude is based on professional judgement using the broad criteria in Table 7.

Table 7: Assessment of Magnitude of Change for Visual Receptors	
Magnitude	**Typical Criteria for Visual Receptors**
High	The proposed development, or part of it, would become the dominant feature or focal point of the view.
Medium	The proposed development, or part of it, would form a noticeable feature or element of the view.
Low	The proposed development, or part of it, would be perceptible but would not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the proposed development would be discernible, or the development is at such a distance that it would form a barely noticeable feature or element of the view.

Where magnitude of change is considered to fall between high, medium and low categories, intermediate categories of *low medium* and *medium high* will be introduced.

Beneficial or Adverse Change

Magnitude is assessed as being either a beneficial or adverse change where:

- For beneficial change the proposed development, or part of it, would be perceived as a positive addition in the context of existing view character;
- For adverse change the proposed development, or part of it, would be perceived as an alien or intrusive component in the context of existing view character.

View Value

Where a view is recognised as being of special value, for example in relation to a scenic drive, a named panoramic viewpoint or distinct views which feature in literature or art, this would be recorded and taken into account during the assessment of magnitude.

11. SIGNIFICANCE OF LANDSCAPE AND VISUAL EFFECTS

The *significance* of an effect is dependent on the *sensitivity* of a landscape resource or visual receptor and the *magnitude* of the change. The significance of an effect can be determined using the indicative matrix as shown in Table 8.

Table 8: Indicative Assessment Matrix

	Sensitivity of receptor		
Magnitude of change	Low	Medium	High
High	Moderate effect	Moderate major effect	Major effect
Medium high	Minor moderate effect	Moderate effect	Moderate major effect
Medium	Minor effect	Minor moderate effect	Moderate effect
Low medium	Minor negligible effect	Minor effect	Minor moderate effect
Low	Negligible effect	Minor negligible effect	Minor effect
Negligible	Negligible effect	Negligible effect	Minor negligible effect

Professional judgement and experience is used to identify levels of significance of effect for each receptor with the outcome being reported on a seven point scale:

- Major
- Moderate major
- Moderate
- Minor moderate
- Minor
- Minor negligible
- Negligible

The significance of effects can generally be defined as shown in Table 9. The intermediary categories of *minor negligible, minor moderate* and *moderate major* will be used where the significance of effect is considered to fall between the broad definitions outlined below.

Table 9: Definition of Significance Scale	
Criteria	**Description**
Major	Large scale changes in landscape or visual conditions, affecting high sensitivity receptors.
Moderate	Noticeable changes in landscape or visual conditions, likely to be affecting high or medium sensitivity receptors.
Minor	Small changes in landscape or visual conditions, affecting any receptors.
Negligible	Insignificant changes in landscape or visual conditions, affecting any receptors.

For the purposes of this assessment **major, moderate major** and **moderate** effects may be considered to be likely significant effects in terms of EIA Regulations.

The identified *significance* of an effect carries forward the ***beneficial*** or ***adverse*** nature of the effect identified in the assessment of *magnitude* of impact.

Where an effect is not expected to change the baseline condition, or results in a change that is neither beneficial or adverse, it is considered to be ***neutral***.

12. DURATION AND PERMANENCY OF EFFECTS, ASSESSMENT OF MITIGATION MEASURES AND RESIDUAL EFFECTS

A development may have different effects on landscape and visual receptors at different points in time. For example, construction effects may be different to operational effects, or a project may be built in discrete phases.

The assessment process should identify and record the effects on landscape and visual receptors at appropriate stages in the life of a development and state whether these effects are temporary or permanent and over which timescales they would occur.

For physical loss of landscape features the potential reversibility (or irreversibility) of the effect is taken into account in the assessment of magnitude of change. Where reversible effects occur commentary should also be provided on the timescales likely to be involved in re-establishing the feature (short term 0-5 years, medium term 5-15 years or long term 15 years plus). For landscape character and visual effects duration and permanency are taken into account through the assessment of the scheme at distinct stages, with key relationships being drawn out in supporting text.

Built-in mitigation measures are taken into account as part of the initial assessment of effects. The longer term effect of mitigation measures, for example planting works, is identified separately by assessing subsequent phases and/or the long term residual effects of a scheme. Where a project involves the planned long-term removal of development features, as may occur in renewable energy schemes for example, this would also be taken into account during the assessment of residual effects.

13. CUMULATIVE EFFECTS

The 2002 edition of the GLVIA provides a definition of cumulative landscape and visual effects as those that:

'result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future.'

Discussions with the planning authority and key stakeholders should be undertaken to establish whether cumulative likely significant effects could arise from landscape and visual changes associated with the development proposal. 'Actions likely to occur in the foreseeable future' should be interpreted as live or approved planning applications.

If potential for likely significant cumulative effects is identified, the range and nature of other projects to be considered should be established and the range of potential physical, character and visual effects should be identified and assessed against the baseline resource. In practice, cumulative LVIA effects are most likely to arise from intervisibility of development features. ZTV mapping will be used as an initial means of establishing intervisibility between the proposed scheme and cumulative development features, supported by fieldwork to confirm likely effects on the ground. The extent of study area considered for cumulative effects should be based on the ZTV for the development proposal itself.

14. ITERATIVE EIA PROCESS AND MITIGATION DESIGN

EIA and project development activities are normally parallel processes. The outcome of EIA studies should feed back into the design process to ensure environmental factors are taken account of, with the overall aim of avoiding adverse environmental effects in the first instance or reducing unavoidable impacts to acceptable levels.

Based on the initial findings of the LVIA process design changes and/or landscape measures may be proposed to help integrate a development into its landscape setting and to mitigate any adverse landscape or visual effects that have been identified. The LVIA should record this process and identify which measures have been incorporated into a scheme.

15. PHOTOMONTAGE TECHNIQUE

Photomontages may be prepared to illustrate the effect of a proposed scheme within an existing scene. Photomontages may be used to illustrate the effects of a development proposal at key stages in its life, for example:

- Existing view (baseline);
- Construction stage (possibly split into separate phases of construction where distinct changes occur);
- Completed scheme at Year 1 (including mitigation);
- Completed scheme at Year 15 (to demonstrate the possible growth effects of landscape mitigation measures);
- Completed scheme at decommissioning stage.

For each project, however, the stages of a development to be illustrated in photomontages would be agreed with the planning authority and would be dependent on the nature of the development and/or landscape setting.

Methodology for photomontage production is based on the Scottish Natural Heritage publication *'Visual Representation of Wind Farms'* (Version 2.1, December 2014). The process can be summarised as follows:

- Agree representative photomontage locations with the planning authority and/or key stakeholders;
- Undertake site photography using full format DSLR with 50mm prime lens, taking a single frame shot at a fixed height above ground level, centred on the development site and/or a panorama (to be digitally stitched together) and recording viewpoint location in longitude, latitude and elevation (X, Y and Z) co-ordinates using a hand held GPS device;

- Prepare digital 3D model of the proposed development with the model set to real world co-ordinates;
- Render the proposed development using a virtual camera location based on the X, Y and Z co-ordinates taken in the field;
- Insert the development render into the baseline digital photograph using industry standard software;
- Undertake photo editing of the development render and baseline digital photograph (for example to remove existing features or add mitigation measures) to create a realistic impression within the digital photograph;
- Render the final photograph and present in graphic format at 260mm high by 820mm wide.

As an additional step in the process it can be useful to provide the planning authority and key stakeholders with 'schematic' photomontages to illustrate the nature of a development in a simple modelled form within the baseline photograph rather than in full rendered/ photo real format.

End.

Appendix 2

LVIA Representative Viewpoint Analysis Tables

VIEWPOINT 1 (Refer to Figure 2366.07, Representative Viewpoints for larger image)

Looking north west from the Isle of Anglesey Coastal Path, near properties at Peibio Close

Receptor name: Isle of Anglesey Coastal Path / properties at Peibio Close					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E225635, N382349	12mAOD	301 º	03/09/2018, 11.00	Excellent	540m
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					

LANDMAP Visual & Sensory Aspect Area:

Penrhos Coastal Park (bordering Holyhead & Penrhos Beach).

Description of existing view / view quality

A foreground of open, rough amenity grassland, with sea and harbour in mid ground and distant views across Holyhead Bay to the west coast of Anglesey. There are oblique views from properties at Peibio Close towards Salt Island, approximately 550m to the north west. The Isle of Anglesey Coastal Path crosses open grassland to the north of these properties. There is the smell and sound of the sea.

Views are open and expansive, with the focus across Holyhead Bay and headland areas on Anglesey to the east. Views towards the proposed site include foreground industrial / workshop buildings and poor boundary fences that significantly detract from the view. Holyhead mountain can be seen above industrial buildings; its presence reduced by intervening detractors. There are views to the south west toward the dominant (former) aluminium works buildings and stack.

The proposed Salt Island site area is most visible, seen behind Admiralty Pier and lighthouse. The northern section of the proposed Pelham Patch Development is also partially visible. Both development site areas are strongly contained within the existing port setting. Existing port features combine a mix of older features (piers, lighthouses and Harbour Office tower) with modern features. Brightly coloured container / haulage lorries, three large storage silos, lighting masts and the ro-ro ramps at Terminal 3 & 5 are prominent features in the view, seen above the horizon. Ferry movements to and from terminals are a characterful visual feature.

There are attractive features in the view, strong foreground visual detractors and the busy visual interest of the existing port. Overall, view quality is moderate. There is a low sense of tranquillity with industrial and port features dominating the scene towards proposed site areas.

Size or scale of change in the view / Degree of contrast or integration within the view

Construction stage:

Site compounds, storage and batching areas on Admiralty Pier would not be significant in the view, seen against the backdrop of existing buildings, structures vehicles etc on Salt Island. Tall plant, haulage vehicles, dredging and importation of materials by sea going vessels would appear similar to existing port activity. Flashing amber vehicular warning lights would be a distraction in the view. Temporary lighting would be seen in context of existing lighting within the town and port areas. Overall, limited change in the view with construction activity integrating with existing port activity.

Operational stage (refer to Photomontage 01):

Salt Island Expansion: Proposed eastern quay wall would be visible, seen extending north from Admiralty Pier and partially screening views to Terminal 5 structures, the existing rip- rap shoreline and a portion of open sea. The proposed ground plane would be seen as a thin sliver of land. The quay wall would be contiguous with existing harbour wall / sea defence features. Proposed High Bay Warehouses would be seen against a backdrop of existing buildings, structures and lorry / containers. Proposed tall lighting masts would be seen on the horizon to the east of existing lighting on the island. Lorry / coaches / containers would be visible on the proposed reclamation ground plane, partially screening views to existing Terminal 3 & 5 structures and Holyhead Breakwater.

Pelham Patch Development: Proposed quay wall would be partially visible, seen above South Pier and extending south of George IV Arch. The proposed ground plane would be seen as a thin sliver of land. The quay wall would appear contiguous with existing harbour wall features. Stored containers may be visible, seen in context of existing lorry / containers on Salt Island. The majority of the Pelham Patch Development site would be screened by intervening raised ground and scrub vegetation.

The proposed scheme would be seen in context of existing port and harbour features. There would be limited change in the existing view with proposed and existing features appearing contiguous. The proposed ground planes would not be prominent appearing as a thin sliver of land across the low level view. There would be a very low degree of contrast in the view with proposed and existing features appearing to visually integrate. Proposed tall lighting masts on Salt Island Expansion would extend across the skyline further to the east, although these would be seen above existing, lower lighting columns extending along Terminals 4 & 5.

Larger cruise ships would be seen in closer proximity to this location when docked at the proposed Salt Island facility. The presence of cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of receptors.

Duration and reversibility

Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.

Overall magnitude of change and assessment of significance

Project stage	**Magnitude of change**	**Sensitivity**	**Significance**
Construction	Low adverse	High	Minor adverse
Completion of development (Year 1)	Negligible adverse		Minor negligible adverse

VIEWPOINT 2 (Refer to Figure 2366.07, Representative Viewpoints for larger image)

Looking north from Skinners Monument, near properties at Harbour View

Receptor name: Skinners Monument / properties at Harbour View					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E225061, N382247	25mAOD	21º	03/09/2018, 11-45	Excellent	505m
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Holyhead (bordering Holyhead Harbour)					
Description of existing view / view quality					
Elevated, panoramic view. Foreground of steeply descending rocky/ grassy slopes towards harbour with houses to the east. The scene is dominated by large ferry terminal buildings, the railway station and other workshops, ancillary structures, including lighting masts seen high in the skyline. There are large parking and hardstanding areas. Vehicular movements from Salt Island and the other ferry terminals are prominent, particularly during peak disembarkation periods. Ferry movements to and from terminals are a particular feature in views. Pastel coloured residential property facades facing onto the port from the west, provide a middle distance horizon and contrast in scale and form to port facilities. Holyhead Mountain rises clearly into the skyline on the far horizon and is a focal point of the view. Distant views are towards Holyhead Bay and the west coast of Anglesey. Holyhead Breakwater extends below the horizon line and forms a partial backdrop to Salt Island. Brightly coloured container / haulage lorries, storage silos, lighting masts and the roll-on roll-off (ro-ro) vehicular ramps are prominent features. Built features of cultural heritage interest are less prominent in the view, being dominated by modern port facilities and structures. The northern breakwater shoreline to the proposed Salt Island Expansion site is partially visible. The proposed Pelham Patch Development site is clearly visible; the area of intertidal water clearly defined by Old Harbour walls. The scene is visually busy and the perceived tranquillity low due to vehicular movements, noise and activity. Overall view quality is moderate; features within the view are varied, mostly urban / utilitarian but with a strong overall visual character and features that are attractive.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: Site compounds, storage and batching areas on Admiralty Pier would not be significant in the view, seen against the backdrop of existing buildings, structures vehicles etc on Salt Island. Laydown area near Terminal 1 would also appear in character with existing port features. Tall plant, haulage vehicles, dredging and importation of materials by sea going vessels would appear similar to existing port activity. Flashing amber vehicular warning lights would be a distraction in the view. Temporary lighting would be seen in context of existing lighting within the town and port areas. Overall, limited change in the view with construction activity integrating with existing port activity. Operational stage (refer to Photomontage 02): Salt Island Expansion: A small area of the proposed ground plane would be visible seen above Admiralty Pier, screening a small portion of open sea. Proposed High Bay Warehouses would be seen against a backdrop of proposed expansion area and existing terminal facilities. Proposed tall lighting masts would be visible above the far horizon of Anglesey. Lorry / coaches / containers would be visible on the proposed reclamation ground plane, partially screening views to existing Terminal 3 & 5 structures. Pelham Patch Development: Proposed features would be highly visible from the elevated vantage point. The proposed ground plane would be seen across the existing intertidal harbour area; open sea areas in the harbour replaced by raised hardstanding. Stored containers would be visible against a backdrop of Salt Island and vehicular movements along the island access road. The proposed quay wall would appear contiguous with existing harbour wall features. Vessels mooring alongside the quay wall would be clearly visible. The proposed scheme would be seen in context of existing port and harbour features. Although Pelham Patch Development would be relatively prominent there would be limited change in overall view character. There would be a low degree of contrast in the view with proposed and existing features appearing to visually integrate. Proposed tall lighting masts on Salt Island Expansion would extend across the skyline further to the east, although these would be seen above existing, lower lighting columns extending along Terminals 4 & 5, harbour areas and street lighting. Larger cruise ships would be seen in closer proximity to this location when docked at the proposed Salt Island facility. Vessels mooring alongside Pelham Patch would also be more prominent. Cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of receptors. Increased ferry activity would also increase the duration and frequency of port traffic movements although the overall effects upon existing visual character would be limited.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage		**Magnitude of change**	**Sensitivity**	**Significance**	
Construction		Low adverse	High	Minor adverse	
Completion of development (Year 1)		Low adverse		Minor adverse	

VIEWPOINT 3 (Refer to Figure 2366.07, Representative Viewpoints for larger image)

Looking south east from properties at Fair View, near the Isle of Anglesey Coastal Path

Receptor name: Properties at Fair View / Isle of Anglesey Coastal Path

Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E224990, N382903	4mAOD	147º	03/09/2018, 12.02	Excellent	30m
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)

Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations

LANDMAP Visual & Sensory Aspect Area:

Holyhead (bordering Holyhead Harbour)

Description of existing view / view quality

Properties at Fair View and those fronting onto Marine Square, orientate towards the northern boundary of proposed Pelham Patch Development site. The location lies within the Holyhead Beach Conservation Area. Existing views are across the A5154 road and access road to Fair View. A tall steel palisade security fence along the port boundary is a harsh intrusion in the view. Vehicular movements, including large lorries and coaches can be seen immediately within the fenced boundary, and are particularly prominent during peak embarkation / disembarkation periods. The security fence filters views into the Old harbour and is dominant in the skyline looking east. The fence continues to the north east; Harbour Office tower slightly projects above the fence line although the dominant features are tall lighting masts on Salt Island, docked ferries and ships funnels seen in the middle distance. Old warehouses are prominent within Marine Yard to the south. Pastel coloured building facades around Marine Square are attractive features in the view.

The proposed Pelham Patch Development is seen in the filtered view as a narrow strip of water within the Old Harbour. Existing harbour walls are visible to the north east and south west of the site. The proposed Salt Island development site is not visible.

Perceived tranquillity is low due in particular to close range vehicular movements. Overall view quality is low; the port security fence dominates the scene, filtering views and distracting from the colour, variety and activity within the old harbour. Vehicle movements along the port service lane and public highway are a significant detractor within the view.

Size or scale of change in the view / Degree of contrast or integration within the view

Construction stage:

Site compounds, storage and batching areas on Admiralty Pier and laydown area near Terminal 1 would not be significant in the view, seen against a backdrop of existing port facilities. There would be close range views of tall plant, haulage vehicles and other activity during Pelham Patch works. Flashing amber vehicular warning lights would be a distraction in the view. Temporary lighting would be seen in context of existing lighting. Close range activity would be intrusive in the view with combinations of works intensifying visual intrusion at certain periods.

Operational stage (refer to Photomontage 03):

Salt Island Expansion: No clear intervisibility with the proposed Salt Island site. Possible views to upper sections of proposed tall lighting masts, seen in context of existing tall masts and columns.

Pelham Patch Development: The proposed ground plane would partially screen open sea areas in the Old Harbour and a section of existing quay wall to the south. Storage containers would be seen against a backdrop of industrial units and residential properties on rising ground to the south of the port. Containers would obstruct certain views to the south. Standing vehicles may interrupt filtered views (through boundary fencing) to the harbour although this would be temporary and vary as vehicles come and go.

The proposed boundary fence would be chain link and less dominant in the view and allow more open views across the boundary than existing fencing. There would be a new security fence at approximately 50m distance within the site area. The proposed access road alignment would also be located within the site and at greater distance from the receptor location, slightly reducing the existing close range effects of traffic movements.

The proposed scheme would be seen in context of existing port and harbour features. Pelham Patch Development would be relatively prominent although there would be limited change in the overall character of the existing view. Proposed and existing features would visually integrate and there would be a low degree of contrast in the view.

Larger cruise ships would be seen in closer proximity to this location when docked at the proposed Salt Island facility. The presence of cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of receptors. Increased ferry activity would also increase the duration and frequency of port traffic movements although the overall effects upon existing visual character would be limited.

Duration and reversibility

Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.

Overall magnitude of change and assessment of significance

Project stage	**Magnitude of change**	**Sensitivity**	**Significance**
Construction	Medium adverse	High	Moderate adverse
Completion of development (Year 1)	Low adverse		Minor adverse

Comment: Construction stage effects are considered to be worst case and may reduce in intensity and significance at certain periods.

VIEWPOINT 4 (Refer to Figure 2366.08, Representative Viewpoints for larger image)

Looking east from public open space off Prince of Wales Road

Receptor name: Public open space off Prince of Wales Road					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E224822, N383099	9mAOD	118º	03/09/2018, 12.21	Excellent	287m
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Holyhead Harbour (bordering Holyhead)					
Description of existing view / view quality					
The location lies within the Holyhead Beach Conservation Area. The view contrasts in character from simpler elements and open aspect to more complex and cluttered urban / port features. The foreground of mown amenity grass / playing fields is open in character and allows wide, exposed views to the north across New Harbour. Holyhead Breakwater forms a clean northern horizon to the harbour, punctuated by the lighthouse at its end. The west coast of Anglesey forms the distant horizon. To the north east and east the pillars and gantries of Terminal 4 jetty are prominent within the harbour. The rip-rap western shore to Salt Island contrasts with natural intertidal rock outcrops and islands within the bay, also home to small moored vessels. Storage silos and docked ferries / ferry movements are prominent above the skyline on Salt Island, as are tall lighting masts and the multi coloured freight containers that are parked along its western side. A very small section of the proposed Pelham Patch Development may be visible to the south west of the Harbour Office tower and George IV Arch. The ground plane of the proposed Salt Island development site is not visible. Perceived tranquillity is low due in part to vehicle movements along the Price of Wales Road and port activity. Overall view quality is moderate; a balance between simple, attractive features and visually prominent or cluttered elements that detract.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: Glimpsed views to certain construction related activity with upper sections of taller plant etc being visible. However, there would be negligible change in the view with construction works integrating with existing busy port activity and features. Operational stage: Salt Island Expansion: No intervisibility with the proposed Salt Island Expansion ground plane. There would be views to upper sections of proposed tall lighting masts, seen in context of existing masts and columns. Upper sections of proposed High Bay Warehouses would be seen above lorries / freight containers and against a backdrop of distant hills on Anglesey. Pelham Patch Development: No intervisibility with the proposed ground plane. There may be glimpsed views to containers on the site but this would not be significant in context of the existing scene. Larger cruise ships would be seen docked at the proposed Salt Island Expansion mooring and would be a transient, dominant feature in views. The presence of cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of receptors.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage		**Magnitude of change**	**Sensitivity**	**Significance**	
Construction		Negligible adverse	High	Minor negligible adverse	
Completion of development (Year 1)		Negligible adverse		Minor negligible adverse	
Comment:					

VIEWPOINT 5 (Refer to Figure 2366.08, Representative Viewpoints for larger image)

Looking south from near the lighthouse on Holyhead Breakwater

Receptor name: Holyhead Breakwater					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E225691, N384739	8mAOD	193º	03/09/2018, 13.18	Excellent	1.45km
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Holyhead Harbour					
Description of existing view / view quality					
An expansive, open and exposed view from the breakwater. There are dramatic sounds of waves breaking against seaward defences, the call of gulls and wind. Distant land masses on Anglesey are seen across Holyhead Bay. Holyhead Mountain is the dominant land mass to the south west. The Snowdonia and Lleyn Peninsula mountain ranges are seen on the far horizon to the south east. The former aluminium works stack and main building is highly prominent in the skyline. Holyhead town forms a low, rising horizon to the south. The square Ucheldre Centre tower and Skinners Monument are just visible on the horizon. Ferries docked at Salt Island Terminals 3 & 5 are visible on the skyline, seen behind the Orthios Jetty that extends out into New Harbour. Berthed ferries screen views to the eastern margins of Salt Island. Perceived tranquillity is moderate due to large ferry activity. Overall view quality is high with the expanse of sea and land masses balancing the urban and port features.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: Glimpsed views to certain construction related activity with upper sections of taller plant being visible. However, there would be very limited change in the view with construction activity integrating with existing port activity and features. Dredging and importation of materials by sea going vessels would appear similar to existing port activity. Flashing amber vehicular warning lights may be a distraction in the distant view. Temporary lighting would be seen in context of existing lighting within the town and port areas. Overall, limited change in the view with construction activity integrating with existing port activity and features. Operational stage: Salt Island Expansion: The proposed northern quay wall would be screened by Terminal 3, 5 and the Orthios Jetty structures. There would be views to upper sections of proposed tall lighting masts, although these would be seen in context of existing masts and columns. Upper sections of the proposed High Bay Warehouses would be visible against a backdrop of structures on Admiralty Pier and residential and industrial buildings on rising ground to the east of Holyhead. Pelham Patch Development: No intervisibility with the proposed ground plane or site features. Overall no significant visual effects. Proposed development features would be glimpsed only in the distant view and seen in context of existing port and harbour features. Proposed and existing features would visually integrate and there would be a low degree of contrast in the view.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage		**Magnitude of change**	**Sensitivity**	**Significance**	
Construction		Negligible adverse	High	Minor negligible adverse	
Completion of development (Year 1)		Negligible adverse		Minor negligible adverse	
Comment:					

VIEWPOINT 6 (Refer to Figure 2366.08, Representative Viewpoints for larger image)

Looking east from Holyhead Mountain (Anglesey AONB)

Receptor name:					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E222449, N383002	130mAOD	90º	15/11/2018, 10.36	Good	2.5km
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Holyhead Mountain					
Description of existing view / view quality					
An elevated, panoramic view affording highly attractive distant and expansive views across Holyhead and Holyhead Bay with open views to the Anglesey coastline. The mountain terrain forms part of Anglesey AONB. The dramatic form of Holyhead Breakwater is a primary element in views. Orthios Jetty projects out from Salt Island across New Harbour towards the breakwater. Salt Island is visible, with docked or moving ferries the most prominent associated feature. Storage silos and raised ramps from Terminal 3 and 5 can be seen to the north of Salt Island. Lighting masts on Salt Island can be seen rising above Outer Harbour. Numerous moored yachts are visible within the New Harbour marina. Residential areas, industry and Holyhead Port merge into one across the middle distant scene, contrasting with open landscape on Anglesey and the mainland in the distance. The former aluminium works stack and main building is prominent, with the stack clearly visible against the distant landscape. Penrhyn Bay Caravan Park and turbines at Llyn Alaw Wind Farm can be seen in the distance on the Isle of Anglesey.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: Glimpsed, distant views to certain construction related activity however, there would be very limited change in the view with construction works visually integrating with existing busy port activity and features. Operational stage: A very small section of the proposed eastern Salt Island Expansion area would be visible extending to the north from Admiralty Pier towards Terminal 5. Upper sections of the proposed High Bay Warehouses would be visible. Proposed lighting masts would be seen behind existing masts on Salt Island. A sliver of the proposed Pelham Patch Development land, alongside quay wall, may be visible. Given the overall distance to site proposed features would be barely discernible in the view. In context of the wider view glimpsed, distant views to proposed features would not be significant. Proposed and existing features would visually integrate and there would be no significant degree of contrast in the view.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage		**Magnitude of change**	**Sensitivity**	**Significance**	
Construction		Negligible adverse	High	Minor negligible adverse	
Completion of development (Year 1)		Negligible adverse		Minor negligible adverse	
Comment:					

VIEWPOINT 7 (Refer to Figure 2366.09, Representative Viewpoints for larger image)

Looking north west from Penrhos Beach (Anglesey AONB), on headland near the Isle of Anglesey Coastal Path

Receptor name: Penrhos Beach					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E226590, N381812	11mAOD	317º	03/09/2018, 14.43	Excellent	1.5km
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Penrhos Beach					
Description of existing view / view quality					
The eastern headland to the beach area offers a slightly elevated view across Holyhead Bay and Holyhead to the west. The location is one of the closest to the proposed sites from within the AONB. The Isle of Anglesey Coastal Path follows the headland margin. Views are across a grassy rocky foreshore and the dominant expanse of sea in the middle distance. Distant horizons are formed by the sea to the north and by Holyhead town and Holyhead Mountain to the west. The mountain is a prominent and attractive feature in the view. The Anglesey coastline forms the horizon to the east. Salt Island is clearly visible, with raised ferry ramps on Terminals 3 & 5 and the three storage tanks prominent features against the skyline. Docked and moving ferries are notable features in the view. Orthios Jetty extends out across the New Harbour and partially screens views to the breakwater on the far horizon. Lighting masts are visible in the skyline above Salt Island. The proposed Salt Island development site is visible between the Admiralty Pier lighthouse and ferry terminal jetties to the north; visually linked by the existing rip-rap shoreline. The proposed Pelham Patch Development is barely discernible, only very partially visible to the south of the Harbour Office tower. The existing port and harbour form a narrow 'sliver' of developed land, seen within the wider panoramic view between a vast sky and expanse of sea. Overall view quality is good with visual detractors limited to the relatively distant port features on Salt Island that project into the skyline.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: Glimpsed views to certain construction related activity with upper sections of taller plant just visible on the horizon. However, there would be very limited change in the view with construction activity integrating with existing busy port features. Dredging and importation of materials by sea going vessels would appear similar to existing port activity. Flashing amber vehicular warning lights may be a distraction in the distant view. Temporary lighting would be seen in context of existing lighting within the town and port areas. Overall, limited change in the view with construction activity integrating with existing port activity and features. Operational stage: Salt Island Expansion: The proposed eastern quay wall would be visible extending to the north from Admiralty Pier towards Terminal 5. The wall would be seen in place of the existing rip rap sea defence and partially screen the Terminal 5 ro-ro facility. Upper sections of the proposed High Bay Warehouses would be visible. Proposed lighting masts would be seen in context of existing masts on Salt Island. Pelham Patch Development: possible glimpsed, distant view to the northern section of the proposed quay wall although barely discernible in the view with no significant effect. Larger cruise ships would be seen docked at the proposed Salt Island Expansion mooring. The presence of cruise ship and ferry activity is an integral feature of existing visual character and new or altered activity would have no significant bearing on the experience of receptors. In context of the wider panorama, distant glimpsed views to proposed features would not be significant. Proposed and existing features would visually integrate and there would be no significant degree of contrast in the view.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage	**Magnitude of change**	**Sensitivity**	**Significance**		
Construction	Negligible adverse	High	Minor negligible adverse		
Completion of development (Year 1)	Negligible adverse		Minor negligible adverse		
Comment:					

VIEWPOINT 8 (Refer to Figure 2366.09, Representative Viewpoints for larger image)

Looking west from the Isle of Anglesey Coastal Path (Anglesey AONB), near properties and holiday chalets at Penrhyn

Receptor name: Penrhyn / Isle of Anglesey Coastal Path					
Grid reference:	**Elevation:**	**Orientation:**	**Date & time:**	**Visibility:**	**Distance to site boundary:**
E228723, N383931	4mAOD	254º	03/09/2018, 15.21	Excellent	3.1km
Designated site or feature	Residential	PROW	Recreational	Road	Other (describe below)
Plan reference for photograph location: Figure 2366.02, Aerial Photograph and Photograph Locations					
LANDMAP Visual & Sensory Aspect Area:					
Northwest Coast (bordering North-west Drumlins)					
Description of existing view / view quality					
The coastal margin is highly attractive and mostly unspoilt. There is a stoney / sandy shoreline foreground with middle distant views dominated by the sea. Views are open and expansive. Holy Island is seen as a thin sliver of land between sea and sky. Holyhead Mountain is prominent on the horizon as is the stack at the former aluminium works site. Existing port features are barely discernible, seen against a backdrop of Holyhead town and mountain horizon. Overall view quality is good with the only notable visual detractor being the aluminium works stack to the south west.					
Size or scale of change in the view / Degree of contrast or integration within the view					
Construction stage: construction stage activity would barely be perceptible in the distant view with no significant effect. Operational stage: Although theoretically visible proposed features would be seen against a very narrow band of dense urban, port and industrial development. Proposed features would barely be perceptible in the distant view with no significant effect. Larger cruise ships would be seen docked at the proposed Salt Island Expansion mooring although would have no significant bearing on the experience of receptors. In context of the wider panorama, distant glimpsed views to proposed features would not be significant. Proposed and existing features would visually integrate and there would be no significant degree of contrast in the view.					
Duration and reversibility					
Construction activity would be short term and temporary. Proposed development and associated shipping / support activity would be a permanent feature and not reversible.					
Overall magnitude of change and assessment of significance					
Project stage	**Magnitude of change**	**Sensitivity**	**Significance**		
Construction	Negligible adverse	High	Minor negligible adverse		
Completion of development (Year 1)	Negligible adverse		Minor negligible adverse		
Comment:					

Appendix 3

LVIA Glossary of Terms

Glossary of Terms

Term	Definition
Access land	Land where the public have access either by legal right or by informal agreement.
Baseline studies	Work done to determine and describe the environmental conditions against which any future changes can be measured or predicted and assessed.
Characterisation	The process of identifying areas of similar landscape character, classifying and mapping them and describing their character.
Characteristics	Elements, or combinations of elements, which make a contribution to distinctive landscape character.
Consultation bodies	Any body specified in the relevant EIA Regulations which the competent authority must consult in respect of an EIA, and which also has a duty to provide a scoping opinion and information.
Designated landscape	Areas of landscape identified as being of importance at international, national or local levels, either defined by statute or identified in development plans or other documents.
Development	Any proposal that results in a change to the landscape and/or visual environment.
Direct effect	An effect that is directly attributable to the proposed development.
'Do nothing' situation	Continued change or evolution in the landscape in the absence of the proposed development.
Elements	Individual parts which make up the landscape, such as, for example, trees, hedges and buildings.
Enhancement	Proposals that seek to improve the landscape resource and the visual amenity of the proposed development site and its wider setting, over and above its baseline condition.
Environmental Impact Assessment (EIA)	The process of gathering environmental information; describing a development; identifying and describing the likely significant environmental effects of the project; defining ways of preventing/avoiding, reducing, or offsetting or compensating for any adverse effects; consulting the general public and specific bodies with responsibilities for the environment; and presenting the results to the competent authority to inform the decision on whether the project should proceed.

Term	Definition
Environmental Statement	A statement that includes the information that is reasonably required to assess the environmental effects of the development and which the applicant can, having regard in particular to current knowledge and methods of assessment, reasonably be required to compile, but that includes at least the information referred to in the EIA Regulations.
Feature	Particularly prominent or eye-catching elements in the landscape, such as tree clumps, church towers or wooded skylines OR a particular aspect of the project proposal.
Filtered view	A view that is partially obscured by intervening features – often used to describe a view seen through branches and leaves of trees and other vegetation.
Framed view	A defined view seen between obstructing features – often used to describe a narrow view between buildings, landforms or dense vegetation.
Geographical Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.
Heritage	The historic environment and especially valued assets and qualities such as historic buildings and cultural traditions.
Indirect effects	Effects that result indirectly from the proposed project as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.
Intermittent view	A view that becomes available at intervals – typically used to describe a view where gaps and breaks in intervening buildings or vegetation allow a receptor to see a series of narrow or 'framed' views as they move along a route.
Iterative design process	The process by which project design is amended and improved by successive stages of refinement which respond to growing understanding of environmental issues.
Key characteristics	Those combinations of elements which are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Land cover	The surface cover of the land, usually expressed in terms of vegetation cover or lack of it. Related to but not the same as land use.
Land use	What land is used for, based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.

Term	Definition
Landform	The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape	An area, as perceived by people, the character of which is the result of the action and interaction of natural and/or human factors.
Landscape and Visual Impact Assessment (LVIA)	A tool used to identify and assess the likely significance of the effects of change resulting from development both on the landscape as an environmental resource in its own right and on people's views and visual amenity.
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape Character Areas (LCAs)	These are single unique areas which are the discrete geographical areas of a particular landscape type.
Landscape Character Assessment (LCA)	The process of identifying and describing variation in the character of the landscape, and using this information to assist in managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make landscapes distinctive. The process results in the production of a Landscape Character Assessment.
Landscape Character Types (LCT's)	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Landscape classification	A process of sorting the landscape into different types using selected criteria but without attaching relative values to different sorts of landscape.
Landscape effects	Effects on the landscape as a resource in its own right.
Landscape quality (condition)	A measure of the physical state of the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
Landscape receptors	Defined aspects of the landscape resource that have the potential to be affected by a proposal.
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a whole variety of reasons.

Term	Definition
Magnitude (of effect)	A term that combines judgements about the size and scale of effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Obstructed view	Used to describe a view that is, or becomes physically blocked by an intervening feature, eg a building at close range.
Parameters	A limit or boundary which defines the scope of a particular process or activity.
Perception	Combines the sensory (that we receive through our senses) with the cognitive (our knowledge and understanding gained from many sources and experiences).
Photomontage	A visualisation which superimposes an image (often computer generated) of a proposed development upon a photograph or series of photographs.
Receptors	See Landscape receptors and Visual receptors.
Representative Viewpoints	Viewpoints selected to represent the experience of different types of visual receptor (users of public rights of way, residential properties, transport routes, heritage and recreational sites etc) for the purpose of LVIA. A viewpoint may represent a range of different receptor types or groups of similar receptors.
Scoping	The process of identifying the issues to be addressed by an EJA, It is a method of ensuring that an EIA focuses on the important issues and avoids those that are considered to be less significant.
Screened view	Used to describe elements in a view that cannot be seen due to intervening features, such as dense vegetation, buildings, topographical variation or a combination of features.
Seascape	Landscapes with views of the coast or seas, and coasts and adjacent marine environments with cultural, historical and archaeological links with each other.
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor.
Significance	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.
Stakeholders	The whole constituency of individuals and groups who have an interest in a subject or place.

Term	Definition
Susceptibility	The ability of a defined landscape or visual receptor to accommodate the specific proposed development without undue negative consequences.
Townscape	The character and composition of the built environment including the buildings and the relationships between them, the different types of urban open space, including green spaces, and the relationship between buildings and open spaces.
Tranquillity	A state of calm and quietude associated with peace, considered to be a significant asset of landscape.
Visual amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.
Visual effects	Effects on specific views and on the general visual amenity experienced by people.
Visual receptors	Individuals and/or defined groups of people who have the potential to be affected by a proposal.
Visualisation	A computer simulation, photomontage or other technique illustrating the predicted appearance of a development.
Zone of Theoretical Visibility (ZTV)	A map, usually digitally produced, showing areas of land within which a development is theoretically visible.

Appendix 4

Consultee Correspondence

Thank you for your reply John.

The points made a duly noted. I can confirm we are also consulting NRW.

kind regards

Mike

On 19/09/2018 07:46, John I. Williams wrote:

Good morning Mike

Have viewed the images and justification documents provided by you in respect of the above with my landscape colleague. They provide a good selection of representative viewpoints for visual receptors such as the AONB, Public Open Space, and Wales Coast Path. As noted photomontages or wire frame may only be relevant to images 1 and 2. It is likely to be more of a visual than landscape assessment (there should be limited direct effects on natural landscape features on the site) and effects on the townscape and port heritage would feature more in the heritage assessment.

As we believe that the source of material to fill the areas under consideration would be supplied from the dredging operation to widen and deepen a channel into the port itself, we consider that there would be no landscape impact as such. However, if material were to be processed and stored on shore, then this would have to be considered in any LVIA undertaken.

Finally, I would confirm that our role in the consideration of Stena's application for a Marine Licence would be as a consultee only and that the application itself will be dealt with by the Welsh Government/Natural Resources Wales. Given this, I presume that you will also consult NRW as to the appropriateness of the viewpoints selected.

Regards

John

From: Mike Estell <mike.estell@estellwarren.co.uk>
Sent: 13 September 2018 16:24
To: John I. Williams <JohnWilliams2@ynysmon.gov.uk>
Cc: Gardiner, J (Jamie) <jamie.gardiner@rhdhv.com>; Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Subject: Holyhead Port Expansion

Hi John

Good to talk to you earlier.

We are undertaking the visual assessment of the proposed Holyhead Port Expansion. Our study will form part of the Environmental Statement to be prepared by RHDHV.

We have identified a series of 'representative viewpoints' that we intend to use as the basis of our assessment. I have attached PDFs of the study area / draft ZTV

(indicating view locations) and the photograph sheets (3 pages). The commentary document gives an outline of locations and reason for selection.

Receptor locations identified include views from the AONB, coastal path and other closer range, high sensitivity receptors. Overall, we consider the number and range of views will provide a comprehensive basis for identifying issues and potential significant effects of the development.

At this stage we are seeking your approval of the selected representative viewpoints and your comments or suggestions for alternative or additional locations.

A further issue to consider will be the requirement for photomontages. The proposed permanent visible structures will be limited to a series of 'sheds' (approx. 12m above ground level), cranes and lighting masts. Those structures would not be significant in the more distant views. In our opinion Views 1, 2 & 3 may be the most beneficial to illustrate as photomontage views, although it's debatable whether or not the production of photomontages is of real merit in this case. We will get a better idea when design proposals are finalised although we'd be very grateful for your initial thoughts.

Let me know if you have any queries or require further information.

kind regards

Mike

--
Mike Estell
Director

Estell Warren Landscape Architecture
5B Chevin Mill
Leeds Road
Otley
West Yorkshire
LS21 1BT

Tel: 01943 464384
Web: www.estellwarren.co.uk

Hi Mike,

I don't think I forwarded this to you before Christmas, but this is confirmation that the Penrhyn viewpoint is not required.

I will be in touch with the updated 3d model and project description.

Thanks

Sarah

From: North Planning [mailto:NorthPlanning@cyfoethnaturiolcymru.gov.uk]
Sent: 20 December 2018 17:47
To: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Cc: Jamie Gardiner <jamie.gardiner@rhdhv.com>
Subject: RE: Holyhead Port - Holyhead Port Expansion - LVIA viewpoints (Pre-App charged) - NRW Response NRW:01060239

Hello Sarah,

Apologies for the long delay in providing you with a response to Jamie Gardiner's memo of the 19th November 2019.

Our Landscape Architect, Richard Sumner, has now reviewed the information within the memo regarding our initial reccomendation for an additional viewpoint at Penrhyn Caravan Park.

To confirm we are content with the conclusions reached that this proposed additional viewpoint is not required.

Kind regards,

Delyth

---------- Original Message ----------
From: Sarah Marjoram
Received: Mon Nov 19 2018 13:09:48 GMT+0000 (GMT Standard Time)
To: North planning; North Planning Mailbox Queue
Cc: Jamie Gardiner; Jamie Gardiner; jamie.gardiner@rhdhv.com
Subject: Holyhead Port - Holyhead Port Expansion - LVIA viewpoints (Pre-App charged) - NRW Response NRW:01060239

Hi Delyth,

Please see our response to NRW's comments attached.

We would be grateful for a response from NRW to confirm if you agree with our conclusion.

Many thanks,

Sarah

From: North Planning [mailto:NorthPlanning@cyfoethnaturiolcymru.gov.uk]
Sent: 01 November 2018 10:16
To: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Subject: Holyhead Port - Holyhead Port Expansion - LVIA viewpoints (Pre-App charged) - NRW Response NRW:0106023

Dear Sarah,
Please find attached our response to the above consultation, if you have any queries please do not hesitate to contact me.

Please note that the invoice for the work will follow at a later date.

Kind Regards

Delyth Rowlands

Tîm Cynllunio Datblygu / Development Planning Team

Cyfoeth Naturiol Cymru / Natural Resources Wales

Ffôn / Tel: 03000 655265
Gwefan / Website: www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu defnyddio a'u gwella mewn modd cynaliadwy, yn awr ac yn y dyfodol.
Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

Appendix I

Traffic Appendices

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I2	2021 Forecast Flows
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I4	Construction Programme
I5	In-migrant Distribution
I6	Resident Distribution
I7	Construction Vehicle Assignment
I8	2021 Peak Daily Construction Flows
I9	2023 Peak Daily Operational Flows
I10	Cruise Call Traffic Derivation
I11	Operational Vehicle Assignment

I1 – Stena Line Commissioned Surveys

APPENDIX I1

Victoria Road, Holyhead ATC 1

Site No. 460301 **Site Ref.** 460301
Holyhead
Channel: Northbound

03 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	146	0	86	15	45	0
01:00	144	0	84	18	42	0
02:00	53	0	18	16	19	0
03:00	21	0	11	2	8	0
04:00	38	0	20	12	6	0
05:00	51	0	21	16	14	0
06:00	140	0	87	21	32	0
07:00	306	2	237	17	50	0
08:00	441	2	397	11	30	1
09:00	424	2	385	13	24	0
10:00	472	0	443	9	19	1
11:00	440	0	400	16	23	1
12:00	428	2	386	16	24	0
13:00	457	3	384	12	57	1
14:00	404	1	357	23	22	1
15:00	473	0	402	27	37	7
16:00	528	4	433	48	41	2
17:00	501	0	421	51	28	1
18:00	419	0	330	48	39	2
19:00	346	1	262	46	36	1
20:00	182	0	149	15	18	0
21:00	162	0	123	14	25	0
22:00	117	0	78	10	28	1
23:00	108	0	49	10	48	1
Total 12H(7-19)	5293	16	4575	291	394	17
16H(6-22)	6123	17	5196	387	505	18
18H(6-24)	6348	17	5323	407	581	20
24H(0-24)	6801	17	5563	486	715	20
AM Peak	10:00	09:00	10:00	06:00	07:00	11:00
	472	2	443	21	50	1
PM Peak	16:00	16:00	16:00	17:00	13:00	15:00
	528	4	433	51	57	7

04 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	115	0	41	14	59	1
01:00	114	0	23	19	70	2
02:00	29	1	2	3	23	0
03:00	13	0	0	5	8	0
04:00	29	0	11	7	11	0
05:00	51	0	21	4	26	0
06:00	128	0	62	14	52	0
07:00	301	3	194	40	62	2
08:00	460	0	356	76	22	6
09:00	355	0	273	58	21	3
10:00	391	1	291	49	50	0
11:00	437	1	330	54	50	2
12:00	533	0	369	76	85	3
13:00	523	1	414	61	43	4
14:00	422	0	384	19	18	1
15:00	499	0	470	15	12	2
16:00	556	1	500	24	31	0
17:00	484	0	442	19	23	0
18:00	436	1	381	22	31	1
19:00	383	1	321	17	44	0
20:00	237	1	193	12	31	0
21:00	174	1	141	17	15	0
22:00	146	0	101	9	35	1
23:00	123	0	81	5	37	0
Total 12H(7-19)	5397	8	4404	513	448	24
16H(6-22)	6319	11	5121	573	590	24
18H(6-24)	6588	11	5303	587	662	25
24H(0-24)	6939	12	5401	639	859	28
AM Peak	08:00	07:00	08:00	08:00	01:00	08:00
	460	3	356	76	70	6
PM Peak	16:00	21:00	16:00	12:00	12:00	13:00
	556	1	500	76	85	4

05 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	142	0	84	10	48	0
01:00	164	0	86	25	53	0
02:00	38	0	20	4	14	0
03:00	30	0	6	13	11	0
04:00	39	0	12	13	14	0
05:00	49	0	25	14	10	0
06:00	107	0	64	19	24	0
07:00	245	1	152	29	61	2
08:00	440	0	383	37	20	0
09:00	449	0	395	35	19	0
10:00	411	0	357	29	25	0
11:00	379	2	309	30	37	1
12:00	469	1	390	29	48	1
13:00	482	1	402	35	43	1
14:00	424	0	376	25	23	0
15:00	494	1	424	33	30	6
16:00	503	0	449	28	23	3
17:00	471	0	421	27	23	0
18:00	446	0	381	28	37	0
19:00	371	1	295	29	44	2
20:00	203	0	154	25	24	0
21:00	200	0	151	21	27	1
22:00	162	0	115	24	22	1
23:00	137	0	82	13	41	1
Total 12H(7-19)	5213	6	4439	365	389	14
16H(6-22)	6094	7	5103	459	508	17
18H(6-24)	6393	7	5300	496	571	19
24H(0-24)	6855	7	5533	575	721	19
AM Peak	09:00	11:00	09:00	08:00	07:00	07:00
	449	2	395	37	61	2
PM Peak	16:00	19:00	16:00	13:00	12:00	15:00
	503	1	449	35	48	6

06 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	159	0	110	10	38	1
01:00	142	0	86	7	49	0
02:00	33	0	14	2	17	0
03:00	26	0	5	11	10	0
04:00	18	0	10	2	6	0
05:00	31	0	16	6	9	0
06:00	82	0	28	41	13	0
07:00	152	0	74	40	38	0
08:00	187	0	150	21	16	0
09:00	286	0	240	37	9	0
10:00	368	0	320	28	20	0
11:00	448	0	381	41	26	0
12:00	518	2	439	45	30	2
13:00	469	0	419	33	17	0
14:00	374	2	335	25	12	0
15:00	357	1	324	17	15	0
16:00	388	0	349	22	17	0
17:00	347	0	311	19	17	0
18:00	341	1	302	25	13	0
19:00	292	0	248	25	19	0
20:00	183	0	149	22	11	1
21:00	131	0	103	19	9	0
22:00	152	0	117	18	17	0
23:00	100	0	79	12	9	0
Total 12H(7-19)	4235	6	3644	353	230	2
16H(6-22)	4923	6	4172	460	282	3
18H(6-24)	5175	6	4368	490	308	3
24H(0-24)	5584	6	4609	528	437	4
AM Peak	11:00	11:00	11:00	11:00	01:00	00:00
	448	0	381	41	49	1
PM Peak	12:00	14:00	12:00	12:00	12:00	12:00
	518	2	439	45	30	2

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Holyhead
Channel: Northbound

07 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	113	0	95	9	9	0
01:00	97	0	73	6	18	0
02:00	43	0	33	1	9	0
03:00	22	0	19	1	2	0
04:00	33	0	22	1	10	0
05:00	24	0	16	1	7	0
06:00	62	0	43	10	9	0
07:00	109	0	78	14	17	0
08:00	107	0	81	7	19	0
09:00	141	0	116	20	4	1
10:00	291	1	258	21	11	0
11:00	347	0	314	19	14	0
12:00	511	0	454	21	36	0
13:00	539	2	484	27	26	0
14:00	301	0	275	14	12	0
15:00	319	0	286	21	12	0
16:00	278	0	248	18	11	1
17:00	258	0	226	17	15	0
18:00	294	0	249	20	25	0
19:00	239	2	201	23	13	0
20:00	160	0	132	16	12	0
21:00	110	0	89	3	17	1
22:00	85	0	74	0	11	0
23:00	65	0	52	1	12	0
Total 12H(7-19)	3495	3	3069	219	202	2
16H(6-22)	4066	5	3534	271	253	3
18H(6-24)	4216	5	3660	272	276	3
24H(0-24)	4548	5	3918	291	331	3
AM Peak	11:00	10:00	11:00	10:00	08:00	09:00
	347	1	314	21	19	1
PM Peak	13:00	19:00	13:00	13:00	12:00	21:00
	539	2	484	27	36	1

08 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	91	0	41	4	46	0
01:00	83	0	23	9	50	1
02:00	24	0	3	1	20	0
03:00	11	0	2	0	9	0
04:00	23	0	8	1	14	0
05:00	38	0	21	1	15	1
06:00	80	0	46	12	22	0
07:00	284	0	219	29	35	1
08:00	470	1	400	40	29	0
09:00	385	0	332	34	19	0
10:00	409	1	336	38	32	2
11:00	417	0	344	38	35	0
12:00	482	0	406	41	34	1
13:00	473	3	393	42	35	0
14:00	362	3	317	24	16	2
15:00	447	2	397	30	15	3
16:00	508	2	451	27	26	2
17:00	439	2	381	28	28	0
18:00	404	0	341	22	41	0
19:00	314	0	253	24	36	1
20:00	168	0	122	20	25	1
21:00	146	0	119	3	24	0
22:00	118	0	79	11	27	1
23:00	104	0	54	2	46	2
Total 12H(7-19)	5080	14	4317	393	345	11
16H(6-22)	5788	14	4857	452	452	13
18H(6-24)	6010	14	4990	465	525	16
24H(0-24)	6280	14	5088	481	679	18
AM Peak	08:00	10:00	08:00	08:00	01:00	10:00
	470	1	400	40	50	2
PM Peak	16:00	14:00	16:00	13:00	23:00	15:00
	508	3	451	42	46	3

09 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	108	0	55	8	45	0
01:00	149	0	65	8	76	0
02:00	46	0	14	5	27	0
03:00	20	0	8	5	7	0
04:00	21	0	12	6	3	0
05:00	45	0	22	14	9	0
06:00	138	0	78	29	31	0
07:00	284	2	218	26	38	0
08:00	470	0	413	29	27	1
09:00	392	0	343	28	20	1
10:00	362	1	308	28	25	0
11:00	422	0	357	27	37	1
12:00	489	2	405	38	44	0
13:00	464	2	383	37	42	0
14:00	436	1	390	28	17	0
15:00	451	0	406	23	16	6
16:00	500	2	433	37	27	1
17:00	472	0	413	30	29	0
18:00	450	2	401	22	24	1
19:00	340	0	275	32	33	0
20:00	212	0	171	16	25	0
21:00	166	1	141	13	11	0
22:00	135	0	99	11	24	1
23:00	124	0	64	16	43	1
Total 12H(7-19)	5192	12	4470	353	346	11
16H(6-22)	6048	13	5135	443	446	11
18H(6-24)	6307	13	5298	470	513	13
24H(0-24)	6696	13	5474	516	680	13
AM Peak	08:00	07:00	08:00	08:00	01:00	11:00
	470	2	413	29	76	1
PM Peak	16:00	18:00	16:00	12:00	12:00	15:00
	500	2	433	38	44	6

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Holyhead
Channel: Southbound

03 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	372	1	272	47	48	4
01:00	81	0	58	11	11	1
02:00	47	0	35	6	6	0
03:00	33	0	24	4	5	0
04:00	16	0	12	2	2	0
05:00	47	0	35	6	6	0
06:00	291	0	213	37	38	3
07:00	276	1	201	35	36	3
08:00	366	1	266	49	48	2
09:00	370	2	267	50	49	2
10:00	354	1	256	48	47	2
11:00	410	0	298	55	54	3
12:00	550	1	400	73	72	4
13:00	396	3	287	53	51	2
14:00	361	3	260	49	47	2
15:00	357	4	257	47	46	3
16:00	444	2	322	59	59	2
17:00	463	3	335	62	61	2
18:00	617	4	447	81	80	5
19:00	319	2	230	43	43	1
20:00	190	0	138	26	25	1
21:00	155	0	113	22	19	1
22:00	85	0	62	11	12	0
23:00	58	0	42	8	8	0
Total						
12H(7-19)	4964	25	3596	661	650	32
16H(6-22)	5919	27	4290	789	775	38
18H(6-24)	6062	27	4394	808	795	38
24H(0-24)	6658	28	4830	884	873	43
AM Peak	11:00	09:00	11:00	11:00	11:00	00:00
	410	2	298	55	54	4
PM Peak	18:00	18:00	18:00	18:00	18:00	18:00
	617	4	447	81	80	5

04 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	337	2	244	43	45	3
01:00	172	0	125	22	23	2
02:00	55	0	40	7	8	0
03:00	23	0	17	3	3	0
04:00	31	0	23	4	4	0
05:00	104	0	76	13	14	1
06:00	188	0	137	24	25	2
07:00	261	0	189	34	35	3
08:00	401	2	289	51	55	4
09:00	330	3	236	42	45	4
10:00	361	5	257	46	49	4
11:00	515	4	372	65	69	5
12:00	581	2	419	75	79	6
13:00	410	0	297	53	56	4
14:00	402	5	288	51	54	4
15:00	453	2	326	58	62	5
16:00	490	6	351	62	66	5
17:00	528	4	379	68	72	5
18:00	574	3	413	74	78	6
19:00	243	2	174	31	33	3
20:00	167	0	121	21	23	2
21:00	129	0	93	17	18	1
22:00	58	0	42	8	8	0
23:00	54	0	40	7	7	0
Total						
12H(7-19)	5306	36	3816	679	720	55
16H(6-22)	6033	38	4341	772	819	63
18H(6-24)	6145	38	4423	787	834	63
24H(0-24)	6867	40	4948	879	931	69
AM Peak	11:00	10:00	11:00	11:00	11:00	11:00
	515	5	372	65	69	5
PM Peak	12:00	16:00	12:00	12:00	12:00	18:00
	581	6	419	75	79	6

05 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	337	1	251	40	42	3
01:00	74	0	56	9	9	0
02:00	47	0	35	6	6	0
03:00	23	0	17	3	3	0
04:00	18	0	13	2	3	0
05:00	73	0	56	8	9	0
06:00	169	0	126	20	22	1
07:00	250	0	187	30	31	2
08:00	398	4	295	47	49	3
09:00	406	3	302	48	49	4
10:00	428	6	315	50	53	4
11:00	485	2	361	58	60	4
12:00	570	4	425	67	70	4
13:00	442	1	330	52	55	4
14:00	458	3	341	54	56	4
15:00	496	2	372	59	61	2
16:00	531	2	399	63	65	2
17:00	641	0	481	76	79	5
18:00	496	4	369	58	61	4
19:00	309	0	231	36	38	4
20:00	187	0	141	22	23	1
21:00	174	0	129	21	21	3
22:00	96	0	72	12	12	0
23:00	76	0	58	9	9	0
Total						
12H(7-19)	5601	31	4177	662	689	42
16H(6-22)	6440	31	4804	761	793	51
18H(6-24)	6612	31	4934	782	814	51
24H(0-24)	7184	32	5362	850	886	54
AM Peak	11:00	10:00	11:00	11:00	11:00	11:00
	485	6	361	58	60	4
PM Peak	17:00	18:00	17:00	17:00	17:00	17:00
	641	4	481	76	79	5

06 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/Van	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	295	2	206	45	42	0
01:00	76	0	54	11	11	0
02:00	39	0	27	6	6	0
03:00	22	0	16	3	3	0
04:00	20	0	14	3	3	0
05:00	25	0	16	4	4	1
06:00	198	0	140	30	28	0
07:00	111	0	77	17	16	1
08:00	160	0	113	24	23	0
09:00	291	3	200	44	42	2
10:00	368	2	256	57	53	0
11:00	386	3	269	59	55	0
12:00	748	2	526	112	105	3
13:00	424	4	294	65	61	0
14:00	399	4	277	61	57	0
15:00	328	2	229	50	47	0
16:00	313	1	218	48	45	1
17:00	324	1	226	50	47	0
18:00	440	5	305	67	63	0
19:00	268	1	186	42	39	0
20:00	186	0	130	29	27	0
21:00	139	0	97	22	20	0
22:00	100	0	70	16	14	0
23:00	84	0	59	13	12	0
Total						
12H(7-19)	4292	27	2990	654	614	7
16H(6-22)	5083	28	3543	777	728	7
18H(6-24)	5267	28	3672	806	754	7
24H(0-24)	5744	30	4005	878	823	8
AM Peak	11:00	11:00	11:00	11:00	11:00	09:00
	386	3	269	59	55	2
PM Peak	12:00	18:00	12:00	12:00	12:00	12:00
	748	5	526	112	105	3

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Holyhead
Channel: Southbound

07 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/IVan	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	200	2	122	51	25	0
01:00	180	2	110	45	23	0
02:00	29	0	18	7	4	0
03:00	23	0	14	6	3	0
04:00	25	0	15	7	3	0
05:00	29	0	17	7	4	1
06:00	129	2	78	32	16	1
07:00	77	0	41	17	8	11
08:00	77	1	46	20	10	0
09:00	158	2	96	40	20	0
10:00	218	2	131	56	28	1
11:00	472	5	287	119	59	2
12:00	458	5	278	116	58	1
13:00	352	4	213	90	45	0
14:00	309	3	187	79	40	0
15:00	303	3	183	78	39	0
16:00	262	3	158	67	34	0
17:00	187	2	113	48	24	0
18:00	325	4	197	83	41	0
19:00	221	2	133	57	28	1
20:00	109	1	65	28	14	1
21:00	104	1	62	27	14	0
22:00	57	0	35	15	7	0
23:00	34	0	20	9	5	0
Total						
12H(7-19)	3198	34	1930	813	406	15
16H(6-22)	3761	40	2268	957	478	18
18H(6-24)	3852	40	2323	981	490	18
24H(0-24)	4338	44	2619	1104	552	19
AM Peak	11:00	11:00	11:00	11:00	11:00	07:00
	472	5	287	119	59	11
PM Peak	12:00	12:00	12:00	12:00	12:00	20:00
	458	5	278	116	58	1

08 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/IVan	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	307	1	223	39	41	3
01:00	103	0	75	13	14	1
02:00	18	0	14	2	2	0
03:00	10	0	8	1	1	0
04:00	17	0	13	2	2	0
05:00	37	0	27	5	5	0
06:00	200	0	145	25	27	3
07:00	254	2	182	32	34	4
08:00	327	3	238	42	44	0
09:00	310	3	222	40	42	3
10:00	327	4	234	42	44	3
11:00	466	4	337	59	63	3
12:00	587	2	426	75	80	4
13:00	391	4	282	50	54	1
14:00	382	3	276	49	52	2
15:00	461	4	329	60	62	6
16:00	472	5	339	61	64	3
17:00	414	2	296	53	57	6
18:00	443	3	320	56	60	4
19:00	270	3	193	35	37	2
20:00	146	0	104	18	20	4
21:00	121	0	87	16	17	1
22:00	60	0	44	8	8	0
23:00	50	0	36	7	7	0
Total						
12H(7-19)	4834	39	3481	619	656	39
16H(6-22)	5571	42	4010	713	757	49
18H(6-24)	5681	42	4090	728	772	49
24H(0-24)	6173	43	4450	790	837	53
AM Peak	11:00	11:00	11:00	11:00	11:00	07:00
	466	4	337	59	63	4
PM Peak	12:00	16:00	12:00	12:00	12:00	17:00
	587	5	426	75	80	6

09 Oct 2018	Total Volume	Bin 1 M/Cycle	Bin 2 Car/IVan	Bin 3 LGV	Bin 4 HGV	Bin 5 Bus
00:00	392	2	288	47	51	4
01:00	100	0	74	12	13	1
02:00	52	0	39	6	7	0
03:00	14	0	10	2	2	0
04:00	19	0	15	2	2	0
05:00	71	0	53	9	9	0
06:00	207	3	151	25	27	1
07:00	299	3	220	36	39	1
08:00	388	6	283	46	50	3
09:00	343	3	253	41	44	2
10:00	369	3	270	44	48	4
11:00	403	3	295	49	52	4
12:00	605	4	445	73	79	4
13:00	426	3	313	52	55	3
14:00	444	3	325	54	57	5
15:00	498	5	366	60	65	2
16:00	488	5	357	58	64	4
17:00	461	3	339	56	60	3
18:00	579	3	427	70	75	4
19:00	265	1	195	32	35	2
20:00	146	0	106	18	19	3
21:00	148	0	108	17	19	4
22:00	79	0	59	9	11	0
23:00	45	0	34	5	6	0
Total						
12H(7-19)	5303	44	3893	639	688	39
16H(6-22)	6069	48	4453	731	788	49
18H(6-24)	6193	48	4546	745	805	49
24H(0-24)	6841	50	5025	823	889	54
AM Peak	11:00	08:00	11:00	11:00	11:00	11:00
	403	6	295	49	52	4
PM Peak	12:00	16:00	12:00	12:00	12:00	14:00
	605	5	445	73	79	5

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (1) Railway Station / Ferry Access / Llanfawr Road / A55

Approach: Railway Station

	Left to Ferry Access								Ahead to Llanfawr Road								Right to A55								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	1	0	0	1	0	0	0	2	0	0	1	0	0	0	0	1	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
1415 - 1430	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	3	0	0	7	1	0	0	0	8	0	0	0	0	0	0	0	0
1430 - 1445	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
1445 - 1500	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**26**	**1**	**0**	**0**	**0**	**27**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	11	0	0	0	0	0	0	0	0
1515 - 1530	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
1530 - 1545	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
1545 - 1600	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**22**	**1**	**0**	**0**	**0**	**23**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
1615 - 1630	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0
1630 - 1645	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	6	0	0	0	0	6	0	0	0	0	0	0	0	0
1645 - 1700	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2	1	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**6**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**1**	**0**	**15**	**2**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	1	0	1	0	0	0	0	2	0	0	2	0	0	0	0	2	1	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0
1715 - 1730	1	0	2	0	0	0	0	3	0	0	2	0	0	0	0	2	1	0	5	0	0	0	0	6	0	0	0	0	0	0	0	0
1730 - 1745	0	0	1	0	0	0	0	1	0	0	4	0	0	0	0	4	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
1745 - 1800	2	0	0	1	0	1	2	6	0	0	3	0	0	0	0	3	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**4**	**0**	**4**	**1**	**0**	**1**	**2**	**12**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**11**	**2**	**0**	**11**	**1**	**0**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1800 - 1815	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
1815 - 1830	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
1830 - 1845	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	8	0	0	0	0	8	0	0	0	0	0	0	0	0
1845 - 1900	0	0	1	1	0	0	1	3	0	0	2	0	0	0	1	3	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**1**	**0**	**0**	**1**	**4**	**0**	**0**	**7**	**0**	**0**	**0**	**1**	**8**	**0**	**0**	**21**	**1**	**0**	**0**	**0**	**22**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	2	0	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1915 - 1930	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
1930 - 1945	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
1945 - 2000	1	0	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**3**	**1**	**0**	**0**	**0**	**5**	**1**	**0**	**3**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2030 - 2045	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2100 - 2115	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
2115 - 2130	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	2	0	0	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
2245 - 2300	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2330 - 2345	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0030 - 0045	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
0045 - 0100	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**6**	**1**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0
0115 - 0130	0	0	1	1	0	0	0	2	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	4	0	0	0	0	0	0	0	0
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
0645 - 0700	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**7**	**3**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
0715 - 0730	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	2	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
0730 - 0745	0	0	0	1	0	0	0	1	0	0	2	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0745 - 0800	0	0	2	0	0	0	0	2	0	0	0	0	0	0	1	1	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**3**	**1**	**0**	**0**	**0**	**5**	**0**	**0**	**3**	**0**	**0**	**0**	**3**	**6**	**0**	**0**	**12**	**2**	**0**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0800 - 0815	0	0	0	1	0	0	1	2	0	0	2	0	0	0	0	2	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
0815 - 0830	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
0830 - 0845	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	9	0	0	0	0	9	0	0	0	0	0	0	0	0
0845 - 0900	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**3**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**23**	**2**	**0**	**0**	**0**	**25**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
0915 - 0930	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0930 - 0945	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	5	1	0	0	0	6	0	0	0	0	0	0	0	0
0945 - 1000	0	0	1	1	0	0	0	2	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**9**	**3**	**0**	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
1015 - 1030	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	4	2	0	0	0	6	0	0	0	0	0	0	0	0
1030 - 1045	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	9	0	0	0	0	0	0	0	0
1045 - 1100	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	2	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**6**	**0**	**0**	**21**	**3**	**0**	**0**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
1115 - 1130	1	0	0	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
1130 - 1145	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
1145 - 1200	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**17**	**1**	**0**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	0	1	1	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	9	0	0	0	0	9	0	0	1	1	0	0	0	2
1215 - 1230	0	0	1	0	0	0	0	1	0	0	5	0	0	0	0	5	0	0	8	1	1	0	0	10	0	0	0	0	0	0	0	0
1230 - 1245	0	0	2	0	0	0	0	2	0	0	4	0	0	0	0	4	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
1245 - 1300	1	0	4	1	0	0	0	6	0	0	2	1	0	0	0	3	0	0	7	0	0	0	1	8	0	0	0	0	0	0	0	0
Hourly Total	**1**	**1**	**8**	**1**	**0**	**0**	**0**	**11**	**0**	**0**	**12**	**1**	**0**	**0**	**0**	**13**	**0**	**0**	**28**	**1**	**1**	**0**	**1**	**31**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**
1300 - 1315	0	0	0	1	0	0	0	1	0	0	4	0	0	0	0	4	0	0	7	1	0	0	0	8	0	0	0	0	0	0	0	0
1315 - 1330	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8	0	0	0	0	0	0	0	0
1330 - 1345	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
1345 - 1400	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**4**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**21**	**3**	**0**	**0**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**15**	**1**	**36**	**19**	**0**	**1**	**4**	**76**	**2**	**0**	**88**	**2**	**0**	**0**	**7**	**99**	**3**	**1**	**287**	**25**	**1**	**0**	**1**	**318**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (1) Railway Station / Ferry Access / Llanfawr Road / A55

