

Aberaeron Coastal Defence Scheme

Environmental Statement

Ceredigion County Council

June 2021

Notice

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Document history

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Client signoff

Client Ceredigion County Council
 Scheme Aberaeron Coastal Defence Scheme
 Job number 5182114

Client signature
 / date

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EIA Quality Mark

This Environmental Statement and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development have been undertaken in line with our commitments as members of the EIA Quality Mark.

The EIA Quality Mark is a voluntary scheme operated by the Institute of Environmental Management and Assessment (IEMA) through our EIA activities are independently reviewed, on an annual basis, to ensure we continue to deliver excellence in the following areas:

- EIA Management*
- EIA Team Capabilities*
- EIA Regulatory Compliance*
- EIA Context & Influence*
- EIA Content*
- EIA Presentation*
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1 Introduction

1.1 Background to this Document

1.1.1 Purpose of this Document

The Aberaeron Coastal Defence Scheme (herein referred to as 'the Scheme') is being developed by Ceredigion County Council (CCC), to provide increased protection to the town of Aberaeron from coastal flooding. The Scheme comprises five elements, which are interlinked as integral parts to the overall flood defence scheme. The scheme elements are:

- 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 the walls.
- Flood wall construction at the following locations:
 - Removal of the existing set back flood wall along Quay Parade/Pen Cei and reconstruction of a new masonry and glass wall, as well as grouting repairs of the existing quayside wall;
 - Raising of the existing River Aeron flood wall between the rear of the Monachty Hotel and the A487 referred to as the River Aeron wall; and
 - Construction of a new masonry and glass wall flood wall between Pwll Cam and the Monachty Hotel (and connecting with the existing adjacent River Aeron 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 and extension of the existing rock revetment; and
 - Beach renourishment.

The Scheme has a 1 in 200 year design return period for wave overtopping within the harbour, with the rock revetment on South Beach having a 1 in 200 year standard of protection. The Scheme also provides a 1 in 1,000 year standard of protection against extreme sea levels for the design life (100 years) of the Scheme. The design of the Scheme has been carried out in line with the requirements of the Welsh Government for the development of residential areas in relation to flood risk (TAN15, Welsh Government 2014), as well as in line with guidance for flood and coastal erosion risk management and adaptation to climate change (Welsh Government, 2017).

An illustrative plan of the Scheme is provided in Figure 5182114-ATK-MAR-GEN-DR-C-1000 in Appendix A. Detailed drawings for all scheme elements are also contained in Appendix A.

The developer of the Scheme is Ceredigion County Council and the contact is:

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This Environmental Statement (ES) has been prepared to document the Environmental Impact Assessment (EIA) of the Scheme. This ES will support the planning application, submitted to Ceredigion County Council (CCC) and the Marine Licence application, which will be submitted to Natural Resources Wales/Cyfoeth Naturiol Cymru (NRW), both in May 2021. A Summary of Environmental Impacts table describes how the environmental impacts set out in this ES will be avoided, managed and mitigated where possible. The actions will be provided to the contractor in the form of a CEMP. A Non-Technical Summary of the ES is also included as part of the planning and Marine Licence applications.

1.1.2 Consenting Regime

The Scheme will require permissions and licences under a number of different consenting regimes. These are discussed as follows.

Marine Licence

Under the Marine and Coastal Access Act (MCAA) 2009, a marine licence is required for licensed activities (defined in Section 66 of the MCAA) including those involving deposit or removal of a substance or object in the 'UK marine area', as defined in Section 42 of the MCAA. This is the area below Mean High Water Springs (MHWS) and up to the extent of the tidal influence in rivers. This is not restricted to construction activity but relates to any deposit or removal activity and includes construction, dredging, taking samples (e.g. ground investigations, trial pits, bore holes) and disposal of dredged material to sea.

A marine license is required for the proposed elements of the works that fall below MHWS. This will comprise all elements of the scheme. The relevant regulator for marine licences in Wales is NRW. A marine licence application will be made to the Marine Licensing Team (MLT) of NRW.

Planning Permission

The Scheme falls within the jurisdiction of CCC as the Local Planning Authority, of which the jurisdictional boundary extends down to Mean Low Water (MLW). The Scheme includes work that constitutes development under the Town and Country Planning Act 1990 (as amended) and planning permission is therefore required. A planning application for the Scheme, covering work down to MLW, will be made to CCC's Planning Department.

Listed Building Consent

Listed building consent is required under the Planning (Listed Buildings and Conservation Areas) Act 1990 for any work involving the alteration, extension or demolition of a listed building. The consent is determined by Cadw. Listed Building Consent will be required for the works to South Pier, North Pier and Quay Parade.

Harbour Works Licence

The Aberayron Harbour Order 1956 together with the Aberaeron Harbour Act 1807 gives powers to 'The Council' to undertake works, with Section 14 giving 'powers to maintain and improve works' for 'harbour protection'. 'The Council' of today is CCC and they operate as the harbour authority. CCC have determined that the harbour works may be undertaken under these powers without a need for a licence.

Crown Estate Consent

Much of the foreshore and the seabed in the UK is in the ownership of the Crown Estate. CCC has an existing lease from the Crown Estate for all the coastal areas in the county. CCC is consulting with the Crown Estate to determine whether any further permissions are required from them for the Scheme.

Flood Risk Activity Permit

A Flood Risk Activity Permit (FRAP) is required to carry out works in, over, under or near a main river or a flood defence (including a sea defence), or within a flood plain. NRW is the consenting authority for a FRAP. The permit is required to ensure development activities do not cause a risk of flooding or make existing flood risk worse, and to ensure any works will not interfere with present flood risk management assets or adversely affect the local environment. There are exemptions and exclusions for the need for a FRAP. Excluded flood risk activities include licensable marine activities, as many of the requirements of the FRAP would be covered under a marine licence. NRW has confirmed that during the consultation period for marine licence, they will liaise with the Marine Licencing team to determine which aspects of this Scheme would be covered by the Marine Licence and which may require a FRAP.

SSSI Assent

Sites of Special Scientific Interest (SSSIs) are designated under the Wildlife and Countryside Act (WCA) 1981. Under Section 28(H) of the WCA, statutory bodies (Section 28G authorities) need to obtain the assent of NRW to carry out an operation which may damage a SSSI (whether or not within the SSSI). The coastline of Aberaeron is located in the Aberarth-Carreg Wylan SSSI (see Section 9), and because of the construction works being undertaken, NRW will be notified through both the marine licensing and planning application process of the need for assent as part of the application process.

Landowner Consent

Landowner consent will be needed for some of the works that are proposed to take place on private land. This includes consent for the following:

- Rock revetment to the rear of the Monachty Hotel: the revetment is managed by NRW.
- Wall raising adjacent to The Hive restaurant: permission will be needed from the Hive to erect a glass wall atop of the perimeter wall adjacent to the new Pwll Cam flood gate. A party wall agreement between The Hive and CCC for the abutment will also be needed.
- Wall construction between the Monachty Hotel and the A487: part of the wall will be constructed in place of the existing CCC flood defence asset which is on the boundary of land owned by the Monachty Hotel. CCC will therefore agree changes to the flood defence with the property owner. This also applies to the Toad Hall and Conglfean property.

All other assets affected by the works are owned and managed by CCC.

1.2 Background to EIA

In Wales, the requirement to undertake EIA for certain types of developments/activities is set out in a number of pieces of legislation and depends on the consenting process being followed. The relevant EIA Regulations in relation to the proposed Scheme are:

- The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (SL (5)100) as amended; and
- Marine Works (Environmental Impact Assessment) and Marine Strategy (Amendment) Regulations SI 2018/287.

Under the requirements of the Town and Country Planning EIA Regulations (as amended) in Wales, certain types of development require an EIA to be undertaken. Schedule 2, 10(m) of the EIA Regulations states that an EIA is required for the '*Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works*'. The proposed works at Aberaeron comprise coastal work that comprises sea defence work through construction.

