

Cyngor Gwynedd

Barmouth North Promenade FAS

Water Framework Directive Assessment

Reference: BMTH-ARP-EWE-ZZ-RP-OE-000003

P03 | 2026/03/26



images copyright: Mike Alexander



Llywodraeth Cymru
Welsh Government



This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Document Verification

Project title	Barmouth North Promenade FAS
Document title	Water Framework Directive Assessment
File reference	BMTH-ARP-EWE-ZZ-RP-OE-000003
Status	S4 Suitable for review and authorization

Revision	Role	Name	Date
P03	Author	Bethan Follis	2026/03/24
	Checker	Cat Wallace	2026/03/26
	Approver	Tom Edwards	2026/03/26
	Authoriser		
	Client		

Revision History

Revision	Author	Date	Description
P03	BF	2026/03/24	For planning
P02	BF	2025/10/02	For PAC
P01	RT	2025/08/12	For client issue

Contents

1. The Project	1
1.1 Overview of the Project	1
1.2 Purpose of this Report	1
1.3 Other supporting environmental reports	1
1.4 Assumptions and limitations	2
2. Legislative Context	3
3. Assessment methodology	4
3.1 Scope of assessment	4
3.2 Data sources	4
4. Project Site	5
4.1 Location	5
4.2 Site description	5
4.3 WFD habitat classification	9
4.4 Waterbodies	10
5. The Proposed Development	11
5.2 Construction programme	16
5.3 Construction methods	16
5.4 Maintenance and design life	19
5.5 Materials sourcing	20
5.6 Embedded mitigation	22
6. Baseline (screening) assessment	26
6.1 Overview	26
6.2 Relevant WFD waterbodies	26
6.3 Meirionnydd	26
6.4 Cardigan Bay North	26
6.5 Mawddach Estuary	28
6.6 Screening conclusions	29
7. Scoping assessment	30
7.1 Hydromorphology	30
7.2 Biology	30
7.3 Water quality	33
7.4 WFD protected areas	34
7.5 Invasive non-native species (INNS)	34
7.6 Scoping summary	35
8. Detailed assessment	36
8.2 Hydromorphology	36
8.3 Biology: higher sensitivity habitats	38
8.4 Water quality	39
8.5 Protected areas	39

8.6 INNS	40
9. Conclusion	42

Tables

Table 5-1	Proposed coastal defence works	11
Table 5-2	Construction duration of activities.	16
Table 5-3	Proposed asset design life	19
Table 6-1	Relevant waterbodies for the Proposed Development	26
Table 6-2	Summary of 2021 WFD status for 'Cardigan Bay North' coastal waterbody	27
Table 7-1	Hydromorphology scoping assessment	30
Table 7-2	Higher sensitivity and lower sensitivity habitats – for information only	30
Table 7-3	Habitats scoping assessment	31
Table 7-4	Fish scoping assessment	31
Table 7-5	Water quality scoping assessment	33
Table 7-6	WFD protected areas scoping assessment	34
Table 7-7	INNS scoping assessment	34
Table 7-8	Scoping assessment summary	35

Figures

Figure 1	WFD Waterbodies	43
Figure 2	WFD Protected Areas	44

Pictures

Picture 1	Coastal processes figure from ABPmer study [8]	8
Picture 2	WFD higher sensitivity habitats	9
Picture 3	WFD lower sensitivity habitats	10
Picture 4	Site Plan showing existing arrangement	11
Picture 51	Site compound location	19
Picture 6	Suggested location of main ship anchoring site and route of smaller barge to site.	21
Picture 7	Ecological status classification process (Source: Environment Agency, 2015)	50
Picture 8	Groundwater body status classification (Source: UKTAG, 2012)	53

Appendix A	Determination of WER Status	49
Appendix B	WER Assessment Process	56
Appendix C	Stockpile Locations Plan	60

1. The Project

1.1 Overview of the Project

- 1.1.1 Cyngor Gwynedd, supported by YGC, propose to carry out coastal flood and erosion risk management works (hereby referred to as the “Proposed Development”) on a 1.2km length of frontage at the North Promenade region in Barmouth, Gwynedd. The Proposed Development at Barmouth North Promenade comprises new and improved sea defences, placemaking and surface water drainage improvements. The design life and maintenance requirements for each element of the design are given with respect to the required standard of protection and the Shoreline Management Plan 2 (SMP2). For each element of the design, the proposed construction methods and materials are provided with an overview of the duration of construction and considerations for programming. The Proposed Development is discussed in further detail in section 5.

1.2 Purpose of this Report

- 1.2.1 The purpose of this assessment is to identify potential effects of the ‘Barmouth North Promenade Flood Alleviation Scheme’ (hereafter referred to as “the Proposed Development”) on the current status and future status objectives of waterbodies present at the Site, with reference to the Water Framework Directive (WFD). The key objectives of the assessment are to:
- Identify the relevant WFD water bodies that may be affected by the Proposed Development and collate the available baseline information.
 - Identify activities with the potential to affect the water bodies at the site.
 - Undertake a preliminary assessment to identify the baseline condition at the site and the likely impacts of the Proposed Development on the current status and status objectives of the relevant waterbodies (including identification of any additional mitigation requirements).
 - Identify any risks of non-compliance with water body objectives and associated requirements for further detailed impact assessment and/or mitigation design.
 - Identify potential enhancement opportunities to support the delivery of water body objectives.
- 1.2.2 The report summarises the assessment methodology and results. The assessment has been undertaken in accordance with relevant guidance (see Appendix A) and has involved a desk-based study using readily available baseline information and existing available site information.
- 1.2.3 This assessment comprises a ‘living document’ and will be reviewed and updated as necessary in liaison with Natural Resources Wales (NRW) to support future business case stages and the final construction consents and approvals process.

1.3 Other supporting environmental reports

- 1.3.1 This report is supported by and should be read in conjunction with the following reports:

- BMTH-ARP-EBD-ZZ-RP-OE-000001 (Preliminary Ecological Appraisal RML with Arup summary).
- BMTH-ARP-EBD-ZZ-RP-OE-000003 (Habitats Regulations Assessment Screening and Appropriate Assessment).
- BMTH-ARP-VES-OFFSH-RP-OE-000001 (Barmouth North Promenade FAS Intertidal Biotope Survey Report).
- BMTH-ARP_EBD_OFFSH-TN-OE-000001 (Priority Habitat – Blue Mussel (*Mytilus edulis*) Assessment).

1.4 Assumptions and limitations

- 1.4.1 The WFD water body classification data in this assessment has been taken from NRW's Water Watch Wales website for WFD Cycle 3 (2021). These classifications are considered to provide the current best estimate of status and are the formal baseline against which the NRW will assess compliance with the 'no deterioration' objective.

2. Legislative Context

- 2.1.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations (WER) (amended 2017) is currently the largest and most influential piece of UK legislation for the water environment and transposes the European Commission Water Framework Directive (WFD) into English and Welsh law. Natural Resources Wales is the competent authority responsible for delivering the requirements of the WFD (as transposed) in Wales. Although the UK legislation is now referred to as the 'WER' the common usage term remains as WFD; this is the preferred term of reference for legislation and associated data in this report.
- 2.1.2 Under the WFD, water bodies are the basic management units. These water bodies form part of a larger River Basin District (RBD), for which River Basin Management Plans (RBMPs) are developed and environmental objectives are set. These RBMPs are produced every six years, in accordance with the river basin management planning cycle.
- 2.1.3 The WFD requires classification of the current condition of water bodies. This is referred to as their 'status' or, for artificial or Heavily Modified Water Bodies (HMWBs), their 'potential'. The WFD also requires the setting of a series of objectives for maintaining or improving conditions so that water bodies reach and/or maintain at least 'Good' overall status or potential in the future. These overall Environmental Objectives are to:
- Prevent the deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters.
 - Aim to achieve at least 'Good' status or potential for all water bodies by 2015. Where this has not been possible and is subject to the criteria set out in the Directive, aim to achieve Good by 2021 or 2027.
 - Meet the requirements of WFD Protected Areas.
 - Promote sustainable use of water as a natural resource.
 - Conserve habitats and species that depend directly on water.
 - Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment.
 - Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.
 - Contribute to mitigating the effects of floods and droughts.
- 2.1.4 All new (and on-going) activities in the water environment need to be guided by the requirements of the WFD. This includes ensuring that no changes occur that cause a deterioration of current status of a water body or prevent the achievement of the future status objectives of a water body.

3. Assessment methodology

3.1 Scope of assessment

- 3.1.1 WER Compliance Assessments typically comprise a stepped process undertaken in parallel with the design development for a project. This includes the following key steps:
- Screening assessment.
 - Scoping assessment.
 - Detailed impact assessment (where required).
 - Application of Article 4.7 / Regulation 19 (where applicable).
- 3.1.2 Further guidance on the WFD assessment for estuarine and coastal waters is provided by the Environment Agency [1].
- 3.1.3 This report comprises the screening, scoping and detailed assessment stages to support the planning and marine licence applications for the Proposed Development, to be submitted to Cyngor Gwynedd local planning authority and the NRW marine licencing team respectively. The assessment is based on a desk-based study using readily available desk-based information. An Environmental Impact Assessment (EIA) has been prepared in parallel with this report.
- 3.1.4 The spatial scope of the assessment includes all water bodies potentially affected by the Proposed Development. The assessment considers the potential impacts of the Proposed Development on the relevant quality elements associated with the water bodies affected, at the water body scale.
- 3.1.5 The assessment focuses on the permanent impacts of the Proposed Development. Temporary impacts, typically resulting from construction activities, are not considered to result in a deterioration in WFD status if the water body:
- Is only impacted for a short time period.
 - Is likely to recover within a short time period.
 - Is likely to recover without the need for any restoration measures.

3.2 Data sources

- 3.2.1 The following datasets and resources are readily available online and have been collated to support this assessment:
- Western Wales River Basin Management Plan [2].
 - Welsh part of the Severn Cycle 3 RBMP 2021 water body status classification and status objectives data [3].
 - WFD Protected Area data.
 - The British Geological Society Interactive Map (see) [4].
 - Designated Site and WFD Habitat Sensitivity information [5].

4. Project Site

4.1 Location

- 4.1.1 The red line boundary for the Proposed Development encompasses a 1.2km length of frontage of the North Promenade region in Barmouth, Gwynedd (approximate grid reference SH 60786 15941 to SH 60163 17448. The red line Boundary for the Proposed Development is shown in ES Volume 4, Figure 1.1. The area within the red line boundary has been defined as ‘the Site’ and 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.

4.2 Site description

Geology

- 4.2.1 The British Geological Survey (BGS) 1:50,000 scale mapping indicates that the bedrock geology directly beneath the Site predominantly comprises sandstones, mudstones and turbiditic siltstones, conglomerates and manganese ore beds of the Harlech Grits Group. The bedrock geology of the eastern most section of the Site comprises thick bedded turbiditic sandstones, conglomerates and laminated sandstones, with thin siltstone and mudstones intercalations.
- 4.2.2 The superficial geology of the Site comprises predominantly coastal deposits of gravel, sand, silt and clay [4]. The superficial geology of the eastern most section of the Site, comprises blown sand.

Topography

- 4.2.3 Levels within the Site range from circa +5m Above Ordnance Datum (AOD) to circa 0m AOD [6].

Land use

- 4.2.4 The land use of the Site is coastal and urban in nature, comprising a long sandy and fine-shingle beach in Cardigan Bay. The promenade provides access to the Barmouth Beach. The beach levels significantly decrease, and the defences deteriorate in condition, moving towards the northern extent of the Site.
- 4.2.5 Directly to the east of the Site is the settlement of Barmouth, occupying a linear strip of coastline between the beach and Barmouth Slab, a natural rock climbing area reaching a height of 253m AOD.

Ecology

- 4.2.6 A Preliminary Ecological Appraisal (PEA) was undertaken in September 2024 by Richards, Moorehead & Laing Ltd (RML) to inform the proposed improvement works to the flood defences at North Promenade, Barmouth [7]. The Site was found to comprise predominantly hardstanding, bare ground and structures along Marine Parade interspersed with small parcels of coastal and amenity grassland, tall ruderal vegetation and scrub, with adjacent coastal and intertidal habitat including mud/sand and cobble/shingle habitat. Invasive non-native species (INNS) were noted on the Site including Japanese Knotweed

(*Reynoutria japonica*), montbretia (*Crocsmia x crocosmiiflora*) and Japanese rose (*Rosa rugosa*). Habitats identified were assessed as suitable to support protected species including birds, bats, otter (*Lutra lutra*), other mammals including hedgehog (*Erinaceus europaeus*), reptiles and amphibians.

4.2.7 In addition to the PEA:

- A breeding bird habitat appraisal survey was undertaken during summer 2024.
- Passage and wintering bird surveys were undertaken monthly between October-March 2024/2025.
- An Intertidal Biotope Survey was undertaken in September 2025.
- Otters and Water vole surveys were undertaken in November 2024.
- A blue mussel *Mytilus edulis* assessment was undertaken in March 2025
- A *Sabellaria alveolata* survey was undertaken in May 2025.
- These surveys along with other information sources have informed a detailed baseline that has been prepared for ES Volume 2, Chapter 6 Biodiversity and Protected Sites.

WFD protected areas and statutory designated sites

4.2.8 The location of the Site in relation to WFD waterbodies is illustrated in Figure 1.

4.2.9 Interrogation of the 'Water Watch Wales' [3] website identified the following WFD protected areas are located within 5km of the Site. The location of the Site in relation to WFD Protected Areas is illustrated in Figure 2.

Drinking Water Protected Areas

4.2.10 The eastern extent of the Site intersects the Meirionnydd groundwater Drinking Water Protected Area, classified as not at risk.

4.2.11 The "Un-named tributary near Afon Dysynni" Drinking Water Protected Area river catchment is located approximately 4km south of the Site.

4.2.12 There are no lake Drinking Water Protected Areas within 5km of the Site.

Areas designated for the protection of economically significant aquatic species

4.2.13 The Mawddach shellfish waters protected area is located some 670m south of the Site and encompasses the lower reaches of the Mawddach Estuary.

Bathing Waters

4.2.14 Barmouth beach is a designated Bathing Water. NRW assesses water quality at the site from May to September. The water quality sample point 20014 is located opposite the North Avenue (latitude, longitude: 52.72, -4.062, easting, northing: 260840, 315900).

4.2.15 Annual water quality assessments for bathing water in Barmouth is Excellent in 2025, as well as Excellent in 2024, 2023, 2022, 2021.

Nitrate Vulnerable Zones (NVZs)

4.2.16 No NVZs were identified within 5km of the Site.

International statutory designated sites

- 4.2.17 There are four internationally designated sites for nature conservation within 5km of the Site, comprising:
- Llyn Peninsula and the Sarnau Special Area of Conservation (SAC), located 31m west of the Site.
 - The Meirionnydd Oakwoods and Bat Sites SAC, located 350m east of the Site.
 - Northern Cardigan Bay Special Protection Area (SPA), located 2.14km west of the Site.
 - Morfa Harlech a Morfa Dyffryn SAC, located 4.76km northwest of the Site.

