

Cyngor Gwynedd

Barmouth North Promenade FAS

Intertidal Biotope Survey Report

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Llywodraeth Cymru
Welsh Government



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1. The Project

1.1 Scheme Overview

- 1.1.1 Cyngor Gwynedd, supported by YGC, propose to carry out coastal flood and erosion risk management works on a 1.2km length of frontage at the North Promenade region in Barmouth, Gwynedd. The 1.2km scheme area comprises a mix of hard coastal defences (sheet piled wall, concrete revetment, and wave recurve wall, with masonry setback walls). The defences run parallel with the promenade and adjacent to Marine Parade.
- 1.1.2 The preferred option will reduce the long-term flood risk to both people and properties along the Barmouth seafront, bringing the area in line with its SMP2 policy of 'hold the line', with the longer-term considerations towards 'managed realignment'. The project will contribute towards managing flood risk, coastal erosion, and structural failure of the primary coastal defences, adapting to the increasing pressures associated with coastal erosion and climate change.
- 1.1.3 An Outline Business Case (OBC) was submitted by Cyngor Gwynedd in 2021 to seek approval and funding from Welsh Government for the design development and consenting of the project (Stage 1). YGC appointed Alun Griffiths (Contractors) Ltd, with Arup (the 'AGC Team') to progress Stage 1 of the project, which includes developing the outline design, undertake an Environmental Impact Assessment (EIA), Consenting, Detailed Design and Full Business Case (FBC).
- 1.1.4 The preferred option outlined in the OBC comprised of the elements listed below, which are to be refined and developed through Stage 1. These elements are collectively referred to in this report as 'the Scheme'.
- Alternative primary wall to be rebuilt structurally and increased by +600mm (from 5.65mOD to 6.25mOD) over a length of approximately 1.2km.
 - Tertiary flood wall to be re-built structurally and increased by +450mm (from 6.4mOD to 6.85mOD) over a length of approximately 1.1km.
 - Existing sheet piles to be refurbished over approximately 515m length.
 - Additional 300m of rock toe armour to be provided to protect the primary sea wall and revetment.
 - 560m of shingle beach profile to be built out to protect the primary sea wall and revetment. Extents to be defined during detailed design. Dependant on stability of shingle material as a result of coastal processes.
 - Refurbishment of culverted outfall and reinstatement of flap valve.
 - Demountable flood defences to be installed with the arrangement to be confirmed during the detailed design.

1.2 Scheme Objectives

- 1.2.1 Cyngor Gwynedd seek a solution to reduce coastal flood and erosion risk to Barmouth North Promenade, whilst improving the amenity and environmental value of this section of coastline. Placemaking opportunities such as beach access, dwell spaces and facilities, and improved connectivity and wayfinding have the potential to leverage the less-used asset, broadening the appeal of Barmouth and reducing pressure on the popular South Promenade area.
- 1.2.2 The following Investment Objectives have been identified in the OBC:
- To reduce the threat of coastal flood and erosion risk to people and property with due consideration of SMP2 policy to ensure the long-term resilience and vitality of the community;
 - To support, and where possible enhance, recreation and amenity value of the local area;
 - To maintain, and where possible enhance, natural and historic environments;
 - To ensure marine amenity activities can continue to grow; and
 - Ensure an affordable and deliverable whole life option through a partnership approach and contributions.

1.3 Purpose of this Report

- 1.3.1 Gwynedd Council / Alun Griffiths Contractors commissioned Ove Arup and Partners Limited (Arup) to undertake an Intertidal Biotope Survey to characterise the baseline marine biodiversity of the North Promenade frontage. This report focusses on the proposed upgrade to the extant sea defences comprising a desk study utilising publicly available data and field survey implementing an intertidal marine biotope survey.
- 1.3.2 Biotopes are discrete marine habitat types defined by their characterising species and associated physical characteristics, such as substrata, depth, salinity, wave exposure, tidal energy conditions, physiographic feature type (e.g. linear coast, estuary), etc. Biotopes provide a simplified description of the variation in biological community across a region, to make it easier to visualise patterns and see which areas are similar in character. In the UK there are two commonly used classification schemes – the Marine Habitat Classification for Britain and Ireland and the Europe-wide EUNIS (European Nature Information System) which is strongly based on the UK system. This report applies the UK JNCC MNCR system, since this was developed specifically for UK marine habitats. The MNCR can also be readily converted to the EUNIS system if required or interpolate the data to describe broader marine habitats as needed.
- 1.3.3 Appendix A contains a drawing showing the layout of the Scheme as described in 1.1.4 above.

2. Methodology

2.1 Desk Study

- 2.1.1 A desk study of open access data sources was undertaken to identify key protected and priority species present. Key data sources included:
- DataMap Wales¹
 - MagicMap²
 - Wales Environmental Information Portal³
 - Wales INNS Portal⁴
 - Welsh Marine Planning Portal⁵
 - Shoreline Management Plan⁶
- 2.1.2 Records for Marine Protected Areas, Water Framework Directive (WFD) Higher and Lower Sensitivity Habitats, Shellfish Waters Protected Areas (SWPAs), Environment (Wales) Act Section 7 Priority species and habitats, OSPAR Marine Habitats, Marine Article 17 Habitats Features, and Marine Invasive non-native species were identified in and around the study area.

