

Appendix L – Water Framework Directive Assessment

Aberaeron Coastal Defence Scheme

Water Framework Directive Assessment
Ceredigion County Council

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Notice

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1. Introduction

Atkins was commissioned by Ceredigion County Council (CCC) to develop proposals for a coastal defence scheme for Aberaeron in order to reduce risks associated with coastal flooding within the town, known as Aberaeron Coastal Defence Scheme (herein referred to as ‘the Scheme’).

Aberaeron is situated on a low plateau. Flooding and storm damage have happened many times in the past. These events continue today. With climate change and the predicted rises in sea levels, storms and flooding are likely to increase in frequency and severity. Low-lying areas of Aberaeron are at risk of flooding generated by extreme tidal waters and wave overtopping along the northern side of the harbour. The layout of the harbour entrance means that waves freely propagate through the entrance channel into the harbour itself. Aberaeron is exposed to a wide range of wave conditions from the North-West and South-West. Storm waves enter the harbour and overtop the harbour walls. During heavy rain, large amounts of water also enters the harbour down the River Aeron. High tide, heavy rain and storm waves can all combine to make water levels and wave heights even higher.

Engineering works were carried out at North Beach of Aberaeron in 2009 which included the replacement with new timber groynes, a beach nourishment programme, reconstruction of the sea wall and construction of a revetment along the North Beach. The works have since provided improved protection to the northern part of the town from overtopping inundation from the sea, providing 1 in 200 year (1% Annual Exceedance Probability (AEP)) standard of protection against flooding.

Since completion of the works along North Beach, Aberaeron has still experienced a number of flood events. This is primarily due to overtopping along Pen Cei/Quay Parade (north) side of the harbour, adjacent to Pwll Cam and properties opposite the River Aeron A487 road bridge (See Section 1.1 and Figure 1-1).

The Scheme will comprise of five key linked elements (refer to Section 3.1) to provide increased protection to the town of Aberaeron from coastal flooding. An illustrative plan of the Scheme showing the key elements is provided in Figure 1-1. A more detailed description of the ‘Site’ and its location can be found in Section 1.1.

This document presents the Water Framework Directive (WFD) compliance assessment for the Scheme. The aims of the document are to:

- Provide background information on the WFD legislation and the proposed works;
- Provide a high-level baseline understanding of the affected water bodies in the context of the WFD;
- Provide an assessment of the potential for the proposed works to cause deterioration in the WFD status of any water body directly or indirectly affected by the works; and
- Provide an assessment of the potential impacts on water body improvement measures and the ability to meet WFD objectives, as well as to suggest control measures where necessary.

1.1. Scheme Location

The Scheme is located in Aberaeron (NGR SN 45627 62917). Aberaeron is situated on the west coast of Wales in Cardigan Bay, approximately 30km south of Aberystwyth. This area is characterised by the presence of two and three-storey terraces of brightly coloured rendered houses of similar and sympathetic architectural style laid out on a grid-plan, with the occasional landmark building such the Harbourmaster Hotel and the Town Hall.

The main harbour lies directly at the mouth of the River Aeron with many boats beached in the harbour during low tide. In the north-east corner of the harbour is a smaller, contained harbour (Pwll Cam) in which water is maintained several feet deep by a sill where shallow draft boats are moored to the harbour wall.

Much of Aberaeron town is centred around the harbour, with the coastal frontage split into North and South Beaches either side of two piers, which protect the harbour entrance. The two piers, North and South pier, extend from the harbour entrance at the end of the associated quays. The seaward end (head) of South Pier is currently fenced off due to it being unsafe for use and in need of repair. There is a crib groyne at the base of South Pier which is in a state of disrepair.

South Beach is a mixed shingle and sand beach, with shingle on the upper beach, and sand on the lower beach. North beach is of similar topography, but with the addition of mussel beds and *Sabellaria* reef

assemblages. There are six timber groynes along South Beach in varying states of repair, and a rock revetment along the upper beach. North Beach also consists of groynes and rock revetments which are in better condition due to the engineering works carried out in 2009 as discussed above.

To the south of the Harbour, an area of open land adjacent to CCC's offices is proposed to be used as the construction compound.

The Scheme is also located partially within the boundary of the following statutory nature conservation designations:

- West Wales Marine Special Area of Conservation (SAC)
- Cardigan Bay Special Area of Conservation (SAC)
- Aberarth - Carreg Wylan Site of Special Scientific Interest (SSSI)

The extent of the Scheme boundary is shown in Figure 1-1.



2. Methodology

2.1. The Water Framework Directive – Legislative Background

The Water Framework Directive 2000/60/EC is a European Directive fully transposed into UK law following Brexit. Its purpose is to establish a framework for the protection and improvement of inland surface waterbodies, estuaries, coastal waters and groundwater. The framework for delivering the Directive is through River Basin Management Planning, which requires surface water bodies to achieve both Good Chemical Status (GCS) and Good Ecological Status (GES), and for groundwater bodies to achieve both Good Chemical Status (GCS) and Good Quantitative Status (GQS). The River Basin Management Plans (RBMPs) outline the actions required to enable natural water bodies to achieve this. Artificial and Heavily Modified Water Bodies (AHMWB) are surface water bodies that may be prevented from reaching GES due to the modifications necessary to maintain their function for essential human uses, such as flood defence, navigation or drinking water supply. They are, however, required to achieve Good Ecological Potential (GEP), through the implementation of a series of mitigation measures outlined in the RBMP.

New activities and Schemes that affect the water environment may adversely impact biological, hydromorphological, physicochemical and/or chemical quality elements (WFD quality elements), leading to a deterioration in water body status. They may also render proposed improvement measures ineffective, leading to the water body failing to meet its WFD objectives for GES/GEP. Under the WFD, activities and Schemes must not cause deterioration in water body status or prevent a water body from meeting GES/GEP by invalidating improvement measures. A summary of key WFD objectives are presented in Figure 2-1.

In addition to protecting and improving water bodies, the WFD also requires that each Member State develops a register of 'Protected Areas', which are "all areas lying within each river basin district which have been designated as requiring special protection under specific Community legislation for the protection of their surface water and groundwater or for the conservation of habitats and species directly depending on water". In the United Kingdom, these Protected Areas are:

- Areas with water-dependent habitats that are protected under the Birds and Habitats Directives, and (by Government policy) under the Ramsar Convention;
- Drinking Water Protected Areas;
- Shellfish Waters;
- Bathing Waters;
- Nutrient Sensitive Areas.

The potential impacts of new activities and Schemes on these WFD Protected Areas must also be considered in order to ensure compliance with the overall requirements of the WFD.

WFD Objectives

The WFD is a European Directive which sets out a strategic planning process for the purposes of managing, protecting and improving the water environment. The main objectives of the WFD are to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters;
- Aim to achieve at least 'Good Status' for all waters by 2015 (2021 or 2027) where fully justified within an extended deadline under Article 4.4;
- Promote sustainable use of water;
- 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; and
- Help reduce the effects of floods and droughts.

Natural Resources Wales are responsible for implementing the WFD in Wales, with the Environment Agency having joint responsibility for cross-border areas. They monitor, advise and manage many aspects of the water environment through regulating discharges, abstractions and processing environmental permits and licences. Natural Resources Wales and the Environment Agency are committed to implement environmental improvements by reducing the physical impacts of flood risk management activities within artificial or heavily modified water bodies.

WFD Classification

The WFD classification for a defined water body is produced by the assessment of a wide variety of different 'elements' which includes:

- '*biological elements*' such as fish, invertebrates, Phytobenthos (which includes plants, macro-algae, phytoplankton);
- '*supporting elements*' that include chemical measurements such as ammonia, dissolved oxygen, pH, phosphate, copper, zinc and temperature; and
- '*supporting conditions*' (sometimes referred to as hydromorphology) that assess the physical attributes of the water body such as 'quantity and dynamics of flow' and 'morphology'.

The assessment given for each element is also accompanied by a measure of certainty in the result. The status classification is published in the RBMP and provides a baseline condition against which compliance and future improvements can be measured.

WFD Compliance

There are three key objectives against which the impacts of proposed works on a water body need to be assessed to determine compliance with the overarching objectives of the WFD:

- Objective 1: The Scheme will not cause a deterioration in any element of water body classification.
- Objective 2: The Scheme will not prevent the WFD status objectives from being reached within the water body or other downstream water bodies.
- Objective 3: The Scheme will contribute to the delivery of the relevant WFD objectives. In this case, it will be what contribution the scheme can make towards the water body reaching its objective GEP through planned RBMP mitigation measures.

Objective 1 and Objective 2 must be met to avoid infringement of the WFD. The delivery of the third objective is central to the implementation of the WFD, where it can be supported through its operational activities. If it is considered that the Scheme is likely to cause deterioration in water body status or prevent a water body from meeting its ecological objectives, then an assessment would be made against the conditions listed in Article 4.7 of the WFD. Article 4.7 can be invoked if; 'new modifications' are of overriding public interest and/or the environmental and social benefits of achieving the WFD objectives are outweighed by the benefits of the new modifications to human health, safety and sustainable development; there are no significantly better environmental options that are technically feasible or not disproportionately costly; and all practicable steps for mitigation have been taken.

Figure 2-1 - Background to WFD Assessments

2.2. Approach to the WFD Assessment

2.2.1. 'Clearing the Waters for All' guidance

Natural Resources Wales (NRW) is the lead authority for the implementation of the Water Framework Directive (WFD) in Wales, whereas, the Environment Agency (EA) is the lead authority for the WFD in England. The EA has developed guidance to support carrying out WFD assessments for new Schemes in estuarine and coastal waters - "Clearing the Waters for All" (Agency, 2016), published on www.gov.uk. This guidance can be utilised in WFD assessments in Wales and is applicable to activities in the marine environment up to 1 nautical mile out to sea. This guidance recommends a three-staged process to the WFD Assessment, comprising:

- Screening – to exclude any activities that do not need to go through the scoping or impact assessment stages;
- Scoping – to identify the receptors that are potentially at risk from the proposed activity and need impact assessment; and
- Impact assessment – considers the potential impacts of the proposed activity, identifies ways to avoid or minimise impacts, and shows if the activity may cause deterioration or jeopardise the water body achieving good status.

The guidance also recommends that all activities are considered, including each relevant stage (e.g. construction, operation and decommissioning), and that all waterbodies that could both directly and indirectly be affected by the activities are included.

This WFD assessment has broadly followed the principles outlined in the 'Clearing the Waters for All' guidance.

2.2.2. Data Sources

A number of surveys and assessments have been carried out to inform the development of the Scheme. Where relevant, the details of these have been used to inform this WFD assessment. Online sources of information have also been used. The key data sources that have informed this assessment are:

- Current WFD status classification data from the Water Watch Wales Map (Natural Resources Wales, 2020);
- Data on WFD Protected Areas and WFD Higher and Lower Sensitivity Habitats (Natural England, 2021);
- Western Wales River Basin Management Plan 2015-2021 Summary (Natural Resources Wales, 2015);
- Wales Water Body Objectives and measures update 2017 (Natural Resources Wales, 2017);
- Numerical Sediment Modelling (Atkins, 2020);
- Beach Nourishment - Comparison of source and target shingle (Atkins, 2021); and
- Flood Consequence Assessment (Atkins, 2021a).

2.2.3. Structure and Content of this Report

The structure of this report and a summary of the contents and steps undertaken to complete each section are detailed in Table 2-1.

Table 2-1 - WFD Assessment Report Structure

Chapter	Title	Content and Steps
1	Introduction	Introduces the purpose of the Scheme and the context of its location.
2	Methodology	Describes the legislative context to the assessment and the overall approach, including guidance used and data sources.
3	Proposed Works and Programme	Sets out the outline description of the activities that will be carried out at each Scheme stage, including construction, operation and decommissioning.
4	Screening	Identification of the activities described in Chapter 3 that may impact on the quality elements of WFD waterbodies; and identification of water bodies that are relevant to the Scheme.
5	Scoping	Presentation of the baseline conditions for the relevant quality elements of each water body screened in for assessment, and consideration of the potential risk of deterioration from Scheme activities screened in.
6	Assessment	Detailed examination of and commentary on the risks identified at Scoping, and their potential to result in deterioration of any quality elements. This step includes potential measures that may be used to avoid or reduce the potential magnitude or scale of any effects. The assessment includes consideration of effects on WFD Protected Areas.
7	Conclusion	A summary of the conclusions drawn by the WFD Assessment.

3. Proposed Works and Programme

3.1. Proposed Scheme

The works are centred around the Harbour, specifically the Inner Harbour of Pwll Cam and Pen Cei/Quay Parade, and extend along South Beach and some works taking place to the south of North Beach.

The Scheme is made up of five linked elements, described as follows and presented in Figure 1-1.