Site hydromorphology

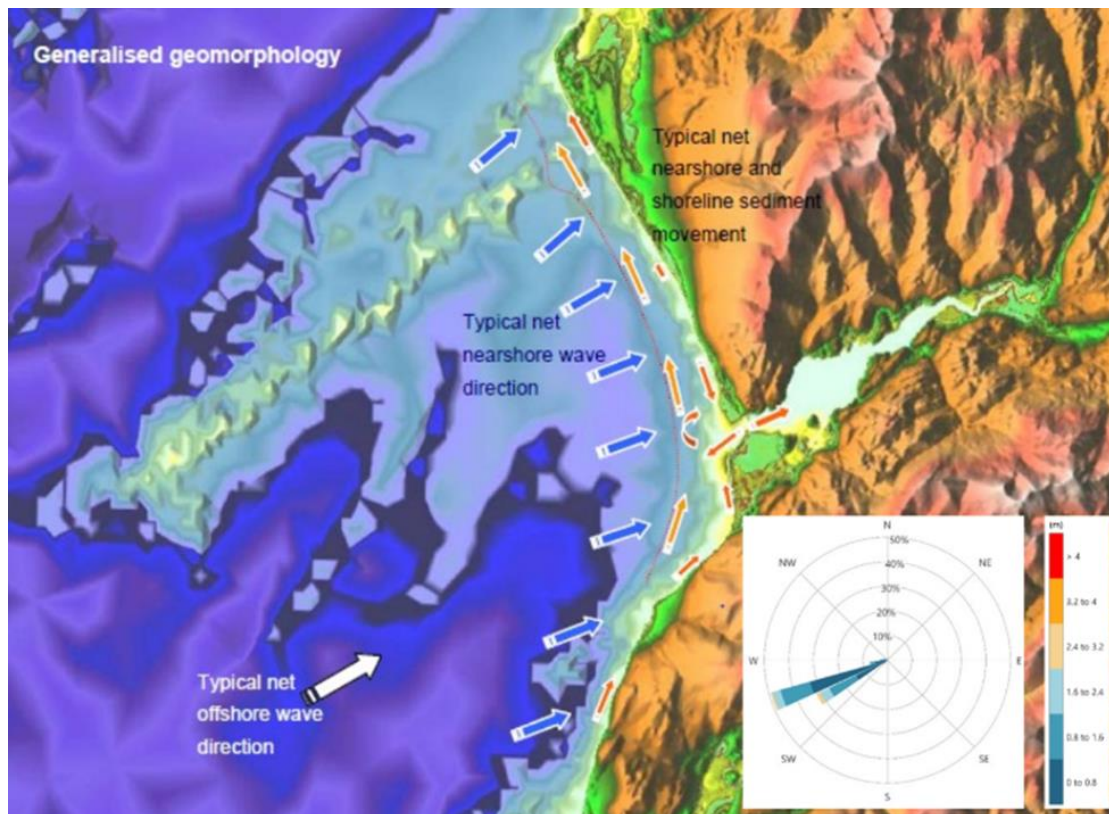
- 4.2.18 ES Volume 2, Chapter 12 Marine and Coastal Physical Processes includes a description of the hydromorphological baseline at the Site. This section of the report summarises these findings.

Shoreline Management Plan (SMP) 2 implications

- 4.2.19 The current SMP2 policy for the unit containing Proposed Development is “Hold the Line” in Epoch 1, moving to “Managed Realignment” in Epoch 2 and Epoch 3. The Proposed Development deviates from the policy framework set out in the SMP2 on the understanding that the SMP2 timescales are subject to some flexibility with the main objective of effective implementation. This is based on the recognition that an extended timeframe is achievable given the nature of existing coastal defence assets and residual coastal risk, allowing a successful strategy for implementing a managed realignment approach.

Sediment transport

- 4.2.20 A baseline sediment transport model was developed by ABPmer in 2019 (refer to Section 3 of R3589). The baseline model was run for years 2007 to 2016, without accounting for sea level rise.
- 4.2.21 The model indicates limited shoreline change, reflecting the observed stability of the upper shingle/cobble beach. Sediment transport rates are generally low in relation to transport rates that can occur along an open coast subject to similar wave heights.
- 4.2.22 Where transport occurs, net movement is slightly southerly north of North Promenade and northerly along the southern section of North Promenade and northern Barmouth South frontage.



Picture 1 Coastal processes figure from ABPmer study [8]

Beach evolution

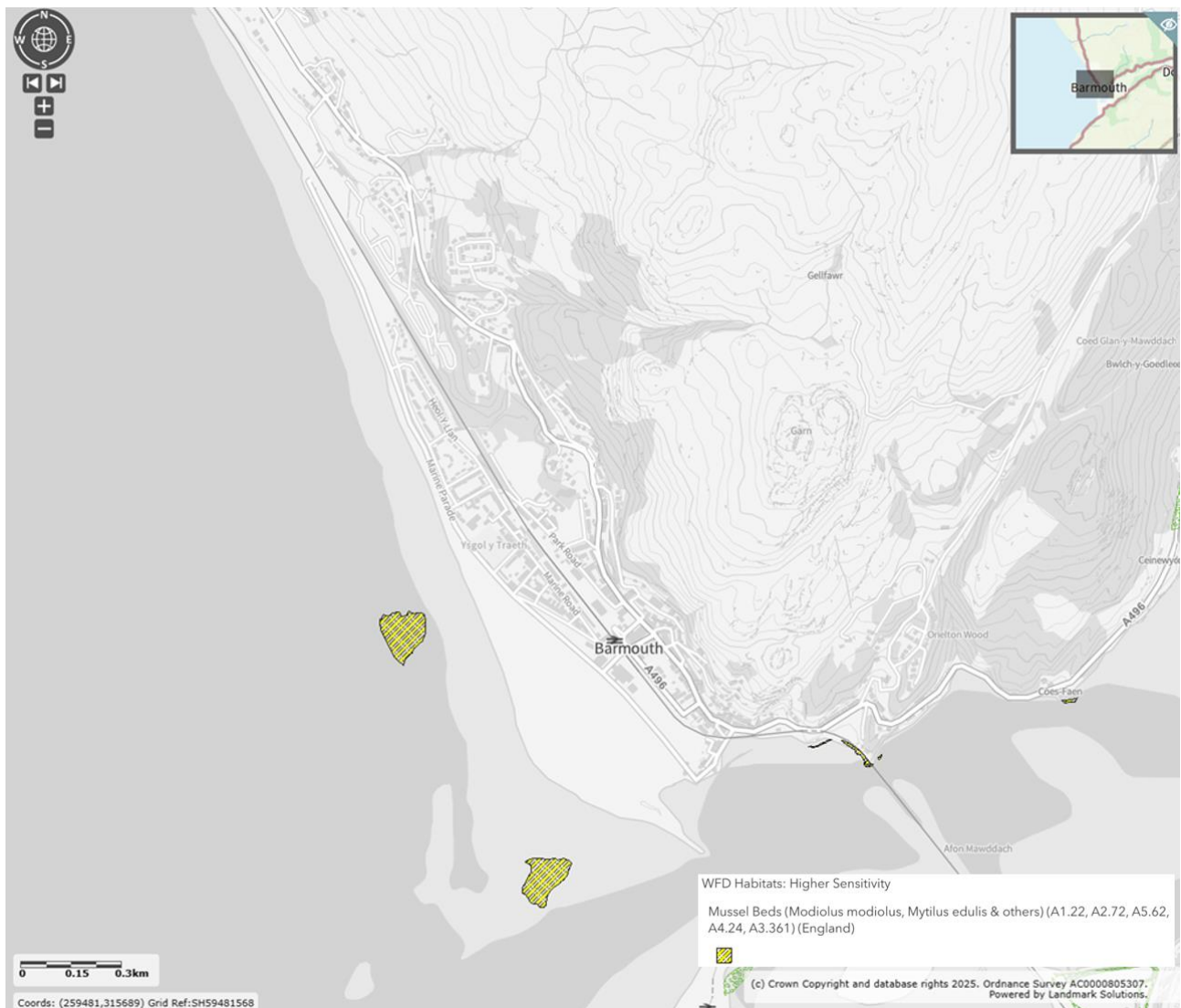
4.2.23 Based on assessments by ABPmer (2019, 2021 and 2024) [9] [8] [10] [11] [12] using existing topographic data, aerial photographs and sediment transport modelling (2021):

- It was observed that in the past, the northern part of Barmouth Beach has experienced sediment loss and declining beach levels, while the southern part (dunes area) has seen sediment accretion and rising beach levels. Local scouring is present at the toe of the seawall exposing the sheet pile foundation.
- The groynes in the north have limited functionality in trapping sediments due to missing timber planks and are almost completely exposed. Similarly, the groynes in the south are almost completely covered in sediment and with limited functionality. There is only one partially refurbished groyne which holds a significant volume of coarse sediment (shingle/cobble).
- In-between each of the groynes there are small pocket of sand-shingle beaches which become sandier in a southerly direction.
- The rate of erosion is likely to increase with sea level rise which will result in larger waves reaching the promenade and in turn increasing beach lowering. The SMP2 suggests the rate of erosion could increase by a factor of 1.7 to 2.5 times the existing base rate over the next 100 years.

4.3 WFD habitat classification

Higher sensitivity habitats

- 4.3.1 Blue mussel beds are located on lower sections of some of the groynes within the Site. Blue mussels were also recorded on the long sea outfall pipe which will be retained. Further blue mussel beds are located 155m to the southwest of the Site.
- 4.3.2 The desk-based Blue Mussel Assessment [13] also confirmed blue mussel beds are highly likely to be present below Mean Low Water Springs (MLWS) in proximity to the Proposed Development boundary. For the purpose of this assessment, a precautionary approach is taken in assuming these mussel beds are WFD higher sensitivity habitats. Further blue mussel beds are located 155m to the southwest of the Site, as shown in Picture 2.

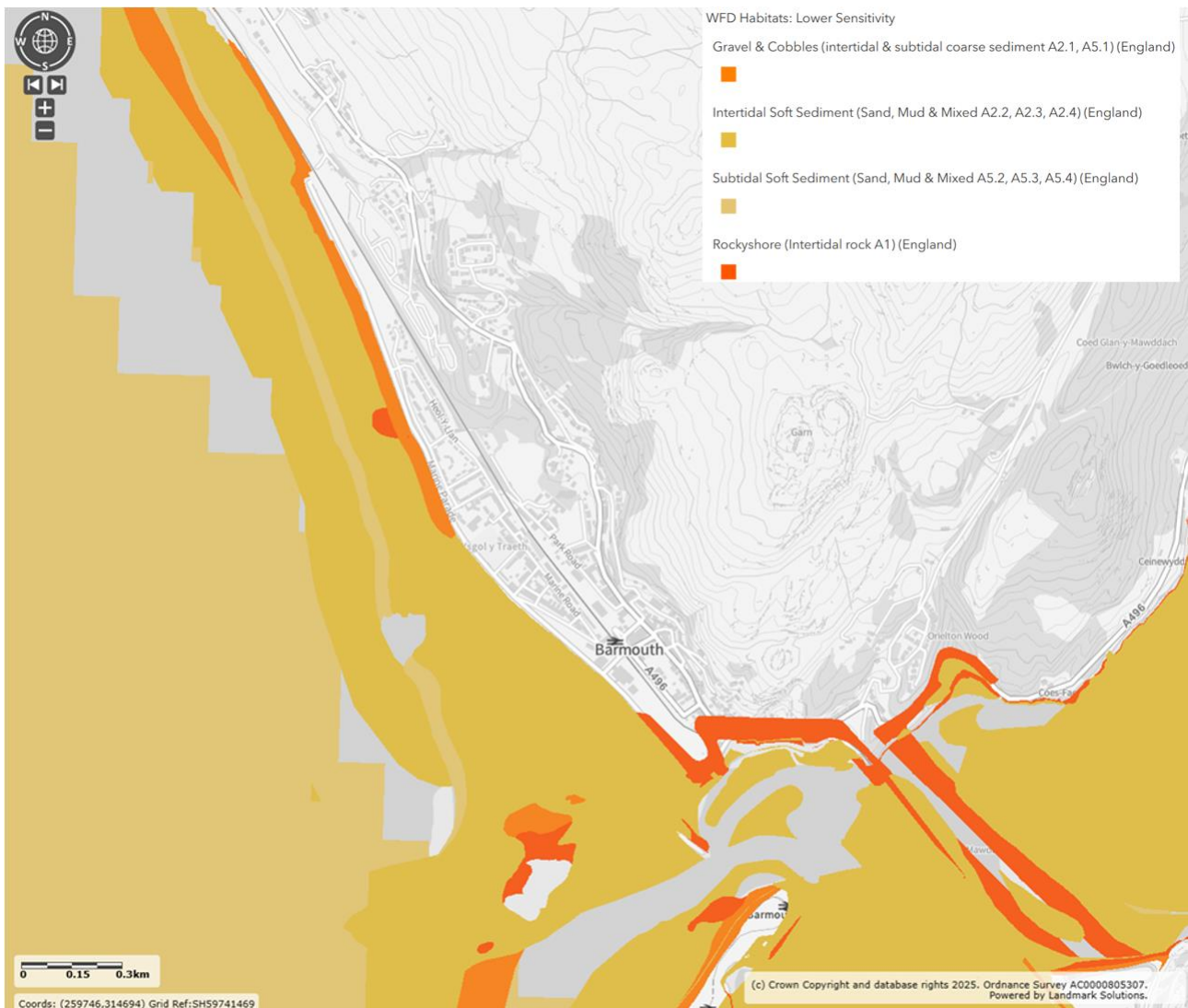


Picture 2 WFD higher sensitivity habitats

Lower sensitivity habitats

- 4.3.3 Four WFD lower sensitivity habitats are located within and/or adjacent to the Site, comprising:
- Gravel and Cobbles are present within the northern extent of the Site.

- Intertidal Soft Sediment is present throughout the Site.
- Subtidal Soft Sediment is present within the western extent of the Site.
- Rockyshore is present within the centre of the Site.