2.2 Intertidal Biotope Survey

- 2.2.1 An Intertidal Biotope Survey was undertaken by experienced marine ecologists on 30 September and 1 October 2024 informed by a pre-defined red line boundary [0- Figure 1] extending from SH 60750 15923 at the south of the site to SH 59957 17750 in the north. The survey exceeded the RLB extent to account for potential important and / or sensitive features that may experience indirect effects from the development of FCERM enhancements.
- 2.2.2 The survey was undertaken in accordance with the Marine Nature Conservation Review (MNCR) Intermediate Level survey for rapid biotope assessment comprising broad biotope appraisal and identification of conspicuous flora and fauna. The survey was timed to target spring tides at low water to maximise the extent of accessible intertidal habitat. The Intertidal Biotope Survey was undertaken two hours either side of low water on spring tides to maximise lower shore access; tides occurred as follows:
- Monday 30 September 2024 – low water at 14:54 [tidal height of 1.36m Above Chart Datum – Barmouth].
 - Tuesday 1 October 2024 – low water at 15:27 [1.23m].

¹ <https://datamap.gov.wales/> [Accessed October 2024]

² <https://magic.defra.gov.uk/MagicMap.aspx> [Accessed October 2024]

³ <https://smnr-nrw.hub.arcgis.com/apps/c7770d2881394c899123bae210afe370/explore> [Accessed October 2024]

⁴ <https://wales-species-inns.nbnatlas.org/#tabs-2> [Accessed October 2024]

⁵ <https://lle.gov.wales/apps/marineportal/#lat=52.5129&lon=-3.9111&z=8&tgt=false&layers=231,390> [Accessed October 2024]

⁶ [SMP2 | GABC](#) [Accessed October 2024]

- 2.2.3 The survey was undertaken in accordance with the JNCC's Marine Nature Conservation Review (MNCR) methodology, which was developed to provide a comprehensive baseline of information on marine habitats and species, to aid coastal zone and marine management and to contribute to the identification of areas of marine natural heritage importance throughout Great Britain. MNCR focussed on benthic habitats and their associated communities, which together are described as 'biotopes' in inshore areas. The MNCR developed methods for survey, assessment and recording to enable systematic and consistent descriptions of the character of habitats present and the abundance of species in them so that comparisons between sites could be undertaken. The MNCR survey methodology was employed for the intertidal survey.
- 2.2.4 In accordance with MNCR guidance an intermediate-level survey was considered appropriate to describe baseline conditions. This enabled a rapid assessment of habitats and conspicuous fauna, between MHWS and MLWS, in addition to physical characteristics of the site and potential modifiers. Abundances are described according to the MNCR SACFOR scale, which in summary is as follows: Superabundant (>80%), Abundant (40-79%), Common (20-39%), Frequent (10-19%), Occasional (5-9%), Rare (1-5%) and Present (<1%).
- 2.2.5 To support identification of the soft sediment biotopes, rigid sieves were implemented to evaluate the macrobenthic infauna of discrete 0.02m² sediment samples in situ; in accordance with the Marine Monitoring Handbook Procedural Guideline No. 3-1. As outlined below:
- 2.2.6 *Sediment biotopes - collect two spade loads (approximately 0.02m²) of sediment, dug to a depth of 20–25cm and sieved through a 0.5mm mesh sieve. At some sample stations it may be necessary to repeat where infauna are scarce. Species present and their abundance are recorded. Specimens are taken of species that are considered important to identify the biotope and not identified in the field.*
- 2.2.7 Infauna densities were low, resulting in several negative samples, which was ultimately diagnostic. However, repeat sampling was undertaken as presented in the methodology. Specimens were identified in situ and subsequently utilising magnifying hand lenses and photography to support identification via Hayward and Ryland⁷.
- 2.2.8 Biotopes were assigned in accordance with the MNCR Version 04.05 [Version 22.04 is under development, but only proposes changes to sublittoral biotopes, whilst the only updates to Version 15.03 were to include Deep Sea Biotopes].

Limitations

- 2.2.9 The survey was undertaken within the recommended months of April to October. The advisory survey period typically permits suitable daylight hours around spring tides, better weather and greater floristic density and diversity. At the time of survey (30 September – 1 October 2024) the weather was warm (13°C). Monday 30 September experienced strong winds and heavy rain, whilst 1 October was fine with moderate winds and occasional showers. The strong onshore wind may have influenced the low tide level such that access to the full

⁷ Handbook of the Marine Fauna of North-West Europe. Hayward, P.J. & Ryland, J.S. 1995.

low tide was restricted by the low pressure and strong onshore winds. This may have limited access to the lowest available tides. However, the survey was timed to take advantage of spring tides with the biotopes in the vicinity of MLWS assessed at each low tide. It is therefore considered that the biotopes and species identified are representative.