Under the requirements of the Marine Works and Marine Strategy EIA Regulations (as amended) in Wales, Part 2(8-1) of the Regulations indicates that if the Scheme falls under Annex II of the EIA Directive (2014/52/EU)¹ and is likely to have a significant impact on the environment, then an EIA is required. The Scheme falls under the Annex II description of coastal work and due to its size, nature and location adjacent to conservation sites, requires EIA.

The purpose of the Environmental Impact Assessment (EIA) process is to identify and assess the significant environmental impacts that may arise through implementation of the Scheme, and to identify suitable mitigation measures to avoid or reduce the impact of any significant adverse effects. The EIA process also seeks to identify opportunities arising from the Scheme, that otherwise might not occur, for the benefit of local people and the environment. The EIA process therefore influences the Scheme proposals to ensure that they work for the developer, community and environment, and contribute to meeting the objective of sustainable development. Control measures, intended to avoid or mitigate potential significant impacts, are documented in the Environmental Statement, transferred to the CEMP and will be included in the Contractor's Works Specification.

1.2.1 Habitats Regulations Assessment (HRA)

Aberaeron is located in the north-east corner of the Cardigan Bay / Bae Ceredigion SAC and the West Wales Marine SAC. There are no Ramsar sites or SPAs within 10km of Aberaeron Harbour.

There are several statutory designated sites located outside of the 10km radius of the proposed Scheme, which have migratory or transient qualifying species with the potential to occur within the area of the Scheme. These sites include:

- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC;
- Northern Cardigan Bay / Gogledd Bae Ceredigion SPA; and the
- Cors Fochno and Dyfi Estuary Ramsar and SPA site.

Within the UK there exists a network of conservation sites for rare and threatened species of birds and habitats. The network is comprised of Special Areas of Conservation (SAC) and Special Protection Areas (SPA). These sites are protected by the Conservation of Habitats and Species Regulations 2017 as amended (known as the Habitats Regulations). Following the UK's exit from the European Union (EU), the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 made changes to the 2017 Habitats Regulations so that the European sites no longer form part of the EU's ecological network but now form part of a UK national site network. They continue, however, to be referred to as 'European Sites'. The list of habitat types and species for which existing sites were designated, however, remain listed in Annexes I and II for the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC).

In addition to the UK network of SACs and SPAs, many of the SPA sites are also designated as Ramsar sites. The Ramsar Convention on Wetlands of International Importance is an international mechanism which aims to protect internationally important wetlands, of particular importance to migratory bird species. In the UK, Ramsar sites are extended the same protection as SACs and SPAs and are therefore also considered in the HRA assessment.

Under Regulation 48 of the Habitats Regulations, the competent authority (in this case CCC and NRW) is required to carry out a Habitats Regulations Assessment (HRA) of any plan or Scheme which is (a) likely to have a significant effect on a European site (either alone or in combination with other plans or Schemes), and (b) not directly connected with or necessary to the management of the site. Under the Regulations, the applicant has an obligation to provide the competent authorities with such information as the authority may reasonably require for the purposes of the assessment.

In 2018, an initial HRA screening assessment was carried out during the early stages of the design, and alongside the EIA scoping assessment, to identify the potential for likely significant

¹ Although the UK is no longer part of the European Union, the Annex II Schemes listed in the EIA Directive remain as a reference in the Marine EIA Regulations.

effects of the Scheme on the European sites. The report concluded that there is potential for the Scheme to have a likely significant effect on species and habitat features within the Cardigan Bay / Bae Ceredigion SAC, the West Wales Marine / Gorllewin Cymru Forol cSAC and the Northern Cardigan Bay / Gogledd Bae Ceredigion SPA. In addition to this, NRW confirmed in their EIA scoping opinion (April 2019), that the ES should include information to inform the HRA. It should be noted, that at the time of the HRA screening assessment, the breakwater and flood gate at Pwll Cam did not form part of the Scheme design.

Following the findings of the HRA screening assessment and EIA scoping opinion, a 'shadow' HRA has been carried out as part of the EIA process for the Scheme. An 'Information for HRA' report is provided as a separate document for submission with the planning application and marine licence application, to provide the relevant information to the competent authorities in undertaking the HRA. A summary of the 'shadow' HRA can be found in section 9.

1.2.2 WFD Assessment

The Water Framework Directive (WFD) originates from the EU but has been retained in UK law following the UK's exit, via The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, as amended. For the purposes of this ES, the assessment of the Scheme in relation to the Water Environment Regulations is continued to be referred to as a WFD Assessment (some industry practitioners may start referring to it as a Water Environment Regulations Assessment).

The Water Environment Regulations applies to all coastal and estuarine waters in Wales, to a distance of 1 nautical mile (nm). Under the Regulations, any activity or Scheme with the potential to have an impact directly or indirectly on water body ecology will require a 'WFD Assessment'. A WFD Assessment will consider whether the activity or Scheme has the potential to cause deterioration in the ecological status or ecological potential of that water body or adjacent water bodies. The WFD Assessment also considers the biological, physiochemical and hydromorphological qualities of a water body.

NRW confirmed in their scoping opinion (April 2019) that a WFD assessment is required. The WFD Assessment has been produced as a separate document for submission with the marine licence application and planning application. The findings of the assessment are summarised in section 13.

1.2.3 Flood Consequence Assessment

A Flood Consequence Assessment (FCA) has been prepared for the planning application.

The objectives of the FCA assessment are to:

- Set out the planning policy context in terms of flood risk.
- Demonstrate the baseline flood risk and overland flow paths in the area of, and around, the proposed scheme.
- Specifically assess the with-scheme risk and compare this with the baseline flood extents.
- Define the flood consequences for the scheme.
- Identify the flood risk to the proposed scheme itself and the consequences of the proposed scheme on the existing flood risk in the locality.
- Inform any options to mitigate potential adverse impacts on flood risk.

1.2.4 Structure of the Environmental Impact Assessment

The structure of this ES is as follows:

- Non-Technical Summary – which presents the key findings of the ES in plain language. This is included at the start of this ES, and as a separate document.
- Section 1 – provides an **introduction** to the Scheme, which explains the purpose of this document, the legal consenting structure within which it sits, and the background to the Scheme, including the need for it to take place, and a description of its location.
- Section 2 – a **description of the Scheme development**, setting out the context of the Scheme and a description of how the design of the option has been developed. This chapter also includes a description of the consultation carried out for the Scheme and how this has influenced the design.
- Section 3 – a description of **the preferred option** with a more detailed description of the final Scheme for which consent is being applied, including its final design, and methods of construction.
- Section 4 – a summary of the planning policy context of the development.
- Section 5 – a summary of **stages of the EIA process**, including consultation responses following the submission of the EIA Scoping Report for the scoping opinion request (see Appendix B).
- Section 6 to Section 18 – the **assessment of the impacts** on each environmental receptor identified for inclusion in the ES from the scoping phase. This section describes the baseline conditions, likely significant effects of the Scheme, mitigation measures to avoid, reduce or compensate for each negative impact identified, and the significance of any residual impacts that cannot be fully mitigated. The topics covered are:
 - Recreation and tourism
 - Human health
 - Socio-economics
 - Ecology
 - Historic environment
 - Landscape and visual amenity
 - Coastal processes
 - Water Quality
 - Soils and ground conditions
 - Traffic and transport
 - Noise and vibration
 - Air quality
 - Climate change
- Chapter 19 – an assessment of **cumulative impacts** from the interaction of the Scheme with other consented or proposed schemes.

- Section 20 – **Conclusions** of the impacts, mitigation and residual impacts after mitigation measures and the combined and in-combination effects of the various receptors considered together and alongside the potential impacts of other known plans and Schemes in the area or over the same timescale.
- Section 21 – References.
- Section 22 – List of abbreviations.
- Appendices - supporting information and analysis undertaken as part of the EIA process.