- Construction of a new rock breakwater extending out from the North Pier.
- Refurbishment and re-building of the pier-head of South Pier including grouting repairs of walls
- Flood wall construction at the following locations:
 - Raising of the existing flood wall along Pen Cei/Quay Parade including grouting repairs of the existing quay wall
 - Raising of the existing flood wall between the rear of Monachty Hotel and the A487
 - New flood wall between Pwll Cam and the Monachty Hotel (and connecting with the existing adjacent flood wall between the Monachty Hotel and A487)
- Construction of a flood gate at Pwll Cam inner harbour.
- Improvements to the existing defences on South Beach:
 - Replacement of existing timber groynes
 - Replacement of existing rock revetment
 - Beach renourishment

The Scheme provides a 1 in 200 year (1% Annual Exceedance Probability (AEP)) standard of protection against flooding by wave overtopping and a 1 in 1000 year (0.1% Annual Exceedance Probability (AEP)) level of protection against an increase in water levels over the life of the scheme. The design of the Scheme has been carried out in line with the National Strategy on Flood and Coastal Erosion Risk Management (FCERM) (Welsh Government, 2020a) for Wales in order to reduce the risk of flooding to homes and businesses. The scheme uses the Welsh Government's FCERM Business Case Guidance (Welsh Government, 2019) and is in line with guidance for climate change (Welsh Government, 2004) and (Welsh Government, 2017). Assessment of flood risk follows TAN 15 guidance.

3.2. Site Access and Construction Methods

3.2.1. Site Access

The site compound will be located on a grass field in between Ysgol Gyrnadd Aberaeron Primary School and South Beach. A temporary gravel access track will be constructed from the car park of the CCC Penmorfa offices to the compound area. Removal of topsoil and grass will also be required for this operation. Both the site compound and gravel track will be removed following construction, and the area re-topsoiled and grassed/seeded, returning it to its existing condition. The site compound will be used to store construction materials, plant and machinery, site offices and basic welfare facilities for the contractors (self-contained kitchen/toilets).

The site compound will also contain a storage area for diesel and fuels and all refuelling of plant will take place in the site compound. All fuels will be stored and handled in accordance with best practice procedures. The contractor will be required to produce a Construction Environmental Management Plan (CEMP) which will set out an emergency response procedure in the event of a chemical leak or spill. The CEMP will also include methods for maintaining a tidy site. All staff on site will be briefed on the contents of the CEMP including the emergency procedures before commencing the works. Upon completion, the site compound will be removed and the area reinstated.

All materials for this Scheme, including the site compound units, will be delivered to site by road. There is a possibility however, that the rock for the breakwater and revetment may come by sea, as well at the Pwll Cam flood gate. The exact details are yet to be finalised and will be determined in conjunction with the appointed contractor. Road access to the site will be by way of the A487, turning onto the unmarked entrance road to CCC Penmorfa offices.

Should delivery of rock for the breakwater and revetment be by sea, the rock is likely to be sourced from a European quarry. The rock would be transported by ship or barge, which will anchor offshore of Aberaeron for a couple of weeks. Rock can be brought ashore by using a shallow draught barge controlled by a small tug to meet the main vessel and the rock will be transferred individually from the main ship onto the barge using an on-board excavator equipped with a hydraulically operated grab. The tug and barge will transport the rock to the site of the breakwater, where rock is left on the beach.

For the harbour wall raising at Quay Parade, materials will be transported from the site compound, along the A487, into Regent Street and follows the one-way system down Tabernacle Street/Market Street and Cadwgan Place and onto Quay Parade. For the wall raising to the rear of the Monachty Hotel and up to the A487 road bridge, access to this area is via the Market Street car park to the north of Pwll Cam.

There will be a need to create a temporary sheet pile cofferdam at the entrance of Pwll Cam to construct the new gate. The flood gate for Pwll Cam may be transported by a barge, pulled into the harbour by tug boat. Liaison will be carried out with the CCC Harbourmaster with regards to the need for preparing a Notice to Mariners informing them of this aspect of the works. Alternatively, the gate might be installed from land and the gate brought in by road. For this, a temporary access road formed of crushed stone materials could be constructed from the slipway and along the eastern dock wall within the Pwll Cam harbour on the dock seabed adjacent to the proposed gate location. In addition, a Notice to Mariners is also likely to be needed for the South Pier, South Beach and new breakwater works, due to the proximity of vessels moving in and out of the harbour.

3.2.2. Construction Method

3.2.2.1. North Pier Breakwater

Before the breakwater is constructed, some excavation of the shingle seabed is required to 'toe-in' the outer perimeter of the breakwater below the sea-bed. This will enable the breakwater to be protected from any scour which may arise from large storm waves which might wash out some shingle and undermine the base of the breakwater and to prevent movement from future settlement. The excavation will be carried out using a number of long-reach and 360 degree tracked excavators (see Figure 3-1) positioned on the beach at low tide. Excavation will be carried out at low tide for the sections of breakwater that will be above MLWS. For sections of the breakwater below MLWS, excavation will take place under water. The shingle material removed will be stockpiled above MHWS on South Beach with some of it being re-used in the core of the breakwater and some as shingle recharge on South Beach. The total amount of material excavated is estimated to be 12,916m³ (8,000m³) is estimated to be used on South Beach as shingle nourishment, and 4,916m³ in the breakwater core).

Prior to the placement of the breakwater rocks, a geofabric mat will be positioned onto the seabed in the excavated footprint of the breakwater. In addition to helping reduce settlement once the breakwater is constructed, it will also help reduce the washout of bed material beneath the rocks and reduce scour in the future. The mat will be laid on the seabed by a tracked excavator (see Figure 3-2), with rocks placed onto the mat to hold it into position before the rest of the breakwater construction commences.

The rock for the breakwater will sourced from a quarry or number of different quarries, depending on the quantities available and to ensure a constant supply of rock for the scheme. The rock will be transported to site by sea and/or by road. For delivery by road, it is likely the rock would be sourced from a local Welsh quarry, with more than one quarry required due to the volume of rock needed. The rock would be transported to the site compound via the A487. It is estimated that there will be 25 round trips made to site per day over a period of 6 to 9 months using articulated lorries for the larger 6 -10 t rock and tipper lorries for the 0.3 to 1t rock. In between each rock delivery to the site compound, 25t dump trucks (Figure 3-4) will transport the rock from the stockpile in the site compound to the breakwater location, thus maintaining space in the compound for more rock to be delivered. There will be stockpiles of rock temporarily placed on the beach to organise the rock into sizes and due to tidal working.

The rock will be transported from the site compound to South Beach via dump trucks which will use a temporary access ramp formed out of rocks leading from the site compound onto the beach. These dump trucks will then transport the rock along South Beach to the breakwater. The transportation of rock from the

site compound to the stockpile areas will continue for approximately 6 - 9 months (movement of approximately 6no. 20t dumpers per day). The dumpers will be required to reduce their footprint on the beach by keeping vehicle movements to the upper beach area and avoiding the intertidal area as much as possible to reduce sediment becoming mobilised into the water and increasing turbidity. Although South Beach forms part of the SSSI and there is a high presence of *Sabellaria alveolata* along the coastline, generally this habitat is absent from the intertidal area at South Beach.

The rocks will be picked up from the stockpile area by a long reach 360 excavator (35-40t) with a grab (see Figure 3-3) attachment to carefully pick up and place the rock. These will be located on the beach for the breakwater construction. For the smaller core rock, dump trucks will be used to tip the rock on top of the geofabric layer and assisted by excavators to spread the rock material. It is likely that the breakwater will be constructed starting from the landward end and progressing seaward. This will allow machinery constructing the parts of the breakwater in the subtidal zone to work from the top of the newly constructed portions of the breakwater.

For delivery by sea, the rock is likely to be sourced from a European quarry. The rock supplied will be transported to the quayside where approximately 25,000t of rock will be loaded onto a barge. The barge vessel will set sail to the site where it will anchor offshore of Aberaeron for around 1 to 2 weeks before setting sail for another load.

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 breakwater or South Beach 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.

At no time will there be any beaching of boats on the beach. 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. 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 are estimated to be required to transport the rock.

At the end of the existing North Pier, the existing concrete wave wall will be removed to enable access for construction machinery onto the pier. Demolition of the wall will be carried out using a back-hoe excavator and breaker to break out the concrete, with the material removed off site to a licenced tip. The material is likely to be removed via Quay Parade.

Before completing the breakwater construction, a concrete walkway will be constructed along the full length. Pre-cast concrete 'u'-shaped units will be manufactured in a factory offsite and transported directly to North Pier via Quay Parade, using 8m long trucks with 2 concrete blocks per truck. It is estimated that there will be 4 deliveries to site per day over a period of 1 month, approximately 100 round trips.

The concrete 'u'-shaped units will be positioned on the top of the breakwater with a mobile crane and concrete will be poured into the precast units using a concrete pump and concrete delivery lorries. Rock armour will be placed around the precast units to secure them in place. The surface of the concrete blocks will be left exposed to form a concrete footpath on top of the breakwater. This footpath will provide access for recreation as well as for future maintenance of the structure.

Repair work to the surface slab will be undertaken at the end of the existing North Pier. This will involve vertical drilling and grouting which will take place from the surface of the pier. Holes measuring 35mm will be drilled down into the top surface of the pier to a depth of 5m. The holes will be drilled in a staggered diamond shape pattern at a distance of 1m north to south and 2m east to west. The holes will be injected with a combination of lime and cement grout to stabilise the loose ground beneath the surface slab.

Signage and navigation markers (including electricity cables for navigation lights) will also be installed. Existing life rings are present on North Pier and the need for any additional life rings/buoys will be determined by CCC.

3.2.2.2. South Pier Refurbishment

The seaward end of the South Pier will be demolished using machine mounted breakers, grabs and hand tools. Machinery and equipment will be located on the beach. Sections of concrete, masonry and other arisings will be removed from site by dumpers. There is the potential for some of the masonry to be salvaged and recycled. The demolition work will take place during low tides for ease of access by the contractor. Working at low tide will help to reduce the amount of debris falling into the water. To further reduce this, a geotextile layer, or similar, will be placed on the seabed to help capture falling debris for

removal from site before the tide rises. The contractor may also decide to build a level temporary working platform at the base of the pierhead, which is built out of imported rock materials that will be eventually used for the rock breakwater. In this scenario geotextile will be used to ensure separation between imported and indigenous materials so that total removal of the working platform can take place on completion.

Once the collapsing degraded pier head has been removed, concrete or steel piles will be driven into the ground using a piling rig (see Figure 3-6) positioned on the beach. The piles are required to support the weight of the structure for the new pier head. This will be carried out using a combination of pre-augering and driving of piles which will take place intermittently over two months. Precast concrete wall units will be manufactured in a factory and will be transported to South Pier. These will be built up in sections to form the shape of the pier. Once the external precast concrete shell is constructed, concrete pumps will be used to pump wet concrete into the pre-cast shell units to infill the units. Alternatively, to using precast sections, the contractor may decide to make up curved forms (moulds) which are put into the final wall positions into which concrete will be poured directly.

Along the south side of the pier, steel sheet piles over a 10m section will be placed along the base of the wall below the level of the shingle bank to protect the southern side of the pier from the effects of scour and abrasion which result from shingle moved around by strong waves.

Following the piling and installation of the external concrete walls and steel sheet piles, there will be a three-month period of wall grouting and stone masonry repairs. The horizontal and vertical grouting will require hand-held drills being used to drill into the wall face and top of the structure into any voids present. These holes will then be filled with temporary plastic pipes which will be used to pump lime and cement grout into the voids. Localised masonry repairs and repointing works will be required to the masonry face of the structure. These works will require the use of scaffolding (see Figure 3-7) and negative mobile elevated working platforms (see Figure 3-8) to undertake the repairs.

The relatively small amount of rock required at the end of the pier head will be constructed in a similar method to the breakwater and using the same source with the rock brought to site from either a Welsh or European quarry and transported to site by road or sea respectively. The rock colour will be specified to be grey, to remain consistent with the existing defence structures and the new breakwater construction at North Pier. Please refer to previous section for rock delivery, transport and placement methods.

3.2.2.3. South Beach - Groynes

The timber planks for the groynes will be removed using hand cutting tools and saws. The existing groyne piles will be removed by using an excavator with a grab or chain attachment. This plant will pull the piles out of the ground and place them into the wheeled dumpers for onward disposal. There are existing concrete steps present at the end of the existing timber groynes and these will need to be broken out with an excavator and a breaker. The material will then be placed into dumpers and disposed of at an off-site tip.

The groyne piles and timber planks will be brought onto the beach from the site compound on dump trucks. The timber posts will be inserted into the ground using a piling rig to drive the piles into the ground by a percussion and vibration piling technique. Hand tools will be used to attach the horizontal panels to the timber piles. The groyne works will take approximately two weeks to remove the existing groynes, two weeks to drive in the new piles and a further four weeks to attach the planks. Work will have to take place at low tide to gain access and this has the benefit of avoiding sediment disturbance.

South Beach – Rock Revetment

To construct the new revetment, the existing rock revetment will be removed using an excavator (35t-40t) with a grab and rocks will be loaded onto dump trucks. The existing rocks will be stockpiled for re-use, with the existing 1-4t rocks to be re-used for the making up for low spots in the ground along the location of the proposed defence. Some of the existing shingle around the existing structure will be temporarily removed to construct the new revetment and will then be reinstated around the completed revetment on completion. The intention is to use all reclaimed rock and shingle within the South Beach works. Non-indigenous material which may include hitherto undiscovered concrete, steel or other non-natural debris will be removed to an off-site tip.