Approach: Ferry Access

	Left to Llanfawr Road								Ahead to A55								Right to Railway Station								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**
1400 - 1415	0	0	0	0	0	0	0	**0**	0	0	7	3	3	6	0	**19**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1415 - 1430	0	0	1	0	0	0	0	**1**	0	0	3	6	1	3	0	**13**	0	0	2	1	0	0	0	**3**	0	0	0	0	0	1	0	**1**
1430 - 1445	0	0	0	0	0	0	0	**0**	0	0	3	1	2	0	0	**6**	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
1445 - 1500	0	0	0	0	0	0	0	**0**	0	0	7	2	2	2	0	**13**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**20**	**12**	**8**	**11**	**0**	**51**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**4**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**3**
1500 - 1515	0	0	0	2	0	0	0	**2**	0	0	1	2	0	0	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1515 - 1530	0	0	0	1	0	0	0	**1**	0	0	2	2	1	0	0	**5**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1530 - 1545	0	0	0	1	0	0	0	**1**	0	0	1	1	4	4	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	1	1	0	0	**2**
1545 - 1600	0	0	1	0	0	0	0	**1**	0	0	2	1	1	1	0	**5**	0	0	0	1	0	0	0	**1**	0	0	0	0	1	0	0	**1**
Hourly Total	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**5**	**0**	**0**	**6**	**6**	**6**	**5**	**0**	**23**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**3**
1600 - 1615	0	0	1	0	1	0	0	**2**	0	0	3	3	5	2	0	**13**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1615 - 1630	0	0	1	2	0	0	0	**3**	0	3	9	7	2	3	0	**24**	1	0	0	1	0	0	1	**3**	0	0	0	0	0	0	0	**0**
1630 - 1645	0	0	1	1	1	0	0	**3**	0	0	11	7	2	3	0	**23**	1	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1645 - 1700	0	0	0	0	0	0	0	**0**	0	0	3	1	3	2	0	**9**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**3**	**3**	**2**	**0**	**0**	**8**	**0**	**3**	**26**	**18**	**12**	**10**	**0**	**69**	**2**	**0**	**0**	**1**	**0**	**0**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	0	0	0	0	0	0	0	**0**	0	0	4	0	1	2	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1715 - 1730	0	0	3	0	1	0	0	**4**	0	0	2	0	2	0	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	2	0	0	0	**2**
1730 - 1745	0	0	0	0	0	0	0	**0**	0	0	2	3	3	4	0	**12**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
1745 - 1800	0	0	1	0	1	0	0	**2**	0	0	4	3	3	1	0	**11**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**4**	**0**	**2**	**0**	**0**	**6**	**0**	**0**	**12**	**6**	**9**	**7**	**0**	**34**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**3**
1800 - 1815	2	0	1	0	0	0	0	**3**	0	0	4	0	1	3	0	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1815 - 1830	0	0	1	0	1	0	0	**2**	0	1	59	33	1	21	0	**115**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1830 - 1845	0	0	1	0	1	0	0	**2**	0	0	87	29	4	27	1	**148**	1	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1845 - 1900	0	0	0	0	0	1	0	**1**	0	0	48	12	1	22	1	**84**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
Hourly Total	**2**	**0**	**3**	**0**	**2**	**1**	**0**	**8**	**0**	**1**	**198**	**74**	**7**	**73**	**2**	**355**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	0	0	0	1	0	**1**	0	0	3	0	3	2	0	**8**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1915 - 1930	0	0	0	0	1	0	0	**1**	0	0	5	0	1	1	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1930 - 1945	0	0	0	0	1	0	0	**1**	0	1	0	0	3	4	0	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1945 - 2000	0	0	0	0	0	0	0	**0**	0	0	1	0	4	1	0	**6**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**3**	**0**	**1**	**9**	**0**	**11**	**8**	**0**	**29**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	1	0	0	0	0	**1**	0	0	4	2	2	3	0	**11**	1	0	2	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
2015 - 2030	0	0	0	1	0	0	0	**1**	0	0	4	0	4	0	0	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2030 - 2045	0	0	0	1	0	0	0	**1**	0	0	3	0	1	3	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
2045 - 2100	0	0	2	0	0	0	0	**2**	0	0	6	1	0	2	0	**9**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**3**	**2**	**0**	**0**	**0**	**5**	**0**	**0**	**17**	**3**	**7**	**8**	**0**	**35**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
2100 - 2115	0	0	0	0	1	0	0	**1**	0	0	0	0	1	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2115 - 2130	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
2130 - 2145	0	0	0	0	1	0	0	**1**	0	0	0	0	1	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2145 - 2200	0	0	0	0	0	0	0	**0**	0	0	0	0	3	3	0	**6**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**5**	**3**	**0**	**8**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	0	0	0	0	0	0	0	**0**	0	0	1	0	2	1	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2215 - 2230	0	0	0	0	1	0	0	**1**	0	0	0	1	1	1	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2230 - 2245	0	0	0	1	0	0	0	**1**	0	0	0	0	1	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2245 - 2300	0	0	0	0	0	0	0	**0**	0	0	0	0	2	2	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**1**	**6**	**4**	**0**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	0	0	0	0	0	**0**	0	0	0	0	4	0	0	**4**	0	0	0	0	0	0	1	**1**	0	0	0	0	0	0	0	**0**
2315 - 2330	0	0	0	0	0	0	0	**0**	0	0	1	0	5	1	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2330 - 2345	0	0	0	0	0	0	0	**0**	0	0	1	1	2	3	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
2345 - 2400	0	0	0	0	0	0	0	**0**	0	0	0	0	3	2	0	**5**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**14**	**6**	**0**	**23**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
0000 - 0015	0	0	0	0	0	0	0	**0**	0	0	0	0	2	1	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	1	0	0	0	**1**
0015 - 0030	0	0	0	0	0	0	0	**0**	0	0	17	3	3	4	0	**27**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0030 - 0045	0	0	0	1	0	0	0	**1**	0	0	62	19	12	51	3	**147**	0	0	0	2	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0045 - 0100	0	0	0	1	0	0	0	**1**	0	0	49	20	10	74	1	**154**	0	1	0	1	0	0	0	**2**	0	0	0	1	0	0	0	**1**
Hourly Total	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**128**	**42**	**27**	**130**	**4**	**331**	**0**	**1**	**0**	**3**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**
0100 - 0115	0	0	0	0	0	0	0	**0**	0	0	1	5	8	27	0	**41**	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
0115 - 0130	0	0	0	0	0	0	0	**0**	0	0	2	0	2	9	0	**13**	0	0	0	0	0	0	0	**0**	0	0	1	0	0	1	0	**2**
0130 - 0145	0	0	0	0	0	0	0	**0**	0	0	0	0	2	13	0	**15**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0145 - 0200	0	0	0	0	0	0	0	**0**	0	0	1	0	0	11	0	**12**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**5**	**12**	**60**	**0**	**81**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**3**
0200 - 0215	0	0	0	0	0	0	0	**0**	0	0	1	1	4	4	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0215 - 0230	0	0	1	0	0	0	0	**1**	0	0	7	0	0	8	0	**15**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0230 - 0245	0	0	0	0	0	0	0	**0**	0	0	1	1	0	2	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0245 - 0300	0	0	0	0	0	0	0	**0**	0	0	5	0	1	8	0	**14**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**14**	**2**	**5**	**22**	**0**	**43**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	1	0	0	**1**	0	0	1	0	0	3	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0315 - 0330	0	0	0	0	0	0	0	**0**	0	0	0	0	1	2	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0330 - 0345	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
0345 - 0400	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**2**	**6**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
0400 - 0415	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
0415 - 0430	0	0	0	0	0	0	0	**0**	0	0	0	0	1	1	0	**2**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0430 - 0445	0	0	0	0	0	0	0	**0**	0	0	0	0	0	2	0	**2**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
0445 - 0500	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**
0500 - 0515	0	0	0	0	0	0	0	**0**	0	0	0	0	1	1	0	**2**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0515 - 0530	0	0	0	0	0	0	0	**0**	0	0	8	6	2	28	0	**44**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0530 - 0545	0	0	0	0	0	0	0	**0**	0	0	0	1	2	5	0	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0545 - 0600	0	0	0	0	0	0	0	**0**	0	0	5	0	2	3	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**7**	**7**	**37**	**0**	**64**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	0	0	0	0	0	**0**	0	0	13	5	3	35	2	**58**	0	0	0	0	1	0	0	**1**	0	0	0	0	0	0	0	**0**
0615 - 0630	0	0	0	0	0	0	0	**0**	0	0	2	0	1	6	0	**9**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0630 - 0645	0	0	1	0	0	0	0	**1**	0	1	9	1	1	12	0	**24**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0645 - 0700	0	0	1	0	0	0	0	**1**	0	0	5	1	0	12	0	**18**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**1**	**29**	**7**	**5**	**65**	**2**	**109**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	0	0	0	0	0	0	1	**1**	0	0	0	0	2	3	0	**5**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0715 - 0730	0	0	0	0	0	0	0	**0**	0	0	1	1	1	4	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	2	0	1	0	**3**
0730 - 0745	0	0	0	0	0	0	0	**0**	0	0	0	0	1	3	0	**4**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	**1**
0745 - 0800	0	0	0	0	0	0	0	**0**	0	0	1	0	2	4	0	**7**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**1**	**6**	**14**	**0**	**23**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**0**	**4**
0800 - 0815	0	0	0	0	1	0	0	**1**	0	0	2	5	0	2	0	**9**	1	0	0	1	0	0	0	**2**	0	0	0	0	0	1	0	**1**
0815 - 0830	0	0	0	0	0	0	1	**1**	0	0	0	2	2	3	0	**7**	0	0	0	1	0	0	0	**1**	0	0	2	0	0	0	0	**2**
0830 - 0845	0	0	0	0	0	0	0	**0**	0	0	0	3	1	6	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0845 - 0900	0	0	0	1	1	0	0	**2**	0	0	2	2	0	7	0	**11**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**1**	**2**	**0**	**1**	**4**	**0**	**0**	**4**	**12**	**3**	**18**	**0**	**37**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**4**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**3**
0900 - 0915	0	0	1	0	0	0	0	**1**	0	0	2	1	1	2	0	**6**	1	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0915 - 0930	0	0	1	1	0	0	0	**2**	0	0	0	0	3	3	0	**6**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0930 - 0945	0	0	0	2	0	0	0	**2**	0	0	1	2	0	2	0	**5**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0945 - 1000	0	0	0	0	0	0	0	**0**	0	0	1	4	0	0	0	**5**	2	0	1	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**2**	**3**	**0**	**0**	**0**	**5**	**0**	**0**	**4**	**7**	**4**	**7**	**0**	**22**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	0	0	0	0	0	**0**	0	0	3	5	2	1	0	**11**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1015 - 1030	0	0	1	0	0	0	0	**1**	0	0	4	3	1	2	0	**10**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1030 - 1045	0	0	0	0	0	0	0	**0**	0	0	3	5	0	3	0	**11**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1045 - 1100	0	0	0	0	0	0	0	**0**	0	0	2	2	2	2	0	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**12**	**15**	**5**	**8**	**0**	**40**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	0	0	1	1	0	0	0	**2**	0	0	2	4	0	4	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1115 - 1130	0	0	1	0	1	0	0	**2**	0	0	2	4	2	4	0	**12**	0	0	3	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
1130 - 1145	0	0	0	1	0	0	0	**1**	0	2	30	12	2	36	0	**82**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1145 - 1200	0	0	1	0	0	0	0	**1**	0	0	71	11	2	7	1	**92**	1	0	0	0	0	0	0	**1**	0	0	0	0	1	0	0	**1**
Hourly Total	**0**	**0**	**3**	**2**	**1**	**0**	**0**	**6**	**0**	**2**	**105**	**31**	**6**	**51**	**1**	**196**	**1**	**0**	**3**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**
1200 - 1215	0	0	0	0	0	0	0	**0**	0	0	2	3	4	8	0	**17**	0	0	0	0	0	0	0	**0**	0	0	1	0	1	0	0	**2**
1215 - 1230	0	0	0	1	0	0	0	**1**	0	0	50	26	2	24	3	**105**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1230 - 1245	0	1	0	0	1	0	0	**2**	0	1	7	10	6	25	8	**57**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
1245 - 1300	0	0	0	1	0	0	0	**1**	0	0	11	5	4	12	0	**32**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**0**	**2**	**1**	**0**	**0**	**4**	**0**	**1**	**70**	**44**	**16**	**69**	**11**	**211**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**
1300 - 1315	0	0	0	2	0	0	0	**2**	0	0	3	2	4	7	0	**16**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1315 - 1330	0	0	2	1	0	0	0	**3**	0	0	4	1	2	3	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	1	1	0	**2**
1330 - 1345	0	0	0	1	2	0	0	**3**	0	0	6	2	3	6	0	**17**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
1345 - 1400	0	0	2	1	0	0	0	**3**	0	1	5	0	3	3	0	**12**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**4**	**5**	**2**	**0**	**0**	**11**	**0**	**1**	**18**	**5**	**12**	**19**	**0**	**55**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**2**
TOTAL	**2**	**1**	**28**	**25**	**18**	**2**	**2**	**78**	**0**	**10**	**695**	**299**	**196**	**645**	**20**	**1865**	**9**	**1**	**18**	**13**	**1**	**0**	**2**	**44**	**0**	**0**	**7**	**7**	**11**	**6**	**0**	**31**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (1) Railway Station / Ferry Access / Llanfawr Road / A55

Approach: Llanfawr Road

	Left to A55								Ahead to Railway Station								Right to Ferry Access								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	24	8	0	0	1	33	0	0	2	0	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0
1415 - 1430	0	0	19	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1430 - 1445	0	0	36	6	1	0	0	43	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1445 - 1500	0	0	30	1	0	0	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**109**	**21**	**1**	**0**	**1**	**132**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	52	6	0	0	1	59	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1515 - 1530	0	0	36	10	0	0	0	46	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1530 - 1545	0	0	38	6	1	0	0	45	0	0	3	0	0	0	0	3	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1545 - 1600	0	0	42	8	1	0	1	52	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**168**	**30**	**2**	**0**	**2**	**202**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	0	41	3	1	1	1	47	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1615 - 1630	0	0	37	6	2	2	0	47	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1
1630 - 1645	0	1	48	8	1	0	0	58	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1
1645 - 1700	0	0	35	7	1	0	0	43	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**1**	**161**	**24**	**5**	**3**	**1**	**195**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**2**
1700 - 1715	0	0	34	5	0	0	1	40	0	0	4	0	0	0	0	4	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1715 - 1730	1	0	32	5	0	0	0	38	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1730 - 1745	0	0	35	1	0	0	1	37	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1745 - 1800	0	0	25	1	0	0	0	26	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**126**	**12**	**0**	**0**	**2**	**141**	**1**	**0**	**5**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1800 - 1815	0	0	36	5	0	0	0	41	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1815 - 1830	0	0	30	3	1	0	0	34	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1830 - 1845	0	0	20	2	1	0	0	23	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1845 - 1900	0	0	17	5	0	0	1	23	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**103**	**15**	**2**	**0**	**1**	**121**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	21	1	0	1	1	24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1915 - 1930	0	0	19	2	0	1	0	22	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	3	0	0	0	0	0	0	0	0
1930 - 1945	0	0	24	1	0	0	0	25	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0
1945 - 2000	0	0	19	1	1	0	0	21	0	0	2	0	0	0	0	2	0	0	3	1	0	0	0	4	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**83**	**5**	**1**	**2**	**1**	**92**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**9**	**2**	**1**	**0**	**0**	**12**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
2000 - 2015	0	0	10	1	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
2015 - 2030	0	0	5	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
2030 - 2045	0	0	15	1	0	0	0	16	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045 - 2100	0	0	16	0	0	0	1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**46**	**3**	**0**	**0**	**1**	**50**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**1**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2100 - 2115	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2115 - 2130	0	0	8	0	0	0	0	8	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2130 - 2145	0	0	10	0	1	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	1	0	0	0	1
2145 - 2200	0	0	10	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**41**	**1**	**1**	**0**	**0**	**43**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**
2200 - 2215	0	0	8	0	0	1	0	9	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2215 - 2230	0	0	2	0	0	0	0	2	3	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230 - 2245	0	0	11	2	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2245 - 2300	0	0	1	1	0	0	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**22**	**3**	**0**	**1**	**0**	**26**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2315 - 2330	0	0	7	0	0	0	0	7	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2330 - 2345	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**9**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0045 - 0100	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	4	0	0	0	0	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	1	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**2**	**0**	**1**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0530 - 0545	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0545 - 0600	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**9**	**2**	**0**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	8	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0615 - 0630	0	0	8	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0630 - 0645	0	0	2	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0
0645 - 0700	1	0	1	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**19**	**1**	**1**	**0**	**0**	**22**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**2**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	0	0	7	2	0	0	0	9	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0715 - 0730	0	0	10	1	0	1	0	12	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0730 - 0745	0	0	13	4	0	0	0	17	0	0	1	0	0	0	1	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0745 - 0800	0	0	15	3	1	0	0	19	1	0	2	0	0	0	1	4	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**45**	**10**	**1**	**1**	**0**	**57**	**1**	**0**	**4**	**0**	**0**	**0**	**3**	**8**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0800 - 0815	0	0	32	9	0	0	0	41	0	0	1	0	0	0	1	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0815 - 0830	0	0	21	6	1	1	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0830 - 0845	0	0	38	6	0	0	1	45	0	0	2	0	0	0	0	2	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0
0845 - 0900	0	0	44	6	2	0	1	53	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**135**	**27**	**3**	**1**	**2**	**168**	**0**	**0**	**5**	**1**	**0**	**0**	**1**	**7**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	35	7	0	1	0	43	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0915 - 0930	0	1	25	4	0	0	0	30	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0930 - 0945	1	0	26	6	1	0	0	34	0	0	0	1	0	0	0	1	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0945 - 1000	0	0	16	5	0	0	0	21	0	0	1	0	0	0	0	1	0	0	0	2	1	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**1**	**1**	**102**	**22**	**1**	**1**	**0**	**128**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**4**	**0**	**0**	**2**	**2**	**2**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	34	4	0	1	0	39	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1015 - 1030	0	0	31	3	1	0	0	35	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1030 - 1045	0	0	24	5	0	0	0	29	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1045 - 1100	0	0	24	6	1	0	0	31	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**113**	**18**	**2**	**1**	**0**	**134**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	0	0	27	5	2	1	1	36	0	0	2	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1115 - 1130	0	0	45	6	1	0	0	52	0	0	4	0	0	0	0	4	0	0	1	1	1	0	0	3	0	0	0	0	0	0	0	0
1130 - 1145	0	0	24	5	1	0	0	30	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1145 - 1200	0	0	26	9	1	0	0	36	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**122**	**25**	**5**	**1**	**1**	**154**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**11**	**0**	**0**	**2**	**1**	**1**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	0	0	41	6	0	0	0	47	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1215 - 1230	0	0	21	5	1	1	0	28	3	0	0	0	0	0	0	3	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1230 - 1245	0	0	24	6	0	0	0	30	0	0	4	0	0	0	0	4	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
1245 - 1300	0	0	33	5	1	0	1	40	1	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**119**	**22**	**2**	**1**	**1**	**145**	**4**	**0**	**9**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1300 - 1315	2	0	33	7	1	1	0	44	0	0	2	0	0	0	0	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1315 - 1330	0	0	35	5	0	0	0	40	0	0	1	0	0	0	0	1	0	0	2	0	1	0	0	3	0	0	0	0	0	0	0	0
1330 - 1345	0	0	39	6	1	0	0	46	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1345 - 1400	0	0	35	9	2	0	1	47	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**2**	**0**	**142**	**27**	**4**	**1**	**1**	**177**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**3**	**2**	**1**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**5**	**2**	**1689**	**271**	**31**	**14**	**14**	**2026**	**12**	**0**	**65**	**2**	**0**	**0**	**7**	**86**	**0**	**0**	**26**	**26**	**13**	**1**	**3**	**69**	**0**	**0**	**2**	**1**	**0**	**2**	**0**	**5**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (1) Railway Station / Ferry Access / Llanfawr Road / A55

Approach: A55

	Left to Railway Station								Ahead to Ferry Access								Right to Llanfawr Road								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	6	1	0	0	0	7	0	0	1	1	0	4	0	6	0	0	25	5	0	0	1	31	0	0	0	0	0	0	0	0
1415 - 1430	0	0	3	0	0	0	0	3	0	0	2	1	1	4	0	8	0	0	25	7	1	0	0	33	0	0	0	1	0	0	0	1
1430 - 1445	0	0	7	0	0	0	0	7	0	0	1	3	0	2	0	6	0	0	27	9	0	1	0	37	0	0	1	0	0	0	0	1
1445 - 1500	0	0	5	0	0	0	0	5	0	0	2	3	0	4	0	9	0	0	35	4	0	0	0	39	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**21**	**1**	**0**	**0**	**0**	**22**	**0**	**0**	**6**	**8**	**1**	**14**	**0**	**29**	**0**	**0**	**112**	**25**	**1**	**1**	**1**	**140**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**
1500 - 1515	0	0	9	0	0	0	0	9	0	0	1	3	2	6	0	12	0	0	40	6	0	0	1	47	0	0	0	0	0	0	0	0
1515 - 1530	0	0	5	1	0	0	0	6	0	0	4	0	2	6	0	12	0	0	28	6	1	1	0	36	0	0	0	0	0	0	0	0
1530 - 1545	0	0	5	1	0	0	0	6	0	0	2	1	1	5	0	9	0	0	44	5	2	0	0	51	0	0	1	0	0	0	0	1
1545 - 1600	0	0	4	0	0	0	0	4	0	0	5	2	1	7	0	15	0	0	32	5	1	0	0	38	0	0	1	1	0	0	0	2
Hourly Total	**0**	**0**	**23**	**2**	**0**	**0**	**0**	**25**	**0**	**0**	**12**	**6**	**6**	**24**	**0**	**48**	**0**	**0**	**144**	**22**	**4**	**1**	**1**	**172**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**
1600 - 1615	0	0	3	2	0	0	0	5	0	1	2	1	1	8	0	13	0	0	41	4	0	1	1	47	0	0	0	0	0	0	0	0
1615 - 1630	0	0	5	0	0	0	0	5	0	0	2	4	0	7	0	13	0	0	46	4	2	0	0	52	0	0	0	0	0	0	0	0
1630 - 1645	0	0	4	0	0	0	0	4	0	0	2	2	0	13	0	17	0	0	35	7	1	0	0	43	0	0	0	0	0	0	0	0
1645 - 1700	1	0	3	1	0	0	0	5	0	0	1	0	0	13	0	14	0	0	30	1	0	0	1	32	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**15**	**3**	**0**	**0**	**0**	**19**	**0**	**1**	**7**	**7**	**1**	**41**	**0**	**57**	**0**	**0**	**152**	**16**	**3**	**1**	**2**	**174**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	1	0	6	0	0	0	0	7	0	0	5	1	0	10	0	16	0	0	29	5	0	0	0	34	0	0	1	0	0	0	0	1
1715 - 1730	0	0	7	0	0	0	0	7	0	0	3	1	2	11	0	17	0	0	37	1	0	0	0	38	0	0	1	0	0	0	0	1
1730 - 1745	0	0	5	1	0	0	0	6	0	0	6	2	0	7	0	15	0	0	27	5	0	0	0	32	0	0	0	0	0	0	0	0
1745 - 1800	0	0	3	1	0	1	0	5	0	1	11	2	0	2	0	16	0	0	30	2	1	0	0	33	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**21**	**2**	**0**	**1**	**0**	**25**	**0**	**1**	**25**	**6**	**2**	**30**	**0**	**64**	**0**	**0**	**123**	**13**	**1**	**0**	**0**	**137**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**
1800 - 1815	0	0	7	1	0	0	0	8	0	0	12	4	2	6	0	24	0	0	25	4	1	0	0	30	0	0	0	0	0	0	0	0
1815 - 1830	0	0	6	0	0	0	0	6	0	0	15	2	0	8	0	25	0	0	19	2	0	2	0	23	0	0	1	1	0	0	0	2
1830 - 1845	0	0	10	0	0	0	0	10	0	0	13	4	2	9	0	28	0	1	22	1	0	0	0	24	0	0	0	0	0	0	0	0
1845 - 1900	0	0	3	1	0	0	0	4	0	0	20	4	3	12	0	39	0	0	13	5	0	0	0	18	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**26**	**2**	**0**	**0**	**0**	**28**	**0**	**0**	**60**	**14**	**7**	**35**	**0**	**116**	**0**	**1**	**79**	**12**	**1**	**2**	**0**	**95**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**
1900 - 1915	0	0	2	0	0	0	0	2	0	0	13	5	1	4	1	24	0	0	26	1	0	0	0	27	0	0	0	0	0	0	0	0
1915 - 1930	0	0	5	1	0	0	0	6	0	0	21	7	2	13	0	43	0	0	41	4	0	0	1	46	0	0	0	0	0	0	0	0
1930 - 1945	0	0	1	0	0	0	0	1	0	0	5	2	1	7	1	16	0	0	26	5	0	0	1	32	0	0	0	0	0	0	0	0
1945 - 2000	0	0	3	0	0	0	0	3	0	0	4	1	0	7	0	12	0	0	15	1	1	0	0	17	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**11**	**1**	**0**	**0**	**0**	**12**	**0**	**0**	**43**	**15**	**4**	**31**	**2**	**95**	**0**	**0**	**108**	**11**	**1**	**0**	**2**	**122**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	1	0	0	0	0	1	0	0	3	1	0	8	0	12	0	0	12	0	0	0	0	12	0	0	0	0	0	0	0	0
2015 - 2030	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	5	0	0	13	1	0	0	0	14	0	0	1	0	0	0	0	1
2030 - 2045	0	0	0	0	0	0	0	0	0	0	3	0	0	2	0	5	0	0	13	2	0	0	0	15	0	0	1	0	0	0	0	1
2045 - 2100	0	0	2	0	0	0	0	2	0	0	1	1	0	3	0	5	0	0	10	0	0	0	0	10	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**8**	**2**	**0**	**17**	**0**	**27**	**0**	**0**	**48**	**3**	**0**	**0**	**0**	**51**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**
2100 - 2115	0	0	2	0	0	0	0	2	0	0	5	0	1	2	0	8	0	0	14	0	0	1	0	15	0	0	1	0	0	0	0	1
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	2	1	6	0	9	0	0	11	1	0	0	0	12	0	0	2	0	0	0	0	2
2130 - 2145	0	0	2	0	0	0	0	2	0	0	0	4	1	5	0	10	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0
2145 - 2200	0	0	6	1	0	0	0	7	0	0	0	0	0	6	0	6	0	0	6	2	0	0	0	8	0	0	0	1	0	0	0	1
Hourly Total	**0**	**0**	**10**	**1**	**0**	**0**	**0**	**11**	**0**	**0**	**5**	**6**	**3**	**19**	**0**	**33**	**0**	**0**	**37**	**4**	**0**	**1**	**0**	**42**	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**4**
2200 - 2215	0	0	3	0	0	0	0	3	0	0	3	4	0	5	0	12	0	0	9	0	0	0	0	9	0	0	0	0	0	0	0	0
2215 - 2230	0	0	2	0	0	0	0	2	0	0	3	0	1	6	0	10	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
2230 - 2245	0	0	2	0	0	0	0	2	0	0	2	0	0	6	1	9	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0
2245 - 2300	0	0	3	0	0	0	0	3	0	0	4	4	0	12	0	20	0	0	8	2	0	0	0	10	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**12**	**8**	**1**	**29**	**1**	**51**	**0**	**0**	**27**	**2**	**0**	**0**	**0**	**29**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	2	0	0	0	0	2	0	0	4	2	1	15	0	22	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
2315 - 2330	0	0	1	0	0	0	0	1	0	0	2	1	0	13	0	16	1	0	4	0	0	0	0	5	0	0	0	0	0	0	0	0
2330 - 2345	0	0	3	0	0	0	0	3	0	0	3	2	1	12	0	18	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
2345 - 2400	0	0	3	0	0	0	0	3	0	0	7	5	1	9	0	22	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**16**	**10**	**3**	**49**	**0**	**78**	**1**	**0**	**12**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	0	0	0	0	0	0	0	0	5	7	1	16	1	30	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0015 - 0030	0	0	2	0	0	0	0	2	0	0	1	2	0	23	1	27	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
0030 - 0045	0	0	2	0	0	0	0	2	0	0	2	2	1	12	0	17	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0045 - 0100	0	0	3	0	0	0	0	3	0	0	6	6	0	10	0	22	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**14**	**17**	**2**	**61**	**2**	**96**	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	0	1	0	0	0	1	0	0	4	6	5	14	0	29	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0115 - 0130	0	0	1	0	0	0	0	1	0	0	9	5	2	16	0	32	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	1	5	1	3	21	0	31	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0145 - 0200	0	0	1	0	0	0	0	1	0	0	1	3	1	16	1	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**1**	**19**	**15**	**11**	**67**	**1**	**114**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	1	0	1	11	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	1	2	1	6	1	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	6	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	5	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**3**	**6**	**22**	**1**	**35**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**8**	**0**	**8**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0	5	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	2	1	1	2	0	6	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0430 - 0445	0	0	3	0	0	0	0	3	0	0	0	2	2	2	0	6	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	4	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**5**	**3**	**5**	**8**	**0**	**21**	**0**	**0**	**4**	**1**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	1	0	0	0	1	0	0	0	0	2	4	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	2	0	0	0	0	2	0	0	2	0	1	5	0	8	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0530 - 0545	0	0	1	0	0	0	0	1	0	0	0	0	0	6	0	6	0	0	4	0	0	0	0	4	0	0	1	0	0	0	0	1
0545 - 0600	0	0	1	0	0	0	0	1	0	0	4	0	6	3	0	13	0	0	8	0	0	0	0	8	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**4**	**1**	**0**	**0**	**0**	**5**	**0**	**0**	**6**	**0**	**9**	**18**	**0**	**33**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
0600 - 0615	0	0	2	0	0	0	0	2	0	0	2	1	7	4	0	14	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0615 - 0630	0	0	2	0	0	0	0	2	0	0	6	1	7	7	0	21	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0
0630 - 0645	0	0	4	0	0	0	0	4	0	0	11	1	4	11	0	27	0	0	3	0	0	1	0	4	0	0	0	0	0	0	0	0
0645 - 0700	0	0	4	0	0	0	0	4	0	1	16	4	0	12	1	34	0	0	4	0	0	1	0	5	0	0	0	1	0	0	0	1
Hourly Total	**0**	**0**	**12**	**0**	**0**	**0**	**0**	**12**	**0**	**1**	**35**	**7**	**18**	**34**	**1**	**96**	**0**	**0**	**9**	**2**	**0**	**2**	**0**	**13**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**
0700 - 0715	0	0	6	0	0	0	0	6	0	0	11	3	1	15	0	30	0	0	7	3	0	0	0	10	0	0	0	0	0	0	0	0
0715 - 0730	0	0	2	0	0	0	0	2	0	0	23	4	2	11	0	40	0	0	15	0	0	0	0	15	0	0	0	0	0	0	0	0
0730 - 0745	0	0	5	0	0	0	0	5	0	0	34	8	2	14	0	58	0	0	9	5	0	1	0	15	0	0	0	0	0	0	1	1
0745 - 0800	0	0	7	1	0	0	0	8	0	0	26	3	1	12	0	42	0	0	17	7	0	0	0	24	0	0	0	1	0	0	0	1
Hourly Total	**0**	**0**	**20**	**1**	**0**	**0**	**0**	**21**	**0**	**0**	**94**	**18**	**6**	**52**	**0**	**170**	**0**	**0**	**48**	**15**	**0**	**1**	**0**	**64**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**2**
0800 - 0815	0	0	7	0	0	0	0	7	0	1	16	5	1	8	0	31	0	0	15	9	1	2	0	27	0	0	0	0	0	0	0	0
0815 - 0830	0	0	6	0	0	0	0	6	0	1	10	5	2	1	0	19	0	0	27	4	0	0	0	31	0	0	0	0	0	0	0	0
0830 - 0845	0	0	5	0	0	0	0	5	0	0	7	1	1	5	0	14	0	0	34	5	1	0	0	40	0	0	0	0	0	0	0	0
0845 - 0900	0	0	2	0	0	0	0	2	0	0	6	1	1	6	0	14	0	0	47	10	1	0	0	58	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**20**	**0**	**0**	**0**	**0**	**20**	**0**	**2**	**39**	**12**	**5**	**20**	**0**	**78**	**0**	**0**	**123**	**28**	**3**	**2**	**0**	**156**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	2	1	0	0	0	3	0	0	2	2	0	3	0	7	0	0	32	4	0	0	1	37	0	0	0	0	0	0	0	0
0915 - 0930	0	0	7	0	0	0	0	7	0	0	1	0	3	1	0	5	0	0	27	5	0	0	0	32	0	0	1	1	0	0	0	2
0930 - 0945	0	0	1	0	0	0	0	1	0	0	1	1	0	5	0	7	0	0	26	4	0	0	0	30	0	0	0	0	0	0	0	0
0945 - 1000	0	0	10	1	0	0	0	11	0	0	5	3	1	5	0	14	0	0	29	3	0	0	0	32	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**20**	**2**	**0**	**0**	**0**	**22**	**0**	**0**	**9**	**6**	**4**	**14**	**0**	**33**	**0**	**0**	**114**	**16**	**0**	**0**	**1**	**131**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**
1000 - 1015	0	0	2	0	0	0	0	2	1	0	7	3	0	3	0	14	0	0	25	4	1	0	1	31	0	0	1	0	0	0	0	1
1015 - 1030	0	0	10	1	0	0	0	11	0	0	5	2	1	11	0	19	0	0	28	3	0	0	0	31	0	0	1	0	0	0	0	1
1030 - 1045	0	0	5	1	0	0	0	6	0	0	7	4	5	7	0	23	0	0	33	3	1	1	0	38	0	0	0	0	0	0	0	0
1045 - 1100	0	0	4	1	0	0	0	5	0	0	6	4	0	4	0	14	0	0	28	12	1	1	0	42	0	0	4	0	0	0	0	4
Hourly Total	**0**	**0**	**21**	**3**	**0**	**0**	**0**	**24**	**1**	**0**	**25**	**13**	**6**	**25**	**0**	**70**	**0**	**0**	**114**	**22**	**3**	**2**	**1**	**142**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**
1100 - 1115	0	0	4	0	0	0	0	4	0	0	5	1	1	8	0	15	0	0	36	4	0	2	1	43	0	0	0	0	1	0	0	1
1115 - 1130	0	0	9	1	0	0	0	10	0	0	8	1	0	8	0	17	0	0	28	5	0	1	0	34	0	0	3	0	2	0	0	5
1130 - 1145	0	0	9	0	0	0	0	9	0	0	9	2	3	11	1	26	0	0	26	8	0	0	0	34	0	0	0	0	0	0	0	0
1145 - 1200	0	0	5	0	0	0	0	5	0	0	11	3	4	13	0	31	0	0	26	4	0	2	0	32	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**27**	**1**	**0**	**0**	**0**	**28**	**0**	**0**	**33**	**7**	**8**	**40**	**1**	**89**	**0**	**0**	**116**	**21**	**0**	**5**	**1**	**143**	**0**	**0**	**3**	**0**	**3**	**0**	**0**	**6**
1200 - 1215	0	1	13	2	0	0	0	16	0	0	18	2	3	12	2	37	0	0	27	6	1	0	0	34	0	0	0	0	0	0	0	0
1215 - 1230	0	0	5	0	1	0	0	6	0	0	12	3	5	14	1	35	0	0	29	5	0	0	0	34	0	0	1	0	0	0	0	1
1230 - 1245	0	0	6	0	0	0	1	7	0	0	12	7	1	16	2	38	1	0	30	7	1	0	0	39	0	0	0	1	0	0	0	1
1245 - 1300	0	0	6	0	0	0	0	6	0	0	32	8	4	24	0	68	0	0	28	3	0	0	0	31	0	0	1	0	0	0	0	1
Hourly Total	**0**	**1**	**30**	**2**	**1**	**0**	**1**	**35**	**0**	**0**	**74**	**20**	**13**	**66**	**5**	**178**	**1**	**0**	**114**	**21**	**2**	**0**	**0**	**138**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**
1300 - 1315	0	0	1	1	0	0	0	2	0	0	27	7	2	15	1	52	0	0	30	4	0	0	0	34	0	0	1	0	0	0	0	1
1315 - 1330	0	0	7	0	0	0	0	7	0	0	17	2	2	9	0	30	0	0	31	8	0	0	0	39	0	0	0	0	0	1	0	1
1330 - 1345	0	0	4	1	0	0	0	5	0	0	9	1	1	8	0	19	0	0	28	1	1	0	0	30	0	0	0	0	0	0	0	0
1345 - 1400	0	0	3	1	0	0	0	4	0	0	3	2	2	1	0	8	1	0	31	3	0	0	0	35	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**15**	**3**	**0**	**0**	**0**	**18**	**0**	**0**	**56**	**12**	**7**	**33**	**1**	**109**	**1**	**0**	**120**	**16**	**1**	**0**	**0**	**138**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**2**
TOTAL	**2**	**1**	**330**	**27**	**1**	**1**	**1**	**363**	**1**	**6**	**606**	**215**	**128**	**757**	**15**	**1728**	**3**	**1**	**1626**	**253**	**20**	**19**	**9**	**1931**	**0**	**0**	**28**	**8**	**3**	**1**	**1**	**41**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (2) A55 / A5

Approach: A55 (North)

	Ahead to A5								Right to A55 (West)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	12	2	0	0	0	**14**	0	0	26	9	3	6	1	**45**
1415 - 1430	0	0	11	5	0	0	0	**16**	0	0	19	9	1	3	0	**32**
1430 - 1445	0	0	14	0	0	0	0	**14**	0	0	29	6	3	0	0	**38**
1445 - 1500	0	0	14	0	0	0	0	**14**	0	0	31	3	2	2	0	**38**
Hourly Total	**0**	**0**	**51**	**7**	**0**	**0**	**0**	**58**	**0**	**0**	**105**	**27**	**9**	**11**	**1**	**153**
1500 - 1515	0	0	18	2	0	0	0	**20**	0	0	46	4	0	0	1	**51**
1515 - 1530	0	0	11	3	0	0	0	**14**	0	0	34	9	1	0	0	**44**
1530 - 1545	0	0	16	1	1	2	0	**20**	0	0	26	6	4	2	0	**38**
1545 - 1600	0	0	12	3	0	0	0	**15**	0	0	40	8	2	1	1	**52**
Hourly Total	**0**	**0**	**57**	**9**	**1**	**2**	**0**	**69**	**0**	**0**	**146**	**27**	**7**	**3**	**2**	**185**
1600 - 1615	0	0	11	3	1	0	0	**15**	0	0	33	5	5	2	1	**46**
1615 - 1630	0	0	12	3	1	1	0	**17**	0	3	38	12	3	5	0	**61**
1630 - 1645	0	0	15	5	0	0	0	**20**	1	1	49	10	3	3	0	**67**
1645 - 1700	0	0	7	2	0	0	0	**9**	0	0	33	6	5	2	0	**46**
Hourly Total	**0**	**0**	**45**	**13**	**2**	**1**	**0**	**61**	**1**	**4**	**153**	**33**	**16**	**12**	**1**	**220**
1700 - 1715	0	0	9	2	0	1	0	**12**	0	0	30	3	1	1	1	**36**
1715 - 1730	0	0	10	1	0	0	0	**11**	2	0	31	3	1	0	0	**37**
1730 - 1745	0	0	8	0	1	0	0	**9**	0	0	32	4	3	4	1	**44**
1745 - 1800	0	0	6	2	0	0	0	**8**	0	0	28	3	3	1	0	**35**
Hourly Total	**0**	**0**	**33**	**5**	**1**	**1**	**0**	**40**	**2**	**0**	**121**	**13**	**8**	**6**	**2**	**152**
1800 - 1815	0	0	13	2	0	0	0	**15**	0	0	29	5	1	3	0	**38**
1815 - 1830	0	0	16	6	0	0	0	**22**	0	1	70	31	2	22	0	**126**
1830 - 1845	0	0	10	3	0	0	0	**13**	0	0	107	30	5	26	1	**169**
1845 - 1900	0	0	14	2	0	0	0	**16**	0	1	60	13	1	23	2	**100**
Hourly Total	**0**	**0**	**53**	**13**	**0**	**0**	**0**	**66**	**0**	**2**	**266**	**79**	**9**	**74**	**3**	**433**
1900 - 1915	0	0	7	0	0	0	0	**7**	0	0	17	0	3	3	1	**24**
1915 - 1930	0	0	10	0	0	0	0	**10**	0	0	16	3	1	2	0	**22**
1930 - 1945	0	0	6	0	0	0	0	**6**	0	1	24	1	2	4	0	**32**
1945 - 2000	0	0	10	0	0	0	0	**10**	0	0	12	1	5	1	0	**19**
Hourly Total	**0**	**0**	**33**	**0**	**0**	**0**	**0**	**33**	**0**	**1**	**69**	**5**	**11**	**10**	**1**	**97**
2000 - 2015	0	0	2	1	0	0	0	**3**	0	0	16	2	2	3	0	**23**
2015 - 2030	0	0	5	0	0	0	0	**5**	0	0	6	1	4	0	0	**11**
2030 - 2045	0	0	7	0	0	0	0	**7**	0	0	16	1	1	2	0	**20**
2045 - 2100	0	0	3	0	0	0	0	**3**	0	0	22	1	0	3	1	**27**
Hourly Total	**0**	**0**	**17**	**1**	**0**	**0**	**0**	**18**	**0**	**0**	**60**	**5**	**7**	**8**	**1**	**81**
2100 - 2115	0	0	3	0	0	0	0	**3**	0	0	14	1	1	0	0	**16**
2115 - 2130	0	0	3	0	0	0	0	**3**	0	0	6	0	0	0	0	**6**
2130 - 2145	0	0	4	0	0	0	0	**4**	0	0	9	0	2	0	0	**11**
2145 - 2200	0	0	4	0	0	0	0	**4**	0	0	8	0	3	3	0	**14**
Hourly Total	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**37**	**1**	**6**	**3**	**0**	**47**
2200 - 2215	0	0	1	1	0	0	0	**2**	0	0	9	0	1	2	0	**12**
2215 - 2230	0	0	1	0	0	0	0	**1**	0	0	2	1	2	1	0	**6**
2230 - 2245	0	0	3	0	0	0	0	**3**	0	0	12	1	1	0	0	**14**
2245 - 2300	0	0	0	0	0	0	0	**0**	0	0	2	1	2	2	0	**7**
Hourly Total	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**6**	**0**	**0**	**25**	**3**	**6**	**5**	**0**	**39**
2300 - 2315	0	0	1	0	0	0	0	**1**	0	0	2	0	4	0	0	**6**
2315 - 2330	0	0	2	0	0	0	0	**2**	0	0	7	0	5	1	0	**13**
2330 - 2345	0	0	1	0	0	0	0	**1**	0	0	2	1	2	3	0	**8**
2345 - 2400	0	0	0	0	0	0	0	**0**	0	0	2	0	3	2	0	**7**
Hourly Total	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**13**	**1**	**14**	**6**	**0**	**34**
0000 - 0015	0	0	2	0	0	0	0	**2**	0	0	2	0	2	1	0	**5**
0015 - 0030	0	0	1	1	0	0	0	**2**	0	0	18	4	3	4	0	**29**
0030 - 0045	0	0	3	0	0	0	0	**3**	0	0	63	18	14	52	3	**150**
0045 - 0100	0	0	9	0	0	0	0	**9**	0	0	45	19	11	71	1	**147**
Hourly Total	**0**	**0**	**15**	**1**	**0**	**0**	**0**	**16**	**0**	**0**	**128**	**41**	**30**	**128**	**4**	**331**
0100 - 0115	0	0	0	0	0	0	0	**0**	0	1	5	5	8	29	0	**48**
0115 - 0130	0	0	0	0	0	0	0	**0**	0	0	6	0	2	9	0	**17**
0130 - 0145	0	0	0	0	0	0	0	**0**	0	0	0	0	2	13	0	**15**
0145 - 0200	0	0	0	0	0	0	0	**0**	0	0	1	0	0	11	0	**12**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**12**	**5**	**12**	**62**	**0**	**92**
0200 - 0215	0	0	2	0	1	0	0	**3**	0	0	2	0	3	4	0	**9**
0215 - 0230	0	0	2	0	0	0	0	**2**	0	0	7	0	0	8	0	**15**
0230 - 0245	0	0	1	0	0	0	0	**1**	0	0	3	2	0	2	0	**7**
0245 - 0300	0	0	3	0	1	0	0	**4**	0	0	6	0	0	8	0	**14**
Hourly Total	**0**	**0**	**8**	**0**	**2**	**0**	**0**	**10**	**0**	**0**	**18**	**2**	**3**	**22**	**0**	**45**
0300 - 0315	0	0	0	0	0	0	0	**0**	0	0	1	0	0	3	0	**4**
0315 - 0330	0	0	0	0	1	0	0	**1**	0	0	0	1	0	2	0	**3**
0330 - 0345	0	0	0	0	0	0	0	**0**	0	0	0	0	1	0	0	**1**
0345 - 0400	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	**1**
Hourly Total	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**1**	**6**	**0**	**9**
0400 - 0415	0	0	0	0	0	0	0	**0**	0	0	0	2	0	0	0	**2**
0415 - 0430	0	0	0	0	0	0	0	**0**	0	0	2	0	1	1	0	**4**
0430 - 0445	0	0	2	0	0	0	0	**2**	0	0	0	0	0	2	0	**2**
0445 - 0500	0	0	0	0	0	0	0	**0**	0	0	0	0	0	2	0	**2**
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**2**	**1**	**5**	**0**	**10**
0500 - 0515	0	0	0	0	0	0	0	**0**	0	0	0	2	1	1	0	**4**
0515 - 0530	0	0	2	0	0	0	0	**2**	0	0	9	5	3	28	0	**45**
0530 - 0545	0	0	3	0	1	0	0	**4**	0	0	3	1	1	5	0	**10**
0545 - 0600	0	0	1	1	0	0	0	**2**	0	0	6	0	2	2	0	**10**
Hourly Total	**0**	**0**	**6**	**1**	**1**	**0**	**0**	**8**	**0**	**0**	**18**	**8**	**7**	**36**	**0**	**69**
0600 - 0615	0	0	5	0	0	0	0	**5**	0	0	21	7	0	38	0	**66**
0615 - 0630	0	0	3	0	0	0	0	**3**	0	0	9	1	1	6	0	**17**
0630 - 0645	0	0	4	0	0	0	0	**4**	0	0	8	1	2	11	0	**22**
0645 - 0700	0	0	2	2	0	0	0	**4**	0	0	6	0	0	11	0	**17**
Hourly Total	**0**	**0**	**14**	**2**	**0**	**0**	**0**	**16**	**0**	**0**	**44**	**9**	**3**	**66**	**0**	**122**
0700 - 0715	0	0	1	1	0	0	0	**2**	0	0	11	0	1	3	0	**15**
0715 - 0730	0	0	5	0	1	0	0	**6**	0	0	7	4	0	5	0	**16**
0730 - 0745	0	0	1	0	0	0	1	**2**	0	0	13	3	1	1	0	**18**
0745 - 0800	0	0	3	0	0	0	0	**3**	0	0	20	5	3	6	0	**34**
Hourly Total	**0**	**0**	**10**	**1**	**1**	**0**	**1**	**13**	**0**	**0**	**51**	**12**	**5**	**15**	**0**	**83**
0800 - 0815	0	0	9	2	0	0	0	**11**	0	0	33	11	0	2	0	**46**
0815 - 0830	0	0	4	2	0	0	0	**6**	0	0	20	6	3	4	1	**34**
0830 - 0845	0	0	12	4	0	0	0	**16**	0	0	39	2	1	5	1	**48**
0845 - 0900	0	0	10	2	1	0	0	**13**	0	0	38	7	1	7	1	**54**
Hourly Total	**0**	**0**	**35**	**10**	**1**	**0**	**0**	**46**	**0**	**0**	**130**	**26**	**5**	**18**	**3**	**182**
0900 - 0915	0	0	6	1	0	0	0	**7**	0	0	31	11	1	3	0	**46**
0915 - 0930	0	0	10	2	0	0	0	**12**	0	1	19	3	1	3	0	**27**
0930 - 0945	0	0	12	3	0	0	0	**15**	0	0	20	7	2	2	0	**31**
0945 - 1000	0	0	6	2	0	0	0	**8**	0	0	14	7	0	0	0	**21**
Hourly Total	**0**	**0**	**34**	**8**	**0**	**0**	**0**	**42**	**0**	**1**	**84**	**28**	**4**	**8**	**0**	**125**
1000 - 1015	0	0	18	1	0	0	0	**19**	0	0	22	9	2	2	0	**35**
1015 - 1030	0	0	11	3	0	0	0	**14**	0	0	26	5	2	2	0	**35**
1030 - 1045	0	0	10	4	0	0	0	**14**	0	0	25	6	0	3	0	**34**
1045 - 1100	0	0	11	2	1	0	0	**14**	0	0	23	7	2	2	0	**34**
Hourly Total	**0**	**0**	**50**	**10**	**1**	**0**	**0**	**61**	**0**	**0**	**96**	**27**	**6**	**9**	**0**	**138**
1100 - 1115	0	0	11	0	0	0	0	**11**	0	0	20	9	2	5	1	**37**
1115 - 1130	0	0	17	2	0	0	0	**19**	0	0	36	8	5	4	0	**53**
1130 - 1145	0	0	14	2	0	0	0	**16**	0	4	39	13	3	35	0	**94**
1145 - 1200	0	0	19	3	0	0	0	**22**	0	0	92	18	4	8	1	**123**
Hourly Total	**0**	**0**	**61**	**7**	**0**	**0**	**0**	**68**	**0**	**4**	**187**	**48**	**14**	**52**	**2**	**307**
1200 - 1215	0	0	18	1	0	0	0	**19**	0	0	35	7	3	9	0	**54**
1215 - 1230	0	0	18	6	1	0	0	**25**	0	0	68	25	3	24	3	**123**
1230 - 1245	0	0	8	3	1	0	0	**12**	0	1	30	17	6	25	8	**87**
1245 - 1300	0	0	9	1	1	0	0	**11**	0	0	33	8	4	12	2	**59**
Hourly Total	**0**	**0**	**53**	**11**	**3**	**0**	**0**	**67**	**0**	**1**	**166**	**57**	**16**	**70**	**13**	**323**
1300 - 1315	0	0	10	4	0	0	0	**14**	0	0	33	9	5	8	0	**55**
1315 - 1330	0	0	19	3	0	0	0	**22**	0	0	30	2	2	4	0	**38**
1330 - 1345	0	0	14	1	1	0	0	**16**	0	0	32	6	3	6	0	**47**
1345 - 1400	0	0	14	5	1	0	0	**20**	0	0	30	5	4	3	1	**43**
Hourly Total	**0**	**0**	**57**	**13**	**2**	**0**	**0**	**72**	**0**	**0**	**125**	**22**	**14**	**21**	**1**	**183**

TOTAL	**0**	**0**	**657**	**113**	**16**	**4**	**1**	**791**	**3**	**14**	**2057**	**482**	**214**	**656**	**34**	**3460**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (2) A55 / A5

Approach: A5

	Left to A55 (West)								Ahead to A55 (North)								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	1	0	42	4	0	0	1	48	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0
1415 - 1430	0	0	44	3	0	0	0	47	0	0	5	5	0	0	0	10	0	0	0	0	0	0	0	0
1430 - 1445	0	1	40	6	0	0	2	49	0	0	11	4	0	0	0	15	0	0	0	0	0	0	0	0
1445 - 1500	0	0	49	3	0	0	3	55	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0
Hourly Total	**1**	**1**	**175**	**16**	**0**	**0**	**6**	**199**	**0**	**0**	**35**	**11**	**0**	**0**	**0**	**46**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	53	3	0	0	1	57	0	0	8	2	0	0	0	10	0	0	0	0	0	0	0	0
1515 - 1530	0	1	34	2	0	0	0	37	0	0	11	3	0	0	0	14	0	0	0	0	0	0	0	0
1530 - 1545	0	0	54	3	0	0	2	59	0	0	19	1	0	0	0	20	0	0	0	0	0	0	0	0
1545 - 1600	0	1	64	2	0	0	0	67	0	0	13	2	0	0	0	15	0	0	0	0	0	0	0	0
Hourly Total	**0**	**2**	**205**	**10**	**0**	**0**	**3**	**220**	**0**	**0**	**51**	**8**	**0**	**0**	**0**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	0	55	6	1	0	1	63	0	0	11	3	0	0	0	14	0	0	0	0	0	0	0	0
1615 - 1630	0	1	43	3	0	0	2	49	0	0	9	1	0	0	0	10	0	0	0	0	0	0	0	0
1630 - 1645	0	0	49	1	1	0	2	53	0	0	12	2	1	0	0	15	0	0	0	0	0	0	0	0
1645 - 1700	2	1	61	9	0	0	2	75	0	0	9	2	0	0	1	12	0	0	0	0	0	0	0	0
Hourly Total	**2**	**2**	**208**	**19**	**2**	**0**	**7**	**240**	**0**	**0**	**41**	**8**	**1**	**0**	**1**	**51**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	0	0	40	8	1	0	1	50	0	0	9	2	0	0	0	11	0	0	0	0	0	0	0	0
1715 - 1730	0	0	47	3	0	0	1	51	0	0	6	1	1	0	0	8	0	0	0	0	0	0	0	0
1730 - 1745	0	0	48	6	0	0	1	55	0	0	14	1	0	0	0	15	0	0	0	0	0	0	0	0
1745 - 1800	1	1	48	5	0	0	1	56	0	1	8	3	1	0	0	13	0	0	0	0	0	0	0	0
Hourly Total	**1**	**1**	**183**	**22**	**1**	**0**	**4**	**212**	**0**	**1**	**37**	**7**	**2**	**0**	**0**	**47**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1800 - 1815	0	0	38	7	0	1	1	47	0	0	15	3	1	0	0	19	0	0	0	0	0	0	0	0
1815 - 1830	0	0	33	5	0	0	0	38	0	0	11	0	0	0	0	11	0	0	0	0	0	0	0	0
1830 - 1845	0	1	48	3	0	0	1	53	0	0	15	2	0	0	0	17	0	0	0	0	0	0	0	0
1845 - 1900	0	0	33	4	0	0	1	38	0	0	5	2	0	0	0	7	0	0	0	0	0	0	0	0
Hourly Total	**0**	**1**	**152**	**19**	**0**	**1**	**3**	**176**	**0**	**0**	**46**	**7**	**1**	**0**	**0**	**54**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	2	0	33	2	0	0	0	37	0	0	8	2	0	0	0	10	0	0	0	0	0	0	0	0
1915 - 1930	0	0	36	2	0	0	1	39	0	0	7	2	0	0	0	9	0	0	0	0	0	0	0	0
1930 - 1945	0	0	34	2	0	1	0	37	0	0	7	0	1	0	1	9	0	0	0	0	0	0	0	0
1945 - 2000	0	0	23	1	0	0	0	24	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**2**	**0**	**126**	**7**	**0**	**1**	**1**	**137**	**0**	**0**	**22**	**5**	**1**	**0**	**1**	**29**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	20	2	0	0	0	22	0	0	2	0	0	0	0	2	0	0	1	0	0	0	0	1
2015 - 2030	0	0	22	4	0	0	0	26	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
2030 - 2045	0	0	16	1	0	0	1	18	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0
2045 - 2100	0	0	13	2	0	0	0	15	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**71**	**9**	**0**	**0**	**1**	**81**	**0**	**0**	**9**	**1**	**0**	**0**	**0**	**10**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
2100 - 2115	0	0	22	1	0	0	0	23	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0
2115 - 2130	0	0	16	0	0	0	0	16	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
2130 - 2145	0	0	14	0	0	0	0	14	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
2145 - 2200	0	0	16	0	0	0	1	17	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**68**	**1**	**0**	**0**	**1**	**70**	**0**	**0**	**10**	**3**	**0**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	0	0	9	1	0	0	1	11	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
2215 - 2230	0	0	10	1	0	0	0	11	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2230 - 2245	0	0	4	1	0	0	0	5	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
2245 - 2300	0	0	6	0	0	0	0	6	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**29**	**3**	**0**	**0**	**1**	**33**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	4	0	0	0	0	4	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
2315 - 2330	0	0	4	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2330 - 2345	0	0	2	0	0	0	0	2	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
2345 - 2400	0	0	4	0	0	0	1	5	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**14**	**0**	**0**	**0**	**1**	**15**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0030 - 0045	0	0	4	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0045 - 0100	0	2	2	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**2**	**11**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	2	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0115 - 0130	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0130 - 0145	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0230 - 0245	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0245 - 0300	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0445 - 0500	0	0	1	0	0	0	1	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	2	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0530 - 0545	0	0	2	0	0	0	0	2	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0545 - 0600	0	0	4	2	0	0	1	7	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**8**	**2**	**0**	**0**	**1**	**11**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	5	1	0	0	1	7	0	0	2	0	1	0	0	3	0	0	0	0	0	0	0	0
0615 - 0630	0	0	6	0	0	0	0	6	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0
0630 - 0645	1	0	9	0	0	0	0	10	0	0	3	0	1	0	0	4	0	0	0	0	0	0	0	0
0645 - 0700	0	0	6	2	0	0	1	9	0	0	6	0	0	0	0	6	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**26**	**3**	**0**	**0**	**2**	**32**	**0**	**0**	**12**	**1**	**2**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	0	0	4	1	0	0	1	6	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0
0715 - 0730	0	0	21	4	0	0	1	26	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
0730 - 0745	1	0	8	3	0	1	2	15	0	0	5	2	0	0	1	8	0	0	0	0	0	0	0	0
0745 - 0800	0	0	24	5	0	0	1	30	0	0	8	1	1	0	0	10	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**57**	**13**	**0**	**1**	**5**	**77**	**0**	**0**	**26**	**4**	**1**	**0**	**1**	**32**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0800 - 0815	1	0	23	6	0	0	0	30	0	0	6	5	0	0	0	11	0	0	0	0	0	0	0	0
0815 - 0830	0	0	30	4	0	1	2	37	0	0	3	2	0	0	0	5	0	0	0	0	0	0	0	0
0830 - 0845	0	0	45	5	0	0	2	52	0	0	8	3	1	0	0	12	0	0	0	0	0	0	0	0
0845 - 0900	0	0	54	4	0	0	1	59	0	0	8	2	0	0	0	10	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**152**	**19**	**0**	**1**	**5**	**178**	**0**	**0**	**25**	**12**	**1**	**0**	**0**	**38**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	46	3	0	0	0	49	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0
0915 - 0930	0	0	30	3	0	0	1	34	0	0	10	1	0	0	0	11	0	0	0	0	0	0	0	0
0930 - 0945	0	0	34	8	0	0	1	43	0	0	7	3	0	0	0	10	0	0	0	0	0	0	0	0
0945 - 1000	0	0	38	3	0	0	1	42	0	0	15	1	0	0	0	16	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**148**	**17**	**0**	**0**	**3**	**168**	**0**	**0**	**38**	**6**	**0**	**0**	**0**	**44**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	1	0	38	6	2	0	0	47	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
1015 - 1030	0	0	35	2	0	0	1	38	0	0	13	3	0	0	0	16	0	0	0	0	0	0	0	0
1030 - 1045	0	0	35	5	0	0	4	44	0	0	12	3	0	0	0	15	0	0	0	0	0	0	0	0
1045 - 1100	0	0	34	1	0	1	1	37	0	0	14	5	0	0	0	19	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**142**	**14**	**2**	**1**	**6**	**166**	**0**	**0**	**46**	**11**	**0**	**0**	**0**	**57**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	2	0	43	5	0	0	1	51	0	0	19	4	0	0	0	23	0	0	0	0	0	0	0	0
1115 - 1130	0	0	36	4	0	0	3	43	0	0	16	0	1	0	0	17	0	0	0	0	0	0	0	0
1130 - 1145	0	0	26	5	0	0	1	32	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0
1145 - 1200	1	1	40	5	0	0	0	47	0	0	6	2	0	0	0	8	0	0	0	0	0	0	0	0
Hourly Total	**3**	**1**	**145**	**19**	**0**	**0**	**5**	**173**	**0**	**0**	**54**	**7**	**1**	**0**	**0**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	0	0	27	2	0	0	1	30	0	0	15	2	1	0	1	19	0	0	0	0	0	0	0	0
1215 - 1230	0	0	34	2	0	0	1	37	1	0	10	1	0	0	0	12	0	0	0	0	0	0	0	0
1230 - 1245	0	0	30	2	0	1	4	37	0	1	14	2	0	0	0	17	0	0	0	0	0	0	0	0
1245 - 1300	0	0	29	6	0	0	0	35	0	0	10	3	0	0	0	13	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**120**	**12**	**0**	**1**	**6**	**139**	**1**	**1**	**49**	**8**	**1**	**0**	**1**	**61**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1300 - 1315	0	2	23	2	0	0	1	28	0	0	8	2	1	0	0	11	0	0	0	0	0	0	0	0
1315 - 1330	0	0	32	4	0	0	2	38	0	0	6	2	0	0	0	8	0	0	0	0	0	0	0	0
1330 - 1345	0	0	37	2	0	0	3	42	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0
1345 - 1400	0	0	34	5	0	0	1	40	0	0	7	1	0	0	0	8	0	0	0	0	0	0	0	0
Hourly Total	**0**	**2**	**126**	**13**	**0**	**0**	**7**	**148**	**0**	**0**	**28**	**5**	**1**	**0**	**0**	**34**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**13**	**12**	**2176**	**219**	**5**	**6**	**69**	**2500**	**1**	**2**	**557**	**104**	**14**	**0**	**4**	**682**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (2) A55 / A5

Approach: A55 (West)