1.2.5 Availability of the Environmental Statement

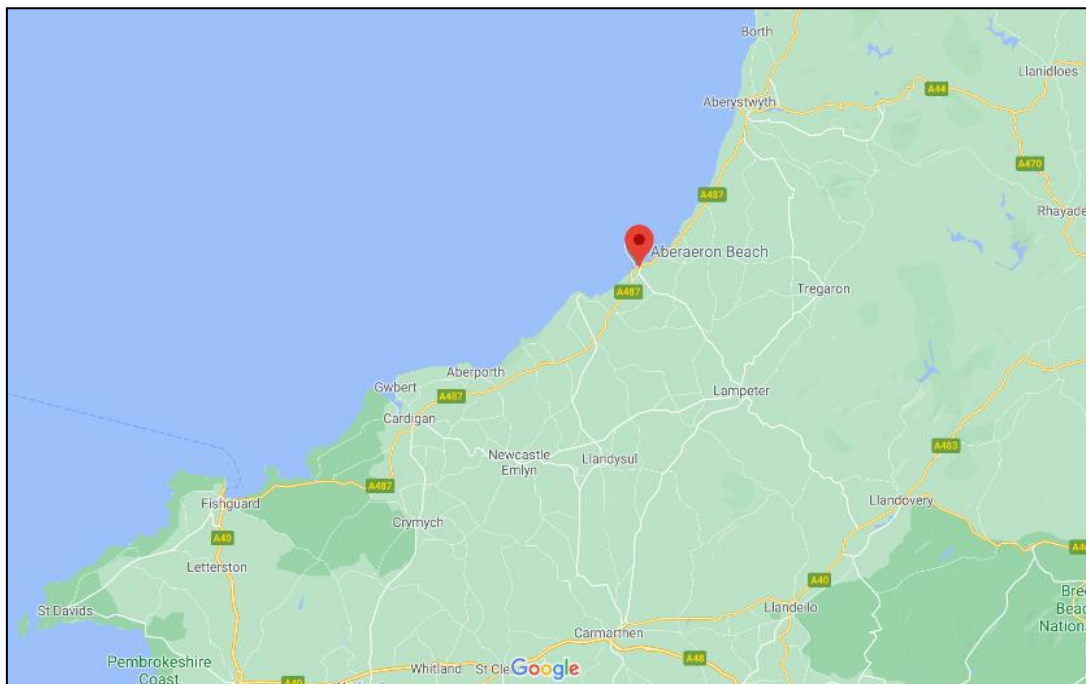
This ES, Appendices and all other supporting information will be available for inspection. Due to restrictions required by the ongoing global coronavirus pandemic, it is likely that only electronic versions will be available during the planning and marine licencing determination periods. The ES will be available on the following website: www.ceredigion.gov.uk. Should the current Covid-19 restrictions be lifted, the documents will also be available at Ceredigion County Council, Neuadd Cyngor Ceredigion Penmorfa, Aberaeron, Ceredigion, SA46 0PA.

1.3 Background to the Scheme

1.3.1 Site Location

Aberaeron is situated on the west coast of Wales in Cardigan Bay, approximately 30km south of Aberystwyth. The town is centred around the harbour, with the coastline split into the North and South Beaches either side of the harbour entrance. A North Pier and a South Pier mark the entrance to the harbour. The River Aeron runs through the town and discharges into Cardigan Bay through the harbour.

Figure 1-1 Site Location



Source: www.google.co.uk

1.3.2 Description of the Site

Aberaeron is a popular tourist destination, particularly in the summer months and school holidays, with the harbour and beachfront a focal point for visitors.

The harbour lies directly at the mouth of the River Aeron with many boats moored using a series of 'trot moorings' which leave the boats beached in the harbour during low tide. In the north-east corner of the harbour is a smaller dock (Pwll Cam) in which water is maintained by a concrete cill on the seabed across the entrance to the dock, where shallow draft boats are moored on running moorings to the harbour wall.

The harbour is accessible to the public on all sides, with the most popular areas being along the promenade around Pwll Cam and along Quay Parade/Pen Cei on the northern side of the harbour. The houses surrounding the harbour are characterised by colourful Georgian houses including the Harbourmaster Hotel, many of which are listed buildings of historic interest. The Hive café is at the easternmost end of Quay Parade, where it meets Cadwgan Place. Also located at Pwll Cam is the harbour car park. The south side of the harbour is bordered by a grassed area on top of the river wall, with the properties of Belle Vue Terrace to the rear. A footbridge over the River Aeron located at Pwll Cam connects both sides of the harbour. Both piers at the harbour mouth are accessible to the public, although the seaward end (head) of South Pier is currently fenced off as it is at risk of collapse and in need of repair.

The beachfront comprises South Beach and North Beach, separated by the harbour mouth. Both beaches comprise a mixed shingle and sand beach. The defences on South Beach comprise six timber groynes in varying states of repair, and a rock revetment along the upper beach. Residential properties are located behind the beach on Beach Parade as well as the Aberaeron Yacht Club and its car park. Further south along South Beach, the immediate hinterland is characterised by grassland. Along North Beach, a series of newer coast defences are in place, following the implementation of a coast defence scheme in 2009, comprising groynes, a rock revetment, sea wall and beach nourishment.

1.4 Need for the Scheme

Aberaeron has a long history of flooding from a combined risk of flooding and erosion. Low-lying areas of Aberaeron are at risk of flooding generated by extreme tidal waters and wave overtopping from the harbour, and areas to the rear of South Beach are at risk of flooding resulting from beach erosion. The layout of the harbour entrance is such that during a north-easterly storm event, waves travelling across the Irish Sea are able to easily propagate into the harbour. The existing piers at the mouth of the harbour offer little protection from these large waves. During a storm event coupled with heavy rain, water levels also rise in the River Aeron, raising water levels in the harbour even further as the river tries to discharge into the sea against strong incoming waves.

Figure 1-2 Flooding along Quay Parade



Engineering works were carried out at North Beach in 2009, which included the replacement of existing timber groynes, new rock groynes, a beach nourishment programme, reconstruction of the sea wall and construction of a rock revetment along the North Beach. These works have provided improved protection to the northern part of the town from overtopping inundation from the sea, reducing the level of flood risk to a 1 in 200 year event, or 0.5% Annual Exceedance Probability (AEP).

Despite the improvements to flood risk management in the northern part of the town, parts of Aberaeron have continued to experience flooding; particularly in the harbour area (around Quay Parade, Pwll Cam and in the area between the Monachty Hotel and the A487 road bridge) and at South Beach (along Beach Parade and at the Aberaeron Yacht Club). Most recently, flooding occurred in 2017 during Storm Brian and in 2018 during Storm Callum, which caused a record increase in fluvial water levels along the River Aeron and led to property flooding and the loss of eight boats in the harbour through capsizing. The flooding is caused by waves entering the harbour, and wave overtopping of the harbour walls and shingle ridge on South Beach.

The harbour is currently only afforded protection by the two piers at the mouth of the harbour as well as from a flood wall along Quay Parade, which is set back from the edge of the quayside wall. Further into the harbour near the A487 road bridge, flood walls are located on both banks of the River Aeron.

Modelling results have indicated that the existing flood wall along Quay Parade has a present day 1 in 5 (100% AEP) standard of protection against wave overtopping. The current level of protection provided by the wall is predicted to reduce over time with climate change, rising sea levels and increased intensity of storms. Furthermore, the flood wall is not continuous around the harbour.

Although the two piers offer some shelter to the harbour, they do not provide enough protection from present day storm events, with waves able to overtop the structures and penetrate directly into the harbour. The piers were built over 200 years ago and over this period there have been changes to the coastline (erosion). The design based on empirical guidance at the time would not have been able to forecast the future needs and in addition development of the town has grown up around the harbour, and increased the number of properties at risk.