3. Marine Ecology Baseline

3.1 Desk Study

Publicly Available Data

3.1.1 Desk study results are outlined in the following section.

3.1.2 Several Marine Protected Areas have been identified via Magic Maps and Wales Environmental Information Portal within and around the study area:

- Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau Special Area of Conservation (SAC) (Marine Component) - adjacent to the study area to the west – offshore from the Mean Low Water Springs (MLWS) mark. Nearest designated features to the study area include Mudflats and Sandflats, Estuaries and *Salicornia* approximately 200m south of the study area. Additionally, there are sandbanks which are slightly covered by sea water all the time (subtidal sandbanks) approximately 5km offshore from the study area. This site is designated for large shallow inlets and bays, however the nearest this feature lies to the study area is approximately 10km northwest. The site is also designated for reefs, however the nearest this feature lies to the study area is approximately 7km northwest. The site is also designated for bottlenose dolphin (*Tursiops truncatus*), otter (*Lutra lutra*) and grey seal (*Halichoerus grypus*). Much of the area of the SAC is subtidal, but there are also extensive intertidal areas.
- Northern Cardigan Bay / Gogledd Bae Ceredigion Special Protection Area (SPA) (Marine Components) (approximately 2km west of the study area). This site is designated for supporting more than 1% of the GB population of red-throated diver (*Gavia stellata*). Wintering red-throated divers start to arrive in UK coastal waters from September, with numbers peaking during the winter and declining in Welsh waters from late February. Supporting habitats include the Sarnau reefs of Northern Cardigan Bay. Conservation objectives for this site state that the foraging habitat of this species should not decrease significantly, and its quality should remain unaffected by anthropogenic factors.

3.1.3 DataMap Wales shows records of the following habitats listed under Environment (Wales) Act Section 7 and OSPAR: Marine Habitats, within and around the study area [Appendix B- Figure 2]:

- Mussel beds (approximately 100m west of the study area).
- Estuarine rocky habitats (approximately 1km southeast of the study area).
- Intertidal mudflats (approximately 1km southeast of the study area).
- Atlantic Salt Meadow (approximately 1.5km southeast of the study area).

3.1.4 DataMap Wales shows records of the following Marine Article 17 Habitats Features within the study area [Appendix B- Figure 3]:

- Intertidal Reef (Rocky) (within study area).
- Mudflats and Sandflats (approximately 200m south of study area)..

- Estuaries (immediately south of the study area).
 - Estuaries Associated Sediment (approximately 200m south of study area).
- 3.1.5 No Marine Invasive Non-Native Species (INNS) records were identified within or immediately surrounding the study area on the Wales INNS Portal⁸.
- 3.1.6 Several Water Framework Directive (WFD) Higher Sensitivity Habitats (identified via Magic Maps) have been recorded within and around the study area:
- Mussel Beds (*Modiolus modiolus*, *Mytilus edulis* & others) (A1.22, A2.72, A5.62, A4.24, A3.361) (approximately 100m west of the study area). It should be noted that rocky reef areas identified in aerial basemaps has potential to be mussel beds, or Section 7 reef.
 - Saltmarsh (A2.5) (approximately 1.5km southeast of the study area).
- 3.1.7 Several WFD Lower Sensitivity Habitats have been recorded within the study area:
- Gravel & Cobbles (intertidal & subtidal coarse sediment A2.1, A5.1) (within study area).
 - Intertidal Soft Sediment (Sand, Mud & Mixed A2.2, A2.3, A2.4) (within study area).
 - Rocky shore (Intertidal rock A1) (within study area).
 - Subtidal Soft Sediment (Sand, Mud & Mixed A5.2, A5.3, A5.4) (approximately 100m west of the study area).
- 3.1.8 The following Shellfish Waters Protected Areas (SWPAs) were identified via DataMap Wales in the immediate area:
- Mawddach (800m southeast of the study area).
- 3.1.9 The following fish nursery and spawning grounds were identified in the offshore areas adjacent to the study area via the Welsh Marine Planning Portal:
- Nursery grounds for anglerfish, whiting, spotted ray, thornback ray and forage fish.
 - Spawning grounds for cod, plaice, sole, sandeel and whiting.
- 3.1.10 The following marine mammal records were identified in the offshore areas adjacent to the study area via the Welsh Marine Planning Portal:
- Bottlenose dolphin.
 - Harbour porpoise.
 - A seal pupping and haul out site was also identified approximately 1km south of the study area [approximate grid reference - SH 60940 15019].

⁸ <https://wales-species-inns.nbnatlas.org/#tabs-2> [Accessed October 2024]

3.2 Intertidal Biotope Survey

Site Characterisation

Upper Shore

- 3.2.1 The upper extent of the shore is characterised by areas of barren littoral shingle bordering the existing sea wall, varying in width throughout the length of the sea wall. These areas comprise cobbles and pebbles of various sizes, typically with no conspicuous macrofauna. This habitat is typical of exposed open coasts. This biotope was identified as LS.LCS.Sh.BarSh⁹ - Barren littoral shingle.
- 3.2.2 The upper shore to the south also encompassed narrow areas of barren littoral coarse sand along the beach. This habitat is characterised by freely draining sand and lack of macrofaunal communities. This biotope was identified as LS.LSa.MoSa.BarSa¹⁰ - Barren littoral coarse sand.
- 3.2.3 At the northern end of the promenade, several areas of the sea wall and exposed sheet pile along the existing sea wall was colonised by green algae (*Ulva spp.*) [F] and barnacle communities (*Chthamalus sp.*) [F].