	Left to A55 (North)								Right to A5								U-Turn							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	25	4	1	3	1	**34**	0	0	40	8	1	0	0	**49**	0	0	0	0	0	0	0	**0**
1415 - 1430	0	0	23	6	1	4	0	**34**	0	0	34	2	0	0	1	**37**	0	0	0	0	0	0	0	**0**
1430 - 1445	0	0	27	8	0	3	0	**38**	0	0	29	7	0	0	2	**38**	0	0	0	0	0	0	0	**0**
1445 - 1500	0	0	33	5	0	4	0	**42**	1	0	35	2	0	0	0	**38**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**108**	**23**	**2**	**14**	**1**	**148**	**1**	**0**	**138**	**19**	**1**	**0**	**3**	**162**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	42	8	2	6	1	**59**	0	0	43	3	0	0	0	**46**	0	0	0	0	0	0	0	**0**
1515 - 1530	0	0	25	4	4	8	0	**41**	0	0	55	2	0	0	1	**58**	0	0	0	0	0	0	0	**0**
1530 - 1545	0	0	32	4	2	5	0	**43**	0	2	39	3	0	0	2	**46**	0	0	0	0	0	0	0	**0**
1545 - 1600	0	0	29	7	2	7	0	**45**	0	1	41	9	0	0	2	**53**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**128**	**23**	**10**	**26**	**1**	**188**	**0**	**3**	**178**	**17**	**0**	**0**	**5**	**203**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	1	35	4	1	10	1	**52**	0	0	27	4	0	0	0	**31**	0	0	0	0	0	0	0	**0**
1615 - 1630	0	0	48	5	2	6	0	**61**	0	0	41	5	1	0	2	**49**	0	0	0	0	0	0	0	**0**
1630 - 1645	0	0	27	7	0	13	0	**47**	1	0	46	9	0	0	0	**56**	0	0	0	0	0	0	0	**0**
1645 - 1700	0	0	25	0	0	13	0	**38**	1	0	32	9	0	1	1	**44**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**135**	**16**	**3**	**42**	**1**	**198**	**2**	**0**	**146**	**27**	**1**	**1**	**3**	**180**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	1	0	31	4	0	11	0	**47**	0	0	42	1	0	0	2	**45**	0	0	0	0	0	0	0	**0**
1715 - 1730	0	0	42	2	1	10	0	**55**	2	0	39	1	0	0	2	**44**	0	0	0	0	0	0	0	**0**
1730 - 1745	0	0	24	7	0	7	0	**38**	0	0	37	5	0	0	0	**42**	0	0	0	0	0	0	0	**0**
1745 - 1800	0	0	37	2	0	3	0	**42**	0	0	29	1	0	0	2	**32**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**134**	**15**	**1**	**31**	**0**	**182**	**2**	**0**	**147**	**8**	**0**	**0**	**6**	**163**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1800 - 1815	0	0	30	5	2	5	0	**42**	0	0	23	8	0	0	0	**31**	0	0	0	0	0	0	0	**0**
1815 - 1830	0	0	27	6	0	10	0	**43**	0	1	33	8	0	0	1	**43**	0	0	0	0	0	0	0	**0**
1830 - 1845	0	1	33	3	2	10	0	**49**	0	0	21	1	0	0	1	**23**	0	0	0	0	0	0	0	**0**
1845 - 1900	0	0	28	7	3	12	0	**50**	2	0	20	1	0	0	2	**25**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**118**	**21**	**7**	**37**	**0**	**184**	**2**	**1**	**97**	**18**	**0**	**0**	**4**	**122**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	36	4	1	3	1	**45**	0	1	18	2	0	0	0	**21**	0	0	0	0	0	0	0	**0**
1915 - 1930	0	0	56	10	2	13	1	**82**	0	0	18	0	0	0	0	**18**	0	0	0	0	0	0	0	**0**
1930 - 1945	0	0	25	7	0	8	1	**41**	0	1	20	3	0	0	1	**25**	0	0	0	0	0	0	0	**0**
1945 - 2000	0	0	23	1	1	7	0	**32**	0	0	16	0	0	0	0	**16**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**140**	**22**	**4**	**31**	**3**	**200**	**0**	**2**	**72**	**5**	**0**	**0**	**1**	**80**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	15	1	0	8	0	**24**	0	0	17	3	0	1	0	**21**	0	0	0	0	0	0	0	**0**
2015 - 2030	0	0	10	1	0	4	0	**15**	0	1	19	1	0	0	0	**21**	0	0	0	0	0	0	0	**0**
2030 - 2045	0	0	15	0	0	2	0	**17**	0	0	12	2	0	0	0	**14**	0	0	0	0	0	0	0	**0**
2045 - 2100	0	0	12	2	0	3	0	**17**	0	0	13	2	0	0	1	**16**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**52**	**4**	**0**	**17**	**0**	**73**	**0**	**1**	**61**	**8**	**0**	**1**	**1**	**72**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2100 - 2115	0	0	18	0	1	3	0	**22**	0	0	15	0	0	0	1	**16**	0	0	0	0	0	0	0	**0**
2115 - 2130	0	0	11	2	1	7	0	**21**	0	0	14	1	0	0	0	**15**	0	0	0	0	0	0	0	**0**
2130 - 2145	0	0	8	4	1	5	0	**18**	0	0	4	1	0	0	0	**5**	0	0	0	0	0	0	0	**0**
2145 - 2200	0	0	8	3	0	5	0	**16**	0	0	10	0	0	0	1	**11**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**45**	**9**	**3**	**20**	**0**	**77**	**0**	**0**	**43**	**2**	**0**	**0**	**2**	**47**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	0	0	12	5	0	5	0	**22**	0	0	16	0	0	0	0	**16**	0	0	0	0	0	0	0	**0**
2215 - 2230	0	0	9	0	1	6	0	**16**	0	1	7	0	0	0	1	**9**	0	0	0	0	0	0	0	**0**
2230 - 2245	0	0	8	0	0	6	1	**15**	0	0	8	1	0	0	0	**9**	0	0	0	0	0	0	0	**0**
2245 - 2300	0	0	10	6	0	12	0	**28**	0	0	7	1	0	0	0	**8**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**39**	**11**	**1**	**29**	**1**	**81**	**0**	**1**	**38**	**2**	**0**	**0**	**1**	**42**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	8	2	1	15	0	**26**	0	0	5	1	0	0	0	**6**	0	0	0	0	0	0	0	**0**
2315 - 2330	1	0	5	2	0	14	0	**22**	0	0	6	1	0	0	0	**7**	0	0	0	0	0	0	0	**0**
2330 - 2345	0	0	4	3	0	11	0	**18**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
2345 - 2400	0	0	10	4	1	9	0	**24**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**27**	**11**	**2**	**49**	**0**	**90**	**0**	**0**	**14**	**2**	**0**	**0**	**0**	**16**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	5	7	1	17	0	**30**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0015 - 0030	0	0	7	1	0	24	1	**33**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0030 - 0045	0	0	3	1	1	11	0	**16**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0045 - 0100	0	0	5	7	0	9	1	**22**	0	0	4	0	0	0	0	**4**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**20**	**16**	**2**	**61**	**2**	**101**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	5	7	4	15	0	**31**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0115 - 0130	0	0	9	5	2	15	0	**31**	2	0	0	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0130 - 0145	0	1	6	1	3	23	0	**34**	2	0	0	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0145 - 0200	0	0	3	3	1	14	1	**22**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**23**	**16**	**10**	**67**	**1**	**118**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	2	1	0	12	0	**15**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0215 - 0230	0	0	1	0	1	5	1	**8**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0230 - 0245	0	0	0	0	3	3	0	**6**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0245 - 0300	0	0	1	1	1	3	0	**6**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**4**	**2**	**5**	**23**	**1**	**35**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	2	0	**2**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0315 - 0330	0	0	0	2	0	4	0	**6**	0	0	1	1	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0330 - 0345	0	0	0	1	0	1	0	**2**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0345 - 0400	0	0	0	0	0	1	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**3**	**0**	**8**	**0**	**11**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	2	0	1	3	0	**6**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0415 - 0430	0	0	2	1	1	2	0	**6**	0	1	0	1	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0430 - 0445	0	0	4	2	2	2	0	**10**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0445 - 0500	0	0	1	1	1	1	0	**4**	0	1	2	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**9**	**4**	**5**	**8**	**0**	**26**	**0**	**2**	**3**	**1**	**0**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	1	2	4	0	**7**	0	0	0	0	0	0	1	**1**	0	0	0	0	0	0	0	**0**
0515 - 0530	0	0	5	0	0	5	0	**10**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0530 - 0545	0	0	4	0	0	6	0	**10**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0545 - 0600	0	0	12	0	6	3	0	**21**	0	0	7	1	0	0	0	**8**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**21**	**1**	**8**	**18**	**0**	**48**	**0**	**0**	**9**	**1**	**0**	**0**	**1**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	5	2	7	4	0	**18**	0	0	4	1	0	0	0	**5**	0	0	0	0	0	0	0	**0**
0615 - 0630	0	0	7	2	6	7	0	**22**	0	0	5	0	1	0	1	**7**	0	0	0	0	0	0	0	**0**
0630 - 0645	0	0	14	2	3	12	0	**31**	0	2	7	0	0	0	0	**9**	0	0	0	0	0	0	0	**0**
0645 - 0700	0	0	20	4	0	13	1	**38**	0	0	8	2	0	1	1	**12**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**46**	**10**	**16**	**36**	**1**	**109**	**0**	**2**	**24**	**3**	**1**	**1**	**2**	**33**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	0	0	19	5	1	15	0	**40**	0	1	2	1	0	0	0	**4**	0	0	0	0	0	0	0	**0**
0715 - 0730	1	0	32	4	2	11	0	**50**	0	0	4	3	0	0	1	**8**	0	0	0	0	0	0	0	**0**
0730 - 0745	0	0	43	11	2	16	0	**72**	0	0	21	5	0	0	2	**28**	0	0	0	0	0	0	0	**0**
0745 - 0800	0	0	44	11	0	11	0	**66**	0	0	14	4	0	0	2	**20**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**138**	**31**	**5**	**53**	**0**	**228**	**0**	**1**	**41**	**13**	**0**	**0**	**5**	**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0800 - 0815	0	1	31	10	1	10	0	**53**	0	0	16	2	0	0	3	**21**	0	0	0	0	0	0	0	**0**
0815 - 0830	2	0	38	6	3	2	0	**51**	0	0	15	4	0	0	3	**22**	0	0	0	0	0	0	0	**0**
0830 - 0845	0	0	41	3	3	5	0	**52**	0	0	19	6	0	0	1	**26**	0	0	0	0	0	0	0	**0**
0845 - 0900	0	0	47	7	0	6	0	**60**	0	0	33	4	0	0	2	**39**	0	0	0	0	0	0	0	**0**
Hourly Total	**2**	**1**	**157**	**26**	**7**	**23**	**0**	**216**	**0**	**0**	**83**	**16**	**0**	**0**	**9**	**108**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	30	6	0	3	1	**40**	0	0	29	7	0	0	1	**37**	0	0	0	0	0	0	0	**0**
0915 - 0930	0	0	27	5	3	1	0	**36**	0	0	21	2	0	0	1	**24**	0	0	0	0	0	0	0	**0**
0930 - 0945	0	0	22	2	0	6	0	**30**	0	0	21	5	0	0	3	**29**	0	0	0	0	0	0	0	**0**
0945 - 1000	0	0	30	6	1	4	0	**41**	0	0	27	5	1	0	0	**33**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**109**	**19**	**4**	**14**	**1**	**147**	**0**	**0**	**98**	**19**	**1**	**0**	**5**	**123**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	29	7	0	3	1	**40**	0	0	19	0	0	0	1	**20**	0	0	0	0	0	0	0	**0**
1015 - 1030	0	0	34	4	2	11	0	**51**	1	0	27	5	1	0	0	**34**	0	0	0	0	0	0	0	**0**
1030 - 1045	0	0	34	5	6	8	0	**53**	0	0	27	5	0	0	2	**34**	0	0	0	0	0	0	0	**0**
1045 - 1100	0	0	24	12	1	5	0	**42**	1	0	31	3	2	0	1	**38**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**121**	**28**	**9**	**27**	**1**	**186**	**2**	**0**	**104**	**13**	**3**	**0**	**4**	**126**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	0	0	27	1	2	10	1	**41**	0	0	29	7	1	0	1	**38**	0	0	0	0	0	0	0	**0**
1115 - 1130	1	0	32	7	1	9	0	**50**	1	0	24	6	0	0	2	**33**	0	0	0	0	0	0	0	**0**
1130 - 1145	0	0	30	10	4	11	1	**56**	0	0	27	5	0	0	1	**33**	0	0	0	0	0	0	0	**0**
1145 - 1200	0	0	35	4	4	15	0	**58**	0	0	23	4	0	0	2	**29**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**124**	**22**	**11**	**45**	**2**	**205**	**1**	**0**	**103**	**22**	**1**	**0**	**6**	**133**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	0	0	40	9	3	11	1	**64**	0	1	31	6	1	0	1	**40**	0	0	0	0	0	0	0	**0**
1215 - 1230	1	0	32	9	5	14	1	**62**	1	0	29	4	0	0	0	**34**	0	0	1	0	0	0	0	**1**
1230 - 1245	0	0	35	11	2	18	3	**69**	0	0	28	6	0	0	1	**35**	0	0	0	0	0	0	0	**0**
1245 - 1300	0	0	57	8	5	23	0	**93**	1	0	36	3	0	0	1	**41**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**164**	**37**	**15**	**66**	**5**	**288**	**2**	**1**	**124**	**19**	**1**	**0**	**3**	**150**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1300 - 1315	0	0	50	10	1	16	1	**78**	0	0	25	5	0	0	0	**30**	0	0	0	0	0	0	0	**0**
1315 - 1330	0	0	48	8	2	8	0	**66**	0	1	34	2	0	0	1	**38**	0	0	0	0	0	0	0	**0**
1330 - 1345	0	0	34	3	2	8	0	**47**	0	0	27	2	0	0	2	**31**	0	0	0	0	0	0	0	**0**
1345 - 1400	1	0	31	4	2	1	0	**39**	0	0	31	9	0	0	3	**43**	0	0	0	0	0	0	0	**0**
Hourly Total	**1**	**0**	**163**	**25**	**7**	**33**	**1**	**230**	**0**	**1**	**117**	**18**	**0**	**0**	**6**	**142**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**8**	**4**	**2025**	**395**	**137**	**778**	**22**	**3369**	**16**	**15**	**1650**	**234**	**9**	**3**	**67**	**1994**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (3) A5154 / A55

Approach: A5154

	Left to A55 (East)								Ahead to A55 (South)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	41	6	1	0	1	**49**	0	0	68	6	0	0	1	**75**
1415 - 1430	0	0	40	5	0	0	1	**46**	0	1	64	7	0	0	0	**72**
1430 - 1445	0	0	41	11	0	0	4	**56**	0	0	71	9	1	0	1	**82**
1445 - 1500	1	0	46	2	0	0	0	**49**	0	0	62	11	0	0	2	**75**
Hourly Total	**1**	**0**	**168**	**24**	**1**	**0**	**6**	**200**	**0**	**1**	**265**	**33**	**1**	**0**	**4**	**304**
1500 - 1515	0	0	50	9	0	0	1	**60**	0	0	84	9	1	0	2	**96**
1515 - 1530	0	0	58	8	0	0	2	**68**	0	0	90	5	0	0	2	**97**
1530 - 1545	0	2	49	8	0	0	2	**61**	0	1	99	12	0	0	1	**113**
1545 - 1600	0	1	48	5	0	0	1	**55**	0	1	89	9	0	0	2	**101**
Hourly Total	**0**	**3**	**205**	**30**	**0**	**0**	**6**	**244**	**0**	**2**	**362**	**35**	**1**	**0**	**7**	**407**
1600 - 1615	0	0	44	4	1	0	1	**50**	0	0	90	9	0	0	1	**100**
1615 - 1630	0	0	54	10	2	0	1	**67**	0	0	64	12	0	0	0	**76**
1630 - 1645	1	0	50	9	0	0	0	**60**	0	0	86	15	0	0	2	**103**
1645 - 1700	1	0	38	8	0	1	1	**49**	0	0	85	8	1	0	0	**94**
Hourly Total	**2**	**0**	**186**	**31**	**3**	**1**	**3**	**226**	**0**	**0**	**325**	**44**	**1**	**0**	**3**	**373**
1700 - 1715	2	0	57	1	0	0	2	**62**	0	0	98	7	0	0	1	**106**
1715 - 1730	1	0	50	3	0	0	4	**58**	0	0	79	4	0	0	0	**83**
1730 - 1745	0	0	41	5	0	0	0	**46**	0	0	73	19	0	0	4	**96**
1745 - 1800	0	0	38	1	0	0	2	**41**	0	0	62	10	1	0	0	**73**
Hourly Total	**3**	**0**	**186**	**10**	**0**	**0**	**8**	**207**	**0**	**0**	**312**	**40**	**1**	**0**	**5**	**358**
1800 - 1815	0	0	30	7	0	0	0	**37**	0	0	52	8	0	0	0	**60**
1815 - 1830	0	0	45	5	0	0	1	**51**	0	0	40	6	0	0	0	**46**
1830 - 1845	0	1	26	1	0	0	1	**29**	0	0	51	3	0	0	0	**54**
1845 - 1900	2	0	26	2	0	0	2	**32**	0	0	49	2	0	0	0	**51**
Hourly Total	**2**	**1**	**127**	**15**	**0**	**0**	**4**	**149**	**0**	**0**	**192**	**19**	**0**	**0**	**0**	**211**
1900 - 1915	0	1	32	3	0	0	0	**36**	0	1	48	8	0	0	0	**57**
1915 - 1930	0	0	38	3	0	0	0	**41**	0	0	34	3	0	0	0	**37**
1930 - 1945	0	0	23	2	0	0	2	**27**	0	0	47	4	0	0	1	**52**
1945 - 2000	0	0	21	0	0	1	0	**22**	0	0	40	0	0	0	0	**40**
Hourly Total	**0**	**1**	**114**	**8**	**0**	**1**	**2**	**126**	**0**	**1**	**169**	**15**	**0**	**0**	**1**	**186**
2000 - 2015	0	0	24	2	0	0	0	**26**	0	0	39	2	0	0	0	**41**
2015 - 2030	1	0	20	1	0	0	0	**22**	0	0	14	1	0	0	0	**15**
2030 - 2045	0	0	18	2	0	0	0	**20**	0	0	24	2	0	0	0	**26**
2045 - 2100	0	0	17	2	0	0	1	**20**	0	0	20	3	0	0	0	**23**
Hourly Total	**1**	**0**	**79**	**7**	**0**	**0**	**1**	**88**	**0**	**0**	**97**	**8**	**0**	**0**	**0**	**105**
2100 - 2115	0	0	23	0	0	0	1	**24**	0	0	23	2	0	0	0	**25**
2115 - 2130	0	0	20	1	0	0	0	**21**	0	0	23	3	0	0	0	**26**
2130 - 2145	0	0	10	3	0	0	0	**13**	0	0	16	2	0	0	0	**18**
2145 - 2200	0	0	11	0	0	0	1	**12**	0	0	15	1	0	0	0	**16**
Hourly Total	**0**	**0**	**64**	**4**	**0**	**0**	**2**	**70**	**0**	**0**	**77**	**8**	**0**	**0**	**0**	**85**
2200 - 2215	0	0	21	0	0	0	0	**21**	0	0	17	11	0	0	0	**28**
2215 - 2230	0	0	5	0	0	1	0	**6**	0	0	12	2	0	0	0	**14**
2230 - 2245	0	0	10	2	0	0	0	**12**	0	0	13	0	0	0	0	**13**
2245 - 2300	0	0	14	0	0	0	0	**14**	0	0	14	0	0	0	0	**14**
Hourly Total	**0**	**0**	**50**	**2**	**0**	**1**	**0**	**53**	**0**	**0**	**56**	**13**	**0**	**0**	**0**	**69**
2300 - 2315	0	0	8	0	0	0	0	**8**	0	0	3	0	0	0	0	**3**
2315 - 2330	0	0	5	1	0	0	0	**6**	0	0	5	0	0	0	0	**5**
2330 - 2345	0	0	3	1	0	0	0	**4**	0	0	4	1	0	0	0	**5**
2345 - 2400	0	0	2	1	0	0	0	**3**	0	0	4	1	0	0	0	**5**
Hourly Total	**0**	**0**	**18**	**3**	**0**	**0**	**0**	**21**	**0**	**0**	**16**	**2**	**0**	**0**	**0**	**18**
0000 - 0015	0	0	0	1	0	0	0	**1**	0	0	2	0	0	0	1	**3**
0015 - 0030	0	0	4	0	0	1	0	**5**	0	0	2	0	0	0	0	**2**
0030 - 0045	0	0	3	0	0	0	0	**3**	0	0	3	0	0	0	0	**3**
0045 - 0100	0	0	2	1	0	0	0	**3**	0	0	0	1	0	0	0	**1**
Hourly Total	**0**	**0**	**9**	**2**	**0**	**1**	**0**	**12**	**0**	**0**	**7**	**1**	**0**	**0**	**1**	**9**
0100 - 0115	0	0	0	0	0	0	0	**0**	0	0	2	0	0	0	0	**2**
0115 - 0130	1	0	2	0	0	0	0	**3**	0	0	3	0	0	0	0	**3**
0130 - 0145	2	1	2	0	0	0	0	**5**	0	0	3	0	0	0	0	**3**
0145 - 0200	0	0	2	0	0	0	0	**2**	0	0	1	0	0	0	0	**1**
Hourly Total	**3**	**1**	**6**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**9**
0200 - 0215	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
0215 - 0230	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**
0230 - 0245	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0245 - 0300	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**
0300 - 0315	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0315 - 0330	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0330 - 0345	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**
0345 - 0400	0	0	1	0	0	0	0	**1**	0	0	2	0	0	0	0	**2**
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**
0400 - 0415	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**
0415 - 0430	0	1	1	0	0	0	0	**2**	0	0	2	0	0	0	0	**2**
0430 - 0445	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**
0445 - 0500	0	1	2	0	0	0	0	**3**	0	0	2	0	0	0	0	**2**
Hourly Total	**0**	**2**	**5**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**
0500 - 0515	0	0	1	0	0	0	1	**2**	0	0	5	0	0	0	0	**5**
0515 - 0530	0	0	4	0	0	0	0	**4**	0	0	1	2	0	0	0	**3**
0530 - 0545	0	0	5	0	0	0	0	**5**	0	0	6	0	0	0	0	**6**
0545 - 0600	0	0	7	0	0	0	0	**7**	0	0	12	0	0	0	0	**12**
Hourly Total	**0**	**0**	**17**	**0**	**0**	**0**	**1**	**18**	**0**	**0**	**24**	**2**	**0**	**0**	**0**	**26**
0600 - 0615	0	0	4	1	0	0	0	**5**	0	0	7	2	1	0	0	**10**
0615 - 0630	0	0	6	1	1	0	1	**9**	0	0	15	3	0	0	0	**18**
0630 - 0645	1	0	10	0	0	0	0	**11**	0	0	13	2	0	1	0	**16**
0645 - 0700	0	1	13	2	0	0	1	**17**	0	0	14	7	0	0	0	**21**
Hourly Total	**1**	**1**	**33**	**4**	**1**	**0**	**2**	**42**	**0**	**0**	**49**	**14**	**1**	**1**	**0**	**65**
0700 - 0715	0	1	7	1	0	0	0	**9**	0	0	15	5	1	0	2	**23**
0715 - 0730	0	0	13	3	0	0	1	**17**	0	2	43	10	0	0	0	**55**
0730 - 0745	0	0	36	10	0	0	2	**48**	0	1	49	11	0	0	1	**62**
0745 - 0800	0	0	32	5	0	0	2	**39**	0	1	43	9	0	0	2	**55**
Hourly Total	**0**	**1**	**88**	**19**	**0**	**0**	**5**	**113**	**0**	**4**	**150**	**35**	**1**	**0**	**5**	**195**
0800 - 0815	0	0	19	5	0	0	3	**27**	0	0	46	4	1	0	1	**52**
0815 - 0830	1	0	27	3	0	0	3	**34**	0	0	55	11	1	0	2	**69**
0830 - 0845	0	0	32	6	2	0	1	**41**	0	0	74	11	0	0	1	**86**
0845 - 0900	0	1	53	6	0	0	2	**62**	0	0	77	8	0	0	2	**87**
Hourly Total	**1**	**1**	**131**	**20**	**2**	**0**	**9**	**164**	**0**	**0**	**252**	**34**	**2**	**0**	**6**	**294**
0900 - 0915	0	0	36	2	0	0	2	**40**	0	0	67	14	1	1	1	**84**
0915 - 0930	0	0	32	2	0	0	1	**35**	0	1	46	3	2	0	1	**53**
0930 - 0945	0	0	28	3	0	0	3	**34**	0	0	51	11	0	1	3	**66**
0945 - 1000	0	1	37	3	1	0	0	**42**	0	0	41	8	0	0	1	**50**
Hourly Total	**0**	**1**	**133**	**10**	**1**	**0**	**6**	**151**	**0**	**1**	**205**	**36**	**3**	**2**	**6**	**253**
1000 - 1015	0	0	31	2	0	0	2	**35**	0	0	49	10	1	0	0	**60**
1015 - 1030	0	0	37	6	0	0	0	**43**	0	0	60	8	3	0	0	**71**
1030 - 1045	1	0	41	6	0	0	2	**50**	0	0	60	3	0	0	1	**64**
1045 - 1100	1	0	39	8	2	0	1	**51**	0	0	54	6	4	0	0	**64**
Hourly Total	**2**	**0**	**148**	**22**	**2**	**0**	**5**	**179**	**0**	**0**	**223**	**27**	**8**	**0**	**1**	**259**
1100 - 1115	0	0	48	4	2	0	2	**56**	0	0	51	6	2	0	1	**60**
1115 - 1130	1	0	40	5	0	0	2	**48**	0	0	42	5	2	0	1	**50**
1130 - 1145	0	0	37	7	0	0	2	**46**	0	0	53	7	1	0	1	**62**
1145 - 1200	0	0	30	4	0	0	1	**35**	0	0	59	13	1	0	0	**73**
Hourly Total	**1**	**0**	**155**	**20**	**2**	**0**	**7**	**185**	**0**	**0**	**205**	**31**	**6**	**0**	**3**	**245**
1200 - 1215	0	1	32	8	0	0	1	**42**	0	0	83	6	1	0	0	**90**
1215 - 1230	1	0	35	6	1	0	1	**44**	0	1	63	10	1	0	1	**76**
1230 - 1245	1	0	35	5	1	0	2	**44**	0	0	62	12	0	0	1	**75**
1245 - 1300	0	0	51	3	0	0	0	**54**	0	0	59	9	1	0	0	**69**
Hourly Total	**2**	**1**	**153**	**22**	**2**	**0**	**4**	**184**	**0**	**1**	**267**	**37**	**3**	**0**	**2**	**310**
1300 - 1315	0	0	30	7	0	0	0	**37**	0	0	71	9	3	1	1	**85**
1315 - 1330	0	1	37	5	0	0	0	**43**	0	0	57	12	2	0	0	**71**
1330 - 1345	1	0	38	3	0	0	2	**44**	0	0	67	13	1	0	0	**81**
1345 - 1400	0	0	39	5	0	0	3	**47**	0	0	52	8	2	0	1	**63**
Hourly Total	**1**	**1**	**144**	**20**	**0**	**0**	**5**	**171**	**0**	**0**	**247**	**42**	**8**	**1**	**2**	**300**
TOTAL	**20**	**14**	**2222**	**273**	**14**	**4**	**76**	**2623**	**0**	**10**	**3520**	**476**	**36**	**4**	**46**	**4092**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (3) A5154 / A55

Approach: A55 (East)

	Left to A55 (South)								Right to A5154							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	16	2	3	6	0	27	1	0	46	11	0	0	1	59
1415 - 1430	0	0	14	4	1	3	0	22	0	0	47	8	0	0	1	56
1430 - 1445	0	0	17	2	3	0	0	22	0	1	57	7	0	0	2	67
1445 - 1500	0	0	13	2	2	2	0	19	0	0	68	5	0	0	3	76
Hourly Total	**0**	**0**	**60**	**10**	**9**	**11**	**0**	**90**	**1**	**1**	**218**	**31**	**0**	**0**	**7**	**258**
1500 - 1515	0	0	24	0	0	0	0	24	0	0	77	6	0	0	2	85
1515 - 1530	0	1	17	3	1	0	0	22	0	0	54	8	0	0	0	62
1530 - 1545	0	0	19	2	3	2	0	26	0	0	52	9	1	0	2	64
1545 - 1600	0	0	23	5	2	1	0	31	0	0	77	6	0	0	1	84
Hourly Total	**0**	**1**	**83**	**10**	**6**	**3**	**0**	**103**	**0**	**0**	**260**	**29**	**1**	**0**	**5**	**295**
1600 - 1615	0	0	21	2	6	1	0	30	0	0	70	7	0	0	2	79
1615 - 1630	0	1	27	7	3	5	0	43	0	3	59	8	0	0	2	72
1630 - 1645	0	1	35	4	4	3	0	47	0	0	68	7	0	0	2	77
1645 - 1700	0	0	22	3	4	3	0	32	1	1	71	11	0	0	2	86
Hourly Total	**0**	**2**	**105**	**16**	**17**	**12**	**0**	**152**	**1**	**4**	**268**	**33**	**0**	**0**	**8**	**314**
1700 - 1715	0	0	27	4	1	1	0	33	0	0	49	7	0	0	2	58
1715 - 1730	2	0	28	3	1	0	0	34	2	0	58	7	0	0	0	67
1730 - 1745	0	0	16	3	3	3	0	25	0	0	68	6	0	0	2	76
1745 - 1800	0	0	13	1	3	1	1	19	1	1	56	6	0	0	0	64
Hourly Total	**2**	**0**	**84**	**11**	**8**	**5**	**1**	**111**	**3**	**1**	**231**	**26**	**0**	**0**	**4**	**265**
1800 - 1815	0	0	32	3	1	3	0	39	0	0	39	10	0	1	0	50
1815 - 1830	0	1	55	27	4	20	0	107	0	0	40	5	0	0	0	45
1830 - 1845	0	0	94	27	4	31	1	157	0	0	56	5	0	0	2	63
1845 - 1900	0	1	45	13	1	23	2	85	0	0	52	5	0	0	1	58
Hourly Total	**0**	**2**	**226**	**70**	**10**	**77**	**3**	**388**	**0**	**0**	**187**	**25**	**0**	**1**	**3**	**216**
1900 - 1915	0	1	9	0	2	3	0	15	2	1	42	4	0	0	1	50
1915 - 1930	0	0	18	3	2	2	0	25	0	0	37	3	0	0	1	41
1930 - 1945	0	1	17	1	2	4	0	25	0	0	36	4	0	1	0	41
1945 - 2000	0	0	7	1	4	1	0	13	0	0	29	2	0	0	0	31
Hourly Total	**0**	**2**	**51**	**5**	**10**	**10**	**0**	**78**	**2**	**1**	**144**	**13**	**0**	**1**	**2**	**163**
2000 - 2015	0	0	13	1	3	3	0	20	0	0	21	0	0	0	0	21
2015 - 2030	0	0	9	0	4	0	0	13	0	0	25	3	0	0	0	28
2030 - 2045	0	0	7	3	0	2	0	12	0	0	20	0	0	0	1	21
2045 - 2100	0	0	10	0	1	3	0	14	0	0	27	2	0	0	1	30
Hourly Total	**0**	**0**	**39**	**4**	**8**	**8**	**0**	**59**	**0**	**0**	**93**	**5**	**0**	**0**	**2**	**100**
2100 - 2115	0	0	14	0	2	0	0	16	0	0	29	3	0	0	0	32
2115 - 2130	0	0	7	0	0	0	0	7	0	0	17	0	0	0	0	17
2130 - 2145	0	0	6	0	2	0	0	8	0	0	16	0	0	0	0	16
2145 - 2200	0	0	5	0	3	3	0	11	0	0	18	0	0	0	1	19
Hourly Total	**0**	**0**	**32**	**0**	**7**	**3**	**0**	**42**	**0**	**0**	**80**	**3**	**0**	**0**	**1**	**84**
2200 - 2215	1	0	11	1	1	2	0	16	0	0	10	1	0	0	1	12
2215 - 2230	0	0	4	1	2	1	0	8	0	0	8	1	0	0	0	9
2230 - 2245	0	0	7	0	1	0	0	8	0	0	7	0	0	0	0	7
2245 - 2300	0	0	2	3	2	2	0	9	0	0	5	1	0	0	0	6
Hourly Total	**1**	**0**	**24**	**5**	**6**	**5**	**0**	**41**	**0**	**0**	**30**	**3**	**0**	**0**	**1**	**34**
2300 - 2315	0	0	5	0	4	0	0	9	0	0	4	0	0	0	0	4
2315 - 2330	0	0	6	0	4	1	0	11	0	0	6	0	0	0	0	6
2330 - 2345	0	0	1	0	2	3	0	6	0	0	3	0	0	0	0	3
2345 - 2400	0	0	2	0	3	2	0	7	0	0	2	1	0	0	1	4
Hourly Total	**0**	**0**	**14**	**0**	**13**	**6**	**0**	**33**	**0**	**0**	**15**	**1**	**0**	**0**	**1**	**17**
0000 - 0015	0	0	1	0	2	1	0	4	0	0	4	0	0	0	0	4
0015 - 0030	0	0	11	4	3	4	0	22	0	0	3	0	0	0	0	3
0030 - 0045	0	0	71	16	14	53	2	156	0	0	3	0	0	0	0	3
0045 - 0100	0	1	49	18	10	71	2	151	0	0	3	0	0	0	0	3
Hourly Total	**0**	**1**	**132**	**38**	**29**	**129**	**4**	**333**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**13**
0100 - 0115	0	1	6	5	9	29	0	50	0	0	0	0	0	0	0	0
0115 - 0130	0	0	4	0	2	9	0	15	0	0	3	0	0	0	0	3
0130 - 0145	0	0	1	0	2	13	0	16	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	11	0	11	0	0	1	0	0	0	0	1
Hourly Total	**0**	**1**	**11**	**5**	**13**	**62**	**0**	**92**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**
0200 - 0215	0	0	0	0	3	4	0	7	0	0	1	0	0	0	0	1
0215 - 0230	0	0	4	0	0	7	0	11	0	0	5	0	0	0	0	5
0230 - 0245	0	0	2	1	0	3	0	6	0	0	3	0	0	0	0	3
0245 - 0300	0	0	4	0	0	8	0	12	0	0	4	0	0	0	0	4
Hourly Total	**0**	**0**	**10**	**1**	**3**	**22**	**0**	**36**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**13**
0300 - 0315	0	0	2	0	0	3	0	5	0	0	1	0	0	0	0	1
0315 - 0330	0	0	1	0	0	2	0	3	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0345 - 0400	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**3**	**0**	**0**	**6**	**0**	**9**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**
0400 - 0415	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0
0415 - 0430	0	0	1	1	1	1	0	4	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	2	0	2	0	4	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	2	0	2	0	0	2	0	0	0	1	3
Hourly Total	**0**	**0**	**1**	**4**	**1**	**6**	**0**	**12**	**0**	**0**	**2**	**0**	**0**	**0**	**1**	**3**
0500 - 0515	0	0	0	2	1	1	0	4	0	0	0	0	0	0	0	0
0515 - 0530	0	0	6	6	2	27	0	41	0	0	1	0	0	0	0	1
0530 - 0545	0	0	3	0	2	5	0	10	0	0	1	0	0	0	0	1
0545 - 0600	0	0	6	1	2	2	0	11	0	0	3	1	0	0	1	5
Hourly Total	**0**	**0**	**15**	**9**	**7**	**35**	**0**	**66**	**0**	**0**	**5**	**1**	**0**	**0**	**1**	**7**
0600 - 0615	0	0	16	9	1	36	2	64	0	0	6	1	0	0	1	8
0615 - 0630	0	0	7	2	1	8	0	18	0	0	5	0	0	0	0	5
0630 - 0645	0	0	5	0	2	11	0	18	1	0	11	0	0	0	0	12
0645 - 0700	0	0	7	1	0	11	0	19	0	0	7	0	0	0	1	8
Hourly Total	**0**	**0**	**35**	**12**	**4**	**66**	**2**	**119**	**1**	**0**	**29**	**1**	**0**	**0**	**2**	**33**
0700 - 0715	0	0	5	2	1	4	0	12	0	0	11	0	1	0	1	13
0715 - 0730	0	0	7	4	0	5	0	16	0	0	20	4	0	0	1	25
0730 - 0745	0	0	9	2	1	2	1	15	0	0	14	4	0	0	1	19
0745 - 0800	0	0	17	4	2	6	0	29	0	0	27	5	1	0	1	34
Hourly Total	**0**	**0**	**38**	**12**	**4**	**17**	**1**	**72**	**0**	**0**	**72**	**13**	**2**	**0**	**4**	**91**
0800 - 0815	0	0	19	9	0	2	0	30	1	0	38	7	0	0	0	46
0815 - 0830	0	0	16	6	2	3	0	27	0	0	32	4	2	1	1	40
0830 - 0845	0	0	18	5	0	5	0	28	0	0	54	6	1	1	2	64
0845 - 0900	0	0	9	4	1	7	0	21	0	0	86	4	0	0	2	92
Hourly Total	**0**	**0**	**62**	**24**	**3**	**17**	**0**	**106**	**1**	**0**	**210**	**21**	**3**	**2**	**5**	**242**
0900 - 0915	0	0	20	6	0	3	0	29	0	0	64	7	0	0	0	71
0915 - 0930	0	1	8	3	2	0	1	15	0	0	39	2	0	0	1	42
0930 - 0945	0	0	13	5	2	2	0	22	0	0	44	9	1	0	2	56
0945 - 1000	0	0	15	4	0	0	0	19	0	0	38	5	0	0	2	45
Hourly Total	**0**	**1**	**56**	**18**	**4**	**5**	**1**	**85**	**0**	**0**	**185**	**23**	**1**	**0**	**5**	**214**
1000 - 1015	0	0	17	4	2	2	0	25	0	0	40	7	2	0	0	49
1015 - 1030	0	0	15	3	2	2	0	22	0	0	46	7	0	0	1	54
1030 - 1045	0	0	16	7	0	3	0	26	0	0	44	5	0	0	4	53
1045 - 1100	0	0	14	1	2	3	1	21	0	0	35	10	0	0	0	45
Hourly Total	**0**	**0**	**62**	**15**	**6**	**10**	**1**	**94**	**0**	**0**	**165**	**29**	**2**	**0**	**5**	**201**
1100 - 1115	0	0	24	6	0	5	0	35	0	1	38	6	2	0	2	49
1115 - 1130	0	0	19	4	4	4	0	31	0	0	49	9	1	0	2	61
1130 - 1145	0	4	33	16	3	34	0	90	0	0	32	5	1	0	3	41
1145 - 1200	0	0	87	16	4	9	0	116	0	1	42	7	0	0	0	50
Hourly Total	**0**	**4**	**163**	**42**	**11**	**52**	**0**	**272**	**0**	**2**	**161**	**27**	**4**	**0**	**7**	**201**
1200 - 1215	0	0	22	3	3	8	0	36	0	0	34	5	0	0	1	40
1215 - 1230	0	0	68	22	3	25	3	121	0	0	39	4	0	0	1	44
1230 - 1245	0	1	24	18	6	25	8	82	1	0	30	6	0	0	4	41
1245 - 1300	0	0	24	8	4	12	1	49	0	0	37	9	0	0	0	46
Hourly Total	**0**	**1**	**138**	**51**	**16**	**70**	**12**	**288**	**1**	**0**	**140**	**24**	**0**	**0**	**6**	**171**
1300 - 1315	0	0	25	5	4	8	0	42	0	2	32	4	0	0	2	40
1315 - 1330	0	0	25	3	5	4	0	37	0	0	38	4	0	0	1	43
1330 - 1345	0	0	25	4	2	6	0	37	0	0	40	6	1	0	3	50
1345 - 1400	0	0	12	4	2	3	0	21	0	0	52	2	0	0	2	56
Hourly Total	**0**	**0**	**87**	**16**	**13**	**21**	**0**	**137**	**0**	**2**	**162**	**16**	**1**	**0**	**8**	**189**
TOTAL	**3**	**15**	**1531**	**378**	**208**	**658**	**25**	**2818**	**10**	**11**	**2691**	**324**	**14**	**4**	**78**	**3132**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (3) A5154 / A55

Approach: A55 (South)

	Ahead to A5154								Right to A55 (East)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	62	8	1	0	0	**71**	0	0	24	4	0	4	0	**32**
1415 - 1430	0	0	63	7	0	0	2	**72**	0	0	18	3	1	4	0	**26**
1430 - 1445	0	0	79	7	0	0	0	**86**	0	0	13	4	0	3	0	**20**
1445 - 1500	0	0	73	7	0	0	1	**81**	0	0	18	4	0	4	0	**26**
Hourly Total	**0**	**0**	**277**	**29**	**1**	**0**	**3**	**310**	**0**	**0**	**73**	**15**	**1**	**15**	**0**	**104**
1500 - 1515	0	0	80	7	0	0	2	**89**	0	0	34	3	2	6	0	**45**
1515 - 1530	0	1	64	15	0	0	0	**80**	0	0	22	0	4	9	0	**35**
1530 - 1545	0	0	73	8	0	0	3	**84**	0	0	22	1	2	5	0	**30**
1545 - 1600	0	1	88	5	0	0	3	**97**	0	0	22	5	2	7	0	**36**
Hourly Total	**0**	**2**	**305**	**35**	**0**	**0**	**8**	**350**	**0**	**0**	**100**	**9**	**10**	**27**	**0**	**146**
1600 - 1615	0	1	76	6	0	0	1	**84**	0	1	24	4	0	11	0	**40**
1615 - 1630	0	0	89	9	0	0	1	**99**	0	0	29	6	1	6	1	**43**
1630 - 1645	0	3	96	8	0	0	0	**107**	0	0	21	7	0	13	0	**41**
1645 - 1700	0	1	81	12	0	0	1	**95**	0	0	21	0	0	12	0	**33**
Hourly Total	**0**	**5**	**342**	**35**	**0**	**0**	**3**	**385**	**0**	**1**	**95**	**17**	**1**	**42**	**1**	**157**
1700 - 1715	0	0	71	13	0	0	1	**85**	0	0	22	2	0	11	0	**35**
1715 - 1730	0	2	106	8	0	0	2	**118**	0	0	24	2	1	9	0	**36**
1730 - 1745	0	0	67	10	0	0	0	**77**	0	0	23	5	0	7	0	**35**
1745 - 1800	1	0	79	14	0	0	1	**95**	0	0	30	2	0	3	0	**35**
Hourly Total	**1**	**2**	**323**	**45**	**0**	**0**	**4**	**375**	**0**	**0**	**99**	**11**	**1**	**30**	**0**	**141**
1800 - 1815	0	0	71	3	0	0	0	**74**	0	0	22	6	1	7	0	**36**
1815 - 1830	0	0	62	7	0	0	1	**70**	0	0	19	4	1	10	0	**34**
1830 - 1845	0	1	53	6	0	0	0	**60**	0	1	24	5	2	9	0	**41**
1845 - 1900	0	1	61	5	0	0	0	**67**	0	0	20	7	3	11	0	**41**
Hourly Total	**0**	**2**	**247**	**21**	**0**	**0**	**1**	**271**	**0**	**1**	**85**	**22**	**7**	**37**	**0**	**152**
1900 - 1915	0	0	47	4	0	0	0	**51**	0	0	25	3	1	6	1	**36**
1915 - 1930	0	0	46	6	0	0	0	**52**	0	0	34	8	4	11	0	**57**
1930 - 1945	0	0	37	5	0	0	0	**42**	1	0	18	8	0	8	1	**36**
1945 - 2000	0	0	39	4	0	0	0	**43**	0	0	21	2	0	6	0	**29**
Hourly Total	**0**	**0**	**169**	**19**	**0**	**0**	**0**	**188**	**1**	**0**	**98**	**21**	**5**	**31**	**2**	**158**
2000 - 2015	0	0	38	3	0	0	0	**41**	1	0	8	1	0	8	0	**18**
2015 - 2030	0	0	34	2	0	0	0	**36**	0	0	11	1	0	4	0	**16**
2030 - 2045	0	0	26	1	0	0	0	**27**	0	0	9	1	0	2	0	**12**
2045 - 2100	0	0	24	1	0	1	0	**26**	0	0	8	0	0	2	0	**10**
Hourly Total	**0**	**0**	**122**	**7**	**0**	**1**	**0**	**130**	**1**	**0**	**36**	**3**	**0**	**16**	**0**	**56**
2100 - 2115	0	0	24	2	0	1	0	**27**	0	0	9	6	1	3	0	**19**
2115 - 2130	0	0	26	1	0	0	0	**27**	0	0	6	1	1	7	0	**15**
2130 - 2145	0	0	25	1	0	0	0	**26**	0	0	4	3	1	5	0	**13**
2145 - 2200	0	0	25	0	0	0	0	**25**	0	0	7	2	0	5	0	**14**
Hourly Total	**0**	**0**	**100**	**4**	**0**	**1**	**0**	**105**	**0**	**0**	**26**	**12**	**3**	**20**	**0**	**61**
2200 - 2215	0	0	15	0	0	0	0	**15**	0	0	6	2	1	5	0	**14**
2215 - 2230	0	0	13	1	0	0	0	**14**	0	0	11	0	0	6	0	**17**
2230 - 2245	0	0	14	2	0	0	0	**16**	0	0	4	0	0	6	1	**11**
2245 - 2300	0	0	12	0	0	0	0	**12**	0	0	5	3	0	12	0	**20**
Hourly Total	**0**	**0**	**54**	**3**	**0**	**0**	**0**	**57**	**0**	**0**	**26**	**5**	**1**	**29**	**1**	**62**
2300 - 2315	0	0	8	0	0	0	0	**8**	0	0	4	1	1	15	0	**21**
2315 - 2330	0	0	9	0	0	0	0	**9**	0	0	5	2	0	13	1	**21**
2330 - 2345	0	0	7	0	0	0	0	**7**	0	0	5	2	0	11	0	**18**
2345 - 2400	0	0	6	2	0	0	0	**8**	0	0	8	4	1	9	0	**22**
Hourly Total	**0**	**0**	**30**	**2**	**0**	**0**	**0**	**32**	**0**	**0**	**22**	**9**	**2**	**48**	**1**	**82**
0000 - 0015	0	0	5	0	0	1	0	**6**	0	0	3	7	1	17	1	**29**
0015 - 0030	0	0	5	1	0	0	0	**6**	0	0	5	2	2	23	1	**33**
0030 - 0045	0	0	5	0	0	0	0	**5**	0	1	3	0	0	10	0	**14**
0045 - 0100	0	0	3	0	0	0	0	**3**	0	0	8	4	0	9	0	**21**
Hourly Total	**0**	**0**	**18**	**1**	**0**	**1**	**0**	**20**	**0**	**1**	**19**	**13**	**3**	**59**	**2**	**97**
0100 - 0115	0	0	0	0	0	0	0	**0**	0	0	5	4	4	15	1	**29**
0115 - 0130	0	0	4	0	0	0	0	**4**	0	0	8	5	5	16	0	**34**
0130 - 0145	0	0	0	0	0	0	0	**0**	0	0	5	1	1	23	0	**30**
0145 - 0200	0	0	0	0	0	0	0	**0**	0	0	1	0	0	16	1	**18**
Hourly Total	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**19**	**10**	**10**	**70**	**2**	**111**
0200 - 0215	0	0	0	0	0	0	0	**0**	0	0	2	1	0	11	0	**14**
0215 - 0230	0	0	0	1	0	0	0	**1**	0	0	0	0	1	6	0	**7**
0230 - 0245	0	0	0	0	0	0	0	**0**	0	0	0	0	3	3	0	**6**
0245 - 0300	0	0	0	0	0	0	0	**0**	0	0	0	0	2	3	0	**5**
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**1**	**6**	**23**	**0**	**32**
0300 - 0315	0	0	0	0	0	0	0	**0**	0	0	0	1	0	2	0	**3**
0315 - 0330	0	0	0	0	0	0	0	**0**	0	0	1	2	0	4	0	**7**
0330 - 0345	0	0	0	0	0	0	0	**0**	0	0	0	1	0	1	0	**2**
0345 - 0400	0	0	0	0	0	0	0	**0**	0	0	0	0	0	1	0	**1**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**4**	**0**	**8**	**0**	**13**
0400 - 0415	0	0	2	0	0	0	0	**2**	0	0	1	1	1	3	0	**6**
0415 - 0430	0	0	1	0	0	0	0	**1**	0	0	2	1	2	2	0	**7**
0430 - 0445	0	0	0	0	0	0	0	**0**	0	0	4	3	1	2	0	**10**
0445 - 0500	0	0	1	0	0	0	0	**1**	0	0	0	1	1	1	0	**3**
Hourly Total	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**7**	**6**	**5**	**8**	**0**	**26**
0500 - 0515	0	0	2	0	0	0	0	**2**	0	0	1	1	2	4	0	**8**
0515 - 0530	0	0	1	2	0	0	0	**3**	0	0	1	0	0	5	0	**6**
0530 - 0545	0	0	1	0	0	0	0	**1**	0	0	2	0	0	6	0	**8**
0545 - 0600	0	0	3	0	0	0	0	**3**	0	0	10	1	5	3	0	**19**
Hourly Total	**0**	**0**	**7**	**2**	**0**	**0**	**0**	**9**	**0**	**0**	**14**	**2**	**7**	**18**	**0**	**41**
0600 - 0615	0	0	4	1	0	0	0	**5**	0	0	4	2	7	4	0	**17**
0615 - 0630	0	0	8	1	0	0	0	**9**	0	0	7	1	6	7	0	**21**
0630 - 0645	0	0	5	1	0	0	0	**6**	0	0	10	2	2	12	0	**26**
0645 - 0700	0	0	8	3	0	0	1	**12**	0	0	17	4	1	14	1	**37**
Hourly Total	**0**	**0**	**25**	**6**	**0**	**0**	**1**	**32**	**0**	**0**	**38**	**9**	**16**	**37**	**1**	**101**
0700 - 0715	0	0	11	0	0	0	0	**11**	0	0	14	6	1	14	0	**35**
0715 - 0730	0	0	15	5	0	0	0	**20**	0	0	23	3	2	14	0	**42**
0730 - 0745	0	0	27	8	0	2	1	**38**	0	0	27	10	2	14	0	**53**
0745 - 0800	1	0	46	6	0	0	2	**55**	0	0	26	10	0	11	0	**47**
Hourly Total	**1**	**0**	**99**	**19**	**0**	**2**	**3**	**124**	**0**	**0**	**90**	**29**	**5**	**53**	**0**	**177**
0800 - 0815	0	0	28	13	1	0	1	**43**	0	1	24	10	2	10	0	**47**
0815 - 0830	0	1	50	9	0	0	1	**61**	0	0	33	7	2	2	0	**44**
0830 - 0845	0	0	83	11	1	0	7	**102**	0	0	24	5	1	5	0	**35**
0845 - 0900	0	0	93	14	3	0	0	**110**	0	0	23	6	1	6	0	**36**
Hourly Total	**0**	**1**	**254**	**47**	**5**	**0**	**9**	**316**	**0**	**1**	**104**	**28**	**6**	**23**	**0**	**162**
0900 - 0915	1	0	73	12	1	0	2	**89**	0	0	23	9	0	3	0	**35**
0915 - 0930	0	0	51	10	0	1	1	**63**	0	0	12	5	3	2	0	**22**
0930 - 0945	1	0	50	11	2	1	1	**66**	0	0	17	4	0	5	0	**26**
0945 - 1000	1	0	43	9	2	0	1	**56**	0	0	12	8	1	4	0	**25**
Hourly Total	**3**	**0**	**217**	**42**	**5**	**2**	**5**	**274**	**0**	**0**	**64**	**26**	**4**	**14**	**0**	**108**
1000 - 1015	0	0	51	10	0	0	0	**61**	0	0	14	6	1	3	0	**24**
1015 - 1030	0	1	50	5	5	1	1	**63**	0	0	22	2	3	11	0	**38**
1030 - 1045	0	0	55	11	4	0	0	**70**	0	0	21	4	6	8	0	**39**
1045 - 1100	0	0	64	11	0	0	1	**76**	0	0	18	9	1	5	0	**33**
Hourly Total	**0**	**1**	**220**	**37**	**9**	**1**	**2**	**270**	**0**	**0**	**75**	**21**	**11**	**27**	**0**	**134**
1100 - 1115	0	0	50	6	0	0	1	**57**	0	0	16	4	2	9	0	**31**
1115 - 1130	0	0	59	8	0	0	1	**68**	0	0	23	7	1	10	0	**41**
1130 - 1145	0	0	62	4	3	0	1	**70**	0	0	27	9	4	11	0	**51**
1145 - 1200	0	1	65	13	2	0	0	**81**	1	0	31	4	4	15	1	**56**
Hourly Total	**0**	**1**	**236**	**31**	**5**	**0**	**3**	**276**	**1**	**0**	**97**	**24**	**11**	**45**	**1**	**179**
1200 - 1215	0	0	67	17	3	0	2	**89**	0	0	32	10	4	11	1	**58**
1215 - 1230	0	0	59	10	1	0	0	**70**	0	1	26	6	4	14	0	**51**
1230 - 1245	0	0	54	8	1	0	0	**63**	0	0	27	9	1	18	2	**57**
1245 - 1300	0	0	65	9	2	0	0	**76**	0	0	41	8	5	23	1	**78**
Hourly Total	**0**	**0**	**245**	**44**	**7**	**0**	**2**	**298**	**0**	**1**	**126**	**33**	**14**	**66**	**4**	**244**
1300 - 1315	0	0	78	6	0	0	2	**86**	0	0	44	8	1	16	1	**70**
1315 - 1330	0	0	65	12	1	0	0	**78**	0	0	46	6	2	8	1	**63**
1330 - 1345	0	0	57	11	1	1	1	**71**	0	0	29	2	2	8	0	**41**
1345 - 1400	1	0	76	8	2	0	0	**87**	0	0	24	8	2	1	0	**35**
Hourly Total	**1**	**0**	**276**	**37**	**4**	**1**	**3**	**322**	**0**	**0**	**143**	**24**	**7**	**33**	**2**	**209**
TOTAL	**6**	**14**	**3574**	**467**	**36**	**9**	**47**	**4153**	**3**	**5**	**1459**	**354**	**136**	**779**	**17**	**2753**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (4) Kingsland Roundabout

Approach: A55 (North)

	Ahead to A55 (South)								Ahead to Kingsland Road (South)								Right to Fire Station								Last Right to Kingsland Road (North)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	34	5	3	6	1	49	0	0	37	3	0	0	0	40	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	13
1415 - 1430	0	0	34	5	1	3	0	43	0	1	26	3	0	0	0	30	0	0	0	0	0	0	0	0	0	0	17	3	0	0	0	20
1430 - 1445	0	0	38	6	2	0	0	46	0	0	31	5	1	0	1	38	0	0	0	0	1	0	0	1	0	0	18	2	0	0	0	20
1445 - 1500	0	0	27	9	2	2	2	42	0	0	32	1	0	0	0	33	0	0	0	0	0	0	0	0	0	0	18	2	0	0	0	20
Hourly Total	0	0	133	25	8	11	3	180	0	1	126	12	1	0	1	141	0	0	0	0	1	0	0	1	0	0	66	7	0	0	0	73
1500 - 1515	0	0	46	5	1	0	0	52	0	0	38	1	0	0	1	40	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	23
1515 - 1530	0	0	46	3	1	0	1	51	0	0	41	3	0	0	2	46	0	0	0	0	0	0	0	0	0	0	20	2	0	0	0	22
1530 - 1545	0	1	56	7	3	2	0	69	0	0	41	5	0	0	1	47	0	0	0	0	0	0	0	0	0	0	24	2	0	0	0	26
1545 - 1600	0	0	47	3	2	1	1	54	0	0	44	5	0	0	0	49	0	0	0	0	0	0	0	0	0	0	20	6	0	0	0	26
Hourly Total	0	1	195	18	7	3	2	226	0	0	164	14	0	0	4	182	0	0	0	0	0	0	0	0	0	0	84	13	0	0	0	97
1600 - 1615	0	0	54	4	6	1	1	66	0	0	35	6	0	0	1	42	0	0	0	0	0	0	0	0	0	0	26	2	0	0	0	28
1615 - 1630	0	0	35	11	3	4	0	53	0	0	35	4	0	1	0	40	0	0	0	0	0	0	0	0	0	0	20	2	0	0	0	22
1630 - 1645	0	0	54	10	4	3	1	72	0	0	46	5	0	0	1	52	0	0	0	0	0	0	0	0	0	0	21	3	0	0	0	24
1645 - 1700	0	2	44	3	5	3	0	57	0	0	41	6	0	0	0	47	0	0	0	0	0	0	0	0	0	0	20	2	0	0	0	22
Hourly Total	0	2	187	28	18	11	2	248	0	0	157	21	0	1	2	181	0	0	0	0	0	0	0	0	0	0	87	9	0	0	0	96
1700 - 1715	0	0	61	6	1	1	0	69	0	0	37	4	0	0	0	41	0	0	0	0	0	0	0	0	0	0	26	2	0	0	0	28
1715 - 1730	0	0	49	2	0	0	0	51	0	0	33	4	0	0	0	37	0	0	0	1	0	0	0	1	0	0	28	2	0	0	0	30
1730 - 1745	0	0	41	11	3	3	3	61	0	0	32	7	1	0	1	41	0	0	0	0	0	0	0	0	0	0	16	3	0	0	0	19
1745 - 1800	0	0	27	4	3	1	1	36	0	0	28	4	0	0	0	32	0	0	1	0	0	0	0	1	0	0	18	1	0	0	0	19
Hourly Total	0	0	178	23	7	5	4	217	0	0	130	19	1	0	1	151	0	0	1	1	0	0	0	2	0	0	88	8	0	0	0	96
1800 - 1815	0	0	32	4	1	3	0	40	0	0	32	4	0	0	0	36	0	0	0	0	0	0	0	0	0	0	16	1	0	0	0	17
1815 - 1830	0	0	49	25	4	20	1	99	0	0	31	5	0	0	0	36	0	0	0	1	0	0	0	1	0	0	16	3	0	0	0	19
1830 - 1845	0	0	67	27	6	30	1	131	0	0	46	1	0	0	0	47	0	0	0	0	0	0	0	0	0	0	32	5	0	0	0	37
1845 - 1900	0	0	39	4	2	24	2	71	0	1	44	4	0	0	0	49	0	0	0	1	0	0	0	1	0	0	15	4	0	0	0	19
Hourly Total	0	0	187	60	13	77	4	341	0	1	153	14	0	0	0	168	0	0	0	2	0	0	0	2	0	0	79	13	0	0	0	92
1900 - 1915	0	0	19	5	2	3	0	29	0	1	30	1	0	0	0	32	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	11
1915 - 1930	0	0	14	5	2	2	0	23	0	0	25	1	0	0	0	26	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10
1930 - 1945	0	1	18	2	2	4	1	28	0	0	35	2	0	0	0	37	0	0	0	0	0	0	0	0	0	1	11	1	0	0	0	13
1945 - 2000	0	0	14	0	4	1	0	19	0	0	28	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	8
Hourly Total	0	1	65	12	10	10	1	99	0	1	118	4	0	0	0	123	0	0	0	0	0	0	0	0	0	1	38	3	0	0	0	42
2000 - 2015	0	0	23	2	3	3	0	31	0	0	21	2	0	0	0	23	0	0	0	0	0	0	0	0	0	0	8	1	0	0	0	9
2015 - 2030	0	0	7	1	4	0	0	12	0	0	11	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
2030 - 2045	0	0	13	0	0	2	0	15	0	0	10	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10	2	0	0	0	12
2045 - 2100	0	0	10	2	1	3	0	16	0	0	15	1	0	0	0	16	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5
Hourly Total	0	0	53	5	8	8	0	74	0	0	57	3	0	0	0	60	0	0	0	0	0	0	0	0	0	0	28	4	0	0	0	32
2100 - 2115	0	0	8	3	1	0	0	12	0	0	18	0	0	0	0	18	0	0	1	0	0	0	0	1	0	0	9	0	0	0	0	9
2115 - 2130	0	0	12	3	1	0	0	16	0	0	14	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
2130 - 2145	0	0	5	1	2	0	0	8	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
2145 - 2200	0	0	4	1	2	3	0	10	0	0	11	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	6
Hourly Total	0	0	29	8	6	3	0	46	0	0	56	1	0	0	0	57	0	0	1	0	0	0	0	1	0	0	25	0	1	0	0	26
2200 - 2215	0	0	8	12	0	2	0	22	0	1	14	0	1	0	0	16	0	0	1	0	0	0	0	1	0	0	6	0	0	0	0	6
2215 - 2230	0	0	2	1	2	1	0	6	0	0	9	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	6
2230 - 2245	0	0	4	0	1	0	0	5	0	0	9	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
2245 - 2300	0	0	6	3	2	2	0	13	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
Hourly Total	0	0	20	16	5	5	0	46	0	1	37	0	1	0	0	39	0	0	1	0	0	0	0	1	0	0	20	2	0	0	0	22
2300 - 2315	0	0	3	0	4	0	0	7	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2315 - 2330	0	0	4	0	4	1	0	9	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2330 - 2345	0	0	0	1	2	3	0	6	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2345 - 2400	0	0	1	1	3	2	0	7	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Hourly Total	0	0	8	2	13	6	0	29	0	0	16	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
0000 - 0015	0	0	2	0	2	0	1	5	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0015 - 0030	0	0	9	4	3	4	0	20	0	0	2	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	2
0030 - 0045	0	0	65	15	14	53	2	149	0	0	7	1	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0045 - 0100	0	1	45	18	10	71	2	147	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
Hourly Total	0	1	121	37	29	128	5	321	0	0	13	2	0	0	0	15	0	0	1	0	0	0	0	1	0	0	6	0	0	0	0	6
0100 - 0115	0	1	9	3	7	30	0	50	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	1	1	4	9	0	15	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
0130 - 0145	0	0	2	0	2	12	0	16	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	11	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Hourly Total	0	1	12	4	13	62	0	92	0	0	4	2	0	0	0	6	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5
0200 - 0215	0	0	0	0	3	4	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	2	0	0	7	0	9	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0230 - 0245	0	0	2	0	0	3	0	5	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	2	0	0	8	0	10	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	6	0	3	22	0	31	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0300 - 0315	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	2	0	0	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	2	0	0	1	0	3	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	4	0	0	6	0	10	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0415 - 0430	0	0	3	0	1	1	0	5	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	1	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0445 - 0500	0	0	2	0	0	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	7	0	1	5	0	13	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0500 - 0515	0	0	5	2	1	1	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	7	7	2	27	0	43	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0530 - 0545	0	0	4	0	2	5	0	11	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0545 - 0600	0	0	9	1	2	2	0	14	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Hourly Total	0	0	25	10	7	35	0	77	0	0	8	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6
0600 - 0615	0	0	17	10	2	39	2	70	0	0	3	1	0	0	0	4	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	2
0615 - 0630	0	0	16	5	1	6	0	28	0	0	4	0	0	0	0	4	0	0	1	0	0	0	0	1	0	0	4	0	0	0	0	4
0630 - 0645	0	0	12	1	2	12	0	27	0	0	4	1	0	0	0	5	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1
0645 - 0700	0	0	13	6	0	11	0	30	0	0	6	2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Hourly Total	0	0	58	22	5	68	2	155	0	0	17	4	0	0	0	21	0	0	3	0	0	0	0	3	0	0	9	0	0	0	0	9
0700 - 0715	0	0	14	5	0	4	1	24	0	0	6	2	1	0	0	9	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0715 - 0730	0	2	37	9	0	5	1	54	0	0	12	3	0	0	0	15	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5
0730 - 0745	0	1	39	9	2	2	0	53	0	0	11	3	0	0	2	16	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	7
0745 - 0800	0	1	35	9	0	6	2	53	0	0	15	3	0	0	0	18	0	0	1	0	0	0	0	1	0	0	8	1	0	0	0	9
Hourly Total	0	4	125	32	2	17	4	184	0	0	44	11	1	0	2	58	0	0	1	0	0	0	0	1	0	0	20	3	0	0	0	23
0800 - 0815	0	0	37	5	0	2	0	44	0	0	17	3	0	0	1	21	0	0	0	0	0	0	0	0	0	0	9	3	0	0	0	12
0815 - 0830	0	0	32	8	3	3	0	46	0	0	24	5	0	0	1	30	0	0	0	0	0	0	0	0	0	0	15	3	0	0	0	18
0830 - 0845	0	0	54	10	2	5	2	73	0	0	22	6	0	0	0	28	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	18
0845 - 0900	0	0	25	9	0	7	0	41	0	0	37	2	0	0	1	40	0	0	0	0	0	0	0	0	0	0	25	2	0	0	0	27
Hourly Total	0	0	148	32	5	17	2	204	0	0	100	16	0	0	3	119	0	0	0	0	0	0	0	0	0	0	66	9	0	0	0	75
0900 - 0915	0	0	34	14	0	4	2	54	0	0	34	3	0	0	0	37	0	0	0	0	0	0	0	0	0	0	19	3	0	0	0	22
0915 - 0930	0	0	21	4	1	0	2	28	0	0	29	0	1	0	0	30	0	0	0	0	0	0	0	0	0	0	15	3	0	0	0	18
0930 - 0945	0	2	26	14	3	3	2	50	0	0	19	1	0	0	0	20	0	0	0	0	0	0	0	0	0	0	12	1	0	0	0	13
0945 - 1000	0	0	22	7	1	0	1	31	0	0	19	2	0	0	0	21	0	0	0	0	0	0	0	0	0	0	16	2	0	0	0	18
Hourly Total	0	2	103	39	5	7	7	163	0	0	101	6	1	0	0	108	0	0	0	0	0	0	0	0	0	0	62	9	0	0	0	71
1000 - 1015	0	0	32	7	3	0	1	43	0	0	22	4	0	0	0	26	0	0	1	0	0	0	0	1	0	0	11	2	0	0	0	13
1015 - 1030	0	0	36	3	4	3	0	46	0	0	25	5	1	0	0	31	0	0	0	0	0	0	0	0	0	0	14	3	0	0	0	17
1030 - 1045	0	0	28	6	1	4	0	39	0	0	28	3	0	0	0	31	0	0	1	0	0	0	0	1	0	0	15	2	0	0	0	17
1045 - 1100	0	0	32	4	5	3	0	44	0	0	24	5	0	0	1	30	0	0	0	0	0	0	0	0	0	0	12	2	0	0	0	14
Hourly Total	0	0	128	20	13	10	1	172	0	0	99	17	1	0	1	118	0	0	2	0	0	0	0	2	0	0	52	9	0	0	0	61
1100 - 1115	0	0	37	3	1	2	0	43	0	0	21	4	0	1	1	27	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	18
1115 - 1130	0	0	24	6	5	6	0	41	0	0	27	4	0	0	1	32	0	0	0	0	0	0	0	0	0	0	14	3	0	0	0	17
1130 - 1145	0	0	54	18	4	33	1	110	0	0	25	1	0	1	0	27	0	0	0	0	0	0	0	0	0	0	11	2	0	0	0	13
1145 - 1200	0	4	93	14	5	6	0	122	0	0	29	12	0	0	0	41	0	0	0	0	0	0	0	0	0	0	16	3	0	0	0	19
Hourly Total	0	4	208	41	15	47	1	316	0	0	102	21	0	2	2	127	0	0	0	0	0	0	0	0	0	0	58	9	0	0	0	67
1200 - 1215	0	0	50	5	4	8	0	67	0	0	38	2	0	0	0	40	0	0	0	0	0	0	0	0	0	0	18	2	0	0	0	20
1215 - 1230	0	1	77	27	2	25	4	136	0	0	35	3	0	0	0	38	0	0	0	0	0	0	0	0	0	0	18	1	2	0	0	21
1230 - 1245	0	1	36	25	3	28	6	99	0	0	37	4	0	0	3	44	0	0	0	0	0	0	0	0	0	0	14	1	0	0	0	15
1245 - 1300	0	0	45	10	4	13	1	73	0	0	24	6	1	0	0	31	0	0	0	0	0	0	0	0	0	0	13	2	0	0	0	15
Hourly Total	0	2	208	67	13	74	11	375	0	0	134	15	1	0	3	153	0	0	0	0	0	0	0	0	0	0	63	6	2	0	0	71
1300 - 1315	0	0	51	4	6	9	0	70	0	0	22	7	1	0	1	31	0	0	0	0	0	0	0	0	0	0	19	3	0	0	0	22
1315 - 1330	0	0	43	6	6	5	0	60	0	0	22	4	0	0	0	26	0	0	0	0	0	0	0	0	0	0	18	4	0	0	0	22
1330 - 1345	0	0	51	8	4	5	0	68	0	0	26	7	0	0	0	33	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	23
1345 - 1400	0	0	29	10	4	3	0	46	0	0	18	1	0	0	1	20	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	18
Hourly Total	0	0	174	28	20	22	0	244	0	0	88	19	1	0	2	110	0	0	0	0	0	0	0	0	0	0	74	11	0	0	0	85
TOTAL	0	18	2382	529	226	659	49	3863	0	4	1731	202	8	3	21	1969	0	0	10	3	1	0	0	14	0	1	945	115	3	0	0	1064

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (4) Kingsland Roundabout

Approach: A55 (South)