The South Pier is in a significant state of disrepair and at risk of imminent collapse. The head of the pier is currently fenced off from public access to maintain health and safety. Its loss would lead to a further reduction in the standard of protection of the harbour.

The collapse of the head of South Pier would soon lead to the collapse of the main body of the pier. The South Pier artificially maintains a wide beach crest at the northern end of South Beach, providing a defence against erosion and reduces the occurrence of tidal flooding landward onto Beach Parade (Hyder, 2013b). Should South Pier collapse, the retained beach material would be distributed across the harbour entrance. Loss of the pier would dramatically increase the risk of flooding and erosion to residential properties along Beach Parade and access to the harbour entrance would be lost, due of the distribution of beach material across the entrance. Further, the northern end of the South Beach would continue to erode.

The groynes along South Beach are also in poor condition and are predicted to collapse in the near future (within one to three years). Further loss of the rock revetment is predicted between five to 15 years. The loss of coastal defences along South Beach would result in the loss of shingle beach, and consequently, more regular flooding is predicted to occur as water inundates via Beach Parade.

The predicted loss of the existing coastal defences as well as the limited flood defences within the harbour, highlights the need for the Scheme in order to protect the harbour, town and South Beach from flooding and storm damage. The coastal defences along Aberaeron, as photographed during a site visit in October 2018 by the design team are presented in Figure 1-3 to Figure 1-8.



Figure 1-3 Eroding Cliff on South Beach



Figure 1-4 Rock Revetment along South Beach



Figure 1-5 Dilapidated South Pier

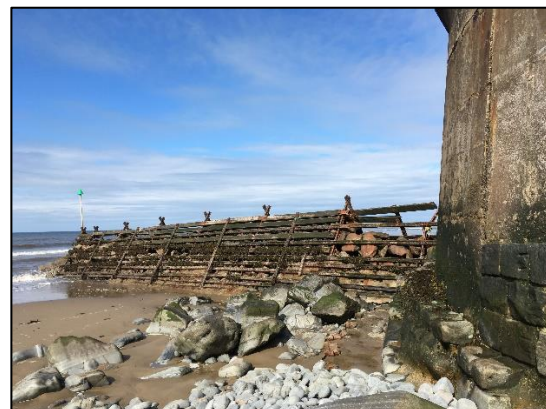


Figure 1-6 Dilapidated Crib Groyne at South Pier



Figure 1-7 Groynes along South Beach



Figure 1-8 Weathered Groyne along South Beach

The long-term flood risk at Aberaeron is presented within Figure 1-9. (excluding flood risk from wave overtopping). The majority of Aberaeron is located within Flood Zone 3, with a section of the north of Quay Parade closest to the North Pier located in Flood Zone 2. Flood Zone 3 is an area with a 1% (1 in 100 year) chance or greater of flooding from rivers in any given year, and/or where there is a 0.5% (1 in 200 year) chance or greater of flooding from the sea in any given year. Flood Zone 2 is an area where flooding has been recorded in the past, with a 0.1% (1 in 1000 year) chance of flooding from rivers or the sea in any given year. Atkins Flood Consequence Assessment, May 2021 provides additional detail.

Figure 1-9 Long-term Flood Risk at Aberaeron (NRW, 2018)



2 Scheme Development

2.1 Introduction

This section sets out the alternative options that were considered for the Scheme, from the strategic level progressing down to the development of the final option that is described and assessed in this ES. This includes variations to the design of the options that were considered during the option development, but not subsequently taken forward for the final Scheme. The full detail of the final Scheme option is presented in Chapter 3.

2.2 Strategic Context

The strategic context for the Scheme is outlined in this section. The identified need for the Scheme, and its subsequent development has been influenced and set by regional and national plans. The key studies that have formed the strategic development of the Scheme are summarised below.

2.2.1 National Strategy for Flood and Coastal Erosion Risk Management in Wales (FCERM), 2020

The National Strategy FCERM sets out the Welsh Government's objectives and measures on flood and coastal erosion risk management and provides the policy framework to help public bodies, communities and other organisations work together to manage flood risk. The National Strategy FCERM provides a consistent approach to prioritise flood schemes for those communities most at risk.

The Welsh Government provides capital and revenue funding for Natural Resources Wales (NRW) and for Local Authorities to manage the risks of coastal flooding and erosion. The Welsh Government allocates funding through two programmes:

- **Flood and Coastal Investment Programme** - allocates funding to NRW and Local Authorities based on national priorities; and
- **Coastal Risk Management Programme** - provides capital funding to support Local Authority coastal protection schemes delivered between 2018-19 and 2021-22.

2.2.2 Shoreline Management Plan

The key policy driver for the Scheme is the West of Wales Shoreline Management Plan 2 (SMP2, 2012) which sets out policies for coastal management over a 100-year horizon. In the SMP2, Aberaeron is part of Coastal Area C, Section 4 – New Quay Head to Sarn Gynfelyn. The Scheme itself is contained within Policy Development Zone 8 (PDZ8) – Aberaeron Plateau. The West of Wales SMP2 states that the management policy for Aberaeron is to 'hold the line' to 2105.

2.3 Design Evolution

The need for improvement of the coastal defences at Aberaeron has been investigated over the last decade, with various engineering proposals put forward to provide the requisite standard of protection, optimise value for money as well as balance the needs of the environment and the public.

As described in section 1.4, works to protect Aberaeron from coastal flooding have included significant engineering works completed in 2009 at the North Beach. These works have had a significant benefit in protecting the northern part of the town from overtopping flood risk from the sea, but only addressed part of the flood risk problems. Flooding remains a problem around the harbour area of the town; particularly from waves entering the harbour and overtopping the harbour walls, as well as overtopping along South Beach.

The Scheme put forward in this ES therefore seeks to address the remaining coastal flood risk to Aberaeron in the South Beach and harbour areas.

Since the publication of the SMP2 in 2012, the following studies have been carried out.

- In 2013, the Aberaeron Harbour Scheme Appraisal Report (PAR) was produced (Hyder, 2013). This was followed in 2014 by the Aberaeron South Pier Scheme (Hyder, 2014). These studies envisaged two separate Schemes for the Harbour and the South Pier/South Beach areas. These studies considered a range of options for the South Pier and Harbour, which were developed following the methodology detailed in the Environment Agency Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG; Environment Agency, 2010). A recommendation for raising the existing setback sea wall in the Harbour and extending it to the A487 road bridge was made as well as repairing the end of the South Pier and works to South Beach.
- A review of the Hyder PAR was completed by Martin Wright Associates (MWA) in April 2014. MWA also proposed a single strategic scheme covering both the South Pier/South Beach and the Harbour, which demonstrated an improved benefit to cost ratio.
- Subsequently, CCC commissioned a further review of the scheme and the 2013 and 2014 reports described above. This review was set out in a Design Strategy completed by Opus in 2017, which confirmed a preferred option for the scheme consisting of the aforementioned raising of the setback wall in the Harbour and works to the South Pier and South Beach. The proposed scheme was updated and costs and damages reassessed following the FCERM-AG approach.

On the basis of the Opus report, Atkins was appointed to complete the detailed design of the Scheme and complete the final business case.

2.3.1 Inner Harbour Options

A longlist of options was considered by Hyder in their 2013 report.

Option 1 - Do nothing. Under the Do-Nothing scenario, it is assumed that no maintenance or capital works would occur to the sea walls. The sea defences would remain prone to overtopping which would increase with climate change and result in an increased risk of flooding of properties.

Option 2 - Do Minimum - Maintenance works. This option would involve maintaining the existing structure of the setback flood wall along Quay Parade for as long as possible. This would delay failure of the wall for an estimated 40 years. When the wall fails it is assumed that it is replaced with a new wall of the same form as the existing. This option assumes that the current situation is maintained indefinitely. It also assumed that some initial repairs would be undertaken on the secondary wall, which includes repair of expansion joints and voids filled. The initial repairs would be followed by periodic monitoring and maintenance. This option would not provide protection against rising still water levels because there are gaps and drainage holes in the existing wall.