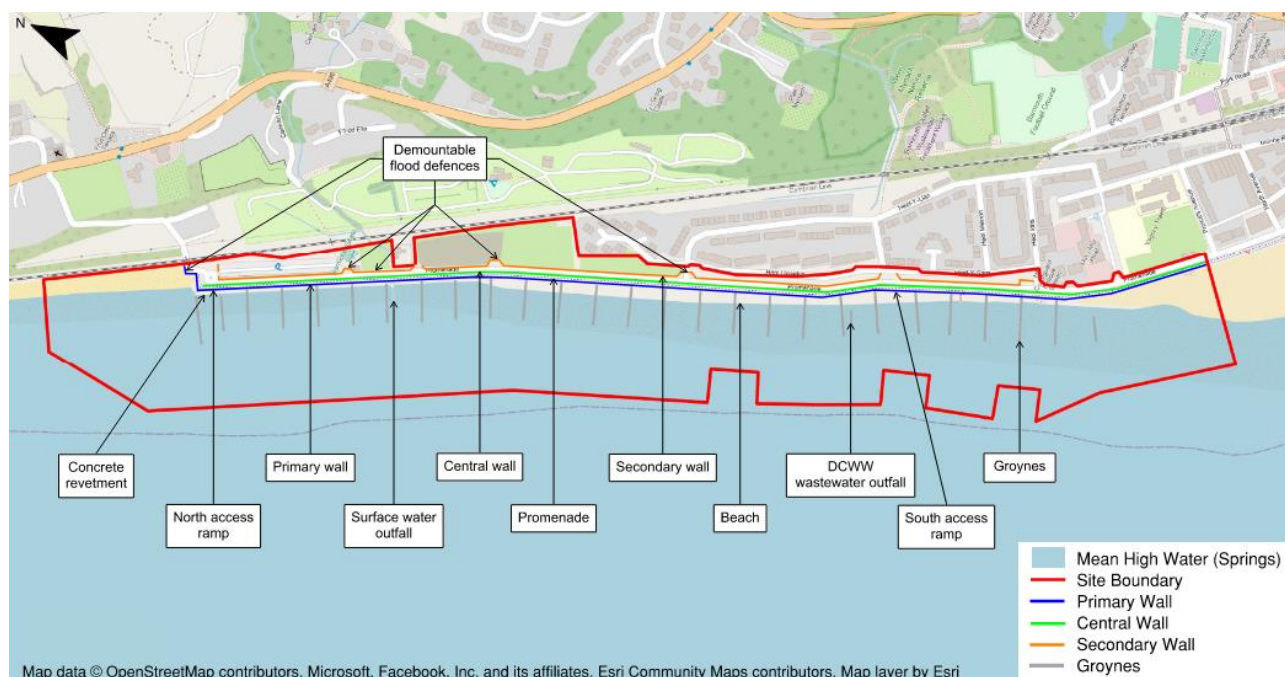
Picture 3 WFD lower sensitivity habitats

4.4 Waterbodies

- 4.4.1 The western extent of the Site falls below Mean High Water Springs (MHWS) and therefore intersects a small part of Cardigan Bay.
- 4.4.2 In addition, two small, non-WFD watercourses discharge to the sea within the Site. These are known as the Hofotty and Gellfawr and both are culverted beneath the existing Promenade. Two Dŵr Cymru Welsh Water (DCWW) outfalls extend under the promenade to discharge at the beach. There is also a pumped surface water drainage system.
- 4.4.3 The mouth of the Mawddach Estuary is located 20m south of the Site.

5. The Proposed Development

5.1.1 This section provides a description of the Proposed Development. Key site elements are detailed in Table 5-1 with a brief description of the proposed works for each location in the Proposed Development. Picture 4 provides a site plan showing the existing arrangements.



Picture 4 Site Plan showing existing arrangement

Table 5-1 Proposed coastal defence works

Asset	Existing Description	Proposed Development
Beach	The Beach is primarily made up of sand with a shingle berm north of the promenade and dunes to the south. There is some coarse sediment (cobble/boulders) in the southern extent of the site and a coarse sediment fillet along northern half the frontage. To the south, the beach widens with sand dunes.	New rock revetment to be constructed at the top of the beach (950m in length) utilising rock armour (boulders) of a maximum grading of 3-6t. No other material is to be added to the beach. [Please note - During the development of the proposals, a 125m extension of the Rock Revetment beyond the northern end of the Promenade was considered, in order to prevent over topping of the shingle embankment and outflanking of the North Promenade Defence. In addition, 225 m of the revetment extended to the South of the ramp opposite Heol-y-Plas. At the time of preparing the Environmental Statement, these areas were included in the assessments to ensure a “conservative” scenario was considered. Through further physical modelling and flood modelling it has been determined that these areas are

Asset	Existing Description	Proposed Development
		not required and has been subsequently removed from the Scheme, however some of the assessments still include it.] Coarse sediments will be redistributed along the beach front rather than being removed. The coordinates for the rock revetment include: Northwest end of rock revetment: 260187, 317354 and southeast end of rock revetment: 260613, 316390
Groynes	Timber groynes situated in front of the northern promenade at roughly 45m intervals, the majority of which have damaged and/or missing boards.	The groynes are to be removed. Refurbishment is not proposed or required as part of the Proposed Development.
Concrete revetment	A concrete revetment runs at the top of the beach. A sheet pile cut-off toe has been installed running along its length, buried in the sand.	The existing concrete revetment is to remain. Existing sheet piles to be refurbished over a ~950m length to the north of the promenade, including a capping beam which will also be accessible to pedestrians for recreation. Existing buried concrete apron to the South of the Proposed Development to be covered by proposed rock armour.
Primary wall	Precast concrete wave recurve wall units.	The primary wall is to remain, with localised patch repairs to joints and sealant where required. The coordinates for the primary wall include: Northwest end of primary wall: 260282, 317263 and southeast end of primary wall: 260800, 316057.
Central wall	Separating the promenade and highway, an unreinforced stone wall with large sections of missing stones and many drainage holes. There are benches built into the wall and several access points enabling access between the beach and highway via the promenade.	The central wall is not required to provide a flood defence function. It will therefore be replaced with a new kerb and balustrade to provide separation between the promenade and highway.
Secondary wall	Unreinforced stone wall running parallel to the Central Wall on the opposite side of the Marine Parade highway, with demountable flood defences (stop logs) at multiple locations as below.	New reinforced concrete wall, generally on the alignment of the existing defective secondary wall. Max height of 1.55m, which may vary across length. Facing the promenade, the wall will include a concave recurve shape. Where feasible, the wall will have a textured concrete finish.

Asset	Existing Description	Proposed Development
		The secondary wall runs from Heol Idris to and around the North Promenade Car Park, tying into the existing railway level crossing. The foundations of the wall will be designed to allow for future raising by up to 150mm. This is estimated to be required in 2055 but will be subject to further monitoring of storms and water levels, and would require its own consenting process. The coordinates for the secondary wall include: Northwest end of secondary wall: 260364, 317114 and southeast end of secondary wall: 260800, 316057.
Demountable flood defences	Wooden boards slotted into stop logs bridging the gaps in the secondary wall at access points. Many demountable defences are in place as the default position.	Existing stoplogs will be replaced with either a continuation of the secondary wall, or flood gates. A total of nine number flood gates are to be installed
Promenade	A concrete walkway along the sea front from South to North Barmouth, running between the primary and central walls.	Raised planters, cycle stands, seating and other street furniture will be included. New street lighting is proposed.
Beach access ramps	Existing access ramps provided at the north and south of the promenade. Existing gradients (1:7 at North, 1:15 at South) pose accessibility challenges.	Existing ramp to the north of the Proposed Development to be rebuilt/extended at 1:21 gradient, extending up to 1.7m below beach level.
Beach access steps	Existing access steps, within the concrete revetment, are provided at regular intervals (100-150m) along the promenade. Due to erosion, many of these are in poor condition and provide access to the concrete revetment only, not beach level.	The access steps within the scheme extents (6 no.) will be rebuilt, complying with relevant standards to improve accessibility, and extended through the rock revetment to the beach, extending up to 1.7m below beach level.
Promenade access ramp	An existing landward ramp with a 1:6 slope connects Marine Parade, with the junction of Heol-Llywelyn, Heol-y-Sarn and Heol-y-Plas heading landward.	The existing landward ramp will be removed and replaced with both steps and a new ramp with a gradient of 1:21 or shallower.
Highway	The single carriageway Marine Parade runs the entire length of the promenade between the central and secondary walls. The seaward side is demarcated for parking, and there is a pavement on the landward side.	The carriageway will be resurfaced as part of the Proposed Development. Car parking demarcation is to be switched to the landward side of the road to reduce the risk of clash with the central balustrade, and improve access to the pavement.

Asset	Existing Description	Proposed Development
		Crossing points are to be added to improve accessibility and safety for pedestrians.
Outfalls	One culverted watercourse discharges to the sea at the North of the site. Two DCWW outfalls extend under the promenade to discharge at the beach. There is also a pumped surface water drainage system.	The surface water pumping station and DCWW outfalls are not included as part of the scope of the Proposed Development. These will be protected during construction only. The outfall by the café is to be extended under the proposed rock revetment and refurbished (including non-return valve).
Landscape and Public Realm	The existing north promenade is very limited in terms of amenity provision both for soft and hard landscape. Green areas and planting are absent along the promenade and road corridor. A number of moveable raise planters with palm trees are placed along the southern promenade and extend nearer the school Ysgol Y Traeth but do not encroach into the Proposed Development. The only areas of grass are located behind the secondary wall and adjacent to the residential areas. However, these are maintained as amenity grass, with limited aesthetic value. Seating areas are provided along the central wall and in limited locations along the secondary wall, however these have fallen into disrepair due to storm damage to the central wall and are not to current inclusivity standards. The promenade surface is showing its age and feels worn, with visible signs of cracking and patched up areas. Lighting columns are present along the secondary wall, however the light spill coverage appears insufficient, resulting in a non-uniform coverage and multiple dark areas along the promenade.	The following measures will be proposed as part of the public spaces design both in terms soft and hard landscape: - Improved and increased seating areas. - Raised planters with vegetation at key nodes and more significant amenity green areas around the northern car park. - Improved road crossing points for pedestrians. - Delineated areas for commercial activities (e.g. designated locations for food and beverage trucks) near the northern car park. - Cycle parking areas. - Improved signage/wayfinding. - Improved access to beach through the rock revetment. - Improved lighting provision.

- 5.1.2 A 950m-long rock revetment will be the first formal line of defence against coastal flooding. The rock revetment arrangement is as follows for the majority of its extent, although levels vary and the rock revetment widens at the northern end. The rock revetment begins at beach level (approx. 0mAOD) and ramps up in two stages to meet the concrete revetment. The rock revetment initially ramps up at a 1 in 1.5 gradient over a distance of approximately 3.2m and levels off to form a 2.8m long landing. The second incline is at a 1 in 3 gradient over a distance of ~2.5m finishing with an 8m level section.
- 5.1.3 A symmetrical section of the rock revetment extends beyond the north promenade for 125m, in front of the existing shingle berm. The rock revetment ramps up from beach level at a 1 in 1.5 gradient for 3.6m and levels out to

create a 3.6m landing, then ramps up at a 1 in 3 gradient for ~4.5m and levels out at the crest for 4.8m. The rock revetment ramps down on the landward side creating a symmetrical section.

- 5.1.4 Approximately 48000t of primary rock and 15000t of smaller graded material is required for the entire rock revetment.
- 5.1.5 A concrete capping beam will be laid over the flat portion of the existing concrete revetment to allow limited amenity use. This will include an upstand to discourage access to the rock revetment.
- 5.1.6 The existing beach access steps in the concrete revetment will be refurbished and extended through the rock revetment to the beach. There will be six 2m wide stepped access points consisting of flat landings in line with the rock revetment and steps where the rock revetment is sloped. The new steps are to be precast concrete elements, supported by sheet piles.
- 5.1.7 The north access ramp will be extended to provide access to maintenance vehicles and improve accessibility through the new rock revetment. Similar to the steps, these are to be precast concrete supported by sheet piles.
- 5.1.8 The primary wall separates the promenade from the beach. The existing wall will remain unchanged aside from localised repairs as needed. The promenade will typically be 5.3m wide and continue to provide the main active travel route along the seafront. Various low maintenance placemaking features such as benches and planting will be installed along the promenade.
- 5.1.9 The existing central wall will be demolished and replaced with a kerb and balustrade to provide separation between the promenade and highway. Several openings will be incorporated into the balustrade, including at formalised pedestrian crossing points along Marine Parade, which align with openings in the secondary wall.
- 5.1.10 The carriageway will be resurfaced as part of the Proposed Development. Car parking demarcation is to be switched to the landward side of the road, and crossing points are to be added to improve access.
- 5.1.11 The layout of the car park at the north of the site, and associated surrounding infrastructure, will be redesigned to rationalise vehicle movements and parking, while enhancing active travel provision, amenity spaces, and public realm features.
- 5.1.12 The secondary wall will be rebuilt in reinforced concrete and raised to a maximum height of 1.55m. The face of the wall facing the sea will include a concave recurve shape. The rear vertical face (and possibly the front face) will have a textured concrete finish. The wall will extend around the rear of the car park, between the car park and railway. In this section, it will be constructed entirely in concrete and will not include a recurve.
- 5.1.13 There are nine new flood gates in the Proposed Development, located along the primary and secondary walls. This includes across the Network Rail level crossings, and across access points to adjoining roads such as Heol Idris and Heol-y-Llan. Four of the flood gates will replace existing stop logs, the remaining five are located where there were previously gaps in the line of defence.
- 5.1.14 The existing lighting columns on the promenade will be removed and new columns will be installed along the promenade to increase illumination of the promenade and roadway, whilst reducing light spill which currently occurs within the existing arrangement. The lighting has been designed as:

- Tall asymmetric double lighting columns (estimated 8m - 10m height) positioned at regular intervals.
- Well-shielded luminaires with asymmetric optics for precise light direction.
- Designed to light the road and the promenade.
- Warm white light sources (max 2700K) to reduce impacts on ecological receptors.

5.2 Construction programme

5.2.1 Works are scheduled to commence in April 2027 and due to be completed in spring 2029, taking approximately 24 months. The estimated timescale for each element's construction is detailed in Table 5-2.

Table 5-2 Construction duration of activities.

Activity	Programme
Beach and rock revetment	12 months
Primary wall, central balustrade and secondary wall	12 months
Placemaking	12 months

5.2.2 Regular working hours are scheduled to be between 07:00 and 19:00, although much of the construction work subject to beach access will require variations around tidal patterns. It is estimated that 50 full-time staff will be on site for the duration of the construction: 15 office staff and 35 construction workers.

5.3 Construction methods

Revetment

5.3.1 To construct the rock revetment existing shingle and sand in the footprint of the proposed rock revetment will be excavated using a 35t-40t excavator. Shingle and sand will be moved to an on-site stockpile location using a dump truck. Any non-indigenous material or non-natural debris will be removed and disposed of at a nearby tip. A geotextile separation membrane will be placed on the excavated surface. Rocks will be individually placed from the temporary stockpiles on the beach with a 50t excavator with a grab. This work will be undertaken at low tides.

Beach access steps

5.3.2 Sheet piles will be placed either side of the area where the steps will be constructed reaching a height above MHWS, this will be carried out using a 70t piling rig. Shingle/sand will be excavated using a 35t-40t excavator and moved to a stockpile area on the beach above MHWS with dump trucks. Rubble will be placed between the two sheet pile walls and steel framework constructed to support the steps. Precast concrete slabs and steps will be placed on top of the steel frame to form the steps and landings using a 70t crane with a maximum lifting height of 55m. The sheet piling will be cut down to follow the line of the concrete steps and a concrete capping beam cast in situ. A 30m concrete pump

will be used to pour concrete from a concrete mixer truck parked on Marine Parade.