	Left to Kingsland Road (South)								Left to Fire Station								Ahead to Kingsland Road (North)								Ahead to A55 (North)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	9	3	1	0	0	13	0	0	0	0	0	0	0	0	0	0	16	2	0	0	0	18	0	0	42	7	1	5	0	55
1415 - 1430	0	0	12	4	0	0	0	16	0	0	0	0	2	0	0	2	0	0	17	4	2	0	0	23	0	0	41	4	1	3	0	49
1430 - 1445	0	0	12	1	0	0	0	13	0	0	0	0	0	0	0	0	0	0	21	4	0	0	0	25	0	0	50	5	0	3	0	58
1445 - 1500	0	0	10	4	1	0	0	15	0	0	0	0	0	0	0	0	0	0	22	5	0	0	0	27	0	0	35	8	0	4	1	48
Hourly Total	**0**	**0**	**43**	**12**	**2**	**0**	**0**	**57**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**76**	**15**	**2**	**0**	**0**	**93**	**0**	**0**	**168**	**24**	**2**	**15**	**1**	**210**
1500 - 1515	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0	0	0	12	6	0	0	0	18	0	0	46	5	2	6	2	61
1515 - 1530	0	0	6	2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	11	2	0	0	0	13	0	1	34	7	4	8	0	54
1530 - 1545	0	0	18	2	0	0	0	20	0	0	0	0	0	0	0	0	1	0	15	2	1	0	0	19	0	0	40	5	2	5	1	53
1545 - 1600	0	0	17	1	0	0	0	18	0	0	0	0	1	0	0	1	0	0	16	3	0	0	0	19	0	1	48	4	2	6	0	61
Hourly Total	**0**	**0**	**54**	**6**	**0**	**0**	**0**	**60**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**54**	**13**	**1**	**0**	**0**	**69**	**0**	**2**	**168**	**21**	**10**	**25**	**3**	**229**
1600 - 1615	0	0	19	2	0	0	0	21	0	0	1	0	0	0	0	1	0	0	21	3	0	0	0	24	0	1	44	7	0	11	1	64
1615 - 1630	0	0	22	5	0	0	0	27	0	0	1	0	0	0	0	1	0	1	17	3	0	0	0	21	0	0	56	7	1	6	1	71
1630 - 1645	0	0	18	2	0	0	0	20	0	0	0	0	0	0	0	0	0	0	19	6	0	0	0	25	0	3	66	7	0	13	0	89
1645 - 1700	0	0	21	3	0	0	0	24	0	0	1	0	0	0	0	1	0	0	14	2	0	0	0	16	0	1	51	5	0	12	0	69
Hourly Total	**0**	**0**	**80**	**12**	**0**	**0**	**0**	**92**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**71**	**14**	**0**	**0**	**0**	**86**	**0**	**5**	**217**	**26**	**1**	**42**	**2**	**293**
1700 - 1715	0	0	20	3	0	0	0	23	0	0	0	0	0	0	0	0	0	0	38	2	0	0	0	40	0	0	48	13	0	11	0	72
1715 - 1730	0	0	23	0	0	0	0	23	0	0	0	2	0	0	0	2	0	0	20	2	0	1	0	23	0	1	70	5	1	9	1	87
1730 - 1745	0	0	23	2	0	1	0	26	0	0	0	0	0	0	0	0	0	0	22	6	0	0	0	28	0	0	46	6	0	7	0	59
1745 - 1800	0	0	19	1	0	0	0	20	0	0	0	0	1	0	0	1	0	0	19	3	0	0	0	22	0	0	49	11	0	2	0	62
Hourly Total	**0**	**0**	**85**	**6**	**0**	**1**	**0**	**92**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**3**	**0**	**0**	**99**	**13**	**0**	**1**	**0**	**113**	**0**	**1**	**213**	**35**	**1**	**29**	**1**	**280**
1800 - 1815	0	0	21	2	0	0	0	23	0	0	0	0	1	0	0	1	0	0	16	1	0	0	0	17	0	0	48	6	2	7	0	63
1815 - 1830	0	0	15	2	0	0	0	17	0	0	1	0	0	0	0	1	0	0	17	2	0	0	0	19	0	0	40	7	0	10	1	58
1830 - 1845	0	0	16	6	0	0	0	22	0	0	0	0	0	0	0	0	0	0	16	5	0	0	0	21	0	0	26	7	2	10	0	45
1845 - 1900	0	0	15	0	0	0	0	15	0	0	0	1	0	0	0	1	0	0	19	3	0	0	0	22	0	1	43	6	3	10	0	63
Hourly Total	**0**	**0**	**67**	**10**	**0**	**0**	**0**	**77**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**3**	**0**	**0**	**68**	**11**	**0**	**0**	**0**	**79**	**0**	**1**	**157**	**26**	**7**	**37**	**1**	**229**
1900 - 1915	0	0	15	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	13	3	0	0	0	16	0	0	33	8	1	6	1	49
1915 - 1930	0	0	14	1	0	0	0	15	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8	0	0	35	8	4	12	0	59
1930 - 1945	0	0	14	1	0	0	0	15	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	8	0	0	24	9	0	7	1	41
1945 - 2000	0	0	5	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	7	0	0	22	4	0	6	0	32
Hourly Total	**0**	**0**	**48**	**2**	**0**	**0**	**0**	**50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**33**	**6**	**0**	**0**	**0**	**39**	**0**	**0**	**114**	**29**	**5**	**31**	**2**	**181**
2000 - 2015	0	0	8	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	7	1	0	0	0	8	0	0	21	2	0	8	0	31
2015 - 2030	0	0	6	1	0	0	0	7	0	0	0	0	1	0	0	1	0	0	7	0	0	0	0	7	0	0	20	1	0	4	0	25
2030 - 2045	0	0	7	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	10	2	0	0	0	12	0	0	15	2	0	2	0	19
2045 - 2100	0	0	6	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	14	0	0	3	0	17
Hourly Total	**0**	**0**	**27**	**2**	**0**	**0**	**0**	**29**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**27**	**3**	**0**	**0**	**0**	**30**	**0**	**0**	**70**	**5**	**0**	**17**	**0**	**92**
2100 - 2115	0	0	2	0	0	0	0	2	0	0	1	0	0	0	0	1	0	0	7	0	0	0	0	7	0	0	7	7	1	4	0	19
2115 - 2130	0	0	3	0	0	0	0	3	0	0	1	0	0	0	0	1	0	0	4	0	0	0	0	4	0	0	10	0	1	7	0	18
2130 - 2145	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	10	1	1	5	0	17
2145 - 2200	0	0	6	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5	0	0	15	1	0	5	0	21
Hourly Total	**0**	**0**	**15**	**1**	**0**	**0**	**0**	**16**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**20**	**1**	**0**	**0**	**0**	**21**	**0**	**0**	**42**	**9**	**3**	**21**	**0**	**75**
2200 - 2215	0	0	6	0	1	0	0	7	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	5	2	1	7	0	15
2215 - 2230	0	0	4	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	0	9	0	0	4	0	13
2230 - 2245	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	10	0	0	6	1	17
2245 - 2300	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	8	4	0	12	0	24
Hourly Total	**0**	**0**	**15**	**2**	**1**	**0**	**0**	**18**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**1**	**0**	**0**	**0**	**10**	**0**	**0**	**32**	**6**	**1**	**29**	**1**	**69**
2300 - 2315	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	1	15	0	21
2315 - 2330	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	8	1	0	14	1	24
2330 - 2345	0	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	10	0	16
2345 - 2400	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	0	9	3	1	9	0	22
Hourly Total	**0**	**0**	**9**	**2**	**0**	**0**	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**26**	**6**	**2**	**48**	**1**	**83**
0000 - 0015	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	8	7	2	16	0	33
0015 - 0030	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	2	2	23	0	32
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	1	12	0	21
0045 - 0100	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	11	4	0	9	0	24
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**30**	**15**	**5**	**60**	**0**	**110**
0100 - 0115	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	5	4	4	15	1	29
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	7	6	4	16	0	33
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	2	22	0	29
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1	17
Hourly Total	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**1**	**15**	**11**	**10**	**69**	**2**	**108**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	11	0	13
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	0	7
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	6
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	5
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**6**	**23**	**0**	**31**
0300 - 0315	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	3
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	3	0	5	0	9
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Hourly Total	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**4**	**0**	**8**	**0**	**13**
0400 - 0415	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	3	0	6
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	6
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	5
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	1	0	3
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**3**	**5**	**8**	**0**	**20**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	2	4	0	8
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	0	7
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6
0545 - 0600	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	8	0	5	3	0	16
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**9**	**3**	**7**	**18**	**0**	**37**
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	0	0	3	0	8	4	0	15
0615 - 0630	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	7	9	0	21
0630 - 0645	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	2	10	0	19
0645 - 0700	0	0	4	0	0	1	0	5	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	10	4	0	14	2	30
Hourly Total	**0**	**0**	**8**	**1**	**0**	**1**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**4**	**0**	**0**	**23**	**6**	**17**	**37**	**2**	**85**
0700 - 0715	0	0	2	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	4	2	0	0	0	6	0	0	14	6	1	12	0	33
0715 - 0730	0	0	5	1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	23	6	2	14	0	45
0730 - 0745	0	0	3	5	0	0	0	8	0	0	0	0	0	0	0	0	0	0	5	3	0	0	0	8	0	0	30	6	2	15	1	54
0745 - 0800	0	0	6	1	0	0	0	7	0	0	0	0	0	0	0	0	0	0	11	1	0	1	0	13	0	0	41	11	0	10	2	64
Hourly Total	**0**	**0**	**16**	**7**	**0**	**1**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**25**	**6**	**0**	**1**	**0**	**32**	**0**	**0**	**108**	**29**	**5**	**51**	**3**	**196**
0800 - 0815	0	0	4	6	0	1	0	11	0	0	0	0	0	0	0	0	0	0	13	4	1	0	0	18	0	0	28	16	2	10	0	56
0815 - 0830	0	0	7	2	0	0	0	9	0	0	0	0	0	0	0	0	0	0	18	6	0	0	0	24	0	0	38	11	3	2	0	54
0830 - 0845	0	0	10	3	0	0	0	13	0	0	1	0	0	0	0	1	0	0	18	2	0	0	0	20	0	0	50	9	2	5	5	71
0845 - 0900	0	0	15	5	0	0	0	20	0	0	1	0	1	0	0	2	0	0	17	3	1	0	0	21	0	0	41	11	4	6	0	62
Hourly Total	**0**	**0**	**36**	**16**	**0**	**1**	**0**	**53**	**0**	**0**	**2**	**0**	**1**	**0**	**0**	**3**	**0**	**0**	**66**	**15**	**2**	**0**	**0**	**83**	**0**	**0**	**157**	**47**	**11**	**23**	**5**	**243**
0900 - 0915	0	0	11	3	1	1	0	16	0	0	0	0	0	0	0	0	0	0	15	2	0	0	0	17	0	0	39	14	0	3	1	57
0915 - 0930	0	0	16	5	0	0	0	21	0	0	0	0	0	0	0	0	0	0	11	1	0	0	0	12	0	0	28	7	1	3	1	40
0930 - 0945	0	0	6	3	0	0	0	9	0	0	0	0	1	0	0	1	0	0	13	4	1	0	0	18	0	0	33	10	3	6	0	52
0945 - 1000	0	0	5	3	0	0	0	8	0	0	1	0	0	0	0	1	0	0	12	4	0	0	0	16	0	0	23	13	2	4	0	42
Hourly Total	**0**	**0**	**38**	**14**	**1**	**1**	**0**	**54**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**51**	**11**	**1**	**0**	**0**	**63**	**0**	**0**	**123**	**44**	**6**	**16**	**2**	**191**
1000 - 1015	0	0	6	3	0	0	0	9	0	0	0	0	0	0	0	0	0	0	14	3	1	0	0	18	0	0	31	9	0	5	0	45
1015 - 1030	0	0	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	9	1	0	0	0	10	0	0	33	3	6	10	1	53
1030 - 1045	0	0	8	4	1	1	0	14	0	0	0	0	0	0	0	0	0	0	9	7	0	0	0	16	0	0	36	11	8	8	0	63
1045 - 1100	0	0	20	3	0	0	0	23	0	0	0	0	0	0	0	0	0	0	8	2	0	0	0	10	0	0	40	8	1	5	0	54
Hourly Total	**0**	**0**	**37**	**11**	**1**	**1**	**0**	**50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**40**	**13**	**1**	**0**	**0**	**54**	**0**	**0**	**140**	**31**	**15**	**28**	**1**	**215**
1100 - 1115	0	0	13	5	0	0	0	18	0	0	0	0	0	0	0	0	0	0	15	4	0	0	0	19	0	0	34	6	2	11	0	53
1115 - 1130	0	0	10	2	1	1	0	14	0	0	0	0	0	0	0	0	0	0	14	2	0	0	0	16	0	0	39	7	2	10	1	59
1130 - 1145	0	0	13	1	0	0	0	14	0	0	0	0	0	0	0	0	0	0	14	4	0	1	0	19	0	0	47	8	5	10	2	72
1145 - 1200	0	0	21	1	0	0	0	22	0	0	1	0	0	0	0	1	0	0	14	3	0	0	0	17	0	0	50	7	6	13	0	76
Hourly Total	**0**	**0**	**57**	**9**	**1**	**1**	**0**	**68**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**57**	**13**	**0**	**1**	**0**	**71**	**0**	**0**	**170**	**28**	**15**	**44**	**3**	**260**
1200 - 1215	0	0	18	3	1	1	0	23	0	0	0	0	0	0	0	0	0	0	11	2	0	0	0	13	0	0	53	14	8	12	2	89
1215 - 1230	0	0	12	2	0	0	0	14	0	0	0	0	0	0	0	0	0	0	8	2	0	0	0	10	0	1	38	10	4	13	0	66
1230 - 1245	0	0	13	4	0	0	0	17	0	0	0	0	0	0	0	0	0	0	16	0	0	1	0	17	0	0	34	12	1	19	2	68
1245 - 1300	0	0	13	1	0	0	0	14	0	0	1	0	0	0	0	1	0	0	20	5	0	0	0	25	0	0	57	11	5	22	0	95
Hourly Total	**0**	**0**	**56**	**10**	**1**	**1**	**0**	**68**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**55**	**9**	**0**	**1**	**0**	**65**	**0**	**1**	**182**	**47**	**18**	**66**	**4**	**318**
1300 - 1315	0	0	15	0	0	1	0	16	0	0	0	0	0	0	0	0	0	0	17	4	0	0	0	21	0	0	76	9	2	14	1	102
1315 - 1330	0	0	17	4	1	1	0	23	0	0	1	1	0	0	0	2	0	0	18	6	0	0	0	24	0	0	62	11	2	8	1	84
1330 - 1345	0	0	16	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	18	6	0	0	0	24	0	0	51	9	2	10	0	72
1345 - 1400	0	0	14	4	0	0	0	18	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	15	0	0	54	4	1	1	0	60
Hourly Total	**0**	**0**	**62**	**8**	**1**	**2**	**0**	**73**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**68**	**16**	**0**	**0**	**0**	**84**	**0**	**0**	**243**	**33**	**7**	**33**	**2**	**318**
TOTAL	**0**	**0**	**758**	**133**	**8**	**11**	**0**	**910**	**0**	**0**	**14**	**4**	**8**	**0**	**0**	**26**	**1**	**1**	**834**	**161**	**8**	**4**	**0**	**1009**	**0**	**11**	**2413**	**489**	**159**	**778**	**36**	**3886**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (4) Kingsland Roundabout

Approach: Kingsland Road (South)

	First Left to Fire Station								Second Left to Kingsland Road (North)								Ahead to A55 (North)								Right to A55 (South)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	0	0	0	0	0	0	1	1	12	0	0	0	0	14	0	0	37	3	0	0	0	40	0	0	23	3	0	0	1	27
1415 - 1430	0	0	1	0	0	0	0	1	0	0	14	2	0	0	0	16	0	0	26	4	0	0	2	32	0	0	17	4	0	0	0	21
1430 - 1445	0	0	0	0	0	0	0	0	1	0	16	3	0	0	0	20	0	0	28	4	0	0	0	32	0	0	22	4	0	0	1	27
1445 - 1500	0	0	1	0	0	0	0	1	1	0	24	6	0	0	0	31	0	0	42	2	0	0	0	44	0	0	24	7	0	0	1	32
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**3**	**1**	**66**	**11**	**0**	**0**	**0**	**81**	**0**	**0**	**133**	**13**	**0**	**0**	**2**	**148**	**0**	**0**	**86**	**18**	**0**	**0**	**3**	**107**
1500 - 1515	0	0	0	0	0	0	0	0	0	0	23	5	0	0	0	28	0	0	43	2	0	0	0	45	0	0	24	7	0	0	0	31
1515 - 1530	0	0	0	0	0	0	0	0	0	0	24	4	0	0	0	28	0	0	40	4	0	1	0	45	0	0	26	6	0	0	0	32
1530 - 1545	0	0	1	0	0	0	0	1	0	0	21	2	0	0	0	23	0	0	48	4	0	0	2	54	0	0	21	4	0	0	0	25
1545 - 1600	0	0	1	0	0	0	0	1	0	0	20	3	1	0	1	25	0	0	51	6	0	1	3	61	0	0	26	4	0	0	2	32
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**88**	**14**	**1**	**0**	**1**	**104**	**0**	**0**	**182**	**16**	**0**	**2**	**5**	**205**	**0**	**0**	**97**	**21**	**0**	**0**	**2**	**120**
1600 - 1615	0	0	0	0	0	0	0	0	0	0	26	2	0	0	0	28	0	0	39	3	0	0	0	42	0	0	31	2	0	0	1	34
1615 - 1630	0	0	0	0	0	0	0	0	0	0	21	4	0	0	0	25	0	0	40	6	0	0	1	47	0	0	33	6	0	0	1	40
1630 - 1645	0	0	0	1	0	0	0	1	0	0	12	2	0	0	0	14	0	0	40	4	0	0	0	44	0	0	27	6	0	0	1	34
1645 - 1700	0	0	0	0	0	0	0	0	3	0	20	2	0	0	0	25	0	0	41	5	0	0	1	47	0	0	25	2	0	0	0	27
Hourly Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**3**	**0**	**79**	**10**	**0**	**0**	**0**	**92**	**0**	**0**	**160**	**18**	**0**	**0**	**2**	**180**	**0**	**0**	**116**	**16**	**0**	**0**	**3**	**135**
1700 - 1715	0	0	1	0	0	0	0	1	0	0	23	3	0	0	0	26	0	0	30	3	0	0	1	34	0	0	36	3	0	0	1	40
1715 - 1730	0	0	0	0	0	0	0	0	1	0	13	4	0	0	0	18	0	1	58	5	0	0	2	66	0	0	15	4	0	0	0	19
1730 - 1745	0	0	1	0	0	0	0	1	0	0	19	2	0	0	0	21	0	0	24	7	0	0	0	31	0	0	27	1	0	0	1	29
1745 - 1800	0	0	1	1	0	0	0	2	0	0	23	1	0	0	0	24	1	0	42	3	0	1	0	47	0	0	25	2	0	0	0	27
Hourly Total	**0**	**0**	**3**	**1**	**0**	**0**	**0**	**4**	**1**	**0**	**78**	**10**	**0**	**0**	**0**	**89**	**1**	**1**	**154**	**18**	**0**	**1**	**3**	**178**	**0**	**0**	**103**	**10**	**0**	**0**	**2**	**115**
1800 - 1815	0	0	1	0	0	0	0	1	1	0	16	2	0	0	0	19	0	0	37	1	0	0	0	38	0	0	18	2	0	0	0	20
1815 - 1830	0	0	1	0	0	0	0	1	0	0	16	1	0	0	0	17	0	0	37	2	0	0	0	39	0	1	29	2	0	0	0	32
1830 - 1845	0	0	0	0	0	0	0	0	0	0	17	1	0	0	0	18	0	1	40	2	0	0	0	43	0	0	20	3	1	0	0	24
1845 - 1900	0	0	1	0	0	0	0	1	0	0	14	5	0	0	0	19	0	0	29	6	0	0	0	35	0	0	21	3	0	0	0	24
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**63**	**9**	**0**	**0**	**0**	**73**	**0**	**1**	**143**	**11**	**0**	**0**	**0**	**155**	**0**	**1**	**88**	**10**	**1**	**0**	**0**	**100**
1900 - 1915	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	13	0	0	30	1	0	0	0	31	0	0	18	1	0	0	0	19
1915 - 1930	0	0	0	0	0	0	0	0	2	0	17	0	1	0	0	20	0	0	38	1	0	0	0	39	0	0	15	1	1	0	0	17
1930 - 1945	0	0	1	0	0	0	0	1	0	0	12	2	0	0	0	14	0	0	25	2	0	0	0	27	0	0	14	1	0	0	0	15
1945 - 2000	0	0	0	0	0	0	0	0	0	0	9	2	0	0	0	11	0	0	26	2	0	0	0	28	0	0	17	0	0	0	0	17
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**51**	**4**	**1**	**0**	**0**	**58**	**0**	**0**	**119**	**6**	**0**	**0**	**0**	**125**	**0**	**0**	**64**	**3**	**1**	**0**	**0**	**68**
2000 - 2015	0	0	0	0	0	0	0	0	1	1	8	2	0	0	0	12	0	0	22	1	0	0	0	23	1	0	19	2	0	0	0	22
2015 - 2030	0	0	0	0	0	0	0	0	0	0	15	2	0	0	0	17	0	0	21	0	0	0	0	21	0	0	14	1	0	0	0	15
2030 - 2045	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	9	0	0	16	0	0	0	0	16	0	0	9	0	0	0	0	9
2045 - 2100	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4	0	0	14	0	0	0	0	14	0	0	10	0	0	0	0	10
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**36**	**4**	**0**	**0**	**0**	**42**	**0**	**0**	**73**	**1**	**0**	**0**	**0**	**74**	**1**	**0**	**52**	**3**	**0**	**0**	**0**	**56**
2100 - 2115	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10	0	0	19	0	0	0	0	19	0	0	8	1	0	0	0	9
2115 - 2130	0	0	0	0	0	0	0	0	2	0	8	0	0	0	0	10	0	0	18	2	0	0	0	20	0	0	10	1	0	0	0	11
2130 - 2145	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	10	0	0	16	2	0	0	0	18	0	0	6	0	0	0	0	6
2145 - 2200	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	17	1	0	0	0	18	0	0	6	0	0	0	0	6
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**33**	**0**	**0**	**0**	**0**	**35**	**0**	**0**	**70**	**5**	**0**	**0**	**0**	**75**	**0**	**0**	**30**	**2**	**0**	**0**	**0**	**32**
2200 - 2215	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5	0	0	13	0	0	0	0	13	0	0	2	0	0	0	0	2
2215 - 2230	0	0	0	0	0	0	0	0	1	0	8	1	0	0	0	10	0	0	15	0	0	0	0	15	0	0	3	0	2	0	0	5
2230 - 2245	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	7	0	0	7	0	0	0	0	7	0	0	3	0	0	0	0	3
2245 - 2300	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	7	0	0	0	0	7	0	0	3	0	0	0	0	3
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**23**	**3**	**0**	**0**	**0**	**27**	**0**	**0**	**42**	**0**	**0**	**0**	**0**	**42**	**0**	**0**	**11**	**0**	**2**	**0**	**0**	**13**
2300 - 2315	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	5	0	0	0	0	5	0	0	4	0	0	0	0	4
2315 - 2330	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	5	1	0	0	0	6	0	0	3	0	1	0	0	4
2330 - 2345	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	7	2	0	0	0	9	0	0	2	0	0	0	0	2
2345 - 2400	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	4	2	0	0	0	6	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**21**	**5**	**0**	**0**	**0**	**26**	**0**	**0**	**10**	**0**	**1**	**0**	**0**	**11**
0000 - 0015	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	2	0	0	0	0	2
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	1	0	3	0	0	1	0	0	0	0	1
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**6**	**0**	**0**	**1**	**0**	**7**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	1	0	0	0	0	1
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	3	0	0	0	0	3	0	0	1	2	0	0	0	3
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**	**0**	**4**	**0**	**0**	**6**	**1**	**0**	**0**	**0**	**7**	**0**	**0**	**3**	**2**	**0**	**0**	**0**	**5**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
0515 - 0530	0	0	1	0	0	0	0	1	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	1	0	0	0	5
0530 - 0545	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	2	2	0	0	0	4
0545 - 0600	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	3	0	0	0	0	3	0	0	2	0	0	0	0	2
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**1**	**0**	**0**	**0**	**5**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**	**0**	**0**	**10**	**3**	**0**	**0**	**0**	**13**
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4	0	0	0	0	4
0615 - 0630	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	7	1	0	0	0	8	0	1	8	1	0	0	0	10
0630 - 0645	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	6	0	0	0	0	6	0	0	10	1	0	0	0	11
0645 - 0700	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	3	0	0	10	3	0	0	0	13	0	0	10	2	0	0	0	12
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**1**	**0**	**0**	**0**	**8**	**0**	**0**	**25**	**4**	**0**	**0**	**0**	**29**	**0**	**1**	**32**	**4**	**0**	**0**	**0**	**37**
0700 - 0715	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	8	1	0	1	0	10	0	0	11	2	0	0	0	13
0715 - 0730	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	3	0	0	11	2	0	1	0	14	0	0	12	2	0	0	0	14
0730 - 0745	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	6	0	0	14	8	0	1	0	23	0	0	19	8	0	0	0	27
0745 - 0800	0	0	0	0	0	0	0	0	0	0	10	1	0	0	0	11	1	0	24	2	0	0	0	27	0	0	16	1	0	0	0	17
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**23**	**2**	**0**	**0**	**0**	**25**	**1**	**0**	**57**	**13**	**0**	**3**	**0**	**74**	**0**	**0**	**58**	**13**	**0**	**0**	**0**	**71**
0800 - 0815	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	9	0	1	16	7	0	0	1	25	0	0	25	4	0	0	0	29
0815 - 0830	0	0	0	0	0	0	0	0	0	0	19	1	0	0	0	20	0	1	33	3	0	0	1	38	0	0	24	2	0	0	0	26
0830 - 0845	0	0	0	0	0	0	0	0	3	0	21	1	0	0	0	25	0	0	43	5	0	0	2	50	0	0	25	5	0	0	0	30
0845 - 0900	0	0	1	0	0	0	0	1	0	0	48	4	0	0	0	52	0	0	56	9	0	0	0	65	0	0	31	5	0	1	0	37
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**93**	**10**	**0**	**0**	**0**	**106**	**0**	**2**	**148**	**24**	**0**	**0**	**4**	**178**	**0**	**0**	**105**	**16**	**0**	**1**	**0**	**122**
0900 - 0915	0	0	0	0	0	0	0	0	0	0	19	2	1	0	0	22	1	0	39	4	0	0	1	45	0	0	23	1	0	0	1	25
0915 - 0930	0	0	1	0	0	0	0	1	0	0	17	1	0	0	0	18	0	0	26	8	0	0	0	34	0	0	28	1	0	0	0	29
0930 - 0945	0	0	0	0	0	0	0	0	0	0	14	3	0	0	0	17	1	0	27	3	0	0	1	32	0	0	19	6	1	0	0	26
0945 - 1000	0	0	0	0	0	0	0	0	0	0	20	1	0	0	0	21	1	0	24	3	0	0	0	28	0	0	21	4	0	0	0	25
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**70**	**7**	**1**	**0**	**0**	**78**	**3**	**0**	**116**	**18**	**0**	**0**	**2**	**139**	**0**	**0**	**91**	**12**	**1**	**0**	**1**	**105**
1000 - 1015	0	0	1	0	0	0	0	1	0	0	10	1	0	0	0	11	0	0	27	5	0	0	0	32	0	0	22	2	0	0	0	24
1015 - 1030	0	0	1	0	0	0	0	1	0	0	15	4	0	0	0	19	0	0	27	3	2	0	0	32	0	0	16	5	0	0	0	21
1030 - 1045	0	0	1	0	0	0	0	1	1	0	18	1	0	0	0	20	0	0	31	7	2	0	0	40	0	0	16	5	0	0	0	21
1045 - 1100	0	0	0	0	0	0	0	0	0	0	13	4	0	0	0	17	0	0	35	7	0	0	1	43	0	0	19	5	0	0	0	24
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**1**	**0**	**56**	**10**	**0**	**0**	**0**	**67**	**0**	**0**	**120**	**22**	**4**	**0**	**1**	**147**	**0**	**0**	**73**	**17**	**0**	**0**	**0**	**90**
1100 - 1115	0	0	1	0	0	0	0	1	2	0	17	1	0	0	0	20	0	0	24	3	0	0	1	28	0	0	18	2	1	0	0	21
1115 - 1130	0	0	0	0	0	0	0	0	0	0	20	3	0	0	0	23	0	0	29	6	0	0	0	35	0	0	26	3	0	0	0	29
1130 - 1145	0	0	0	0	0	0	0	0	0	0	13	2	0	0	0	15	0	0	27	1	0	0	0	28	0	0	17	2	0	0	1	20
1145 - 1200	0	0	1	0	0	0	0	1	0	0	17	4	0	0	0	21	0	0	36	9	0	0	0	45	0	0	29	3	0	0	0	32
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**67**	**10**	**0**	**0**	**0**	**79**	**0**	**0**	**116**	**19**	**0**	**0**	**1**	**136**	**0**	**0**	**90**	**10**	**1**	**0**	**1**	**102**
1200 - 1215	0	0	0	0	0	0	0	0	1	0	16	1	0	0	0	18	0	0	42	8	0	0	1	51	0	0	23	2	0	0	1	26
1215 - 1230	0	0	0	0	0	0	0	0	0	0	17	2	1	0	0	20	1	0	36	4	1	0	0	42	0	0	18	2	0	0	0	20
1230 - 1245	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	15	0	0	39	2	0	0	1	42	0	0	26	3	1	1	0	31
1245 - 1300	0	0	0	0	0	0	0	0	1	0	16	0	0	0	0	17	0	1	34	4	0	0	0	39	0	0	25	2	0	0	1	28
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**64**	**3**	**1**	**0**	**0**	**70**	**1**	**1**	**151**	**18**	**1**	**0**	**2**	**174**	**0**	**0**	**92**	**9**	**1**	**1**	**2**	**105**
1300 - 1315	0	0	1	0	0	0	0	1	0	1	14	2	0	0	0	17	0	1	36	4	0	0	1	42	0	0	24	3	0	0	0	27
1315 - 1330	0	0	0	0	0	0	0	0	0	0	13	4	1	0	0	18	0	0	34	5	0	1	1	41	0	0	21	3	0	0	0	24
1330 - 1345	0	0	0	0	0	0	0	0	0	0	7	1	1	0	0	9	0	0	26	4	1	0	1	32	0	0	19	3	1	0	0	23
1345 - 1400	0	0	0	0	0	0	0	0	0	0	20	1	1	0	0	22	0	0	34	5	2	0	0	41	0	0	18	4	2	2	0	26
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**54**	**8**	**3**	**0**	**0**	**66**	**0**	**1**	**130**	**18**	**3**	**1**	**3**	**156**	**0**	**0**	**82**	**13**	**3**	**2**	**0**	**100**
TOTAL	**0**	**0**	**21**	**2**	**0**	**0**	**0**	**23**	**22**	**3**	**969**	**120**	**7**	**0**	**1**	**1122**	**6**	**6**	**1984**	**231**	**8**	**8**	**25**	**2268**	**1**	**2**	**1299**	**182**	**11**	**4**	**14**	**1513**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (4) Kingsland Roundabout

Approach: Fire Station

	Left to Kingsland Road (North)								Left to A55 (North)								Right to A55 (South)								Right to Kingsland Road (South)							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	TOTAL
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1415 - 1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1430 - 1445	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1515 - 1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1530 - 1545	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1545 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1730 - 1745	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1745 - 1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2030 - 2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2045 - 2100	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2130 - 2145	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230 - 2245	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0530 - 0545	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
0630 - 0645	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
0715 - 0730	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0730 - 0745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0830 - 0845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0845 - 0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0930 - 0945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0945 - 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015 - 1030	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1045 - 1100	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1100 - 1115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
1115 - 1130	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130 - 1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1145 - 1200	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1200 - 1215	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1215 - 1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1230 - 1245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1245 - 1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1300 - 1315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1315 - 1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1330 - 1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1345 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**10**	**0**	**0**	**9**	**1**	**1**	**0**	**0**	**11**	**0**	**0**	**13**	**2**	**4**	**0**	**0**	**19**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**

Holyhead - Manual Traffic Survey, Wednesday 3rd / Thursday 4th October 2018

Junction: (4) Kingsland Roundabout

Approach: Kingsland Road (North)

	Left to A55 (North)								Ahead to A55 (South)								Right to Kingsland Road (South)								Last Right to Fire Station							
TIME	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**	P/CYCLE	M/CYCLE	CAR	LGV	OGV1	OGV2	BUS	**TOTAL**
1400 - 1415	0	0	12	2	0	0	0	**14**	0	0	12	6	1	1	0	**20**	0	0	13	2	0	0	0	**15**	0	0	0	0	0	0	0	**0**
1415 - 1430	0	0	14	3	0	0	0	**17**	0	0	17	3	0	0	0	**20**	0	0	15	2	0	0	0	**17**	0	0	0	0	0	0	0	**0**
1430 - 1445	0	0	11	2	0	0	0	**13**	0	0	22	4	1	0	0	**27**	0	0	20	4	0	0	1	**25**	0	0	0	0	0	0	0	**0**
1445 - 1500	0	0	14	2	0	0	0	**16**	0	0	19	6	1	0	0	**26**	0	0	22	0	0	0	0	**22**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**51**	**9**	**0**	**0**	**0**	**60**	**0**	**0**	**70**	**19**	**3**	**1**	**0**	**93**	**0**	**0**	**70**	**8**	**0**	**0**	**1**	**79**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	0	0	20	1	0	0	0	**21**	0	0	23	5	0	0	0	**28**	0	0	17	0	0	0	0	**17**	0	0	0	0	0	0	0	**0**
1515 - 1530	0	0	15	2	0	0	0	**17**	0	0	49	4	0	0	0	**53**	0	0	41	4	0	0	0	**45**	0	0	0	0	0	0	0	**0**
1530 - 1545	0	0	6	0	0	0	0	**6**	0	0	26	5	0	0	0	**31**	0	0	28	4	0	0	0	**32**	0	0	0	0	0	0	0	**0**
1545 - 1600	0	0	10	2	0	0	0	**12**	0	0	19	3	0	0	0	**22**	0	0	26	2	0	0	0	**28**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**51**	**5**	**0**	**0**	**0**	**56**	**0**	**0**	**117**	**17**	**0**	**0**	**0**	**134**	**0**	**0**	**112**	**10**	**0**	**0**	**0**	**122**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1600 - 1615	0	1	17	1	0	0	0	**19**	0	0	27	5	0	0	0	**32**	0	0	16	6	0	0	0	**22**	0	0	0	0	0	0	0	**0**
1615 - 1630	0	0	20	2	0	0	0	**22**	0	0	33	10	1	0	1	**45**	0	0	25	4	0	0	0	**29**	0	0	0	0	0	0	0	**0**
1630 - 1645	0	0	13	2	0	0	0	**15**	0	0	30	4	0	0	0	**34**	0	0	26	3	0	0	0	**29**	0	0	0	0	0	0	0	**0**
1645 - 1700	0	0	10	1	0	0	0	**11**	0	0	27	7	1	0	0	**35**	0	0	22	3	0	0	0	**25**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**60**	**6**	**0**	**0**	**0**	**67**	**0**	**0**	**117**	**26**	**2**	**0**	**1**	**146**	**0**	**0**	**89**	**16**	**0**	**0**	**0**	**105**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	0	0	9	1	0	0	0	**10**	0	0	38	4	0	0	0	**42**	0	0	28	3	0	0	0	**31**	0	0	0	0	0	0	0	**0**
1715 - 1730	0	0	8	0	0	0	0	**8**	0	0	35	1	0	0	0	**36**	0	0	23	3	0	0	0	**26**	0	0	0	0	0	0	0	**0**
1730 - 1745	0	0	17	2	0	0	0	**19**	0	0	27	1	0	0	0	**28**	0	0	22	3	0	0	0	**25**	0	0	0	0	0	0	0	**0**
1745 - 1800	0	0	18	0	0	0	0	**18**	0	0	23	2	0	0	0	**25**	0	0	24	2	0	0	0	**26**	0	0	1	0	0	0	0	**1**
Hourly Total	**0**	**0**	**52**	**3**	**0**	**0**	**0**	**55**	**0**	**0**	**123**	**8**	**0**	**0**	**0**	**131**	**0**	**0**	**97**	**11**	**0**	**0**	**0**	**108**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1800 - 1815	0	0	8	2	0	0	0	**10**	0	0	21	5	0	0	0	**26**	0	0	29	5	0	0	0	**34**	0	0	0	0	0	0	0	**0**
1815 - 1830	0	0	4	2	0	0	0	**6**	0	0	17	2	0	0	0	**19**	0	0	10	0	0	0	0	**10**	0	0	0	0	0	0	0	**0**
1830 - 1845	0	0	10	1	0	0	0	**11**	0	0	25	5	0	0	0	**30**	0	0	13	0	0	0	0	**13**	0	0	0	0	0	0	0	**0**
1845 - 1900	2	0	9	0	0	0	0	**11**	0	0	18	2	0	0	0	**20**	0	0	19	2	0	0	0	**21**	0	0	0	0	0	0	0	**0**
Hourly Total	**2**	**0**	**31**	**5**	**0**	**0**	**0**	**38**	**0**	**0**	**81**	**14**	**0**	**0**	**0**	**95**	**0**	**0**	**71**	**7**	**0**	**0**	**0**	**78**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	9	0	0	0	0	**9**	0	0	14	1	0	0	0	**15**	0	0	19	1	0	0	0	**20**	0	0	0	0	0	0	0	**0**
1915 - 1930	0	0	5	3	0	0	0	**8**	0	0	5	3	0	0	0	**8**	0	0	10	1	0	0	0	**11**	0	0	0	0	0	0	0	**0**
1930 - 1945	0	0	7	2	0	0	0	**9**	0	0	8	1	0	0	0	**9**	0	0	17	0	0	0	0	**17**	0	0	0	0	0	0	0	**0**
1945 - 2000	0	0	11	0	0	0	0	**11**	0	0	5	1	0	0	0	**6**	0	1	7	0	0	0	0	**8**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**32**	**5**	**0**	**0**	**0**	**37**	**0**	**0**	**32**	**6**	**0**	**0**	**0**	**38**	**0**	**1**	**53**	**2**	**0**	**0**	**0**	**56**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	3	1	0	0	0	**4**	0	0	9	0	0	0	0	**9**	0	0	9	0	0	0	0	**9**	0	0	0	0	0	0	0	**0**
2015 - 2030	0	0	4	2	0	0	0	**6**	0	0	7	1	0	0	0	**8**	0	0	12	0	0	0	0	**12**	0	0	0	0	0	0	0	**0**
2030 - 2045	0	0	3	0	0	0	0	**3**	0	0	12	0	0	0	0	**12**	0	0	10	0	0	0	0	**10**	0	0	0	0	0	0	0	**0**
2045 - 2100	0	0	4	1	0	0	0	**5**	0	0	6	0	0	0	0	**6**	0	0	9	0	0	0	0	**9**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**14**	**4**	**0**	**0**	**0**	**18**	**0**	**0**	**34**	**1**	**0**	**0**	**0**	**35**	**0**	**0**	**40**	**0**	**0**	**0**	**0**	**40**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2100 - 2115	0	0	7	0	0	0	0	**7**	0	0	5	5	0	0	0	**10**	0	0	14	0	0	0	0	**14**	0	0	1	0	0	0	0	**1**
2115 - 2130	0	0	4	0	0	0	0	**4**	0	0	9	2	0	0	0	**11**	0	0	10	0	0	0	0	**10**	0	0	0	0	0	0	0	**0**
2130 - 2145	0	0	2	0	0	0	0	**2**	0	0	3	0	0	0	0	**3**	0	0	8	0	0	0	0	**8**	0	0	0	0	0	0	0	**0**
2145 - 2200	0	0	1	0	0	0	0	**1**	0	0	2	0	0	0	0	**2**	0	0	3	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**19**	**7**	**0**	**0**	**0**	**26**	**0**	**0**	**35**	**0**	**0**	**0**	**0**	**35**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
2200 - 2215	0	0	2	1	0	0	0	**3**	0	0	4	0	0	0	0	**4**	0	0	8	0	0	0	0	**8**	0	0	0	0	0	0	0	**0**
2215 - 2230	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
2230 - 2245	0	0	3	0	0	0	0	**3**	0	0	3	0	0	0	0	**3**	0	0	4	0	0	0	0	**4**	0	0	0	0	0	0	0	**0**
2245 - 2300	0	0	2	0	0	0	0	**2**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**7**	**1**	**0**	**0**	**0**	**8**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**14**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	1	0	0	0	0	**1**	0	0	2	0	0	0	0	**2**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
2315 - 2330	0	0	2	0	0	0	0	**2**	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
2330 - 2345	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
2345 - 2400	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0000 - 0015	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0015 - 0030	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0030 - 0045	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0045 - 0100	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0115 - 0130	0	0	0	0	0	0	0	**0**	0	0	0	1	0	0	0	**1**	0	0	2	0	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0130 - 0145	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0145 - 0200	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0215 - 0230	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	0	1	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0230 - 0245	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0245 - 0300	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0315 - 0330	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0330 - 0345	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0345 - 0400	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0415 - 0430	0	0	0	0	0	0	0	**0**	0	0	1	0	0	0	0	**1**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0430 - 0445	0	0	1	2	0	0	0	**3**	0	1	2	1	0	0	0	**4**	0	0	1	0	0	0	0	**1**	0	0	0	0	0	0	0	**0**
0445 - 0500	0	0	0	0	0	0	0	**0**	0	0	3	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**3**	**0**	**1**	**6**	**1**	**0**	**0**	**0**	**8**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	2	0	0	0	0	**2**	0	0	3	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0515 - 0530	0	0	1	0	0	0	0	**1**	0	0	11	0	0	0	0	**11**	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	**0**
0530 - 0545	0	0	0	0	0	0	0	**0**	0	0	4	0	0	1	0	**5**	0	0	3	0	0	0	0	**3**	0	0	0	0	0	0	0	**0**
0545 - 0600	0	0	2	1	0	0	0	**3**	1	0	6	1	0	0	0	**8**	0	0	4	0	0	0	0	**4**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**5**	**1**	**0**	**0**	**0**	**6**	**1**	**0**	**24**	**1**	**0**	**1**	**0**	**27**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	2	0	0	0	0	**2**	0	0	4	1	0	0	0	**5**	0	0	1	1	0	0	0	**2**	0	0	0	0	0	0	0	**0**
0615 - 0630	0	0	4	0	0	0	0	**4**	0	0	12	1	0	0	0	**13**	0	0	2	0	0	0	0	**2**	0	0	1	0	0	0	0	**1**
0630 - 0645	0	0	2	1	0	0	0	**3**	0	0	5	4	0	0	0	**9**	0	0	2	1	0	0	0	**3**	0	0	0	0	0	0	0	**0**
0645 - 0700	0	0	5	1	0	0	0	**6**	0	0	10	2	0	0	0	**12**	0	0	4	2	0	0	0	**6**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**13**	**2**	**0**	**0**	**0**	**15**	**0**	**0**	**31**	**8**	**0**	**0**	**0**	**39**	**0**	**0**	**9**	**4**	**0**	**0**	**0**	**13**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
0700 - 0715	0	0	2	1	0	0	0	**3**	0	0	12	5	0	0	0	**17**	0	0	6	2	0	0	0	**8**	0	0	0	0	0	0	0	**0**
0715 - 0730	0	0	6	0	0	0	0	**6**	0	0	29	5	0	1	0	**35**	0	0	10	5	0	0	0	**15**	0	0	0	0	0	0	0	**0**
0730 - 0745	0	0	10	4	0	0	0	**14**	0	1	19	6	0	0	0	**26**	0	0	7	2	0	0	0	**9**	0	0	0	0	0	0	0	**0**
0745 - 0800	0	0	7	3	0	0	0	**10**	0	0	22	4	0	0	0	**26**	0	0	20	3	0	0	0	**23**	0	0	1	0	0	0	0	**1**
Hourly Total	**0**	**0**	**25**	**8**	**0**	**0**	**0**	**33**	**0**	**1**	**82**	**20**	**0**	**1**	**0**	**104**	**0**	**0**	**43**	**12**	**0**	**0**	**0**	**55**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
0800 - 0815	0	0	6	1	0	0	0	**7**	0	0	30	4	0	0	0	**34**	0	0	13	2	0	0	0	**15**	0	0	0	0	0	0	0	**0**
0815 - 0830	0	0	14	2	0	0	0	**16**	0	0	23	5	0	1	0	**29**	0	0	22	6	0	0	0	**28**	0	0	0	0	0	0	0	**0**
0830 - 0845	0	0	15	2	0	0	0	**17**	0	0	28	2	2	0	0	**32**	0	0	21	1	0	0	0	**22**	0	0	0	0	0	0	0	**0**
0845 - 0900	0	0	18	1	0	0	0	**19**	0	0	36	4	0	0	0	**40**	0	0	40	1	0	0	0	**41**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**53**	**6**	**0**	**0**	**0**	**59**	**0**	**0**	**117**	**15**	**2**	**1**	**0**	**135**	**0**	**0**	**96**	**10**	**0**	**0**	**0**	**106**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	16	2	0	0	0	**18**	0	0	32	4	1	0	0	**37**	0	0	34	4	0	0	0	**38**	0	0	0	0	0	0	0	**0**
0915 - 0930	0	0	9	1	1	0	0	**11**	0	0	20	2	0	0	0	**22**	0	0	13	0	0	0	0	**13**	0	0	0	0	0	0	0	**0**
0930 - 0945	0	0	10	0	0	0	1	**11**	0	0	20	2	1	0	0	**23**	0	0	16	4	0	0	0	**20**	0	0	0	0	0	0	0	**0**
0945 - 1000	0	0	9	2	0	0	0	**11**	0	0	24	4	0	1	0	**29**	0	0	17	2	0	0	0	**19**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**44**	**5**	**1**	**0**	**1**	**51**	**0**	**0**	**96**	**12**	**2**	**1**	**0**	**111**	**0**	**0**	**80**	**10**	**0**	**0**	**0**	**90**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1000 - 1015	0	0	7	1	0	0	0	**8**	0	0	18	2	0	0	0	**20**	0	0	17	3	0	0	0	**20**	0	0	1	0	0	0	0	**1**
1015 - 1030	0	1	11	1	0	0	0	**13**	0	0	16	6	0	0	1	**23**	0	0	16	4	0	0	0	**20**	0	0	0	0	0	0	0	**0**
1030 - 1045	0	0	11	1	0	0	0	**12**	0	0	18	5	0	0	0	**23**	0	0	18	3	0	0	0	**21**	0	0	1	0	0	0	0	**1**
1045 - 1100	0	0	11	4	0	0	0	**15**	0	0	22	4	0	0	0	**26**	0	0	14	6	0	0	0	**20**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**1**	**40**	**7**	**0**	**0**	**0**	**48**	**0**	**0**	**74**	**17**	**0**	**0**	**1**	**92**	**0**	**0**	**65**	**16**	**0**	**0**	**0**	**81**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**2**
1100 - 1115	0	0	8	2	0	0	0	**10**	0	0	17	2	0	0	0	**19**	0	0	15	2	0	0	0	**17**	0	0	0	0	0	0	0	**0**
1115 - 1130	0	0	13	4	0	0	0	**17**	0	0	24	1	0	0	0	**25**	0	0	19	1	0	0	0	**20**	0	0	0	0	0	0	0	**0**
1130 - 1145	0	0	15	6	0	0	0	**21**	0	0	20	2	0	0	1	**23**	0	0	21	1	0	0	0	**22**	0	0	0	0	0	0	0	**0**
1145 - 1200	0	0	12	1	0	1	0	**14**	0	0	19	3	0	0	0	**22**	0	0	14	8	0	0	0	**22**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**48**	**13**	**0**	**1**	**0**	**62**	**0**	**0**	**80**	**8**	**0**	**0**	**1**	**89**	**0**	**0**	**69**	**12**	**0**	**0**	**0**	**81**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	0	0	8	3	0	0	0	**11**	0	0	23	4	0	0	1	**28**	0	0	19	2	0	0	0	**21**	0	0	0	0	0	0	0	**0**
1215 - 1230	0	0	11	3	0	0	0	**14**	0	0	24	3	0	0	0	**27**	0	0	17	3	0	0	0	**20**	0	0	0	0	0	0	0	**0**
1230 - 1245	0	0	9	2	1	0	0	**12**	0	0	19	5	3	0	0	**27**	0	0	20	1	0	0	0	**21**	0	0	0	0	0	0	0	**0**
1245 - 1300	0	0	13	2	0	0	0	**15**	0	0	31	4	0	0	0	**35**	0	0	17	4	0	0	0	**21**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**41**	**10**	**1**	**0**	**0**	**52**	**0**	**0**	**97**	**16**	**3**	**0**	**1**	**117**	**0**	**0**	**73**	**10**	**0**	**0**	**0**	**83**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1300 - 1315	0	0	10	1	0	0	0	**11**	0	0	35	3	0	0	0	**38**	0	0	17	3	0	0	0	**20**	0	0	0	0	0	0	0	**0**
1315 - 1330	0	0	12	2	0	0	0	**14**	0	0	28	4	0	0	0	**32**	0	0	15	6	0	0	0	**21**	0	0	0	0	0	0	0	**0**
1330 - 1345	0	0	9	2	0	0	1	**12**	0	0	35	2	1	0	0	**38**	0	0	19	2	0	0	0	**21**	0	0	0	0	0	0	0	**0**
1345 - 1400	0	0	12	6	0	0	0	**18**	0	0	28	6	0	1	0	**35**	0	0	17	0	0	0	0	**17**	0	0	0	0	0	0	0	**0**
Hourly Total	**0**	**0**	**43**	**11**	**0**	**0**	**1**	**55**	**0**	**0**	**126**	**15**	**1**	**1**	**0**	**143**	**0**	**0**	**68**	**11**	**0**	**0**	**0**	**79**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**2**	**2**	**634**	**103**	**2**	**1**	**2**	**746**	**1**	**2**	**1344**	**212**	**13**	**6**	**4**	**1582**	**0**	**1**	**1101**	**140**	**0**	**0**	**1**	**1243**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**

Holyhead - 15 Min Max Queue Survey, Wednesday 3rd and Thursday 4th October 2018

Time	Train Station Lane 1	Train Station Lane 2	Ferry Port Lane 1	Ferry Port Lane 2	Llanfawr Road	A55
14:15	1	0	0	0	1	3
14:30	1	0	1	0	1	0
14:45	0	0	1	0	2	0
15:00	0	0	0	0	1	0
15:15	1	0	1	0	0	0
15:30	1	0	0	0	0	0
15:45	0	0	0	0	1	0
16:00	0	0	0	0	0	1
16:15	1	0	2	0	0	1
16:30	0	0	2	2	0	3
16:45	0	0	1	0	1	3
17:00	0	0	0	1	0	0
17:15	0	0	0	0	2	0
17:30	0	1	0	0	0	0
17:45	0	0	0	1	1	0
18:00	1	0	0	0	0	0
18:15	0	0	2	0	0	0
18:30	0	0	10	25	4	0
18:45	0	0	10	35	5	0
19:00	1	3	10	35	3	0
19:15	0	0	0	1	0	0
19:30	1	0	1	0	2	0
19:45	0	0	1	0	0	0
20:00	0	0	0	0	0	0
20:15	0	0	1	0	0	0
20:30	0	0	1	0	0	0
20:45	0	0	0	0	0	0
21:00	0	0	0	0	0	0
21:15	0	0	0	0	0	0
21:30	0	0	0	0	0	0
21:45	0	0	0	0	0	0
22:00	0	0	0	0	0	0
22:15	0	0	0	0	0	0
22:30	0	0	0	0	0	0
22:45	0	0	1	0	0	0
23:00	0	0	0	0	0	0
23:15	0	1	0	0	0	0
23:30	0	0	0	0	0	0
23:45	0	0	0	0	0	0
00:00	0	0	0	0	0	0
00:15	0	0	0	0	0	0
00:30	0	0	0	0	1	0
00:45	1	0	2	35	0	0
01:00	0	0	3	35	1	0
01:15	0	0	0	35	1	0
01:30	0	0	0	1	0	0
01:45	0	0	0	0	0	0
02:00	0	0	0	0	0	0
02:15	0	0	0	0	0	0
02:30	0	0	0	0	0	0
02:45	0	0	0	0	0	0
03:00	0	0	0	0	0	0
03:15	0	0	0	0	0	0
03:30	0	0	0	0	0	0
03:45	0	0	0	0	0	0
04:00	0	0	0	0	0	0
04:15	0	0	0	0	0	0
04:30	0	0	0	0	0	0
04:45	0	0	0	0	0	0
05:00	0	0	0	0	0	0
05:15	0	0	0	0	0	0
05:30	0	0	0	0	0	0
05:45	0	0	0	0	0	0
06:00	0	0	0	0	0	0
06:15	0	0	0	0	1	0
06:30	0	0	0	0	0	0
06:45	0	0	0	0	0	0
07:00	0	0	0	0	0	0
07:15	0	0	0	0	0	1
07:30	1	0	0	0	0	0
07:45	0	0	0	0	0	2
08:00	1	0	1	0	0	0
08:15	2	0	2	0	1	1
08:30	0	0	0	0	0	0
08:45	1	0	0	0	1	0
09:00	0	0	0	0	0	0
09:15	1	0	0	0	0	0
09:30	1	0	1	0	0	0
09:45	0	0	0	0	1	2
10:00	1	0	0	0	0	0
10:15	2	0	0	0	1	0
10:30	0	0	0	1	1	3
10:45	0	0	0	0	1	0
11:00	0	0	1	1	0	0
11:15	1	0	2	0	0	0
11:30	1	0	0	0	1	0
11:45	0	0	4	35	4	0
12:00	1	0	8	35	6	0
12:15	0	0	0	0	0	1
12:30	0	0	3	20	3	0
12:45	0	0	3	35	0	0
13:00	2	0	0	1	0	2
13:15	2	0	0	1	0	1
13:30	1	1	0	0	0	0
13:45	2	0	1	0	0	1
14:00	0	0	0	0	0	1

Holyhead - 15 Min Max Queue Survey, Wednesday 3rd and Thursday

Time	A55 North Lane 1	A55 North Lane 2	A5 London Road Lane 1	A5 London Road Lane 2	A55 West Lane 1	A55 West Lane 2
14:15	2	2	4	1	1	4
14:30	1	3	2	2	2	2
14:45	2	3	0	1	1	3
15:00	0	5	2	1	2	2
15:15	1	2	3	1	4	4
15:30	1	2	3	1	3	2
15:45	1	2	2	2	2	2
16:00	1	3	4	1	2	5
16:15	4	1	3	1	1	4
16:30	1	2	4	1	2	5
16:45	1	4	2	0	1	4
17:00	1	2	4	1	1	8
17:15	1	3	2	1	1	4
17:30	1	3	4	1	1	2
17:45	0	4	3	1	1	3
18:00	1	2	3	2	0	2
18:15	1	4	1	2	2	3
18:30	2	25	6	2	1	4
18:45	2	16	4	5	5	1
19:00	1	15	1	0	1	1
19:15	0	2	4	1	6	0
19:30	2	1	1	1	2	1
19:45	1	3	0	1	1	1
20:00	0	1	1	0	0	1
20:15	1	1	1	0	1	2
20:30	1	2	4	1	0	3
20:45	0	1	2	0	0	2
21:00	1	0	1	0	1	0
21:15	0	1	1	2	1	0
21:30	2	2	1	0	1	3
21:45	1	1	1	1	0	0
22:00	0	0	1	0	0	1
22:15	0	1	1	0	0	0
22:30	0	1	1	0	0	0
22:45	0	1	1	1	1	0
23:00	0	1	2	1	1	1
23:15	0	1	0	1	0	0
23:30	0	1	0	0	0	0
23:45	0	1	0	1	1	0
00:00	0	1	1	1	0	0
00:15	0	0	1	0	0	0
00:30	0	0	0	0	0	0
00:45	0	8	1	1	0	0
01:00	0	7	1	1	0	1
01:15	0	7	1	0	0	0
01:30	0	1	0	0	0	1
01:45	0	1	0	0	0	0
02:00	0	0	0	0	0	0
02:15	0	0	0	0	0	0
02:30	0	1	1	1	0	0
02:45	0	0	0	0	0	0
03:00	0	0	1	0	0	0
03:15	0	1	1	0	0	0
03:30	0	0	0	0	0	0
03:45	0	0	0	0	0	0
04:00	0	0	1	0	0	0
04:15	0	0	0	1	0	0
04:30	0	0	0	0	0	1
04:45	0	0	0	0	0	0
05:00	0	0	0	0	0	1
05:15	0	0	0	0	0	0
05:30	0	0	0	0	0	0
05:45	0	0	1	1	0	0
06:00	0	0	0	0	0	1
06:15	0	7	1	0	0	0
06:30	0	2	0	1	0	0
06:45	0	1	1	1	0	2
07:00	0	1	1	0	0	0
07:15	0	1	0	1	0	1
07:30	0	0	1	1	2	0
07:45	0	2	1	1	0	1
08:00	0	1	0	3	4	0
08:15	0	5	1	2	0	1
08:30	1	2	4	2	2	2
08:45	3	4	5	1	1	4
09:00	2	5	4	0	1	2
09:15	1	5	2	1	1	3
09:30	1	3	2	0	1	2
09:45	1	2	3	2	2	1
10:00	1	4	2	4	2	3
10:15	1	2	2	1	1	1
10:30	0	2	1	2	1	1
10:45	1	3	3	1	4	3
11:00	2	3	1	2	1	1
11:15	1	3	3	1	0	1
11:30	2	3	3	1	1	2
11:45	16	14	3	0	2	2
12:00	16	16	2	2	2	3
12:15	10	12	3	2	1	4
12:30	13	16	1	1	1	1
12:45	15	16	2	2	2	2
13:00	2	5	1	3	1	2
13:15	1	4	3	1	1	2
13:30	1	3	2	1	2	2
13:45	0	3	1	1	1	1
14:00	2	3	1	2	1	1

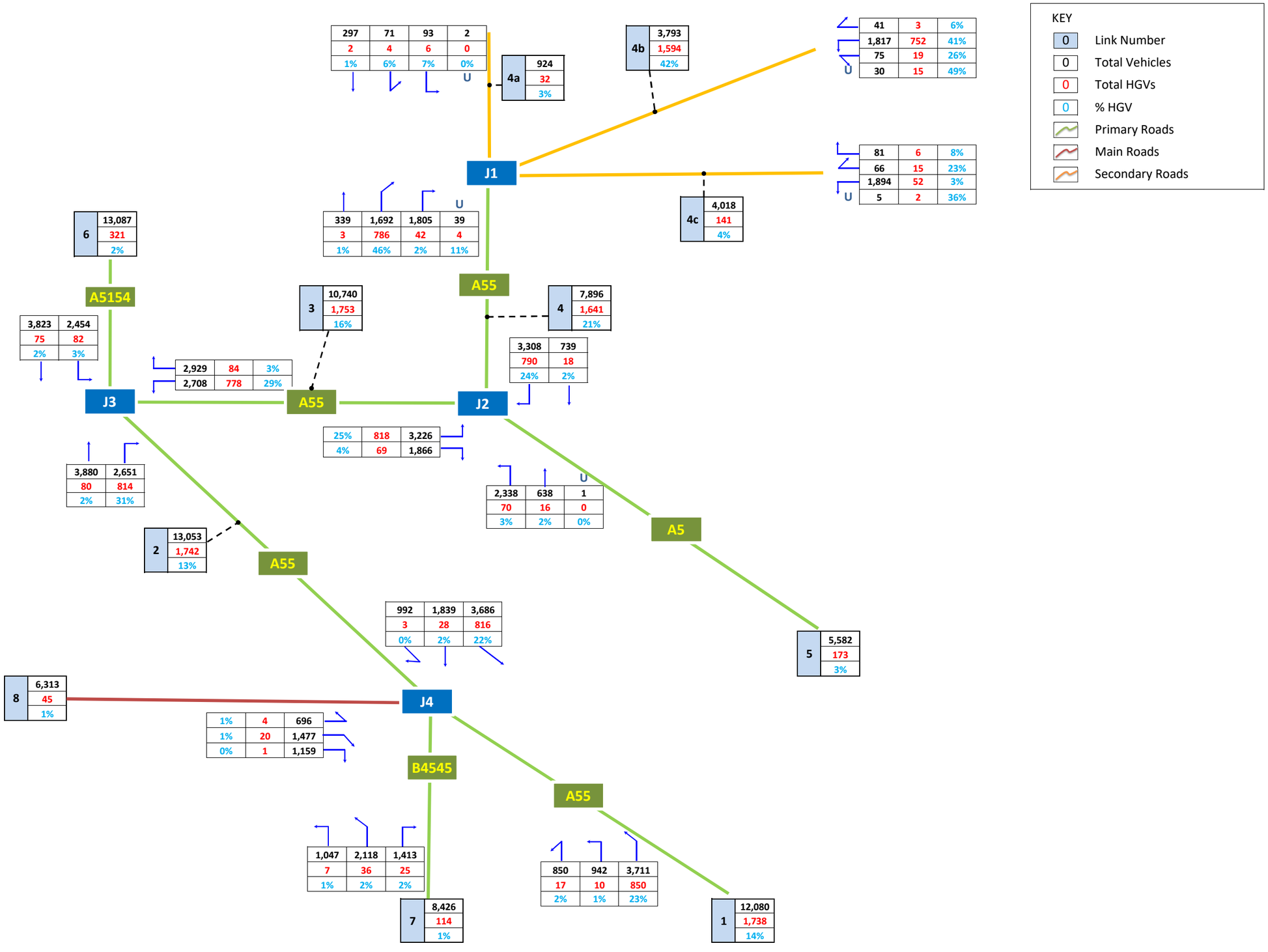
Holyhead - 15 Min Max Queue Survey, Wednesday 3rd and Thursday 4th October 2018

Time	A5154 Lane 1	A5154 Lane 2	A55 London Road Lane 1	A55 London Road Lane 2	A55 Victoria Road Lane 1	A55 Victoria Road Lane 2
14:15	2	6	1	5	2	2
14:30	1	5	2	4	2	1
14:45	3	8	1	7	3	4
15:00	2	7	3	7	2	3
15:15	2	8	5	6	3	4
15:30	3	7	3	9	5	4
15:45	7	11	8	5	7	6
16:00	6	12	7	6	6	5
16:15	8	8	6	3	8	7
16:30	8	9	3	6	9	7
16:45	9	10	10	3	7	8
17:00	3	6	2	5	6	7
17:15	2	5	4	7	5	5
17:30	3	7	4	4	7	6
17:45	3	5	3	6	6	4
18:00	3	4	2	3	4	3
18:15	2	6	5	4	5	2
18:30	3	8	12	5	4	5
18:45	3	7	11	5	4	6
19:00	5	4	12	4	3	4
19:15	2	4	4	7	6	7
19:30	2	4	2	4	6	6
19:45	3	2	1	2	3	6
20:00	4	1	6	3	6	4
20:15	2	4	5	2	2	1
20:30	3	3	5	2	1	2
20:45	3	1	2	1	5	6
21:00	3	2	6	2	1	3
21:15	4	3	3	4	4	3
21:30	3	4	3	6	3	4
21:45	5	1	1	2	1	4
22:00	5	1	6	5	3	1
22:15	2	2	1	4	4	4
22:30	4	1	2	3	1	1
22:45	5	1	2	1	2	2
23:00	4	4	3	2	1	3
23:15	2	3	1	2	1	3
23:30	4	1	1	2	2	1
23:45	4	4	1	2	3	1
00:00	3	1	2	3	2	2
00:15	2	2	1	2	1	2
00:30	3	2	6	8	1	2
00:45	2	3	7	6	2	1
01:00	3	4	9	7	1	3
01:15	4	1	3	1	2	3
01:30	2	3	2	0	2	0
01:45	0	1	3	3	1	2
02:00	0	0	0	0	0	0
02:15	0	0	0	0	0	0
02:30	0	0	0	0	0	0
02:45	0	0	0	0	0	0
03:00	0	0	0	0	0	0
03:15	0	0	0	0	0	0
03:30	0	0	1	0	0	0
03:45	0	0	0	0	0	0
04:00	0	1	0	0	0	0
04:15	0	0	0	0	0	0
04:30	0	0	0	0	0	0
04:45	0	0	0	0	0	0
05:00	0	0	0	0	0	0
05:15	1	0	0	2	2	1
05:30	0	1	1	1	0	0
05:45	1	0	0	3	2	0
06:00	2	0	0	0	0	0
06:15	1	0	2	0	2	2
06:30	0	1	2	1	1	1
06:45	1	0	1	1	2	2
07:00	2	1	0	2	0	0
07:15	2	2	2	0	0	2
07:30	3	2	1	3	2	0
07:45	0	2	3	1	3	3
08:00	3	4	1	1	1	2
08:15	2	4	2	3	1	3
08:30	4	6	4	5	3	3
08:45	3	5	1	7	5	4
09:00	5	8	10	3	4	3
09:15	4	9	3	4	2	1
09:30	1	4	2	4	1	3
09:45	2	4	5	3	5	5
10:00	3	2	5	2	4	4
10:15	4	3	4	4	2	2
10:30	4	3	4	3	2	3
10:45	3	4	2	3	2	4
11:00	3	5	3	3	2	5
11:15	3	4	5	3	4	5
11:30	3	4	3	4	4	2
11:45	3	2	10	5	3	5
12:00	5	8	4	3	5	2
12:15	2	3	5	4	5	5
12:30	2	5	5	8	4	2
12:45	5	5	5	4	5	3
13:00	3	4	2	5	2	2
13:15	1	2	1	3	4	1
13:30	3	2	4	4	3	2
13:45	1	1	2	1	4	2
14:00	4	3	1	2	2	1

Holyhead - 15 Min Max Queue Survey, Wednesday 3rd and Thursday 4th October 2018

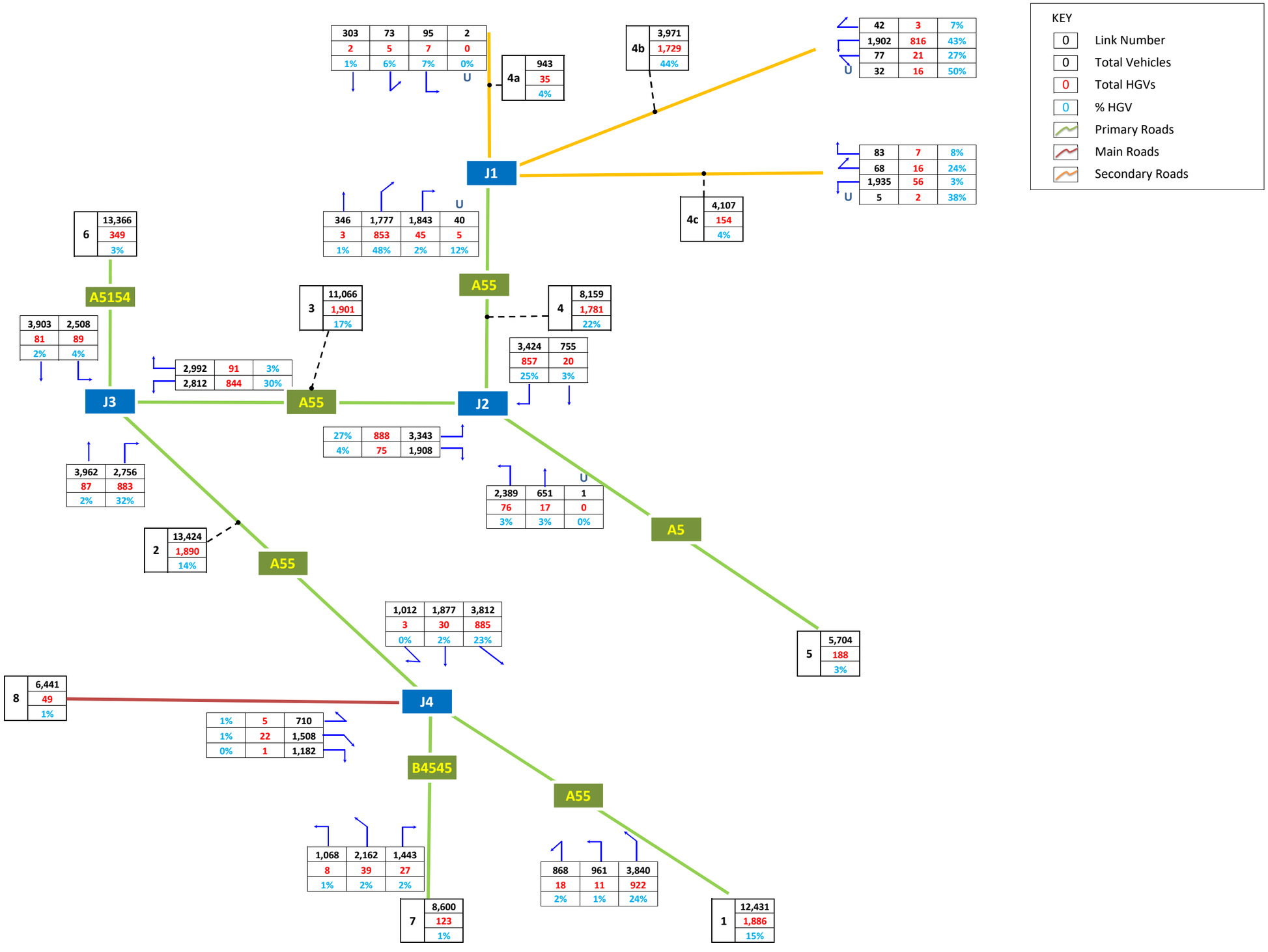
Time	A55 Victoria Road Lane 1	A55 Victoria Road Lane 2	N Wales Expy Lane 1	N Wales Expy Lane 2	Kingsland Road South	Kingsland Road North
14:15	1	2	2	0	0	4
14:30	3	2	1	0	5	2
14:45	1	0	2	0	2	3
15:00	0	0	1	1	3	3
15:15	2	1	2	1	6	5
15:30	2	0	3	1	3	5
15:45	1	0	1	1	2	6
16:00	1	1	2	2	2	4
16:15	1	0	1	2	3	4
16:30	0	0	2	2	3	7
16:45	3	1	3	0	4	7
17:00	1	3	6	2	5	6
17:15	2	6	4	3	4	7
17:30	4	2	5	3	4	4
17:45	3	2	3	2	3	6
18:00	3	2	2	1	4	5
18:15	2	0	3	1	3	3
18:30	2	2	2	2	4	4
18:45	3	3	3	1	2	4
19:00	2	0	1	0	1	4
19:15	1	0	3	2	4	2
19:30	0	0	1	0	2	0
19:45	0	0	0	0	3	0
20:00	1	0	0	0	0	0
20:15	1	0	0	0	0	0
20:30	0	0	0	0	0	0
20:45	1	0	0	0	0	0
21:00	0	0	0	0	0	0
21:15	0	0	0	0	0	1
21:30	0	0	0	0	0	0
21:45	0	0	0	0	0	0
22:00	0	0	0	0	0	0
22:15	1	0	0	0	0	0
22:30	0	0	0	0	0	0
22:45	0	0	0	0	0	0
23:00	0	0	0	0	0	0
23:15	0	1	0	0	0	1
23:30	0	0	0	0	0	0
23:45	0	0	0	0	0	0
00:00	0	0	0	0	0	0
00:15	0	0	0	0	0	0
00:30	0	0	0	0	0	0
00:45	0	0	0	0	0	0
01:00	0	0	0	0	0	0
01:15	0	0	0	0	0	0
01:30	0	0	0	0	0	0
01:45	0	0	0	0	0	0
02:00	0	0	0	0	0	0
02:15	0	0	0	0	0	0
02:30	0	0	0	0	0	0
02:45	0	0	0	0	0	0
03:00	0	0	0	0	0	0
03:15	0	0	0	0	0	0
03:30	0	0	0	0	0	0
03:45	0	0	0	0	0	0
04:00	0	0	0	0	0	0
04:15	0	0	0	0	0	0
04:30	0	0	0	0	0	0
04:45	0	0	0	0	0	0
05:00	1	0	0	0	0	0
05:15	0	0	0	0	0	0
05:30	1	0	0	0	0	0
05:45	0	0	0	0	0	0
06:00	0	0	0	0	0	0
06:15	0	0	0	0	0	0
06:30	0	0	0	0	0	0
06:45	0	0	0	0	1	1
07:00	1	1	0	0	1	1
07:15	0	0	1	0	1	1
07:30	0	0	0	0	0	3
07:45	0	0	0	0	1	3
08:00	2	1	3	2	2	5
08:15	1	0	1	1	2	3
08:30	1	2	0	0	1	6
08:45	2	0	4	0	3	6
09:00	1	1	5	1	4	2
09:15	0	3	2	1	4	4
09:30	0	2	2	0	1	3
09:45	2	2	2	1	2	3
10:00	0	1	3	2	4	5
10:15	1	1	2	2	4	4
10:30	1	0	3	2	5	4
10:45	0	1	2	3	3	3
11:00	0	0	4	4	4	2
11:15	0	0	3	1	3	4
11:30	1	0	5	3	4	2
11:45	0	0	8	3	5	4
12:00	0	0	6	1	3	1
12:15	0	1	5	3	4	2
12:30	0	0	4	3	3	1
12:45	2	0	4	5	2	2
13:00	0	0	5	3	3	4
13:15	0	0	2	3	4	2
13:30	1	3	3	3	3	0
13:45	0	2	4	3	3	1
14:00	0	0	3	2	1	0