Option 3 - Impermeable Flood Defence +4.60m AOD Crest Level. This option would involve the construction of a new impermeable flood defence along the north side of the harbour, with +4.60m AOD crest level. The height of the wall above the existing level of the pavement varies and is approximately 0.70m, which is similar to the existing setback wall. The option consists of an impermeable wall, tilt barriers and flood gates along the harbour side, around the inner harbour and along the right bank of the river up to Bridge Street. This provides a defence against still water levels, plus protection against wave overtopping. The total length of the defence along this route is 544m. In order to incorporate the wall sympathetically within the local streetscape this option suggests a new one-way system to Quay Parade, with areas of shared surface for vehicles and pedestrians and parking bays.

Option 4 - Impermeable Flood Defence +4.92m AOD Crest Level. This option would involve the construction of a new impermeable flood defence along the north side of the harbour, with +4.92m AOD crest level. The height of the wall above the existing level of the pavement varies and is approximately 0.90m. The option is identical to Option 3, as described above, with the exception that the wall height increases to a level of +4.92m AOD.

Option 5 - Impermeable Flood Defence +5.20m AOD Crest Level. This option would involve the construction of a new impermeable flood defence along the north side of the harbour, with +5.20 m AOD crest level. The height of the wall above the existing level of the pavement varies and is approximately 1.0 to 1.3m. The option is identical to Option 3, as described above, with the exception that the wall height increases to a level of +5.20m AOD.

Option 5a - Impermeable Flood Defence +5.20m AOD Crest Level. with demountable section. This option would involve the construction of a new impermeable flood defence along the north side of the harbour, with +5.20 m AOD crest level. The level of a 5.20m AOD defence would be achieved by a 4.90m AOD wall and 0.30m demountable defence for approximately 180m along Quay Parade. It is recommended the setback wall is set at a continuous level of 5.20m AOD without demountable defences from The Hive around the inner Harbour for approximately 290m. Due to the proximity of the wall to the properties neighbouring Bridge Street, the height of the wall should be negotiated with local residents and it is expected the wall would be between 4.90m AOD and 5.20m AOD at this location for a stretch of 65m.

Option 6 - New buttress. This option would involve constructing a new buttress against the existing North Pier wall, extending 10m into the harbour entrance. The buttress would reduce the height of north westerly waves within the harbour and subsequently reduce wave overtopping. The buttress would deflect waves that enter the harbour and prevent waves running along the harbour wall. The new buttress wall would be approximately 35m long by 10m wide. The new structure would be clad in masonry stone similar to that of the existing harbour wall. This option assumes that the existing flood wall would be maintained as per Option 2.

Option 7 - 35m Long Extension to the South Pier. This option would involve the construction of an extension to the South Pier to reduce the wave action from north westerly waves within the harbour and subsequently reduce wave overtopping within the harbour. The extension would be constructed of reinforced concrete and clad with stone on the harbour side, similar to the existing pier, to match the character of the existing structure. The dimension of the proposed extension would be approximately 35m long and 12.5m wide. This option assumes that the existing setback flood wall would be maintained as per Option 2, and the costs associated with the Do Minimum option are included in the costs for Option 7.

Option 8 - 75m Long Extension to the South Pier. Similar to Option 7, this option would involve extending the South Pier to provide protection from waves entering the harbour. For this option the dimensions of the proposed extension would be increased to approximately 75m long and 12.5m wide. This option assumes that the existing flood wall would be maintained as per Option 2, and the costs associated with the Do Minimum option are included in the costs for Option 8. Works would be undertaken to the existing pier structure to ensure the structure is stable before the extension work.

Option 9 - Offshore Breakwater. This option would involve the construction of a breakwater located 120m offshore of the South Pier. The breakwater would provide protection and a reduction of the intensity of wave action in the harbour, subsequently reducing wave overtopping within the harbour. The breakwater would be constructed of primary rock armour of quarried stone between 5-10 tonnes. The crest level of the breakwater would be 5.30m AOD, which would be a similar level to the top of the existing North and South Piers. The length of the breakwater along the crest would be 120m, the width of the structure is approximately 45m. This option assumes the existing setback flood wall at Quay Parade would be maintained as per Option 2, and the costs associated with the Do Minimum option are included in the costs for Option 9.

Grout curtain - In addition for all the above options it was proposed to install a grout curtain. Due to the high permeability of ground and the harbour wall, tide levels have a significant effect on groundwater levels. As a result, an impermeable wall alone would not be sufficient to prevent

flooding caused by extreme tide levels after taking into account sea level rise. Several technical solutions have been explored and the construction of a grout curtain has been selected as the most effective and feasible option at this location. This involves drilling and injecting grout into the ground to reduce the permeability over a length of 400m from the outermost extent of Options 4, 5 and 5a, around the inner harbour to adjacent to the footbridge. The costs for the grout curtain have been incorporated into each of the options which include the construction of an impermeable wall.

2.3.1.1 Selection of the preferred option (Harbour)

Options 2, 3, 6 and 8 were rejected, and not considered for further shortlisting. Option 2 was rejected as it would not reduce the flood risks, particularly over the long term but would only delay flood risk in the short term. Option 3 was rejected as its crest level is lower than the existing defences in some parts of the harbour and would therefore not provide a consistent standard of protection. Option 6 was rejected after modelling indicated that this option was least effective in reducing waves in the harbour, and would have other impacts on navigation and designated heritage assets. Option 8 was ruled out since although it reduced wave heights, its length (at 75m) was only slightly more effective than the shorter and cheaper Option 7.

Option 5 had the highest performance in terms of the economic justification (benefit cost ratio). However, consideration was made as to whether the wider considerations should affect the choice of the preferred option. Feedback from public consultation indicated there is some local opposition to raising the wall, and to Option 5 in particular. The owners of businesses and property along Pen Cei were particularly opposed to Option 5 as it would have a direct impact on views from their properties. There was a concern that having a 1.0m to 1.3m high wall along Pen Cei could damage tourism, recreation and reduce business to the harbour side, especially during the summer months.

The next best performing option was Option 5a. At the public consultation it was commented by residents that a lower wall level (as under Option 4) plus a demountable crest would be more acceptable to the community and businesses along Pen Cei. This option would provide flexibility to only have a raised wall during storm events and then revert to a lower wall during normal conditions. However, the minimum height of the wall would still need to be set to protect against increasing sea level rises in the future. Option 5a would provide the same standard of protection as Option 5 (assuming the demountable defences are in place along Pen Cei), and would provide a robust solution that the local community indicated that they would generally support.

Option 4 (with lower walls than Option 5/5a) did not perform as well in terms of flood protection as Option 5 or 5a, and would not provide the required reduction in flood risks.

In addition to the negative environmental impacts associated with Options 7, 8 and 9 it is considered that the structures would have a significant impact on the coastal landscape. Under Option 9, to reduce the impact of wave action, the required dimensions of the breakwater would need to be 120m long, 45m wide and the crest level of the structure would be 5.30m AOD. The structure would be visible throughout the tidal cycle and there would be no positive aesthetic impacts. The 35m long pier extension proposed for Option 7 would change the appearance of the listed pier structure and would impact upon the view from the harbour out to sea.

Option 5a provides the highest standard of protection of flooding from overtopping and still water levels. It was also considered that Option 5a would provide the most adaptable solution, as there is the potential to increase the height of the demountable defences in the future at the location of highest risk of overtopping (along Pen Cei).

2.3.2 South Pier Options

In contrast to the options above for the harbour which included lengthening the South Pier to provide better wave reduction for the Harbour, separate consideration of repair/replacement only options were considered for the South Pier. The long-list of options for the South Pier is included by Hyder in their 2013 South Pier report.