An excavator on the beach will excavate the area where the new revetment will be placed. Approximately 8,848m³ (5,550t) of shingle will be excavated, with all excavated material reused as nourishment. The excavated shingle material will be stockpiled within the beach above MHWS before it is needed for re-use, although this is not critical and shingle can be temporarily located immediately seaward of completed sections of revetment, before being relocated to its final position.

A geofabric separation membrane will then be laid onto the excavated surface prior to the placement of new rock for the revetment. The imported rock for the scheme will be transported to the site compound and stored there initially. The rock will then be transported to the beach by dumpers and tipped onto the beach. At this point the excavator with the grab will sort the rock into stockpiles for temporary storage on the beach before placing into the revetment. Rock will be placed to form the revetment using an excavator with a grab one rock at a time. This work will be undertaken at low tides. The volume of imported rock required for the revetment is estimated to be 14,534m³.

South Beach - Renourishment

As described in the above sections, the material for the beach nourishment will be stockpiled on the beach following the breakwater and revetment excavation work, ready for re-use on the beach. It is unlikely that shingle material will also need to be imported, but if required, this would be brought from the site compound via dump trucks. A bulldozer (see Figure 3-5) will spread the material to the required slope at low tide.

Flood wall: Quay Parade

The removal of the existing flood wall and construction of the new raised wall will take place in sections to allow the existing flood wall to maintain its current function during the construction phase of the new works. This also allows parking to be maintained alongside the wall where work is not taking place and to maintain access along the road. Residents along Quay Parade have parking at the rear of their properties. It is estimated that approximately 5m length of wall will be removed per day and reconstruction of the same length of wall will take a further 4 days. Approximately 5m of wall will therefore be removed and reconstructed per week.

Work will commence with the removal of street furniture, lighting and signage. This will be carried out using hand tools, with the items set aside for re-installment following construction. Currently, the lighting is located on the seaward side of the flood wall. Benches will be reinstated to their existing location on the seaward side of the wall with the potential for additional new seating to be provided. Options are also being considered to fix seating directly onto the walls.

The existing inland concrete flood wall will be removed in sections, including its foundation to a depth of 1.5m using an angle grinder, pneumatic breaker, excavator and dumper. Material will be removed from site by loading the material onto small 3 to 5T wheeled dump trucks.

Excavation will be carried out to a depth of 1m into the footway for the wall using disc cutters, pneumatic breakers and excavators to construct the footings for the new wall. The lower concrete and masonry-clad portion of the wall will be constructed by erecting steel reinforcement and pouring concrete into temporary timber formwork (moulds) to form the wall and foundations. The temporary formwork (moulds) is needed to keep the concrete in place while it is setting and is then removed once concrete is set. The concrete wall will be clad with stone masonry to provide a finish that is similar to the existing quay wall.

The glass panels will be manufactured in a factory and transported to Quay Parade. The glass panels will be inserted into pre-determined fixing points cast in the reinforced concrete wall, secured and sealed accordingly. The panels will be supported by steel posts on each side of the glass panel and fixed to the top of the wall.

The tilt barriers will be manufactured off site in a factory. Excavation through disc cutting and breaking will be carried out to a depth of 500mm into the footpath to recess the tilt barrier into the footway and to keep it flush (when closed) with the surrounding walkway. Each tilt barrier should take approximately 1 week to install.

Flood Wall: Pwll Cam to Monachty Hotel

The construction of this section of wall will follow a similar methodology to that at Quay Parade. Excavation will be carried out to a depth of 1m into the quayside for the wall footings using disc cutters, excavators and 3T dumpers. The lower masonry portion of the wall will be constructed by erecting temporary timber formwork (moulds) to form the wall foundation and wall by pouring concrete between the formwork (moulds). Once concrete is set the temporary formwork will be removed leaving the shape of the new wall. The wall will be clad with the same stone masonry as the new wall at Quay Parade, to provide a finish that is similar to existing quay walls, and that will be in keeping with the existing surrounds. The glass panels, will be transported to site from a factory, and will be fixed to the top of the wall by attaching them to steel columns fixed on top on the wall.

To the west of the entrance to Pwll Cam, and adjacent to The Hive, a short 10m long section of wall will also be raised with concrete and masonry cladding to 5.2mOD with glass panels.

A tilt barrier will be constructed at the entrance to the footbridge over the River Aeron. The tilt barriers will be manufactured off site for installation. A recess will be formed within the newly constructed terrace area to a depth of 500mm to house the tilt barrier into the footway. The tilt barriers are spring loaded and will be operated with a key held by CCC. The installation of the barrier should take approximately 1 week.

Flood Wall: Monachty Hotel to A487

To undertake the works from the footbridge to the property adjacent to the Monachty Hotel the existing rock revetment in front of the wall will need to be temporarily moved and placed alongside the river channel to create a working area/access track, so that the existing wall can be removed and the new wall constructed. It will also be necessary to remove part of the existing boundary wall at the rear corner of the Monachty Hotel to create an access route. The rock from the revetment will be shaped to retain a temporary working platform for the works in this area. This will be undertaken using excavators with a grab attachment working in the river when the tide is low. The excavators will be able to move into the harbour using the slipway at Doc Bach (near Beach Parade).

The new wall construction at Toad Hall will require the base to be constructed of a steel piled foundation driven into the hard ground using a piling rig (see Figure 3-6). Attached landward of the piles will be a (steel) reinforced concrete base for the wall. To construct this, there will be a need for a portable pump to pump out water at the bottom of the excavation (as a result of tidal ingress). On top of the concrete base a new vertical concrete wall will be constructed which will be clad with masonry. The top level of the wall will house glass panels to the same 5.2m AOD crest height as the other flood walls being constructed for this Scheme. On completion of these works the existing rock revetment will be relocated in its original position but placed against the new wall so that it matches its existing appearance and continues to provide scour protection along the river frontage.

The existing wall from the A487 road bridge will be connected to the new wall constructed between Pwll Cam and the Monachty Hotel as described above. Work to raise this stretch of existing wall will involve constructing a reinforced concrete capping beam onto the top of the wall which will be anchored into the existing wall using steel dowels and resin grouting. The small scale of work and limited access will necessitate using hand tools for the most part. The glass panels will be fixed to the top of the new capping beam between the new steel columns on top of the wall.

Construction access to carry out these works is very limited in this location due to the proximity of residential properties behind the wall. It is likely that a temporary scaffolding platform will be erected in the river channel next to the wall. Work to raise the wall would take place from this platform, thus avoiding the need to access the site from property gardens. Materials would be brought onto the working scaffold area via the temporary working area/access track to the rear of the Monachty Hotel. The scaffolding platforms would be screened to enable much of the debris from the works to land on the platform rather than falling into the water.

Pwll Cam Flood gate

There will be a need to create a temporary sheet pile cofferdam at the entrance of Pwll Cam to construct the new gate. Following the cofferdam construction, the working area along with Pwll Cam will be dry and pumps may be required to remove any groundwater or rainwater inflows. Prior to constructing the cofferdam, a fish rescue will be undertaken in the dock. The cofferdam will be constructed at low tide.

To ensure that the walls supporting the gate have sufficient strength, a precast or formed concrete wall will be constructed to create the concrete abutments upon which the flood gate will be attached. Due to the access limitations at Pwll Cam, consideration of options for this aspect of the construction will be a key part of the contractor procurement process. If the wall is precast, the units would arrive to site from the factory by road. If a formed wall is proposed by the contractor, formwork (moulds) would be erected to form the shape of the wall, with concrete then poured into the formwork before setting and then the formwork removed. The wall will be clad with stone masonry to provide a finish that is similar to the existing quay wall.

Drilling and grouting of walls will also take place to consolidate existing masonry and repair cracks and holes in the entrance channel walls alongside the Hive. The existing sill at the entrance to Pwll Cam will be removed by excavation using a saw cutter and excavator to remove existing concrete. A new concrete sill would then be cast onto the prepared ground.

For all of the wall grouting, drilling and lowering of the cill, this work would be done behind the cofferdam in the dry.

Piling (see Figure 3-6) will be required below the abutment walls and cill to provide the foundations for the wall abutments to resist the force of the water at high tide and during storm events. A total of 12 concrete or steel piles will be inserted into the harbour bed across the channel entrance underneath the footprint of the new gate. The piling will take place over a period of approximately 20 days. Piling is likely to be pre-augured and driven but will depend on the contractor's method statement and the results of the ground investigation. Two steel tension anchor bars for each abutment measuring 20mm in diameter, will also be drilled into the ground below the seabed to provide further resistance against the resultant forces of on the gate and abutments. Further anchor bars will be drilled into adjacent wall to provide additional structural restraint.

The flood gate will be manufactured off-site and is likely to be brought to site via a barge due to its size and the limited quayside access. A tug-boat will guide the barge (see Figure 3-11) into the harbour, with a crane positioned on the barge (see Figure 3-12) used to lift the gate into position. Depending on the time taken to offload the gate from the barge, the barge may need to rest on the harbour bed until it can leave on the next high tide. There will be a smaller crane located either in the car park (Figure 3-11) or adjacent to the slipway which will be used for ancillary activities.

There is a possibility that the gate might be installed from land and the gate brought in by road. An alternative option is that a temporary access road formed of crushed stone materials could be constructed from the slipway and along the eastern dock wall on the dock seabed to the gate location. This temporary structure would be installed after construction of the cofferdam and would provide a working platform to access the gate area including a location for a heavy-duty crane to position itself for lifting the gate.

Installation of the gate is the only aspect of the Scheme that may require some night-time working. This is because the installation is a continuous operation likely to take more than 12 hours to complete. The contractor would follow best practice procedures for work at night, including measures to minimise noise and directional lighting.

The construction of the gate will also require some digging of service trenches using saw cutters and excavators or similar to bury electrical cables for the gate operation which will connect to mains services in Market Street. A control kiosk to house the gate operating equipment will be constructed in close proximity to the gate. It is likely to be located to the east of the entrance to Pwll Cam adjacent to the gate. The design of this structure is not yet confirmed, but could be housed within a small compound comprised of masonry walls to blend with the existing abutment and flood defence walls.

Figure 3-1 - Tracked Excavator with Bucket for Excavation



Figure 3-2 - Tracked Excavator Placing Geotextile



Figure 3-3 - Tracked Excavator with Grab to Pick Up and Place Rock



Figure 3-4 - Wheeled Dumper Transporting Rock



Figure 3-5 - Dozer to Spread out the Imported Shingle



Figure 3-6 - Piling Rig



Figure 3-7 - Scaffolding for South Pier and Wall Repairs



Figure 3-8 - Negative Mobile Elevated Working Platforms (MEWP's) to Repair Walls from Above High Water



Figure 3-9 - Crane and Basket to Carry Operatives for Wall Repairs



Figure 3-10 - Repointing and Wall Repairs by Rope Access



Figure 3-11 - Barge, Tug, Crane and Gate at Milford Marina



Figure 3-12 Barge, Crane and Gate at Milford Marina



3.2.3. Outline Construction Programme

The works are scheduled to commence in winter 2021 and be completed by winter 2022, a duration of approximately 12 months. Construction will commence with the new breakwater with the other Scheme

elements overlapping over the 12 month period. It is estimated that the construction timescale for each phase of the works will be as follows:

Activity	Programme
New breakwater	12 months
Restoration of South Pier	6 months
Flood Walls	6 months
Pwll Cam flood gate	9 months
South Beach improvement works	9 months

It should be noted that these durations are weather dependent and will rely on the contractor appointed and their detailed method statement.

In order for the Scheme to be completed in the shortest time possible, construction will be carried out Monday to Sunday from 7am to 7pm. Within these working hours, significant elements of work will be restricted to periods of low tide only. Work that can take place at all tide states will include work to all three flood walls and the grouting repairs of quay walls. There will be no work over Christmas, New Year and Easter public holiday and Bank Holidays.

3.3. Operation

Following construction, the Scheme will provide protection from erosion and flooding for a 1 in 200 year standard of protection from flooding through wave overtopping of the harbour walls. The Scheme has been designed to account for current predictions of sea level rise over the next 100 years. Numerical modelling of the breakwater has indicated that sediment accretion may occur at the seaward end of the breakwater and in the harbour channel. Further assessment of this can be referred to in Table 6-2. CCC will be responsible for the regular maintenance of specific elements of the Scheme and will monitor of seabed levels following construction. Regular maintenance dredging of the harbour is already undertaken by CCC on an annual basis due to the transport of sediment into the harbour from sea and river sources. Long-term maintenance measures and monitoring will be decided at a later point by CCC and have not been considered as part of this Scheme.

3.4. Decommissioning

No decommissioning is required or proposed as part of the Scheme. There are therefore no potential pathways for impacts associated with decommissioning, and decommissioning effects have not been considered within the assessment.

4. Screening

4.1. Screening of WFD Water Bodies

This screening exercise was completed to identify waterbodies that are relevant to the Aberaeron Coastal Defence Scheme. A study boundary also known as zone of influence was set for the screening, which was the Site area, plus (for surface waters) one water body upstream and downstream of the Site. For groundwater, only immediately underlying groundwater bodies were included in the screening, as individual groundwater bodies are designated as “hydraulically coherent” systems that do not have interactions with other groundwater bodies.