I2 – 2021 Forecast Flows



	Project Title Holyhead Port Expansion	**Appendix Title** 2021 24hr AADT Forecast Flows	**Appendix No** I2
	Job Number PB6108	**Date** Mar-19	

I3 – 2023 Forecast Flows



	Project Title Holyhead Port Expansion	**Appendix Title** 2019 24hr AADT Forecast Flows	**Appendix No** I3
	Job Number PB6108	**Date** Mar-19	

I4 – Construction Programme

Holyhead Port Expansion - Appendix !4
Construction Programme for Environmental Permissions
Date: 09/01/2019
WEEKS (typical HGV daily deliveries per week)

Work elements	Vans / Utility vehicles / cars	Weight (Tonnes)	Total HGV Deliveries	Duration (Weeks)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Enabling Works																																																										
Contract Award																																																										
Site Mobilisation			60	3	4.0	4.0	4.0																																																				
Set up concrete batchin plant			20	1				4.0																																																			
Delivery of jack-up barges																																																										
Quay Walls																																																										
Piling area A																																																										
Piling Area B																																																										
Revetment to Northern Wall & Breakwater																																																										
Dredging																																																										
Reclemation Area A											Pacement of material to take as long as dredging																																																						
Place material		337,600	16,880	52							65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
Cement mixing of upper soil		25,600	3,200	20																				32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32																
Anchor wall & tie rods																																																										
Placement and compaction of dredged clay																																																										
Surcharge																																																										
Fill piles (Area A)		1,040	52	10																																																						
Capping Beam Construction & Quay furniture		13,600	680	24																																																						
Dredge friont of wall and place scour protection																																																										
Remove surcharge																																																										
Drainage																																																										
Service ducting																																																										
Pavement		80,000	4,000	14																																																						
Heavy lift pad and piled foundations																																																									
Fencing																																																										
Reclemation Area B																																																										
Place material		92,800	4,640	26																									35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7							
Cement mixing of upper soil		6,720	840	16																																																							
Anchor wall & tie rods			60	12																																																						
Fill piles (Area B)		176	9	1																																																						
Capping Beam Construction & Quay furniture		4,160	208	12																																																						
Dredge friont of wall and place scour protection																																																										
Drainage																																																										
Pavement / gravel finish		29,600	1,480	12																																																						
Fencing																																																										
Road realignment																																																										
Culvert		112	6	1																																																							
Placement of new road		800	40	14																																																						
Excavate old road		1,600	80	8																																																						
Snagging and demob			100	4																																																							
			32354.4																																																									
Total HGV Deliveries					0	4	4	4	4	0	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	64.9	96.9	96.9	96.9	96.9	96.9	133	133	133	133	133	133	133	133	133	133	133	133	134	133	139	106	107	106	107	117	118	117	118	117	118	117	82.1	81.1
Contingency	1.2																																																									
Total HGV Deliveries (with 20% contigency)					0	5	5	5	5	0	78	78	78	78	78	78	78	78	78	78	78	78	78	78	116	116	116	116	116	159	159	159	159	159	159	159	159	159	159	159	160	159	167	128	129	128	129	140	141	140	141	140	141	140	99	97
total HGV Movements (with 20% contigency)					0	10	10	10	10	0	156	156	156	156	156	156	156	156	156	156	156	156	156	156	233	233	233	233	233	318	318	318	318	318	318	318	318	318	318	318	321	318	334	255	258	255	258	280	283	280	283	280	283	280	197	195
Contractors staff / sub-contractors with contingency					0	36	36	36	40	40	72	72	72	72	75	75	75	75	75	72	72	72	72	30	30	30	30	30	36	36	36	36	36	72	72	72	72	72	72	72	76	76	76	76	76	72	72	72	72	72	72	72	60	60
Contractors Staff / Sub-Contractors Vehicle Movements					0	72	72	72	80	80	144	144	144	144	150	150	150	150	150	144	144	144	144	60	60	60	60	60	72	72	72	72	72	144	144	144	144	144	144	144	144	152	152	152	152	152	144	144	144	144	144	144	144	120	120

Key

Construction activity with no associated traffic movements
Construction activity with planned traffic movements

Work elements	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	Total
Enabling Works																																																							0
Contract Award																																																							0
Site Mobilisation																																																							60
Set up concrete batchin plant																																																							20
Delivery of jack-up barges																																																							0
Quay Walls																																																							0
Piling area A																																																							0
Piling Area B																																																							0
Revetment to Northern Wall & Breakwater																																																							0
Dredging																																																							0
Reclemation Area A																																																							0
Place material	65	65	65	65	65	65																																																	16880
Cement mixing of upper soil																																																							3200
Anchor wall & tie rods																																																							0
Placement and compaction of dredged clay																																																							0
Surcharge																																																							0
Fill piles (Area A)	1.0		1.0																																																			52
Capping Beam Construction & Quay furniture	6	6	6	6	6	6	6	6	6	6																																												680
Dredge friont of wall and place scour protection																																																							0
Remove surcharge																																																							0
Drainage																																																							0
Service ducting																																																							0
Pavement																																			57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1							4000
Heavy lift pad and piled foundations	85 piles and slab to be constructed. Assume 16 weeks not on critical path, start date not known.																																																					0
Fencing																																																							0
Reclemation Area B																																																							0
Place material																																																							4640
Cement mixing of upper soil	11	11	11	11	11	11	11																																														840
Anchor wall & tie rods	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0																																									60
Fill piles (Area B)				1.76																																																		8.8
Capping Beam Construction & Quay furniture						3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5																																					208
Dredge friont of wall and place scour protection																																																						0
Drainage																																																							0
Pavement / gravel finish																	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7																															1480
Fencing																																																							0
Road realignment																																																							0
Culvert																							1																																			6
Placement of new road																							1	1	1	1	1	1	1	1	1	1	1	1	1	1																							40
Excavate old road																																						2	2	2	2	2	2	2	2											80
Snagging and demob																																																				5	5	5	5	100
																																																						32354.4
Total HGV Deliveries	83.1	82.1	83.1	83.8	82.1	85.6	20.6	10.1	10.1	10.1	4.47	4.47	3.47	3.47	3.47	3.47	28.1	24.7	24.7	24.7	24.7	24.7	26.4	25.2	25.2	25.2	25.2	25.2	0.57	0.57	0.57	0.57	0.57	0.57	57.7	57.7	57.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	59.1	57.1	57.1	57.1	0	0	5	5	5	5	
Contingency																																																							
Total HGV Deliveries (with 20% contigency)	100	99	100	101	99	103	25	12	12	12	5	5	4	4	4	4	34	30	30	30	30	30	32	30	30	30	30	30	1	1	1	1	1	1	69	69	69	71	71	71	71	71	71	71	71	69	69	69	0	0	6	6	6	6	167
total HGV Movements (with 20% contigency)	200	197	200	201	197	205	50	24	24	24	11	11	8	8	8	8	68	59	59	59	59	59	63	61	61	61	61	61	1	1	1	1	1	1	139	139	137	142	142	142	142	142	142	142	142	137	137	137	0	0	12	12	12	12	334
Contractors staff / sub-contractors with contingency	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	50	50	50	50	50	50	50	50	50	60	60	60	72	72	72	72	72	72	72	72	72	72	72	72	72	30	30	30	30	36	36	36	36	36	36	10	10	
Contractors Staff / Sub-Contractors Vehicle Movements	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	100	100	100	100	100	100	100	100	100	120	120	120	144	144	144	144	144	144	144	144	144	144	144	144	144	60	60	60	60	72	72	72	72	72	72	20	20	

Key

Construction activity with no associated traffic movements

Construction activity with planned traffic movements

I5 – In-migrant Distribution

Appendix I5

In-migrant Labour Distribution (45 mins)

Postcode	No. of rooms per post code	Journey time (mins) *	No. of rooms factored by journey time **	Percentage distribution	Point of entry to study area
LL24	17	45	0.4	0.5%	Link 1
LL33	13	40	0.3	0.4%	Link 1
LL34	15	45	0.3	0.4%	Link 1
LL54	74	45	1.6	2.2%	Link 1
LL55	441	45	9.8	13.0%	Link 1
LL56	29	28	1.0	1.4%	Link 1
LL57	248	35	7.1	9.4%	Link 1
LL58	91	35	2.6	3.5%	Link 1
LL59	44	27	1.6	2.2%	Link 1
LL60	29	20	1.5	1.9%	Link 1
LL61	35	30	1.2	1.5%	Link 1
LL62	4	26	0.2	0.2%	Link 1
LL63	17	16	1.1	1.4%	Link 1
LL64	41	19	2.2	2.9%	Link 1
LL65 1	51	8	6.4	8.5%	Link 6
LL65 2	184	8	23.0	30.5%	Link 7
LL65 3	63	12	5.3	7.0%	Link 5
LL65 4	34	17	2.0	2.7%	Link 7
LL67	48	25	1.9	2.5%	Link 5
LL68	26	31	0.8	1.1%	Link 5
LL69	2	32	0.1	0.1%	Link 1
LL71	2	26	0.1	0.1%	Link 1
LL72	22	38	0.6	0.8%	Link 1
LL74	55	33	1.7	2.2%	Link 1
LL75	21	32	0.7	0.9%	Link 1
LL77	43	25	1.7	2.3%	Link 1
LL78	12	34	0.4	0.5%	Link 1
Total	**1661**		**75**	**100%**	

Point of entry to study area	Percentage distribution of workers by point of entry
Link 1	47.71%
Link 5	10.63%
Link 6	8.46%
Link 7	33.19%
Total	**100.00%**

Notes:

* Journey time from centre of post code to Leiston

** Number of rooms divided by the journey time

I6 – Resident Distribution

Appendix I6

Resident Labour Distribution (60mins)

Postcode	No. of workers per post code	Journey time (mins) *	No. of workers factored by journey time **	Percentage distribution	Point of entry to study area
LL28	334	49	6.8	2.61%	Link 1
LL29	705	51	13.8	5.30%	Link 1
LL30	577	49	11.8	4.52%	Link 1
LL31	437	46	9.5	3.64%	Link 1
LL32	244	56	4.4	1.67%	Link 1
LL33	116	44	2.6	1.01%	Link 1
LL34	194	51	3.8	1.46%	Link 1
LL52	140	60	2.3	0.89%	Link 1
LL54	596	53	11.2	4.31%	Link 1
LL55	892	45	19.8	7.60%	Link 1
LL56	92	28	3.3	1.26%	Link 1
LL57	836	35	23.9	9.16%	Link 1
LL58	126	35	3.6	1.38%	Link 1
LL59	192	27	7.1	2.73%	Link 1
LL60	209	20	10.5	4.01%	Link 1
LL61	211	30	7.0	2.70%	Link 1
LL62	61	26	2.3	0.90%	Link 1
LL63	87	16	5.4	2.09%	Link 1
LL65-1	155	8	19.4	7.43%	Link 6
LL65-2	212	8	26.5	10.16%	Link 7
LL65-3	281	12	23.4	8.98%	Link 1
LL65-4	137	17	8.1	3.09%	Link 5
LL67	156	25	6.2	2.39%	Link 5
LL68	289	31	9.3	3.57%	Link 5
LL69	123	32	3.8	1.47%	Link 1
LL74	131	33	4.0	1.52%	Link 1
LL77	270	25	10.8	4.14%	Link 1
Total	**7,803**		**261**	**100.00%**	

Point of entry to study area	Percentage distribution of workers by point of entry
Link 1	73.35%
Link 5	9.06%
Link 6	7.43%
Link 7	10.16%
Total	**100.00%**

Notes:

* Journey time from centre of post code to Holyhead Port entrance

** Number of workers divided by the journey time

I7 – Construction Vehicle Assessment

Appendix I7

Employee Assignment

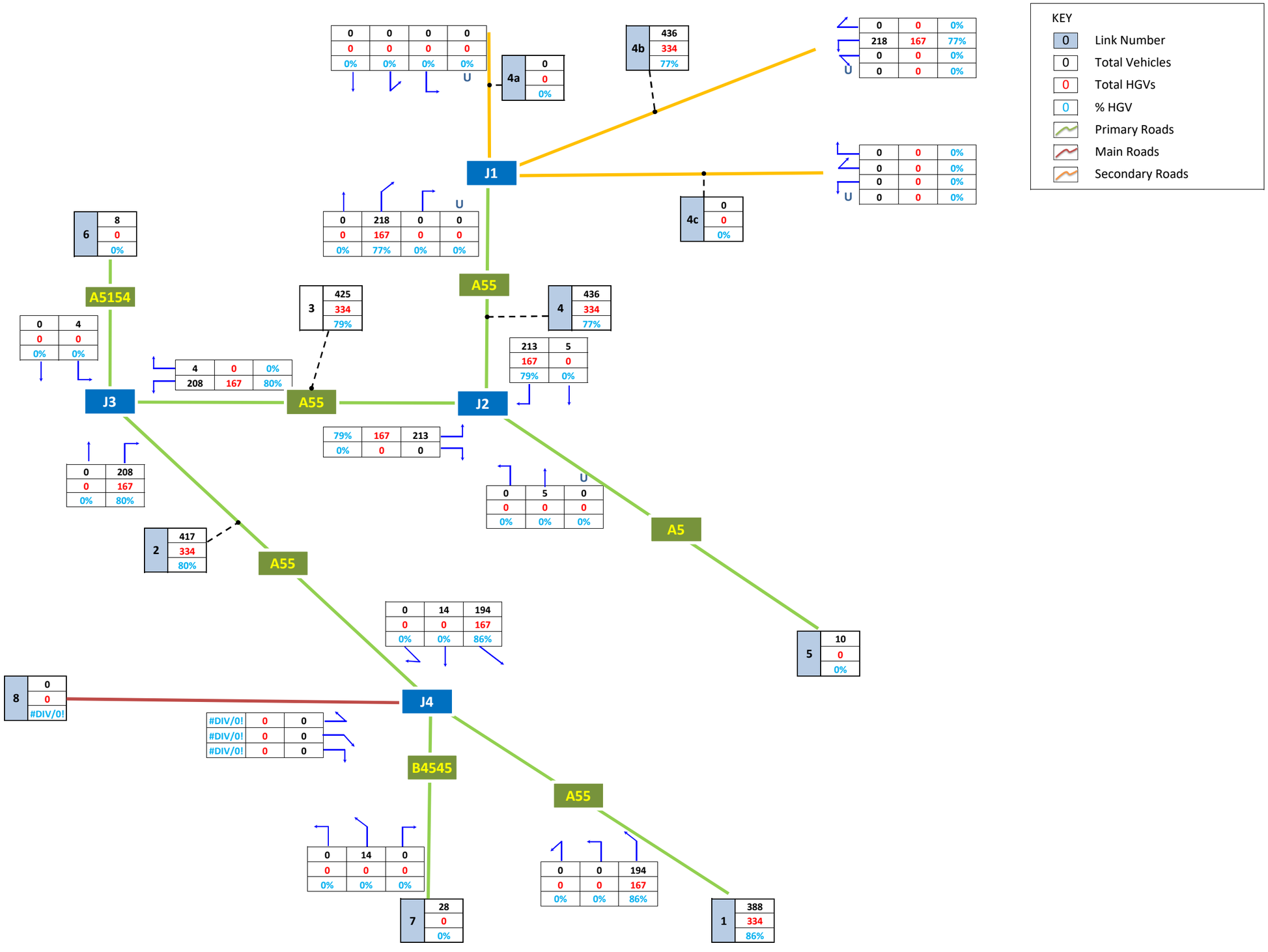
Holyhead Port Entrance	Total employees	76
	Car-share ratio	1.5
	Total Employee Vehicles	51
	Percentage resident workers	0.22
	Percentage in-migrant workers	0.78
	Total resident workers vehicles	11
	Total in-migrant workers vehicles	40

	Residents		In-migrant		Combined	Links										
Point of entry to study area	Percentage split	Total worker vehicles (one-way)	Percentage split	Total worker vehicles (one-way)	Total worker vehicles (one-way)	1	2	3	4	4a	4b	4c	5	6	7	8
1	73.4%	8.2	47.7%	18.9	27.0	27	27	27	27		27					
5	9.1%	1.0	10.6%	4.2	5.2				5.2		5.2		5.2			
6	7.4%	0.8	8.5%	3.3	4.2			4	4		4			4		
7	10.2%	1.1	33.2%	13.1	14.2		14.2	14.2	14.2		14.2				14.2	
Total worker vehicles (one-way)						27	41	45	51	0	51	0	5	4	14	0
Total worker vehicles (two-way)						54	83	91	101	0	101	0	10	8	28	0

HGV Assignment

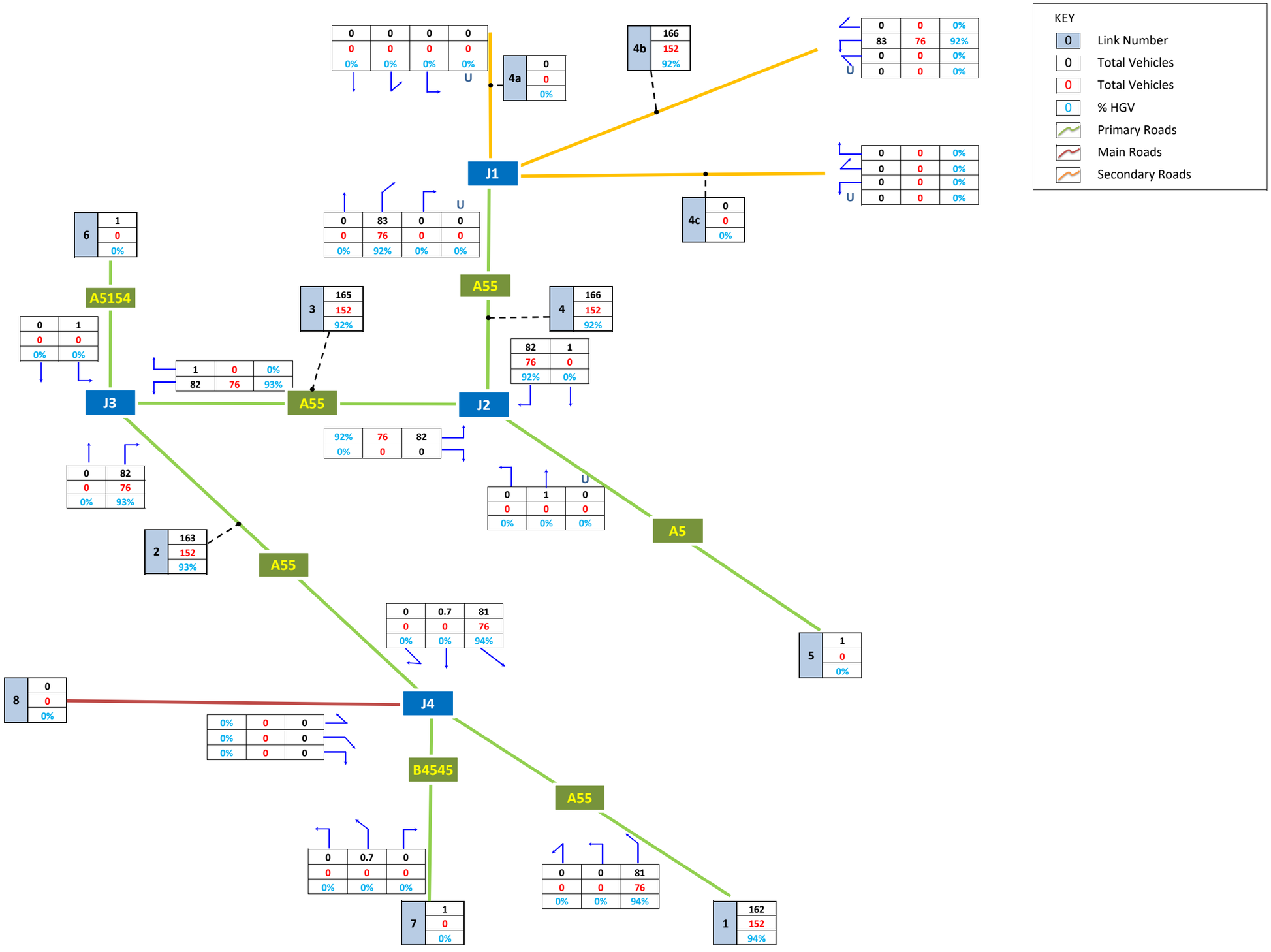
		Links										
Access	Peak Movements	1	2	3	4	4a	4b	4c	5	6	7	8
Port Access	334	334	334	334	334		334					

I8 – 2021 Peak Daily Construction Flows



	Project Title Holyhead Port Expansion	**Appendix Title** 2021 Peak Daily Constuction Flows	**Appendix No** I8
	Job Number PB6108	**Date** Mar-19	

I9 – 2023 Peak Daily Operational Flows



	Project Title Holyhead Port Expansion	**Appendix Title** 2023 Peak Daily Operational Flows	**Appendix No** I9
	Job Number PB6108	**Date** Mar-19	

I10 – Cruise Call Traffic Derivation

Appendix I10

HGV Cruise Calls Derivation

Peak month

	2018									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	11	11	11	11	11	11	14	14	5	5
Number of coaches movements per month	87	87	87	87	87	87	110	110	40	40
Number of taxi movements per month	17.5	17.5	17.5	17.5	17.5	17.5	22	22	8	8
Number of coach movements per cruise call	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0
Number of taxi movements per cruise call	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6

	2019 (forecast daily movements)									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	12	12	12	12	12	12	16	16	6	6
Number of coaches movements per month	97	97	97	97	97	97	128	128	55	55
Number of taxi movements per month	19.5	19.5	19.5	19.5	19.5	19.5	26	26	10.5	10.5
Number of coach movements per cruise call	8.1	8.1	8.1	8.1	8.1	8.1	8.0	8.0	9.2	9.2
Number of taxi movements per cruise call	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.8	1.8

	2020 forecast daily movements)									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	13	13	14	14	15	15	18	18	7	7
Number of coaches movements per month	105	105	109	109	174	174	185	185	75	75
Number of taxi movements per month	21	21	21.5	21.5	35	35	37	37	15	15
Number of coach movements per cruise call	8.1	8.1	7.8	7.8	11.6	11.6	10.3	10.3	10.7	10.7
Number of taxi movements per cruise call	1.6	1.6	1.5	1.5	2.3	2.3	2.1	2.1	2.1	2.1

	2021 (forecast daily movements)									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	14	14	16	16	16	16	20	20	9	9
Number of coaches movements per month	125	125	159	159	206	206	237	237	125	125
Number of taxi movements per month	25	25	32	32	41.5	41.5	47.5	47.5	25	25
Number of coach movements per cruise call	8.9	8.9	9.9	9.9	12.9	12.9	11.9	11.9	13.9	13.9
Number of taxi movements per cruise call	1.8	1.8	2.0	2.0	2.6	2.6	2.4	2.4	2.8	2.8

	2022 (forecast daily movements)									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	15	15	18	18	18	18	22	22	10	10
Number of coaches movements per month	145	145	203	203	263	263	282	282	145	145
Number of taxi movements per month	29	29	40.5	40.5	53	53	56	56	27	27
Number of coach movements per cruise call	9.7	9.7	11.3	11.3	14.6	14.6	12.8	12.8	14.5	14.5
Number of taxi movements per cruise call	1.9	1.9	2.3	2.3	2.9	2.9	2.5	2.5	2.7	2.7

	2023 (forecast daily movements)									
	May		June		July		August		September	
	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures	Arrivals	Departures
Number of cruise calls per month	16	16	19	19	20	20	24	24	12	12
Number of coaches movements per month	165	165	247	247	320	320	327	327	165	165
Number of taxi movements per month	33	33	49	49	65	65	65	65	33	33
Number of coach movements per cruise call	10.3	10.3	13.0	13.0	16.0	16.0	13.6	13.6	13.8	13.8
Number of taxi movements per cruise call	2.1	2.1	2.6	2.6	3.3	3.3	2.7	2.7	2.8	2.8

I11 – Operational Vehicle Assignment

Appendix I11 - Employee Assignment (Operation)

Holyhead Port Entrance	Total Daily Employees	7
	Car-share ratio	1.0
	Total Daily vehicles	7
	Percentage resident workers	1.00
	Percentage in-migrant workers	0
	Total resident workers vehicles	7
	Total in-migrant workers vehicles	0

	Residents		In-migrant		Combined	Links										
Point of entry to study area	Percentage split	Total worker vehicles (one-way)	Percentage split	Total worker vehicles (one-way)	Total worker vehicles (one-way)	1	2	3	4	4a	4b	4c	5	6	7	8
1	73.4%	5.0	47.7%	0.0	5.0	5	5	5	5		5					
5	9.1%	0.6	10.6%	0.0	0.6				0.6		0.6		0.6			
6	7.4%	0.5	8.5%	0.0	0.5			1	1		1			1		
7	10.2%	0.7	33.2%	0.0	0.7		0.7	0.7	0.7		0.7				0.7	
Total worker vehicles (one-way)						5	6	6	7	0	7	0	1	1	1	0
Total worker vehicles (two-way)						10	11	13	14	0	14	0	1	1	1	0

		Links										
Access	Peak Daily Movements	1	2	3	4	4a	4b	4c	5	6	7	8
Port Access	152	152	152	152	152	0	152	0	0	0	0	0

Appendix J

Socio-Economic Assessment

Holyhead Port Expansion: Socio-economic impact assessment

Final Report

prepared for

Royal HaskoningDHV

June 2019

RPA
Risk & Policy Analysts

Holyhead Port Expansion:
Socio-economic impact assessment

June 2019

Final Report

Quality Assurance	
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1 The approach

1.1 Overview

The socio-economic impact assessment (SEIA) methodology is intended to enable the cultural, economic, environmental and social impacts (positive and negative) of the Holyhead Port Expansion to be described, quantified and, to the extent possible, monetised. This is therefore in line with the requirements of the Well-Being of Future Generations Act (WFG).

Table 1-1 summarises the key elements of the methodology and Table 1-2 highlights where the specific requests in the Scoping Opinion provided by Natural Resources Wales (NRW) fit within our approach. The overall methodological approach is the same for the construction phase as for the operational phase. No account is taken of a decommissioning phase for there are no plans to decommission the terminal.

Table 1-1: Overview of structure of the methodology

Stage	Economic		Cultural, Social impacts	Distributional analysis
	Direct	Indirect		
Construction / Operation	Gross Value Added (GVA) Jobs created/ supported By sector	Knock-on GVA Knock-on jobs By sector (where data are available)	Social clusters Supply chain capacity Capacity of local services	Who pays Who benefits Assessment of which groups are impacted more/less than average

The socio-economic assessment takes potential impacts identified in the other chapters of the Environmental Statement (ES) and links them to economic sectors. Table 1-2 shows how the chapters map onto the economic sectors. Clearly there are linkages between some of these sectors; there are also linkages between other types of impacts covered in the EIA and the social and economic impacts notably:

- Noise and vibration (on local communities, tourism, commercial fisheries, etc. depending on the type, location, timing and magnitude of noise and vibration);
- Air quality (on local communities, tourism, recreational boating, etc. depending on magnitude and location of air quality issues);
- Archaeology and cultural heritage (on local communities, tourism, etc. depending on type and magnitude of impacts);
- Nature conservation designations, marine ecology, fish and shellfish resource, marine mammals, ornithology and terrestrial and intertidal ecology (on local communities, tourism, recreational activities, etc. depending on type and magnitude of impacts); and
- Coastal processes, marine water and sediment quality (on commercial shipping and recreational boating, etc. depending on location and magnitude of impacts).

Table 1-2: Mapping EIA to SEIA										
ES chapter	SEIA section (depending on the type, location, timing and magnitude of impact)									
	Ports and harbours	Commercial shipping	Traffic and transport	Commercial fisheries	Aquaculture	Tourism	Recreational boating	Water sports	Coast protection and flood defence	Local communities
Nature Conservation Designations						✓				✓
Coastal Processes									✓	
Marine Water and Sediment Quality				✓	✓	✓		✓		
Marine and Coastal Ecology				✓	✓			✓		✓
Fish and Shellfish Resource				✓	✓					
Marine Mammals						✓				✓
Commercial Fisheries				✓	✓					
Ornithology						✓				✓
Commercial and Recreational Navigation		✓	✓	✓	✓		✓	✓		
Traffic and Transport			✓	✓	✓	✓	✓	✓		✓
Noise and Vibration				✓	✓	✓	✓	✓		✓
Air Quality						✓	✓	✓		✓
Archaeology and Cultural Heritage						✓				✓
Visual effects						✓	✓	✓		✓

1.2 Construction phase

The **direct economic impact assessment** is based on:

1. Description and quantification of the likely effects of the activities. Table 1-3 shows how the methodology builds on the scoping opinion;
2. Assessment of whether the costs incurred are likely to result in a change in output from a range of key economic sectors[1]. The sectors considered are shown in Table 1-4;
3. Where a sector is expected to be impacted by a change in output (turnover), an estimate is made of the likely effects on GVA for the sector; and
4. Direct employment effects are then estimated by comparing GVA per job to identify what the changes in jobs might be.

[1] These vary from the sectors given in Table 3 as the statistics align with SIC (2007) industry classifications.

Table 1-3: Linking the methodology to the Scoping Opinion from NRW				
Stage	Economic		Cultural, Social impacts	Distributional analysis
	Direct	Indirect		
Construction	Direct benefits to local employment and business opportunities (number, type, quality) Direct impacts on tourism Direct impacts on fishing and fishing opportunities	Indirect benefits to local employment and business opportunities Indirect impacts on tourism Indirect impacts on fishing and fishing opportunities	Assessment of positive local outcomes Local supply chain impacts Impacts of contractor migration Access to local services Impacts on local facilities and accommodation (providers and existing users) Cumulative impact assessment	Identification of where positive and negative local outcomes occur and to whom Flow of benefits along supply chain, including from use of local materials and opportunities to maximise community benefits Cumulative impact assessment
Operation	Direct benefits to local employment and business opportunities (number, type, quality) Direct impacts on tourism Direct impacts of passing trade Direct impacts on fishing and fishing opportunities Direct impacts of increased passenger numbers	Indirect benefits to local employment and business opportunities Indirect impacts on tourism Indirect impacts of passing trade Indirect impacts on fishing and fishing opportunities Indirect impacts of increased passenger numbers	Assessment of positive local outcomes Local supply chain impacts Knock-on effects of local expenditure Impacts on local facilities Impact of transient visitors, including traffic Impacts on transport more widely, e.g. rail Cumulative impact assessment	Identification of where positive and negative local outcomes occur and to whom Flow of benefits along supply chain, including opportunities to maximise community benefits Cumulative impact assessment

Table 1-4: Sectors included in the socio-economic assessment	
• Aquaculture • Coast protection and flood defence • Commercial fisheries • Commercial shipping • Local communities • Traffic and transport	• Ports and harbours • Recreational boating • Tourism • Waste disposal • Water sports

Indirect economic impacts are the knock-on effects that result from the direct changes in GVA and employment. They occur because of linkages in the economy between different sectors and within sectors. Indirect and induced effects can be captured through the use of input-output modelling and the Type I (indirect) and Type II (indirect plus induced) multipliers that such modelling produces. Specific

input-output modelling has not been undertaken; however, existing models and multipliers are available and have been used. Input-output modelling has been undertaken for Wales but the models have not been updated beyond 2007. Instead a study from 2017 has been used which includes multipliers for different aspects of the maritime sector in Wales[2]. These include the following multipliers for different maritime sectors:

- Ports industry: indirect impact: 0.79 and induced impact: 0.70;
- Shipping industry: indirect impact: 0.64 and induced impact: 0.50;
- Marine industry: indirect impact: 0.55 and induced impact 0.39;
- Maritime business services industry: indirect impact 0.89 and induced impact 0.36; and
- Maritime sector in Wales as a whole: direct, indirect and induced impact of 2.17 (i.e. 1.17 for indirect and induced impacts).

The Scoping Opinion identifies a need to focus in particular on impacts on the tourism and fishing industries. Tourism benefits and multipliers are taken from work undertaken by Blue Chip Tourism:

- Expenditure forecasts for cruise ships (Blue Chip Tourism figures):
  - Port of Call Spend per Passenger £48.36
  - Port of Call Spend per Crew Member (23 Euros @ 40% going ashore) £7.96
  - Direct Spend Port of Call per passenger £51.65
- Anticipated Impacts over 20 Year Project Lifespan (Blue Chip Tourism figures):
  - Grand Total Direct Expenditure £115,869,308
  - Multiplier 1.34
  - Grand Total Direct & Indirect Expenditure £155,671,324

Fishing benefits and multipliers are based on work by Seafish (2008) compared with the Wales input-output multipliers. Input-output modelling has been undertaken for Wales but the models have not been updated beyond 2007. Consideration is given to where significant changes have occurred in GVA and number of jobs by industry sector since 2007 to provide a narrative on likely uncertainties. Comparison can also be made with the UK-wide multipliers, which were last updated in 2018 but which relate to 2014 economic data, and those for Scotland, which were updated in 2017 but also relate to 2014 economic data, to provide further validation of the indirect effect calculations[3]. It is important to note however that only Type I multipliers are currently being produced for the UK as a whole, due to uncertainties surrounding Type II multipliers and assumptions.

- Seafish multipliers[4] (Type II multipliers including direct, indirect and induced effects for the domestic fleet only):

---

[2] Cebr (2017): The economic contribution of the maritime sector in Wales: a report for Maritime UK and the Welsh Ports Group, accessed at: https://www.britishports.org.uk/system/files/documents/report_on_the_maritime_sector_in_wales_-_english.pdf on 18th April 2019.

[3] A further complication is that the Wales input-output tables relate to the 2003 SIC codes whereas the UK and Scotland input-output tables relate to the 2007 SIC codes. Since industry sectors may not match exactly; this will add further uncertainties to the assessment. Furthermore, the Wales statistics will be aligned with the 2007 SIC codes.

[4] Seafish (2008): The economic impacts of the UK sea fishing and fish processing sectors: an input-output analysis, accessed at: https://www.seafish.org/media/Publications/2006_I-O_Key_Features_Final_090108.pdf on 18th April 2019.

    - Sea fishing (multipliers are for UK as a whole):
        - Demersal: 3.62 (output), 2.50 (employment multiplier) and 51.26 (employment effect)
        - Shellfish: 3.56 (output), 1.53 (employment multiplier) and 76.35 (employment effect)
        - Pelagic: 2.79 (output), 5.60 (employment multiplier) and 23.41 (employment effect)
    - Fish processing:
        - Demersal: 4.59 (output), 5.64 (employment multiplier) and 44.48 (employment effect)
        - Shellfish: 4.81 (output), 6.21 (employment multiplier) and 48.53 (employment effect)
        - Pelagic: 4.94 (output), 5.93 (employment multiplier) and 46.42 (employment effect)
- Wales input-output multipliers[5]:
    - Agriculture, forestry and fishing:
        - Type I: 1.44 (output) and 1.17 (employment multiplier)
        - Type II: 1.54 (output) and 1.21 (employment multiplier)

Multipliers for other sectors, for example, construction are based on the Wales input-output multipliers. For construction, the Type I output multiplier is 1.46 and Type II is 1.62. The type I employment multiplier is 1.45 and Type II is 1.69[5].

The above bullets show that the multipliers for Wales are more aggregated than those from Seafish and are also much smaller, although the Seafish values are for the UK as a whole and not specific to Wales. The Seafish multipliers are used in the economic analysis, with the Wales values used to give a lower range to test sensitivity of the potential impacts.

Use of multipliers provides the basis for assessing direct and indirect (and induced) impacts across all the relevant sectors. Our approach also captures knock-on impacts on wider sectors, enabling comments to be made also on the local employment and business opportunities from comparison of impacts across all relevant sectors.

The WFG requires public bodies (including Natural Resources Wales (NRW)) to improve the social, economic, environmental and cultural well-being of Wales. Our approach, therefore, includes a **social and cultural assessment** of potential impacts to ensure that these have been given equal consideration alongside the economic and environmental effects of the port expansion. Unlike the economic effects, it is difficult to monetise the social and cultural impacts but it is important that they are assessed so they can inform decision-making.

Our approach to the assessment of social and cultural impacts is based on the identification of value clusters. This is based on work undertaken by Collingwood Environmental Planning for Marine Scotland (unpublished). The value clusters were identified through discussion with local communities around the Scottish coast. Although the value clusters reported were associated with the development of offshore

[5] Cardiff University (2010): The input-output tables for Wales 2007, July 2010, accessed at: https://www.cardiff.ac.uk/__data/assets/pdf_file/0010/698869/input-output-tables-2007-final-30-6.pdf on 18th April 2019.

wind, it is considered that these provide the best categories to enable the wider social and cultural impacts to be assessed. The value clusters for use in the study are presented in Table 1-5.

Our approach considers each impact against the relevant value clusters in order to provide a narrative of the likely impacts. To enable comparison of impacts we use a rating system that enables a typical level of impact to be identified and rated. The rating system is provided in Table 1-6 below. This has been revised in line with the actual impacts to ensure it reflects the range of predicted impacts and to reflect their local importance.

The methodology involves identification of one rating for each value cluster and sector. The rating assigned is justified drawing on the evidence from the socio-economic impact assessment and from description of potential impacts from the other chapters of the ES. Data gaps that exist are filled through use of descriptive impacts. Such descriptions are developed as part of the socio-economic assessment and are included as part of the justification for the rating that is assigned.

Table 1-5: Value clusters used in the social and cultural assessment		
Value cluster level	**Value cluster**	**Details**
Individual	Family, family life, inter-generational issues	Linked to extent to which a family can stay connected, can be located near to each other and can obtain support from the family network
	Jobs, career, employment	Linked to job opportunities
	Money, cost of living	Linked to income and the cost of living
Community	Local jobs, local industry, community sustainability	Linked to economic growth, participation, including how changes in participation in recreational activities may affect local industry and community sustainability, innovation, exports and productivity
	Transport connections, technology connections	Linked to any impacts on transport connections (e.g. shipping)
	Education	Linked to skill levels and training
	Shops, housing	Linked to availability and quality of housing
	Socialising, recreation, parks, leisure	Linked to levels of physical activity, and visits to the outdoor
	Friends, being involved, supporting others	Linked to feelings of belonging to their community, levels of discrimination and crime and views on the neighbourhood as a place to live
	Local identity, cultural heritage, Welsh	Linked to the extent to which traditions can be maintained
	Healthcare	Linked to access to healthcare services, such as GP, and satisfaction with health care services
	Connection to nature, landscape	Linked access and use of local green spaces, and personal concern over damage to the natural environment and climate change
	Local political and decision-making systems	Linked to involvement (perceived or actual) in decision-making, including participation in local decision-making, employee voice and access to justice
Wider political and environmental context	Landscape, seascape, wildlife, environmental change	Linked to climate change, greenhouse gas emissions and energy from renewable sources, and condition of protected nature sites
	National and international level political and decision-making systems	Linked to Wales' reputation and access to justice
Based on work undertaken by Collingwood Environmental Planning et al. (2016): A two way conversation with the people of Scotland on the social impact of offshore renewables, Final Dialogue Report, March 2016 (study unpublished). Details developed specifically for this project to capture the relevant effects within each cluster		

Table 1-6: Value clusters used in the social and cultural assessment	
Negative impacts (-)	**Positive impacts (+)**
Major (- - - -): sufficient negative impacts predicted to have a noticeable effect that is sufficient to cause complaints and/or protests from the community	Major (+ + + +): sufficient positive impacts predicted to have a noticeable effect that is sufficient to enable new services or activities within the community
Moderate (- - -): sufficient negative impacts predicted that result in concerns being raised by the community	Moderate (+ + +): sufficient positive impacts predicted that result in increased levels or expansion of existing activities or services
Minor (- -): negative impacts predicted that may be noticed but which are accepted by the majority of the community	Minor (+ +): positive impacts predicted that may be noticed but which support existing services or activities but not the extent that they can expand
Negligible (-): small negative impacts that are unlikely to be noticed by the majority of the community	Negligible (+): small positive impacts that are unlikely to be noticed by the majority of the community
Neutral/no overall impact: 0	
Based on work undertaken by RPA with ABPmer for a series of socio-economic impact assessments undertaken for Scottish Government and Marine Scotland	

The **distributional analysis** builds upon the economic, social and cultural impact assessment to identify who bears the costs and who benefits from the proposed port expansion. The analysis highlights:

- If and where there may be specific groups that are impacted disproportionately;
- Where there may be opportunities to deliver more benefits to the local community; and
- Where local benefits could be maximised.

The distributional analysis is structured in the same way as the social and cultural assessment, i.e. it links potential impacts to the value clusters. The impacts themselves are broken down to reflect the different groups that could be impacted differently due to their ability to adapt, their resilience to change and their vulnerability to specific effects.

The distributional analysis involves reviewing the ratings assigned to a typical impact and assessing whether this rating should be increased or decreased for each sub-group. The justifications included with the average rating from the social and cultural impact assessment are used as the basis for identifying if an impact is expected to be worse (more negative or less positive) for each group. Where there is expected to be a difference, the rating is revised for that group and further justification (in the form of a narrative description) is provided as to why that change has been made.

The results of the distributional analysis are then considered to identify if there are opportunities associated with the port expansion that could be utilised to deliver more positive impacts or reduce negative impacts, and where and how those local benefits could be maximised. We have also reviewed the approach used for the Llangefni Link Road project to bring in further opportunities to identify where local benefits could be maximised.

1.3 Operational phase

The methodology for the operational phase follows the same principles as the construction phase, although the impacts extend over a longer time period. The operational phase assessment focuses on impacts post-construction and includes specific issues such as the knock-on effects of local expenditure

and impact of transient visitors. Of particular importance during operation are the potential impacts of passing trade. Additional sub-groups for consideration during the distributional analysis are added where necessary due to the different types of impacts that could occur and their longer duration.

Timing of potential impacts and the potential for them to degrade or increase over time also form an important part of the assessment during the operational phase. This is separate from the cumulative impact assessment as it does not look to identify the combined effects across different developments; instead, the focus is on whether impacts could become more significant over time as capacities, e.g. of services and facilities, are reached. Conversely, for supply chain impacts, capacities may increase as businesses develop and expand. The same may be true of some services, while others (e.g. education, healthcare, transport infrastructure) may need external investment to be able to expand such that they may be adversely affected if numbers of people using those services continue to increase over time.

The approach to distributional analysis is as for the construction phase, with specific sub-groups that may be more (or less) affected being identified and ratings revised, as appropriate.

1.4 Cumulative impact assessment

The cumulative impact assessment focuses on identifying how potential impacts from the proposed Holyhead Port Expansion could combine with those of other developments to result in overall greater effects. One of the issues with a cumulative impact assessment is whether impacts are assumed to be additive or synergistic. Although it is recognised that impacts may reach a threshold above which the combined effects may be greater than would be suggested from an additive approach, it can be difficult to find evidence on which to base any assumptions. Our method, therefore, uses an additive approach unless there is clear evidence (usually provided by stakeholders) that a synergistic effect could occur.

2 Summary of potential impacts from the proposed Holyhead Port Expansion during construction

2.1 Overview of section

This section provides a summary of the potential direct, indirect and social and cultural impacts from the proposed Holyhead Port Expansion during construction. This information is then used as the basis for considering what the cumulative impacts with other developments within Holyhead and Anglesey.

The source of information for the impacts is identified as are any uncertainties and assumptions that have been made during the analysis.

2.2 Potential direct economic impacts from construction

The port sector makes a key contribution to the Welsh economy; Holyhead is the third busiest port in Wales and specialises in movement of goods by lorry - 98% of its cargo is roll-on / roll-off (Ro-Ro) .

The Port also supports a significant ferry link with Ireland and handles, on average, approximately 470,000 passenger cars, motorcycles and buses every year. As a result, Holyhead Port is the busiest ferry port in Wales and was the second busiest ferry port (short-sea routes) in the UK in 2017 (Department for Transport, 2018b).

Potential impacts during the construction phase are described across the following sectors:

- Ports and harbours
- Commercial shipping
- Commercial fisheries
- Aquaculture
- Traffic and transport
- Tourism
- Recreational boating
- Water sports
- Coast protection and flood defence
- Local communities

The proposed Holyhead Port Expansion is predicted to create 889 FTE person years of jobs during construction (FTE Person years, over two years). Multipliers for construction in Wales suggest that these direct jobs could result in a further 400 indirect FTE jobs and 213 induced FTE jobs person years[6]. This is the total potential number of jobs and the extent to which the job opportunities are available to local people will depend on current capacity in terms of economically inactive people and their associated skills within the Holyhead and Anglesey areas. Where there are limits to the capacity of local firms to provide the skills needed through local employment, some investment may leak outside of Anglesey, to North

[6] Calculated as 889 x 0.45 for indirect jobs (with multiplier being 1.45 of which 1 is for direct jobs and 0.45 for indirect jobs) and 0.24 for the difference between indirect and induced jobs (1.69 – 1.45).

Wales, Wales more generally or wider. Any such leakage would result in workers needing to migrate to Holyhead and Anglesey. Annual construction GVA per head in Anglesey is £61,000 (figures for 2015)[7]. The construction phase could therefore deliver £54 million GVA over two years.

The harbour expansion may disrupt the services in the short term as construction activities would result in an increase in the number of vessels visiting and moving around the port, particularly as a result of those associated with the exportation of dredged material to the Holyhead North (IS043) offshore disposal site. These impacts could raise navigational risk and shipping journey time. This would also apply to commercial fishing boats, landing at (or operating out of) Holyhead Port. As a result of the services provided by Port Control however, the navigational safety is not expected to be significantly affected neither the navigational times to complete a journey. Timely receipt of Notices to Mariners, as is standard practice for activities within the Port authority's jurisdiction, will allow fishing vessels to plan their activities during the construction works, which are temporary and short- to mid-term in nature.

With regard to aquaculture, mussel beds are located approximately 2.5 km south-east of the proposed scheme (Food Standards Agency, 2018). As the impacts on water quality are expected to be minor, no impacts are envisaged for the beds. Thus, no impacts on aquaculture are expected.

There could also be a temporary increase in traffic flow. The EIA notes that the introduction of construction traffic does not have a significant effect on the daily traffic profile. Impacts are therefore considered to be minor.

Tourism makes a significant contribution to the Isle of Anglesey's economy. In 2015 its total economic impact was £279 million, with over 1.6 million visitors to the island[8]. The tourism industry is a major source of employment on Anglesey and it has the second highest percentage of main jobs in tourism (14%) for the whole of England and Wales[9]. The island's coastline is a particular draw for many visitors: figures indicate that coastal destinations are by far the most popular destination type for overnight visitors to North Wales, where 51% of trips are to the seaside[10]. Much of the Anglesey's coastline has been designated an Area of Outstanding Natural Beauty (AONB), including three sections of Heritage Coast, and popular forms of recreation include sailing, angling, cycling, walking and wind surfing[11].Tourism associated with Holyhead Port includes the marina, sailing club, maritime museum,

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7 GVA per head for construction in Anglesey was £61,000 in 2015, accessed at: https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/regionalgvaibylocalauthorityintheuk on 18th April 2019.

8 Isle of Anglesey County Council, 2016, Destination Anglesey Management Plan 2016 – 2020 accessed at https://www.anglesey.gov.uk/Journals/u/b/n/Destination-Anglesey-Management-Plan-2016---2020-low-res.pdf on 2nd August 2018

9 ONS, 2015, Sub-National Tourism: A spatial classification of areas in England and Wales to show the importance of tourism, at county and unitary authority level, 2011 to 2013 accessed at https://www.ons.gov.uk/peoplepopulationandcommunity/leisureandtourism/bulletins/subnationaltourism/aspatialclassificationofareasinenglandandwalestoshowtheimportanceoftourismatcountyandunitaryauthoritylevel2011to2013 on 2nd August 2018

10 Statistics for Wales, 2017, Regional Tourism Profiles, 2014: North Wales accessed at https://gov.wales/docs/caecd/research/2017/170308-regional-tourism-profiles-2014-north-wales-en.pdf on 2nd August 2018

11 Isle of Anglesey County Council, 2015, The Anglesey Area of Outstanding Natural Beauty (AONB) accessed at http://www.anglesey.gov.uk/planning-and-waste/countryside/areas-of-outstanding-natural-beauty-aonbs/the-anglesey-aonb/ on 2nd August 2018

ferry terminal and other recreational facilities. The port caters for around 2 million transient visitors annually through ferries and international cruise ships[12]. Overall potential impacts on tourism during construction are most likely to be associated with visual amenity (but limited to peak phases of activity at the Pelham Patch Development Site) and then associated with specific visitor activities, such as wildlife watching (minor adverse to negligible), or visits to heritage sites (moderate adverse to minor). Potential impacts on tourism may be more affected by availability of accommodation due to the potential influx of contractors undertaking the construction works. However, this will not represent a loss to accommodation providers (where these accommodation are instead used to house contractors) although there may be a loss to visitor attractions (should there be a reduction in accommodation available to visitors).

The impacts to recreational users, including water sport users, of the Port will be similar as for tourists, e.g. visual amenity, but they may see their activities restricted due to construction traffic. It is unlikely that charter / private vessels that use the area, would traditionally operate within the approaches to the port as this is currently an area of relatively high vessel traffic. Regardless, the small area of the dredging footprint means that any vessels operating within Holyhead Bay would easily be able to move into nearby, unaffected areas if necessary, and the low intensity of activities would minimise the risk of impacts arising from displacement. As for commercial fishing and some of the sectors above, the Port Control will be able to accommodate the different users. Potential impacts on recreational boating during construction are identified as being low to negligible at worst; there are not expected to be any impacts on costs for the recreational boating sector.

Coastal defences at Holyhead Port include a sea wall, groynes and the main breakwater (Royal Haskoning, 2011a). The main breakwater provides shelter to a significant area of the coast and without it, many areas within the inner Holyhead Bay would be exposed to coastal flooding. The EIA assessed that changes in sea-bed level and the wave regime due to capital dredging of the approach channel will have negligible impacts. There are no impacts anticipated on coastal defence and flood risk in the study area during the construction phase of the proposed scheme.

Potential impacts from local changes in air quality and visual impact associated with the Pelham Patch reclamation activity may have some localised effects on quality of life of local communities, but these are expected to be short-lived. Potential impacts on heritage may affect sense of identity, although again these are expected to be localised. As such, impacts may be on specific groups within the community rather than on the community as a whole. It is not possible to monetise these potential impacts. The residual impact significance considered to be minor adverse.

The potential impacts during construction are summarised in Table 2-1. These main impacts are benefits to employment associated with the construction impacts themselves and knock-on benefits to local businesses through investment in the local supply chain.

[12] Isle of Anglesey County Council, 2016, Destination Anglesey Management Plan 2016 – 2020 accessed at https://www.anglesey.gov.uk/Journals/u/b/n/Destination-Anglesey-Management-Plan-2016---2020-low-res.pdf on 2nd August 2018

Table 2-1: Summary of potential direct impacts on industry sectors during construction		
Sector	**Summary of potential impacts**	**Assumptions and further description of impacts**
Ports and harbours[1]	Significant positive benefits	The proposed Holyhead Port Expansion is predicted to create **889 FTE person years of jobs** during construction (over two years). Multipliers for construction in Wales suggest that these direct jobs could result in a further 400 indirect FTE jobs and 213 induced FTE jobs person years. **Total GVA** generated over the two year construction period is estimated at **£54 million over two years** in Present Value terms
Commercial shipping[2]	Minor adverse	The construction activities associated with the Proposed Scheme would result in an increase in the number of vessels visiting and moving around the port with increased navigational risks and time implications. The Port control is expected to mitigate such impacts to be minimal.
Commercial fisheries	Minor adverse	A small number of vessels fish within the approach channel footprint, which would be displaced to alternative fishing grounds during dredging operations. There is low intensity potting for lobsters and crabs within Holyhead Bay. However, potting appears to be focused away from areas adjacent to the port and the port entrance, and the low intensity of the fishery would minimise the risk of impacts arising from displacement
Aquaculture	No impacts	Mussels beds will not be affected by minor changes in water quality
Traffic and transport	Minor adverse	The introduction of construction traffic does not have a significant effect on the daily traffic profile
Tourism	Moderate to minor adverse	For users, there may be minor impacts due to visual amenity and potential losses in accommodation capacities. Impacts on accommodation services will be limited but there may be minor negative impact to tourist attractions if number of visitors decline.
Recreational boating	Minor adverse	Low number of users. Minor impacts due to visual amenity and restrictions on navigation to minimise risk but also issue of notices by the Port Control.
Water sports	Minor adverse	Possible loss of access for some shore-based angling around the harbour but low impact and temporary Possible reduction in harbour-based dive trips but no impacts expected in harbour
Coast protection and flood defence	No impact	Changes in sea-bed level and the wave regime due to capital dredging of the approach channel will have negligible impacts on coastal defence structures and flood risk.
Local communities	Minor adverse impact	Local changes in air quality and visual impact associated with the Pelham Patch reclamation activity may have some localised effects on quality of life of local communities Minor adverse impact on known heritage assets

Table 2-1: Summary of potential direct impacts on industry sectors during construction		
Sector	**Summary of potential impacts**	**Assumptions and further description of impacts**
1: The following activities are included under this section (from Blue Chip Tourism): • Warehousing and Storage. Identified through SIC code 52101, "Operation of Warehousing and Storage Facilities for Water Transport activities"; • Port Authority Management, Port Security and Marshals, Port Marine and Vessel Management Services, Marine Pilots, Port Harbour Support Vessels, and Engineering and Maintenance Identified through SIC code 52220, "Service activities incidental to water transportation"; • Stevedores, cargo and passenger handling including crane/vehicle/plant drivers/operators Identified through SIC code 52241, "Cargo Handling for Water Transport Activities"; and • Border Agency, Home Office and HMRC staff operating in Ports Identified as public sector employees operating in UK ports. Institute for Government, Port Freight Statistics, Cebr analysis. 2: Commercial shipping includes the following: • International transport of passengers; • Transport of passengers on inland waterways; • International transport of freight; and • Transport of freight on inland waterways.		

2.3 Potential indirect economic impacts from construction

Multipliers for construction in Wales suggest that a further £25 million GVA per year over two years could be generated due to indirect benefits and £8.6 million GVA per year over two years from induced benefits[13]. Thus, **total GVA** generated over the two year construction period is estimated at **£33 million over two years** in Present Value terms. As with job estimates, the total GVA that is retained in Anglesey will depend on the capacity of the local supply chain to provide the services and fulfil contracts for work required during construction.

Potential indirect jobs from construction are estimated at 400 FTE person year jobs with a further 213 induced FTE person year jobs. These job estimates are based on application of Type I and Type II multipliers. Potential indirect jobs, which result from knock-on benefits along the supply chain will, like direct jobs, depend upon the capacity of the local supply chain to provide the required services. Induced jobs, which are based on spend of wages from direct and indirect jobs, may be more likely to be local unless contractors go home for weekends or at the end of contract periods.

Construction is not expected to result in indirect impacts on specific sectors since, in most cases, the direct impacts are not expected to be significant.

[13] Calculated as £54 million x 0.46 for indirect jobs (with multiplier being 1.46 of which 1 is for direct jobs and 0.46 for indirect jobs) and 0.16 for the difference between indirect and induced jobs (1.62 – 1.46).

2.4 Social and cultural impacts from construction

2.4.1 Screening of potential social and cultural impacts

There are expected to be significant positive benefits to individuals and the local community from the investment, through the creation of jobs. The extent to which jobs provide benefits to local people, including young people and those who are long-term unemployed could be facilitated by a Community Benefits Agenda focused on training, upskilling and requirement for contracts to be made available to local firms.

Table 2-2 provides the results of the screening of potential social and cultural impacts. Each of the impacts identified above, where these are negligible or greater, are included in the table. The potential effects are considered against each of the clusters to show where social and cultural effects could be expected. The magnitude of potential impact from the EIA was used to inform the magnitude of rating assigned to the social and cultural effects.

Subsequent sections only include potential impacts where these are expected to affect the social clusters in question.

Table 2-2: Potential impacts on value clusters (construction)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Creation of 889 construction jobs and 613 indirect and induced jobs (FTE person years)		Y	Y	Y			Y				Y				
Presence of large contractor workforce		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y
Additional £87 million in GVA (through direct, indirect and induced effects on employment)				Y			Y						Y		Y
Vessels approaching and leaving the port (commercial and recreational)					Y			Y							
Increase in traffic flow					Y										
Fishing vessels approaching and leaving the port		Y	Y	Y											

Table 2-2: Potential impacts on value clusters (construction)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Displacement to alternative fishing grounds (crabs and lobsters)		Y	Y	Y											
Fishing for whelk within vicinity of Holyhead North disposal site		Y	Y	Y											
Disruption to fishing fleet		Y	Y	Y											
Impacts on finfish and shellfish		Y	Y	Y											
Impacts on availability of accommodation (tourists)				Y			Y								
Air quality/dust and exhaust emissions from HGV movements								Y			Y				
Noise and vibration impacts								Y			Y	Y	Y		
Visual amenity impacts								Y		Y		Y			

Table 2-2: Potential impacts on value clusters (construction)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Impacts on marine ecology (divers, wildlife watchers)				Y	Y			Y				Y			
Impacts on guillemots (birdwatchers)					Y			Y				Y			
Impacts on sea anglers				Y	Y			Y				Y			

2.4.2 Rating of potential social and cultural impacts

Potential Individual impacts

Potential individual impacts are assessed against three value clusters:

- Family, family life, inter-generational issues;
- Jobs, career, employment; and
- Money, cost of living.

The predicted impacts on each cluster with a rating of magnitude are shown in Table 2-3.

Table 2-3: Predicted impacts on individual value clusters

Potential impact	Value clusters affected		
	Individual		
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living
Creation of 889 construction jobs	Short-term impacts of construction jobs not expected to result in any effects	Potential for local people to obtain jobs, increasing employment level locally and potentially reducing the local unemployment rate from 4.8% (December 2018) to closer to the average for Wales 4.5%[14]	Average weekly earnings in construction in December 2017 were £607 (compared with £513 across the whole economy)[15], with potential for increased income if people move into the construction sector
	No impact	Minor (+ +)	Minor (+ +)
Presence of large contractor workforce	Short-term impacts of construction workforce not expected to result in any effects	The available workforce in the construction sector is currently low in Wales (4%) compared with GB average of 9%[16] so many of the jobs may be taken up by people moving to the area temporarily with limited benefits to the local area, although Community Benefits	Where a large non-local workforce moves into the area, there could be knock-on effect on the cost of living due to increased demand for housing and other services

[14] Based on ILO unemployment rates for Anglesey, accessed at: https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/People-and-Work/Unemployment/ILO-Unemployment/ilounemploymentrates-by-welshlocalareas-year on 11th April 2019.

[15] Based on ONS data on average weekly earnings, accessed at: https://www.ons.gov.uk/generator?uri=/businessindustryandtrade/constructionindustry/articles/constructionstatistics/number192018edition/a7645843&format=xls on 11th April 2019.

[16] Based on ONS data on regional concentrations of construction-specific employment as a percentage, accessed at: https://www.ons.gov.uk/file?uri=/businessindustryandtrade/constructionindustry/articles/constructionstatistics/number192018edition/7689f4d1.xlsx on 11th April 2019.

Table 2-3: Predicted impacts on individual value clusters			
Potential impact	**Value clusters affected**		
	Individual		
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**
		Agenda could help retain jobs locally by encouraging training and upskilling	
	No impact	Negligible (-)	Minor (- -)
Impacts on fishing covering: fishing vessels approaching and leaving the port; displacement to alternative fishing grounds; Fishing for whelk within vicinity of Holyhead North disposal site; disruption to fishing fleet; impacts on finfish and shellfish	No impacts expected due to temporary nature of construction impacts	Possible impacts on individual fishers, but these are generally expected to be small such that the choice of fishing as a career should not be impacted	Possible impacts on individual fishers in terms of value of landings or effort needed to generate the same level of catch. Impacts are expected to be low so impacts in terms of income should be minimised. Whelk fishers may be more likely to see a reduction in income so should be limited to the fishing community as a whole
	No impact	Negligible (-)	Minor (- -)

Potential community impacts

Potential community impacts are considered against nine value clusters, with a description of the impacts and ratings to identify likely magnitude of effects given in Tables 2-4 to 2-6:

- Table 2-4: Local jobs, local industry, community sustainability; transport connections, technology connections; and education;
- Table 2-5: shops, housing; socialising recreation, parks, leisure; and friends, being involved, supporting others; and
- Table 2-6: local identify, cultural heritage, Welsh heritage; healthcare; connection to nature, landscape; local political and decision-making systems.

Table 2-4: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (1)		
	Local jobs, local industry, community sustainability	**Transport connections, technology connections**	**Education**
Creation of 889 construction jobs	Potential benefits for local construction firms, and knock-on benefits for supply chain that could help benefit local industry, but may be reduced if	No impact from the creation of construction jobs	No impact from the creation of construction jobs

Table 2-4: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (1)		
	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education
	many of the contracts are not allocated to local firms (given capacity). This could be avoided through use of a Community Benefits Agenda that focuses on training and upskilling		
	Minor (+ +)	No impact	No impact
Presence of large contractor workforce	Potential brings income into the area which could benefit community sustainability (although short-term during construction), but will depend on number of jobs and contracts that are given to local firms	Additional workforce likely to result in additional traffic for workers coming to/leaving the site, with potential for increased congestion around shift patterns, although impacts are expected to be small. Local issues and concerns surrounding current traffic congestion in Holyhead and Anglesey may mean this is sufficient for the local community to complain	An influx of temporary workers may not have a significant impact on education as it may be less likely that they will relocate with families than if the work was longer-term or permanent
	Minor (+ +)	Minor (- -)	Negligible (-)
Additional £87 million in GVA (through direct, indirect and induced effects on employment)	Increased GVA generated in Anglesey could have benefits for local jobs, industry and community sustainability but this will depend how much of the investment is retained locally, with this linked to capacity of existing supply chains on Anglesey to provide the skills and people needed to undertake the required work. Construction in the North Wales economic region has grown since 2015 to 106.0 (ranked 26th out of 44 growth areas) suggesting there is some capacity for growth but this may not be sufficient	No impacts expected from increased GVA during construction	No impacts expected from increased GVA during construction

Table 2-4: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (1)		
	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education
	to meet full demand, but some expansion of the local supply chain is expected		
	Moderate (+ + +)	No impact	No impact
Vessels approaching and leaving the port (boat users, commercial and recreational)	No impacts expected from any changes in movement of boats during construction	May be some effects on boat movements and risk of collisions but these are rated as minor, reducing to negligible with mitigation	No impacts expected from any changes in movement of boats during construction
	No impact	Negligible (-)	No impact
Increase in traffic flow	No impacts expected from any changes in traffic during construction	Increase in construction traffic is not expected to have a significant impact on the daily traffic profile. Traffic is a concern of residents of Holyhead so any increase, even small, may be an issue for some residents	No impacts expected from any changes in traffic during construction
	No impact	Minor (- -)	No impact
Impacts on fishing covering: fishing vessels approaching and leaving the port; displacement to alternative fishing grounds; Fishing for whelk within vicinity of Holyhead North disposal site; disruption to fishing fleet; impacts on finfish and shellfish	Any impacts on income to fishers may have knock-on effects on fishing supply chains that could impact other local jobs and industries. Impacts are expected to be small, even for whelk fishing, such that knock-on effects should be negligible. Since impacts on other fisheries are negligible, the overall effects across the wider supply chain and community sustainability should also be negligible	No impacts expected due to temporary nature of construction impacts	No impacts expected due to temporary nature of construction impacts
	Negligible (-)	No impact	No impact
Impacts on availability of accommodation (tourists)	Loss of available accommodation could have knock-on impacts on tourism businesses that rely on visitor trade (however, this could be	No impacts expected	No impacts expected

Table 2-4: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (1)		
	Local jobs, local industry, community sustainability	**Transport connections, technology connections**	**Education**
	compensated for by additional business from contractors, especially food/drink service). Visitor attractions may be most affected		
	Minor (- -)	No impact	No impact
Impacts on guillemots (birdwatchers)	May be minor impacts on some bird species (e.g. guillemots) but this is unlikely to have sufficient knock-on effects to reduce level of birdwatching activity, with this likely to be focused outside of Holyhead in most cases	Impacts on movement of boats could affect birdwatching boat movements but mitigation measures are expected to reduce impacts to negligible and most activity will be outside of the harbour	No impacts expected
	Negligible (-)	Negligible (-)	No impact
Impacts on sea anglers	May be some impacts in terms of access for angling during construction, but this is mainly land based so will not significantly affect sea angling charter boats	Impacts on movement of boats could affect angling charter boat movements but mitigation measures are expected to reduce impacts to negligible	No impacts expected
	Negligible (-)	Negligible (-)	No impact

Table 2-5: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (2)		
	Shops, housing	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**
Creation of 889 construction jobs	Increased income could encourage additional local spend with benefits for shops. Increased wages for those taking up construction jobs could also reduce the proportion of income spent on housing (average spend on housing including fuel and power in UK was 72.6% in	No impacts expected from creation of construction jobs	No impacts expected from creation of construction jobs

Table 2-5: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (2)			
	Shops, housing		Socialising, recreation, parks, leisure	Friends, being involved, supporting others
	2016/17[17]. Benefits would be temporary though so may not be sufficient for services to expand			
	Minor (+ +)		No impacts	No impacts
Presence of large contractor workforce	An influx of workers would help support local shops, but this benefit may be negated by increased demand for housing that could push up prices and result in local people being unable to afford to rent, or being able to find housing during the construction period. There may be benefits locally if local people are able to rent out rooms for contractors during the construction period		Presence of a large workforce could increase demand for leisure facilities, although this may be limited to those who move to the area during the construction work. This could affect local access to recreational facilities or enjoyment if there is overcrowding. Increased income over a short time period is unlikely to result in expansion of facilities	The large workforce would increase number of people and could enable new networks and friends to be made, although this will depend on interaction between the contractor workforce and the local community. Integration could be facilitated where a reasonable proportion of the jobs are taken up by local people
	Minor (- -) from increased demand	Minor (+ +) for increased spend	Negligible (+)	Negligible (-)
Additional £87 million in GVA (through direct, indirect and induced effects on employment)	Increased GVA could result in greater spending with knock-on benefits for supply chains and associated services		No impacts expected from creation of construction jobs	No impacts expected from creation of construction jobs
	Minor (+ +)		No impacts	No impacts
Impacts on availability of accommodation (tourists)	Increase in demand for accommodation from the construction workforce could mean that there is limited accommodation available for visitors. Accommodation providers may see increased occupancy rates with contractors so overall there may be a benefit to		No impacts expected	No impacts expected

[17] From ONS data on family spending in the UK: financial year ending March 2017, accessed at: https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/bulletins/familyspendingintheuk/financialyearending2017 on 11th April 2019.