Option 1 - Do nothing. Under the Do-Nothing scenario, it is assumed that no maintenance or capital works would occur to the South Pier. There would be the rapid loss of the whole of the South Pier Structure as a result of continued wave action on the structure which would expose the fill material inside the pier. The pier material would distribute itself across the harbour entrance and in addition the shingle material retained by the pier would be drawn down leading to a realignment of the beach crest and erosion of land and properties,

Option 2 - Do minimum. This option would involve maintaining the existing structure of the South Pier for as long as possible. This would delay failure of the end of the pier for an estimated 10-15 years. Initial repairs would be required to make the structure safe and remedy the existing areas of damage. These would include, replacement of the concrete deck where it is damaged, repair of pointing around the masonry blocks and replacement of any missing blocks, filling of any voids within the structure with grout and installation of ties through the structure to minimise further movement.

Option 3 - Remove the Pier Head. This option would involve demolishing the head of the South Pier. By completely removing the damaged end of the pier, the integrity of the remaining structure can be protected. The end would be carefully dismantled with the masonry blocks being used to close the end of the remainder of the pier and prevent the core material being eroded. The existing crib groyne would be extended to meet the new pier head. This would prevent beach sediment from spilling through from the South Beach and filling the harbour entrance. To protect the toe of the pier head from abrasion, there would be multiple layers of masonry blocks at the base of the walls, similar to the existing structure. As well as extending the crib groyne, the existing structure would be refurbished. This would involve replacing and re-fixing the steel and timber crib work that have detached.

Option 4 - Strengthening and Stabilisation Works. In order to stabilise the movement of the pier, a series of rock anchors would be drilled through the pier head into the underlying alluvial deposits. In addition to the anchors, there would be a series of concrete piles bored into the pier core material. The new rock anchors and piles and pier walls would be connected to a new deck slab to tie the structure together. This would enable the pier head to be connected back to the main body of the pier and thereby aid in stabilisation of the end of the pier.

The pointing between masonry blocks would be repaired and any voids in the structure filled with grout. To add further protection to the pier, large diameter rocks would be placed at the head to further reduce the energy imparted by the incoming waves.

Option 5 - Rebuild the Pier with Improved Foundations. The end of the existing pier would be demolished and the existing masonry blocks from the harbour side retained for reuse. Piles would be driven into the ground to provide a foundation upon which reinforced concrete walls would be constructed to form the new pier head. The existing masonry blocks would be reused to face the pier so that it matches the current pier. The new pier head would be filled with general fill to provide additional mass to the structure. A new concrete deck slab would be constructed on top of the compacted core fill and be supported by the reinforced concrete walls. The new structure would be designed with a 100 year design life. The option maintains the existing appearance of the pier ensuring it fits in with the town's conservation status and the listed status of the structure. During the works, the existing crib groyne will be refurbished

Option 6 - Rebuild the Pier with a New Pier Head. This option would involve demolishing the existing pier head and building a completely new structure that would be more efficient at absorbing the wave energy and less susceptible to damage. The front face of the structure would be open to allow waves to enter and dissipate energy through the rock armour fill. The existing pier head would be removed and the end of the existing pier would be encased by a new wall. This would ensure that no fill would be lost and that the existing pier structure would maintain its structural integrity. The new pier head structure would be founded on a concrete ring beam supported on concrete piles, driven into competent ground material. A series of concrete columns would be constructed on top of the beam, providing support to a new concrete deck. Large diameter rocks would be placed within the void created by the new deck and columns, to absorb the wave impact. Rocks would be placed around the base of the pier. The existing crib groyne would be refurbished

2.3.2.1 Selection of the preferred option

Option 3 would result in a shorter arrangement, requiring a significant change to the structure and character of the pier. This option was rejected on the basis of impacts to the designated heritage asset, and that it would be unlikely to receive support from Cadw.

Options 2 and 4 would maintain the existing structure for as long as possible, however, it was considered unlikely that a long-term design life of 100 years could be achieved. Option 2 would have the shortest design life at only 1-15 years. These options were therefore rejected.

The preferred option for South Pier is Option 5, comprising the re-building of an approximate 10m length of the head of the pier. Option 5 was supported within the feedback from the public consultation undertaken in Aberaeron in October 2012. The majority of respondents (77%) supported works to the South Pier that are sympathetic to its listed status, and the character of the wider Harbour.

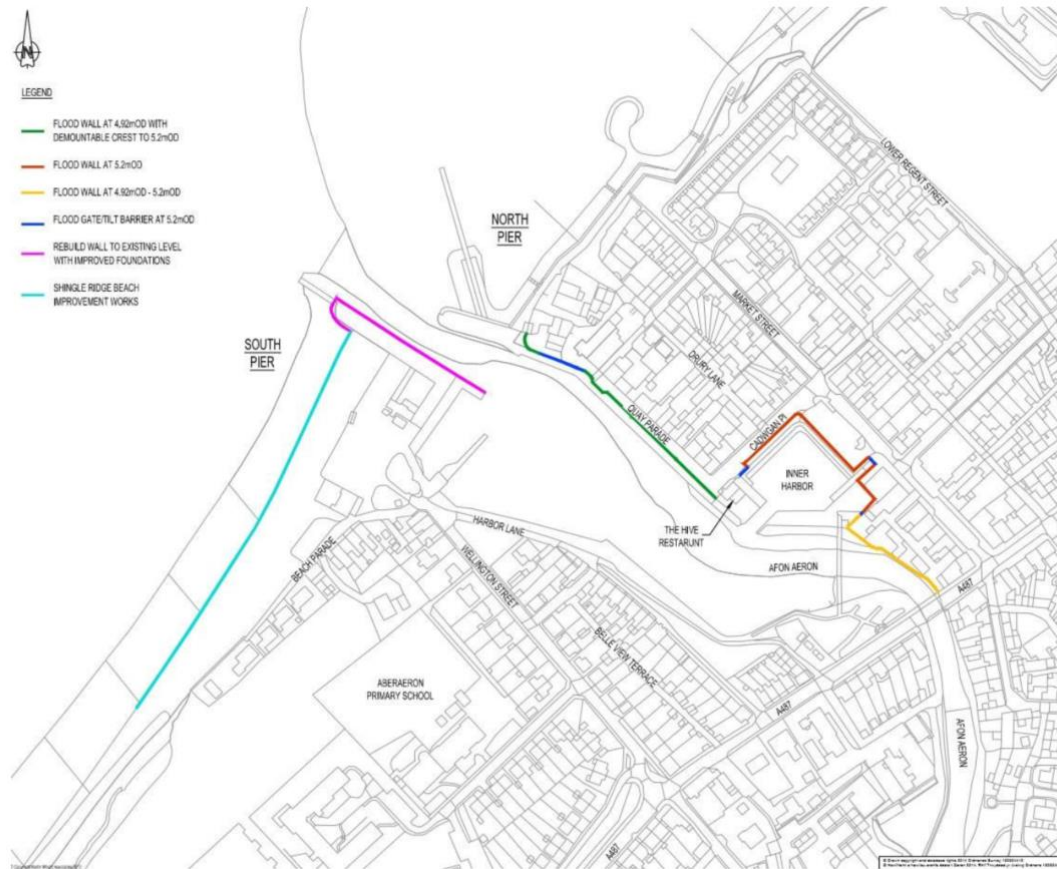
2.3.3 Further development of the scheme

The MWA PAR report (2014) supported the selected options for the Harbour and the South Pier, and recommended that both options take place as an overall strategic scheme, but in addition to the preferred options suggested that additional works be introduced to supplement the preferred options and provide a more robust solution to the perceived problems. The additional works suggested were as follows:

- Construct an offshore structure in the vicinity of the harbour entrance to lessen the impact of waves within the inner harbour, as per Option 9 of the Hyder report, and;
- Improve the stability of the South Beach by reinstating the dilapidated timber/steel groynes and existing rock armour revetment.