Beach access ramps

- 5.3.3 Construction methodology of the ramps is similar to the access steps. The existing ramp will remain in place and the proposed ramp constructed on top and around the existing concrete structure. Sheet piles will be placed on either side of the proposed ramp footprint with bedding rock and loose rock infill between the sheet piles. A geotextile layer with concrete blinding layer will be poured over the fill material to create a smooth surface at the correct gradient. A precast concrete base slab is to be placed on top of this and form a connection with the sheet piles. Bulk concrete pour anchored into the existing ramp will raise the level of the top section of the existing ramp to join the new ramp. The top level of concrete parapets is to remain above the top of the rock revetment and a balustrade railing on top. The concrete parapet is designed to prevent the public from walking along the top of the wall. Rock revetment will be placed around the ramp and over the existing ramps, partially embedded in mass concrete to reduce risk of units shifting.

Sheet piling

- 5.3.4 New sheet piling will be installed using 70t piling rig and a crane with a maximum lifting height of 55m.

Primary wall

- 5.3.5 Localised concrete repairs and filling of joints will be carried out using hand tools where required – isolated sections of the promenade would need to be cordoned off while this is carried out.

Central balustrade

- 5.3.6 The central balustrade will be constructed by demolishing the existing masonry wall, excavating the promenade surface and reconstructing the kerb and balustrade. Two gangs will begin in the south separated by a small gap and move north to increase efficiency. The balustrade will be built in sections of up to 5m to reduce disruption and traffic management required. Street furniture such as signage and benches will be removed and stored to be replaced following construction. Traffic management measures will be required as work will take place on and adjacent to the west lane of Marine Parade (see section **Error! Reference source not found.**).
- 5.3.7 The existing wall will be demolished using an angle grinder, pneumatic breaker, excavator and dump trucks. The waste material will be transported offsite for disposal. Kerb and balustrade units would be transported from the compound, along the promenade, using lightweight tractor and trailer units. Lifting equipment will be used to lift the units into place and connection details will be completed by hand.
- 5.3.8 .

Secondary wall

- 5.3.9 Construction of the secondary wall will involve demolition and reconstruction of the existing wall. Two gangs will begin in the south separated by a small gap and move north to increase efficiency of the crane and other equipment. The wall will be built in 5m sections to reduce disruption and traffic management required. Street furniture such as signage will be removed and stored to be replaced following construction of the secondary wall. Traffic management measures will be required as work will take place adjacent to the east lane of Marine Parade.
- 5.3.10 The existing wall will be demolished using an angle grinder, pneumatic breaker, excavator and dump trucks. The waste material will be transported offsite for disposal. Excavation of the existing wall foundations is not required due to the use of sheet piles. Sheet piles will be lifted using a crane and driven using a piling rig to construct the wall's foundations.
- 5.3.11 The concrete recurve wall will be constructed on top and connected to the sheet piles. This is likely to be constructed in-situ with concrete brought onto site and poured into formwork, although the use of precast units may be possible.

Groyne Removal

- 5.3.12 The timber groynes will be removed using hand cutting tools and machinery. Groyne piles will be removed using an excavator with a grab or chain attachment. Concrete steps attached to the existing concrete revetment at the end of each groyne will be broken out with an excavator and a breaker. Waste material from the groynes and steps will be removed from site using dump trucks. Groyne removal will take approximately two weeks.

Outfall extension

- 5.3.13 The existing surface water outfall will be extended through the rock armour to provide a new outfall. The outfall is likely to be extended in the same pipe material, with concrete surround for protection. The pipes will be lifted into position with an excavator, and shutters placed around the pipes prior to pouring concrete using a mobile concrete pump. A proprietary flap valve will be fixed to the end of the encased pipe.

Demountable defences

- 5.3.14 Temporary demountable flood defences would be installed where existing flood defence features are temporarily removed as part of construction, prior to the construction of the permanent works.

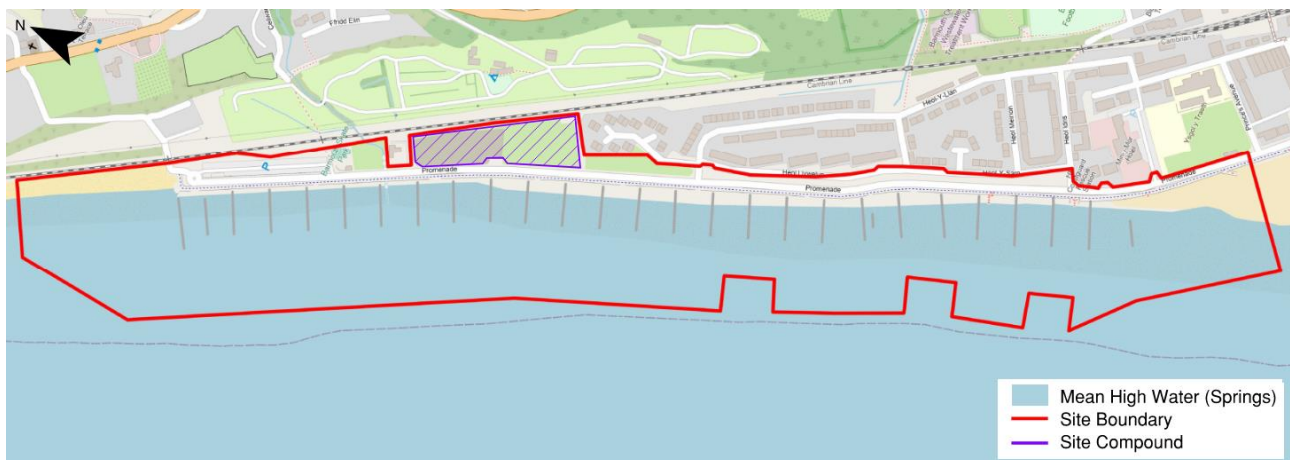
Lighting

- 5.3.15 Throughout the duration of the project temporary lighting will be required to allow works to continue outside of daylight hours, this will mainly occur during the winter months. This includes permanent work lighting which will be temporary lighting installed in the same place throughout the project and task specific lighting which will be in place for specific sections of the works for a shorter length of time. All temporary lighting will be directed away from the sensitive areas identified by the Ecological Clerk of Works (ECoW).

- 5.3.16 Flood lighting, security lights, and any other obtrusive external lighting shall be sensitively located to avoid nuisance to neighbouring properties and should only provide the necessary luminance for the relevant tasks. Site compound lighting will be installed to light up compound walkways and access, and directed into the site compound causing no disturbance to the local environment outside of the compound.
- 5.3.17 Permanent work lighting:
- All cabins in the site compound.
 - Stockpile area in yard.
 - On ramps for unloading/turning around for deliveries.
 - Along any working area (on the beach or top of the promenade).
- 5.3.18 Task specific lighting:
- Mobile Tower lights.
 - Hand held lighting & Head torches.
 - Vehicle and Plant lighting.

Site compound

- 5.3.19 The construction compound will be located on privately owned land to the east of Marine Parade as shown in Picture 5. Arrangements have been made with the landowner for use of the land during the construction period. The compound will accommodate welfare, office and parking facilities.



Picture 5 Site compound location

5.4 Maintenance and design life

Table 5-3 Proposed asset design life

Asset	Proposed design life
Sheet pile cut-off	100 years
Rock revetment	50 years (overtopping) 200 years (start of damage)
Primary wave wall	As existing
Secondary flood wall	Walls and bases 120 years

Asset	Proposed design life
	Joint sealants 10 years
Flood gates	Flood gate itself 60 years Seals and other parts 15 years
Culvert flap valves	25 years
Public realm hard landscaping	Will vary for different products and materials, but will aim for robust materials to maximise design life and maintenance requirements
Public realm soft landscaping	
Highway and drainage	40 years
Handrails	25 years

- 5.4.1 All coastal flood defence assets will be inspected annually. Where maintenance is required, this is likely to involve similar land-based plant to the construction of the revetment (described in **Error! Reference source not found.**), reshaping individual elements of the new revetment to match the construction details. Access would be via the existing access ramps to the beach. Maintenance is more likely to occur after large storm events.
- 5.4.2 The Proposed Development is being designed to provide a standard of protection to 2075, in line with the Shoreline Management Plan (and proposed Major Change). However, structural elements will be designed with a design life as set out in Table 5-3. It is therefore assumed that the defences will remain in place past 2075 and will not be decommissioned. The standard of protection will reduce over time.

5.5 Materials sourcing

- 5.5.1 By volume, the main element of the works to be sourced is the rock armour (63,000 t). The rock is to be a high-quality, sufficiently dense rock such as granite or basalt. At this stage, it is possible that this will be delivered either by road from local quarries or via marine transport, sourced from overseas. The preferred method is for sourcing by road, however given the uncertainty around availability, price and other impacts at this stage, the possibility of marine deliveries is to be assessed.
- 5.5.2 There will be a requirement for further imported materials i.e. reinforcement, masonry and concrete for the works, but these quantities and transport movements are much less. These materials are to be sourced locally and brought in by road.

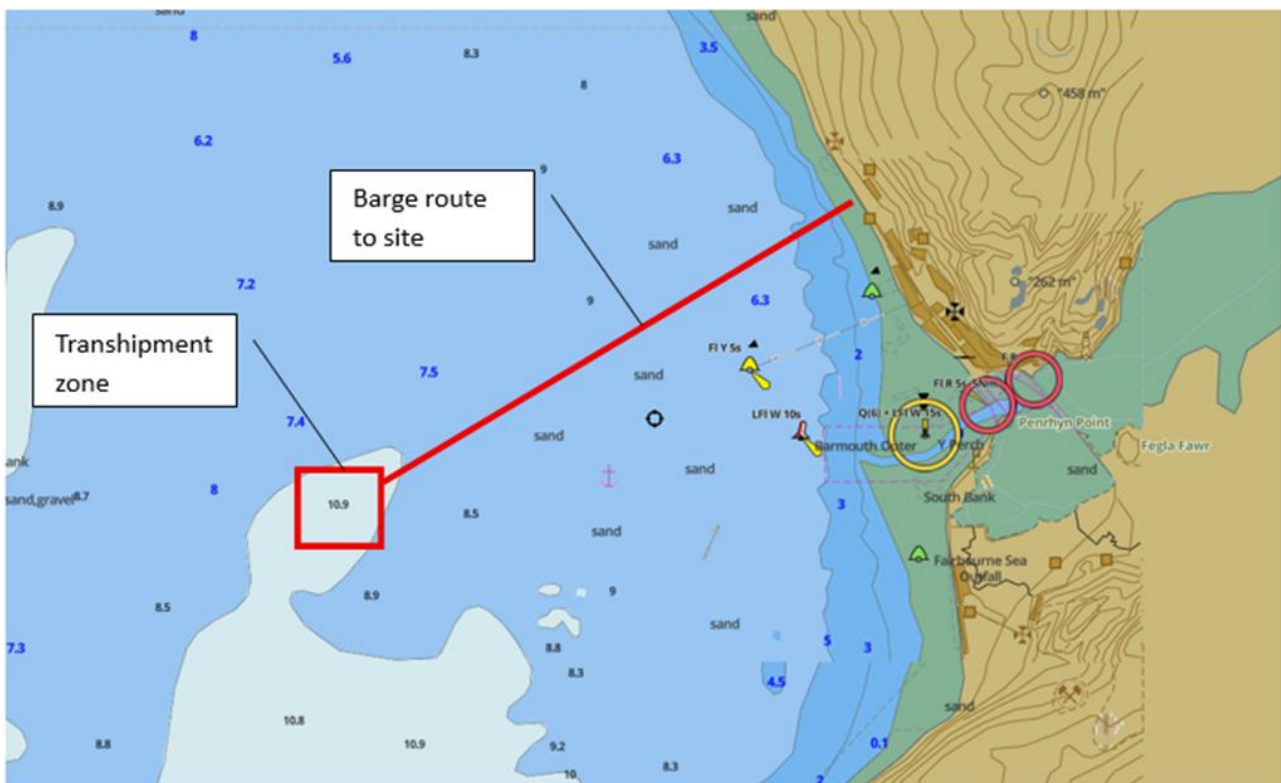
Delivery by Road – Option 1

- 5.5.3 The approximate volume of rock required for the Proposed Development is 63,000t, which if delivered by road would equate to around 20 round trips per day over a period of 10 months using heavy goods vehicles (HGVs).
- 5.5.4 The rock for the Proposed Development will initially be delivered to the site compound area adjacent to the promenade. This rock will be transported to the beach and organised into temporary stockpile areas below high water prior to

placement within the beach structures. All other material will be stored above MHWS in the site compound area.

Delivery by Sea – Option 2

- 5.5.5 For delivery by sea, the rock is likely to be sourced from a European quarry. The 63,000t of rock required will be transported in approximately 25,000t loads via a barge. The barge vessel will sail to the site where it will anchor offshore of Barmouth for around 1 to 2 weeks before setting sail for another load.
- 5.5.6 A shallow draught tipper boat or smaller barge of capacity 1,000-3,000t will travel with the main vessel and the rock armour will be transferred individually from the main ship onto the tipper boat or barge using an on-board excavator equipped with a hydraulically operated grab. The tipper boat will transport the rock to the site of the proposed rock revetment at high tide and tip the rock onto the seabed. At low tide this will be sorted into sizes and placed in the breakwater footprint using the excavator and grab. See Picture 6 or suggested anchoring site and route of the small barge between the main ship and the site of the Proposed Development.



Picture 6 Suggested location of main ship anchoring site and route of smaller barge to site.

- 5.5.7 The tipper boat or barge will shuttle to and from the main ship transferring rock to the breakwater site. It is estimated that 10-20 journeys to and from the main ship will be required per load. Once the main ship has been unloaded, it will return to collect more rock from the quarry. A total of up to 4 return trips for the main ship are estimated to be required to transport the rock.
- 5.5.8 Navigational safety and lighting will be required for some of the works below high water. The works to the revetment/beach will be limited to daylight hours 'in the dry' i.e. during low tides only. This will prevent interference with harbour navigation access. Vessels will be lit and marked appropriately conforming to

relevant code, including the MCA requirements. The harbourmaster will be notified of the dates of works, in advance.

- 5.5.9 There would be one or two tugs on site for barge handling and control. Upon delivery, the main barge will approach the shoreline shortly before the following high tide. Some vessels will be running their engines when offloading is taking place. Marine Gas Oil (MGO) will be used as fuel. At no time will there be any beaching of boats on the beach.
- 5.5.10 In the unlikely event of an emergency, the Harbourmaster will be contacted so that a Notice to Mariners can be raised and / or lighting or buoying installed if required to limit further damage, nuisance or incidents occurring. In the unlikely event that plant becomes trapped and has to be abandoned, the harbourmaster will be alerted, so that a notice to mariners can be raised. Depending on location and if deemed necessary, requirements to mark or light the obstacle until it is removed can be agreed with the harbourmaster. Conditions of contract will be placed to ensure that the contractor is responsible for the removal of any obstructions to navigation caused by abandoned plant.