Table 2-5: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (2)		
	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others
	the community (other than for some visitor attractions, as described above)		
	Minor (+ +)	No impact	No impact
Air quality/dust and exhaust emissions from HGV movements (residents, tourists)	No impacts expected	Dust and exhaust emissions could have impacts on the extent to which people wish to be outside so could affect recreation and leisure activities, although impacts are expected to be localised and short-term	No impacts expected
	No impact	Negligible (-)	No impact
Noise and vibration during construction (residents, tourists)	No impacts expected	Noise and vibration could also discourage people from being outside in certain locations, although impacts are expected to be localised to residents in the vicinity of the site. They could choose to visit other locations during construction such that impacts are negligible	No impacts expected
	No impact	Negligible (-)	No impact

Table 2-5: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (2)		
	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others
Visual amenity during construction (residents, tourists)	No impacts expected	Changes in visual amenity could affect the extent to which people wish to recreate in certain locations. Lighting at night may also change the cultural setting, e.g. loss of views of stars. Impacts are expected to be small given the high levels of light pollution that currently exist in Holyhead (class 5, which restricts views of certain celestial objects)[18]	No impacts expected
	No impact	Negligible (-)	No impact
Impacts on marine ecology (divers, wildlife watchers)	No impacts expected	Impacts on charter boats should be negligible so effects on diving and wildlife watching are also expected to be negligible	No impacts expected
	No impact	Negligible (-)	No impact
Impacts on guillemots (birdwatchers)	No impacts expected	Impacts on charter boats should be negligible so effects on birdwatching from sea are also expected to be negligible. May be some impacts due to disturbance of birds in and around the harbour, but these are also expected to be negligible	No impacts expected
	No impact	Negligible (-)	No impact
Impacts on sea anglers	No impacts expected	Impacts on movement of boats could affect angling charter boat movements but mitigation measures are expected to reduce impacts to negligible. Access to the harbour may be restricted which may have a minor impact on	No impacts expected

[18] Based on light pollution map, accessed at: https://www.lightpollutionmap.info/#zoom=10&lat=7030164&lon=-481101&layers=B0FFFFTFFFF on 11th April 2019.

Table 2-5: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (2)		
	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others
		sea angling opportunities during construction for those who do not have access to a boat	
	No impact	Minor (- -)	No impact

Table 2-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems
Creation of 889 construction jobs	No impacts expected from creation of construction jobs	Demand for services may increase if there are additional construction injuries, but it is assumed that good site management practices would be employed	No impacts expected from creation of construction jobs	No impacts expected from creation of construction jobs
	No impact	Negligible (-)	No impact	No impact
Presence of large contractor workforce	The influx of contractors could have a negative effect on local identity and could affect opportunities for speaking Welsh (given that many people moving for work are unlikely to speak Welsh). This is one of the key concerns of the Anglesey community	An influx of workers over a short time period may add extra demand to healthcare services, but because the change in temporary may not enable a growth in services. During the construction period, local people may find it more difficult to access healthcare services. This may cause the community to raise concerns	No impacts expected with the workforce; impacts associated with effects of construction (e.g. pollution) are considered separately	Construction workforce would be temporary and so are unlikely to get involved in local decision-making. However, some issues may be raised as highlighted elsewhere that may require responses to be provided by local politicians to avoid any tensions

Table 2-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems
	Moderate (- - -)	Moderate (- - -)	No impact	Minor (- -)
Additional £87 million in GVA (through direct, indirect and induced effects on employment)	No impacts expected from creation of construction jobs	No impacts expected from creation of construction jobs	No impacts expected from creation of construction jobs	Increased GVA may result in the region having more investment that needs to be allocated with this then requiring more decisions at the local level, which could improve local decision-making systems, including on any associated knock-on development
	No impacts	No impacts	No impacts	Negligible (+)
Air quality/dust and exhaust emissions from HGV movements (residents, tourists)	No impacts expected	Reduced air quality could have knock-on impacts for healthcare, especially for those with breathing difficulties. Dust emission from excavation and construction activities as well as exhaust emissions could locally reduce air quality	Dust and exhaust emissions could have impacts on the extent to which people wish to be outside so could affect their connection to nature and landscapes. Any impacts on the environment should be small and short-term	No impacts expected
	No impact	Minor (- -)	Negligible (-)	No impact

Table 2-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems
Noise and vibration during construction (residents, tourists)	No impacts expected	Noise and vibration could affect the mental health and well-being of those residents that are most exposed during construction activities and from traffic movements. While traffic impacts are expected to be small, there may be some concerns from residents, especially where traffic is already an issue	Noise and vibration could also discourage people from being outside with impacts for connection to landscape and nature, although impacts are expected to be localised to residents in the vicinity of the site so are unlikely to be noticeable for most	May be complaints, e.g. to local authority if there are additional noise and vibration issues, especially where these are related to traffic. This will require management by local decision-makers. Any complaints are likely to be from concentrated groups of residents rather than community-wide
	No impact	Minor (- -)	Negligible (-)	Minor (- -)
Visual amenity during construction (residents, tourists)	Any additional loss of view of night sky may have impacts on certain members of the population but is unlikely to significantly affect sense of identity	No impacts expected	Any additional loss of view of night sky may have impacts on connection to nature/space	No impacts expected
	Negligible (-)	No impact	Negligible (-)	No impact
Impacts on marine ecology (divers, wildlife watchers)	No impacts expected	No impacts expected	Impacts on diving and wildlife watching are expected to be small so knock-on effects for connection to nature should also be small	No impacts expected
	No impact	No impact	Negligible (-)	No impact
Impacts on guillemots (birdwatchers)	No impacts expected	No impacts expected	Impacts on birdwatching are expected to be small so knock-on	No impacts expected

Table 2-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems
			effects for connection to nature should also be small	
	No impact	No impact	Negligible (-)	No impact
Impacts on sea anglers	No impacts expected	No impacts expected	Impacts on sea angling from loss of access may affect connection with nature for some members of the community	No impacts expected
	No impact	No impact	Minor (- -)	No impact

Potential impacts on wider political and environmental context

Potential impacts on wider political and environmental context are assessed against two value clusters:

- Landscape, seascape, wildlife, environmental change; and
- National and international level political and decision-making systems.

The predicted impacts on each cluster with a rating of magnitude are shown in Table 2-7.

Table 2-7: Potential impacts on political and environmental value clusters		
Potential impact	Value clusters affected	
	Wider political and environmental context	
	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
Presence of large contractor workforce	No impacts expected as a result of an influx of workers, with any concerns over pollution considered separately	Could be impacts if the local community raises issues that are not addressed locally such that they escalate to national level. The likelihood of such impacts are expected to be small, however
	No impact	Negligible (-)
Additional £87 million in GVA (through direct, indirect and induced effects on employment)	No impacts expected from creation of construction jobs	Additional investment may improve Anglesey's reputation at the national and international levels which could help attract further investment. However, the likelihood of such impacts is expected to be small
	No impacts	Negligible (+)

2.4.3 Summary of potential social and cultural impacts from construction

Table 4-3 summarises the potential social and cultural impacts. Table 4-3 shows that there are expected to be noticeable economic benefits to individuals and to the community from the investment. Extra jobs and money in the community could also help to support local shops and services. There are also anticipated to be some negative impacts, mainly associated with the increased demand placed on housing and services from an influx of contractors. The extent to which local contracts and local contractors are used is, therefore, key to ensuring that the economic benefits are maximised while any negative social and cultural impacts are minimised. Potential impacts from construction activities are generally small, although may be noticeable for some groups hence the minor (- -) ratings.

The presence of a large contractor workforce can be both an economic benefit in terms of increasing spend that support shops and provides income for accommodation providers but can also be negative if it pushes up prices, especially for accommodation, with knock-on effects on the local community in an area which already has a high housing deprivation score.

Table 2-8: Summary of the results of the social and cultural impacts assessment during construction															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
Creation of 889 construction jobs	0	+ +	+ +	+ +	0	0	+ +	0	0	0	-	0	0	0	0
Presence of large contractor workforce	0	-	- -	+ +	- -	-	- - to + +	+	-	- - -	- - -	0	- -	0	-
Additional £87 million in GVA	0	0	0	+ + +	0	0	+ +	0	0	0	0	0	+	0	+
Vessels approaching and leaving the port	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0
Increase in traffic flow	0	0	0	0	- -	0	0	0	0	0	0	0	0	0	0
Impacts on fishing	0	-	- -	-	0	0	0	0	0	0	0	0	0	0	0

Table 2-8: Summary of the results of the social and cultural impacts assessment during construction															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
Impacts on availability of accommodation	0	0	0	- -	0	0	+ +	0	0	0	0	0	0	0	0
Air quality/dust and exhaust emissions from HGV movements	0	0	0	0	0	0	0	-	0	0	- -	-	0	0	0
Noise and vibration during construction	0	0	0	0	0	0	0	-	0	0	- -	-	- -	0	0
Visual amenity during construction	0	0	0	0	0	0	0	-	0	-	0	-	0	0	0
Impacts on guillemots (birdwatchers)	0	0	0	-	-	0	0	-	0	0	0	-	0	0	0

Table 2-8: Summary of the results of the social and cultural impacts assessment during construction															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
Impacts on sea anglers	0	0	0	-	-	0	0	- -	0	0	0	- -	0	0	0

2.5 Distributional analysis

The distributional analysis considers whether the potential impacts identified above in the social and cultural assessment could potentially have greater impacts on some groups within the local community. A review of statistics and reports on Anglesey suggest that potential impacts should be considered against the key groups set out in Table 2-9[19]. An initial screening assessment has been undertaken to identify those vulnerable groups that could be affected disproportionately (based on Isle of Anglesey Council, 2018)[20]. Those groups where potential impacts are identified are then assessed as to whether the rating of potential impacts would increase (either be more of a benefit or more of a negative effect) for the group in question than for the community as a whole. An explanation where a change is made is provided below Table 2-9. Where a particular group has an ES chapter dedicated to its potential impacts (e.g. fishing, recreational boating) then a specific assessment on sub-groups is not undertaken. However, potential impacts on 'specific interest groups' are included in Table 2-9 to capture effects on particular members and/or groups within the community. '0' is used where the group is not expected to be affected by the potential impact.

Table 2-9: Vulnerable groups, Anglesey

Vulnerable group	Likelihood of being specifically impacted by this study
Welsh speakers (57% of residents on the Isle of Anglesey speak Welsh. Recent figures show that 46% speak Welsh every day on Anglesey, compared to 11% across Wales[21])	Possible – influx of contractors could affect Welsh speakers, especially where the contractors do not speak Welsh
People with learning disabilities	Unlikely – there are no impacts that would affect people with learning disabilities disproportionately
People with mental health needs	Unlikely – there are no impacts that would affect people with learning disabilities disproportionately
Young people (16-24)	Possible – the additional job opportunities and opportunities for training could benefit young people
Vulnerable single parents	Unlikely – there are no impacts that would affect vulnerable single parents disproportionately
People at risk of domestic abuse	Unlikely – there are no impacts that would affect people at risk of domestic abuse disproportionately
People leaving prison	Unlikely – there are no impacts that would affect people leaving prison disproportionately
People engaging in substance misuse	Unlikely – there are no impacts that would affect people engaging in substance abuse disproportionately
Older people	Possible – older people may be more vulnerable to additional impacts on services
People with housing needs (Holyhead's housing deprivation score is especially high[22])	Possible – those with housing needs may be affected by changes in availability or cost of housing

[19] Includes consideration of key groups from the North Wales Population Assessment

[20] *Isle of Anglesey County Council 2018, The Supporting People Anglesey Newsletter (Issue 12) accessible at https://www.anglesey.gov.uk/en/Residents/Housing/Supporting-People-preventing-homelessness/About-Supporting-People.aspx on 28th March 2019*

[21] Gwynedd and Môn Public Services Board, 2017, Anglesey Well-being Assessment accessed at https://www.llesiantgwyneddamon.org/Uploads/Pages/Library/3-4-9-70-1-Anglesey-Well-Being-Assessment.pdf on 1st August 2018

[22] Isle of Anglesey County Council, 2013, Holyhead 2020: Realising Sustainable Community Benefit Strategic Outline Programme (SOP), accessed at https://www.anglesey.gov.uk/Journals/2014/02/19/w/o/f/HOLYHEAD-2020-VVP-SOP-STAGE-2.pdf on 1st August 2018

Table 2-9: Vulnerable groups, Anglesey	
Vulnerable group	**Likelihood of being specifically impacted by this study**
Economically inactive (aged 25 and over), not in education or training, and/or who have complex barriers to employment	Possible – additional job opportunities and training may enable increased access to employment opportunities
Long-Term Unemployed (aged 25 and over), and/or who have complex barriers to employment	Possible – additional job opportunities and training may enable increased access to employment opportunities

Table 2-10: Potential impacts on vulnerable and special interest groups

Potential impact	Main assessment rating	Vulnerable groups						Specific interest groups						
		Welsh speakers	Young people (16-24)	Older people	People with housing needs	Economically inactive	Long-term unemployed	Those living nearest to the port	Those living near to the A55	Visitors to Holyhead	Visitors to Anglesey	Local interest groups	Local business owners	Boat/charter operators
Creation of 889 construction jobs	++	++	+++	0	++	+++	+++	++	++	0	0	0	+++	0
Presence of large contractor workforce	-	--	-	-	--	-	-	--	-	--	-	0	++	+
Additional £87 million in GVA (through direct, indirect and induced effects on employment)	+++	+++	+++	++	++	+++	+++	+++	+++	+++	++	0	+++	+++
Vessels approaching and leaving the port (boat users, commercial and recreational)	-	0	0	0	0	0	0	-	--	--	-	--	+	--
Increase in traffic flow	--	0	--	--	--	0	0	--	--	--	--	--	--	--
Fishing vessels approaching and leaving the port	-	0	0	0	0	0	0	--	-	--	-	-	--	--
Displacement to alternative fishing grounds (crabs and lobsters)	-	0	0	0	0	0	0	0	0	0	0	0	0	--
Fishing for whelk within vicinity of Holyhead North disposal site	--	0	0	0	0	0	0	0	0	--	-	0	--	0
Disruption to fishing fleet	-	0	0	0	0	0	0	0	0	0	0	0	0	--
Impacts on finfish and shellfish	-	0	0	0	0	0	0	0	0	0	0	0	--	0

Table 2-10: Potential impacts on vulnerable and special interest groups														
Potential impact	Main assessment rating	Vulnerable groups						Specific interest groups						
		Welsh speakers	Young people (16-24)	Older people	People with housing needs	Economically inactive	Long-term unemployed	Those living nearest to the port	Those living near to the A55	Visitors to Holyhead	Visitors to Anglesey	Local interest groups	Local business owners	Boat/charter operators
Impacts on availability of accommodation (tourists)	--	0	0	---	---	0	0	0	0	---	--	0	--	---
Air quality/dust and exhaust emissions from HGV movements (residents, tourists)	-	0	--	--	0	0	0	--	--	--	-	0	--	0
Noise and vibration during construction (residents, tourists)	-	0	--	--	0	0	0	--	--	--	-	0	--	0
Visual amenity during construction (residents, tourists)	-	0	-	--	0	0	0	--	--	--	-	--	--	-
Impacts on guillemots (birdwatchers)	-	0	0	0	0	0	0	0	0	-	-	--	-	--
Impacts on sea anglers	--	0	0	0	0	0	0	0	0	--	--	---	-	+

2.5.1 Groups seeing an increase in benefits

An increase in benefits is potentially associated with creation of jobs and GVA for those groups that are currently disadvantaged. Delivery of these greater benefits is likely to require training (especially for young people and the long-term unemployed) to be able to take advantage of the job opportunities. A Community Benefits Agenda that includes job placements and training to help upskill local people could have particular advantages for these groups. The economically inactive may also be able to benefit more due to creation of a significant number of jobs over a two year period.

Local businesses could benefit from knock-on increases in spending associated with new jobs and GVA. This could help improve the quality of services with further additional benefits for visitors to the area. Visitors to Holyhead would benefit more, but there would also be benefits to visitors to Anglesey more generally where spend from the increased employment spreads across the island.

Boat and charter operators could both benefit and be impacted during construction. There may be opportunities for additional charter activities due to increased demand while sea angling from the port is restricted. At the same time, increased boat movements may make trips around the harbour more difficult.

2.5.2 Groups seeing fewer benefits

Some groups may not see the same level of benefits. These are generally those who are not involved in the jobs market, such as older people or those for whom increased jobs may push up the costs of living (e.g. rental accommodation). Those people already have housing needs may not benefit as much from an increase in GVA unless they can directly benefit through obtaining new employment. There is a risk that some people may face additional housing costs but may not themselves financially benefit from the construction activities.

2.5.3 Groups seeing an increase in negative impacts

Increases in negative impacts mainly occur on those who may be more at risk from specific impacts, e.g. air quality on young people and older people, who may be more inconvenienced from impacts such as increases in traffic, including those living near to the port or visiting the area, and those who may find their opportunities limited, e.g. special interest groups such as boating, sailing, history, ecology, birdwatching groups whose activities may be affected during construction.

Potential impacts on accommodation availability where jobs are taken up by workers from outside the local area could have disproportionate effects on those who already experience housing issues, and for visitors at peak times (although accommodation availability suggests that capacity should be sufficient).

2.5.4 Groups seeing a reduction in negative impacts

There is only a small number of groups that show a reduction in terms of negative impacts and this is where exposure to the impact is expected to be limited, such as for visitors to Anglesey who may only travel through Holyhead, e.g. when arriving by ferry. Local business owners may also not be impacted greatly by impacts on sea anglers during construction due to the impacts on income to businesses likely to be small. Sea angling charter boats may see a benefit during construction due to land access to sea angling from the port being restricted, such that more people may be encouraged to chart a boat to continue sea angling during construction.

2.5.5 Summary of distributional impacts from construction

Table 2-11 presents a summary of the potential distributional impacts by identifying which groups may benefit more from the construction activities and investment and which may see greater impacts. Some individuals may fall into more than one group, e.g. a young person living near to the port with housing needs, such that the overall impacts may depend on their particular circumstances. The young person could benefit from increased job opportunities (especially if these include training), which could offset any impacts associated with visual amenity from construction and provide them with an income that helps them to meet their housing needs. Conversely, another young person may not have the right skills so may not be able to benefit from the job opportunities and may find that their housing costs increase due to greater demand from workers moving into the area.

Table 2-11: Summary of the distributional effects during construction			
Groups typically seeing an increase in benefits	**Groups typically seeing fewer benefits**	**Groups typically seeing fewer negative impacts**	**Groups typically seeing an increase in negative impacts**
Young people Economically inactive Long-term unemployed Local business owners Boat/charter operators	Older people	Visitors to Anglesey	People with housing needs Those living near the port or near the A55 Visitors to Holyhead Sea anglers Commercial fishermen
Minor to moderate benefit	Negligible to minor benefit	Negligible to minor negative effects	Minor to (limited or perceived) moderate negative effects

3 Summary of potential impacts during the operational phase

3.1 Overview

This section provides a summary of the potential direct, indirect and social and cultural impacts from the proposed Holyhead Port Expansion during operation. This information is then used as the basis for considering what are the cumulative impacts with other developments within Holyhead and Anglesey.

The source of information for the impacts is identified, as are any uncertainties and assumptions that have been made during the analysis.

3.1 Potential direct economic impacts from operation

Potential impacts during the operational phase are described for the same sectors, namely:

- Ports and harbours
- Commercial shipping
- Traffic and transport
- Commercial fisheries
- Aquaculture
- Tourism
- Recreational boating
- Water sports
- Coast protection and flood defence
- Local communities

There would be positive impacts during the operational phase as a result of the increased warehousing and storage activities. An estimate of the number of jobs (FTE person years) created and jobs safeguarded is 2,500 and 10,500, respectively, for ports and harbours. Overall, the expansion is expected to generate over 13,000 jobs to the Anglesey local economy (Blue Chip Tourism).

Based on the trends in GVA and employment, employees operating in the ports industry are highly productive, as measured by GVA per job. The estimated average productivity of the ports industry across the years 2010 to 2015 is compared against the average productivity level of the Maritime sector and the UK as a whole. The ports industry as a whole is slightly less productive than the broader Maritime sector but higher than the UK average; while the average industry job generated £74,900 in GVA in 2015, the average job in the UK economy only generated £50,800. The total impacts, monetised, are thus estimated at **£974 million** over the operational life of the project (design life of 50 years followed by a maintenance programme to ensure that the facilities can continue to be used and assuming productivity remains constant in real terms).

There may be some adverse impacts on commercial shipping due to an increase in navigational risk and possible increase in pilotage costs for an increased number of vessels (increased impact for port but increased costs for commercial shipping) but these are expected to be minimal compared to the benefits. Once completed, the new reclaimed areas will allow cruise ships to berth at Salt Island, rather than at the Orthios Jetty or anchoring within Holyhead Bay. The number of cruise ships predicted to visit Holyhead over the next three years will increase by 40%, from 60 in 2019 to 80 in 2022.

The new berth at Salt Island will also support the importation of cargo through the provision of the heavy lift pad. Should the Wylfa Newydd Nuclear Power Station (Wylfa) project go ahead, this would require

one cargo vessel every two months for seven years and five barges per week berthing at Pelham Patch. The magnitude of the potential impact of increased vessel numbers is considered to be medium. However, due to the navigational safety service provided by Port Control, it is considered that vessels approaching and leaving the port will be able to adapt to any potential impacts during operation and as such are considered to be of low sensitivity. Consequently an impact of minor adverse significance is predicted during the operational phase. This impact could be outweighed by the benefits from increased infrastructure provision and increased capacity in operations (the former mostly for passenger and latter for freight).

There may be some minor impacts for lobster and crab fisheries operating within Holyhead Bay. These effects are not expected to result in a decrease in landings value since there is the opportunity for the boats to fish other locations. Operation of the port is not expected to result in any effects on aquaculture.

Holyhead is a busy ferry port for ships to and from Ireland and regularly receives calls from cruise ships cruising the Irish Sea. Holyhead is currently achieving calls from circa 60% of those cruise vessels that it can physically accept in the port, measured against the market leader Dublin. Although present numbers are restricted by physical limitations, it is expected that the Holyhead Port Expansion project will improve vehicle and passenger movements and enable larger vessels to call at the port. Forecasts by Blue Chip Tourism (2018)[23] suggest that the new facility will result in a 25% increase in cruise ship numbers per annum by 2021, equating to 25,644 additional passengers. Expenditure forecasts for cruise ships are (Blue Chip Tourism figures):

- Port of Call Spend per Passenger £48.36
- Port of Call Spend per Crew Member (23 Euros @ 40% going ashore) £7.96
- Direct Spend Port of Call per passenger £51.65

This results in anticipated impacts over 50 Year Project Lifespan of (Blue Chip Tourism figures):

- Grand Total Direct Expenditure £290m
- Multiplier 1.34
- Grand Total Direct & Indirect Expenditure £388m.

Anticipated cruise employment impacts over the 50 year project lifespan are 2,500 jobs created in person years[24]. Since these jobs are all associated with spend in Holyhead, they are all local jobs.

There may be some increase in pilotage charges for small craft using the harbour which could result in increased costs of recreational boating. The potential impacts from a change in visual amenity could linked to a reduction in enjoyment of boating but again these impacts are identified as being minor adverse such that any reduction in the value of enjoyment should be low. It is unlikely that any increase in pilotage costs would result in impacts on employment, unless the costs increase to the point where boat owners choose to moor their craft elsewhere. Such changes could impact on the local supply chain, however, it is unlikely that the effects of operation would result in such changes given that the impacts are defined as minor adverse. The potential impacts on water sports are also likely to be limited, due to access to and from the port, and potential increase in pilotage costs and visual amenity.

There would be negligible changes to the wave regime due to the presence of the approach channel and reclaimed areas. Alteration of wave heights and patterns of wave energy reflection approaching Holyhead Port and the surrounding coastline could alter the performance of the flood and coastal

[23] Blue Chip Tourism (2018), Holyhead Port – Additional Cruise Forecasts – 17th April 2018
[24] Ibid.

defences. The port expansion would cause no impact to the current tidal regime. The potential impact on sediment transport and erosion/accretion patterns would be low.

Impacts on the local community are expected to be minor and localised. As a result no effects are expected on employment.

Table 3-1: Summary of potential impacts on industry sectors during operation		
Sector	**Summary of potential impacts**	**Assumptions and further description of impacts**
Ports and harbours[1]	Significant positive benefits	The proposed Holyhead Port Expansion is predicted to create new jobs and sustain existing jobs. An estimate of the number of jobs (FTE person years) created and jobs safeguarded is 2,500 and 10,500 respectively. Overall, the expansion is expected to generate over 13,000 jobs to the Anglesey local economy (Blue Chip Tourism)
Commercial shipping[2]	Moderate to minor positive	Impacts are predicted to vary. There may be some additional costs incurred by vessels using Port Control in ensuring that they are able to adapt, with this potential reflected in increased pilotage costs. Any additional port costs are not expected to be sufficiently significant to result in changes in employment, but there may be benefits from the improvements to local infrastructure
Commercial fisheries	Minor adverse	A small number of vessels fish within the approach channel footprint, which would be displaced to alternative fishing grounds during dredging operations. There is low intensity potting for lobsters and crabs within Holyhead Bay. However, potting appears to be focused away from areas adjacent to the port and the port entrance, and the low intensity of the fishery would minimise the risk of impacts arising from displacement
Aquaculture	No impacts	Mussels beds will not be affected by minor changes in water quality
Traffic and transport	Minor adverse	The introduction of additional traffic does not have a significant effect on the daily traffic profile
Tourism	Moderate to significant positive	For users, there may be minor impacts due to visual amenity and potential losses in accommodation capacities. Impacts on accommodation services and tourism more generally could be significant due to the increase in cruise services and operations. The new facility will result in a 25% increase in cruise ship numbers per annum by 2021
Recreational boating	Minor adverse	Low number of users. Minor impacts due to visual amenity and restrictions on navigation to minimise risk but also issue of notices by the Port Control
Water sports	Minor adverse	Possible loss of access for some shore-based angling activities around the harbour but low impact and temporary. Possible reduction in harbour-based dive trips but also likely to be low impact and temporary
Coast protection and flood defence	No impact	Changes in sea-bed level and the wave regime due to capital dredging of the approach channel will have negligible impacts on coastal defence structures and flood risk
Local communities	Minor adverse impact	Local changes in air quality and visual impact associated with the Pelham Patch reclamation activity may have some localised effects on quality of life of local communities. Minor adverse impact on known heritage assets

Table 3-1: Summary of potential impacts on industry sectors during operation		
Sector	**Summary of potential impacts**	**Assumptions and further description of impacts**
1: The following activities are included under this section (from Blue Chip Tourism): • Warehousing and Storage. Identified through SIC code 52101, "Operation of Warehousing and Storage Facilities for Water Transport activities"; • Port Authority Management, Port Security and Marshals, Port Marine and Vessel Management Services, Marine Pilots, Port Harbour Support Vessels, and Engineering and Maintenance. Identified through SIC code 52220, "Service activities incidental to water transportation"; • Stevedores, cargo and passenger handling including crane/vehicle/plant drivers/operators. Identified through SIC code 52241, "Cargo Handling for Water Transport Activities"; and • Border Agency, Home Office and HMRC staff operating in Ports Identified as public sector employees operating in UK ports. Institute for Government, Port Freight Statistics, Cebr analysis. 2: Commercial shipping includes the following: • International transport of passengers; • Transport of passengers on inland waterways; • International transport of freight; and • Transport of freight on inland waterways.		

3.2 Predicted indirect economic impacts

An estimated 1,400 jobs (person years) are expected to be created in other related sectors during operation (indirect and induced jobs in e.g. commercial shipping and tourism sector), with a further 5,880 jobs (person years) safeguarded.

Indirect and induced GVA can be estimated using multipliers. Taking the multiplier for indirect and induced effects from the maritime sector in Wales as a whole (1.17[25]) would give indirect GVA benefits of **£1,140 million** over the operational life of the project.

Potential direct impacts on other sectors are mostly small, with maximum of minor adverse effects on sectors such as commercial shipping, commercial fisheries (lobster/crab fishing), recreational boating, and water sports. As such, it is not expected that there will be noticeable indirect effects. Indirect effects on heritage assets during operation are considered to be minor adverse as a worst case.

3.3 Social and cultural assessment

3.3.1 Screening of potential social and cultural impacts

Table 3-2 provides the results of the screening of potential impacts. Each of the potential impacts identified above, where these are negligible or greater, are included in the table. The potential effects are considered against each of the clusters to show where social and cultural effects could be expected. The magnitude of potential impact from the EIA is used to inform the magnitude of rating assigned to the social and cultural effects during the operational phase. Subsequent sections only include impacts where these are expected to affect the social clusters in question.

[25] Cebr (2017): The economic contribution of the maritime sector in Wales: a report for Maritime UK and the Welsh Ports Group, accessed at: https://www.britishports.org.uk/system/files/documents/report_on_the_maritime_sector_in_wales_-_english.pdf on 18th April 2019. Applied to the direct GVA effect of £974 million.

Table 3-2: Potential impacts on value clusters (Operational impacts)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
2,500 jobs created in direct port employment (person years)		Y	Y	Y	Y	Y	Y	Y		Y	Y		Y		
1,400 indirect and induced jobs created (person years)		Y	Y	Y	Y	Y	Y	Y		Y	Y		Y		
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)		Y	Y	Y		Y	Y	Y		Y	Y		Y		
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project				Y			Y				Y		Y		Y

Table 3-2: Potential impacts on value clusters (Operational impacts)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Increase in number of cruise ships from May 2022		Y	Y	Y	Y			Y		Y					
Additional traffic demand due to development					Y										
Displacement from fishing grounds				Y											
Impacts on lobster and crab fishers				Y											
Impacts on landings				Y											
Impacts on aquaculture				Y											

Table 3-2: Potential impacts on value clusters (Operational impacts)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Impacts on air quality (residents, tourists)											Y	Y			
Impacts from noise and vibration (residents, tourists)											Y	Y			
Impacts from visual amenity (residents, tourists)								Y				Y			
Impacts on marine ecology (divers, wildlife watchers)								Y				Y			
Impacts on ornithology (birdwatchers)								Y				Y			
Impacts on recreational boating (charter/ private vessels)								Y				Y			

Table 3-2: Potential impacts on value clusters (Operational impacts)															
Potential impact	**Value clusters affected**														
	Individual			**Community**										**Wider political and environmental context**	
	Family, family life, inter-generational issues	**Jobs, career, employment**	**Money, cost of living**	**Local jobs, local industry, community sustainability**	**Transport connections, technology connections**	**Education**	**Shops, housing**	**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**	**Local identity, cultural heritage, Welsh language**	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**	**Landscape, seascape, wildlife, environmental change**	**National and international level political and decision-making systems**
Impacts on water sports								Y		Y		Y			

3.3.2 Rating of potential social and cultural impacts

Potential individual impacts

Individual impacts are assessed against three value clusters:

- Family, family life, inter-generational issues;
- Jobs, career, employment; and
- Money, cost of living.

The predicted impacts on each cluster with a rating of magnitude are shown in Table 3-3.

Table 3-3: Potential impacts on individual value clusters

Potential impact	Value clusters affected		
	Individual		
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living
2,500 jobs created in direct port employment (person years)	No impacts expected from additional direct employment	Potential for local people to obtain jobs, increasing employment level locally and potentially reducing unemployment rate from 4.8% (December 2018) compared with the Wales average of 4.5%[26]	Potential for increased income if people move into the port and cruise ship industry
	No impact	Moderate (+ + +)	Moderate (+ + +)
1,400 indirect and induced jobs created (person years)	No impacts expected from additional indirect and induced jobs	Potential for local people to obtain jobs which are indirectly associated with the port expansion, which may be a new career path	Potential for increased income due to opportunities associated with growth of the port and cruise ship industry
	No impact	Moderate (+ + +)	Moderate (+ + +)
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	No impacts expected from safeguarding jobs	Potential for local people to have job security and enable career development	Potential for stable or increased income alongside opportunities for career development. Increased job security
	No impact	Moderate (+ + +)	Moderate (+ + +)
Increase in number of cruise ships from May 2022	No impacts to expected from increased number of cruise ships	Potential for new employment opportunities and career development	More frequent cruise ships offer greater job security
	No impact	Minor (+ +)	Minor (+ +)

Potential community impacts

Community impacts are considered against nine value clusters, with a description of the impacts and ratings to identify the likely magnitude of effects given in Tables 3-4 to 3-6:

[26] Based on ILO unemployment rates for Anglesey, accessed at: https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/People-and-Work/Unemployment/ILO-Unemployment/ilounemploymentrates-by-welshlocalareas-year on 11th April 2019.

- Table 3-4: Local jobs, local industry, community sustainability; transport connections, technology connections; and education;
- Table 3-5: shops, housing; socialising recreation, parks, leisure; and friends, being involved, supporting others; and
- Table 3-6: local identify, cultural heritage, Welsh heritage; healthcare; connection to nature, landscape; local political and decision-making systems.

Table 3-4: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (1)		
	Local jobs, local industry, community sustainability	**Transport connections, technology connections**	**Education**
2,500 jobs created in direct port employment (person years)	Potential benefits for the local community and local firms, and knock-on benefits for supply chain that could help benefit the local industry. Increased income into the area could benefit community sustainability. Potential to offer professional and quality jobs, which Anglesey is currently lacking[27]. Benefits will depend on the number of jobs which are allocated locally (given capacity)	Additional workforce associated with the operation of the port is likely to result in additional traffic coming to/leaving the site, with potential for increased congestion around shift patterns, although impacts are not expected to be significant. Local issues around traffic on Anglesey may mean this is sufficient for the local community to raise concerns	An influx of workers due to the additional jobs created may increase the numbers of families which relocate to Anglesey, potentially increasing demand on local schools. In 2017 no schools within Holyhead were oversubscribed and therefore it is unlikely that this will cause significant impacts
	Moderate (+ + +)	Minor (- -)	Negligible (-)
1,400 indirect and induced jobs created (person years)	Potential for a broader range of jobs to be created, with more opportunities for local industries to expand into new areas	Additional workforce associated with the operation of the port is likely to result in additional traffic coming to/leaving the site and more generally within the Anglesey area, although impacts are not expected to be significant, with congestion around shift patterns	An influx of workers due to additional jobs created may increase the number of families which relocate to the Anglesey area, potentially increasing demand on local schools. In 2017 no schools within Holyhead were oversubscribed and therefore it is unlikely that this will cause significant impacts[28]
	Moderate (+ + +)	Minor (- -)	Negligible (-)
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	Safeguarding jobs gives security and encourages individuals to stay within the Holyhead area, allowing a more stable community to develop	No impact on transport and technology connectivity expected	Safeguarding jobs gives greater security to families and encourages settlement of families within the Anglesey area, potentially increasing

[27] Anglesey well-being assessment

[28] Schools near Holyhead (192.com) https://www.192.com/schools/search/location?gre=224590&grn=382202&location=Holyhead&showOnlySchoolsIcanGetInto=&faith=&grammar=&state=&ofsted1=&ofsted2=&ofsted3=&ofsted4=&withNoOfstedData=

Table 3-4: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (1)		
	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education
			demand on local schools. In 2017 no schools within Holyhead were oversubscribed and therefore it is unlikely that this will cause significant impacts
	Moderate (+ + +)	No impact	Negligible (-)
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project	Increased GVA generated in Anglesey could have benefits for local jobs, industry and community sustainability but this will depend how much of the investment is retained locally, with this linked to capacity of existing supply chains on Anglesey to provide the skills and people needed to undertake the required work. Welsh ports accounted for approximately 1.2% of Welsh GVA (around £560 million) in 2014	No impacts expected from increased GVA during operation	No impacts expected from increased GVA during operation
	Moderate (+ + +)	No impact	No impact
Increase in number of cruise ships from May 2022	Local jobs and industry associated with cruise ships will potentially grow and be more stable through time, with knock on benefits for the supply chain. Over the 20-year project lifespan the grand total direct and indirect expenditure from cruise ships is anticipated to be around £155 million which will boost the local economy[29]	Improved capacity and links with shipping. Additional visitors from cruise ships leaving on day trips are likely to cause additional traffic within the Holyhead area, with potential for increased congestion which cruise ships are visiting. Local issues around traffic on Anglesey may mean this is sufficient for the local community to raise concerns. However, these impacts will only be sporadic when cruise ships are visiting, and are not expected to be noticeable for most of the community	No impacts expected from increase cruise ship numbers

[29] Blue chip tourism

Table 3-4: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (1)		
	Local jobs, local industry, community sustainability	**Transport connections, technology connections**	**Education**
	Minor (+ +)	Minor (- -)	No impact
Additional traffic demand due to proposed scheme	No impacts expected from additional traffic	Additional activities associated with the port, such as increased number of ferry sailings is likely to increase traffic along the A55. Traffic is a concern of residents of Holyhead so any increase, even small, may be an issue for some residents, although the impacts are not expected to be significant for most members of the community	No impacts expected from additional traffic
	No impact	Minor (- -)	No impact
Displacement from fishing grounds	Any impacts on income to fishers may have knock-on effects on fishing supply chains that could impact other local jobs and industries. Impacts are expected to be small, even for whelk fishing, such that knock-on effects should be negligible. Since impacts on other fisheries are negligible, the overall effects across the wider supply chain and community sustainability should also be negligible	No impacts expected from fishing displacement	No impacts expected from fishing displacement
	Negligible (-)	No impact	No impact
Impacts on lobster and crab fishers	Impacts to lobster and crab fishers are predicted to be minor during the operational phase therefore, knock on effects should be negligible. The overall effects across the wider community sustainability and supply chain should be negligible	No impacts expected on crab and lobster fishers	No impacts expected on crab and lobster fishers
	Negligible (-)	No impact	No impact
Impacts on landings	Impacts on the values of landings due to reductions in fish and shellfish resources are predicted to	No impacts expected on landings	No impacts expected on landings

Table 3-4: Potential impacts on community value clusters			
Potential impact	**Value clusters affected**		
	Community (1)		
	Local jobs, local industry, community sustainability	**Transport connections, technology connections**	**Education**
	be negligible therefore, it is unlikely there will be any significant effects on the fishing community and the associated supply chain		
	Negligible (-)	No impact	No impact
Impacts on aquaculture	Impacts to mussel beds are predicted to be negligible therefore, it is unlikely there will be any significant effects on the fishing community and the associated supply chain	No impacts expected on aquaculture	No impacts expected on aquaculture
	Negligible (-)	No impact	No impact

Table 3-5: Potential impacts on community value clusters					
Potential impact	**Value clusters affected**				
	Community (2)				
	Shops, housing		**Socialising, recreation, parks, leisure**		**Friends, being involved, supporting others**
2,500 jobs created in direct port employment (person years)	Increased wages and income could encourage additional local spending, benefiting local shops. This could encourage increased range and type of shops. Increased wages could also reduce the proportion of income spent on housing. However, more jobs may encourage relocation into Holyhead and put pressure on housing and potentially causing an increase in prices		An influx of people due to the creation of new jobs may cause overcrowding and put pressure on existing services and facilities. However, benefits from increased wages and income may be sufficient to allow for services to expand and investment into leisure facilities		No impacts expected from direct employment
	Minor (+ +) from increased spend	Minor (- -) from increased demand	Minor (+ +) from increased spend	Negligible (-) from increased demand	No impact
1,400 indirect and induced jobs created (person years)	Increased wages and income means will encourage spending in local shops and benefit local development of this sector		Increased wages and income means will encourage spending in existing services and facilities and benefit local development of this sector		No impacts expected from indirect employment

Table 3-5: Potential impacts on community value clusters				
Potential impact	**Value clusters affected**			
	Community (2)			
	Shops, housing		**Socialising, recreation, parks, leisure**	**Friends, being involved, supporting others**
	Minor (+ +)		Minor (+ +)	No impact
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	Job security allows longer term renting and investment into local housing. However, an increase in demand for affordable housing may cause prices to rise and price others out of the market		Job security will encourage relocation into the Holyhead area and therefore increase spending on existing services and facilities, which may allow expansion	No impacts expected from safeguarding jobs
	Minor (+ +) from increased security	Minor (- -) from increased housing costs	Minor (+ +)	No impact
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project	Increased GVA could result in greater spending with knock-on benefits for the local supply chain and associated services		No impacts expected from increased GVA	No impacts expected from increased GVA
	Minor (+ +)		No impact	No impact
Increase in number of cruise ships from May 2022	No impacts expected from increased cruise ships		Increased cruise ship numbers will boost tourism in the area, encouraging greater spending and investment into existing services and facilities. However, there is the potential for overcrowding should the visitor numbers be high	No impacts expected from increased cruise ships
	No impact		Minor (+ +)	No impact
Impacts from visual amenity (residents, tourists)	No impacts expected from altered visual amenity		Since the existing port character is already functional, there is minor potential impact on the visual appearance of the port, except from close range views and from Holyhead mountain	No impacts expected from altered visual amenity
	No impact		Negligible (-)	No impact
Impacts on marine ecology (divers, wildlife watchers)	No impacts expected		Negligible impacts on marine ecology during the operational phase means there is unlikely to be a knock-on impact to divers and wildlife watchers. Impacts on movement of boats could affect dive or	No impacts expected

Table 3-5: Potential impacts on community value clusters			
Potential impact	Value clusters affected		
	Community (2)		
	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others
		wildlife watching charter boat movements but mitigation measures are expected to reduce impacts to negligible	
	No impact	Negligible (-)	No impact
Impacts on ornithology (birdwatchers)	No impacts expected	May be minor impacts on some bird species (e.g. guillemots) during the operation of the port but this is unlikely to have sufficient knock-on effects to reduce level of birdwatching activity, with this likely to be focused outside of Holyhead in most cases	No impacts expected
	No impact	Negligible (-)	No impact
Impacts on recreational boating (charter/ private vessels)	No impacts expected	Impacts on movement of boats could affect recreational vessels but mitigation measures are expected to reduce impacts to negligible	No impacts expected
	No impact	Negligible (-)	
Impacts on water sports	No impacts expected	Increased vessel traffic in the port area could affect water sports however, mitigation measures are expected to reduce any impacts of port traffic to negligible	No impacts expected
	No impact	Negligible (-)	No impact

Table 3-6: Potential impacts on community value clusters				
Potential impact	**Value clusters affected**			
	Community (3)			
	Local identity, cultural heritage, Welsh language	**Healthcare**	**Connection to nature, landscape**	**Local political and decision-making systems**
2,500 jobs created in direct port employment (person years)	An influx of new workers could have a negative effect on local identity and could reduce opportunities to speak welsh if from elsewhere. This is one of the key concerns of the Anglesey community	An influx of new workers could put pressure on the local healthcare system. However, increased wealth may be sufficient to allow for services to expand and encourage investment into healthcare facilities.	No impacts expected	An influx of new workers may increase the number of residents which are involved in local decision making. Some issues may be raised as highlighted elsewhere that may require responses to be provided by local politicians to avoid any tensions
	Minor (- -)	Negligible (+) / Negligible (-)	No impact	Minor (+ +)
1,400 indirect and induced jobs created (person years)	An influx of new workers could have a negative effect on local identity and could reduce opportunities to speak welsh if from elsewhere. This is one of the key concerns of the Anglesey community	An influx of new workers could put pressure on the local healthcare system. However, increased wealth may be sufficient to allow for services to expand and encourage investment into healthcare facilities.	No impacts expected	An influx of new workers may increase the number of residents which are involved in local decision making. Some issues may be raised as highlighted elsewhere that may require responses to be provided by local politicians to avoid any tensions
	Minor (- -)	Negligible (+) / Negligible (-)	No impact	Minor (+ +)
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	The existing workforce will stay in the area and maintain local identity, culture and opportunities to speak Welsh	Safeguarding jobs gives security and encourages individuals to stay within the Holyhead area, allowing a more stable community to develop and so encourage investment on healthcare services.	No impacts expected	Safeguarding jobs gives security and encourages individuals to stay within the Holyhead area, allowing a more stable community to develop who are more likely to take part in local

Table 3-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh language	Healthcare	Connection to nature, landscape	Local political and decision-making systems
				decisions and politics
	Minor (+ +)	Negligible (+)	No impact	Negligible (+)
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project	No impacts expected	Increased GVA may result in the region having more investment into healthcare services and improve overall satisfaction of them	No impacts expected	Increased GVA may result in the region having more investment that needs to be allocated with this then requiring more decisions at the local level, which could improve local decision-making systems, including on any associated knock-on development
	No impact	Minor (+ +)	No impact	Negligible (+)
Increase in number of cruise ships from May 2022	An influx of visitors could have a negative effect on local identity and could reduce opportunities to speak welsh. This is one of the key concerns of the Anglesey community	No impacts expected	No impacts expected	No impacts expected
	Minor (- -)	No impact	No impact	No impact
Impacts on air quality (residents, tourists)	No impacts expected	No impacts expected	Dust and exhaust emissions could have impacts on the extent to which people wish to be outside so could affect their connection to nature and landscapes. The EIA concluded that there will be no significant impact on air quality during the operational phase	No impacts expected

Table 3-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh language	Healthcare	Connection to nature, landscape	Local political and decision-making systems
	No impact	No impact	Negligible (-)	No impact
Impacts from noise and vibration (residents, tourists)	No impacts expected	Noise and vibration could cause health impacts in certain locations, although impacts are expected to be localised to residents and visitors in the vicinity of the site	Noise and vibration can disturb and discourage people from being outside and therefore disrupt connection to nature and the landscape, although impacts are expected to be localised to the vicinity of the site which already has a highly functional character	No impacts expected
	No impact	Negligible (-)	Negligible (-)	No impact
Impacts from visual amenity (residents, tourists)	No impacts expected	No impacts expected	Increased height of structures may reduce views of the sky and impact connection to nature and space. Visual impacts are expected to be negligible	No impacts expected
	No impact	No impact	Negligible (-)	No impact
Impacts on marine ecology (divers, wildlife watchers)	No impacts expected	No impacts expected	Impacts on diving and wildlife watching are expected to be small so knock-on effects for connection to nature should also be negligible	No impacts expected
	No impact	No impact	Negligible (-)	No impact
Impacts on ornithology (birdwatchers)	No impacts expected	No impacts expected	Impacts on birdwatching are expected to be small so knock-on effects for connection to nature should also be negligible	No impacts expected
	No impact	No impact	Negligible (-)	No impact

Table 3-6: Potential impacts on community value clusters				
Potential impact	Value clusters affected			
	Community (3)			
	Local identity, cultural heritage, Welsh language	Healthcare	Connection to nature, landscape	Local political and decision-making systems
Impacts on recreational boating (charter/ private vessels)	No impacts expected	No impacts expected	Impacts on boating from loss of access may affect connection with nature for some members of the community	No impacts expected
	No impact	No impact	Minor (- -)	No impact
Impacts on water sports	Water sports are very popular in Holyhead with many community events and social activities revolving around them. Impacts on water sports from loss of access may impact some members of the community	No impacts expected	No impacts expected	No impacts expected
	Negligible (-)	No impact	No impact	No impact

Potential impacts on wider political and environmental context

Potential impacts on wider political and environmental context are assessed against two value clusters:

- Landscape, seascape, wildlife, environmental change; and
- National and international level political and decision-making systems.

The predicted impacts on each cluster with a rating of magnitude are shown in Table 3-7.

Table 3-7: Potential impacts on political and environmental value clusters		
Potential impact	Value clusters affected	
	Wider political and environmental context	
	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project	No impacts expected	Increased GVA may result in the region having more investment that needs to be allocated with this then requiring more decisions at the national level, which could improve local decision-making systems, including on any associated knock-on development
	No impact	Minor (- -)

3.3.3 Summary of potential impacts from the proposed Holyhead Port Expansion during operation

The operational phase of the proposed scheme is expected to result in significant positive benefits to individuals and the local community from the investment, through the creation of jobs. As with the construction phase, the potential benefits to local people could be facilitated by a Community Benefits Agenda focused on training and upskilling, especially where the local jobs market may not be able to supply all the labour required. Table 3-8 summarises the potential social and cultural impacts.

Table 3-8 shows that there are expected to be noticeable economic benefits to individuals and to the community from the investment. Creation of direct, indirect and induced jobs as well as current jobs that are safeguarded, result in potentially large economic benefits to individuals and the local community. Local residents already identify traffic issues as an issue so increased demand for ferry services as well as traffic associated with passengers from docking cruise ships may be sufficient for some members of the local community to raise concerns. The economic benefits from cruise ships for local tourism businesses (coaches, guides, etc.), visitor attractions and service providers are likely to be significant, although overcrowding when cruise ships are docked may cause negative impacts for local residents and other, non-cruise, visitors. This could also have knock-on effects for Welsh speakers, who may find there is greater demand for English-speaking due to most cruise visitors being unable to converse in Welsh. Potential negative impacts from port activities themselves are generally expected to be negligible.

Table 3-8: Summary of the results of the social and cultural impacts assessment during operation															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
2,500 jobs created in direct port employment (person years)	0	+++	+++	+++	--	-	-- to ++	- to ++	0	--	- to +	0	++	0	0
1,400 indirect and induced jobs created (person years)	0	+++	+++	+++	--	-	++	++	0	--	- to +	0	++	0	0
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	0	+++	+++	+++	0	-	-- to ++	++	0	++	+	0	+	0	0
GVA of £974 million (direct impacts) and £1,140 million	0	+++	+++	+++	0	0	++	0	0	0	++	0	+	0	--

Table 3-8: Summary of the results of the social and cultural impacts assessment during operation															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
(indirect and induced) over the operational life of the project															
Increase in number of cruise ships from May 2022	0	++	++	++	--	0	0	++	0	--	0	0	0	0	0
Additional traffic demand due to development	0	0	0	0	--	0	0	0	0	0	0	0	0	0	0
Displacement from fishing grounds	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
Impacts on lobster and crab fishers	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0

Table 3-8: Summary of the results of the social and cultural impacts assessment during operation															
Potential impact	Value clusters affected														
	Individual			Community										Wider political and environmental context	
	Family, family life, inter-generational issues	Jobs, career, employment	Money, cost of living	Local jobs, local industry, community sustainability	Transport connections, technology connections	Education	Shops, housing	Socialising, recreation, parks, leisure	Friends, being involved, supporting others	Local identity, cultural heritage, Welsh	Healthcare	Connection to nature, landscape	Local political and decision-making systems	Landscape, seascape, wildlife, environmental change	National and international level political and decision-making systems
Impacts on landings	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
Impacts on aquaculture	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
Impacts on air quality	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0
Impacts from noise and vibration	0	0	0	0	0	0	0	0	0	0	-	-	0	0	0
Impacts from visual amenity	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
Impacts on marine ecology	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
Impacts on ornithology	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
Impacts on recreational boating	0	0	0	0	0	0	0	-	0	0	0	--	0	0	0
Impacts on water sports	0	0	0	0	0	0	0	-	0	-	0	0	0	0	0

3.4 Distributional analysis

The distributional analysis for the operational phase follows the same process as is used for the construction phase (drawing on Isle of Anglesey Council, 2018 for vulnerable groups)[30]. The results of the initial screening assessment is provided in Table 3-9. The extent to which each potential impact identified during operation could affect each relevant vulnerable or special interest group is then identified in Table 3-10. An explanation where a change is made is provided below Table 3-10. '0' is used where the group is not expected to be affected by the potential impact.

Table 3-9: Vulnerable groups, Anglesey

Vulnerable group	Likelihood of being specifically impacted by this study
Welsh speakers	Possible – influx of workers and cruise ship visitors could affect Welsh speakers, especially where they do not speak Welsh
People with learning disabilities	Unlikely – there are no impacts that would affect people with learning disabilities disproportionately
People with mental health needs	Unlikely – there are no impacts that would affect people with learning disabilities disproportionately
Young people (16-24)	Possible – the additional job opportunities and opportunities for training could benefit young people
Vulnerable single parents	Unlikely – there are no impacts that would affect vulnerable single parents disproportionately
People at risk of domestic abuse	Unlikely – there are no impacts that would affect people at risk of domestic abuse disproportionately
People leaving prison	Unlikely – there are no impacts that would affect people leaving prison disproportionately
People engaging in substance misuse	Unlikely – there are no impacts that would affect people engaging in substance abuse disproportionately
Older people	Possible – older people may be more vulnerable to additional impacts on services
People with housing needs	Possible – those with housing needs may be affected by changes in availability or cost of housing
Economically inactive (aged 25 and over), not in education or training, and/or who have complex barriers to employment	Possible – additional job opportunities and training may enable increased access to employment opportunities
Long-Term Unemployed (aged 25 and over), and/or who have complex barriers to employment	Possible – additional job opportunities and training may enable increased access to employment opportunities

[30] *Isle of Anglesey County Council 2018, The Supporting People Anglesey Newsletter (Issue 12) accessible at https://www.anglesey.gov.uk/en/Residents/Housing/Supporting-People-preventing-homelessness/About-Supporting-People.aspx on 28th March 2019*

Table 3-10: Potential impacts on vulnerable and special interest groups														
Potential impact	Main assessment rating	Vulnerable groups						Specific interest groups						
		Welsh speakers	Young people (16-24)	Older people	People with housing needs	Economically inactive	Long-term unemployed	Those living nearest to the port	Those living near to the A55	Visitors to Holyhead	Visitors to Anglesey	Local interest groups	Local business owners	Boat/charter operators
2,500 jobs created in direct port employment (person years)	+++	++	+++	0	++	+++	+++	++	++	0	0	0	+++	0
1,400 indirect and induced jobs created (person years)	+++	++	+++	0	++	+++	+++	++	++	0	0	0	+++	0
10,500 jobs safeguarded in the port and harbour sector and 5,880 in other sectors (person years)	+++	++	+++	0	++	+++	+++	++	++	0	0	0	+++	0
GVA of £974 million (direct impacts) and £1,140 million (indirect and induced) over the operational life of the project	++	++	+++	++	++	+++	+++	++	++	++	++	0	++	++
Increase in number of cruise ships from May 2022	++	++	+++	++	++	+++	+++	++	++	+++	++	0	+++	+
	--	---	--	---	--	--	--	---	--	---	--	--	--	--
Additional traffic demand due to development	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Displacement from fishing grounds	-	0	0	0	0	0	0	0	0	0	0	0	0	--
Impacts on lobster and crab fishers	-	0	0	0	0	0	0	0	0	--	-	0	--	--
Impacts on landings	-	0	0	0	0	0	0	0	0	--	-	0	--	--
Impacts on aquaculture	-	0	0	0	0	0	0	0	0	0	0	0	-	0
Impacts on air quality (residents, tourists)	-	0	--	--	0	0	0	--	--	--	-	0	-	0
Impacts from noise and vibration (residents, tourists)	-	0	--	--	0	0	0	--	--	--	-	0	-	0

Table 3-10: Potential impacts on vulnerable and special interest groups														
Potential impact	Main assessment rating	Vulnerable groups						Specific interest groups						
		Welsh speakers	Young people (16-24)	Older people	People with housing needs	Economically inactive	Long-term unemployed	Those living nearest to the port	Those living near to the A55	Visitors to Holyhead	Visitors to Anglesey	Local interest groups	Local business owners	Boat/charter operators
Impacts from visual amenity (residents, tourists)	-	0	-	--	0	0	0	--	--	--	-	-	--	-
Impacts on marine ecology (divers, wildlife watchers)	-	0	0	0	0	0	0	0	0	-	-	--	-	--
Impacts on ornithology (birdwatchers)	-	0	0	0	0	0	0	0	0	-	-	--	-	--
Impacts on recreational boating (charter/ private vessels)	-	0	0	0	0	0	0	0	0	--	-	--	-	--
Impacts on water sports	-	0	0	0	0	0	0	0	0	--	-	--	-	-

3.4.1 Groups seeing an increase in benefits

Groups seeing an increase in benefits are those that could benefit more from the increased job opportunities and GVA than the community as a whole. This could include young people and the long-term unemployed, especially if a Community Benefits Agenda is undertaken with a focus on training and upskilling of local people. The economically inactive could also benefit from the direct and indirect jobs that are created, while currently employed people would benefit from the safeguarding of local jobs. An increase in income from cruise ships could also result in further jobs through the tourist industry, increasing the perception of Anglesey as a destination location with benefits for many local tourism businesses from income from day visitors. However, the increased number of visitors could also have negative impacts for Holyhead with overcrowding at times when cruise ships land. This could include increased traffic from coach tours that may only benefit limited numbers of attractions (i.e. those that are a stop on any tours).

3.4.2 Groups seeing fewer benefits

Groups seeing fewer benefits are mainly those for whom additional jobs would have a direct impact, e.g. older people and those for whom the additional jobs could push up costs, e.g. housing costs. Increased income to a town can have benefits for all in terms of supporting services and shops, but anything that increases costs could have a negative effect on those groups that do not benefit from the additional opportunities. Training and upskilling of these vulnerable groups will be important, therefore, to help ensure that all members of the community can benefit.

3.4.3 Groups seeing an increase in negative impacts

Traffic issues are potentially a large concern for residents of Holyhead, although the traffic assessment suggests that the impacts would not be significant. However, those living near the port and near to the A55 may experience disproportionate effects that may be more noticeable to them. Additionally visitors to Holyhead may experience hold-ups to and from the port that may affect their perception of the area. This may increase perception of impacts for some groups.

Other potential negative effects that could increase are on more vulnerable receptors to noise and air quality. Although overall impacts are expected to be negligible, some groups could experience greater effects. These could include younger and older people, or those with pre-existing hearing or breathing conditions.

Local interest groups may be disproportionately affected by potential impacts or perceptions of likely impacts on their particular interests, which could include sailing, boating, diving, birdwatching, local history, etc. The potential for impacts may initially cause some concerns but are not expected to be significant. As a result, local interest groups are not expected to see any impacts since they are not expected to materialise.

3.4.4 Groups seeing a reduction in negative impacts

During the operational phase, there are no groups that are predicted to see a reduction in any negative impacts.

3.4.5 Summary of distributional impacts from operation

The summary of potential distributional impacts during operation is provided in Table 3-11. As with construction, those who will benefit more are those who are able to take advantage of the additional job opportunities. These should be more available to the local community than during the construction phase since the type of jobs is much wider (especially when existing jobs that are safeguarded are taken into account) and duration of jobs is much longer such that anyone moving to the area to take up a position is more likely to move permanently such that the benefits are retained in the local community. Traffic issues associated with cruise ship docking and demand for English may concern local residents. Those living near to the port and the A55 may be most concerned about perceived negative effects associated with increases in congestion, air quality, and noise and a reduction in visual amenity. However, these impacts are expected to be small, such that perception of the negative effects may be greater than the actual impacts that occur. Some local interest groups may be impacted as a result of increased operations, especially recreational boaters and divers, but these potential impacts are likely to be limited and are unlikely to be realised.

Table 3-11: Summary of the distributional effects during operation			
Groups typically seeing an increase in benefits	**Groups typically seeing fewer benefits**	**Groups typically seeing fewer negative impacts**	**Groups typically seeing an increase in negative impacts**
Young people Economically inactive Long-term unemployed Local business owners	Older people	Visitors to Anglesey	Welsh speakers Those living near the port or near the A55 Visitors to Holyhead Sea anglers Commercial fishermen
Minor to moderate benefit	Negligible to minor benefit	Negligible to minor negative effects	Minor to (limited or perceived) moderate negative effects

4 Cumulative impact assessment for socio-economic impacts

4.1 Other developments that could result in cumulative impacts

The cumulative impact assessment considers the wider impacts that may occur due to the combination of other developments that are underway or under consideration in the Holyhead and Anglesey areas. Table 4-1 summarises the key potential impacts associated with each of these developments, covering jobs predicted to be created, GVA estimated to be generated and any associated other positive and negative effects that could occur in combination with the Holyhead Port Expansion project. Potential cumulative effects are drawn from the assessment of effects from the Holyhead Port Expansion Environmental Statement (Section 24) and include the Energy Island Programme developments (notably the Holyhead Deep Tidal Array (Minesto), West Anglesey Development Zone (Morlais) and Wylfa Newydd) and associated developments such as the Menai Science Park that forms part of the UK's industrial strategy and the North Wales Growth Bid proposal for a model future economy.

Table 4-1: Summary of the key potential impacts from other developments on Holyhead and Anglesey

Development	Jobs created	GVA generated	Other positive effects	Negative effects
Holyhead Deep Tidal Array (Minesto)	17 FTEs created to date with further jobs to be created as the project expands[1]	£10 million investment for 1.5MW project (this is expected to expand to 10MW)[2]	Project will contribute towards growth and investment in marine energy in Anglesey[2]	Short-term impact on kayakers; other impacts not expected to be significant after mitigation measures[2]. Possible cumulative impacts on wildlife watchers due to effects on marine mammals
West Anglesey Development Zone (Morlais)	Estimated to create 300 permanent jobs (includes nuclear centre of excellence)[3]	Includes investment of £500 million with funding for phase 1 of £4.5 million[4]	Jobs locally sourced where possible	Potential impacts on fish and shellfish resources, but this has not been fully assessed in the Morlais project so cumulative effects are expected to be picked up in the EIA for that project. Other impacts expected to be negligible
Wylfa Newydd nuclear power plant	Construction workforce peaking at 8,000 to 10,000 workers and operational workforce of 850[5]	£20 million per year once operational for the Anglesey economy[6]	Jobs and skills strategy to help deliver training to meet skills needed. Tourism Fund to address effects on tourism; Community Impact Fund to deal with unforeseen impacts[5]	Mitigation expected to result in no adverse residual socio-economic, traffic or environmental effects. Some noise impacts for 17 properties during operation[5] Cumulative impacts are expected to be negligible. Traffic

Table 4-1: Summary of the key potential impacts from other developments on Holyhead and Anglesey				
Development	**Jobs created**	**GVA generated**	**Other positive effects**	**Negative effects**
				impacts are not expected to exceed thresholds
Anglesey Eco Park and Biomass Energy Centre	600 temporary construction and 400 long-term operational jobs[7]	£1 billion investment[8]	No information found	No impacts predicted, although assessment of some impacts, e.g. on traffic are yet to be undertaken but are not expected to exceed thresholds
Holyhead Waterfront Regeneration	No information found	£100 million[9]	Creation of amenities such as a maritime museum, visitor centre and youth sailing clubs with marine apprenticeship training facilities[9]	Impacts expected to be negligible (or non-significant in EIA terms). Ornithology impacts could occur during construction but are too distant from the port expansion for cumulative effects. Cumulative effects to visual amenity are not expected to exceed those from the individual schemes
Penrhos Leisure Village (Land and Lakes)	600 jobs during construction and 900 jobs when completed plus a further 110 jobs along the supply chain[11]	£105 million investment[11]	500 glass fronted lodges, expected to be open in 2021[11]	Potential for impacts on ornithology if construction activity goes on simultaneously with the port expansion. Traffic expected to increase but within thresholds so significant impacts are not expected
Holyhead Marina	No information found	No information found	450 fully serviced berths[10]	No information found
Holyhead Breakwater Refurbishment	No information found	£16 million refurbishment costs[12]	No information found	No significant effects expected therefore there are no cumulative impacts predicted

Sources:
[1] Minesto (No Date): Holyhead Deep – the world's first low-flow tidal stream project. Minesto website, accessed at: https://minesto.com/projects/holyhead-deep
[2] Minesto (2016): Deep Green Holyhead Deep Non-technical Summary, March 2016. Accessed at: https://www.iema.net/assets/nts/Xodus/Deep%20Green%20Holyhead%20Deep%20NTS%20March%202016.pdf
[3] Minesto (2016): Deep Green Holyhead Deep Project Phase I (0.5 MW), Environmental Statement, June 2016, accessed at: https://www.minesto.com/sites/default/files/documents/I100194-s14-eias-001-a01_es_compressed.pdf

Table 4-1: Summary of the key potential impacts from other developments on Holyhead and Anglesey				
Development	**Jobs created**	**GVA generated**	**Other positive effects**	**Negative effects**

[4] Kidd J (nd): Current progress in the marine energy sector in Wales and prospects for the future, accessed at: http://www.nuclearpolicy.info/wp/wp-content/uploads/2017/10/Marine_energy_in_Wales.pdf

[5] Horizon Nuclear Power (2016): Wylfa Newydd Generating Station: Environmental Impact Assessment Scoping Report, accessed at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010007/EN010007-000263-Applicant%27s%20scoping%20report.pdf

[6] Horizon Nuclear Power (nd): Wylfa Newydd FAQs, How will the local community benefit, accessed at: https://www.horizonnuclearpower.com/our-sites/wylfa-newydd/faqs

[7] Isle of Anglesey Council (2012); Energy Island Enterprise Zone: a draft prospectus, accessed at : https://www.anglesey.gov.uk/documents/Docs-en/Business/Energy-Island/Energy-Island-Enterprise-Zone-A-draft-prospectus.pdf

[8] Isle of Anglesey Council (2016): Anglesey and Gwynedd Joint Local Development Plan (2011-2026), accessed at: https://www.gwynedd.llyw.cymru/en/Council/Documents---Council/Strategies-and-policies/Environment-and-planning/Planning-policy/Examination-Documents/Operating-Points/S5---PG1.pdf

[9] Conygar (nd): Holyhead Waterfront Development, accessed at: http://www.conygar.com/Print/HolyheadWaterfrontRegeneration/22

[10] Holyhead Marine website – Holyhead Marina. Accessed at: https://www.holyheadmarine.co.uk/holyhead-marina/ on 29th May 2019

[11] Bluestone Wales website – Bluestone Holy Island Resort. Accessed at: https://www.bluestonewales.com/holy-island-resort on 29th May 2019

[12] Isle of Anglesey County Council webpage: Current consultations - Holyhead Breakwater Refurbishment Scheme. Accessed at: https://www.anglesey.gov.uk/en/Get-involved/Consultations/Current-consultations/Holyhead-Breakwater-Refurbishment-Scheme.aspx n 29th May 2019

4.2 Potential cumulative impacts across developments

The potential economic benefits to Anglesey from the combination of developments are large, both in terms of jobs and GVA. Employment benefits are also significant and implementation of the suite of proposed developments could help enable development of the construction supply chain on the island such that future developments can utilise more locally-based contractors as capacity increases. This could help reduce the potential negative impacts associated with an influx of contractors from outside Anglesey, although growth in housing and other services is likely to be required to ensure that increasing demand does not result in negative effects at the community level. The North Wales Growth Deal projects on land and property development, pathways to skills and employment and skills centres of excellence could help support development and themselves benefit from the cumulative impact on economic and social activities. Overall, there is expected to be a net **moderate cumulative benefit** from the combination of developments due to the potential for growth of the construction supply chain to meet local demand and an increase in skilled employment from both construction and operational phases, with some potential negative cumulative impacts from the influx of contractors and workers from outside Anglesey putting additional pressure on housing and other services. This net benefit will help deliver one of the aims of the North Wales Growth Deal, namely resilience in the local economy. The development of infrastructure throughout the island is also likely to lead to **cumulative benefits**, with Holyhead port expansion helping to enable some of the other developments.

The potential within the existing job market could be further increased through provision of training and upskilling through Community Benefits Agendas if these are put in place with each development, with the opportunity for subsequent developments to benefit from activities undertaken in previous ones. This could increase the sustainability of the jobs market and help increase GVA per job in Anglesey, which is currently lower than average for Wales. GVA per filled job in Anglesey in 2017 was

£39,671 compared with an average for Wales of £44,407[31]. Again, this could help deliver a more resilient local economy as a **moderate cumulative benefit** in the short-term potentially **increasing to a large cumulative benefit** in the longer-term across the range of developments. Benefits from training may be lower for those developments that are completed first, e.g. Holyhead Port Expansion is due to begin in 2020 so the social and economic benefits may become more noticeable over time as more developments are delivered.

Traffic impacts resulting from the combination of developments may be a concern for local residents, although most identify negligible or no impacts on traffic and transport taking account of proposed mitigation measures at the individual development level. Concern from residents over traffic levels currently may mean that there is a perception that there could be increased traffic. Overall, the cumulative effects of all developments are **not expected to result in significant impacts on traffic** but there may be perceptions of increased effects at the local level that may need to be managed.

Impacts on fishermen from the combination of developments is likewise not expected to be significant, with each individual development identifying no impacts after mitigation. Hence, there are **not expected to be any cumulative impacts on fishermen**.

Tourism could be affected by increased development, infrastructure and capacity where current visitors are attracted by the natural environment of Anglesey. In general, the individual developments are not expected to result in significant negative impacts on tourism and the Wylfa Newydd project proposes a tourism fund to help address any impacts. Again, the Holyhead Port Expansion could help enable future cumulative benefits for tourism, although care may be needed to manage any perceived negative impacts that could occur due to increased development. As noted above, there are **not expected to be any negative cumulative impacts** from the assessments for each development, so the management may need to be focused on ensuring that perceptions of potential impacts are addressed before any concerns arise within the local community.