Aberaeron is within the Western Wales River Basin District (RBD) and the management strategies for the District are stated in the Western Wales River Basin Management Plan (RBMP). The first RBMP was published in 2009 and set out the management plan for the first six years 2009-2015. The plan was updated in 2015 to cover the second period 2015-2021 and will be updated again in 2021 (yet to be published), and so on. The purpose of the RBMP is to protect and improve the water environment for the wider benefits to people and wildlife – to achieve ‘Good’ status. The majority of baseline data within the study area was obtained from Natural Resources Wales (NRW) Water Watch Wales (Natural Resources Wales, 2020).

NRW’s 2018 Cycle 2 interim classification data (Natural Resources Wales, 2017) provides the most consistent and up to date information for all waterbodies in Wales. Therefore, this data has been used to provide most of the baseline information on the status of waterbodies. However, due to the lack of information and/or to understand the wider pressures and reasons for not achieving ‘Good’ status, where applicable, information may have been supplemented with data from the Western Wales RBMP (Natural Resources Wales, 2015) and/or the more up to date draft consultation data (Natural Resources Wales, 2020).

4.1.1. Surface Water Bodies

In the Western Wales River Basin District, the following surface water bodies are classified as within the zone of influence:

- Cardigan Bay Central (ID:GB651009030000)
- Aeron – confluence with Gwili to tidal limit (ID: GB110063041450)

Aberaeron Harbour is under both tidal and fluvial influence from Cardigan Bay Central (ID:GB651009030000) and Aeron – confluence with Gwili to tidal limit (ID: GB110063041450) respectively.

Cardigan Bay Central (ID: GB651009030000) is a designated coastal water body covering an area of 104 km². Cardigan Bay (the area encompassing all three designated beaches) is a popular tourist destination partly due to its Blue Flag beaches and the potential for spotting a local population of Bottlenose dolphins, which are a designated feature of the Cardigan Bay Special Area of Conservation (SAC) (Visit Wales, 2021a).

Aberaeron’s coastline is split into two main beaches - North and South beach. Neither of the beaches are designated bathing waters. The closest designated bathing waters are Llanrhystud and three areas at New Quay with the closest approximately 7km away; all were classified as ‘Excellent’ or ‘Sufficient’ in 2017 (Welsh Government, 2021).

Further landward and upstream of Aberaeron harbour is the River Aeron (Afon Aeron). The River Aeron is 12.15km in length and its overall WFD classification is ‘Moderate’, with diffuse pollution from farming noted to be the reason why the waterbody has not achieved ‘Good’ status to date. The Aeron catchment which includes, but is not limited to the River Aeron, is predominately rural in nature and supports an important sea trout fishery with a limited number of salmon also present (NRW, 2018). There are local targeted measures to control diffuse pollution led by NRW. It is also noted that there is a National Measure to be led by the

Welsh Government to review the legislation surrounding rural diffuse pollution to also tackle this cause of poor water quality throughout Wales.

Local targeted measures for the River Aeron waterbody have been defined as:

- To control or manage diffuse source inputs;
- Reduce diffuse pollution at source; and
- Farm Infrastructure.

A summary of the screened surface water bodies WFD classification is provided in Table 4-1 below. The location of the Scheme in relation to screened surface water bodies is shown in Figure 4-1.

Table 4-1 - Summary of WFD Classification for Screened Surface Water Bodies (Natural Resources Wales, 2020)

Name	Type	Hydromorphological designation	Waterbody ID	Area (km ²)	Protected Area Designation	Overall Status Cycle 1	Overall Status Objective	Overall Status Cycle 2
Cardigan Bay Central	Coastal	High	GB651009030000	104km ²	Bathing Water Directive Special Area of Conservation (SAC)	Good	Good by 2015	Good
Aeron – confluence with Gwili to tidal limit	River	High/Supports Good	GB110063041450	12.15km (Length)	Not Designated	Moderate	Good by 2021	Moderate

4.1.2. Groundwater Bodies

The groundwater body underlying Aberaeron is the Teifi and Coastal Ceredigion groundwater body. Under the Western Wales RBD, this groundwater body forms part of a Drinking Water Protected Area (DWPA). Teifi and Coastal Ceredigion groundwater body has been assessed as 'not at risk'. The RBMP determined some of the following sources that can impact on groundwater bodies not being able to achieve 'Good' status such as:

- Unregulated discharges e.g. from abandoned mines, leaking subsurface sewers; and
- Pollution from rural areas e.g. excessive use of nutrients such as nitrates.

A summary of the screened ground water bodies WFD classification is provided in Table 4-2 below. The location of the Scheme in relation to the extent of the groundwater body is shown in Figure 4-1

Table 4-2 - Summary of WFD classifications for Groundwater Waterbodies in Proximity to the Scheme (Natural Resources Wales, 2020)

Name	Type	Waterbody ID	Grid Reference	Protected Area Designation	Overall Status Cycle 1	Overall Objective	Overall Status Cycle 2
Teifi and Coastal Ceredigion	Ground water	GB41002G203300	N/A	Drinking Water Protected Area	Poor	Poor* by 2027	Poor

Note: * considered 'technically infeasible' to achieve good water quality by 2021 due to the presence of minewater (NRW River Basin Management Planning Overview Annex).

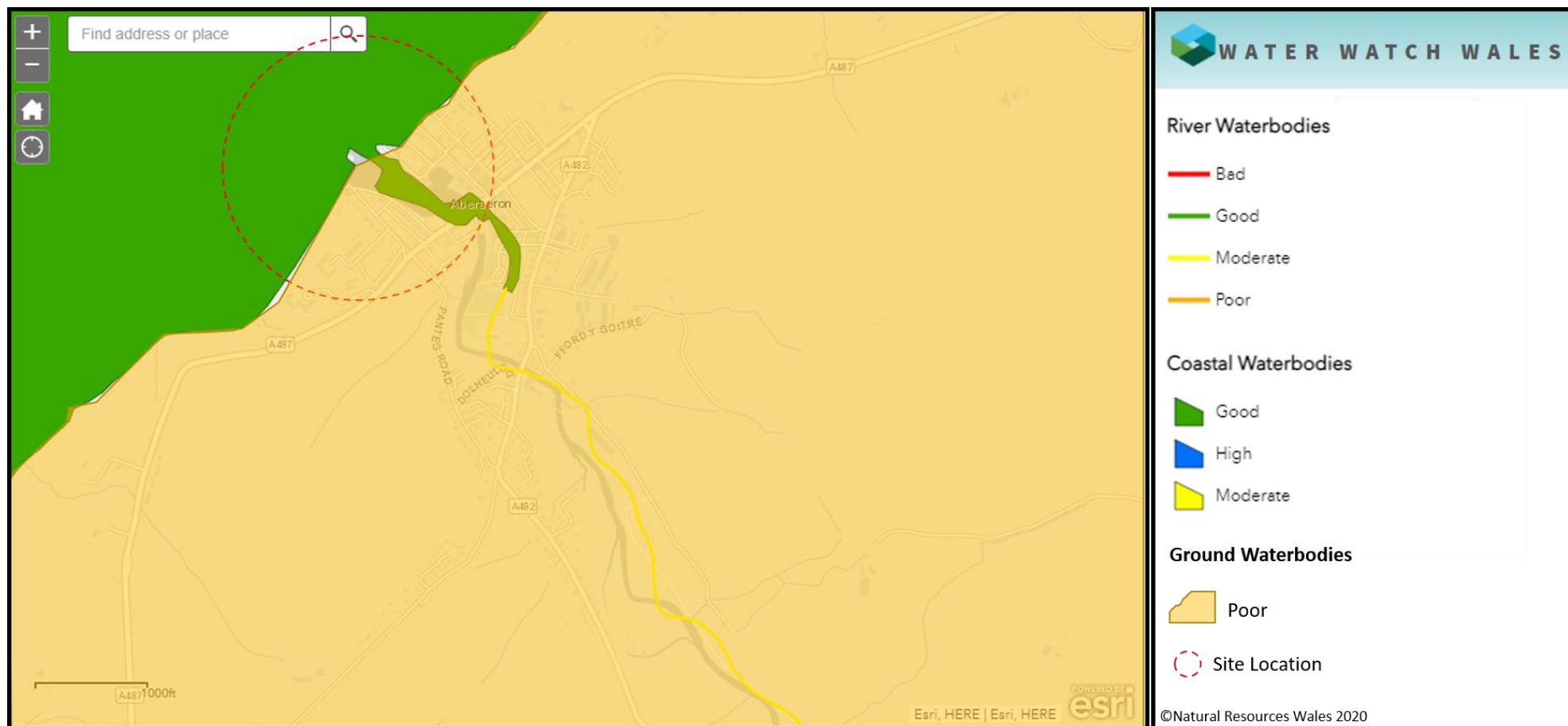


Figure 4-1 - Surrounding Surface and Groundwater Bodies in Relation the Scheme location (Natural Resources Wales, 2020)

4.1.3. Screening summary

The following WFD water bodies have therefore been screened in for further assessment:

- Cardigan Bay Central (ID:GB651009030000)
- Aeron – confluence with Gwili to tidal limit (ID: GB110063041450)
- Teifi and Coastal Ceredigion (GB41002G203300)

4.2. Screening of Relevant Scheme Activities

The screening of relevant activities has been considered for each Scheme stage. The results of the Scheme activity screening are documented in Table 4-3 to Table 4-5.

Table 4-3 - Screening of Scheme Activities: Construction Stage

Scheme element	Activity	Screening rationale
Site establishment and demobilisation	Creation and demobilisation of temporary compound	Screen out –The development of a temporary compound will be located landward, away from designated surface water bodies. All access/egress routes and any associated potential impacts with site establishment and demobilisation will be minor and short-term, with no permanent change to any surface water body, surface water quality or biology elements (WFD higher sensitivity habitats and fish). No deterioration or impacts to designated ground water bodies is expected as all ground-breaking works will be superficial.
North Pier breakwater	Material excavation, rock placement and, operation of plant and machinery	Screen in – Material excavation and rock breakwater installation has the potential to impact on surface water and ground water quality elements.
Re-building seaward head of South Pier	Material removal and replacement and operation of plant and machinery	Screen in – Removal of existing pier material and reconstruction of the pier head has the potential to impact on surface water quality elements and ground water quality elements.
Improvements to South Beach	Groyne replacement, rock revetment, shingle recharge and operation of plant and machinery	Screen in – Groyne replacement, rock revetment and shingle replenishment has the potential to impact on surface water quality elements and ground water quality elements.
Harbour wall raising	Material removal and replacement and operation of plant and machinery	Screen in – These works have the potential to impact on surface water quality elements. No deterioration or impacts to ground water bodies are expected as all ground-break works will be superficial.
Pwll Cam flood gate	Flood gate and control building installation	Screen in – The installation of Pwll Cam flood gate has the potential to impact on surface water quality elements and ground water quality elements.

Table 4-4 - Screening of Scheme Activities: Operation Stage

Scheme element	Activity	Screening rationale
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North Pier breakwater	Changes to surrounding hydromorphological regime	Screen in – The installation of a rock breakwater may change the hydromorphological regime/ coastal processes of this area and therefore has the potential to impact surface water quality elements. No deterioration or impacts to ground water bodies are expected as no ground-breaking works will be taking place post-construction.
Harbour wall raising and Pwll Cam flood gate	Changes to fluvial hydrology	Screen in – The increased height of the harbour wall and installation of a flood gate for Pwll Cam - the inner harbour has the potential to change the fluvial hydrology of the River Aeron during stormy conditions and increase flood risk further upstream.

Table 4-5 - Screening of Scheme Activities: Decommissioning Stage

Scheme element	Activity	Screening rationale
None	None	Screen out - The Scheme does not include any decommissioning activity and has a design life of 100 years.

5. Scoping

5.1. Waterbody Baseline Data

5.1.1. Cardigan Bay Central

Table 5-1 - WFD Status – Cardigan Bay Central (ID: GB651009030000) (Natural Resources Wales, 2017)

Waterbody: – Cardigan Bay Central, Coastal water body		
Overall status: Good		
Ecological status: Good		
Chemical status: Good		
Mitigation measures: Not Yet Assessed		
Biological quality elements:	Physico-chemical quality elements:	Hydromorphological supporting elements:
Fish: Not Assessed	Temperature: Not Assessed	Hydrological Regime: Not Yet Assessed
Invertebrates: Good	pH: Not Assessed	Morphology: High
Macroalgae: High	Dissolved oxygen: High	HMWB: No
Phytoplankton: High	Dissolved Inorganic Nitrogen: High	
	All metal assessed: High	

Cardigan Bay Central (ID: GB651009030000) is a designated coastal water body covering an area of 104 km² (See Section 4.1.1). A summary of the baseline classification for Cardigan Bay Central water body is provided in Table 4-1 with more detail on the WFD status provided in Table 5-1. Based on the 2018 interim Cycle 2 data, Cardigan Bay's overall WFD classification is 'Good' with ecological and chemical Status also classified as 'Good'. Invertebrates have been assessed as the element driving the ecological status.