5.6 Embedded mitigation

- 5.6.1 During Investigation works, general principles of construction best practice and risk mitigation will be followed.
- 5.6.2 Outline measures to reduce construction impacts will be included in the Outline Construction Environmental Management Plan (CEMP) (document reference-EN.F.15). These measures would be secured by a planning condition. The Outline CEMP will define best practice and mitigation measures required for inclusion within the construction method statements, to ensure compliance with relevant environmental legislation, consents, and approvals.
- 5.6.3 The following measures to be included within the Outline CEMP are of particular importance for ensuring compliance with the Water Environment Regulations.

Pollution control

- 5.6.4 The Outline CEMP will contain the following best practice methods to mitigate the risk of pollution:
- Measures to avoid and minimise impacts to the water environment during construction, in alignment with good practice guidance. For the basis of this assessment, it is assumed that environmental good practice advice set out in the Pollution Prevention Guidance (PPG [14]) and replacement Guidance for Pollution Prevention (GPP [15]) series will be implemented on site during the investigation. Whilst PPGs and GPPs do not provide regulatory guidance, they form environmental good practice guidance for the whole UK.
 - All construction activities will be carried out in accordance with guidance outlined within CIRIA best practice guidance [16].
 - A pollution risk assessment will be carried out for the Proposed Development, considering both the storage and transportation of materials used. This will identify potentially hazardous materials or activities and assess the probability and magnitude of potentially harmful effects. From this, a pollution incident response plan (see GPP 21 [17]) will be compiled to identify the specific measures needed to reduce the likelihood of a spillage happening, and to minimise the impact of any spills that may occur.

- All plant operating on the beach will use biodegradable oils and carry spill kits.
- Both the beach and adjacent drains/watercourses will be protected from run-off pollution.
- Ensuring that all site activities in proximity to watercourses and intertidal areas are controlled and are in accordance with relevant legislation and undertaken in compliance with the relevant Guidance for Pollution Prevention (e.g. GPP5 [18]) and industry best practice (CIRIA, CIRIA C741 [19]). Additional measures such as silt fencing, silt busters or bales may be necessary to prevent silt or contaminants from being released into watercourses connected to the site via drainage measures or as surface run off.
- Emergency spill kits are to be maintained at every work location or be easily accessible at all times from a centralised location.
- Spill kits will be deployed in the event of a spillage. In the event of a pollution incident, work should cease in the vicinity of the incident and contaminants must be cleaned up immediately.
- Drip trays and “nappies” to be used under plant when not in use and when re-fuelling.
- The storage and use of hazardous chemicals would be in accordance COSHH Regulations (1998).
- A clean and tidy site will be maintained at all times.
- Bio-oils will be used in plant.
- Daily checks to be carried out before any plant is used on site.
- Equipment to be stored on designated drip trays/bunded areas.
- All fuel will be stored within the site compound, which will house the stationary tank, which will be double skinned, bunded, secure and lockable. This will be sited in a safe position, out of public view, away from heavy movement areas.
- All refuelling operations are to be undertaken at the site compound, at least 10m from any watercourse or intertidal area.
- All refuelling will be carried out with a spillage control kit in place, at the refuelling location (carried by the tractor/item of plant). Care will be taken not to spill any fuel, the operative must remain in attendance at all times and the filling nozzle must not be fixed open unless automatic shut-off nozzle is fitted on the hose.
- A designated, trained and experienced operative will fill the mobile fuel bowser unit from the stationary tank at the site compound using the delivery nozzle.
- Hoses and valves to be checked regularly for signs of wear and renew as and when required.
- If a spill should occur, the following should be used: stop, contain and notify. All spillages, no matter how small, will be cleaned up immediately and reported to the Site Agent.

- All highways affected by the works will be cleansed as and when necessary, following continuous monitoring by the site team to prevent unnecessary build-up of dirt on carriageway surfaces and within associated run off drains.

Minimising disturbance

- 5.6.5 Appropriate measures will be included within the Outline CEMP to reduce potential environmental impacts of any activities within the intertidal zone. This includes measures to:
- Minimise the footprint of any intertidal works as far as reasonable possible to reduce the degree of physical disturbance of the existing marine and coastal environment.
 - Mitigation measures to suppress dust generation will be implemented throughout construction, as and when the requirement is deemed necessary.
 - Constant monitoring of dust levels and effective methods of work should be adopted to prevent dust becoming airborne at the source for example; using wet sweeping methods to prevent accumulation of dust and mud and using effective exhaust ventilation and filtering to minimise potential dust pollution.
 - Reinstate any impacted benthic or marginal habitats where necessary.
 - Reduce associated noise and vibration impacts where possible.
 - Plant will be regularly serviced and maintained.
 - Any excavations and excavated material will be kept damp, where possible, to control dust generation.
 - Construction noise and vibration will be minimised as far as possible in line with best practice.
 - Piling activity during construction will take place at low tide only. This will prohibit noise and vibration travelling through the water column to the intertidal and offshore zones.
 - Use of noise control equipment such as jackets, hoods and shrouds on equipment such as generators.

Biosecurity

- 5.6.6 Good biosecurity practices are vital for preventing the spread of invasive non-native species (INNS) and pathogens such as waterborne fish diseases. Measures will be adopted to minimise the risk of activities leading to the spread of invasive non-native species or pathogens.
- 5.6.7 To avoid the spread of these invasive species the following measures will be detailed within the Outline CEMP and adhered to during construction:
- Contractor's Ecologist to undertake toolbox talks for any INNS prior to works starting. Toolbox talks are to be signed by contractor on site.
 - Fencing will be erected around the working areas.
 - Ensure all site teams are briefed on INNS prevention procedures and made aware of areas on site where INNS are known to be present.
 - Avoid working in areas where INNS are present. Where this is not possible, appropriate biosecurity measures are to be adopted.

- If site members suspect that further INNS may be present or disturbed, they should immediately inform the supervisor, and no attempt should be made to remove or disturb any suspected INNS.
- Assurance should be sought from external contractors that, where possible, machinery is not being brought onto site immediately from works on external waterbodies. Machinery should be dry and free of mud or debris from all previous sites.
- In the event that any operative has used site footwear in proximity to an INNS, footwear should be scrubbed down and left to dry fully prior to reuse on site. If this is not possible then a disinfectant station should be installed. It is recommended that a disinfectant, such as Virkon S, is used which must be stored in a secure container when not in use.

6. Baseline (screening) assessment

6.1 Overview

- 6.1.1 A screening assessment has been undertaken to identify the relevant water bodies that may be affected by the Proposed Development and to collate the latest available baseline data, in order to inform an assessment of the likely effects of the Proposed Development on WFD status and objectives. The location of the Site in relation to WFD waterbodies is illustrated in Figure 1.

6.2 Relevant WFD waterbodies

- 6.2.1 The Proposed Development is located within the 'Meirionnydd' management catchment.
- 6.2.2 The WFD status, status objectives and programme of measures derived by NRW for water bodies located within this River Basin District (RBD) are outlined within the current Cycle 3 Western Wales RBMP [20].

Table 6-1 Relevant waterbodies for the Proposed Development

Operational catchment	WFD water body	ID	Hydro-morphological designation	Screen in for further assessment?
Meirionnydd	Meirionnydd (groundwater body)	GB41002G203200	Natural	Screened out
Cardigan Bay North	Cardigan Bay North (coastal waterbody)	GB621009600000	Natural	Screened in
Mawddach Estuary	Mawddach (transitional waterbody)	GB511006407100	Natural	Screened out

6.3 Meirionnydd

- 6.3.1 The Meirionnydd groundwater body (GB41002G203200) intersects the eastern extent of the Site and is designated 'natural' (not heavily modified or artificial).
- 6.3.2 In WFD Cycle 3 2021, Meirionnydd had an overall status of 'Poor'.

6.4 Cardigan Bay North

- 6.4.1 The Cardigan Bay North coastal waterbody (GB621009600000) intersects the western extent of the Site and is designated as 'natural' (not heavily modified or artificial).
- 6.4.2 In WFD Cycle 3 2021, Cardigan Bay North had an overall status of 'Moderate', with an ecological status of 'Good' and a chemical status of 'Moderate'. A breakdown of the current status of the waterbody is provided in Table 6-2.

Table 6-2 Summary of 2021 WFD status for 'Cardigan Bay North' coastal waterbody

Waterbody	Description, notes or more information
WFD waterbody name	Cardigan Bay North
Waterbody ID	GB621009600000
Waterbody total area (ha)	193,522 ha
Overall status	Moderate
Ecological status	Good
Invertebrates	Good
Infaunal quality index (IQI)	Good
Phytoplankton	Good
Macroalgae	High
Rocky shore macroalgae	High
Dissolved inorganic nitrogen	High
Dissolved oxygen	High
Chemical status	Moderate
Specific pollutants	High
Arsenic	High
Copper	High
Iron	High
Manganese	High
Zinc	High
Priority hazardous substances	Moderate
Cadmium	High
Dioxins	High
Endosulfan	High
Hexabromocyclododecane	High
Hexachlorobutadiene	High
Hexachlorocyclohexane	High
Hexachlorocyclohexane	High
Mercury	Moderate
Nonyphenol	High
Perfluorooctane sulphonate (PFOS)	High
Pentachlorobenzene	High
Polycyclic aromatic hydrocarbons (PAH)	High
Priority substances	High
Benzene	High
Cypermethrin	High
1,2-dichloroethane	High
Dichloromethane	High
Fluorothene	High
Lead	High
Napthalene	High
Nickel	High
Octylphenol	High
Trichloromethane	High
Other pollutants	High

Waterbody	Description, notes or more information
Target water body status and deadline	Good by 2033
Morphology	Not High
Higher sensitivity habitats present	Mussel beds Subtidal Kelp Beds Polychaete Reef
Lower sensitivity habitats present	Gravel & Cobbles Intertidal Soft Sediment Subtidal Soft Sediment Rockyshore Subtidal Rocky Reef
WFD protected areas within 5km	Mawddach Shellfish Waters Protected Area Dyfi Shellfish Waters Protected Area Fathew Drinking Water Protected Area (River Catchment) Un-named tributary near Afon Dysynni Drinking Water Protected Area (River Catchment) Llyn and Eryri Drinking Water Protected Area (Groundwater) Meirionnydd Drinking Water Protected Area (Groundwater) North Ceredigion Rheidol Area Drinking Water Protected Area (Groundwater) Teifi and Coastal Ceredigion Drinking Water Protected Area (Groundwater) Aberdaron Coast and Bardsey Island SPA Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA Northern Cardigan Bay SPA Dyfi Estuary SPA West Wales Marine SAC Lleyn Peninsula and the Sarnau SAC Morfa Harlech a Morfa Dyffryn SAC Meirionnydd Oakwoods and Bat Sites SAC Cadair Idris SAC Cors Fochno SAC Seacliffs of Lleyn SAC Cors Fochno and Dyfi Ramsar Site

6.5 Mawddach Estuary

- 6.5.1 The Mawddach Estuary transitional waterbody (GB511006407100) is located 20m south of the Site and is designated 'natural' (not heavily modified or artificial).
- 6.3.2 In WFD Cycle 3 2021, Mawddach Estuary had an overall status of 'Moderate', with an ecological status of 'Good' and a chemical status of 'Moderate'.

6.6 Screening conclusions

- 6.6.1 The Cardigan Bay North coastal waterbody has been screened into the next stage of the assessment on the basis that the Proposed Development will directly intersect the waterbody and therefore there is risk of potential impacts during both construction and operation on the Cardigan Bay North waterbody.
- 6.6.2 The vertical and lateral extent of the Proposed Development is limited and is unlikely to affect the underlying groundwater. Consequently, the Meirionnydd groundwater body has been screened out of the assessment.
- 6.6.3 The Mawddach Estuary transitional waterbody is considered to be outside of the influence of the Proposed Development and has been screened out of further assessment.

7. Scoping assessment

7.1 Hydromorphology

7.1.1 Table 7-1 considers whether the Proposed Development is likely to require impact assessment due to a potential impact upon hydromorphology.

Table 7-1 Hydromorphology scoping assessment

Consider if your activity:	Yes	No	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		Impact assessment not required	Not a WFD waterbody of high status.
Could significantly impact the hydromorphology of any water body	Impact assessment required		No impacts to morphological conditions or tidal patterns are anticipated during construction. During operation, the proposed revetment, rock armour, ramps and the removal of the groynes has the potential to impact morphological conditions and tidal patterns within the Cardigan Bay North coastal waterbody. A Coastal Processes Study has been undertaken for the Proposed Development.
Is in a water body that is heavily modified for the same use as your activity		Impact assessment not required	The Cardigan Bay North coastal waterbody is designated 'natural' (not heavily modified or artificial).

7.2 Biology

Habitats

Table 7-2 Higher sensitivity and lower sensitivity habitats – for information only

Higher sensitivity habitats ¹	Lower sensitivity habitats ²
Mussel beds	Gravel & Cobbles
Subtidal Kelp Beds	Intertidal Soft Sediment
Polychaete Reef	Subtidal Soft Sediment
	Rocky shore
	Subtidal Rocky Reef

¹ Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.

² Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.

Table 7-3 Habitats scoping assessment

Consider if the footprint of your activity is:	Yes	No	Biology habitats risk issue(s)
0.5km ² or larger	Yes, to one or more requires impact assessment		The Site is approximately 0.25km ² . and therefore does not exceed 0.5km ² .
1% or more of the water body's area			The Site intersects less than 1% of the waterbody's area.
Within 500m of any higher sensitivity habitat			Higher sensitivity habitats comprising blue mussel beds are located on lower sections of the groynes within the Site. Further blue mussel beds are located 155m to the southwest of the Site.
1% or more of any lower sensitivity habitat			The Site contains three lower sensitivity habitats comprising 'Gravel and Cobbles', 'Intertidal Soft Sediment' and 'Rockyshore'. The section of the Site that interacts with these habitats is less than 1% of the total area of these habitats within the waterbody.

Fish

Table 7-4 Fish scoping assessment

Consider your activity:	Yes	No	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary		No	The Site does not intersect an estuary, and the Proposed Development will not present any barrier to the migration of fish into an estuary.
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		No	The Proposed Development does not present any barrier to the movement or migration of fish. The culverted ordinary watercourses and DCWW outfalls present within the Site are

Consider your activity:	Yes	No	Biology fish risk issue(s)
			either blocked or have flap valves/non-return valves installed, making them impassable to fish. Works will predominantly take place between MHWS and MLWS and will not always be accessible to fish. Whilst temporary stockpiles located on the beach below MHWS will be used to store rocks for the rock revetment prior to placement. All other material will be stored above MHWS in the site compound area. Works directly within the marine environment will be limited to transportation of rock armour between a large transport vessel to smaller vessels which will deposit the materials on the beach. Best practice measures outlined in an Outline CEMP will ensure noise impacts are minimised and there is no chemical change to the local marine environment. Any noise disturbance generated during construction would impact only a fractional area of the waterbody.
Could cause entrainment or impingement of fish		No	There is no potential for the Proposed Development to result in fish entrainment or impingement. Excavations will be carried out and backfilled within one tidal window. No excavations will be left over a tidal cycle.