Lower Shore

- 3.2.4 The lower shore is characterised by well sorted and free draining fine sand that was largely retained by a 0.5mm mesh sieve. The sand was clean, displaying no anoxic layer to target depth of c.25cm depth but was relatively devoid of macrofauna. Across the majority of sampling stations, negative results were encountered during sediment sampling. Where positive samples were obtained, only one or two polychaetes were obtained per sample. All polychaetes were identified using hand lens, photography and Hayward & Ryland⁷ as *Scolecopsis spp.*
- 3.2.5 Barmouth North Promenade is an exposed coastline with a westward aspect that results in greater than average disturbance and a notably lower biodiversity and abundance of benthic infauna. The high exposure across the whole frontage provides for a large-scale biotope characterised by a species-poor community; LS.LSa.MoSa.AmSco¹¹ - *Scolecopsis spp.* in littoral mobile sand. This deviates from the existing Intertidal Phase 1 Habitat Survey Natural Resources Wales dataset¹² for this area, in which the majority of the beach is defined as LS.LSa.MoSa.AmSco.Eur¹³ - *Eurydice pulchra* in littoral mobile sand. This existing dataset also identifies SS.SSa.lMuSa.EcorEns¹⁴ - *Echinocardium cordatum* and *Ensis spp.* in lower shore and shallow sublittoral slightly muddy fine sand, which was not identified throughout the intertidal biotope survey.

⁹ <https://mhc.jncc.gov.uk/biotopes/JNCCMNCR00000186> [Accessed October 2024]

¹⁰ <https://mhc.jncc.gov.uk/biotopes/JNCCMNCR00000187> [Accessed October 2024]

¹¹ <https://mhc.jncc.gov.uk/biotopes/jnccmncr00000001> [Accessed October 2024]

¹² Intertidal Phase 1 Habitat Survey | DataMapWales [Accessed October 2024]

¹³ *Eurydice pulchra* in littoral mobile sand - JNCC Marine Habitat Classification [Accessed October 2024]

¹⁴ <https://mhc.jncc.gov.uk/biotopes/jnccmncr00000630> [Accessed October 2024]

However, the precautionary assumption is that this biotope is likely to be present, but not accessible due to its subtidal and infralittoral nature.

- 3.2.6 Discrete areas of littoral rock biotopes were identified within the larger expanse of sandy beach, namely LR.HLR.MusB.Sem.LitX¹⁵- *Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles, and LR.FLR.Eph.UlvPor - *Porphyra purpurea* and *Ulva* spp. on sand-scoured mid or lower eulittoral rock.
- 3.2.7 LR.HLR.MusB.Sem.LitX is characterised by cobbles and pebbles in the eulittoral zone on exposed to moderately exposed shores colonised by the barnacle *Semibalanus balanoides* [A] and the limpet *Patella vulgata* [C] with *Littorina littorea* [C], *Littorina saxatilis* [F] and *Nucella lapillus* [O] typically found in high numbers on and around cobbles and smaller boulders.
- 3.2.8 LR.FLR.Eph.UlvPor¹⁶ is characterised by exposed and moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand. The foliose red seaweed *Porphyra purpurea* [A] and green seaweeds such as *Ulva* spp [F] dominate, with *Semibalanus balanoides* [O], *Austrominius modestus* [O], *Patella vulgata* [O], *Littorina littorea* [O] and *Littorina saxatilis* [O] occurring in the less scoured areas.

Timber Groynes

- 3.2.9 In general, the 28 timber groynes situated along the beach hosted the most biodiverse communities on site, colonised by a range of algae, crustaceans and molluscs. Species identified included typical algae species such as *Pelvetia canaliculata*, *Fucus spiralis*, *Fucus vesiculosus*, *Fucus serratus*, *Fucus ceranoides*, *Halidrys siliquosa*, *Ascophyllum nodosum*, and *Ulva* spp. and gastropods such as *Patella vulgata*, *Patella depressa*, *Littorina littorea*, *Littorina saxatilis*, *Melaraphe neritoides*, *Steromphala umbilicalis* and *Nucella lapillus*. Refer to C for a detailed breakdown of SACFOR scale abundances of species identified on each groyne (with associated grid references).
- 3.2.10 Large extents of blue mussels (*Mytilus edulis*) were observed growing on approximately two thirds of the existing wooden groynes (also refer to section 3.2.16). The upper shore sections of the groynes were relatively barren.
- 3.2.11 In several instances, pools that formed at the base of several of the groynes hosted various species of red algae, fish and prawns including *Gobiidae* [R], *Ammodytiidae* [R], and *Gadoids* [R].

Outfall Pipe

- 3.2.12 A large outfall pipe falls within the centre of the study area (approximate grid reference SH 60561 16350), running diagonally to the shore, into the subtidal area. At mid-tide level, the pipe is colonised by a range of *F. spiralis*, *F. vesiculosus* and *Ulva* spp. At the seaward extent of the pipe, colonisation is dominated by blue mussels (*Mytilus edulis*), limpets (*P. vulgata* and *P. depressa*) and barnacles (*Chthamalus* sp.). Common species such as *L. saxatilis* and *L. littorea* were also observed.

¹⁵ <https://mhc.jncc.gov.uk/biotopes/jnccmncr00001113> [Accessed October 2024]

¹⁶ <https://mhc.jncc.gov.uk/biotopes/jnccmncr00000422> [Accessed October 2024]

Summary of Biotopes Recorded

3.2.13 A detailed breakdown of Intertidal Biotopes identified across the site [Appendix B- Figure 4] are detailed in Table 3-1.