5.1.2. River Aeron

Table 5-2 - WFD Status – River Aeron with Gwili to tidal limit (ID: GB110063041450) (Natural Resources Wales, 2017)

Waterbody: – River Aeron with Gwili to tidal limit		
Overall status: Moderate		
Ecological status: Moderate		
Chemical status: Good		
Mitigation measures: Not Yet Assessed		
Biological quality elements:	Physico-chemical quality elements:	Hydromorphological supporting elements:
Fish: Good	Temperature: High	Hydrological Regime: High
Invertebrates: High	pH: High	Morphology: Supports Good
Macrophytes: Moderate	Dissolved oxygen: High	HMWB: No
Phytobenthos: Moderate	Phosphate: High	
	All metals: Not assessed	

River Aeron (ID: GB110063041450) is a designated river water body with a length of 12.5 km (See Section 4.1.1). A summary of the baseline classification for the River Aeron water body is provided in Table 4-1, with more detail provided in Table 5-2. Based on Cycle 2 data, River Aeron's overall WFD classification is 'Moderate', with ecological and chemical classified as 'Moderate' and 'Good' respectively. Macrophytes and Phytobenthos have been assessed as the element driving the ecological status.

5.1.3. Teifi and Coastal Ceredigion

Table 5-3 - WFD Status – Teifi and Coastal Ceredigion (ID: GB41002G203300) (Natural Resources Wales, 2017)

Waterbody: – Teifi and Coastal Ceredigion

Overall status: Poor

Quantitative status: Good

Chemical status: Poor

The Teifi and Coastal Ceredigion groundwater bodies overall status was classified as 'Poor' in 2018 with objectives to achieve 'Poor' overall status by 2027 (Natural Resources Wales, 2020). The groundwater chemical status was assessed as 'Poor' whilst Quantitative status and Drinking Water protected status was assessed as 'Good' (Natural Resources Wales, 2017). No reason for the water body not achieving good status has been determined. However, Cycle 2 data determined a WFD failing element as 'Chemical Dependent Surface Water Body Status'. The RBMP determined specific sources that may impact on groundwaters reaching 'Good' status as discussed in Section 4.1.2.

Preliminary ground investigation (GI) works have taken place within the Scheme area as detailed below. During GI works undertaken in 2008, (Quantum Geotechnical, 2008) groundwater was encountered at depths between 2.07m – 7.09m (dependant on the tide). In 2013 groundwater testing of the harbour was undertaken (Hyder Consulting, 2013). This testing demonstrated that any rise in tide level results in a rise in groundwater level, as the fill material behind the quay is highly permeable (porous). Therefore, it was determined that groundwater could be impacted from activities taking place in the intertidal area. The extent of GI works that have been undertaken include:

- Quantum in 2008 (Quantum Geotechnical, 2008) - the extent of which covered the boundaries of the inner and outer harbours including the North and South Piers.
- WYG in 2019 (WYG, 2019) - the extent of which covered the northern edge of the harbour, South Pier and the entire length of the southern beach.
- Quantum in 2021 (Quantum Geotechnical, 2021) - the extent of which included the core harbour area.

5.1.4. Protected Areas and Sensitive Habitats

The WFD Protected Areas and WFD sensitive habitats within a 2km proximity to the Site (as per the EA recommendation (EA, 2016)) are summarised in Table 5-4. The majority of the information provided on Sensitive Habitats has been sourced from Natural England's interactive MAGIC online mapping service. The location of these habitats is shown in Figure 5-1.

Table 5-4 - Summary of WFD Protected Areas and Sensitive Habitats

WFD Protected Areas	Location in relation to the Site
Special Area of Conservation (SAC)	West Wales Marine/ Gorllewin Cymru Forol SAC and Cardigan Bay/ Bae Ceredigion SAC.
Special Protection Area (SPA)	The closest SPA - Northern Cardigan Bay / Gogledd Bae Ceredigion is over 18km North of the Site.
Drinking Water Protected Area	The closest Drinking Water Protected Area is over 17km east of the Site.
Bathing Waters	One bathing water approximately 10km North of the Site and three designated bathing waters South of the Site near New Quay. The closest of the three-bathing waters is approximately 7km from the Site.
Shellfish Water Protected Area	The closest Shellfish water protected area is located over 30 km North of the Site.
Nitrate Vulnerable Zones	The closest Nitrate Vulnerable Zone is located over 30 km North of the Site.
WFD Sensitive Habitats	Location in relation to the Site

Mussel Beds (Higher Sensitivity)	Sections of mussel beds are shown along North Beach.
Polychaete Reef (Higher Sensitivity)	Significant sections of polychaete reef are spread along North Beach. A site walkover survey determined no Polychaete reef along South Beach.
Gravel and Cobbles (Lower Sensitivity)	Most of the intertidal area of North Beach consists of Gravel and Cobbles with a smaller section located north of South Beach.
Subtidal Rocky Reef (Lower Sensitivity)	The majority of subtidal seabed up to 3.5 km from Aberaeron Harbour consists of Subtidal Rocky Reef.
Intertidal Soft Sediments – sand, mud and mixed (Lower Sensitivity)	There is a small section of Intertidal Soft Sediment located on South Beach.
Rocky shore – intertidal rock (Lower Sensitivity)	There is a large section of Rocky Shore located north of North Beach, a significant section covering South Beach and some sections located within and near the harbour mouth along the edge of the River Aeron opposite Pwll Cam.

MAGiC

WFD Protected Areas and Sensitive Habitats

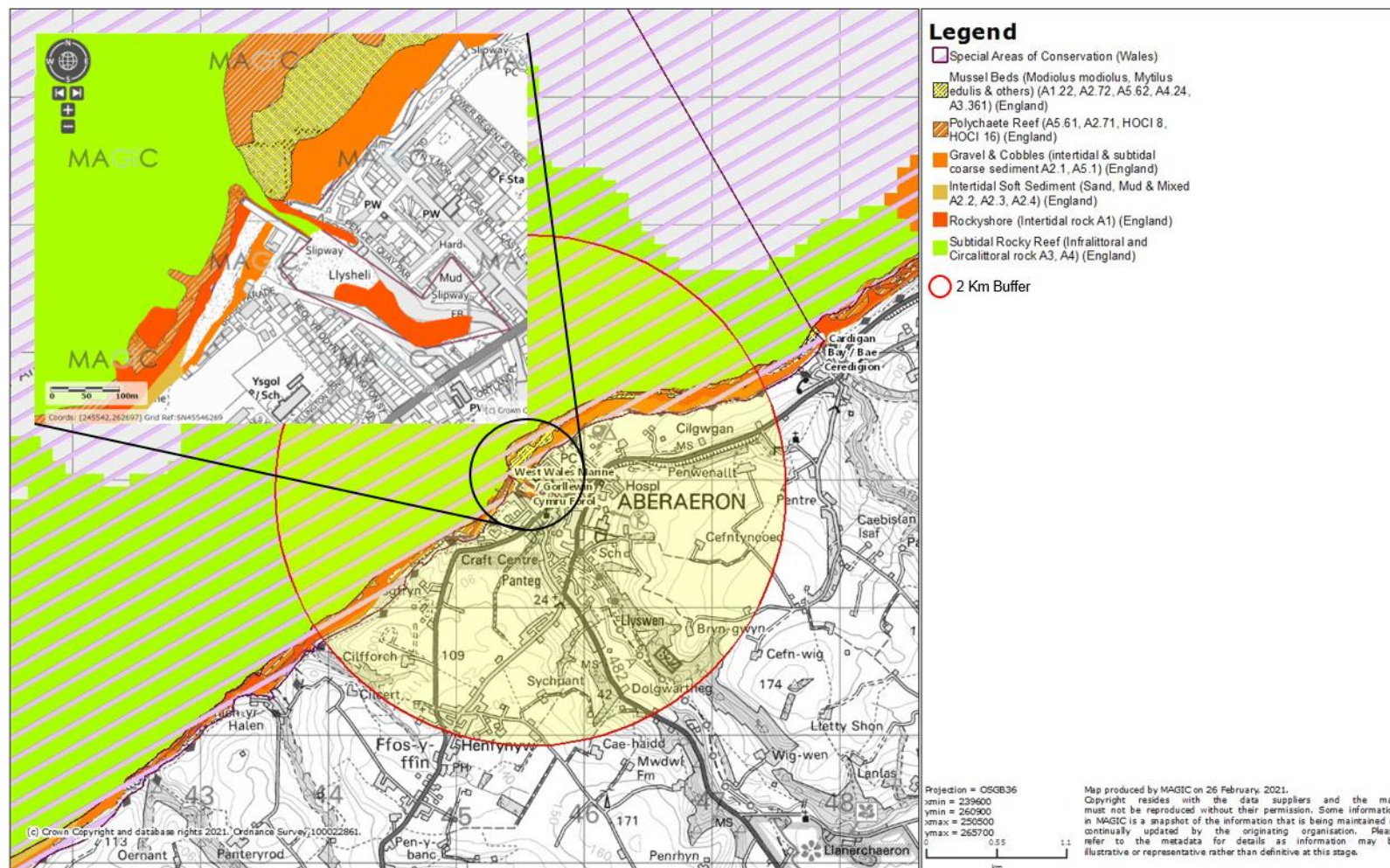


Figure 5-1 - WFD Protected Areas and Sensitive Habitats Within the Area of the Scheme (Natural England, 2021)

5.1.5. Fish

Natural Resources Wales regularly carry out fish surveys to monitor the biology and status of fish stocks within key watercourses. Two monitoring sites have been located on NRW Water Watch Wales interactive mapping along the River Aeron. However, no data is available. Fish have not yet been assessed under the WFD classification for Cardigan Bay Central water body. However, fish has been assessed as 'Good' for the River Aeron water body (See Section 5.1). This does not conclude the absence of fish from Cardigan Bay.

When designating Cardigan Bay SAC, River Lampreys were recorded in Aberaeron Harbour and migrating up the River Aeron. However, numbers were not sufficient to record the population's conservation status as favourable. No Sea Lamprey were recorded in the area during this survey (Countryside Council for Wales, 2009). Both species are designated features of the Cardigan Bay SAC.

5.2. Scoping of Scheme Activities

A Scoping exercise has been undertaken to identify the potential risks of each Scheme activity that has been screened in for further assessment to relevant WFD receptors. The Scoping process has followed the Clearing the Waters for All guidance, and has considered the risks of the Scheme activities during the construction and operation stages (as screened in in Section 4.2) to the following receptors for surface water bodies only:

- Hydromorphology;
- Biology – habitats;
- Biology – fish;
- Water quality; and
- Protected Areas.

The full Scoping exercise is documented in Appendix A. Tables 5-5 to Table 5-6 present the summary results of the identified risks and receptors that have been taken forward to the assessment stage for surface water bodies. A scoping exercise has not been undertaken for the Teifi and Coastal Ceredigion ground water body, but, has been taken forward to the assessment stage.

Table 5-5 - Summary of Scoping for Cardigan Bay Water Body

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Operation stage only – Installation of the rock breakwater has the potential to change the local hydromorphology.
Biology: habitats	Yes	Construction stage - Loss of sensitive habitat such as mussel beds and polychaete reef (<i>Sabellaria alveolata</i>). Operational stage – Changes to morphological conditions has the potential to cause impact on sensitive habitats.
Biology: fish	No	Fish have been scoped out from further assessment
Water quality	Yes	Construction stage - Potential disturbance and re-mobilisation of contaminated sediments during construction activities. Operation stage - Changes in morphological conditions due to the installation of the North pier breakwater may impact on sediment distribution which in turn may affect salinity, temperature and oxygen levels.
Protected areas	Yes	Construction and Operation stages – The Scheme is located in both the Cardigan Bay and West Wales Marine SAC. All other protected areas have been scoped out.
Invasive non-native species	No	Invasive non-native species have been scoped out from further assessment

Table 5-6 - Summary of Scoping for River Aeron Water Body

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Operation stage only – Installation of the increased harbour wall height and Pwll Cam flood gate has the potential to change the fluvial hydrology and increase flood risk upstream during stormy conditions.
Biology: habitats	Yes	Construction stage - Loss of higher sensitive habitats such as mussel beds and polychaete reef (<i>Sabellaria alveolata</i>). Operational stage – Changes to morphological conditions has the potential to impact on sensitive habitats.
Biology: fish	No	Fish have been scoped out from further assessment.
Water quality	No	Water quality has been scoped out from further assessment.
Protected areas	Yes	Construction and Operation stages –Both Cardigan Bay SAC and West Wales Marine SAC are within 2km of the Scheme. All other protected areas have been scoped out.
Invasive non-native species	No	INNS have been scoped out from further assessment.

6. WFD Assessment

6.1. Ground Investigation

The Phase 2 ground investigation, completed by Quantum Geotechnical in January 2021, included collection of geo-environmental soil samples from intrusive investigation locations for laboratory analysis. Appropriate soil sampling and descriptions of identified strata (in accordance with current good practice guidance) were undertaken at exploratory locations within the harbour and foreshore area of the site by the Contractor. Selected samples were instructed for laboratory analysis by Atkins on review of the ground conditions presented in the Quantum Factual Report.