In 2017, CCC commissioned Opus to begin the development of a coast defence scheme for Aberaeron. A scheme comprising three linked elements was presented in the Aberaeron Coastal Defence Scheme Design Strategy (Opus, 2017) report. The strategy identified a preferred option for the inner harbour, South Pier and South Beach. A description of each of these preferred options is provided below and shown in Figure 2-1.

Figure 2-1 Preferred Scheme (Opus, 2017)



The preferred option for the **inner harbour** identified in the Opus (2017) report as Option 5a (carried forward from the 2013 Hyder report), comprised the following elements:

- Construction of approximately 180m of new wall along Pen Cei, with flood gates required to maintain access points;
- Construction of approximately 290m of new wall from The Hive and around Pwll Cam to the rear of the Monachty Hotel, with flood gates required to maintain access points, including across the slipway;
- Construction of approximately 65m of new wall from the rear boundaries of the properties between the Monachty Hotel, Toad Hall and the A487 highway bridge crossing the River Aeron; and
- Construction of approximately 400m of new wall and up to 14m deep grout curtain at the rear of the existing harbour walls. A grout curtain is made up of a series of holes drilled into the ground into which grout is injected. The grout 'joins up' between the drilled holes to create a 'curtain' of grout below ground. The aim of the grout curtain is to create a cut-off to reduce permeability and prevent groundwater flooding as a result of rising tide levels.

The preferred option for **South Pier** (identified in the Opus (2017) report as Option 5 (carried forward from the Hyder (2013) report)), comprises the re-building of an approximate 10m length of the head of the pier using the following general methodology:

- Demolition of the head of the existing pier and rebuilding of a new pier head.

The preferred option for **South Beach** identified in the Opus (2017) report comprises the following elements:

- Remove and replace the dilapidated groyne field, including the crib groyne at the end of South Pier;
- Improve existing rock armour revetment, where required, and extend defences to South Pier; and
- Replenish and/or redistribute shingle on beach.

Following the Opus (2017) report, Atkins was commissioned by CCC to take the strategy further to a Scheme design. Numerical modelling was carried out by Atkins, which resulted in refinement of the preferred options, including some substantial changes to the Scheme design. These changes included the addition of a new breakwater extending from the North Pier and a new flood gate at the entrance of Pwll Cam. It was also determined that the revetment on South Beach did not need extending up to the South Pier. The design changes made in this phase of development are described further in the following sections.

Breakwater

Atkins carried out wave modelling of the proposed options for the improvements to the secondary defence walls and it was found that the proposed secondary wall at +5.2mOD was not effective at reducing wave overtopping at the western end of the harbour near the Harbourmaster Hotel. Consequently, Atkins investigated the use of a detached offshore breakwater structure to reduce the height of waves as they enter the harbour, as suggested in previous studies by Hyder and MWA. This was found only to be partially effective, and did not deal with a full range of wave directions. Atkins then developed an option for a longer rock breakwater structure connected to the North Pier with the head of the breakwater perpendicular to the predominant wave direction. This was found to be more effective and dealt with a range of wave directions.

Improvements to Inner Harbour Walls

The inclusion of a breakwater has a positive effect on reducing wave heights in the harbour from overtopping. The proposed option for raising the secondary defence walls was checked for wave overtopping and found to have a standard of 1 in 200 (2021) and protection against extreme sea levels of 1 in 1000 (2121) when set at a level of +5.2m AOD.

Atkins proposed to construct a secondary defence wall consisting of an upper glass partition and lower masonry wall. This has advantages in that the masonry wall would be no higher than the existing wall, and the use of glass would maintain a feel of openness and light. This mitigates the specific visual impact to residents of the houses along Pen Cei/Quay Parade.

The route of the secondary defence wall was proposed to go as far as the road bridge via the rear of the small Pwll Cam harbour. It was realised that the building of a wall around the Pwll Cam harbour would impact significantly on the character and appearance of Pwll Cam harbour. An alternative option was therefore developed to take the secondary defence wall along the outer wall of Pwll Cam, together with installing a flood defence gate. The flood defence gate has wider benefits, since the Pwll Cam harbour floods on regular spring tides, imposing a limitation on the use of the harbourside to host events or for placement of market stalls.

Going east from Pwll Cam, there are existing boundary walls which also need to be raised. It is proposed to reconstruct walls to the rear of the Monachty Hotel, Toad Hall and Conglfaen and install a glass partition to the top of the walls. A short section of existing flood defence rebuilt in the 1990s next to the road bridge will just require the addition of a glass partition.

A consultation held in September/October 2020 generated very positive responses to the inclusion of the glass walls option for raising the secondary wall. There was also a strong preference for the wall to be located on the outer extent of Pwll Cam.

Atkins investigated the use of a grout curtain as part of the Scheme. It was concluded that the effectiveness of this solution could not be confirmed at this time, as further ground investigation would be needed to ascertain likely sources of ground water ingress in addition to those hypothesised at the harbour wall. It is possible that the proposed grout curtain would only protect ingress from the harbour and that other routes of ingress, particularly from the north-west coastal section may render any solution less effective. It is proposed that this aspect of work is deferred into a future phase of work.

In lieu of the grout curtain proposal, it is proposed to mitigate water inflows through the harbour wall by increasing the impermeability of the harbour wall by grouting. Past condition surveys have indicated voids in the walls and voids behind the wall which cause a concern in respect of the structural integrity of the wall. A grouting scheme for the harbour walls along Pen Cei/Quay Parade will ensure the structural integrity of the walls and decrease the permeability of the wall to reduce groundwater flows.

South Pier

As detailed in the Hyder, MWA and Opus reports, it is proposed to reconstruct the end of the South Pier as set out in the reports. Similarly, to the harbour walls at Pen Cei/Quay Parade condition surveys have indicated voids in the walls and voids behind the wall which cause a concern in respect of the structural integrity of the wall. It is therefore proposed to carry out grouting of the walls in ensure the structural integrity of the South Pier.

South Beach

As detailed in the MWA and Opus reports, it is proposed to reconstruct the rock revetment at the South Beach, to repair timber groynes and to undertake shingle nourishment. Modelling has been carried out to check wave overtopping for a 1 in 200 year (2021) standard of protection. This confirmed that the extent of the rock revetment did not need to extend as far as the South Pier and that the existing shingle bank in front of the yacht club is sufficient. However, as a result of surplus shingle arising out of the excavations needed for the breakwater, there is an opportunity to nourish the beach to improve the level of protection further. This shingle material is a match in terms of type and grading.

The preferred Scheme selected and assessed in this ES now comprise five key elements which are interlinked as integral parts to the flood defence structure. The general arrangement of the Scheme is presented in drawing 5182114-ATK-MAR-GEN-DR-C-1000 and described in detail in Section 3. The proposed works at the harbour offer a 1 in 200 year design return period for wave overtopping, with the South Beach revetment having a 1 in 200 year standard of protection. The Scheme also provides a 1 in 1,000 year standard of protection against extreme sea levels for the its design life (100 years). The five key elements of the final Scheme are:

- 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 the walls.
- Flood wall construction at the following locations:
 - Removal of the existing set back flood wall along Quay Parade/Pen Cei and reconstruction of a new masonry and glass wall, as well as grouting repairs of the existing quayside wall;
 - Raising of the existing River Aeron flood wall between the rear of the Monachty Hotel and the A487 referred to as the River Aeron wall; and
 - Construction of a new masonry and glass wall flood wall between Pwll Cam and the Monachty Hotel (and connecting with the existing adjacent River Aeron 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 and extension of the existing rock revetment; and
 - Beach renourishment.

2.4 Consultation

Consultation has been carried out throughout the development of the Scheme, both formally with statutory consultees, with other regulating bodies and with members of the public and affected landowners.