Table 3-1 Biotopes Identified on Site

Zonation	Biotope Code	Biotope	Locality	Comments / Status
Supralittoral Upper Littoral Fringe Lower Littoral Fringe	LS.LCS.Sh.BarSh	Barren littoral shingle	Cobble ridge – variable width, throughout scheme area	No conspicuous flora or fauna - barren
Supralittoral Upper Littoral Fringe Lower Littoral Fringe	LS.LSa.MoSa.BarSa	Barren littoral coarse sand	Upper beach with larger expanses to south of RLB	No conspicuous flora or fauna - barren
Upper Eulittoral	LR.MLR.BF.FvesB [summer-variant; reduced exposure]	<i>Fucus vesiculosus</i> and barnacle mosaics on moderately exposed mid eulittoral rock	North of RLB; consider indirect effects. Located shoreward of <i>Sabellaria alveolata</i> reef.	Seasonal variation linked to exposure. LR.HLR.MusB.Sem.FvesR [winter variant] <i>Semibalanus balanoides</i> , <i>Fucus vesiculosus</i> and red seaweeds on exposed to moderately exposed eulittoral rock
Mid Eulittoral	LS.LBR.Sab.Salv	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock	North of RLB; consider indirect effects.	Priority Habitat
Upper Eulittoral	LR.HLR.MusB.Sem.LitX	<i>Semibalanus balanoides</i> and <i>Littorina</i> spp. On exposed to moderately exposed eulittoral boulders and cobbles	Central RLB	Stable embedded cobbles in sediment
Upper Eulittoral Mid Eulittoral	LR.FLR.Eph.UlvPor	<i>Porphyra purpurea</i> and <i>Ulva</i> spp. on sand-scoured mid or lower eulittoral rock	Central RLB, South of RLB	Stable embedded cobbles in sediment
Mid Eulittoral Lower Eulittoral	LS.LSa.MoSa.AmSco.Sco	<i>Scolecopsis</i> spp. in littoral mobile sand	Majority of sandy beach	Potential muddy sand biotope at MLWS – as per NRW mapping - no conclusive evidence.

Marine Invasive Non-Native Species (Marine INNS)

- 3.2.14 An invasive barnacle (*Austrominius modestus*) was widespread across the site, including on a number of the groynes. Although it is worth noting that this species is considered lower risk for Wales according to the Marine Invasive Non-native Species Priority Monitoring and Surveillance List for Wales ¹⁷.

Priority Habitats

- 3.2.15 Areas of honeycomb worm (*Sabellaria alveolata*) reefs were identified in the rocky intertidal area just north / northwest of the RLB (approximate grid reference - SH 59992 17689). Noting the importance of the 'reefs' as supportive of wider biodiversity, *Sabellaria* spp. reefs are listed as 'Biogenic Reefs', a sub-category of the 'Reefs' feature under Annex I of the Habitats Directive. *S. alveolata* reef is also listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and is also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the site. The extent of the area identified during the survey meets the minimum requirements (20 metres squared) to be defined as a distinct biotope (approximately 1553 metres squared).
- 3.2.16 Blue mussels (*Mytilus edulis*) were observed growing on approximately two thirds of the existing timber groynes – 22 of 28 groynes, with 11 groynes comprising densities of Abundant or Common. Blue Mussel Beds are listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and are also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the site.

Incidental Observations

- 3.2.17 Several areas of freshwater influence were noted within the study area, namely at two surface water outfalls on the beach (approximate grid reference – SH 60358 17001 and SH 60558 16434). At SH 60558 16434, large expanses of *Ulva* spp. were found in the freshwater discharge area.
- 3.2.18 Several oystercatchers (*Haematopus ostralegus* - 12), curlew (*Numenius arquata* - 1), carrion crow (*Corvus corone* - 3), jackdaw (*Coloeus monedula* - 5) and herring gulls (*Larus argentatus* - 12) were observed feeding on the lower areas of the beach (approximate grid reference SH 60534 16344) and in the vicinity of the mussel-laden outfall pipe.

¹⁷ <https://www.gov.wales/sites/default/files/publications/2018-02/invasive-aquatic-species-priority-marine-species.pdf> [Accessed October 2024]

4. Conclusions

4.1 Summary

- 4.1.1 Overall, the study area largely consists of fine sand with a lack of macroinfauna and low biodiversity. The timber groynes hosted the most biodiverse communities on site, colonised by a range of algae, crustaceans and molluscs.
- 4.1.2 Blue mussels (*Mytilus edulis*) were observed growing on approximately two thirds of the existing timber groynes and on the outfall pipe in relatively high densities and were observed to be a key forage resource to local waders (oystercatcher, etc.). Blue Mussel Beds are listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and are also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the site.
- 4.1.3 Honeycomb worm (*Sabellaria alveolata*) reefs were observed in the rocky intertidal area just north/northwest of the RLB. *S. alveolata* reef is listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and is also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the site.
- 4.1.4 One species of Marine INNS - an invasive barnacle (*Austrominius modestus*) - was identified and was found to be widespread across the site, including on a number of the groynes. However, this species is deemed to be of low risk¹⁷.
- 4.1.5 Online resources reveal several records of historic mussel beds in the areas around the RLB; however, access to these areas was not possible due to tidal height or sublittoral location.

4.2 Recommendations and Next Steps

Further surveys/ investigation and assessment

- 4.2.1 Further surveys work on areas currently outside of the anticipated scheme extents, however there may be an impact depending on transportation of materials by sea and other construction activities. These would likely need to be undertaken in the springtime.
 - Quantitative survey of *Sabellaria alveolata* to determine 'reefiness' and quantify characterisation as a biodiversity hotspot and to provide detailed input to EIA.
 - Further investigation of potential mussel bed biotope - as identified in existing datasets/desk study (refer to figure 2).
- 4.2.2 Further investigation and assessment through the EIA and Marine Licence process:
 - Consideration of coastal squeeze impacts to intertidal habitats with the Habitat Regulations Assessment.
 - Further consideration of wider marine environmental receptors - marine ornithology, marine mammals, subtidal habitats, fish nursery / spawning areas, etc.