A summary of the analysis undertaken is provided below.

6.1.1. Soil Sampling

A total of eight soil samples were scheduled for the following analysis cognisant of current and historical land uses identified on site:

- pH;
- asbestos screen (with quantification if asbestos identified);
- Fraction of Organic Carbon (FOC) and organic matter;
- inorganic parameters: cyanide (total, free and complex), sulphate, sulphide, sulphur, ammonium, ammonia, ammoniacal nitrogen;
- metals / metalloids: antimony, arsenic, beryllium, boron, cadmium, chromium, hexavalent chromium, copper,
- lead, manganese, mercury, nickel, selenium, vanadium and zinc;
- total phenols;
- benzene, toluene, ethylbenzene and xylene (BTEX);
- speciated polycyclic aromatic hydrocarbons (PAHs) USEPA16; and,
- total petroleum hydrocarbons criteria working group (TPH CWG), C5 – C44.

6.1.2. Soil Leachate

A selection of four soil samples were scheduled for 10:1 ratio soil leachate analysis to BSEN1245-2 (2002) for the following testing suite:

- pH;
- inorganic parameters: cyanide (total and free), sulphate, sulphide, ammonium, chloride;
- metals / metalloids: calcium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, hexavalent chromium, cobalt, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, potassium, selenium, sodium, tin, vanadium and zinc; and,
- total phenols;

6.1.3. Controlled Waters

To assess potential risks to the identified controlled water receptors, groundwater laboratory data have been screened against water quality standards (WQS). The screening criteria selected for controlled waters assessment are dependent on the nature of the receptor.

Drinking Water Standards have not been adopted as WQS due to the location of the site in the inter-tidal zone of the River Aeron and likely saline nature of the groundwater which would make it unlikely that it would be utilised as a future potable resource.

Therefore, the primary receptor is the surface water of the River Aeron. Soil leachate data have been screened against coastal and estuarine Environmental Quality Standards (EQS) to assess the potential risk posed to the surface water receptor.

6.1.4. Soil Leachate Assessment Results

Four soil-leachate samples were subject to leachate analysis to BS EN 12457-2 at a dilution ratio of 10:1. The screening results indicate that concentrations of arsenic, copper, lead and iron exceeded the WQS as summarised in Table 6-1.

The soil leachate screening assessment is provided in Appendix G

Table 6-1 - Summary of WQS Soil Leachate Exceedances (EQS)

Determinand	No. of samples	WQS (EQS) (mg/l)	Max. Concentration (mg/l)	No. of Exceedances	Location of Exceedances
Arsenic	4	0.025	0.054	1	TP109, 0.1m
Copper	4	0.00376	0.0067	1	TP111, 1m
Lead	4	0.0013	0.0094	1	TP111, 1m
Iron	4	1.0	1.2	1	TP111, 1m

6.1.5. Discussion of Potential Risks to Controlled Waters

The results indicate that there are exceedances of heavy metal against the WQS for arsenic, copper, lead and iron.

The risks of contaminated soils to the controlled water receptors are not considered to be unacceptable when noting the following lines of evidence:

- the copper and lead EQS screening criteria are conservative Tier 1 values which have not been adjusted for metal bioavailability (m-BAT) based on the chemistry of the receiving water;
- the recorded concentration for copper and lead are less than an order of magnitude above the WQS and spatially, the elevated concentrations are isolated to two locations, TP109 and TP111 within the inner harbour area;
- laboratory soil-leachate tests are generally aggressive and overestimate leachable concentrations which would be observed under natural environment site conditions; and,
- samples recovered comprised a recorded high percentage of gravel which may have been crushed for sampling, potentially affecting the elemental composition of the analysed sub-sample, increasing the surface area of the material and therefore available leachable surfaces.

6.2. WFD Assessment of Impacts

Tables 6-2 to 6-4 present the results of the WFD assessment for Cardigan Bay, River Aeron and Teifi and Coastal Ceredigion water bodies. This assessment considers the effects of the Scheme during both the construction and operational phases on the WFD quality elements of the water body. Where necessary, control measures are proposed to address potential effects on WFD quality elements.

Table 6-2 - Assessment of Impacts on Relevant Quality Elements of the Cardigan Bay Central Water Body

Hydromorphology	Biology	Physico-chemical	Protected Areas	Control Measures that will be employed throughout the works
Hydrological regime: Quantity and dynamics of water flow, tidal prism. Morphological conditions: water column depth variation; Structure and substrate of the sea bed. Mitigation Measures: Conflict with or contribution to Mitigation Measures for HMWBs	Sensitive Habitats: Extent and quality of habitats Fish fauna: Species composition and abundance; Presence of type-specific disturbance sensitive species; Age structure of fish communities. Other elements: Invertebrates and macroalgae	Parameters: Salinity, Nutrient concentrations, pH, Oxygen balance; Acid neutralising capacity, Temperature, Transparency. Pollution by all priority substances identified as being discharged into the water body. Pollution by other substances identified as being discharged in significant quantities into the water body.	Areas with water-dependent habitats that are protected under the Birds and Habitats Directives and the Ramsar Convention, Drinking Water Protected Areas, Shellfish Waters, Bathing Waters and Nutrient Sensitive Areas	
Assessment of Impact	Assessment of Impact	Assessment of Impact	Assessment of Impact	
The proposed Scheme has the potential to impact on the hydromorphology quality elements of Cardigan Bay central during operation only. Operation impacts are associated with the installation of the North Pier rock breakwater which has the potential to impact on morphological conditions resulting in an increase of sediment deposition and/or scour. Numerical sediment modelling was undertaken to assess the effect of these potential impacts (Atkins, 2020). Modelling results determined that a pattern of deposition and scour naturally occurs throughout the year. However, it was determined that this pattern would change with the installation of the breakwater. The most notable changes in sediment distribution included deposition towards the south-west of North beach, whilst other areas of North beach had an overall net loss of sediment. Furthermore, a deposit of sediment was reported in the navigable channel just inside the harbour area and at the toe of the breakwater. However, it was determined that the flow from the River Aeron would likely decrease this sediment deposition which the model could not account for due to model limitations. Overall, it was concluded that the presence of the breakwater would alter sea-bed levels local to the structure compared to the baseline conditions. However, it is to be noted these changes would be localised and would vary dependant on the fluvial inputs which have not been modelled.	The proposed Scheme will not significantly impact fish fauna or other biological elements of the water body. However, installation of the North Pier Breakwater may have localised impacts to the Sensitive Habitats of the water body during construction and operation. Construction impacts are associated with the installation of the Rock breakwater which may result in the loss of some mussel beds and polychaete reef (<i>Sabellaria</i> sp.), both higher sensitivity habitats. Subtidal surveys were undertaken in September 2019 to classify biotopes for the surrounding subtidal area of Aberaeron. In the area closest to where the breakwater will be constructed the survey identified the main biotopes as moderate energy littoral rock and <i>Fucus vesiculosus</i> (Bladder wrack seaweed) on mid eulittoral rock. <i>Sabellaria alveolata</i> (polychaete) reefs were classified towards the seaward end of the breakwater and to the Northern side of the breakwater. Based on the subtidal survey, there will be limited interaction with these higher sensitive habitats. Any loss of habitat will be localised and minimal in comparison to the abundance of polychaete reef and mussel bed in the surrounding intertidal area, which will be negligibly affected by the construction works. Additionally, there is potential for some new mussel communities to settle on the rock breakwater during operation with the added protection from wave exposure. However, at this time as the rock type is unknown, this cannot be concluded as suitable for mussel communities. Operation impacts are associated with the potential for localised impacts on surrounding sensitive habitats particularly mussel beds and polychaete reefs due to the changes in sediment distribution once the breakwater has been installed.	The proposed Scheme has the potential to impact on physico-chemical quality elements during construction and operation. Construction impacts are associated with the potential disturbance and re-mobilisation of contaminated sediments and contamination from potential pollution spills or materials interacting with the waterbody. Materials such as grout mortar which is being used during the harbour wall raising to reinforce the harbour walls, will contain additives to significantly reduce any mixing with the water table. All works undertaken as part of the harbour wall raising will be undertaken landward of the harbour to minimise any interaction with the coastal waterbody. Furthermore, the risk of pollution events and spillages from imported material and plant machinery will be mitigated through contractor licensed suppliers, good planning, best practice working measures, including the Pollution Prevention Guidelines (PPG) and management through the Construction Environmental Management Plan (CEMP). Re-mobilisation of contaminated sediments is particularly linked with the excavation of the new breakwater foundations which are taking place below MLW. Thorough ground investigation (GI) works were undertaken in the surrounding harbour areas and beaches. This included: - Quantum in 2008 (Quantum Geotechnical, 2008) in 2008 - the extent of which covered the boundaries of the inner and outer harbours including the North and South Piers. - WYG in 2019 (WYG, 2019) - the extent of which covered the northern edge of the harbour, South Pier and the entire length of the southern beach.	The following protected areas have been considered as part of this assessment: - Bathing waters - Special Areas of Conservation All other protected areas, as classified above, are located over 10km from the Scheme. Therefore, no significant impacts are expected during construction and/or operation. Construction impacts are associated with any detriment caused to both West Wales Marine/ Gorllewin Cymru Forol SAC and Cardigan Bay/ Bae Ceredigion SAC, particularly the designated features of these sites. A Stage 2 Habitats Regulations Assessment (HRA) was undertaken to fully assess the potential effects of the Scheme on these protected areas and with the implementation of identified mitigation and control measures, has concluded that there are no adverse effects on the integrity of either SAC. The nearest Bathing Water protected areas include one bathing water approximately 10km North of the Site and three designated bathing waters South of the Site near New Quay. The closest of the three-bathing waters is approximately 7km from the Site. The Scheme will not result in any new direct discharges during construction or operation that could affect bacterial loading; all temporary welfare units used in construction will be self-contained. Therefore, due to the distance of the bathing waters from the Site, it is concluded that there will be no impacts on these protected areas as a result of the Scheme.	- All possible works will be carried out from the landward side. - Most works will be carried out at low tide and during daylight hours. This will avoid any noise transmission within the water column, and avoid the need for artificial lighting that could disturb migratory fish. - The Scheme will utilise a circular waste system within the Site. - Site compounds, materials and equipment will be appropriately secured and fenced off, away from the Site if necessary. - The Scheme will make use of well-maintained equipment and plant to minimise potential for fuel/oil and chemical leaks. Plant and machinery will be switched off when not in use. - All equipment and materials used will be in a clean condition prior to their arrival on Site, and on removal from Site. - The proposed works will strictly follow the Pollution Prevention Guidelines (PPGs)/ Guidance on Pollution Prevention (GPPs)¹ and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites.

¹ Pollution Prevention Guidelines (PPGs) are out of date and a review process is currently underway to replace them with Guidance for Pollution Prevention (GPPs). These documents are available at <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>. GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only..