[31] This is higher than GVA per filled job in Gwynedd (£37,821), Conwy and Denbighshire (£38,624) and South West Wales (£38,987) but lower than all other NUTS3 regions in Wales. Source: ONS (2019): Subregional productivity: labour productivity indices by UK NUTS2 and NUTS3 subregions, accessed at: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivitygvaperhourworkedandgvaperfilledjobindicesbyuknuts2andnuts3subregions

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Appendix K

Air Quality

Contents	
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K1 – Construction Phase Dust and Particulate Matter Assessment Methodology

Appendix K1 - Construction Phase Dust and Fine Particulate Matter Assessment

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The following section outlines criteria developed by the Institute of Air Quality Management (IAQM)[1] for the assessment of air quality impacts arising from construction activities. The assessment procedure is divided into five steps and is summarised below:

Step 1: Screening the Need for a Detailed Assessment

An assessment will normally be required where there are human receptors within 350m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). Designated ecological sites within 50m of the site boundary or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s), are also identified at this stage. A designated ecological site refers to any sensitive habitat affected by dust soiling. For locations with a statutory designation, such as a Site of Specific Scientific Interest (SSSI), Special Area of Conservation (SACs) and Special Protection Areas (SPAs), consideration should be given as to whether the particular site is sensitive to dust. Some non-statutory sites may also be considered if appropriate.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

There were a number of human receptors within 350m of the site boundary. The Anglesey Terns SPA and North Anglesey Marine SAC are within 50m of the site boundary, however both are considered not sensitive to dust. A Detailed Assessment was therefore undertaken for human receptors only.

Step 2: Assess the Risk of Dust Impacts

A site is allocated to a risk category on the basis of the scale and nature of the works (Step 2A) and the sensitivity of the area to dust impacts (Step 2B). These two factors are combined in Step 2C to determine the risk of dust impacts before the implementation of mitigation measures. The assigned risk categories may be different for each of the construction activities outlined by the IAQM (demolition, construction, earthworks and trackout).

Step 2A: Define the Potential Dust Emission Magnitude

The IAQM guidance recommends that the dust emission magnitude is determined for demolition, earthworks, construction and trackout. The dust emission magnitude is based on the scale of the anticipated works. **Table 1** describes the potential dust emission class criteria for each outlined construction activity.

[1] Institute of Air Quality Management – 2014 IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London

Table 1: Criteria Used in the Determination of Dust Emission Class

Activity	Criteria used to Determine Dust Emission Class		
	Small	**Medium**	**Large**
Demolition	Total building volume <20,000m^2; Material with low potential for dust release Demolition activities <10m above ground level.	Total building volume 20,000 – 50,000m^2; Potentially dusty material. Height of building between 10-20m above ground level.	Total building volume >50,000m^2; Potentially dusty material. Demolition activities >20m above ground level.
Earthworks	Total site area <2,500m^2; <5 heavy moving earth vehicles active at any one time.	Total site area 2,500 – 10,000m^2; 5 – 10 heavy moving earth moving vehicles active at any one time.	Total site area >10,000m^2, >10 heavy earth moving vehicles active at any one time.
Construction	Total building volume <25,000m^3; Construction material with low potential for dust release.	Total building volume 25,000 – 100,000m^3; Potentially dusty construction material (e.g. concrete).	Total building volume >100,000m^3; On site concrete batching.
Trackout	<10 outward HGV trips in any one day; Unpaved road length <50m.	10 – 50 outward HGV trips in any one day. Unpaved road length 50 – 100m.	>50 outward HGV trips in any one day; Unpaved road length >100m.

Step 2B: Define the Sensitivity of the Area

The sensitivity of the area takes into account the following factors (**Table 2**):

- the specific sensitivities of receptors in the area;
- the proximity and number of receptors;
- the local background PM_{10} concentration; and,
- site-specific factors, such as the presence of natural shelters, such as trees, to reduce the risk of windblown dust.

Table 2: Criteria for Determining Sensitivity of Receptors

Sensitivity of Receptor	Criteria for Determining Sensitivity	
	Dust Soiling Effects	**Health Effects of PM_{10}**
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms	Residential properties, hospitals, schools and residential care homes
Medium	Parks, places of work	Office and shop workers not occupationally exposed to PM_{10}
Low	Playing fields, farmland, footpaths, short-term car parks and roads	Public footpaths, playing fields, parks and shopping streets

The criteria detailed in **Tables 3** and **4** were used to determine the sensitivity of the area to dust soiling effects and human health impacts. **Figure 19.5** in the main report details the distance bands, as detailed in **Tables 3** and **4**, from the site boundary for use in the construction phase assessment.

Table 3: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	**>100**	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	**>1**	Medium	Low	Low	Low
Low	**>1**	Low	Low	Low	Low

Table 4: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32µg.m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	>28-32µg.m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	>24-28µg.m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg.m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentrations	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Step 2C: Define the Risk of Impacts

The dust emission magnitude and sensitivity of the area are combined and the risk of impacts from each activity (demolition, earthworks, construction and trackout) before mitigation is applied should be determined using the criteria detailed in **Tables 5** to **7**.

Table 5: Risk of Dust Impacts- Demolition

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 6: Risk of Dust Impacts- Earthworks and Construction

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 7: Risk of Dust Impacts- Trackout

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3: Site-Specific Mitigation

Step three of the IAQM guidance identifies appropriate site-specific mitigation. These measures are related to whether the site is a low, medium or high-risk site. The highly recommended mitigation for the proposed scheme is detailed in the **Step 3: Site Specific Mitigation Section** of the main report.

Step 4: Determine Significant Effects

With the implementation of the mitigation measures detailed in **Step 3: Site Specific Mitigation Section** of the main report, the residual impacts from the construction are considered to be **not significant**, in accordance with IAQM guidance.

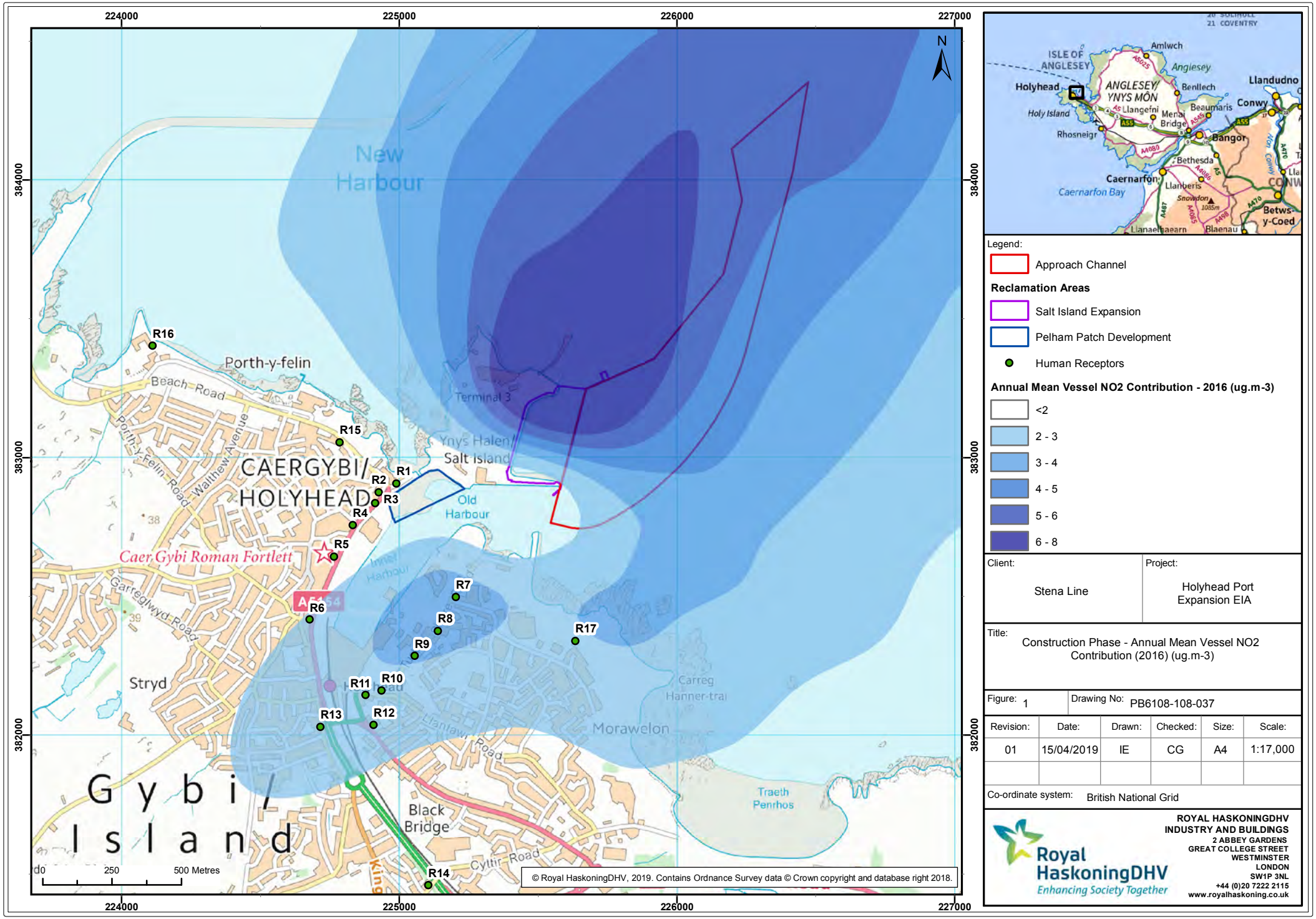
K2 – Air Quality Contour Plots

Appendix K2 - Traffic Data Used in the Air Quality Assessment

Road Link	Verification Year 2017		Year of Peak Construction 'Without Proposed Scheme' (2021)		Year of Peak Construction 'With Proposed Scheme' (2021)		Opening Year 'Without Proposed Scheme' (2023)		Opening Year 'With Proposed Scheme' (2023)		Speed (kph)
	AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)	
A55 - N Wales Expressway	12,611	15.0	12,080	14.4	12,468	16.6	12,431	15.2	12,593	16.2	80
A55 - Victoria Road	13,642	13.9	13,053	13.3	13,470	15.4	13,424	14.1	13,587	15.0	48
A55 - London Road	11,190	17.0	10,740	16.3	11,165	18.7	11,066	17.2	11,230	18.3	48
A55 - North of A55/A5 Junction	8,188	21.8	7,896	20.8	8,332	23.7	8,159	21.8	8,325	23.2	48
A5 London Road*	5,897	3.2	-	-	-	-	-	-	-	-	48 / 64
A5025*	5,424	2.5	-	-	-	-	-	-	-	-	48 / 80
Port Access Road	3,845	45.1	3,793	42.0	4,228	45.6	3,971	43.5	4,137	45.5	48
*Included for model verification only. A5025 traffic flows from DfT Traffic Counts[1]											

[1] https://www.dft.gov.uk/traffic-counts/cp.php?la=Isle+of+Anglesey#50659

K3 – Air Quality Contour Plots



Legend:

- Approach Channel

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development
- Human Receptors

Annual Mean Vessel NO2 Contribution - 2016 (ug.m-3)

- <2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 8

Client:	Project:
Stena Line	Holyhead Port Expansion EIA

Title: Construction Phase - Annual Mean Vessel NO2 Contribution (2016) (ug.m-3)

Figure:	Drawing No:
1	PB6108-108-037

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	15/04/2019	IE	CG	A4	1:17,000

Co-ordinate system: British National Grid

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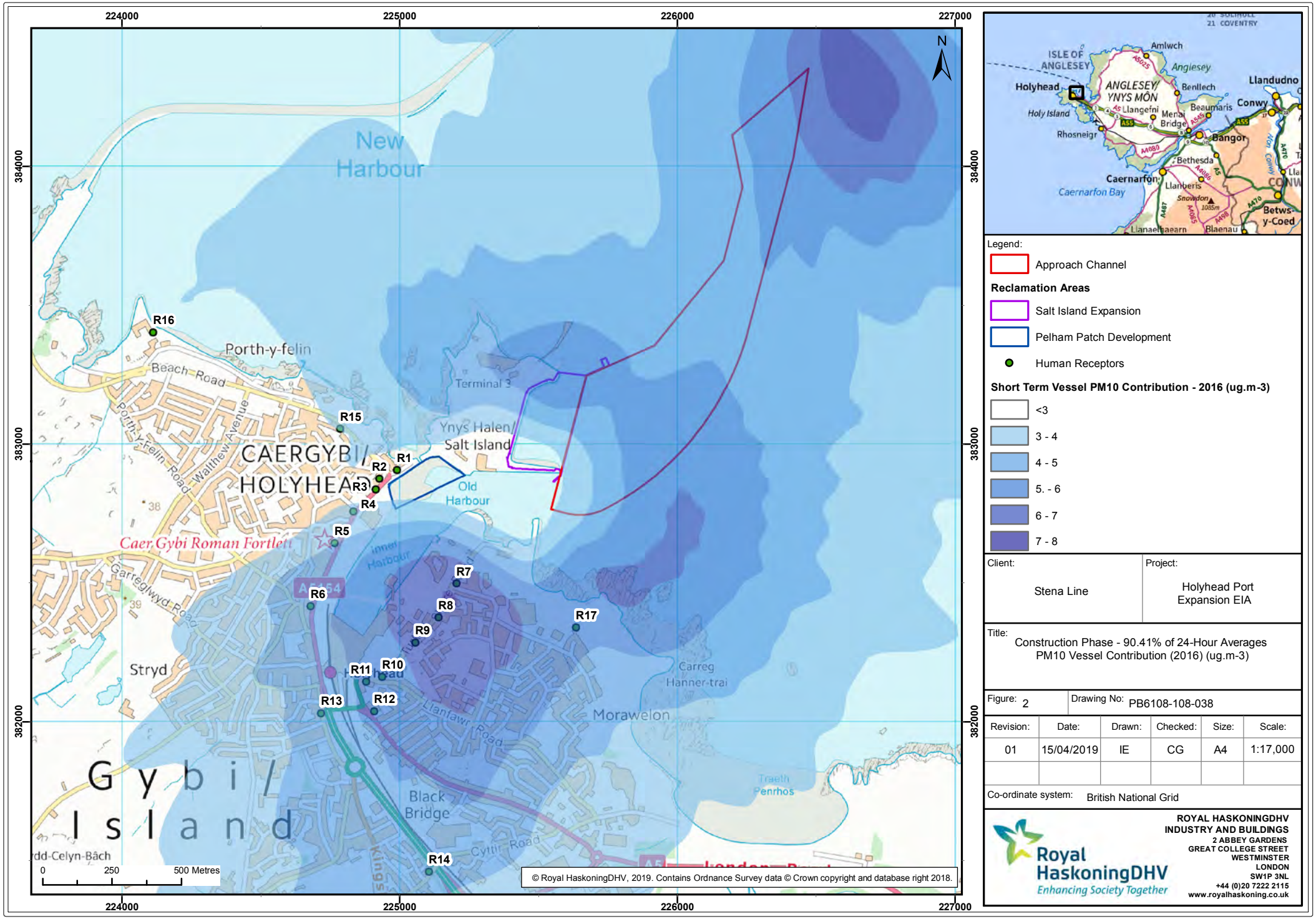

Client:	Stena Line
Project:	Holyhead Port Expansion EIA

Title: Construction Phase - 90.41% of 24-Hour Averages PM10 Vessel Contribution (2016) (ug.m-3)

Figure:	Drawing No:
2	PB6108-108-038

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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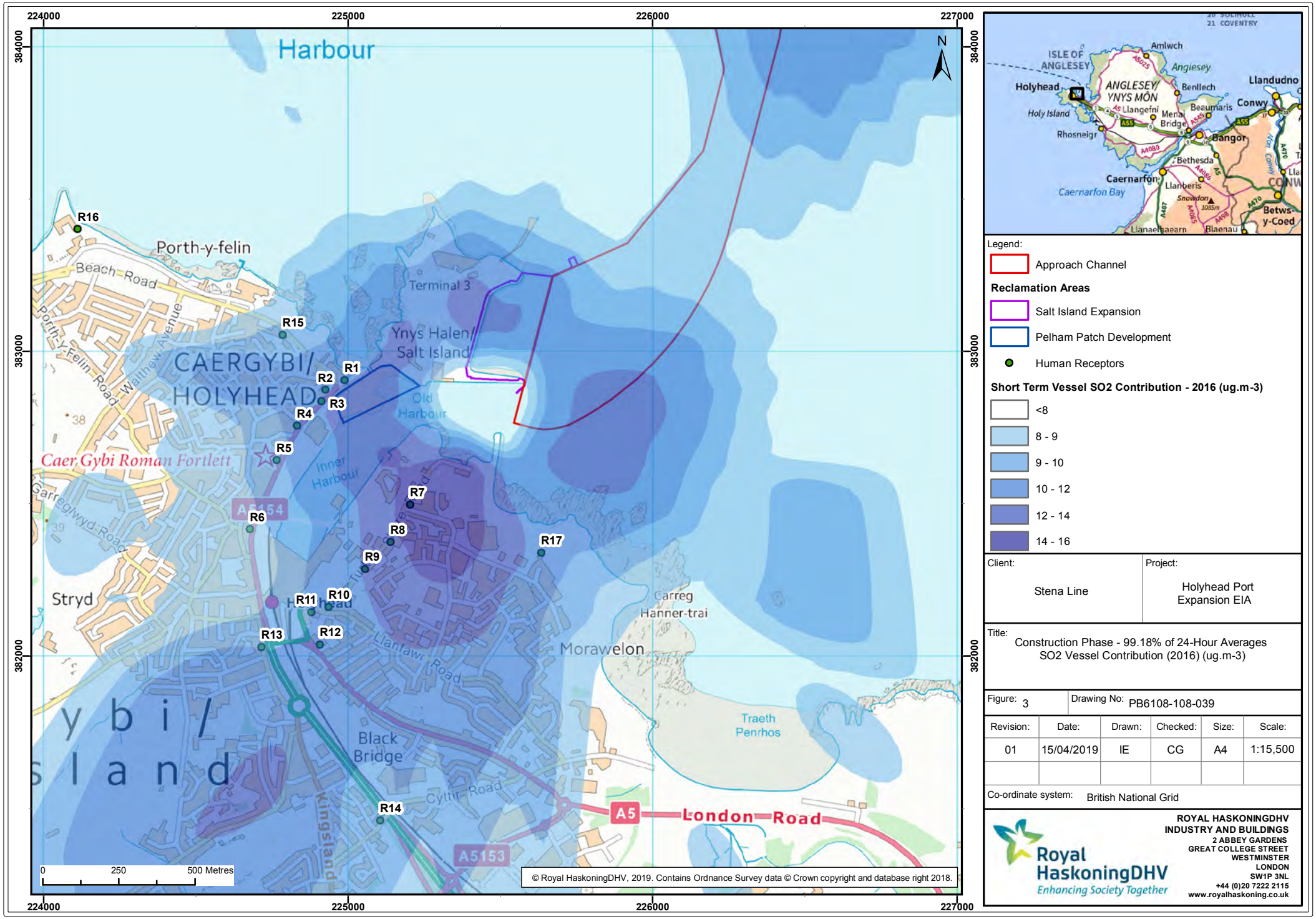

Legend:

- Approach Channel

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development
- Human Receptors

Short Term Vessel SO2 Contribution - 2016 (ug.m-3)

- <8
- 8 - 9
- 9 - 10
- 10 - 12
- 12 - 14
- 14 - 16

Client:	Project:
Stena Line	Holyhead Port Expansion EIA

Title: Construction Phase - 99.18% of 24-Hour Averages SO2 Vessel Contribution (2016) (ug.m-3)

Figure:	Drawing No:
3	PB6108-108-039

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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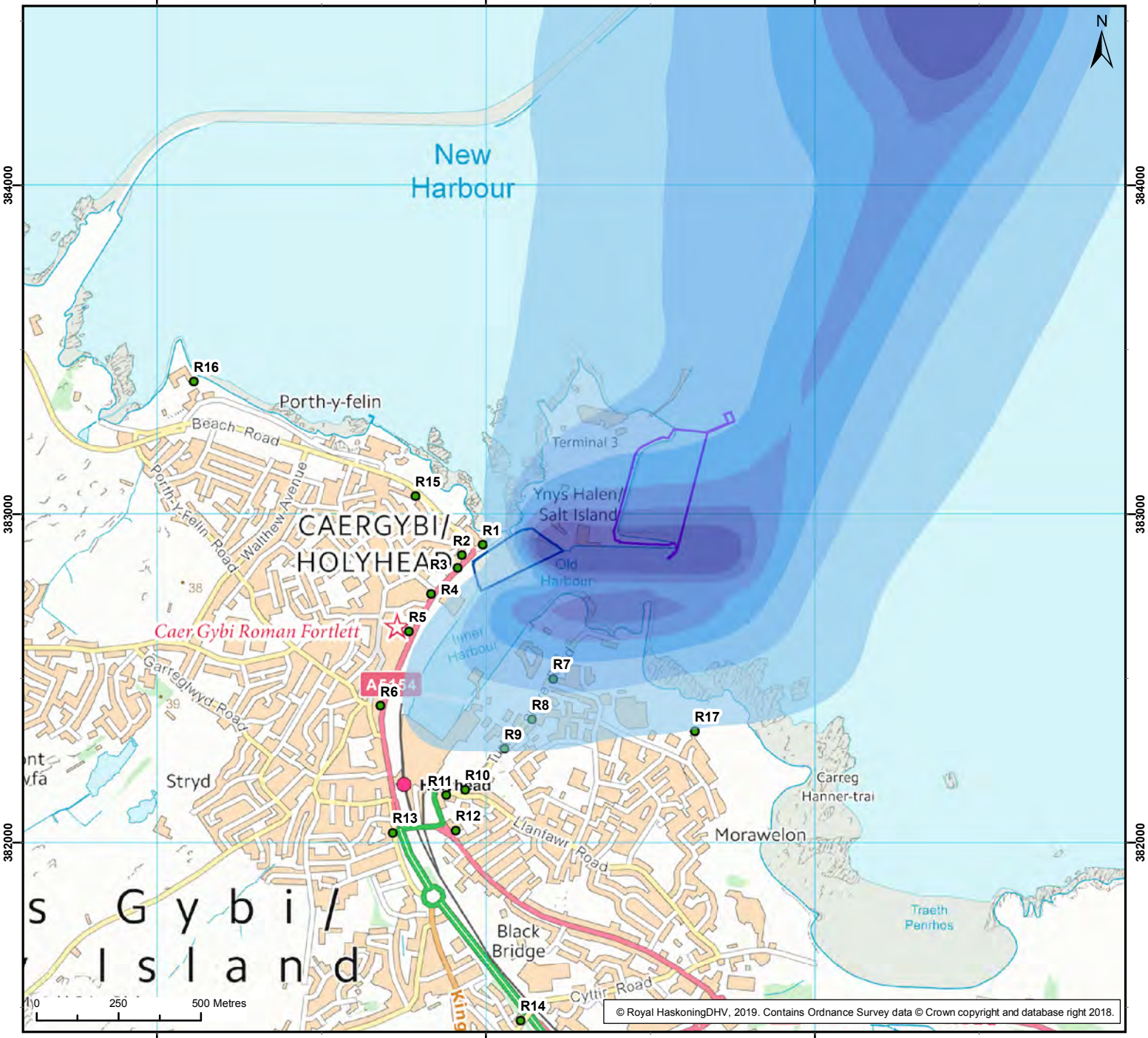

Legend:

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development
- Human Receptors

Annual Mean Vessel NO2 Contribution - 2016 (ug.m-3)

- <2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- 6 - 7
- 7 - 8

Client:	Project:
Stena Line	Holyhead Port Expansion EIA

Title: Operational Phase - Annual Mean NO2 Vessel Contribution (2016) (ug.m-3)

Figure: 4 | Drawing No: PB6108-108-040

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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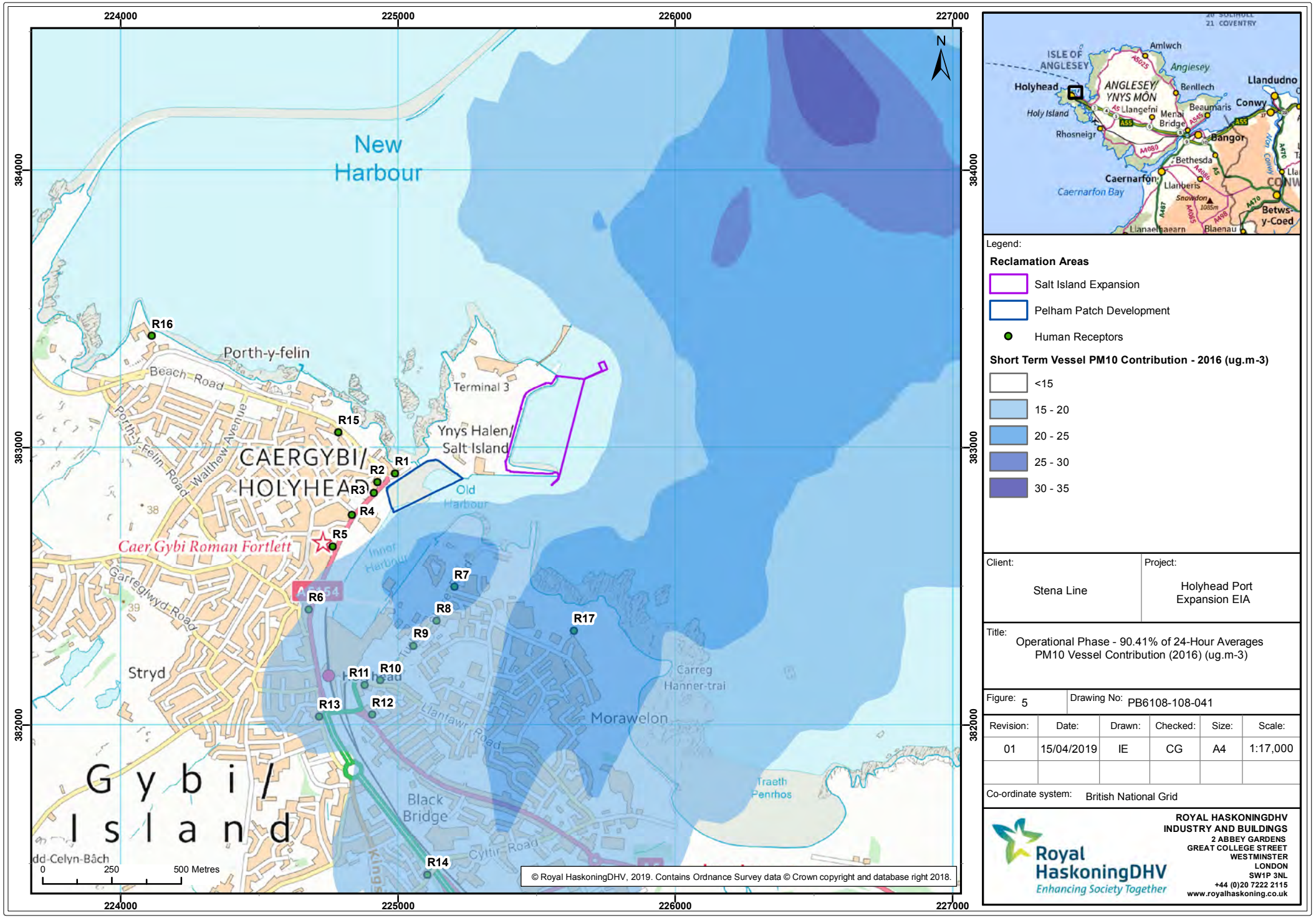

Legend:

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development
- Human Receptors

Short Term Vessel PM10 Contribution - 2016 (ug.m-3)

- <15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35

Client:	Project:
Stena Line	Holyhead Port Expansion EIA

Title: Operational Phase - 90.41% of 24-Hour Averages PM10 Vessel Contribution (2016) (ug.m-3)

Figure:	Drawing No:
5	PB6108-108-041

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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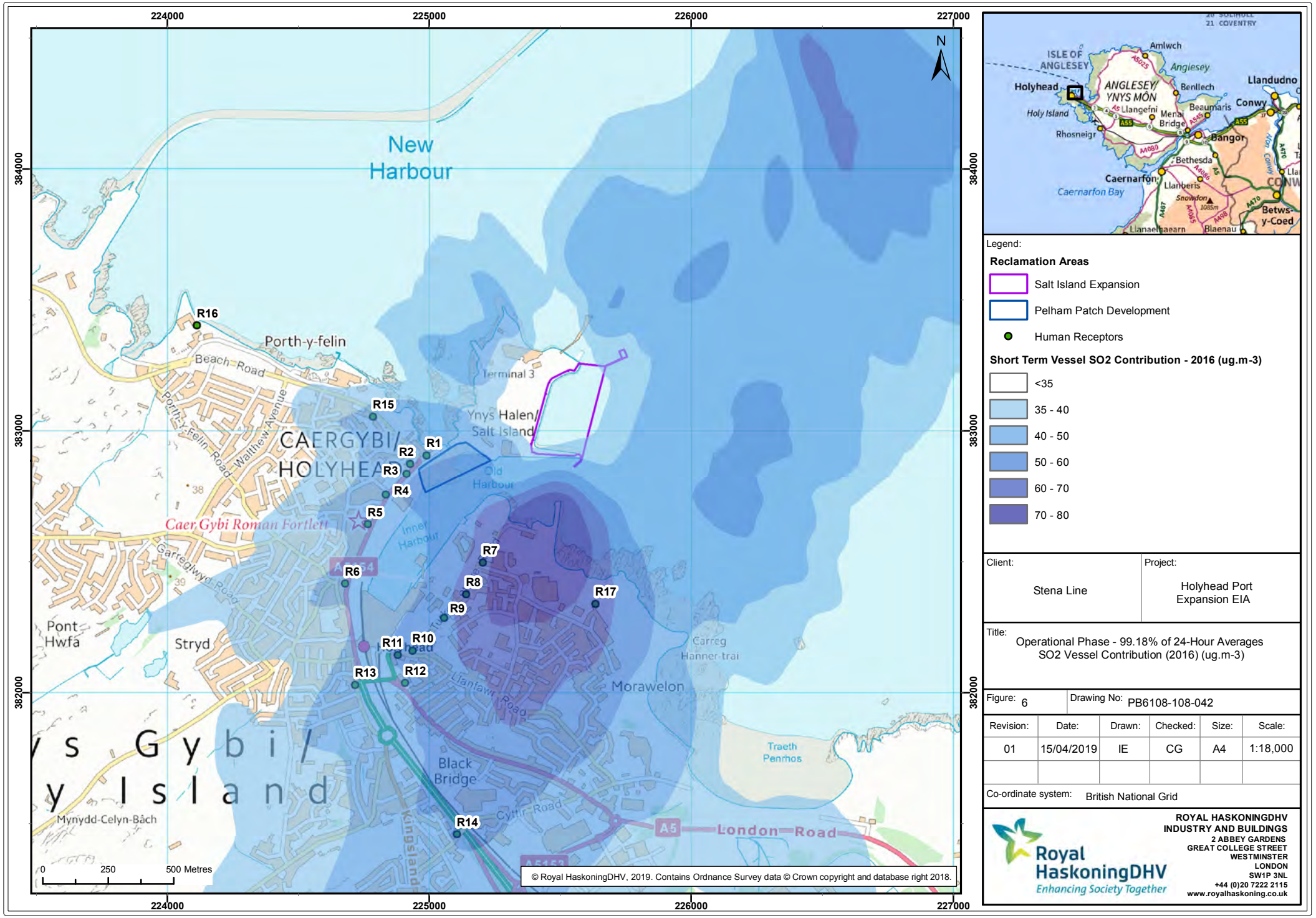

Client:	Project:
Stena Line	Holyhead Port Expansion EIA

Title: Operational Phase - 99.18% of 24-Hour Averages SO2 Vessel Contribution (2016) (ug.m-3)

Figure: 6 | Drawing No: PB6108-108-042

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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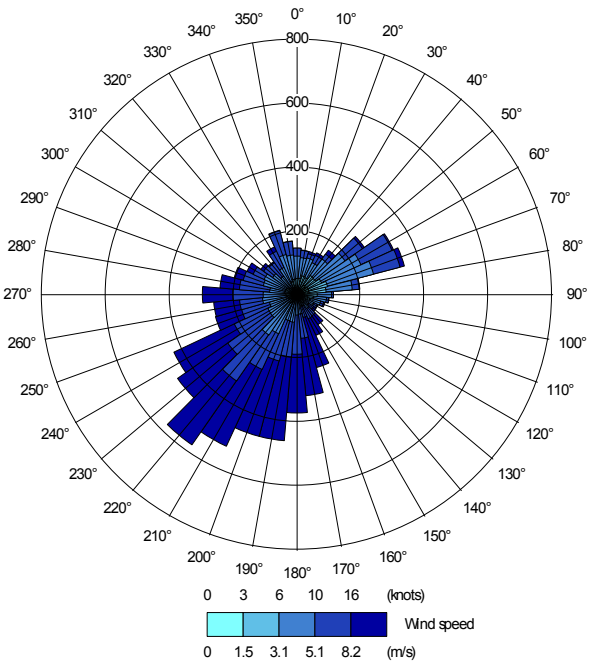
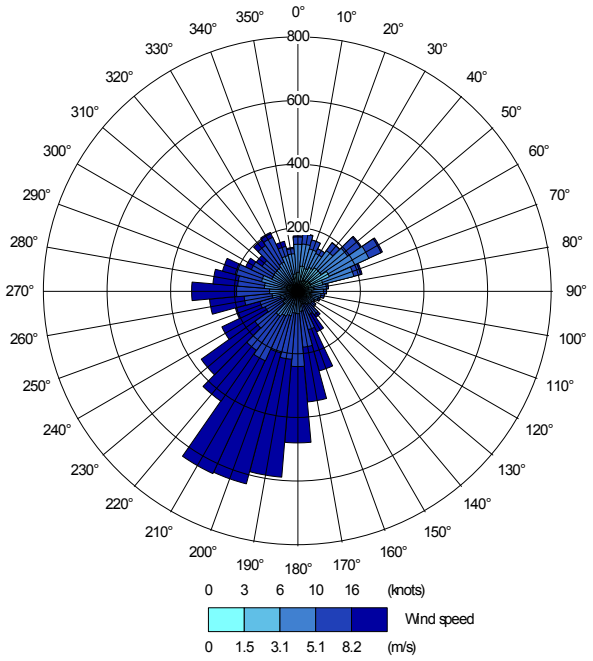
K4 – Valley Meteorological Station Wind Roses

Appendix K4 - Valley Meteorological Station Wind Roses (2014 – 2018)

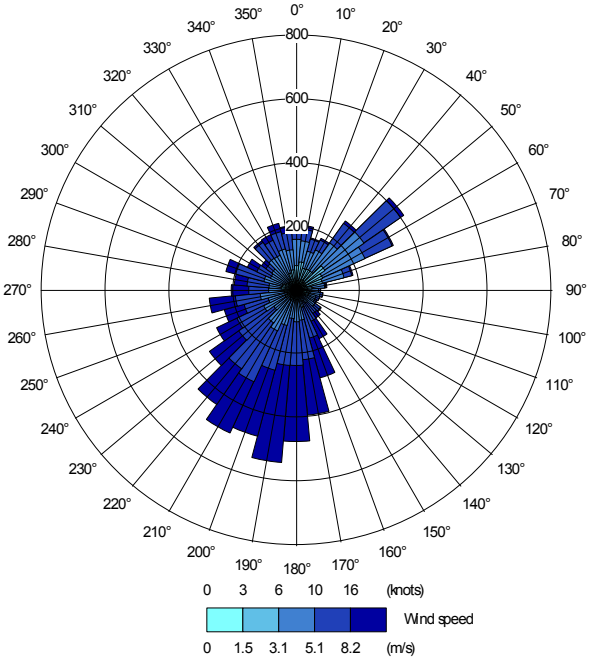
Valley Wind Rose 2014



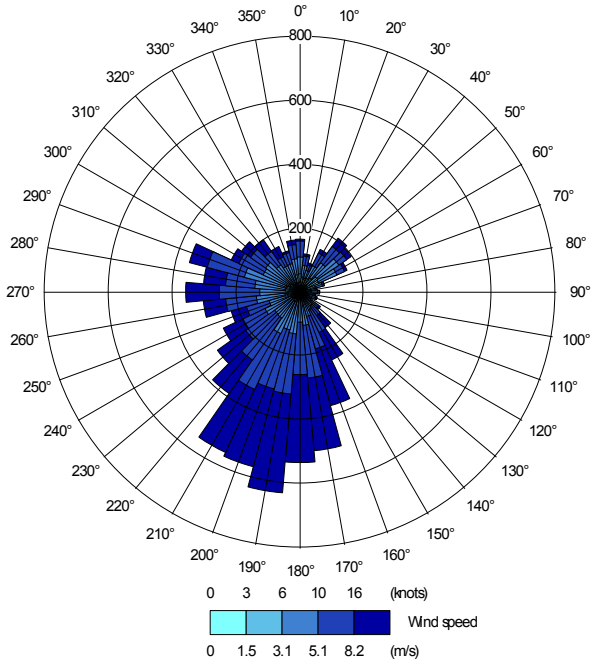
Valley Wind Rose 2015



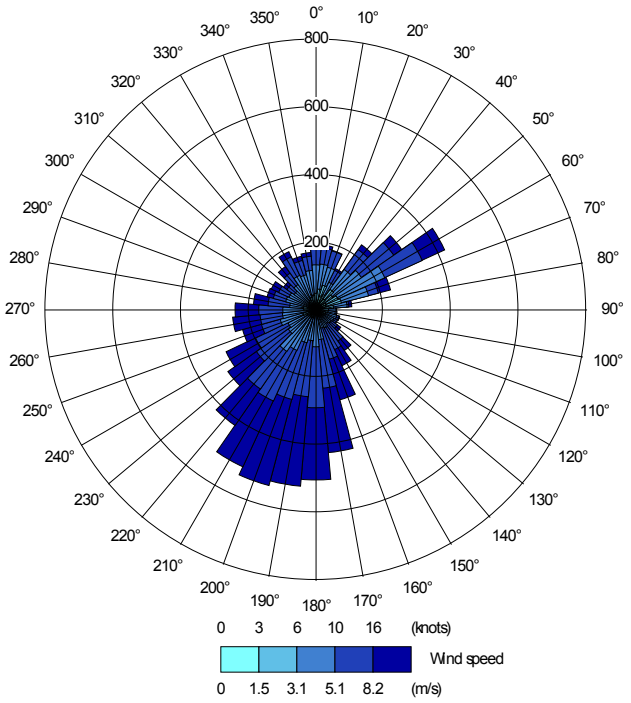
Valley Wind Rose 2016



Valley Wind Rose 2017



Valley Wind Rose 2018



Appendix L

WFD Assessment Tables

1 Completed Stage 3 Scoping Tables

1.1 Construction (construction of quay walls and reclamation and capital dredging)

The following tables summarise the information relevant to the consideration of the requirements of the Water Framework Directive (WFD) for the construction phase activities (tables taken from Clearing the Waters for All; Environment Agency, 2016). Note that although the answer to the question is yes in some instances, the evidence provided in the notes column has allowed the issue to be scoped out of requiring detailed assessment.

Table 1.1 Construction activity information

Your activity	Description, notes or more information	
Applicant name	Stena Line Ports Ltd	
Name of activity	Construction of new quay walls and land reclamation	Capital dredging
Brief description of activity	Construction activities associated with Salt Island Reclamation: • Reclamation of the area to the east of Salt Island (65,750m^2). Approximately 720,000m^3 of fill material will be required. Fill material would comprise approximately 520,000m^3 of the dredged arisings from the approach channel and approximately 200,000m^3 would be imported. • Construction of approximately 590m of new quay walls using either a combi wall design with piles and sheet piles, or a caisson wall method. The piles will be drilled into place, with some percussive piling required to seat the piles into the bedrock. • Installation of scour protection along the new quay wall and a rock revetment along the north wall of the reclaimed area. Construction activities associated with Pelham Patch Development:	An approach channel of approximately 500,000m² is proposed. The target dredge depth for the approach channel is 10m bCD. The estimated volume of dredged material arising from this area is approximately 1.9Mm³. Following the installation of the quay wall for reclamation of Pelham Patch there will be a requirement to remove hard soils at the face of the newly installed wall to 5.5m bCD. The dredged area is approximately 14,655m^2 and is anticipated to be largely made up of rock. Some dredging within the reclamation areas may be required to remove material that does not provide suitable bearing for the reclamation works. The estimated volume of unsuitable soil to be dredged within the reclamation areas, based on the available information, is 37,750m^3 within the Salt Island reclamation and 3,950m^3 in the Pelham Patch reclamation.

Your activity	Description, notes or more information	
	• Reclamation of the area to the east of Marine Yard (24,250m^2) requiring approximately 163,500m^3 of fill material. Fill material would comprise approximately 120,000m^3 of the dredged arisings from the proposed approach channel and 43,500m^3 would be imported. • Construction of a 280m quay wall using either the combi-wall method or caissons. The piles will be drilled into place, with some percussive piling required to seat the piles into the bedrock. • Blocking up of the culvert running under Salt Island Bridge.	If the quay walls are construction with caissons, it would be necessary to dredge a pocket to a depth of 11m bCD for the Salt Island reclamation and 6.5m bCD for the Pelham Patch reclamation. The volume of additional dredging to facilitate construction of a caisson quay wall is estimated to be approximately 90,000m³ for the Salt Island reclamation and 30,000m^3 for the Pelham Patch reclamation. The capital dredging is anticipated to give rise to gravel, soft clay, firm clay and rock. The worst-case overall dredge volume, based upon the caisson wall option, is predicted to be 2,020,975m^3, with the following approximate split of material types: Rock – 141,690m^3, firm clay – 666,000m^3, soft clay – 831,960m^3 and gravel – 366,430m^3. It is anticipated that the softer soils, which can be readily mobilised would be dredged using a trailing suction hopper dredger (TSHD) whilst a back-hoe would be used to dredge the rock (using a rock breaker) and firm soils
Location of activity	See **Figure 25.1**, in main ES	See **Figure 25.1**, in main ES
Footprint of activity	Approximately 9 hectares	Approximately 77 hectares (the area of dredging multiplied by 1.5)
Timings of activity	Estimated to commence in spring 2020 and will take approximately 24 months to complete. The construction of the quay walls at both areas is estimated to take 35 weeks to complete and the reclamation of both areas will take one year. Surcharging of Salt Island will take approximately 40 weeks.	The dredging activities for the approach channel will take place over 19 weeks, with the TSHD and back-hoe dredging occurring concurrently. TSHD will take 19 weeks to complete and the back-how will take 8 weeks to complete. The dredging in front of Pelham Patch and Salt Island will take four and seven weeks to complete, respectively.
Extent of activity	See **Figure 25.1**, in main ES	See **Figure 25.1**, in main ES
Use or release of chemicals	None	No use of chemicals. Sediments could be released during dredging which could contain contamination.

Table 1.2 Surface water compliance criteria

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Construction quay walls and land reclamation	Capital dredging
Hydromorphology	Capable of impacting on the hydromorphology of a water body with high status		✓	No, the water body is not at High status	
	Capable of significantly impacting on the hydromorphology of any waterbody		✓	See operational phase	No, expert-based assessment of deposition from the plume generated from capital dredging indicates that the changes in sea bed elevation would only amount to a maximum of 7m immediately adjacent to the new quay walls of the reclaimed areas, in areas that are within the dredge footprint. In other areas, deposition is predicted to be no more than 10cm. After this initial deposition, this sediment would be continually re-suspended to reduce the thickness even further to a point where it will be effectively zero. This will be the longer-term outcome, once the sediment supply from dredging and reclamation activities has ceased. This means that given these very small magnitude changes in sea bed level arising from capital dredging, the impacts on hydromorphology would not be significant.
	Located in a water body that is heavily modified for the same purpose	✓		Yes, the water body is heavily modified for Navigation, ports and harbours. However, given the evidence provided in the line above for capital dredging this effect is **scoped out**.	Yes, the water body is heavily modified for Navigation, ports and harbours. However, given the evidence provided in the section above this effect is **scoped out**.
Biology (Habitats)	0.5 km^2 or larger	✓ (capital dredge only)		No, the area of the reclaimed areas is 0.09km^2	Yes, the area of the capital dredge is approximately 0.77km^2.

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Construction quay walls and land reclamation	Capital dredging
	1% or more of a waterbody's area	✓ (capital dredge only)		No, the footprint of the reclaimed areas is 0.77% of the water body	**Yes**, the footprint of the capital dredge represents approximately 4% of the waterbody.
	Within 500m of any higher sensitivity habitat	✓		**Yes**, there is a small area of subtidal kelp bed within the Salt Island reclamation area.	**Yes**, there is an area of mussel beds identified to the north-west of the approach channel, within 500m.
	1% or more of any lower sensitivity habitat	✓ (capital dredge only)		No, the footprint of the reclaimed areas is 0.77% of the water body	**Yes**, the footprint of the dredging activities represents approximately 4% of the waterbody.
Biology (Fish)	In an estuary and could affect fish in the estuary, or outside the estuary but could delay or prevent fish entering it or affect migration		✓	This is considered on the basis that the coastal water body may support fish moving between transitional water bodies for which fish are a compliance parameter. Modelled suspended sediment concentrations arising during the land reclamation process are highly localised to the port area and would not cause a barrier to movement. The sediment is predicted to disperse within nine hours once the reclamation is complete. Piling of the quay walls, and rock dredging activities would produce underwater noise. Temporary disturbance may occur within the port boundaries, and limited range in which any form of injury may occur – 110m from source for the most sensitive species. However, the most sensitive species (herring) do not have spawning or nursery grounds nearby. As concluded in the Fish and Shellfish Resource **Chapter 11** potential impacts to fish are not considered to be significant.	This is considered on the basis that the coastal water body may support fish moving between transitional water bodies for which fish are a compliance parameter. Sediment dispersion modelling, presented in **Chapter 8**, indicates that the sediment plume created during the dredging process would be small in scale and localised. It is predicted that suspended sediment concentrations arising from the capital dredge would disperse to within background levels within 2.5 hours. As discussed in Fish and Shellfish Resource **Chapter 11** no impacts to fish are predicted and spawning areas are at sufficient distance from the predicted plume that no impact is predicted occur.
	Capable of impacting on normal fish		✓		

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Construction quay walls and land reclamation	Capital dredging
	behaviour like movement, migration or spawning				
	Capable of causing entrainment or impingement of fish		✓	The activities will not cause the entrainment or impingement of fish.	
Water Quality	Capable of affecting water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring-neap tidal cycle		✓	There will be some sediment loss during reclamation activities, which would occur over the duration of the reclamation activities, approximately 35 weeks. As discussed within **Chapter 9**, this release of sediment is highly localised and is predicted to disperse to within background levels of suspended sediment within nine hours of the quay walls being completed. Impacts on temperature, salinity, oxygen levels, nutrients or microbial patterns are not anticipated due to the nature of the material to be used in the reclamation – dredged material and imported granular fil.	The dredging activities would take place over approximately six months and over this period would have small scale and localised effects on water clarity (see **Chapter 9**). Impacts on temperature, salinity, oxygen levels, nutrients or microbial patterns are not anticipated due to the nature of the material to be dredged – some mixed sediments with stiff or firm clay and rock. These sediments are of glacial origin and do not contain significant amounts of organic material and as such the disturbance of this sediment would not cause a release of nutrients and any corresponding increase in microbes and possible decrease in oxygen.
	Located in a water body with a phytoplankton status of moderate, poor or bad		✓	Phytoplankton status of Holyhead Bay waterbody is High	
	Located in a water body with a history of harmful algae		✓	There is no history of harmful algae in Holyhead Bay waterbody	
Chemical Contamination	The chemicals are on the	✓		The dredging activities would disturb sediment which contains chemicals which are on the EQSD list. During the reclamation process sediments released through the dewatering process may contain contaminates.	

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Construction quay walls and land reclamation	Capital dredging
	Environmental Quality Standards Directive (EQSD) list It disturbs sediment with contaminants above Cefas Action Level 1			Chemical testing was undertaken on sediment samples taken from locations within the dredge area, at the surface, mid-depth and target depth, where possible. Some contaminants were present at levels marginally above Cefas Action Level 1. No contaminants were recorded at levels above Cefas Action Level 2.	
Protected Areas	Located within 2 km of any WFD protected area (SAC, SPA, shellfish waters, bathing waters, nutrient sensitive areas)		✓	Both activities are located within the North Anglesey Marine SAC and Anglesey Terns SPA. European designated sites are considered within the Shadow HRA (**Chapter 26**) therefore, these protected areas are scoped out of detailed assessment. There is a shellfish water located approximately 1.7km from the proposed scheme, however sediment modelling predicts that SSCs will not extend to this location and as such significant non-temporary effects are not anticipated to affect this area. No other protected areas are located within 2km, as such this parameter is scoped out.	
Invasive Non-native Species	Capable of spreading INNS		✓	The International Convention for the Control and Management of Ships Ballast Water and Sediments (BWM Convention) was adopted in 2004 and was implemented in 2017. This introduces global regulations to control the transfer of potentially invasive species. With the treaty now in force ships are required to manage their ballast water. Stena Line Ports Ltd have a Biosecurity Plan in place for dredging activity, which was produced in consultation with NRW, in order to prevent the ingress or spread of INNS within the Port area. It will be ensured that the contractor(s) will adhere to best practice to reduce the spread of INNS as far as possible.	

Table 1.3 Surface water summary for construction – Holyhead Bay water body

Receptor	Construction of quay walls and reclamation areas	Capital dredging
Hydromorphology	No, permanent presence of the new structure is considered under 'operation'.	No, the capital dredging activity is not predicted to have significant effects on hydromorphology
Biology – habitats	No, some subtidal kelp bed is present within the Salt Island reclamation area however, given the extent of this habitat throughout the water body the loss of this is considered to be non-significant.	**Yes**, the capital dredging could potentially impact on more than 1% of a lower sensitivity habitat.
Biology – fish	No, the activities are not taking place within an estuary and suspended sediment concentrations disperse to within background levels in a very short time and will not create a barrier to movement. Spawning and nursery grounds are not considered to be significantly affected.	
Water quality	No, the reclamation of the areas would cause a highly localised release of sediment at the quay walls. This sediment disperses to within background levels within nine hours and will not have a long-term permanent adverse impact on water quality parameters.	No, although the dredging activities will be undertaken over a six-month period, the results of the sediment modelling study indicate that the plumes produced will be small in scale and highly localised and any effects will be short-term and temporary.
Chemical	**Yes**, chemical contamination is present within the sediment to be dredged from the approach channel, which will be used within the reclamation areas at levels above Cefas AL1	
Protected areas	No. European designated sites are considered in **Chapter 26**. There is a shellfish water within 2km however increased SSCs are not predicted to extend to this area and as such no effects are predicted to occur. There are no other Protected Areas within 2km of the works.	
INNS	No, the port's Biosecurity Plan provides sufficient measures to prevent the spread of INNS	

1.2 Operation (presence of reclaimed areas and approach channel)

The following tables summarise the information relevant to the consideration of the requirements of the WFD for the operational phase activities (tables taken from Clearing the Waters for All; Environment Agency, 2016). Note that although the answer to the question is yes in some instances, the evidence provided in the notes column allows the issue to be scoped out of requiring further assessment.

Table 1.4 Operation activity Information

Your activity	Description, notes or more information	
Applicant name	Stena Line Ports Ltd	
Name of activity	Presence of new reclamation areas	Presence of new approach channel
Brief description of activity	It is proposed that the newly reclaimed areas would be used 24 hours a day, seven days a week to accommodate cruise ships and dry bulk vessel movements, as required. Services to be provided once the reclamation of Salt Island is completed will include the provision of potable water to both office buildings, as well as a potable water bunkering system for visiting cruise ships. Following the installation of the fuel pipeline, fuel bunkering services will also be available to any visiting vessels.	There is predicted to be a low requirement for maintenance dredging to maintain the approach channel depth of 10m bCD.
Location of activity	See **Figure 25.1,** in main ES	See **Figure 25.1,** in main ES
Footprint of activity	Approximately 9 hectares	Approximately 50 hectares
Timings of activity	The newly reclaimed areas will be operational from approximately Spring 2022, and will be in use 24 hours per day, 7 days per week.	The new approach channel will be in use from Spring 2020. The frequency of maintenance dredging is not yet defined; however, is considered to be low.
Extent of activity	See **Figure 25.1,** in main ES	See **Figure 25.1,** in main ES
Use or release of chemicals	The new berth at Salt Island will provide re-fuelling facilities to visiting vessels.	None

Table 1.5 Surface water compliance criteria

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Presence of reclaimed areas	Presence of approach channel
Hydromorphology	Capable of impacting on the hydromorphology of a water body with high status		✓	No, the water body is not at High status.	
	Capable of significantly impacting on the hydromorphology of any waterbody		✓	No, the presence of the reclaimed areas and the approach channel would not have a significant impact on the hydromorphology of Holyhead Bay. The changes in significant wave heights would only have a local effect on bedload sediment transport processes in the nearshore zone outside Holyhead Port. The impact on coastal processes is therefore considered to be non-significant (**Chapter 8**). There is no change to significant wave heights tidal currents, and sediment transport and erosion/accretion patterns. These are negligible changes to hydromorphological parameters and therefore would not cause a deterioration in class status to the WFD water body.	
	Located in a water body that is heavily modified for the same purpose	✓		Yes, the water body is heavily modified for Navigation, ports and harbours. However, given the evidence provided in the section above detailed assessment is not considered necessary.	Yes, the water body is heavily modified for Navigation, ports and harbours. However, given the evidence provided in the section above detailed assessment is not considered necessary.
Biology (Habitats)	0.5 km^2 or larger	✓ (approach channel only)		No, the area of the reclaimed areas is 0.09km^2	The requirement for maintenance dredging is predicted to be low due to low volumes of suspended sediment and low bed shear stresses present in Holyhead Bay. The capital dredge is considered to pose the main impact to benthic habitats. Following this, species will recolonise the area, but will be disturbed by maintenance dredging. The habitats present are of lower sensitivity and are common throughout the north Wales region and are considered able to re-establish following each maintenance dredge activity. As such this is **scoped out** of further assessment.
	1% or more of a waterbody's area	✓ (approach channel only)		No, the footprint of the reclaimed areas is 0.77% of the water body	
	Within 500m of any higher sensitivity habitat	✓ (approach channel only)		No, the presence of the reclamation areas will not have an ongoing impact on higher or lower sensitivity habitats.	
	1% or more of any lower sensitivity habitat	✓ (approach			

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Presence of reclaimed areas	Presence of approach channel
		channel only)			
Biology (Fish)	In an estuary and could affect fish in the estuary, or outside the estuary but could delay or prevent fish entering it or affect migration		✓	No, the presence and use of the reclaimed areas will not adversely affect fish movements. The increase in vessel traffic during operation is not expected to impact fish movement, migration or nursery and spawning grounds (**Chapter 11**).	Although there is a low requirement for maintenance dredging to maintain the depth of the approach channel. Effects on SSC are expected to be less than that predicted for the capital dredge activity, as the maintenance dredge requirements are considered to be low. As such no effects on fish are predicted to occur.
	Capable of impacting on normal fish behaviour like movement, migration or spawning		✓		
	Capable of causing entrainment or impingement of fish		✓	The activities will not cause the entrainment or impingement of fish.	
Water Quality	Capable of affecting water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring-neap tidal cycle		✓	No, the presence of the reclaimed areas will not impact on water quality.	No, there is a low requirement for maintenance dredging, and maintenance dredging activities would not be continuous for longer than a spring-neap tidal cycle.
	Located in a water body with a phytoplankton status of moderate, poor or bad		✓	Phytoplankton status of Holyhead Bay waterbody is High	
	Located in a water body with a history of harmful algae		✓	There is no history of harmful algae in Holyhead Bay waterbody	
Chemical Contamination	The chemicals are on the Environmental Quality Standards Directive (EQSD) list		✓	No, the presence of the reclaimed areas will not impact on water quality.	There will be a requirement for maintenance dredging, however the chemical analysis undertaken on sediments within Holyhead Bay for this project indicate that the levels of contamination are very low, with only a few

WFD compliance parameter	Consider if the activity is	Further assessment required?		Notes	
		Yes	No	Presence of reclaimed areas	Presence of approach channel
	It disturbs sediment with contaminants above Cefas Action Level 1				contaminants marginally exceeding Cefas AL1. Any licence sought to undertake this dredging will be supported by further chemical analysis and as such this will be effectively managed post-construction. Therefore, this is **scoped out** of further assessment
Protected Areas	Located within 2 km of any WFD protected area (SAC, SPA, shellfish waters, bathing waters, nutrient sensitive areas)		✓	Both activities are located within the North Anglesey Marine SAC and Anglesey Terns SPA but these are considered in **Chapter 26** so are not considered further here. A shellfish water is located within 2km from the project. Modelling undertaken for the capital dredge indicates that SSCs would not extend this to within this shellfish water. As the maintenance dredging activity will be smaller in scale than the capital dredge, SSCs will not affect this shellfish water. No other Protected Areas are present within 2km.	
Invasive Non-native Species	Capable of spreading INNS		✓	The International Convention for the Control and Management of Ships Ballast Water and Sediments (BWM Convention) was adopted in 2004 and was implemented in 2017. This introduces global regulations to control the transfer of potentially invasive species. With the treaty now in force ships are required to manage their ballast water. Stena Line Ports Ltd have a Biosecurity Plan in place for dredging activity, which was produced in consultation with NRW, in order to prevent the ingress or spread of INNS within the Port area. It will be ensured that the contractor(s) will adhere to best practice to reduce the spread of INNS as far as possible.	

Table 1.6 Surface water summary for operational activities - Holyhead Bay water body

Receptor	Construction of quay walls and reclamation areas	Presence of approach channel
Hydromorphology	No, neither the presence of the reclaimed areas nor the approach channel will have a significant impact on hydromorphology.	
Biology – habitats	No, the reclamation of the areas impacts less than 1% of this waterbody.	No, although some maintenance dredging will be required habitats will be able to recolonise following each activity.
Biology – fish	No, the operational use of the reclaimed areas and approach channel will not have an adverse impact on fish.	
Water quality	No, the presence of the reclaimed areas will not impact water quality.	No, maintenance dredging will not impact water quality.
Chemical	No, the presence of the reclaimed areas will not impact water quality.	No, maintenance dredging will not impact water quality.
Protected areas	No. European designated sites are considered in **Chapter 26**. A shellfish water is located within 2km of the proposed scheme however increased SSCs are not predicted to extend to this area and as such no effects are predicted to occur. There are no other Protected Areas within 2km of the works	
INNS	The port's Biosecurity Plan provides sufficient measures to prevent the spread of INNS	

Appendix M

HRA Screening Report

REPORT

Holyhead Port Expansion

Appendix M – Habitats Regulations Assessment Screening for Likely Significant Effect Report

Client: Stena Line Ports Ltd.

Reference: I&BPB6108R006D0.1

Status: 0.1/Final

Date: 23 June 2019

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Project related

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Acronyms

Acronym	Acronym description
AA	Appropriate Assessment
bCD	below Chart Datum
CCW	Countryside Council of Wales
CIS	Celtic and Irish Sea
cSAC	candidate Special Area of Conservation
EMS	European Marine Site
ES	Environmental Statement
FCS	Favourable Conservation Status
HRA	Habitats Regulation Assessment
IROPI	Imperative Reasons of Over Riding Public Interest
IS	Irish Sea
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effect
MU	Management Unit
MW	Megawatt
NRW	Natural Resources Wales
pSPA	Proposed Special Protection Area
SAC	Special Area of conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STOR	Short-term Operating Reserve
SWEW	South West England and Wales
TSHD	Trailer Suction Hopper Dredger
WADZ	West Anglesey Demonstration Zone

1 Introduction

1.1 Overview

This report presents the outputs of the screening process undertaken under the Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations') on the proposed expansion of Holyhead Port (hereafter referred to as the 'proposed scheme'). Holyhead Port is located on Holy Island (Ynys Gybi) on the western side of the Isle of Anglesey and forms the principal link for surface transport from north Wales and central and northern England to the Republic of Ireland.

The following information is presented in this report:

- An overview of the HRA process and methodology for assessment; and,
- Screening of proposed scheme effects, alone and in-combination with other projects, to determine the potential for 'Likely Significant Effect' (LSE) in respect of the designated interest features of the European sites.

Regulation 63 of the Habitats Regulations defines the procedure for the assessment of the implications of plans or projects on European sites.

2 Proposed Scheme Description

2.1 Overview

A full description of the construction and operation of the proposed scheme can be found in **Chapter 3** of the ES. For ease of reference, the following section presents an abridged version of the proposed scheme description.

2.2 Description of the construction phase

2.2.1 Reclamation areas

The proposed scheme comprises the reclamation of two intertidal/subtidal areas ('Salt Island Expansion' and 'Pelham Patch Development') and the dredging of an approach channel (**Figure 2.1**). It is proposed that the dredged arisings from the approach channel would be used as much as possible as a source of fill material in the reclamation areas. Where this is not possible, land-based sources of suitable granular fill materials will be obtained. For each reclamation area, the placement of fill material will commence at the same time as the construction of the new quay wall. Piling would be undertaken using drilling and driving techniques. The majority of the piling will be done by drilling however, the piles will need to be driven through the soft surface to the hard substrate beneath. Noise modelling will be undertaken in order to assess the impact of noise on sensitive receptors, both on land and within the marine environment. **Table 2.1** summarises the construction works associated with the reclamation areas.

Table 2.1 Summary of reclamation construction works

Site	Use	Construction Works
Salt Island Expansion	New multi-purpose and cruise berth	• Reclamation of the area extending from the northeast to the southeast corner of Salt Island; • Forming approximately 65,750m^2 of new port land; • Requiring 720,000m^3 of fill material; • Construction of a 375m quay wall; • A 30m wall around the lighthouse on Admiralty Pier; • A 100m wall to form the northern extent of the reclaimed area; • A 90m wall extending from the north-eastern extent of the reclaimed area to shelter vessels at berth; • Installation of a reinforced concrete pad; and, • Construction of up to two hi-bay workshops, each with an associated office building.
Pelham Patch Development	New multi-purpose berth and security and customs facility	• Reclamation of the area between Marine Yard and Salt Island; • Forming approximately 24,250m^2 of new port land; • Requiring approximately 163,500m^3 of fill material; • Construction of a 280m quay wall; • Blocking up the culvert running under Salt Island Bridge; • Re-alignment of the fencing and service road to the north of the site which links Salt Island to Holy Island, away from residential and commercial properties; and, • Replacement of the existing perimeter fencing with a more open design to reduce the enclosed character of the area and improve views across the Old Harbour.

An alternative method is considered to be practical for the construction of the quay walls and the retention of infill within the reclamation areas. This involves the use of reinforced concrete caissons (filled with dredge arisings or imported granular material) to form the new quay walls. An alternative for the piled north wall of the Salt Island Expansion reclamation area would be the use of concrete rock armouring to form a rock revetment. The potential environmental impacts from both alternative approaches have been considered within this report.

2.2.2 Approach Channel Dredge

The approach channel to the Port will be deepened to allow navigable access to the Port by larger vessels than is currently possible. The channel will be dredged to a depth of 10m below Chart Datum (bCD) resulting in a total dredge sediment volume of approximately 1.9 million m^3, including an over-dredge allowance of 0.5m. It is estimated that the capital dredge will take up to 12 weeks to complete, commencing in Q1 2020. Maintenance dredging requirements for the approach channel and berths are expected to be low as rates of suspended sediment deposition and the rate of bedload transport in the area are predicted to be minimal (please see **Chapter 8** of the ES for further detail).

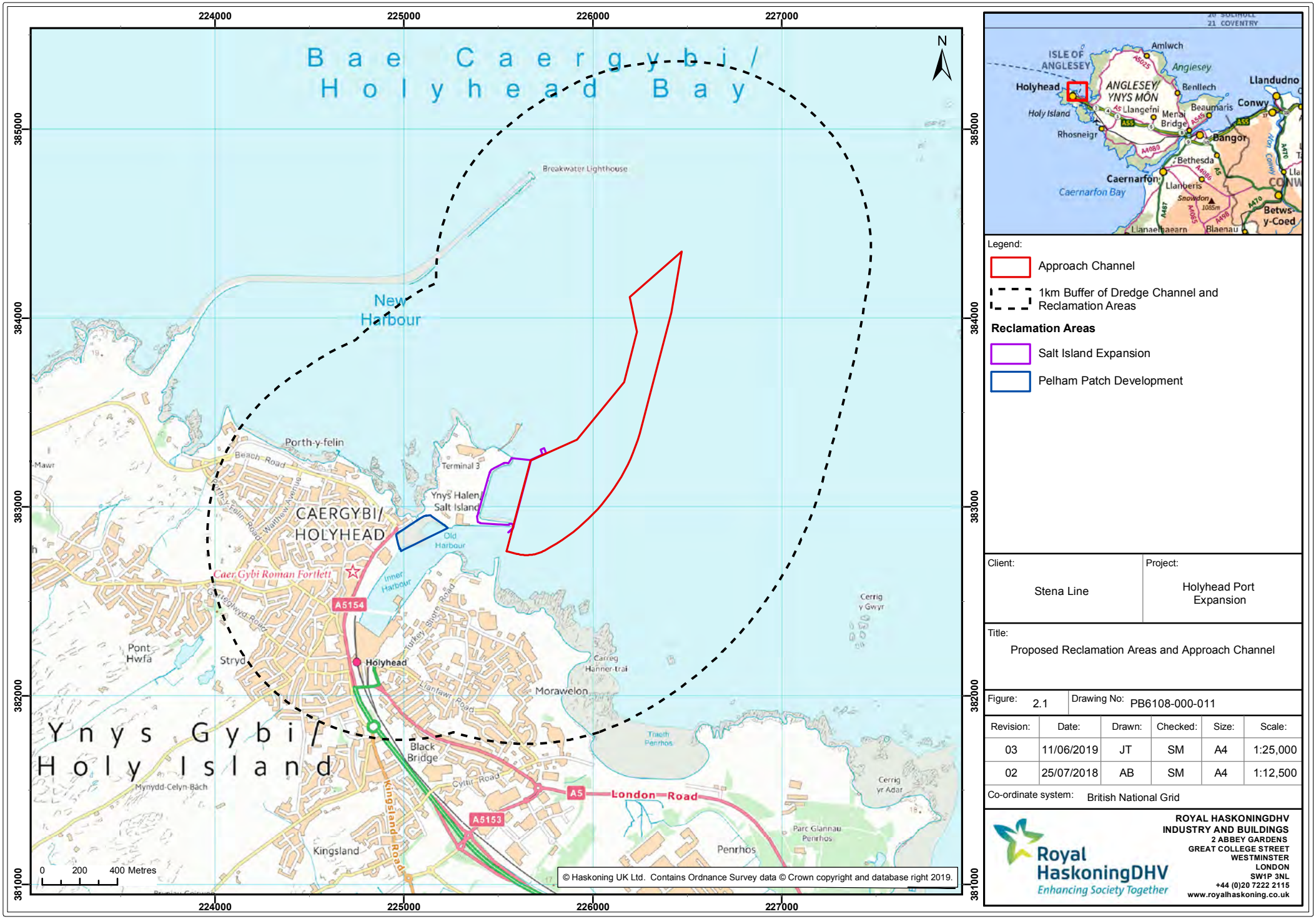
The proposed method of dredging the approach channel is for the softer soils, which can be readily mobilised, to be dredged hydraulically using a trailing suction hopper dredger (TSHD). The TSHD should be capable of dredging sand, gravel and soft clay. The proposed method of dredging rock and firm soils which cannot be dredged using the TSHD is for the soil to be dredged mechanically using a large backhoe dredger. Where dredging of hard soils and rock is required to achieve the required dredge depth, it may be necessary for the backhoe dredger to utilise a rock breaker or ripper to fracture the rock prior to dredging.

2.2.3 Additional dredging

Some dredging within the reclamation areas may be required to remove material that does not provide suitable bearing for the reclamation works. It is anticipated that this dredging would be completed either prior to, or concurrent to, the installation of the quay walls, in which case the dredged soils may be reclaimed to land utilising conventional terrestrial earth moving equipment. If the dredged soils are surplus or unsuitable for re-use on site it would be dredged and taken for offshore disposal.