7.3 Water quality

Table 7-5 Water quality scoping assessment

Consider your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients, or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)		No – Impact assessment not required	Construction of the Proposed Development will take place under standard good practice procedures (such as adherence to current Guidance for Pollution Prevention and CIRIA construction guidance to control sediment run-off or release of pollutants, see section 5.6.
Is in a water body with a phytoplankton status of moderate, poor or bad		No – Impact assessment not required	Phytoplankton status is 'Good' for this waterbody
Is in a water body with a history of harmful algae		No – Impact assessment not required	Macroalgae and Rocky shore macroalgae levels within the waterbody are 'high'. No history of harmful algae.
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		No – Impact assessment not required	No proposal to discharge chemicals into the marine environment. Any spills from construction will be addressed through provisions set out within the Outline CEMP.
It disturbs sediment with contaminants above Cefas Action Level [21]	Yes – Impact assessment required.		A geotechnical desk study [22] of the Site, undertaken in 2018 as part of the Outline Business Case, identified the presence of a sewerage pipe running underneath the Site. An unidentified pollution incident from 2014 was also recorded within 100m, in addition to a license discharge consent operational from 2005 to present.

Consider your activity:	Yes	No	Water quality risk issue(s)
			However, the sewer pipe is present on the 1887 historic OS maps.
The chemicals are on the Environmental Quality Standards Directive (EQSD) list		No – impact assessment not required	No proposal to discharge chemicals into the marine environment.

7.4 WFD protected areas

Table 7-6 WFD protected areas scoping assessment

Consider your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area	Yes - Impact assessment required		Protected areas potentially at risk: • Barmouth Bathing Water, located within the Site; • Llyn Peninsula and the Sarnau SAC, located 31m west of the Site. Other protected areas within 2km: • The Meirionnydd Oakwoods and Bat Sites SAC, located 350m east of the Site; • The Mawddach shellfish waters protected area, located 670m south of the Site; and • Meirionnydd groundwater Drinking Water Protected Area, located partially within the Site.

7.5 Invasive non-native species (INNS)

Table 7-7 INNS scoping assessment

Consider your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	Impact assessment required		There is a potential risk of introduction of invasive species via machinery or by barge. The intertidal biotope survey undertaken on 30 September and 1

Consider your activity could:	Yes	No	INNS risk issue(s)
			October 2024 [23] identified an invasive barnacle (<i>Austrominius modestus</i>) as being widespread across the surveyed area, 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 [24].

7.6 Scoping summary

Table 7-8 Scoping assessment summary

Receptor	Potential risk to receptor	Risk issues for impact assessment
Hydromorphology	Yes	During operation, the proposed revetment, rock armour, ramps and the removal of the groynes has the potential to impact morphological conditions and tidal patterns within the Cardigan Bay North coastal waterbody.
Biology – habitats	Yes	Blue mussel beds are located on lower sections of some of the groynes within the Site. Further blue mussel beds are located 155m to the southwest of the Site.
Biology – fish	No	Not applicable, see Table 7-4
Water quality	Yes	There is potential for contaminated sediment to be present at the Site. Ground Investigation is proposed to understand this potential further.
Protected areas	Yes	Lleyn Peninsula and the Sarnau SAC. Barmouth Bathing Water.
INNS	Yes	Potential risk of introduction and spread of invasive species via machinery or barge.

8. Detailed assessment

- 8.1.1 The WER Scoping Assessment identified potential risks to the following receptors: Hydromorphology, biology (habitats), water quality, protected areas, and INNS.

8.2 Hydromorphology

- 8.2.1 ES Volume 2, Chapter 12 Marine and Coastal Physical Processes includes an assessment of hydromorphological impacts likely to arise from the Proposed Development. This section of the report summarises these findings where relevant to the WFD assessment.

Construction impacts

- 8.2.2 Stockpiles will be used to store excavated material and imported rock required for the construction of the revetment. The exact location of these stockpiles is dependent on the chosen delivery method. There are two options for delivery – Option 1 by road and Option 2 by sea, including different stockpile locations to be utilised for each option.
- 8.2.3 For both options, temporary stockpiles located on the beach below MHWS will be used to store rocks for the rock revetment prior to placement. All sand/shingle excavated from the beach will be stored on the beach above MHWS to be later reinstated along the beach and used for beach recharge.
- 8.2.4 The hydromorphological impact of stockpiling rock armour is expected to be minimal due to the very limited timeframe within which this will be required. In addition, impacts relating to sediment release are also not expected, as works will be taking place during low tide windows.
- 8.2.5 The excavation of sands and shingle and the storage of these materials could cause a potential release of sediment into the sea. This could cause turbidity in the water column and have implications on marine ecology and sensitive habitats on the reef. However, any impacts are expected to be transient and temporary in nature as the works will take place during low tide windows.
- 8.2.6 The removal of groynes will be undertaken in situ and loaded directly onto transport for disposal. Due to the cumulative effect of groynes removal, this could cause a potential mobilisation of suspended sediment and pollutants into the sea. This could cause turbidity in the water column and have implications on marine ecology and sensitive habitats on the reef. However, any impacts are expected to be transient and temporary in nature as the works will take place during low tide windows. The hydromorphological impact of groyne removal would be mitigated by a groynes removal procedure produced by the contractor in the Outline CEMP.
- 8.2.7 Therefore, minor adverse impacts in relation to hydromorphology are anticipated during construction. Due to the scale of the Cardigan Bay North water body in relation to the scale of the proposed works, there will be no meaningful impacts on the hydromorphology of the Cardigan Bay North waterbody.

Operational impacts

Scour

- 8.2.8 During operation, the rock revetment may reduce wave reflections and increase wave energy absorption, reducing scouring of the toe of the wall and avoid potential undermining in this area. However, the rock revetment has been designed with a flat slope of 3:1 to minimise wave reflection and minimise any potential scour effects. Transitions for the ramps have been designed not to protrude on plan. They will be surrounded by rock armour with a buried toe to minimise any potential scour effects.

Sediment transport and beach morphology - revetment

- 8.2.9 The rock revetment will likely generate some localised adverse effect to the shingle beach at the northern and southern boundaries of the revetment. The expected zone of influence for these impacts is approximately 100m. To mitigate this, shingle that is excavated during construction will be deposited in the areas directly north and south of the proposed rock revetment.
- 8.2.10 It is anticipated that the revetment will have minimal effect on longshore sediment transport as due to its geometry parallel to the shoreline it does not retain longshore drift in the nearshore, which has been assessed to be very limited in the baseline. The potential for hydromorphological impact related to this is therefore minimal.
- 8.2.11 Revetments can cause updrift accretion and downdrift erosion due to the partial blockage of longshore sediment transport. The area sheltered behind the rock revetment in the northern end which will be backfilled to avoid further sediment accumulation. This area will be subject to variability of beach levels due to wave overtopping behind the north extent of the rock revetment.
- 8.2.12 The rock revetment will influence the cross-shore transport and the design has taken this into consideration to minimise it. A higher variability of beach levels (accreted or eroded material) in front of the revetment and localised medium to long-term scour of the adjacent seabed may be expected. However, it is expected that this will not interfere with the transport of sediment, alongshore, on/offshore at the bed. Given the limited volumes of scour expected over a high timeframe it is not expected that these can cause any turbidity effects when suspended in the water column, therefore, higher variability of beach levels in front of the rock revetment the effect on turbidity is minimal. Moreover, the occurrence of these variability in levels over a long timeframe can be monitored and would allow for reactive and proactive beach management measures as needed.

Sediment transport and beach morphology – groyne removal

- 8.2.13 Overall, the groynes have been assessed to be in a poor state and providing no significant role on helping to maintain beach levels. Therefore, their removal would generally have limited implications. However, a number of the groynes along the southern end of the frontage are in a slightly better state of repair, in particular, the refurbished groyne at northern end of the coarse sediment upper beach along the southern end of the frontage. Removal of these groynes would result in greater mobility of the beach.

Conclusions

- 8.2.14 It is understood the main driver for the formation of the dune system to the south of the Proposed Development is deposition from the Mawddach River. The proposed development is not considered likely to have any impact on this formation.
- 8.2.15 Although anticipated impacts upon coastal processes in the project area or adjoining areas are limited, it is recommended that a long-term monitoring plan for the beach frontage is implemented as it is not possible to predict with certainty beach evolution over time, due to interaction of several non-linear physical processes and stochastic nature of weather conditions. A long term monitoring plan of the coastal area of the project would help identify potential areas for planned beach management works at Barmouth Beach such as potential placement of beach material from excessive manage wind-blown sand along the foreshore of Barmouth, Gwynedd sand built-up accumulated near the dunes area (see marine licence application for beach management at Barmouth DEML2735) and relocation of sand and shingle within the different sections in front of the rock revetment and at both ends if needed in the future.
- 8.2.16 Minor hydromorphological impacts are anticipated during construction; however, they will affect only a small fraction of the Cardigan Bay North waterbody. In conclusion, there will be no meaningful impact on the hydromorphological conditions of the Cardigan Bay North waterbody.

8.3 Biology: higher sensitivity habitats

- 8.3.1 Higher sensitivity habitats comprising blue mussel beds 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 mussels were also recorded on the outfall pipe discussed above which will be retained. No works are required to this outfall pipe. Further blue mussel beds are located 155m to the southwest of the Site. The desk-based Blue Mussel Assessment confirmed blue mussel beds are highly likely to be present below MLWS in proximity to the Proposed Development boundary.
- 8.3.2 Blue mussel beds are sensitive to changes in water quality (e.g. pollution), mechanical disturbance, and increased sedimentation and turbidity. In the event Option 2 is selected for rock delivery, the production of a Marine Vessel Management Plan (MVMP), would negate any adverse impacts to blue mussel beds which may arise during marine transportation of rock armour. This includes avoidance of loss and fragmentation, damage and degradation, disturbance, and mortality or injury of blue mussels.
- 8.3.3 The timber groynes are to be removed. These are known to provide no coastal defence purpose, limit access and movement along the beach and have damaged and/or missing boards. There will therefore be an initial loss of blue mussel bed habitat and a minor negative impact to higher sensitivity habitats.
- 8.3.4 In the absence of good practice, habitats may be at risk of direct effects or pollution incidents, e.g., sedimentation (from vehicle tracking) or accidental spillages (leaks from machinery/plant).
- 8.3.5 Works within the intertidal zone will be undertaken at low tide to minimise sediment suspension. Production of waste is likely to be minimal and best practice procedures will be integrated to avoid potential pollution incidents.

- 8.3.6 Best practice pollution prevention measures will be employed for marine working, as follows; in addition to biosecurity measures as discussed in section 5.6.
- Site-specific methods will ensure that all site activities are controlled and are in accordance with standard operating procedures, e.g., PPG13 and CIRIA best practice.
 - Limiting the physical works footprint and the dimensions of the access corridor as far as reasonably practicable.
 - All plant will be sourced from a trusted reputable company and will come with spill kits which site personnel will be trained to use.
 - Vehicles will be loaded with all plant and materials necessary to undertake the works to minimise plant movements below MHWS.
 - Minimal quantities of fuels, materials, etc. will be taken on to the foreshore with biodegradable fuel oils implemented where practicable.
 - All storage containers will remain within the site compound and be appropriately banded to prevent any spillages or leaks. No storage of materials or refuelling operations will be permitted outside the site compound.
- 8.3.7 As such, it is reasonable to conclude that no adverse impacts are predicted on higher sensitivity habitats.

8.4 Water quality

- 8.4.1 A geotechnical desk study of the Site, undertaken in 2018 as part of the Outline Business Case, identified the presence of a sewerage pipe running underneath the Site. An unidentified pollution incident from 2014 was also recorded within 100m, in addition to a license discharge consent operational from 2005 to present. However, the sewer pipe is present on 1887 historic OS maps.
- 8.4.2 The Proposed Development will displace sediment below MHWS. This provides a potential pathway for effect through sub-surface sediment being exposed to surface waters.
- 8.4.3 With no visual or olfactory evidence of contamination at the Site, it is likely the site is made up of natural material. Ground investigation is proposed which will provide additional evidence to support this assumption. The risk of incidental disturbance resulting in contamination is therefore considered to be negligible, with no measurable change to status at the water body scale for the Cardigan Bay North coastal waterbody in terms of current WFD status and in the achievement of 'Good' status of WFD elements.
- 8.4.4 The Outline CEMP will be reviewed when available to ensure standard good practice pollution control measures as detailed in section 5.2 above are included.
- 8.4.5 In addition, if Option 2 for transportation of rock armour is selected (delivering rock armour by sea) a MVMP will ensure suitable pollution prevention measures are adhered to.

8.5 Protected areas

- 8.5.1 The Site is within 2km of the following WFD protected areas:

- Meirionnydd groundwater Drinking Water Protected Area, located partially within the Site.
- Llyn Peninsula and the Sarnau SAC, located 31m west of the Site.
- The Meirionnydd Oakwoods and Bat Sites SAC, located 350m east of the Site.
- The Mawddach shellfish waters protected area, located 670m south of the Site.
- Barmouth Bathing Water, within the Site.

- 8.5.2 The blue mussel assessment confirmed that whilst the blue mussels on the timber groynes are considered as a Priority Habitat in Wales, they are not a linked feature of the Llyn Peninsula and the Sarnau SAC [5].
- 8.5.3 Potential pathways for effect include pollution incidents or disturbance during the construction of the Proposed Development.
- 8.5.4 Good practice pollution prevention measures will be employed for marine working, as detailed in section 5.6 above; in addition to biosecurity measures also discussed in section 5.6.
- 8.5.5 To minimise disturbance, piling activity during construction will take place at low tide only. This will prohibit noise and vibration travelling through the water column to the intertidal and offshore zones.
- 8.5.6 In addition, construction activity within Internationally designated sites such as the adjacent SACs will be prohibited. Only transportation of rock armour is permitted through the SACs, as per Option 2 (delivering rock armour by sea), if selected, and will be managed through the application of a Marine Vessel Management Plan (MVMP). The MVMP will detail suitable avoidance measures to ensure sensitive and internationally important receptors area avoided, and any potential impacts arising from marine vessels are adequately mitigated for. The MVMP will include specific limits on vessel speeds, noise levels, and will provide suitable mooring and anchoring locations, and a low impact route through Barmouth Bay to the Proposed Development. Pollution prevention measures and INNS management (through ballast water exchange) will also be included.
- 8.5.7 As such, it is reasonable to conclude that no adverse impacts are predicted on the WFD protected areas.