Hydromorphology	Biology	Physico-chemical	Protected Areas	Control Measures that will be employed throughout the works
Hydrological regime: Quantity and dynamics of water flow, tidal prism. Morphological conditions: water column depth variation; Structure and substrate of the sea bed. Mitigation Measures: Conflict with or contribution to Mitigation Measures for HMWBs	Sensitive Habitats: Extent and quality of habitats Fish fauna: Species composition and abundance; Presence of type-specific disturbance sensitive species; Age structure of fish communities. Other elements: Invertebrates and macroalgae	Parameters: Salinity, Nutrient concentrations, pH, Oxygen balance; Acid neutralising capacity, Temperature, Transparency. Pollution by all priority substances identified as being discharged into the water body. Pollution by other substances identified as being discharged in significant quantities into the water body.	Areas with water-dependent habitats that are protected under the Birds and Habitats Directives and the Ramsar Convention, Drinking Water Protected Areas, Shellfish Waters, Bathing Waters and Nutrient Sensitive Areas	
To mitigate any potential impacts from future changes to sediment distribution in the area, CCC have confirmed that monitoring will be in place once construction is complete to determine if any additional dredging is required. Finally, due to the localised nature of the impacts in relation to the overall waterbody size, the proposed Scheme will not result in the deterioration of the hydromorphological quality elements of this waterbody. Any potential impacts as discussed will be minimised through control measures employed throughout the works and any potential negative impacts will be identified and mitigated via future monitoring carried out by CCC.	Numerical sediment modelling was undertaken to assess the effect on <i>Sabellaria</i> reef and other protected habitats in this water body particularly due to the risk of potential smothering or scouring (Atkins, 2020). Modelling results determined that the presence of the breakwater would alter sea-bed levels local to the structure compared to the baseline conditions. This was most notable to the south west of North beach where an increase in sediment load was reported in the location of <i>Sabellaria</i> reef. These changes may directly impact on non-mobile species such as mussel beds and <i>Sabellaria</i> reef in the long term. However, due to the localised nature and scale of these impacts this is not expected to significantly deteriorate the overall sensitive habitats in this water body. The changes may also indirectly impact benthic invertebrates locally around the Site in the short term from the morphological changes. However, again these are expected to be localised and minimal in comparison to the abundance of these habitats within the surrounding area. Moreover, the increased wave protection from the breakwater may also positively increase species composition and abundance for species such as lobsters and crabs. The subtidal area near Aberaeron is known for local fisherman using crab and lobster pots. Significant consideration on the size of the footprint of the new breakwater has been undertaken to ensure a suitable level of flood protection whilst limiting the potential impacts on the biological quality elements of the waterbody. Any potential local impacts to biological quality elements will be minimised through control measures employed throughout the works. Therefore, due to the localised and small-scale nature of these impacts in relation to the sensitive habitats in this waterbody. The Scheme will not result in the any deterioration to the biological quality elements of this water body during construction or operation.	Quantum in 2021 (Quantum Geotechnical, 2021) - the extent of which included the core harbour area. Soil analysis for soil leachates were tested as part of these GI works and results determined that no visual or olfactory evidence of contamination was evident and when assessed against WQS the risk were considered acceptable. Therefore, it is extremely unlikely that any additional contaminants will be mobilised during construction that are not already within the normal background levels of the area. Sediment mobilisation has the potential to impact on the salinity and clarity of the water body due to changes in turbidity levels from sediment movement. However, numerical sediment modelling (Atkins, 2020) has demonstrated that changes to flow velocities and sediment transport will be minimal, and highly localised to the Site. Furthermore, as part of the GI works (WYG, 2019) and (Quantum Geotechnical, 2021) lab testing for Particle Size Distribution (PSDs) was undertaken. This was mainly to determine that the material excavated as part of the foundations for the breakwater, would be suitable for the South Beach nourishment. PSD Analysis confirmed that the majority of material in this area was within the Sand/Gravel/Cobble range. Therefore, it is likely this will further limit the turbidity when excavation is taking place due to the material type not mainly consisting of fine sediments. Effects on temperature or oxygen balance are highly unlikely as there will be no changes in water levels, flow velocities or nutrient concentrations as a result of the Scheme. Furthermore, no new discharges will be introduced to the water body as a result of the Scheme. Additionally, any disturbance during construction will be short term, temporary and restricted to the immediate area. During operation, the installation of the North Pier breakwater has the potential to impact the salinity and clarity of the water body due to changes in turbidity levels from sediment movement. However, as previously discussed these impacts are expected to be minimal due to the numerical sediment modelling (Atkins, 2020) and GI works that have taken place.		

Hydromorphology	Biology	Physico-chemical	Protected Areas	Control Measures that will be employed throughout the works
Hydrological regime: Quantity and dynamics of water flow, tidal prism. Morphological conditions: water column depth variation; Structure and substrate of the sea bed. Mitigation Measures: Conflict with or contribution to Mitigation Measures for HMWBS	Sensitive Habitats: Extent and quality of habitats Fish fauna: Species composition and abundance; Presence of type-specific disturbance sensitive species; Age structure of fish communities. Other elements: Invertebrates and macroalgae	Parameters: Salinity, Nutrient concentrations, pH, Oxygen balance; Acid neutralising capacity, Temperature, Transparency. Pollution by all priority substances identified as being discharged into the water body. Pollution by other substances identified as being discharged in significant quantities into the water body.	Areas with water-dependent habitats that are protected under the Birds and Habitats Directives and the Ramsar Convention, Drinking Water Protected Areas, Shellfish Waters, Bathing Waters and Nutrient Sensitive Areas	
		Finally, due to the dynamic environment of this water body the Scheme is unlikely to significantly impact the physico-chemical quality elements of this waterbody any impacts are considered to be negligible.		
The proposed Scheme will not result in any deterioration to hydromorphological supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to biological supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to physico-chemical supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed habitat creation will not result in any deterioration to protected areas. The proposal is deemed to be COMPLIANT with this WFD quality element	

Table 6-3 - Assessment of Impacts on Relevant Quality Elements of the River Aeron Water Body

Hydromorphology	Biology	Physico-chemical	Protected Areas	Control Measures that will be employed throughout the works
Hydrological regime: Quantity and dynamics of water flow, tidal prism. Morphological conditions: water column depth variation; Structure and substrate of the sea bed. Mitigation Measures: Conflict with or contribution to Mitigation Measures for HMWBs	Sensitive Habitats: Extent and quality of habitats Fish fauna: Species composition and abundance; Presence of type-specific disturbance sensitive species; Age structure of fish communities. Other elements: Invertebrates and macroalgae	Parameters: Salinity, Nutrient concentrations, pH, Oxygen balance; Acid neutralising capacity, Temperature, Transparency. Pollution by all priority substances identified as being discharged into the water body. Pollution by other substances identified as being discharged in significant quantities into the water body.	Areas with water-dependent habitats that are protected under the Birds and Habitats Directives and the Ramsar Convention, Drinking Water Protected Areas, Shellfish Waters, Bathing Waters and Nutrient Sensitive Areas	
Assessment of Impact	Assessment of Impact	Assessment of Impact	Assessment of Impact	
The proposed Scheme is not expected to significantly impact the morphological conditions of the water body, during construction or operation. However, during operation the Scheme has the potential to impact on the upstream fluvial hydrology, from the enhanced flood defences along the River Aeron. The raising of the harbour walls and installation of a new flood gate at Pwll Cam, has been considered to potentially lead to increased flooding further upstream of the River Aeron during stormy conditions due to the restriction of the flow caused by the addition of and the raised flood defences. Hydraulic modelling was undertaken to ensure the proposed flood defences would not cause detriment during extreme fluvial and wave overtopping events. Modelling results determined that from baseline (scenario) conditions there is no negative impact on flood levels as a result of the raised defences during a 1 in 1000/0.1% annual chance flood event in the Aeron. Therefore, no impacts are expected to the hydrological regime as a result of the Scheme.	The proposed Scheme will not significantly impact fish fauna or other biological elements of the water body during construction or operation.	The proposed Scheme will not significantly impact on physico-chemical quality elements during construction and operation.	Refer to Table 6-2. There are no additional protected areas located in the River Aeron waterbody. Please refer to the assessment of impacts on protected areas for Cardigan Bay Central, as these protected areas are located within 2km of the River Aeron waterbody.	• All possible works will be carried out from the landward side. • Most works will be carried out at low tide and during daylight hours. This will avoid any noise transmission within the water column, and avoid the need for artificial lighting that could disturb migratory fish. • The Scheme will utilise a circular waste system within the Site. • Site compounds, materials and equipment will be appropriately secured and fenced off, away from the Site if necessary. • The Scheme will make use of well-maintained equipment and plant to minimise potential for fuel/oil and chemical leaks. Plant and machinery will be switched off when not in use. • All equipment and materials used will be in a clean condition prior to their arrival on Site, and on removal from Site. • The proposed works will strictly follow the Pollution Prevention Guidelines (PPGs)/ Guidance on Pollution Prevention (GPPs)² and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites.
The proposed Scheme will not result in any deterioration to hydromorphological supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to biological supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to physico-chemical supporting elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to protected areas. The proposal is deemed to be COMPLIANT with this WFD quality element	

² Pollution Prevention Guidelines (PPGs) are out of date and a review process is currently underway to replace them with Guidance for Pollution Prevention (GPPs). These documents are available at <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>. GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only.

Table 6-4 - Assessment of Impacts on Quality Elements for the Teifi and Coastal Ceredigion Groundwater Body

Quantitative	Chemical	Protected Areas	Control Measures that will be employed throughout the works
- Quantitative dependant surface waters - Quantitative groundwater dependent ecosystems - Quantitative saline intrusion - Water balance	- Chemical dependant surface waters - Drinking water protected areas - Chemical groundwater dependant ecosystems - Chemical saline intrusion	Areas with water-dependent habitats that are protected under the Birds and Habitats Directives, and (by Government policy) under the Ramsar Convention, Drinking Water Protected Areas, Shellfish Waters, Bathing Waters and Nutrient Sensitive Areas	
Assessment of Impact	Assessment of Impact	Assessment of Impact	
The proposed Scheme is not expected to significantly impact on quantitative quality elements of the Teifi and Coastal Ceredigion groundwater body. All ground-breaking works such as piling and material excavation are taking place in the intertidal area or on the river bed which may connect to the underlying groundwater. However, no major changes (for example, saline intrusion) are expected due to the small scale of the site and the existing connectivity of the groundwater with Cardigan Bay Central coastal water body, which has a tidal limit up to approximately the A487 road bridge and therefore includes any works taking place along the River Aeron. Construction impacts are associated with additional pathways which may connect to the underlying groundwater. Furthermore, any works taking place in the intertidal area are not expected to significantly change the quantitative elements such as saline intrusion, which is expected in an area with porous geology (See Section 5.1.4). Finally, any works being undertaken landward including the harbour wall raising, are classified as superficial which again limits the potential for groundwater quality elements to be impacted. It is not anticipated that localised changes to groundwater (returning to natural estuarine conditions) will have the capacity to alter the quantitative elements of the groundwater body as a whole. Any local changes to hydro geological regime are expected to regulate quickly (as groundwater levels in the area are dynamic and fluctuate with the tide regardless) with no residual adverse effects anticipated. No impacts to quantitative quality impacts are expected during the operation of the Scheme.	The Teifi and Coastal Ceredigion groundwater is currently at ‘Poor’ status, due to the ‘poor’ status in the general chemical test. This indicates groundwater in the area is adversely affected by high levels of contaminants in the soil, mostly likely caused by historic mining activity and rural and agricultural land management in the wider area. Construction impacts would be associated with changes to the chemistry linked to potential disturbance of contaminated sediments, contamination from potential pollution spills or materials interacting with the waterbody and/or risks of increased saline intrusion to the groundwater body during material excavation. Materials such as grouting which are being used during the harbour wall raising to reinforce the harbour walls, will contain additives to significantly reduce any mixing with the water table. All works undertaken as part of the harbour wall raising will be undertaken landward of the harbour to minimise any interaction with the ground waterbody. Additionally, the risk of pollution events and spillages from imported material and plant machinery will be mitigated through contracting licensed suppliers, good planning, best practice working measures, including the Pollution Prevention Guidelines (PPG) and management through the Construction Environmental Management Plan (CEMP). Furthermore, as previously discussed, leachate tests of geo-environmental samples taken during ground investigation works in 2008, 2019 and 2021 (See Section 5.1.4) showed no visual or olfactory evidence of contamination. Although undetected contaminated sediments have the potential to enter underlying groundwater. These are not considered likely to significantly alter the existing chemical status of the Teifi and Coastal Ceredigion groundwater body, as contamination levels on the Site would be in line with background levels for the area. No impacts to chemical quality impacts are expected during the operation of the Scheme.	Refer to Table 6-2. There are no additional risks to Protected Areas directly related to this water body.	- The Scheme will utilise a circular waste system within the Site. - Site compounds, materials and equipment will be appropriately secured and fenced off, away from the Site if necessary. - The Scheme will make use of well-maintained equipment and plant to minimise potential for fuel/oil and chemical leaks. Plant and machinery will be switched off when not in use. - All equipment and materials used will be in a clean condition prior to their arrival on site, and on removal from site. - The proposed works will strictly follow the Pollution Prevention Guidelines (PPGs)/ Guidance on Pollution Prevention (GPPs)³ and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites.
The proposed Scheme will not result in any deterioration to quantitative elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to chemical quality elements. The proposal is deemed to be COMPLIANT with this WFD quality element	The proposed Scheme will not result in any deterioration to Protected Areas. The proposal is deemed to be COMPLIANT with this WFD quality element.	

³ Pollution Prevention Guidelines (PPGs) are out of date and a review process is currently underway to replace them with Guidance for Pollution Prevention (GPPs). These documents are available at <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>. GPPs provide environmental good practice guidance for the whole UK, and environmental regulatory guidance directly to Northern Ireland, Scotland and Wales only.

7. Conclusion

This document presents a WFD assessment of the proposed coastal defence scheme at Aberaeron against the biological, physico-chemical and hydromorphological quality elements of Cardigan Bay Central and the River Aeron, and the quantitative and chemical quality elements of the Teifi and Coastal Ceredigion ground water bodies.

The Scheme is contributing to Natural Resources Wales' Flood and Coastal Erosion Risk Management capital investment programme. Coastal defence modification is essential to society for flood management.

The Scheme will not result in deterioration to any quality elements of the Cardigan Bay Central water body and is deemed to be COMPLIANT with these WFD quality elements. The main considerations for this water body were the potential hydromorphological and water quality impacts from the installation of the North Pier Breakwater. However, ground investigations determined that any changes to morphological conditions would not be significant from baseline conditions. Whilst potential water quality impacts would be short term and localised to the area.

The Scheme will not result in deterioration to any quality elements of the River Aeron water body and is deemed to be COMPLIANT with these WFD quality elements. The main considerations for this water body were the potential changes to the hydrological regime due to the raising of flood defences around the River Aeron. However, it was determined that the Scheme would not significantly impact the fluvial hydrology.

The Scheme will not result in deterioration to any quality elements of the Teifi and Coastal Ceredigion water body and is deemed to be COMPLIANT with these WFD quality elements. The main considerations for this water body were the potential impacts to the quantitative and chemical elements of the water body. However, it was determined that due to the scale of the Scheme and the geology of the sea and river-bed that these impacts would be minimal, short term and temporary in nature.