- Consideration of *Austrominius modestus* within project Biosecurity risk assessments and INNS management plans.

Recommendations for Design

- 4.2.3 Retention of central to seaward extent of groynes during construction and operation would be recommended to preserve local biodiversity. The upper shore parts of the groynes were observed as relatively barren, so these sections could potentially be removed to enable nearshore access.
- 4.2.4 During construction, it would be considered precautionary to avoid (as far as practically possible) the timber groynes colonised by blue mussels and to retain all except the uppermost sections of the groynes. Similarly, it would be advised to avoid areas of *S. alveolata* reef when planning access routes. Measures will be required to prevent the tracking of vehicles or storage of materials on or near sensitive habitats during construction and consideration of changes to coastal processes during operation. Impacts on *Sabellaria alveolata* and *Mytilus edulis* are to be mitigated in accordance with the mitigation hierarchy: avoid, cancel, reduce or offset adverse effects. A pre-construction survey is advised to enable assessment of *Sabellaria alveolata* reef extent and condition. This will ensure this habitat can be avoided as far as reasonably possible and impacts mitigated.
- 4.2.5 It is strongly recommended that enhancement measures are considered for integration into the design to ensure compliance with marine planning policy, Biodiversity Net Benefit and Green Infrastructure Statement requirements. Artificial structures historically lack drivers to promote biological diversity and so often support different and less diverse communities compared with natural hard-substrate rocky reef habitats. Ecoengineering enhancements can be incorporated into new build structures but also existing structures as part of remedial works or retrofitted. They can be applied to an entire coastal scheme, to a discrete section, or to enhance a niche habitat. For example, microhabitats such as rock pools, crevices, holes, flexible canopies and textured surfaces can be created on structures to provide refuge habitats and enable them to function more like natural reefs. These can be drilled, cut or cast into structure surfaces, or 'bolted-on' in the form of prefabricated habitat units¹⁸. Existing seawall structures at Barmouth could be utilised for addition of water retaining features to promote settlement of species.

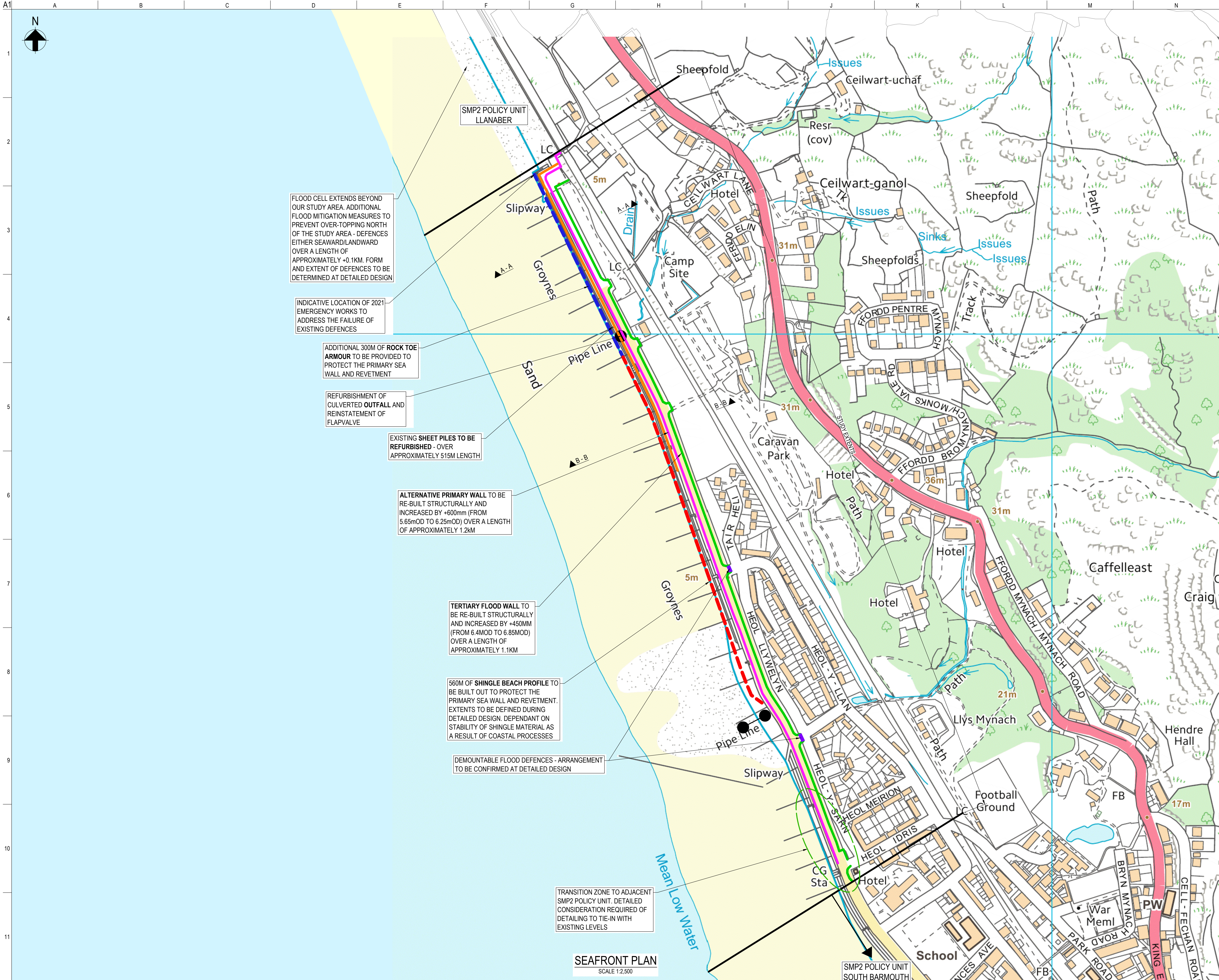
¹⁸ <https://naturalresources.wales/flooding/managing-flood-risk/nature-based-solutions-for-coastal-management/?lang=en> [Accessed October 2024]