8.6 INNS

- 8.6.1 Introducing plant and materials to the marine environment incurs the risk of transporting INNS from one site to the next. In addition, the intertidal biotope survey undertaken on 30 September and 1 October 2024 identified an invasive barnacle (*Austrominius modestus*) as being widespread across the Survey area, including on a number of the groynes. However, this species is considered lower risk for Wales according to the Marine Invasive Non-native Species Priority Monitoring and Surveillance List for Wales [24].
- 8.6.2 To address this risk, an Invasive Species Management Plan will be developed for the treatment and/ or avoidance of these species, to include provisions set out in section 5.6. All machinery, equipment and footwear will be cleaned thoroughly before entering the Site with a suitable disinfectant. In addition, all equipment and footwear will be thoroughly cleaned and disinfected when leaving

site, particularly in areas where INNS have been located in accordance with Check, Clean, Dry guidance. The biosecurity measures proposed will accord with the latest NRW guidance. It is thus assumed that there will be negligible effect with no measurable change to status at the water body scale for the Cardigan Bay North coastal waterbody in terms of current WFD status and in the achievement of 'Good' status of WFD elements.

- 8.6.3 In the event that marine vessel transportation is required, the Invasive Species Management Plan and MVMP will be updated to reflect the risk of introducing new INNS through the release of ballast water.

9. Conclusion

- 9.1.1 The screening stage identified three waterbodies that the Proposed Development could potentially impact the WFD status of, Meirionnydd groundwater body, Cardigan Bay North coastal waterbody and Mawddach transitional waterbody. Only the Cardigan Bay North waterbody was screened into the scoping assessment, due to it having the potential to be directly or indirectly impacted by various components of the Proposed Development.
- 9.1.2 Based on the information available, the WER Scoping Assessment identified potential risks to the following receptors: hydromorphology, biology (habitats), water quality, protected areas, and INNS. Further assessment for each of the risks was conducted.
- 9.1.3 Due to incorporated design measures and the minor, localised nature of anticipated hydromorphological impacts, it is concluded there will be no meaningful impacts on the hydromorphology of the Cardigan Bay North waterbody.
- 9.1.4 For higher sensitivity habitats it is reasonable to conclude that a minor negative impact is predicted due to initial loss of blue mussel habitat following removal of the timber groynes.
- 9.1.5 Implementation of good practice techniques to minimise the risk of disturbance and pollution incidents will be utilised.
- 9.1.6 With regards to water quality, following embedded mitigation to minimise the risk of disturbance and pollution incidents, there would be negligible effect with no measurable change to status at the water body scale for the Cardigan Bay North water body.
- 9.1.7 For protected sites, assuming good practice pollution prevention and biosecurity measures are employed as set out in the Outline CEMP and MVMP (if required), it is reasonable to conclude that no adverse impacts are predicted on the protected habitats as a result of pollution incidents or disturbance during construction.
- 9.1.8 A Habitats Regulations Assessment (HRA) has been undertaken to fully assess potential impacts on internationally designated sites for nature conservation³. The HRA concluded that there will be no adverse effects on the integrity of any international designated sites as a result of the Proposed Development.
- 9.1.9 With regards to INNS, following the development of an Invasive Species Management Plan and adherence to embedded mitigation to minimise the risk introducing or spreading non-native species, there would be negligible effect with no measurable change to status at the water body scale for the Cardigan Bay North water body.
- 9.1.10 In conclusion, the Proposed Development is considered to be compliant with the objectives of the Water Framework Directive.

³ Arup (2025) Barmouth North Promenade FAS Habitats Regulations Assessment Screening for GI. Reference: BMTH-ARP-EBD-ZZ-RP-OE-000004

Figure 1 WFD Waterbodies

Figure 2 WFD Protected Areas

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

References

- [1] Environment Agency, "Water Framework Directive assessment: estuarine and coastal waters," 2023. [Online]. [Accessed 20th June 2025].
- [2] Natural Resources Wales, "Western Wales River Basin Management Plan 2021 - 2027," 2022.
- [3] Natural Resources Wales, "Water Watch Wales," 2023. [Online]. Available: <https://waterwatchwales.naturalresourceswales.gov.uk/en/>. [Accessed 27 June 2025].
- [4] British Geological Society, "Geology of Britain Viewer," 2023. [Online]. Available: <https://mapapps.bgs.ac.uk/geologyofbritain/home.html>. [Accessed 24 June 2025].
- [5] DEFRA, "Multi-Agency Geographic Information for the Countryside (MAGIC) Maps," 2023. [Online]. Available: <https://magic.defra.gov.uk/MagicMap.aspx>. [Accessed 24 June 2025].
- [6] United Kingdom topographic map, "Topographic-map.com," [Online]. Available: <https://en-gb.topographic-map.com/map-cgt/United-Kingdom/?center=52.72674%2C-4.05823&zoom=16>. [Accessed 25 June 2025].
- [7] Ove Arup and Partners Ltd, "Barmouth North Promenade FAS Preliminary Ecological Appraisal (PEA) Reference: BMTH-ARP-EBD-ZZ-RP-OE-000001," 2024.
- [8] ABPmer, "Barmouth North Promenade, Coastal Processes, ABPmer Report No.R.3096. A report produced by ABPmer for Arup," 2019.
- [9] ABPmer, "Barmouth North Promenade, Wave modelling, extremes analysis and overtopping, ABPmer Report No.R.3105. A report produced by ABPmer for Arup," 2019.
- [10] ABPmer, "Barmouth North Promenade, Shoreline modelling - risk reduction assessment, ABPmer Report No. R.3589. A report produced by ABPmer for Arup," 2021.
- [11] ABPmer, "Barmouth North Promenade D&C, Consideration of revised water level estimates, Ref 5501/TN01. A report produced by ABPmer for Arup," 2024.
- [12] ABPmer, "Barmouth North Promenade D&C, Coastal Process and Option Review, Ref 5500/TN02. A report produced by ABPmer for Arup," 2024.
- [13] Ove Arup and Partners Ltd, "BMTH-ARP_EBD_OFFSH-TN-OE-000001 (Priority Habitat – Blue Mussel (*Mytilus edulis*) Assessment)," 2025.
- [14] GOV.UK, "Pollution Prevention Guidance (withdrawn)," [Online]. Available: <https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg>. [Accessed 14 July 2025].

- [15] GOV.UK, "Guidance for Pollution Prevention (GPP) documents," [Online]. Available: <https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/>. [Accessed 14 July 2025].
- [16] CIRIA, "CIRIA," 2025. [Online]. Available: <http://www.ciria.org>.
- [17] Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA), "GPP 21: Pollution incident response planning," [Online]. Available: <https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/gpp-21-pollution-incident-response-planning/>. [Accessed 14 July 2025].
- [18] NetRegs, "Guidance for Pollution Prevention: Works and maintenance in or near water (GPP5)," [Online]. Available: <https://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf>. [Accessed 24 July 2025].
- [19] CIRIA, CIRIA C741: Environmental Good Practice on Site, Fifth ed., 2023.
- [20] Natural Resources Wales, "Western Wales River Basin Management Plan 2021 – 2027," 2022.
- [21] "Cefas Action Level 1 compounds," [Online]. Available: <https://www.gov.uk/guidance/marine-licensing-sediment-analysis-and-sample-plans#sample-plans-and-sediment-analysis>. [Accessed 24 July 2025].
- [22] Ove Arup and Partners Ltd, "Barmouth North Promenade Outline Business Case Geotechnical desk study.," 2018.
- [23] Over Arup and Partners Ltd, "Barmouth North Promenade FAS Intertidal Biotope Survey Report. Reference: BMTH-ARP-VES-OFFSH-RP-OE-000001," 2018.
- [24] W. Government, "Marine Invasive Non-native Species," 2017.

Appendices

Appendix A Determination of WER Status

A.1 Introduction

- A.1.1.1 Surface water bodies and groundwater bodies are defined within WER legislation. There are three types of surface water body, as follows:
- Natural water bodies;
 - Heavily modified water bodies (HMWBs); and,
 - Artificial water bodies (AWBs).
- A.1.1.2 The Overall Status of natural surface water bodies is determined on the basis of their Ecological Status and Chemical Status. The overall status of heavily modified and artificial water bodies is classified based on their ecological potential and chemical status. The overall status of groundwater bodies is determined on the basis of their Quantitative Status and Chemical Status.
- A.1.1.3 Groundwater bodies are defined within WER legislation as Groundwater Management Units (GWMU) and Water Resource Management Units (WRMU) and their status is determined on the basis of quantitative and chemical sub-elements.
- A.1.1.4 The means by which these determinations are made for both surface water and ground water bodies is described in this section.

A.2 Surface water bodies

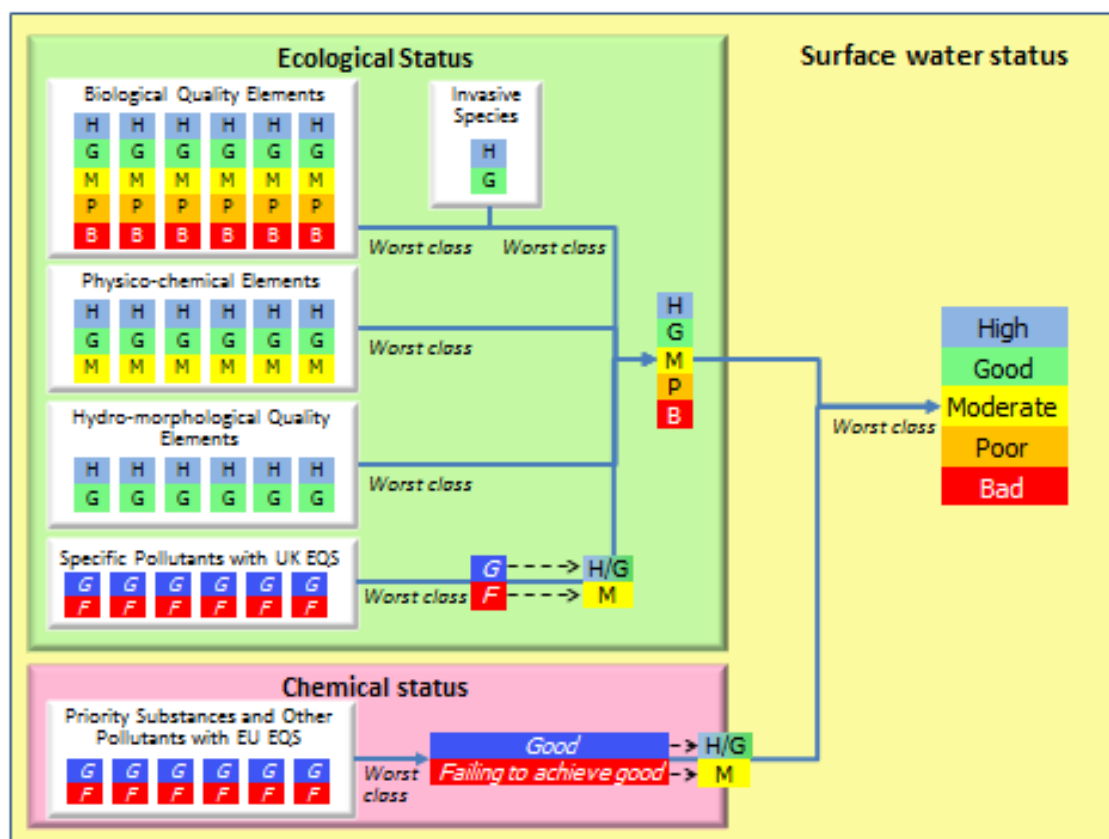
A.2.1 Ecological status

- A.2.1.1 Ecological Status is defined by the overall quality of the structure and functioning of aquatic ecosystems associated with surface waters, i.e. the condition of the watercourse. This is assigned on a scale of high, good, moderate, poor or bad, and on the basis of four classification elements or 'tests', as follows:
- Biological - this test is designed to assess the status indicated by biological quality elements such as fish, invertebrates, macrophytes or phytobenthos (diatoms). The biological quality elements can influence an overall water body status from bad through to high. It is also important to note that the presence of invasive species prevents a water body from achieving high status when all other elements attain high;
 - Physicochemical - this test is designed to assess the status indicated by physicochemical quality elements such as dissolved oxygen, phosphorus and ammonia, against environmental standards. The physicochemical quality elements can only influence an overall water body status from moderate through to high;
 - Specific pollutants - this test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physicochemical test, the specific

pollutant assessment can only influence an overall water body status from moderate through to high; and

- Hydromorphology - for natural surface water bodies this test is undertaken by the NRW during classification when the biological and physicochemical tests indicate that a water body may be of high Overall Status. It specifically assesses hydromorphological quality elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological quality elements do not support high Ecological Status, then the status of the water body is limited to good Overall Status. Hydromorphological assessments are used to determine 'high' Overall Status only and are not used to drive a water body status class below good. The 'does not support good' classification should be reported for the purposes of identifying water bodies which fail the flow test.

A.2.1.2 The worst-case classification is assigned as the overall surface water body status, in a 'one-out all-out' system. This system is summarised in Picture 7.



Picture 7 Ecological status classification process (Source: Environment Agency, 2015)

A.2.2 Chemical status

A.2.2.1 Chemical Status is defined by compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances, in

accordance with the Environmental Quality Standards Directive (2008/105/EC)⁴. This is assigned on a scale of good or fail.

- A.2.2.2 Surface water bodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface water bodies are reported as being of good Chemical Status.