Most of the works near designated water bodies will be undertaken during the day at low tide to mitigate noise and light pollution. The risk of pollution events and spillages from imported material and plant machinery, as well as suitable access and egress routes will be mitigated through contracting licensed suppliers, good planning, best practice working measures, including the Pollution Prevention Guidelines (PPG)/ Guidance for Pollution Prevention (GPPs) and management through the Construction Environmental Management Plan (CEMP).

Liaison with NRW will continue throughout the application process to ensure that all practicable mitigation measures are implemented during the works. Based on the information available and considering the control measures which will be employed throughout the works, the Scheme will not result in any deterioration to the supporting elements of any of the water bodies.

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Appendix A. Scoping of Scheme Activities

SCHEME INFORMATION

Your activity	Description, notes or more information
Name of activity	Aberaeron Coastal Defence Scheme
Brief description of activity	Enhanced coast defence to provide increased protection to the town of Aberaeron from coastal flooding will comprise of 5 linked elements: -Construction of a new breakwater extending from North Pier - Enhancements to South Beach by groyne replacement and shingle replenishment - Refurbishment to South Pier - Harbour wall raising - Installation of flood gate at Pwll Cam
Location of activity (central point XY coordinates or national grid reference)	Central National Grid Reference SN 45455 62789
Footprint of activity (ha)	4.37 ha approximately
Timings of activity (including start and finish dates)	Winter 2021 – Winter 2022 (estimated)
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	The activity covers the footprint area of the following elements of the Scheme (approximately 4.37 ha). Individual footprint areas for the linked elements mentioned below: - North Pier breakwater: 1.08 ha - South Beach and South Pier enhancement: 3.27 ha - Flood gate installation: 0.02 ha

	This is an overestimate to include the whole area of where the works are likely to take place in these areas e.g. activities taking place on South beach will not cover the entire beach area, but the whole area has been included in the estimate. The harbour wall raising has not been included as these activities are taking place landward and will not impact upon any waterbodies. There will be no outputs or regular discharges in either construction or operation.
Use or release of chemicals (state which ones)	No chemicals will be used in construction or released from the site in operation.

SCOPING: CARDIGAN BAY CENTRAL

Water body	Description, notes or more information
WFD water body name	Cardigan Bay Central
Water body ID	GB651009030000
River basin district name	Western Wales
Water body type (estuarine or coastal)	Coastal
Water body total area (ha)	10400
Overall water body status (2016)	Good
Ecological status	Good
Chemical status	Good
Target water body status and deadline	Good by 2021
Hydromorphology status of water body	Not Yet Assessed
Heavily modified water body and for what use	N/A
Higher sensitivity habitats present	Yes
Lower sensitivity habitats present	Yes
Phytoplankton status	High
History of harmful algae	Not assessed
WFD protected areas within 2km	Yes

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

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	Requires impact assessment	Impact assessment not required	No – This is not a High status water body.
Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	Yes - Operation only - Risk present during the installation of the rock breakwater which has the potential to change the local hydromorphology. All other activities of the Scheme are enhancing elements of the coast defence for Aberaeron that already exist and therefore are not significantly impacting the current hydromorphology of Cardigan Bay Central.
Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No - This is not a HMWB.

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats	Lower sensitivity habitats
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	
subtidal kelp beds	
subtidal seagrass	

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	No to all – impact assessment not required	No – Footprint of activity is approximately 0.04km ²
1% or more of the water body's area			No – Footprint of activity is 0.04% of the water body's area.
Within 500m of any higher sensitivity habitat			Yes – Potential risks associated during both construction and operation stages. Mussel beds and polychaete reefs are located immediately adjacent to the North pier and along North beach. They are at risk from the excavation of the rock breakwater. During operation there could be risks (e.g. smothering) associated with potential changes

			in sediment distribution along North Beach due to the installation of the rock breakwater. All other activity impacts on sensitive habitats such as vibration and noise will be short term and temporary in nature. All works will be undertaken during the day at low tide to reduce potential noise and light pollution impacts on higher sensitive habitats.
1% or more of any lower sensitivity habitat			No – Rocky shore is present in the mouth of the harbour and rocky reef extending out from the mouth of the harbour (See Figure 5-1). The footprint of any activities likely to impact on lower sensitivity habitat is much less than 1% . All other activity impacts on sensitive habitats such as vibration and noise will be short term and temporary in nature. All works will be undertaken during the day at low tide to reduce potential noise and light pollution impacts.

Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if 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	Continue with questions	Go to next section	No – Cardigan Bay Central is not 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)	Requires impact assessment	Impact assessment not required	No - During construction the majority of the works will take place during low tide to reduce any potential, noise, vibration and/or light impacts, as well as for logistical reasons. No chemical changes are expected as good practice methods are followed such as the Pollution Prevention Guidelines (PPGs)/ Guidance on Pollution Prevention (GPPs) and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites. Once a contractor has been appointed consideration should be given to forming the breakwater outside of key migration periods to further limit any potential impacts on normal fish behaviour. River Lamprey: Oct-Dec Sea Lamprey: Dec - June

			During operation, the Scheme is not expected to impact on normal fish behaviour migrating through to the River Aeron.
Could cause entrainment or impingement of fish	Requires impact assessment	Impact assessment not required	Not considered to be a risk.

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if 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)	Requires impact assessment	Impact assessment not required	Yes - Construction activities particularly those that require material excavation particularly in the water column has the potential to re-mobilise contaminated sediments. Operation - Changes in morphological conditions due to the installation of the North pier breakwater may impact on sediment distribution which in turn may affect salinity, temperature and oxygen levels.
Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	No - Phytoplankton assessed as High
Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	Not assessed for this water body

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

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	Requires impact assessment	Impact assessment not required	Intrusive ground investigations were undertaken by (WYG, 2019) and (Quantum Geotechnical, 2021). See Section 6.1. Both investigations determined that no visual or olfactory evidence of contamination was evident within the site

			investigation locations and when assessed against WQS the risk were considered acceptable.
It disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment	Impact assessment not required	Intrusive ground investigations were undertaken by (WYG, 2019) and (Quantum Geotechnical, 2021). See Section 6.1. Both investigations determined that no visual or olfactory evidence of contamination was evident within the site investigation locations and when assessed against WQS the risk were considered acceptable.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment ⁵	Impact assessment not required	No chemicals are to be released during construction or operation.

Record the findings for water quality go on to section 4: WFD protected areas.

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

• special areas of conservation (SAC)	• bathing waters
• special protection areas (SPA)	• nutrient sensitive areas
• shellfish waters	

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area	Requires impact assessment	Impact assessment not required	Yes - the Scheme is partially located in the Cardigan Bay SAC and West Wales Marine SAC. Drinking Water Protected Area (DWPA), Shellfish Waters and Bathing Waters are all present but >2km from the proposed activity. Risk of impacts is considered negligible.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	Requires impact assessment	Impact assessment not required	No – INNS have not been recorded on the site to date. However, <i>Sargassum muticum</i> (Brown seaweed) has been recorded in the Cardigan Bay SAC. According to NBN datasets (NBN Atlas Wales, 2021), there are records of this species including south of South Beach. It is noted that these seem outside of the construction limits of the Scheme. However, construction activities will be managed through on-site 'toolbox' talks and bio-security measures to avoid the introduction of INNS from plant and machinery used in other locations or coming from overseas. No impacts are expected as part of the Schemes operation.

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Operation stage only – Installation of the rock breakwater which has the potential to change the local hydromorphology.
Biology: habitats	Yes	Construction stage - Loss of sensitive habitat such as mussel beds and polychaete reef. Operational stage – Changes to morphological conditions has the potential to cause impact on sensitive habitats.
Biology: fish	No	Fish have been scoped out from further assessment
Water quality	Yes	Construction stage - Potential disturbance and re-mobilisation of contaminated sediments during construction activities. Operation stage - Changes in morphological conditions due to the installation of the North Pier breakwater may impact on sediment distribution which in turn may affect salinity, temperature and oxygen levels.
Protected areas	Yes	Construction and Operation stages –Both Cardigan Bay SAC and West Wales Marine SAC are within 2km of the Scheme. All other protected areas have been scoped out.
Invasive non-native species	No	Invasive non-native species have been scoped out from further assessment

SCOPING: RIVER AERON WATER BODY

Water body ¹	Description, notes or more information
WFD water body name	River Aeron
Water body ID	GB110063041450
River basin district name	Western Wales
Water body type (estuarine or coastal)	Surface water
Water body total area (ha)	12.15km ²
Overall water body status (2016)	Moderate
Ecological status	Moderate
Chemical status	Good
Target water body status and deadline	Good by 2021
Hydromorphology status of water body	Supports Good
Heavily modified water body and for what use	No
Higher sensitivity habitats present	No
Lower sensitivity habitats present	Yes
Phytoplankton status	N/A
History of harmful algae	Not stated
WFD protected areas within 2km	Yes

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

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	Requires impact assessment	Impact assessment not required	No – This is not a high status water body
Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	Operation stage only – Installation of the increased harbour wall height and Pwll Cam flood gate has the potential to change the fluvial hydrology and increase flood risk upstream during stormy conditions.
Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No – This is not a HMWB water body

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats	Lower sensitivity habitats
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	
subtidal kelp beds	
subtidal seagrass	

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	No to all – impact assessment not required	No – The overall footprint of the Scheme activities are 0.04km ² . No higher or lower sensitivity habitats are located in the River Aeron.
1% or more of the water body's area			No – None of the works are located in the River Aeron.
Within 500m of any higher sensitivity habitat			Yes – Higher sensitive habitats are located just under approximately 500m away within the Cardigan Bay Central coastal waterbody.

1% or more of any lower sensitivity habitat			No – Scoped out from further assessment.
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Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if 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	Continue with questions	Go to next section	No – This waterbody is not 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)	Requires impact assessment	Impact assessment not required	No – None of the works are expected to impact on normal fish behaviour. Construction and operational risks are scoped out. During construction the majority of the works will take place during low tide to reduce any potential, noise, vibration and/or light impacts, as well as for logistical reasons. No chemical changes are expected as good practice methods are followed such as the Pollution Prevention Guidelines (PPGs)/ Guidance on Pollution Prevention (GPPs) and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites.

			Once a contractor has been appointed consideration should be given to forming the breakwater outside of key migration periods to further limit any potential impacts on normal fish behaviour. River Lamprey: Oct-Dec Sea Lamprey: Dec - June During operation, the Scheme is not expected to impact on normal fish behaviour migrating through the River Aeron.
Could cause entrainment or impingement of fish	Requires impact assessment	Impact assessment not required	Not considered to be a risk.

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if 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)	Requires impact assessment	Impact assessment not required	No – None of the works are expected to affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)
Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	Not assessed for this water body.
Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	Not yet assessed for this water body

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

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	Requires impact assessment	Impact assessment not required	Intrusive ground investigations were undertaken by (WYG, 2019) and (Quantum Geotechnical, 2021). See Section 6.1. Both investigations determined that no visual or olfactory evidence of contamination was evident within the site investigation locations and when assessed against WQS the risk were considered acceptable. Furthermore, no

			activities are being undertaken that will use or release chemicals into the River Aeron.
It disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment	Impact assessment not required	Intrusive ground investigations were undertaken by (WYG, 2019) and (Quantum Geotechnical, 2021). See Section 6.1. Both investigations determined that no visual or olfactory evidence of contamination was evident within the site investigation locations and when assessed against WQS the risk were considered acceptable.. Furthermore, no activities are being undertaken that will use or release chemicals into the River Aeron.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment ⁵	Impact assessment not required	No chemicals are to be released during construction or operation.

Record the findings for water quality go on to section 4: WFD protected areas.

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

• special areas of conservation (SAC)	• bathing waters
• special protection areas (SPA)	• nutrient sensitive areas
• shellfish waters	

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area	Requires impact assessment	Impact assessment not required	Cardigan Bay SAC and West Wales Marine SAC are located approximately 500m from the water body. Some elements of the activity are fully located in the SAC protected areas Drinking water Protected Area, Shellfish Waters and Bathing Waters are all present but >2km from the proposed activity. Risk of impacts is considered negligible.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	Requires impact assessment	Impact assessment not required	No – INNS have not been recorded on the site to date. Construction activities will be managed to avoid the introduction of INNS from plant and machinery used in other locations.

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Operation stage only – Installation of the increased harbour wall height and Pwll Cam flood gate has the potential to change the fluvial hydrology and increase flood risk upstream during stormy conditions.
Biology: habitats	Yes	Construction stage - Loss of higher sensitive habitats such as mussel beds and polychaete reef (<i>Sabellaria alveolata</i>). Operational stage – Changes to morphological conditions has the potential to impact on sensitive habitats.
Biology: fish	No	Fish have been scoped out from further assessment.
Water quality	No	Water quality has been scoped out from further assessment.
Protected areas	Yes	Construction and Operation stages –Both Cardigan Bay SAC and West Wales Marine SAC are within 2km of the Scheme. All other protected areas have been scoped out.
Invasive non-native species	No	INNS have been scoped out from further assessment.

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