Abbreviations List

AGC	Alun Griffiths Contractors
D&B	Design and Build
ECI	Early Contractor Involvement
EIA	Environmental Impact Assessment
ES	Environmental Statement
FAS	Flood Alleviation Scheme
OBC	Outline Business Case
YGC	Ymgynghoriaeth Gwynedd Consultancy

Appendices

Appendix A Scheme Layout



- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 2. ALL LEVELS ARE IN METRES RELATIVE TO ORDINANCE DATUM.
 3. DO NOT SCALE FROM THIS DRAWING.
 4. TO BE READ IN CONJUNCTION WITH DRAWING ARP-XX-EP-DR-CS-001-SK.

- EXISTING DEFENCES:
- EXISTING SURFACE WATER CULVERT
 - EXISTING SURFACE WATER PUMPS AND FLAPPED OUTFALLS

- CONSTRUCTION ACTIVITIES WORKS:
- EXTENTS OF WORKS TO THE ALTERNATIVE PRIMARY WALL
 - EXTENTS OF REFURBISHMENT TO SHEET PILES
 - EXTENTS OF WORKS TO TERTIARY FLOOD DEFENCE WALL
 - EXTENTS OF ROCK TOE STRUCTURE TO AFFORD PROTECTION TO THE PRIMARY DEFENCES
 - EXTENTS OF ADDITIONAL BEACH MATERIAL TO AFFORD PROTECTION TO THE PRIMARY DEFENCES

P02	17/05/21	ASC	JT	RC
For Information				
Issue	Date	By	Chkd	Appd

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Client
YGC
(Ymgynghoriaeth Gwynedd Consultancy)

Job Title
Barmouth North Promenade

Extend Lifespan and Betterment of Existing Defences

Scale at A1 1:2,500

Discipline Civil / Structural

Job No 264326-00 Drawing Status Information

Drawing No ARP-XX-EP-DR-CS-0001-GA Issue P02

Appendix B Intertidal Figures



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0 500 1,000 Metres

LEGEND RED LINE BOUNDARY		SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION								Suitability S0		Drawing Status Initial Status		Project Title BARMOUTH NORTH PROMENADE FAS									
		IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)												Drawing Title FIGURE 1- RED LINE BOUNDARY									
		CONSTRUCTION												GRIFFITHS ARUP									
		NONE																					
		MAINTENANCE / CLEANING												Scale 1:12,000									
		NONE												By BF		Checked GM		Approved --		Authorised --			
		USE														Original Size A3		Date 01/11/24		Date ---		Date ---	
		NONE																					
		DECOMMISSIONING / DEMOLITION								P01.01		31/10/2024		FIGURE 1- RED LINE BOUNDARY		BF		GM		--		--	
		NONE																					
		Rev.		Date		Description				By		Chk'd		App'd		Auth'd							



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LEGEND												SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION										Suitability S0										Drawing Status Initial Status										Project Title BARMOUTH NORTH PROMENADE FAS																																																																															
RED LINE BOUNDARY												IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)																																								Drawing Title FIGURE 2- ENVIRONMENT (WALES) ACT SECTION 7 AND OSPAR MARINE HABITAT RECORDS																																																																					
SECTION 7 AND OSPAR ESTUARINE ROCK HABITATS												CONSTRUCTION																																																		GRIFFITHS ARUP																																																											
SECTION 7 AND OSPAR INTERTIDAL MUDFLATS												NONE																																																												Scale 1:28,000																																																	
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0 1,000 2,000 Metres

LEGEND RED LINE BOUNDARY MARINE ARTICLE 17 INTERTIDAL REEF MARINE ARTICLE 17 ESTUARIES ASSOCIATED SEDIMENT MARINE ARTICLE 17 ESTUARIES MARINE ARTICLE 17 MUDFLATS AND SANDFLATS			SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG) CONSTRUCTION NONE MAINTENANCE / CLEANING NONE USE NONE DECOMMISSIONING / DEMOLITION NONE										Suitability	Drawing Status		Project Title																				
													S0	Initial Status		BARMOUTH NORTH PROMENADE FAS																				
													GRIFFITHS ARUP						Drawing Title																	
																			FIGURE 3- MARINE ARTICLE 17 HABITAT RECORDS																	
																			Scale	1:28,000	By	BF	Checked	GM	Approved	--	Authorised	--								
																			Original Size	A3	Date	01/11/24	Date	25/11/24	Date	---	Date	---								
																			Drawing Number		Project	BMTH	Originator	ARP	Volume	HAC	Revision	P01.01								
																									ZZ	-DR - AX - 000001										
																									Location		Type		Role		Number					
																									Rev.	Date	Description		By	Chk'd	App'd	Auth'd				