A.2.3 Ecological potential for heavily modified (and artificial) water bodies

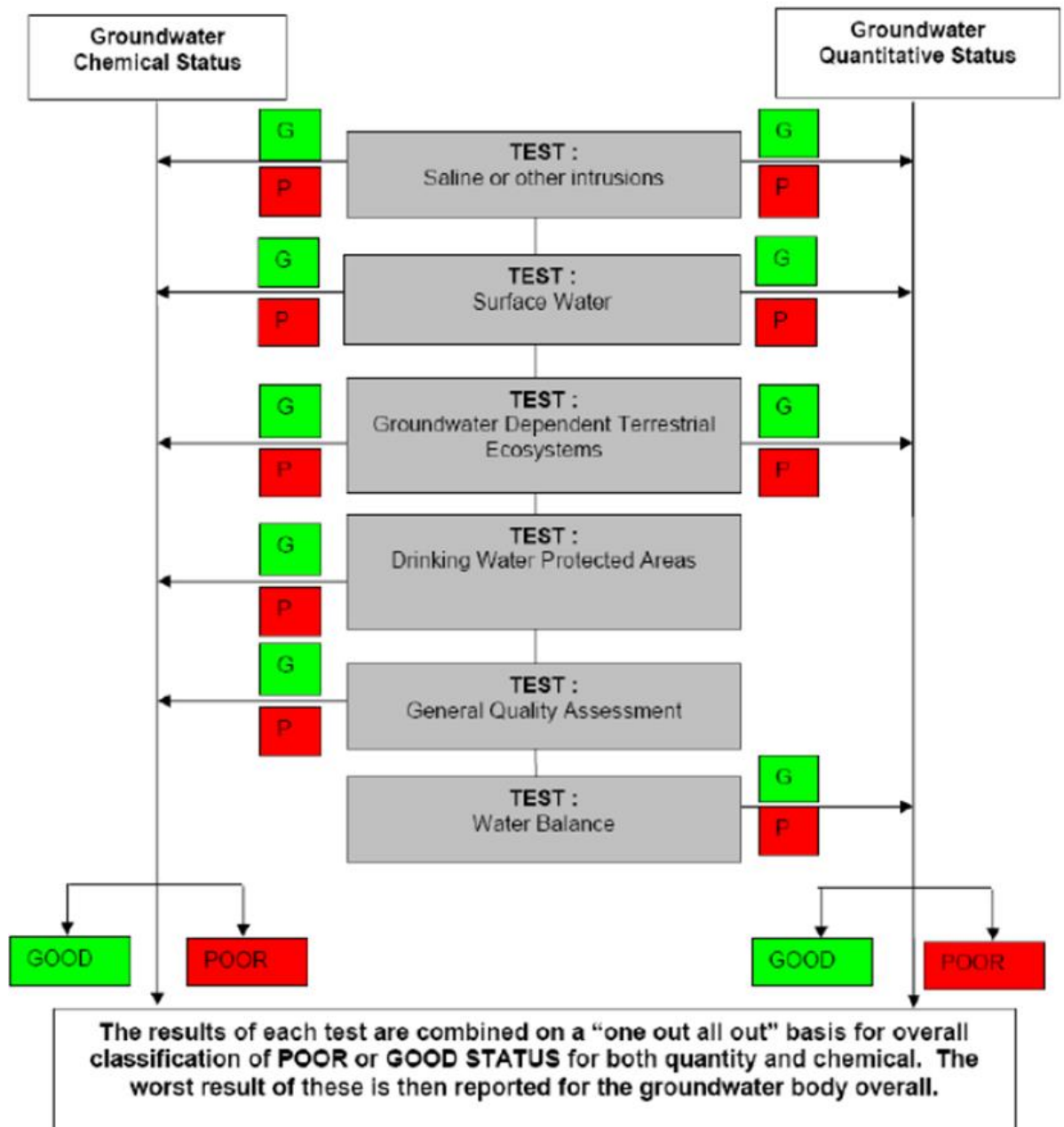
- A.2.3.1 Ecological Potential is assigned to AWB (such as reservoirs and canals), or natural water bodies which, as a result of physical alterations by human activity, are substantially changed in character. The latter are termed HMWB. The term 'ecological potential' is used to classify AWBs and HMWBs as it may be impossible for these water bodies to achieve good Ecological Status (GES) because of their creation or modification for a specific use, such as navigation, water supply or flood protection. The Ecological Potential of an AWB or HMWB represents the degree to which the quality of the water body approaches the optimum condition it could achieve given its artificial or heavily modified state.
- A.2.3.2 AWB and HMWB are subject to an additional set of rules that need to be implemented prior to running the one-out-all-out process. These rules determine which biological quality elements should be used in the water body Ecological Potential classification. Under normal circumstances, AWB and HMWB are classified according to an assessment of mitigation measures, which defines good Ecological Potential (GEP) in water bodies where all applicable mitigation is in place, and moderate ecological potential in water bodies where some or all relevant mitigation is missing. However, to prevent AWB and HMWB being incorrectly classified as good potential in situations where all mitigation is in place, but other pressures are causing an impact (e.g. nutrient enrichment or pollution from toxic substances), the methodology adopted in the UK additionally considers biological indicators providing they are not sensitive to the heavily modified nature of the water body.
- A.2.3.3 AWB and HMWB hydromorphological elements are assessed using a three-stage process, firstly looking at flow, then mitigation measures and biological quality elements.
- A.2.3.4 Flow conditions are assessed initially on a fail or pass basis to determine which of the biological and physicochemical quality elements should be used in the classification of Ecological Potential.
- A.2.3.5 Where the flow conditions are unaffected by the physical modification (flow conditions pass), the water body Ecological Potential is determined by the worst of either the mitigation measures assessment, or any element that is not sensitive to the modified nature of the water body.

⁴ Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008; on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council. Strasbourg, European Parliament and European Council

- A.2.3.6 Where the flow conditions are significantly impacted by the physical modification (flow conditions fail), the water body Ecological Potential is determined by the worst of any of the mitigation measures assessments or the assessment of biological quality elements, physicochemical quality elements or specific pollutants.
- A.2.3.7 Where a water body is designated as artificial or heavily modified for water resources usage, either solely or jointly with other uses, the flow condition is assumed to be good (pass).

A.2.4 Groundwater bodies

- A.2.4.1 Under the WER, groundwater body Overall Status is classified on the basis of Quantitative Status and Chemical Status. The groundwater bodies are separated into GWMU and WRMU. GWMU are sub-divisions of the groundwater to aid the resource assessment process. WRMU are sub-divisions according to the water resource availability and the management of water.
- A.2.4.2 The worst-case classification dictates the Overall Status, via a 'one-out all-out' system. This system is summarised below in Picture 8.



Picture 8 Groundwater body status classification (Source: UKTAG, 2012)

A.2.5 Quantitative status

A.2.5.1 Quantitative Status is defined by the quantity of groundwater available as base flow to watercourses and water-dependent ecosystems and as 'resource' available for use as drinking water and other consumptive purposes. It is assigned on a scale of good or poor, and on the basis of four classification elements or 'tests' as follows:

- Saline or other intrusions - this test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions;

- Surface water - this test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the Ecological Status of associated surface water bodies;
- Groundwater Dependent Terrestrial Ecosystems (GWDTE) - this test is designed to identify groundwater bodies where groundwater abstraction is leading to significant damage to associated GWDTE; and,
- Water balance - this test is designed to identify groundwater bodies where groundwater abstraction exceeds the 'available groundwater resource', defined as the rate of overall recharge to the groundwater body itself less the rate of flow required to meet the ecological needs of associated surface water bodies and GWDTE.

A.2.6 Chemical status

A.2.6.1 Chemical Status is defined by the concentrations of a range of key pollutants, by the quality of groundwater feeding into watercourses and water-dependent ecosystems and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of good or poor, and on the basis of five classifications elements or 'tests', as follows:

- Saline or other intrusions - this test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions;
- Surface water - this test is designed to identify groundwater bodies where groundwater is leading to a significant diminution of the Chemical Status of associated surface water bodies;
- GWDTE - this test is designed to identify groundwater bodies where groundwater is leading to significant damage to associated GWDTE;
- Drinking Water Protected Areas (DrWPA) - this test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WER or at risk of failing in the future. The aim is no deterioration in quality of waters for human consumption; and,
- General quality assessment - this test is designed to identify groundwater bodies where widespread deterioration in quality has, or will, compromise the strategic use of groundwater. The aim is no significant impairment of human use of groundwater and no significant environmental risk from pollutants across a groundwater body. Status is assessed primarily using data collected from NRW monitoring network; therefore, the scale of assessment means that groundwater status is mainly influenced by larger scale effects such as significant abstraction or widespread diffuse pollution.

A.2.7 Environmental standards

A.2.7.1 Under the WER, a range of environmental standards and condition limits are applied in order to help the classification of water body status and the setting of status objectives via the RBMP process. These environmental standards define the range of environmental conditions that support "healthy" aquatic life. For instance, standards are set for the composition of biological communities, the

physicochemical water quality parameters, the concentration of pollutants, and the level of flows in rivers (as described above).

- A.2.7.2 These standards inform the EA on the implementation of the RBMP process, including the identification of measures required to support the achievement of the GES / GEP objectives, as well as underpinning efforts to protect the water environment by helping to regulate activities that could cause adverse impacts.

A.3 WER Assessment requirements for new developments

- A.3.1.1 To ensure compliance with the WER, decision makers must consider whether proposals for new developments have the potential to:
- Cause a deterioration of a water body from its current status or potential.
 - Prevent future attainment of good status or potential where not already achieved.
 - Impact on protected or priority species and habitats.
 - Provide opportunities to improve the water environment.
- A.3.1.2 A ruling by the European Union Court of Justice on 1 July 2015⁵ has significant implications for projects that may impact water bodies, namely:
- Consent for development must not be granted by an authorising authority – unless a derogation is granted - where the project may cause a deterioration in the status of a body of surface water or where it jeopardises the attainment of good Ecological Status or of good Ecological Potential and good Chemical Status by the date laid down in the Directive;
 - That deterioration of the status of the relevant body of surface water includes a fall by one class of any element of the quality elements within the meaning of Annex V of the WER even if the fall does not result in a fall of the classification of the body of surface water as a whole; and,
 - If the quality element is already in the lowest class, any deterioration of that element represents deterioration of status within the meaning of Article 4(1)(a)(i).

A.4 Guidance

- A.4.1.1 Whilst there is no established methodology for assessing compliance with WER legislation, the WER Compliance Assessment will be based upon expert judgement, established best practice and consultation with NRW and will be undertaken in accordance with relevant NRW guidance and the recent advisory guidance provided by The Planning Inspectorate⁶.

⁵ Case 461/13 Bund für – Umwelt Und Naturschutz Deutschland v Bundesrepublik Deutschland ('the Bund case') concerning the interpretation of Article 4(1)(a)(i) to (iii) of the Water Framework Directive 2000/60/EC (WFD)

⁶ The Planning Inspectorate (2017), Advice note eighteen: The Water Framework Directive.

Appendix B WER Assessment Process

B.1 Overview

- B.1.1.1 WER Compliance Assessment is undertaken as an iterative, stepped process, which typically includes the following:
- Step 1: Baseline assessment (screening).
 - Step 2: Preliminary assessment (scoping).
 - Step 3: Detailed impact assessment (where required).
 - Step 4: Application of Article 4.7 (where applicable).
- B.1.1.2 These key process steps are described in further detail in the following sections. Consultation with regulatory authority should be undertaken to share the findings of each step, where necessary/applicable.

B.2 Baseline assessment (screening)

- B.2.1.1 The key objective of the baseline (screening) assessment is to identify the relevant WER surface water and groundwater bodies (including any undesignated tributary watercourses) potentially affected by the proposed development and to establish their baseline condition.
- B.2.1.2 The water body baseline condition of relevant water bodies has been identified via desk-top assessment, utilising readily available information and environmental, asset and operations data obtained from relevant stakeholders, including the EA, Natural England, and Yorkshire Water.
- B.2.1.3 WER baseline datasets have been obtained from Water Watch Wales. This includes:
- RBMP Cycle 2 current status and status objectives data.
 - WER Protected Areas data.
 - Reasons for to achieving good status (RNAG) data.
 - Measures data.
- B.2.1.4 The 2019 and 2022 NRW WER water body status data has been used to inform the assessment. These data are considered to provide the current best estimate of status and the formal baseline against which NRW will assess compliance with the 'no deterioration' objective. Where baseline data is limited, professional judgement has been used in the assessment and a precautionary approach taken with regard to screening.
- B.2.1.5 The relevant WER water bodies present within the potential zone of influence of the proposed development are taken through to the subsequent preliminary assessment (scoping) stage.

B.3 Preliminary assessment (scoping)

- B.3.1.1 The objective of the preliminary (scoping) assessment is to establish the relevant likely effects of the proposed development on the WER status elements of the relevant WER surface water and groundwater bodies. This includes identification of potential impact types and any relevant mitigation measures embedded within the design of proposed development at this stage.
- B.3.1.2 The preliminary assessment considers both the beneficial and adverse effects of the relevant elements of the proposed development and applies a risk-based method in line with existing NRW guidance.
- B.3.1.3 Effects are considered with regard to the risk of the proposed development causing a deterioration in current status and/or a failure to achieve status objectives. The assessment identifies those scheme components / impacts that pose a risk current status or status objectives and thus may require more detailed impact assessment.
- B.3.1.4 The preliminary assessment therefore comprises two parts, as follows:
- Likely effects on current status or potential, involving:
 - Identification of relevant scheme components with potential to impact upon water body status.
 - Identification of likely potential impact and magnitude of effects of the relevant scheme components on the current status of the water body (taking account of any 'embedded' mitigation).
 - Identification of potential risks of deterioration in current status and associated requirements for additional mitigation and/or further detailed assessment.
 - Likely effects on status objectives, involving:
 - Scoping of the relevant scheme components to identify where the proposed development may pose a risk of worsening existing pressures responsible for current status failures (RNAGs) and/or prevent the implementation of measures identified by NRW to address existing status failures.
 - Scoping of relevant scheme components against any available NRW HMWB/ AWB 'mitigation measure assessment' outputs, in order to identify where the proposed development may pose a potential risk of inhibiting the implementation of measures derived to mitigate the impacts of existing physical modifications and operational regimes to support the achievement of good Ecological Potential objectives.

B.4 Detailed impact assessment

- B.4.1.1 Where deemed required, the objective of the detailed impact assessment is to establish the nature and anticipated magnitude of the effects of relevant elements of the proposed development on the WER quality elements of the surface water and groundwater bodies affected. These effects are considered in terms of the potential for deterioration of current status and/or the prevention of

status objectives. This detailed assessment may be based on targeted baseline surveys, monitoring or modelling assessments completed at the impact sites.

- B.4.1.2 As with the preliminary assessment stage, the detailed impact assessment is therefore comprised of two key parts, as follows:
- Assessment of effects on current status of quality element; and,
 - Assessment of effects on status objectives, with regards to any water body RNAG or measures/actions identified as potentially being at risk from the proposed development under the preceding preliminary (scoping) assessment. This is done via expert judgement and consultation with the EA, based on the currently available information.
- B.4.1.3 Where significant effects are identified with regard to the risk of status deterioration and/or the prevention of status objectives, the assessment should identify 'further mitigation' required in order to avoid and/or minimise risks and the residual effects on quality elements at the water body scale.
- B.4.1.4 The detailed impact assessment will also identify if Article 4.7 tests need to be prepared for affected water bodies, where a residual risk to status deterioration and/or prevention of future status objectives has been identified.
- B.4.1.5 A detailed impact assessment has not been deemed required for the proposed development, based on the information available at this stage.

B.5 Article 4.7 tests

- B.5.1.1 Article 4.7 of the WER states that Member States will not be in breach of the Directive when failure to meet its environmental objectives is the result of either new modifications to the physical characteristics of a water body or as a result of new human sustainable development, on the proviso that the modifications or new development proposed are compliant with the four key conditions listed below. In doing so, Article 4.7 provides a means whereby a derogation for a proposed modification or sustainable development may be granted where it meets these four conditions.
- All practicable steps have been taken to mitigate the adverse impact on the status of the water body;
 - The reasons for the modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development; and
 - The beneficial objectives served by the modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.
 - The reasons for the modifications or alterations are clearly identified to NRW, so that they can be specifically set out and explained in the relevant RBMP (as required under Article 13).

B.5.1.2 Article 4.7 tests are not deemed required for the proposed development, based on the information available at this stage.

Appendix C Stockpile Locations Plan