2.2.4 Disposal of dredged material

Following the re-use of dredged material within the reclamation areas, the total volume of dredged material which is proposed to be disposed of offshore has been estimated. The material is composed of soft clay, firm clay, gravel and rock. As presented in Chapter 3 of the ES, the volume of material to be disposed of offshore differs depending on the method used to construct the quay walls. The total volume to be disposed of offshore would therefore be 1.6Mm^3, depending on the construction methodology used The closest licenced offshore disposal site is Holyhead North (IS043).



Legend:

- Approach Channel
- 1km Buffer of Dredge Channel and Reclamation Areas

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development

Client:	Project:
Stena Line	Holyhead Port Expansion

Title: Proposed Reclamation Areas and Approach Channel

Figure:	Drawing No:
2.1	PB6108-000-011

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	11/06/2019	JT	SM	A4	1:25,000
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Co-ordinate system: British National Grid

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2.3 Description of the operational phase

The proposed use of the two reclaimed areas during the operational phase is summarised in **Table 2.2**.

Table 2.2 Summary of operational phase uses of reclamation areas

Area	Operational Use
Salt Island Expansion	• Provide a new deep-water multi-purpose berth for deep-draught vessels and for cruise vessels that currently use the Orthios Jetty; • Provide additional Roll on-Roll off standage; • Fuel bunkering services available for visiting vessels; and, • Berth to be serviced a two ship-to-shore crane and two warehouses.
Pelham Patch Development	• Provide additional multi-purpose berth for dry bulk vessels and barges; and, • Onshore storage for containers and pallets.

3 HRA Process and Methodology

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the 'Habitats Directive') together with Council Directive 2009/147/EC on the Conservation of Wild Birds (the 'Birds Directive') form the cornerstone of Europe's nature conservation policy and allow for the designation by member states of SACs under the Habitats Directive and SPAs under the Birds Directive. Together, these are known as 'Natura 2000' sites. Where SACs or SPAs consist of areas continuously or intermittently covered by tidal waters or any part of the sea in or adjacent to Great Britain up to the limit of territorial waters, they are also referred to as 'European Marine Sites' (EMS).

The Habitats Regulations implement the requirements of the Habitats and Birds Directives into English and Welsh law. The Habitats Regulations make the 'Appropriate Assessment' (AA) process a mandatory requirement for plans and projects that, either alone or in combination with other plans or projects, are likely to have significant effects on European sites. AA is however only one part of the Habitats Regulations Assessment (HRA) process.

As a matter of policy, the Welsh Government also applies the HRA process to candidate SACs (cSACs), proposed SPAs (pSPAs) and sites designated under the 'Convention on Wetlands of International Importance' ('Ramsar sites') (Welsh Assembly Government, 2009).

Regulation 63 of the Habitats Regulations defines the procedure for the assessment of the implications of plans or projects on European sites. Under this Regulation, if a proposed development is unconnected with site management and is likely to significantly affect the designated site, the competent authority must undertake an 'appropriate assessment' (Regulation 63(1)). The HRA process follows a four-staged approach, which is outlined in the following sections.

3.1 Stage 1 – HRA Screening and test of Likely Significant Effect (LSE)

Screening for LSE is the process of identifying whether the activity is taking place within or near an area being put forward for, or already designated as, a European or Ramsar site, and whether the plan or project is directly connected with or necessary to the management of a European or Ramsar site for nature conservation.

Stage 1 also involves assessing whether a proposed plan or project is likely to have a significant effect on the designated features of a European or Ramsar site, either alone or in-combination with other plans or projects (the 'LSE' test). The proposals must be considered against the attributes in the relevant site(s)' 'Conservation Advice Packages', if available. In the absence of updated conservation advice packages, the previous Regulation 35 (or 33) advice packages should be used.

It should be noted that subsequent to the 'Sweetman' ruling[1], it is not appropriate to take account of mitigation measures to avoid or reduce harmful effects of the plan or project when determining LSE.

[1] *European Court of Justice case of People Over Wind, Peter Sweetman v Coillte Teoranta (C-323/17)*

3.2 Stage 2 – Appropriate Assessment

Where a LSE is predicted, the proposed plan or project must be subject to an AA to determine whether it will have an 'adverse effect on the integrity' of a European or Ramsar site in view of that sites' conservation objectives. The 'integrity' of a European or Ramsar site has been defined as "*the coherence of the site's ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or populations of species for which the site has been designated*"[2]. An adverse effect on integrity, therefore, is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature(s) as it did at the time of designation.

If no adverse effect on integrity is predicted, the plan or project can be approved by the competent authority. This may include the consideration of mitigation measures to reduce the likelihood of such effects. However, should adverse effect on site integrity be concluded, or if uncertainty remains as to the absence of adverse effect, alternative solutions to the proposals should be considered to avoid adverse effect on site integrity occurring (Stage 3).

3.3 Stage 3 – Assessment of Alternative Solutions

Stage 3 involves identifying and examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid or reduce the effect on the site(s) so that an adverse effect on site integrity would not occur.

3.4 Stage 4– Imperative Reasons of Overriding Public Interest (IROPI)

Where no alternative solutions exist, and where an adverse effect on site integrity remains, the next stage of the process is to assess whether the development is necessary for 'Imperative reasons of overriding public interest' (IROPI) (Regulation 64). If IROPI can be demonstrated, compensatory measures need to be identified to maintain the overall coherence of the designated site network (Regulation 68).

3.5 Consultation with Natural Resources Wales

Table 3.1 summarises the responses received that are of relevance to the HRA.

*Table 3.1 Summary of consultation with Natural Resources Wales (from scoping opinion, see **Chapter 6** and **Appendix A**)*

Organisation	Comment	Where addressed
NRW Advisory	The following welsh SACs within the relevant management unit (MU) must be included in the assessment: • Harbour Porpoise: North Anglesey Marine, West Wales Marine, Bristol Channel Approaches (Celtic and Irish Seas (CIS) Management Unit (MU) • Bottlenose Dolphin: Pen Llyn ar Sarnau, Cardigan Bay (Irish Sea (IS) MU) • Grey Seal: Pembrokeshire Marine, Cardigan Bay, Pen Llyn ar Sarnau (South and West England and Wales (SWEW) MU)	Section 5
NRW Advisory	There is a potential for noise disturbance from piling construction to have a significant effect on the harbour porpoise SACs in the management unit north Anglesey Marine cSAC. There is insufficient information in the document for NRW advisory to be able to form an opinion whether there is a likely significant effect. Further information on the number of piles, number of piling	Section 5

[2] *Paragraph 20 of ODPM Circular 06/2005 on Biodiversity and Geological Conservation*

Organisation	Comment	Where addressed
	and drilling days, pile size, substrate, hammer energy and noise source level and frequency of both the vibro-piling and drilling is required to inform a habitat regulation assessment and must be included within the Environmental Statement (ES).	

4 Information on European Sites and Conservation Objectives

The European sites which have been identified within 5km of the proposed scheme (**Figure 4.1**) are:

- Anglesey Terns/Morwenoliaid Ynys Môn SPA;
- North Anglesey Marine/Gogledd Môn Forol SAC; and,
- Holy Island Coast/Glannau Ynys Gybi SPA/SAC.

Additional sites were identified within NRW's scoping opinion in order to assess the potential impact of the proposed scheme on mobile marine mammal species (**Figure 4.1**). These are:

- West Wales Marine/Gorllewin Cymru Forol SAC;
- Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC;
- Lleyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC;
- Cardigan Bay/Bae Ceredigion SAC; and,
- Pembrokeshire Marine/Sir Benfro Forol SAC.

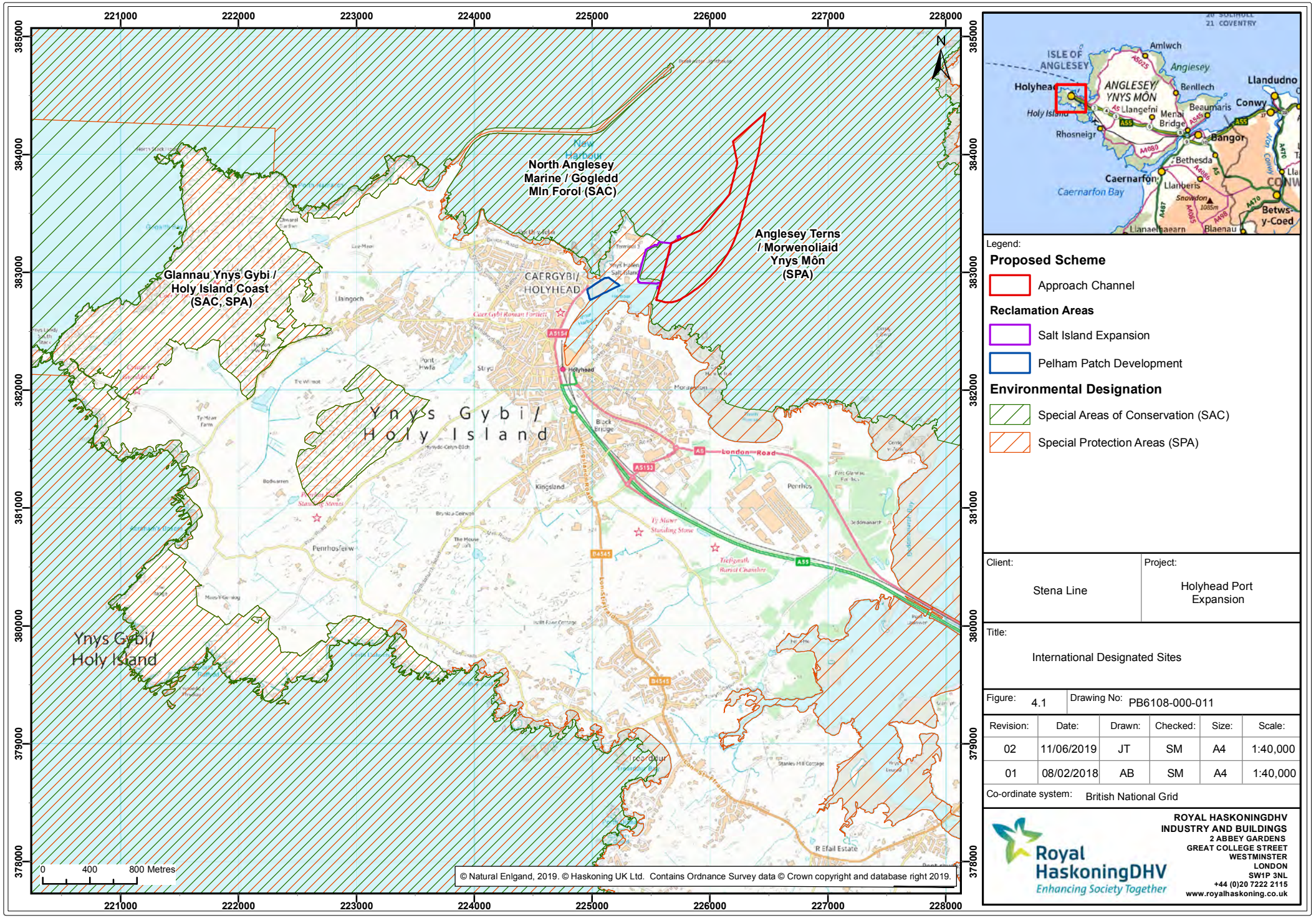
4.1 Anglesey Terns/Morwenoliaid Ynys Môn SPA

The proposed scheme is within the Anglesey Terns/Morwenoliaid Ynys Môn SPA. The site is designated due to its population importance for four species of tern (common tern *Sterna hirundo*, arctic tern *Sterna paradisaea*, roseate tern *Sterna dougalli* and Sandwich tern *Sterna sandvicensis*) (NRW, 2015). The site qualifies as an area used regularly by at least 1% of the Great Britain population of the four species of tern, as listed in Annex I of the Birds Directive.

Table 4.1 Summary of qualifying ornithological interest in Anglesey Terns SPA

Species	Count	% of relevant population	Interest type
Common tern *Sterna hirundo* (breeding)	189 pairs	1.5% of GB population	Annex I species
Arctic tern *Sterna paradisaea* (breeding)	1,290 pairs	2.9% of GB population	Annex I species
Roseate tern *Sterna dougalli* (breeding)	3 pairs	5% of GB population	Annex I species
Sandwich tern *Sterna sandvicensis* (breeding)	460 pairs	3.3% of GB population	Annex I species

The Anglesey Terns SPA incorporates and extends three existing SPAs for terns: Ynys Feurig, Cemlyn Bay and The Skerries SPAs. The purpose of combining and extending the sites is to include the surrounding marine areas used by foraging terns during the breeding season as well as the breeding areas themselves. The Ynys Feurig site is made up of a series of small islets that join the west coast of Anglesey at mid to low tide, while the site of Cemlyn Bay consists of a saline lagoon separated from the sea by a shingle ridge. The Skerries are formed by a group of sparsely vegetated rock formations off the North-West coast of Anglesey (NRW, 2015). The draft Conservation Objectives for the Anglesey Terns SPA are summarised in **Table 4.2** NRW, 2015a).



Legend:

Proposed Scheme

- Approach Channel

Reclamation Areas

- Salt Island Expansion
- Pelham Patch Development

Environmental Designation

- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)

Client:	Project:
Stena Line	Holyhead Port Expansion

Title: International Designated Sites

Figure: 4.1 Drawing No: PB6108-000-011

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
02	11/06/2019	JT	SM	A4	1:40,000
01	08/02/2018	AB	SM	A4	1:40,000

Co-ordinate system: British National Grid

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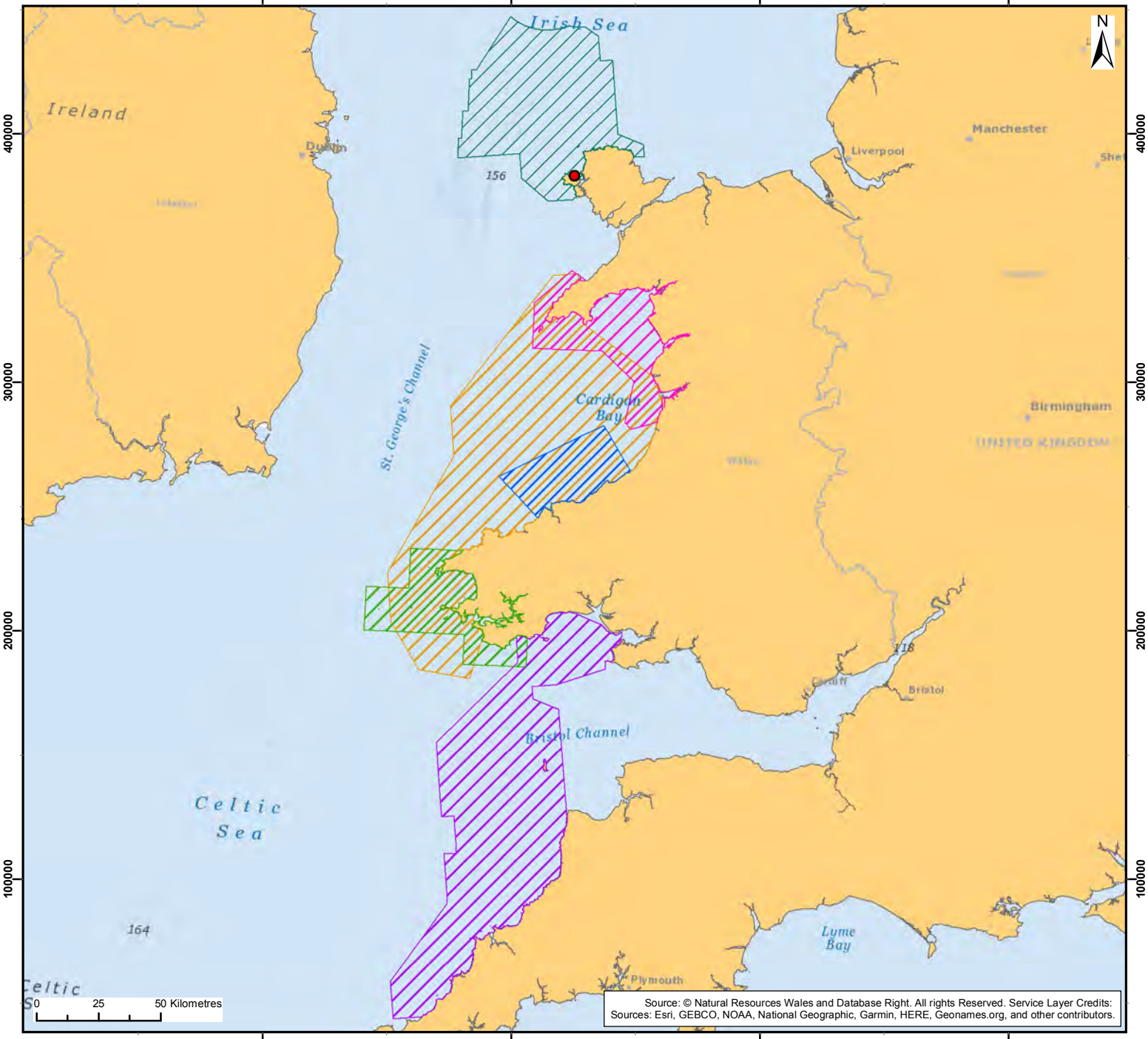

Legend:

- Holyhead Port

Special Areas of Conservation (SAC)

- North Anglesey Marine / Gogledd Mon Forol (SAC)
- Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau (SAC)
- West Wales Marine / Gorllewin Cymru Forol (SAC)
- Cardigan Bay / Bae Ceredigion (SAC)
- Pembrokeshire Marine / Sir Benfro Forol (SAC)
- Bristol Channel Approaches / Dynesfeydd Mor Hafen (SAC)

Client:	Project:
Stena Line	Holyhead Port Expansion

Title: Marine Mammal Special Areas of Conservation (SAC)

Figure: 4.2 | Drawing No: PB6108-108-015

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
03	11/06/19	JT	SM	A4	1:2,250,000
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Co-ordinate system: British National Grid

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Table 4.2 Draft conservation objectives for the Anglesey Terns/Morwenoliaid Ynys Môn SPA (NRW, 2015b)

Objective	Description
The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term.	The breeding population of each designated species should be stable or increasing.
The distribution of the population should be being maintained, or where appropriate increasing.	The range and distribution of terns within the SPA and beyond is not constrained or hindered.
There should be sufficient habitat, of sufficient quality, to support the population in the long term.	The extent of supporting habitats used by terns is stable or increasing. Supporting habitats are of sufficient quality to support the requirements of terns. There are appropriate and sufficient food sources for terns within access of the SPA.
Factors affecting the population or its habitat should be under appropriate control	The number of chicks successfully fledged in the SPA and beyond is sufficient to help sustain the population. Actions or events likely to impinge on the sustainability of the population are under control. There should be no mammalian land predators present in the SPA, and control measures should be in place to ensure that accidental introduction does not take place.

4.2 North Anglesey Marine/Gogledd Môn Forol SAC

The proposed scheme is located within the North Anglesey Marine/Gogledd Môn Forol SAC, which is recognised as an important summer habitat for harbour porpoise, and which has been identified as part of the top 10% persistent high-density areas for the summer seasons within the UK (JNCC and NRW, 2017). The site covers an area of 3,249km^2, reaching north-west from the Isle of Anglesey into the Irish Sea (**Figure 1.1**). This is a single feature site, designated solely for the purpose of aiding the management of harbour porpoise populations throughout UK waters.

The draft conservation objectives for this site are (JNCC *et al.,* 2019):

- To ensure that the integrity of the site is maintained, and the site makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for harbour porpoise in UK waters; and,
- In the context of natural change, this will be achieved by ensuring that:
  - Harbour porpoise is a viable component of the site;
  - There is no significant disturbance of the species; and,
  - The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

With regards to the North Anglesey Marine/Gogledd Môn Forol SAC, harbour porpoise need to be maintained rather than restored. Maintain implies that, based on current knowledge, the feature is regarded as being in favourable condition and will, subject to natural change, remain in this condition.

4.3 Holy Island Coast/Glannau Ynys Gybi SPA

The Holy Island Coast/Glannau Ynys Gybi SPA was designated in 1992 and is located on the west coast of Holy Island (**Figure 1.1**). The site is approximately 352.59ha in area and entirely coincident with three SSSIs: Glannau Ynys Gybi, Tre Wilmot and Glannau Rhoscolyn (CCW, 2008).

The site consists of sea-cliffs with cliff-top heath and grassland. The cliffs are formed from geologically complex and greatly folded strata, comprising grits and sandstones with interbedded shales. The cliffs rise to 120m and the hinterland to 220m on Holyhead Mountain. There are many small offshore stacks and islets. The maritime heath is dominated by heather *Calluna vulgaris*, bell heather *Erica cinerea* and western gorse *Ulex gallii*, and is exposed to strong westerly winds. The site supports a resident population of chough *Pyrrhocorax pyrrhocorax,* which depend on the diverse mix of habitats and their low-intensity agricultural management (CCW, 2008).

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive (**Table 4.3**).

Table 4.3 Summary of qualifying ornithological interest in Holy Island Coast/Glannau Ynys Gybi SPA (CCW, 2008)

Species	Count[3]	% of relevant population	Interest type
Chough *Pyrrhocorax pyrrhocorax* Breeding	18 pairs	5.3% of GB population	Annex I species
Chough Non-breeding	18 pairs	2.6% of GB population	Annex I species

The conservation objective for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied (CCW, 2008):

- The breeding population of chough within the SPA is at least 18 pairs, of which at least 12 should be within the Glannau Ynys Gybi/Tre Wilmot SSSI and at least 6 should be within the Glannau Rhoscolyn SSSI;
- The non-breeding population of chough is at least 18 individuals or 2.5 % of the GB wintering population;
- Sufficient suitable habitat (including Atlantic sea cliffs, maritime grassland, maritime heath, wet heath and dry heath) is present and in appropriate condition to support the breeding populations; and,
- All factors affecting the achievement of these conditions are under control.

4.4 Holy Island Coast/Glannau Ynys Gybi SAC

Holy Island Coast/Glannau Ynys Gybi SAC was designated in 2005 and covers an area of 460ha on Holy Island. Its boundary is entirely coincident with that of two SSSIs: Glannau Ynys Gybi and Tre Wilmot (**Figure 1.1**). **Table 4.4** details the features this site is designated for and their conservation status.

[3] *From 2001 SPA review (Stroud* et al. *2001)*

Table 4.4 Summary of designated features, their conservation status and objectives for Holy Island Coast/Glannau Ynys Gybi SAC (CCW, 2008)

Habitat	Conservation status	Conservation Objective
1230 - Vegetated sea cliffs of the Atlantic and Baltic coasts	Unfavourable	Restore
4010 - Northern Atlantic wet heaths with *Erica tetralix*	Unfavourable declining	Restore
4030 - European dry heaths	Unfavourable declining	Restore

Holy Island Coast/Glannau Ynys Gybi SAC has hard rock acidic cliffs that supports important examples of coastal cliff heathland vegetation. In addition to maritime heath with several rare species such as spotted rock-rose *Tuberaria guttata*, there are extensive maritime cliff-crevice and grassland communities (CCW, 2008).

4.5 West Wales Marine/Gorllewin Cymru Forol SAC

Situated off the coast of Wales from the Llŷn Peninsula in the north to Pembrokeshire in the southwest, the West Wales Marine/Gorllewin Cymru Forol SAC has been identified as an area of importance for harbour porpoise (**Figure 4.1**) (NRW and JNCC, 2019).

The site has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise. The area included within the site covers important summer habitat for porpoises, while parts of the Cardigan Bay area are also identified as important in the winter periods (NRW and JNCC, 2019).

The conservation objectives for the West Wales Marine/Gorllewin Cymru Forol SAC for harbour porpoise are the same as those presented in **Section 4.2** for the North Anglesey Marine/Gogledd Môn Forol SAC.

4.6 Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC

Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC, designated in February 2019 for the protection of harbour porpoise, is within the Celtic and Irish Seas Management Unit (MU). This site spans the Bristol Channel between the northern coast of Cornwall into Carmarthen Bay in Wales (**Figure 4.1**).

The Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise for both important summer and winter habitats (JNCC, 2019). Harbour porpoise presence varies seasonally within this site, occurring all year-round; however, during the winter in persistently higher densities compared to other parts of the Celtic and Irish Seas MU.

The conservation objectives for the Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC for harbour porpoise are the same as those presented in **Section 4.2** for the North Anglesey Marine/Gogledd Môn Forol SAC.

4.7 Llŷn Peninsula and the Sarnau/Pen Llŷn a'r Sarnau SAC

The site covers an area of 1460.11km^2, from the coastlines of the Llŷn Peninsula and the northern part of Cardigan Bay and includes three tidal inlets (**Figure 4.1**). Pen Llŷn a'r Sarnau/Llŷn Peninsula and the Sarnau SAC lists Annex II species bottlenose dolphin (*Tursiops truncatus*) and grey seal (*Halichoerus grypus*) as qualifying features, but they are not a primary reason for site selection (CCW, 2009a).

Bottlenose dolphin are considered to be of significant importance within the Pen Llŷn a'r Sarnau/Llŷn Peninsula and the Sarnau SAC; they do not form a resident population but should be considered as part of the wider Wales population, including those of Cardigan Bay. Photo-identification studies have revealed that the dolphins present in this site travel between the Pen Llŷn a'r Sarnau/Llŷn Peninsula and the Sarnau SAC and Bae Ceredigion/Cardigan Bay SAC. Both these sites are within Cardigan Bay and their population should be considered together (CCW, 2009a and 2009b).
Table 4.5 outlines the conservation objectives which apply to bottlenose dolphin and grey seal.

Table 4.5 The conservation objectives for the Llyn Peninsula and Sarnau/Pen Llyn a'r Sarnau SAC (CCW, 2009a) for bottlenose dolphin and grey seal

Conservation objective	Target
Population	The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: • Population size; • Structure; • Production; and, • Condition of the species within the site. As part of this objective it should be noted that: • Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression; and, • Populations should not be reduced as a consequence of human activity.
Range	The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future: • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered; • There are appropriate and sufficient food resources within the SAC and beyond; and, • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing.
Supporting habitats and species	The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; • Distribution; • Extent; • Structure; • Function and quality of habitat; and, • Prey availability and quality. As part of this objective it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term. • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term.

Conservation objective	Target
	• Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour.
Restoration and recovery	As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.

4.8 Cardigan Bay/Bae Ceredigion SAC

Cardigan Bay is one of the largest bays in the British Isles, measuring over 100km (60 miles) across its westernmost extent from the Llŷn Peninsula to St. David's Head (**Figure 4.1**). The population of bottlenose dolphin forms a primary interest of the Bay and it was for this that the Bay was first selected as a SAC. The SAC covers an area of 958.57km^2, covering an area to the southern extent of Cardigan Bay off the Ceredigion and north Pembrokeshire coastlines extending approximately 12 miles offshore, with 99.5% of the SAC comprising of marine areas and inlets, with a small area of shingle ridges and sea cliffs (CCW, 2009b).

The Cardigan Bay/Bae Ceredigion SAC is a multiple interest site, primarily designated for the bottlenose dolphin, with grey seal listed as a qualifying feature, but not a primary reason for site selection (CCW, 2009b). Cardigan Bay forms one of the biggest resident populations of bottlenose dolphins in the UK, alongside the Moray Firth. Bottlenose dolphins are seen year-round within the SAC. The dolphins appear to use the inshore waters of Cardigan Bay for both feeding and reproduction, and in the summer months calves and juveniles are often observed with adult individuals or groups.

As stated above, with regards to bottlenose dolphin the Cardigan Bay/Bae Ceredigion SAC and Llŷn Peninsula and the Sarnau/Pen Llŷn a'r Sarnau SAC should be considered together. It was estimated in 2007 that there were 397 individuals within the Cardigan Bay/Bae Ceredigion SAC for the period 2001-2007 (CCW, 2009b). More recent population estimates for the wider Cardigan Bay vary between 254 and 330 animals for the years 2011 and 2013 inclusive (Feingold and Evans, 2014). The conservation objectives for the Cardigan Bay/Bae Ceredigion SAC for bottlenose dolphin and grey seal are the same as those presented in **Table 4.5** for the Llŷn Peninsula and the Sarnau/Pen Llŷn a'r Sarnau SAC.

4.9 Pembrokeshire Marine/Sir Benfro Forol SAC

This site covers an area of 1,380.39km^2, including areas of the Pembrokeshire coastline, St Brides Bay and islands of Ramsey, Skomer, Grassolm and Skokholm (**Figure 4.1**). The site was primarily designated for, in part, the Annex I species, including grey seal and shore dock (*Rumex rupestris*) (CCW, 2009c).

The conservation objectives for the Pembrokeshire Marine/Sir Benfro Forol SAC (CCW, 2009c) for grey seal are the same as those presented in **Table 4.5** for the Llŷn Peninsula and the Sarnau/Pen Llŷn a'r Sarnau SAC.

5 Test for Likely Significant Effect

5.1 Introduction

The test for LSE is based on an examination of the likely effects of the proposed scheme on the designated ecological features of the relevant European sites, such that a LSE could arise.

There is no specific definition of what constitutes a LSE; however, guidance (Welsh Assembly Government, 2009) provides information on the determination process and the criteria that can be applied in reaching a decision.

In the context of HRA, LSE is typically taken as any effect that reasonably may be predicted as a consequence of the proposed scheme that may undermine the European Designated Sites' conservation objectives (Welsh Assembly Government, 2009). That is, the term 'likely' infers the presence of a risk that a significant effect could occur. If there is any uncertainty at this screening stage as to whether or not a LSE could arise, the precautionary principle should be applied to ensure that the implications for the site are assessed further at the AA stage.

5.2 Screening Assessment - Alone

The screening assessment of LSE of the proposed scheme alone is presented in **Table 5.1** to **Table 5.9** and in-combination with other relevant plans and projects on European Sites is presented in **Table 5.10** to **Table 5.18**.

Table 5.1 LSE assessment of the proposed scheme on Anglesey Terns/Morwenoliaid Ynys Mon SPA

Name of European Site	**Anglesey Terns/Morwenoliaid Ynys Mon SPA**	
Distance to the Proposed Scheme	**0km (at nearest point)**	
Designated Feature(s)	**Common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), roseate tern (*Sterna dougalli*) and Sandwich tern (*Sterna sandvicensis*)**	
Potential Effects of the Proposed Scheme		**LSE concluded**
Impacts to designated species as a result of disturbance at breeding sites	Breeding sites of the designated tern species are located at Cemlyn Bay, The Skerries and Ynys Feurig which are approximately 13km, 11.5km and 10.5km from the proposed scheme, respectively. As such any noise from construction, dredging or increased traffic would not be detectable to terns at their breeding sites and therefore there will be no LSE.	No
Impacts to designated species as a result of disturbance at foraging sites	The proposed scheme is within the Anglesey Terns SPA, which extends from the breeding sites described above to include foraging areas for terns based on predictive modelling. The rationale for the site boundary is explained in the departmental brief for the SPA (NRW, 2015a). Marine areas adjacent to Holyhead Port were included on the basis of being within the predicted foraging range of Arctic terns breeding within the SPA (this species had the largest predicted foraging range of the three tern species for which the site was classified). The tern foraging range models, based on tracking data for terns breeding within the SPA, indicate that the most intensively used foraging areas are closer to the three breeding colonies. Use of areas further away from the colonies, which are within foraging range (and within the SPA boundary), is less frequent, although these areas are still important. The construction of the port facilities, dredging and piling would create noise levels above background levels. However, any increase in noise will be highly localised and temporary and it is considered highly unlikely that this could cause any avoidance behaviour at the foraging sites. During the operational phase there would be increased vessel traffic associated with the new facilities, though this is not considered to be at levels which might have the potential to impact upon terns using foraging areas, due to the large expanse of foraging areas available. No LSE is therefore predicted as a result of disturbance at foraging sites.	No
Impacts to designated species as a result of loss of foraging habitat	The proposed scheme would result in the loss of approximately 0.02km^2 of intertidal and 0.06km^2 subtidal habitat, which represents the loss of 0.001% and 0.005% of the area of the SPA. It should be noted that most of this habitat would not be lost but would be altered by the initial capital dredge and any subsequent requirement for ongoing maintenance dredging. Given the very small percentage of habitats that would be affected, a LSE on designated species as a result of loss of foraging habitat is not expected.	No

Name of European Site	Anglesey Terns/Morwenoliaid Ynys Mon SPA	
Distance to the Proposed Scheme	**0km (at nearest point)**	
Designated Feature(s)	**Common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), roseate tern (*Sterna dougalli*) and Sandwich tern (*Sterna sandvicensis*)**	
Potential Effects of the Proposed Scheme		**LSE concluded**
Impacts to supporting breeding habitats from changes to coastal processes	Breeding tern colonies within the SPA are located to the north of Anglesey at The Skerries and Cemlyn Bay, approximately 11.5km and 13km from the Port respectively, and to the south at Ynys Feurig, approximately 10.5km from the Port. As such, no LSE on suitable breeding habitats, as a result of reclamation and dredging activities, is therefore predicted.	No
Impacts to supporting foraging habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly effect coastal processes, including hydrodynamic and sedimentary regimes. There is the potential for effects on wave climate and tidal current speeds and direction, both of which drive sediment transport and patterns or erosion and deposition in the coastal and nearshore zones. Due to the presence of the breakwater and the localised nature of the proposed works, effects on coastal processes are considered to be limited to near field and therefore unlikely to have a LSE on supporting foraging habitats within the SPA.	No
Impacts to supporting habitats as a result of pollution events	Best practice control measures would be employed throughout the lifetime of the proposed scheme to avoid and minimise any potential for the release of contaminants, from construction and operational activities. Through the implementation of such measures it is unlikely that a LSE would result.	No

Table 5.2 LSE assessment of the proposed scheme on North Anglesey Marine/Gogledd Mon Forol SAC

Name of European Site	**North Anglesey Marine/Gogledd Môn Forol SAC**	
Distance to Proposed Scheme	**0km (at nearest point)**	**LSE concluded**
Designated Feature	**Harbour porpoise (*Phocoena phocoena*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or auditory injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling, and impact piling). Vessel noise and dredging have the potential to disturb harbour porpoise, and any underwater noise from piling has the potential to cause auditory injury and disturbance to harbour porpoise within the SAC site. To determine the potential effects of underwater noise on harbour porpoise, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage during operation has the potential to increase the risk of collision to harbour porpoise. Harbour porpoise are a small, mobile species and are expected to be able to avoid vessel collisions as they are known to actively avoid vessel noise. However, the potential for an increase in collision risk during the construction and operational phases of the proposed scheme will be considered further in the HRA process.	**Yes**
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. There is the potential for effects on wave climate and tidal current speeds and direction, both of which drive sediment transport and patterns or erosion and deposition in the coastal and nearshore zones. Due to the presence of the breakwater and the localised nature of the proposed works, effects on coastal processes are considered to be limited to near field and therefore are considered unlikely to have the potential for LSE on supporting habitats for harbour porpoise and their prey. However, as a precautionary measure, detailed modelling is being undertaken in order to assess the impact of the change in coastal processes (and sediment regimes) on harbour porpoise and their prey. As such the potential for LSE cannot be discounted at this stage. The results of the Coastal Processes and Marine Water and Sediment Quality chapters of the ES (**Chapters 8** and **9**) will be used to inform this assessment.	**Yes**
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practice control measures would be employed throughout the lifetime of the proposed scheme to avoid minimise any risk, however this would be subject to further review once the construction method statement is in place to ensure that working methods are not likely to give rise to pollution release. The results of the Coastal Processes and Marine Water and Sediment Quality chapters (**Chapters 8** and **9**) of the ES will be used to inform the assessment.	**Yes**
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on harbour porpoise prey species present in the SAC site. It is not possible at this time to rule out any potential for LSE on the supporting prey species in the site SAC and therefore these impacts will be assessed further, using the results of the Fish and Shellfish Resource (**Chapter 11**) of the ES to inform the assessment.	**Yes**

Table 5.3 LSE assessment of the proposed scheme on Holy Island Coast/Glannau Ynys Gybi SPA

Name of European Site	**Holy Island Coast/Glannau Ynys Gybi SPA**	
Distance to Proposed Scheme	**2km (at nearest point)**	**LSE concluded**
Designated Feature	**Chough (*Pyrrhocorax pyrrhocorax*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance	The construction of the proposed scheme would create noise levels above background levels. However, any increase in noise would be highly localised and, due to the distance of the designated site from the port, would not be detectable within the SPA boundary and as such would not have a LSE on breeding or wintering chough.	No
Impacts to terrestrial supporting habitats from changes to coastal processes	Due to the highly localised nature of the proposed scheme it would not have a LSE on the terrestrial supporting habitats for chough.	No
Impacts to supporting habitats below the MHWS level from changes to coastal processes	Chough feed on invertebrates found in on the intertidal in strandlines of rotting seaweed during the winter months and therefore may be adversely impacted by changes in coastal processes. The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes. There is the potential for effects on wave climate and tidal current speeds and direction, both of which drive sediment transport and patterns or erosion and deposition in the coastal and nearshore zones. Due to the presence of the breakwater and the localised nature of the proposed works, effects on coastal processes are considered to be limited to near field and therefore it is considered highly unlikely there will be a LSE on supporting habitats for chough.	No
Impacts to supporting habitats as a result of contamination	Best practice control measures will be employed throughout the lifetime of the proposed scheme. Through the implementation of such measures it is considered highly unlikely that there is potential for a LSE.	No

Table 5.4 LSE assessment of the proposed scheme on Holy Island Coast/Glannau Ynys Gybi SAC

Name of European Site	**Holy Island Coast/Glannau Ynys Gybi SAC**	
Distance to Proposed Scheme	**2km (at nearest point)**	**LSE concluded**
Potential Effects of the Proposed Scheme		
Designated Feature	**Vegetated sea cliffs of the Atlantic and Baltic Coasts**	
Impacts to designated habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes. There is the potential for effects on wave climate and tidal current speeds and direction, both of which drive sediment transport and patterns or erosion and deposition in the coastal and nearshore. Due to the presence of the breakwater and the localised nature of the proposed works, effects on coastal processes are considered to be limited to near field and therefore it is considered unlikely there will be the potential for a LSE on designated habitats.	No
Designated Feature	**European dry heaths**	
Impacts to designated habitats during construction and operational phases	The proposed scheme is a marine project so would not have an LSE on this terrestrial habitat, both as a result of the distance of the proposed scheme from this designated site and the absence of an impact pathway.	No
Designated Feature	**Northern Atlantic wet heaths with *Erica tetralix***	
Impacts to designated habitats during construction and operational phases	The proposed scheme is a marine project and will not have an LSE on this terrestrial habitat, both as a result of the distance of the proposed scheme from this designated site and the absence of an impact pathway.	No

Table 5.5 LSE assessment of the proposed scheme on West Wales Marine/Gorllewin Cymru Forol SAC

Name of European Site	**West Wales Marine/Gorllewin Cymru Forol SAC**	
Distance to Proposed Scheme	**47km (distance measured as realistic ecological path around the coastline)**	**LSE concluded**
Designated Feature	**Harbour porpoise (*Phocoena phocoena*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling and impact piling). Vessel noise and dredging have the potential to disturb harbour porpoise, and any underwater noise from piling has the potential to cause auditory injury and disturbance to harbour porpoise within the SAC site. To determine the potential effects of underwater noise on harbour porpoise, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage during operation has the potential to increase the risk of collision to harbour porpoise. It is not possible to rule out the potential for an increase in collision risk and the potential for LSE on harbour porpoise from the SAC site. Therefore, the potential for LSE as a result of an increase in collision risk during construction and operation will be assessed further.	**Yes**
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. However, given the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats from changes to coastal processes.	No
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practise control measures will be employed throughout the lifetime of the proposed scheme, and it is considered that through the implementation of such measures it is unlikely that there will be a LSE. Taking into account the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats as a result of contamination.	No
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for impacts on harbour porpoise prey species. However, given the distance from the proposed scheme and the SAC site, there is no potential for LSE on harbour porpoise prey species from habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on the prey species present in the SAC site.	No

Table 5.6 LSE assessment of the proposed scheme on Bristol Channel Approaches/Dynesfeydd Mor Hafren SAC

Name of European Site	**Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC**	
Distance to Proposed Scheme	**230km (distance measured as realistic ecological path around the coastline)**	**LSE concluded**
Designated Feature	**Harbour porpoise (*Phocoena phocoena*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling and impact piling). Vessel noise and dredging have the potential to disturb harbour porpoise, and any underwater noise from piling has the potential to cause auditory injury and disturbance to harbour porpoise within the SAC site. To determine the potential effects of underwater noise on harbour porpoise, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage during operation has the potential to increase the risk of collision to harbour porpoise. It is not possible to rule out the potential for an increase in collision risk and the potential for LSE on harbour porpoise from the SAC site. Therefore, the potential for LSE as a result of an increase in collision risk during construction and operation will be assessed further.	**Yes**
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. However, given the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats from changes to coastal processes.	No
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practise control measures will be employed throughout the lifetime of the proposed scheme, and it is considered that through the implementation of such measures it is unlikely that there will be a LSE. Taking this into account and the distance of the proposed scheme from the SAC site, there is no potential LSE to supporting habitats as a result of contamination.	No
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for impacts on harbour porpoise prey species. However, given the distance from the proposed scheme and the SAC site, there is no potential for LSE on harbour porpoise prey species from habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on the prey species present in the SAC site.	No

Table 5.7 LSE assessment of the proposed scheme on Lleyn Peninsula and the Sarnau/Pen Llyn a'r Sarnau SAC

Name of European Site	**Llyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC**	
Distance to Proposed Scheme	**45km (distance measured as realistic ecological path around the coastline)**	**LSE concluded**
Designated Feature	**Bottlenose dolphin (*Tursiops truncatus*) and grey seal (*Halichoerus grypus*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling and impact piling). Vessel noise and dredging have the potential to disturb bottlenose dolphin and grey seal, and any underwater noise piling works has the potential to cause auditory injury and disturbance to bottlenose dolphin and grey seal from the SAC site. To determine the potential effects of underwater noise on bottlenose dolphin and grey seal, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to grey seal as a result of disturbance at haul-out sites	The increase in vessel presence during both the construction and operation phases of the proposed scheme has the potential to cause disturbance to seals at haul-out sites along the coastline in the SAC. However, given the distance from the proposed scheme to the SAC site, there is no potential for any direct disturbance of grey seal at haul-out sites in the SAC as a result of construction vessels. There is also no potential for LSE as a result of increased vessel movements during the operation phase as vessels moving to and from the port would use established vessels routes and would not be within close proximity of the coastline in the SAC site.	No
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage during operation has the potential to increase the risk of collision to bottlenose dolphin and grey seal. It is not possible to rule out the potential for an increase in collision risk and the potential for LSE on bottlenose dolphin and grey seal from the SAC site. Therefore, the potential for LSE as a result of an increase in collision risk during construction and operation will be assessed further.	**Yes**
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. However, given the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats in the SAC from any changes to coastal processes.	No
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practice control measures will be employed throughout the lifetime of the proposed scheme, and it is considered that through the implementation of such measures it is unlikely that a LSE would occur. Taking this and the distance of the proposed scheme from the SAC site into account there is therefore no potential LSE to supporting habitats in the SAC as a result of contamination.	No
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for impacts on bottlenose dolphin and grey seal prey species. However, given the distance from the proposed scheme and the SAC site, there is no potential for LSE on bottlenose dolphin and grey seal prey species from habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on the prey species present in the SAC site.	No

Table 5.8 LSE assessment of the Proposed scheme on Cardigan Bay/Bae Ceredigion SAC

Name of European Site	**Cardigan Bay/Bae Ceredigion SAC**	
Distance to Proposed Scheme	**114km (distance measured as realistic ecological path around the coastline)**	**LSE concluded**
Designated Feature	**Bottlenose dolphin (*Tursiops truncatus*) and grey seal (*Halichoerus grypus*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling and impact piling). Vessel noise and dredging have the potential to disturb bottlenose dolphin and grey seal, and any underwater noise piling works has the potential to cause auditory injury and disturbance to bottlenose dolphin and grey seal from the SAC site. To determine the potential effects of underwater noise on bottlenose dolphin and grey seal, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage during operation has the potential to increase the risk of collision to bottlenose dolphin and grey seal. It is not possible to rule out the potential for an increase in collision risk and the potential for LSE on bottlenose dolphin and grey seal from the SAC site. Therefore, the potential for LSE as a result of an increase in collision risk during construction and operation will be assessed further.	**Yes**
Impacts to grey seal as a result of disturbance at haul-out sites	The increase in vessel presence during both the construction and operation phases of the proposed scheme has the potential to cause disturbance to seals at haul-out sites along the coastline in the SAC. However, given the distance from the proposed scheme to the SAC site, there is no potential for any direct disturbance of grey seal at haul-out sites in the SAC as a result of construction vessels. There is also no potential for LSE as a result of increased vessel movements during the operation phase as vessels moving to and from the port would use established vessels routes and would not be within close proximity of the coastline in the SAC site.	No
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. However, given the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats in the SAC from any changes to coastal processes.	No
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practise control measures will be employed throughout the lifetime of the proposed scheme, and it is considered that through the implementation of such measures it is unlikely that there will be a LSE. Taking this and the distance of the proposed scheme from the SAC site into account there is no potential LSE to supporting habitats in the SAC as a result of contamination.	No
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for impacts on bottlenose dolphin and grey seal prey species. However, given the distance from the proposed scheme and the SAC site, there is no potential for LSE on bottlenose dolphin and grey seal prey species from habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on the prey species present in the SAC site.	No

Table 5.9 LSE assessment of the proposed scheme on Pembrokeshire Marine/Sir Benfro Forol SAC

Name of European Site	**Pembrokeshire Marine/Sir Benfro Forol SAC**	
Distance to Proposed Scheme	**163km (distance measured as realistic ecological path around the coastline)**	**LSE concluded**
Designated Feature	**Grey seal (*Halichoerus grypus*)**	
Potential Effects of the Proposed Scheme		
Impacts to designated species as a result of disturbance and/or injury from underwater noise	Underwater noise sources from the proposed scheme include vessels, dredging works and underwater piling (options include drilling, vibro-piling and impact piling). Vessel noise and dredging have the potential to disturb grey seal, and any underwater noise piling works has the potential to cause auditory injury and disturbance to bottlenose dolphin and grey seal from the SAC site. To determine the potential effects of underwater noise on grey seal, underwater noise modelling will be undertaken to inform the HRA process.	**Yes**
Impacts to designated species as a result of increased collision risk	The presence of both construction vessels and the increase in vessel usage of the proposed scheme has the potential to also increase the risk of collision to grey seal, through both the construction and operation phases of the proposed scheme. It is not possible to rule out the potential for an increase in collision risk and the potential for LSE on the site at present. Therefore, the potential for LSE as a result of an increase in collision risk will be assessed further.	**Yes**
Impacts to grey seal as a result of disturbance at haul-out sites	The increase in vessel presence during both the construction and operation phases of the proposed scheme has the potential to cause disturbance to seals at haul-out sites along the coastline in the SAC. However, given the distance from the proposed scheme to the SAC site, there is no potential for any direct disturbance of grey seal at haul-out sites in the SAC as a result of construction vessels. There is also no potential for LSE as a result of increased vessel movements during the operation phase as vessels moving to and from the port would use established vessels routes and would not be within close proximity of the coastline in the SAC site.	No
Impacts to supporting habitats from changes to coastal processes	The proposed scheme has the potential to directly and indirectly change coastal processes, including hydrodynamic and sedimentary regimes, through land reclamation and dredging. However, given the distance of the proposed scheme from the SAC site there is no potential LSE to supporting habitats in the SAC from any changes to coastal processes.	No
Impacts to supporting habitats as a result of contamination	There is the potential for any re-suspended sediments to introduce contamination into the marine environment from the dredging works. Best practise control measures will be employed throughout the lifetime of the proposed scheme, and it is considered that through the implementation of such measures it is unlikely that there will be a LSE. Taking this and the distance of the proposed scheme from the SAC site into account there is no potential LSE to supporting habitats in the SAC as a result of contamination.	No
Impacts to prey species as a result of habitat loss, underwater noise, contamination and increase in suspended sediments	There is potential for impacts on grey seal prey species. However, given the distance from the proposed scheme and the SAC site, there is no potential for LSE on grey seal prey species from habitat loss as a result of the reclamation, underwater noise sources including vessel noise, dredging works and underwater piling, changes to coastal processes (including the sediment regime) and the potential for increase in contamination as a result of re-suspended sediments to impact on the prey species present in the SAC site.	No

5.3 Screening Assessment - In-combination

The following proposed plans and projects are considered to have the potential to have 'in-combination' effects with the proposed scheme:

- **Holyhead Deep Tidal Array - Phase 1 (Minesto)** – Phase 1 Demonstration Phase will comprise a single 0.5 MW device with a maximum operational period of five years, which will be installed during 2018. At this stage, it is known that onshore infrastructure and further turbines will be proposed for construction, but the details are not known (Minesto, 2016). The site will be located in the southern half of the former 'Holyhead Deep' licenced dredge disposal site.
- **West Anglesey Demonstration Zone (WADZ)** – Morlais Marine Energy are proposing a tidal demonstration array to the south of the former Holyhead Deep disposal site. The proposals also incorporate offshore electrical infrastructure, offshore inter-array cables, landfall and onshore cable route and an onshore substation. The landfall for the export cable from the WADZ will be at Abraham's Bosom on the west of the island. (Royal HaskoningDHV, 2015).
- **Wylfa Newydd Nuclear Power Plant** – Horizon Nuclear Power are proposing the construction of a new nuclear power station. The site is on land beside the former Magnox Wylfa Power Station, which is now being decommissioned. The new nuclear power station at Wylfa is expected to comprise the following components: a power station incorporating nuclear reactors with a combined generating capacity of up to 5.3 GW; construction stage areas and facilities, including a marine off-loading facility; infrastructure and ancillary facilities associated with the operation of a nuclear power station site including cooling water infrastructure; electricity transmission infrastructure; interim waste storage facilities; access roads; and Landscape and biodiversity initiatives and mitigation measures associated with the construction and operation of a new power station (Horizon Nuclear Power, 2009). Disposal of dredged materials will be undertaken at the newly designated 'Holyhead North' dredge disposal site, the northern half of the previous 'Holyhead Deep' disposal site.
- **Anglesey Eco Park and Biomass Energy Centre** – Orthios Group are proposing a 299MW Energy Centre and Eco Park in Penhros, Holyhead, which will comprise: a 299MW biomass power station with aquaculture and hydroponic facilities, a compostable food packaging facility and a deep-water jetty for bulk import. Currently two proposals are being put forward for the project, a Polymer Processing Centre and a Biomass Processing Centre. The Polymer Processing Centre will be fuelled by UK polymers and waste forestry products. The Biomass Processing Centre will process waste wood chippings to produce power and heat[4].
- **Holyhead Waterfront Regeneration** – A joint venture between Stena Line and Conygar Investment Company PLC (Conygar), who are proposing a mixed-use marina development on Newly Beach, Holyhead. This development would include 326 homes, a 500 berth marina and 50,000 sq.ft of marine related retail, leisure,

[4] *http://www.orthios.com/projects/) [Accessed December 2016]*

restaurants hotel and office space. Outline planning permission for this development was granted in 2014; however, no development works have begun. The submission of reserved matters still needs to be made and a marine licence applied for.

- **Holyhead Marina** - Holyhead Marina Ltd. have proposed plans to rebuild the storm (Storm Emma) devastated site and build a new harbour wall. Conygar Investment Company have agreed subject to contract, with their partner, Stena Line Ports Limited to take full control of the joint venture. As part of the transaction, the joint venture company will grant 999-year leases to Stena of the platform at Soldier's Point and currently used by Stena. This development would include a 500 berth marina protected by a half kilometre long "rubble mound breakwater". A detailed assessment of the environmental implications of this type of permanent construction. The plan was given outline permission in June 2018 but Anglesey officials sought advice from the Welsh government.
- **Gwynt y Môr Offshore Wind Farm** - Innogy operates the offshore wind farm with its partners Stadtwerke München, Siemens and UK Green Investment bank. In 2018, the Crowne Estate announced its intention to grant rights to extend seven offshore wind farms, including Gwynt y Môr, subject to a successful HRA. The proposed extension will be no greater than the current operational wind farm capacity (576 MW). The HRA is expected to finish Summer of 2019, after which The Crown Estate will award and Agreement to Lease.
- **Wylfa Decommissioning** – The Wylfa Nuclear Power Station is a former Magnox power station and ceased electricity generation in December 2015. Decommissioning of Wylfa will involve the careful and systematic removal of all plant, equipment and building from the site including the nuclear reactors and all waste. This decommissioning will compromise of three main stages: (1) care and maintenance preparation, estimated to take approximately 10 years to compile; (2) car and maintenance, will last for a number of decades; and, (3) final site clearance, expected to take about eight years. The site is situated west of Cemaes Bay on the Isle of Anglesey.

The following projects are taking place in the vicinity of the proposed scheme, but are not considered to have the potential for a LSE on the European sites, either alone or in-combination:

- **Holy Island Resort** - Land and Lakes and Bluestone Development have planning permission to construct a luxury holiday destination on the Penrhos Estate, including 500 lodges, restaurants, a spa and water park. The project aims to open in 2021. The need for an HRA for this project was scoped out at the start of the application process as the development is not considered to have the potential to significantly affect any European sites.
- **M-Sparc** - Wales' first science park with and estimated investment of £20 million. Construction began in 2016 and the first building is now open and operational. It comprises of meeting spaces, hot desking facilities and lab/workshop space with a café for hosting larger events. This project is located in Gaerwen, on the Isle of Anglesey approximately 24km from the proposed scheme and the boundary of the closest designated site and as such is there is no potential for in-combination effects.

- **Coleg Menai Llangefni** – This development includes proposals for a new Engineering Centre, a Scaffolding training centre and proposals for housing, restaurants and a hotel. The development was given planning approval in July 2017. This development is located approximately 24km away from the proposed scheme and as such there is no potential for in-combination effects.
- **Caergeiling - Short-Term Operativing Reserve (STOR)** – This project is for the installation of generators and associated infrastructure to provide a Short-Term Operating Reserve (STOR) facility with an anticipated capacity of approximately 48MW at Caergeiliog on Anglesey. It is not known whether an HRA will be required for this project; owever, the project is located approximately 7km from the proposed scheme and as such there is no potential for in-combination effects.
- **Holyhead Truck Stop Hotel** – This project is for a 80 bedroom hotel including an ancillary restaurant/bar, parking and turning areas for 84 cars, cycling and bin stores and landscaping. The proposal would be of three and four storeys and have a maximum height of 14.4 metres. The application site is located on an undeveloped plot on the entrance to the Parc Cybi Industrial Estate. The site amounts to an area of 0.68 hectares. The application site is within the Area of Outstanding Natural Beauty. This development is located 5 km from the proposed scheme and as such there is no potential for in-combination effects.
- **A 5MW Solar Farm on Anglesey** – This project comprises the installation of solar PV arrays each measuring 1m x 65m at an angle of 15-30 degrees and maximum height of 3m in height which will connect to the national grid with a maximum energy generating capacity of 49.99MW. The application site, which extends to 0.83 hectares is located with an area of open countryside currently in use as agricultural grazing land. The project is located 43km from the proposed scheme and as such there is no potential for in-combination effects.
- **Hafan y Mor Holiday Park** -This project is for a new extension (242sqm GEA) proposed to the side of the sports drome building which is to accommodate an extended fitness centre, a new reception and entrance as well as an indoor climbing wall. In addition, a new concourse is proposed in front of the extension and existing roads and caravans will be re-aligned where necessary. The project is located over 70km from the proposed scheme and as such there is no potential for in-combination effects.
- **Marine Energy Testing area** –This project consists of test sites where marine energy testing activities will be permitted, firstly, directly adjacent to Pembroke Port Infrastructure. Marine Energy Wales have just submitted a scoping report to Natural Resources Wales and relevant stakeholders. This project is yet consented, nor has a planning application been submitted. Any activity with this project will occur after the proposed scheme, and therefore there will be no potential for in-combination effect.
- **Amlwch LNG** – The project is for a renewal of planning consent for a new Liquid Natural Gas (LNG) plant in Anglesey. Under the proposals tankers will import liquid gas to a mooring 3km from the Amlwch coast. It is currently unknown if and when the project will commence. It is therefore assumed that any activity undertaken will occur

after the proposed scheme has been constructed. The project is located 32km from the proposed scheme and as such there is no potential for in-combination effects.

- **Ireland – United Kingdom electricity Interconnection** -The project is to put physical links which allow the transfer of electricity across the border of UK and Ireland cheaply. This project is not yet consented, nor has a planning application been submitted. United Kingdom Interconnector project will occur after the proposed scheme has been constructed and therefore there will be no potential for in-combination effect.
- **Fishguard port linkspan replacement** – Stenna Line Ports Limited is to apply to authorise construction of a new linkspan bright at the harbour for the ferry service between Fishguard Port in Wales and Rosslare, County Wexford in the Republic of Ireland. The project involves the replacement of the existing linkspan and associated infrastructure. This project is yet consented, nor has a planning application been submitted. Any activity with this project will occur after the proposed scheme, and therefore there will be no potential for in-combination effect.
- **Fishguard Marina Development** – The project is for a 450-berth marina and 250 apartments in Fishguard. The marina development is part of a major regeneration plan drawn up for north Pembrokeshire. Stena Line, the Fishguard harbour operator has now withdrawn from the project. It is therefore assumed that any activity undertaken as part of the Fishguard port linkspan replacement project will occur after the proposed scheme has been constructed, and therefore there will be no potential for in-combination effect.

Table 5.10 to **Table 5.18** present the assessment of whether the proposed scheme has the potential to have in-combination effects with the plans or projects listed above on the designated features of the relevant European sites.

Table 5.10 In-combination Assessment - Anglesey Terns/Morwenoliaid Ynys Mon SPA

Name of European Site	**Anglesey Terns/Morwenoliaid Ynys Mon SPA**	
Designated Features	**Common Tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), roseate tern (*Sterna dougalli*) and Sandwich tern (*Sterna sandvicensis*)**	
Potential effects of the plan or project in-combination with the proposed scheme		**LSE concluded**
Holyhead Deep Phase 1	The EIA for this project determined that this project would not have an adverse effect on the integrity of this site as the designated features are considered to have low or very low sensitivity to tidal devices. Due to the location of Holyhead Deep Phase 1, approximately 12km along the coast from Holyhead Harbour, on the west side of Holy Island, it is therefore considered very unlikely that there would be in-combination effects with the proposed scheme.	No
WADZ	Due to the location of WADZ on the west side of Holy Island (approximately 12km along the coast from Holyhead Harbour) it is considered very unlikely that there would be in-combination effects with the proposed scheme.	No
Wylfa Newydd Nuclear Power Plant	The Shadow HRA for this project (as submitted to the Planning Inspectorate) concluded that, with the adoption of the proposed mitigation measures (including those embedded in the design) there would be no adverse effect on the designated features of the Anglesey Terns/Morwenoliaid Ynys Mon SPA either alone or in-combination with other plans or projects. Although this application is currently subject to determination, due to the reason outlined above it is considered unlikely that the proposed scheme has the potential to have in-combination effects with the Wylfa Newydd project.	No
Anglesey Ecopark and Biomass Energy Centre	No development is planned in the marine environment, therefore there is no direct interaction anticipated with terns and no likelihood of in-combination effects with the proposed scheme.	No
Holyhead Waterfront Regeneration	This is a harbour front development; therefore, no direct interaction is anticipated with tern foraging locations. No in-combination effects are therefore predicted.	No
Holyhead Marina	This is a marina development; therefore, no direct interation is anticipated with tern foraging locations. No in-combination effects are therefore predicted.	No
Wylfa Decommissioning	The HRA for this project concluded that there would be no adverse effect on the Ynys Feurig, Cemlyn Bay and The Skerries SPA (now subsumed within the Anglesey Terns SPA) nor would it inhibit the delivery of Conservation Objectives. No in-combination effects are therefore predicted.	No

Table 5.11 In-combination Assessment - North Anglesey Marine/Gogledd Môn Forol SAC

Name of European Site	**North Anglesey Marine/Gogledd Môn Forol SAC**	
Designated Feature	**Harbour Porpoise (*Phocoena phocoena*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme, and that both projects are within the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and that both projects are within the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and that both projects are within the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with harbour porpoise. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Gwynt y Môr Offshore Wind Farm	Due to the underwater noise effects from the Gwynt y Môr Offshore Wind Farm the is potential for in-combination noise effects.	**Yes**
Wylfa Decommissioning	Due to the location of the Wylfa Nuclear Power Station in proximity to the proposed scheme and that both projects are within the SAC site, there is potential for in-combination effects on harbour porpoises. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**

Table 5.12 In-combination Assessment - Holy Island Coast/Glannau Ynys Gybi SPA

Name of European Site	**Holy Island Coast/Glannau Ynys Gybi SPA**	
Designated Feature	**Chough (*Pyrrhocorax pyrrhocorax*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	This project is located approximately 12km around the coast from Holyhead Harbour and is approximately 6.5km from the SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
WADZ	This project is approximately 10km around the coast from Holyhead Harbour and approximately 4km from the nearest boundary of the SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
Wylfa Newydd Nuclear Power Plant	Shadow HRA: It has been concluded that there is no likelihood of an adverse effect arising with regard to the conservation objectives for chough as a qualifying feature of this SPA. It has also been concluded that there is no potential for LSE with any other plans or projects. As such no in-combination effects are therefore predicted.	No
Anglesey Ecopark and Biomass Energy Centre	This project is approximately 3km from the nearest SPA boundary and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	This project is located approximately 2km from the nearest boundary of the SPA that there will be no direct or indirect pathways impacts to this site. No in-combination effects are therefore predicted.	No
Holyhead Marina	This project is located approximately 2km from the nearest boundary of the SPA that there will be no direct or indirect pathways impacts to this site. No in-combination effects are therefore predicted.	No
Wylfa Decommissioning	Due to the nature of the decommissioning activities and the distance of the works from this site, this site was screened out of further assessment. No in-combination effects are therefore predicted.	No

Table 5.13 In-combination Assessment - Holy Island Coast/Glannau Ynys Gybi SAC

Name of European Site	**Holy Island Coast/Glannau Ynys Gybi SAC**	
Designated Features	**Vegetated sea cliffs of the Atlantic and Baltic Coasts, European dry heaths and Northern Atlantic wet heaths with *Erica tetralix***	
Potential effects of the plan or project in-combination with the proposed Proposed scheme		**LSE concluded**
Holyhead Deep Phase 1	This project is located approximately 12km around the coast from Holyhead Harbour and is approximately 6.5km from the SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
WADZ	This project is approximately 10km around the coast from Holyhead Harbour and approximately 4km from the nearest boundary of the SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
Wylfa Newydd Nuclear Power Plant	This project is approximately 15km from the nearest boundary of this SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No
Anglesey Ecopark and Biomass Energy Centre	This project is approximately 3km from the nearest SPA boundary and as such there will be no direct or indirect pathways impacts to this site. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	This project is located approximately 2km from the nearest boundary of the SPA that there will be no direct or indirect pathways impacts to this site. No in-combination effects are therefore predicted.	No
Holyhead Marina	This project is located approximately 2km from the nearest boundary of the SPA that there will be no direct or indirect pathways impacts to this site. No in-combination effects are therefore predicted.	No
Wylfa Decommissioning	This project is approximately 15km from the nearest boundary of this SPA and as such there will be no direct or indirect pathways for impacts to this site. No in-combination effects are therefore predicted.	No

Table 5.14 In combination Assessment - West Wales Marine/Gorllewin Cymru Forol SAC

Name of European Site	West Wales Marine/Gorllewin Cymru Forol SAC	
Designated Feature	**Harbour Porpoise (*Phocoena phocoena*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with harbour porpoise. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further.	**Yes**
Wylfa Decommissioning	Due to the nature of the decommissioning activities (demolition of buildings and other structures) and the distance between this designated site and the project, no in-combination effects are predicted.	No

Table 5.15 In-combination Assessment - Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC

Name of European Site	**Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC**	
Designated Feature	**Harbour Porpoise (*Phocoena phocoena*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and the SAC site, there is the potential for in-combination effects on harbour porpoise. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with harbour porpoise. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Decommissioning	Due to the nature of the decommissioning activities (demolition of buildings and other structures) and the distance between this designated site and the project, no in-combination effects are predicted.	No

Table 5.16 In-combination Assessment - Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC

Name of European Site	**Lleyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC**	
Designated Feature	**Bottlenose dolphin (*Tursiops truncatus*) and grey seal (*Halichoerus grypus*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with bottlenose dolphin and grey seal. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Decommissioning	Due to the location of the Wylfa Nuclear Power Station in proximity to the proposed scheme and the SAC, there is potential for in-combination underwater noise effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**

Table 5.17 In-combination Assessment - Cardigan Bay/Bae Ceredigion SAC

Name of European Site	**Cardigan Bay/Bae Ceredigion SAC**	
Designated Feature	**Bottlenose dolphin (*Tursiops truncatus*) and grey seal (*Halichoerus grypus*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with bottlenose dolphin and grey seal. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Decommissioning	Due to the location of the Wylfa Nuclear Power Station in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on bottlenose dolphin and grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**

Table 5.18 In-combination Assessment - Pembrokeshire Marine/Sir Benfro Forol SAC

Name of European Site	**Pembrokeshire Marine/Sir Benfro Forol SAC**	
Designated Feature	**Grey seal (*Halichoerus grypus*)**	**LSE concluded**
Potential effects of the plan or project in-combination with the proposed scheme		
Holyhead Deep Phase 1	Due to the location of the Holyhead Deep Phase 1 project in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
WADZ	Due to the location of the WADZ in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Newydd Nuclear Power Plant	Due to the location of the Wylfa Newydd Nuclear Power Plant in proximity to the proposed scheme and the SAC, there is the potential for in-combination effects on grey seal. It is therefore not possible to rule out the potential for LSE and this project will be considered further in the in-combination assessment.	**Yes**
Anglesey Ecopark and Biomass Energy Centre	There is no planned development in the marine environment, so no direct interaction is anticipated with grey seal. No in-combination effects are therefore predicted.	No
Holyhead Waterfront Regeneration	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Holyhead Marina	It is not possible to rule out the potential for in-combination effects based on the currently available information and therefore this project will be considered further in the in-combination assessment.	**Yes**
Wylfa Decommissioning	Due to the nature of the decommissioning activities (demolition of buildings and other structures) and the distance between this designated site and the project, no in-combination effects are predicted.	No

6 Conclusion

6.1 LSE Assessment - Alone

Table 6.1 lists those European sites and qualifying features that have been screened 'in' to the next stage of the HRA process, namely an AA of the potential for the proposed scheme alone to have an adverse effect on integrity of the European sites.

Table 6.1 LSE Assessment - Alone

Site	Feature
North Anglesey Marine/Gogledd Môn Forol SAC	Harbour porpoise
West Wales Marine/Gorllewin Cymru Forol SAC	Harbour porpoise
Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC	Harbour porpoise
Llyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC	Bottlenose dolphin and grey seal
Cardigan Bay/Bae Ceredigion SAC	Bottlenose dolphin and grey seal
Pembrokeshire Marine/Sir Benfro Forol SAC	Grey seal

6.2 LSE Assessment - In-combination

Table 6.2 lists those European sites and qualifying features that have been screened 'in' to the next stage of the HRA process, namely an AA of the potential for the proposed scheme 'in-combination' with other plans and projects, to have an adverse effect on integrity of the European sites.

Table 6.2 LSE Assessment - In-combination

Site	Feature
North Anglesey Marine/Gogledd Môn Forol SAC	Harbour porpoise
West Wales Marine/Gorllewin Cymru Forol SAC	Harbour porpoise
Bristol Channel Approaches/Dynesfeydd Môr Hafren SAC	Harbour porpoise
Llyn Peninsula and the Sarnau/Pen Llyn a`r Sarnau SAC	Bottlenose dolphin and grey seal
Cardigan Bay/Bae Ceredigion SAC	Bottlenose dolphin and grey seal
Pembrokeshire Marine/Sir Benfro Forol SAC	Grey seal

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