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LEGEND				SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION										Suitability	Drawing Status	Project Title														
	RED LINE BOUNDARY		LS.LBR.Sab.Salv	IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)										S0	Initial Status	BARMOUTH NORTH PROMENADE FAS														
	TARGET NOTES		LS.LCS.Sh.BarSh	CONSTRUCTION										GRIFFITHS ARUP		Drawing Title														
	LR.FLR.Eph.UlvPor		LS.LSa.MoSa.AmSco.Sco	NONE												FIGURE 4- INTERTIDAL BIOTOPE SURVEY														
	LR.HLR.MusB.Sem.LitX		LS.LSa.MoSa.BarSa	MAINTENANCE / CLEANING												Scale														
	LR.MLR.BF.FvesB			NONE										Client					1:15,000	By	BF	Checked	GM	Approved	--	Authorised	--			
				USE										CYNGOR GWYNEDD YGC Llywodraeth Cymru Welsh Government		Original Size					A3	Date	05/11/24	Date	25/11/24	Date	---	Date	---	
				DECOMMISSIONING / DEMOLITION												Drawing Number					Project	BMTH	Originator	ARP	Volume	HAC	Revision			
				NONE												P01.01					Location	ZZ	-DR	-AX	-000001	P01.01				
				Rev.															Type					Role						
				Date															Number											
				Description																										
				By																										
				Chk'd																										
				App'd																										
				Auth'd																										

Appendix C Timber Groyne SACFOR Matrix

Key: S - super-abundant, A - abundant, C - common, F - frequent, O - occasional, R - rare, P - present.																																		
	NCBI	SH 60696 16091	SH 60667 16133	SH 60642 16183	SH 60624 16222	SH 60610 16267	SH 60598 16312	SH 60583 16351	SH 60563 16403	SH 60541 16438	SH 60518 16487	SH 60501 16521	SH 60486 16567	SH 60476 16616	SH 60454 16660	SH 60439 16703	SH 60423 16744	SH 60407 16787	SH 60391 16826	SH 60387 16881	SH 60372 16911	SH 60338 16951	SH 60319 16991	SH 60298 17021	SH 60278 17077	SH 60266 17127	SH 60237 17164	SH 60202 17199	SH 60196 17261	SH 60740 15947	SH 60561 16356	SH 60519 16450	SH 60468 16493	
Taxonomic Group	Scientist's Name	Groyne 1	Groyne 2	Groyne 3	Groyne 4	Groyne 5	Groyne 6	Groyne 7	Groyne 8	Groyne 9	Groyne 10	Groyne 11	Groyne 12	Groyne 13	Groyne 14	Groyne 15	Groyne 16	Groyne 17	Groyne 18	Groyne 19	Groyne 20	Groyne 21	Groyne 22	Groyne 23	Groyne 24	Groyne 25	Groyne 26	Groyne 27	Groyne 28	Embedded Cobbles	Outfall Pipe	LR.HLR.Mus B.Sem.LIX	L.R.FLR.Eph. UlyPor	
Chlorophyta	<i>Ulva lactuca</i>	C	A	O	F	C	C	O	O	R						O	O	O	O	R	R	O	R	C	O			O	O	O	C			F
	<i>Green Algal Turf</i>																					O									R			
Rhodophyta	<i>Porphyra</i>	C	F	F	C	O	O		O	R							O	O	O	O		O	O	O	R		O				A			
	<i>Porphyra</i>																																	
	<i>Porphyra</i>																																	
	<i>Porphyra</i>																																	
	<i>Porphyra</i>																																	
Phaeophyta	<i>Phaeophytia</i>																																	
	<i>Phaeophytia</i>																																	
	<i>Phaeophytia</i>																																	
	<i>Phaeophytia</i>																																	
	<i>Phaeophytia</i>																																	
Lichnaceae	<i>Lichina pygmaea</i>			O	F	C	C	C	C	C	O	O	O	R	O	R		O	O	O							O							
	<i>Lichina pygmaea</i>																																	
	<i>Lichina pygmaea</i>																																	
	<i>Lichina pygmaea</i>																																	
	<i>Lichina pygmaea</i>																																	
Mollusca	<i>Patella</i>																																	
	<i>Patella</i>																																	
	<i>Patella</i>																																	
	<i>Patella</i>																																	
	<i>Patella</i>																																	
Cirripedia	<i>Chesteria</i>	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	S	S									
	<i>Chesteria</i>																																	
	<i>Chesteria</i>																																	
	<i>Chesteria</i>																																	
	<i>Chesteria</i>																																	
Cnidaria	<i>Actinia</i>	A	O	C	O	O	O	C	O	O	P	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	C	R			
	<i>Actinia</i>																																	
	<i>Actinia</i>																																	
	<i>Actinia</i>																																	
	<i>Actinia</i>																																	
Crustacea	<i>Gammaridae</i>																																	
	<i>Gammaridae</i>																																	
	<i>Gammaridae</i>																																	
	<i>Gammaridae</i>																																	
	<i>Gammaridae</i>																																	
Pisces	<i>Gobiidae</i>																																	
	<i>Gobiidae</i>																																	
	<i>Gobiidae</i>																																	
	<i>Gobiidae</i>																																	
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