2.4.1 EIA Scoping Consultation

As described in Section 1.2.1, an EIA Scoping Report was produced in 2019, which was submitted for formal consultation to NRW. At the time of the EIA Scoping Report, the Scheme did not contain the breakwater and flood gate at Pwll Cam and therefore these aspects of the design have not been formally consulted on. CCC has recently (March 2021) contacted NRW to inform them of the change in the Scheme design.

The EIA scoping response was received in a letter dated 25 April 2019. In considering the EIA scoping report, NRW confirmed in the letter that they consulted with various consultation bodies, of which the following responded:

- Natural Resources Wales
- Maritime and Coastguard Agency (MCA)
- Royal Yachting Association (RYA)
- Trinity House Lighthouse Service (THLS)
- Ceredigion County Council, Local Biodiversity Officer
- Cadw
- Dyfed Archaeological Trust

A copy of the EIA scoping opinion letter is contained in Appendix B. The responses received all focussed on the scope of the issues proposed for assessment as part of the EIA.

The subsequent changes made to the EIA scope and supporting surveys and investigations as a result of the scoping opinion are summarised in Chapter 5 (Section 5.2.1) of this ES. No comments were received from any of the organisations consulted regarding the proposed design of the Scheme, and therefore it has not been necessary to consider any design changes or modifications in response to the stakeholder consultation. No objections were made to the Scheme during the scoping consultation process.

2.4.2 Pre-Planning Enquiries

Requests for pre-application advice have been submitted to CCC as the local planning authority on three separate occasions in order to gain a detailed understanding of the local consultee's views on the proposals. The enquiries set out the background and need for the Scheme. The requests also set out the proposed option. For later enquiries preliminary drawings of the Scheme

were provided. Planning and Environmental Constraints were set out as well as details of relevant planning policy.

Enquiry dated 4 March 2019

The first request for pre-application advice outlined the work required for initial construction works which were proposed for the South Pier, Harbour Walls and South Beach. It was confirmed a full planning application and listed building consent would be required as the Scheme would interact with the listed South Pier. The LPA consulted several key stakeholders including: Cadw; CCC's Ecologist; CCC Highways Department; Dwr Cymru; and NRW. Though the Scheme was supported in principle, there were several key issues which were identified.

The key issues raised by CCC are set out below:

- The preference for a sea gate to be installed at the harbour entrance as this could remove the need for additional/extended harbour walls;
- The LPA also wished to avoid the need for a new barrier adjacent to the harbour wall and around Pwll Cam if other viable options existed. If this was not possible, it was requested that clear evidence must be submitted as part of a planning application to justify why such alternative schemes could not be implemented;
- If no other options were available, it was highlighted that the key issues around the proposals were the detrimental impact that the glass sea walls could have on the Conservation Area; and
- It was also highlighted that pedestrian permeability in the area was vital. A demountable glass structure was suggested to facilitate crossing points over the harbour wall. The ability to walk directly from Aberaeron town to the Harbour side was key for people to enjoy the harbour and the wider townscape. Additionally, it was advised that consideration should be given to the incorporation of seating along the proposed wall.

Enquiry dated 15 May 2020

The second request for pre-application advice set out an amended design to the South Pier, Harbour Walls and South Beach. This request included the addition of a breakwater extending out from the North Pier in order to minimise the impact of storm surges in the harbour. The general arrangement of the proposed breakwater is shown on Drawing No. 5182114-ATK-MAR-GEN-DR-C-6000 (see Appendix A).

The second request for pre-application advice also included improved pedestrian access and amenities and set out three options for Pwll Cam:

Option 1

The first option proposed a sea defence wall located between the existing trees and road/car park. This retains the current views in and around all areas of the harbour, similar to the existing conditions.

Currently the harbour-side can be easily accessed from all locations. The sea defence wall in this location would create a barrier between the main pedestrian routes and the harbour-side restricting access to a selection of locations. The wall would comprise of masonry and a glass panel on top.

For this option, during flood events and long-term rising sea water levels, the existing trees would be at risk of being sub-merged for prolonged periods. This would affect the long-term health of the trees.

Option 2

The second option proposes a sea defence wall along the edge of the higher walkway. As with Option 1 the wall would comprise of masonry with a glass panel on top. Unlike Option 1, the wall in this location could limit some of the views.

The access to the harbour-side would remain the same as the current arrangement, and the existing trees would be protected against the sea water. The benefit of the wall in this location is the retention of the higher walkway during high tide and storm events.

The removal of kerbs around existing trees and planting would offer wider walkways and offer an opportunity to implement buffer planting between the car park and the harbour-side.

Option 3

In contrast to the previous two concept options, the sea defence wall in this concept is located alongside the River Aeron on the southern peninsula near the existing picnic benches.

This location retains the existing conditions in the harbour with clear views and accessibility.

Alongside the new defence wall, a gate would be required at the entrance to this inner harbour space. The existing wall surrounding The Hive restaurant would need to be raised by approx. 500mm.

In all three options the existing wall located around the steps on the bridge landing is to be removed. This improves the connectivity and visual sight lines when navigating these spaces.

Moreover, the underutilised area of land sits adjacent to the main pedestrian movement route from the pedestrian bridge to the South Beach and National Coastal path via Harbour Lane; refurbishing this area of land indicated would provide an additional area for tourists to interact with the water and enjoy the harbour views.

Cadw; CCC's Ecologist; CCC Highways Department; Dwr Cymru; and NRW were approached for comment and acknowledged the Scheme's improvements were positive as they noted previous comments had been considered in the new design. The key points raised for this consultation were:

- The principle of the breakwater was acceptable, subject to the additional information required by the highways officer, the ecology officer and Cadw. It was also requested for the breakwater to be open to the public via a walkway leading out from the north;
- Regarding the sea walls, greater detail was needed as to the exact heights of the proposed wall and glass so their impact was better understood;
- Whilst the idea of integrated seating into the wall structure was supported, the complex wave shape would result in difficulty in using some natural traditional materials such as stone and would be more difficult to maintain;
- The up and over steps and railings appear bulky and would introduce considerable clutter with limited benefits; and
- The preferred option for Pwll Cam was Option 3. This concept avoided the need for a wall around Pwll Cam which would have a significant effect on pedestrian permeability; views in and from the harbour area; and negative effect on the existing trees as outlined in the responses above.
- The LPA again highlighted concerns raised by Cadw in relation to the materials proposed for the Scheme. This included the view that use of shuttered concrete and glass would not to be suitable in this location. And the suggestion that all the walls should be faced with a natural stone of local provenance; and

- The amenity space proposals were also welcomed and would add much needed green space in the vicinity of the Harbour.

Enquiry dated 18 December 2020

The final pre-application request to the local planning authority focused on additional information on the Scheme in respect of the public realm and included the submission of a heritage desk-based assessment. This Scheme presented included the addition of a pedestrian walkway along the breakwater extending out from the North Pier. It also included the final version of Option 3 for Pwll Cam, as set out above, plus the removal of the existing wall located around the steps on the footbridge landing. This improves the connectivity and visual sight lines when navigating these spaces. The proposed wall height at this location is 2.2m above the area where the picnic tables are. Options will be considered to reduce this impact by raising part of the area where the picnic tables are or providing a step-up platform to enable better views of the area.

Within the pre-application request it was noted that within the original pre-application response it had been suggested that the introduction of a sea defence at the entrance of the harbour, or a 'sea gate', would be a favourable option. However, the installation of a sea gate does not remove the need to raise the level of protection elsewhere around the harbour. In addition, the funding programme for a sea gate is different from the programme being used to develop the coastal defence scheme. Subject to funding being secured for a harbour gate then this would come forward as a separate scheme in a further planning application. The current coastal defence would not prejudice the subsequent installation of a sea gate.

NRW respectfully declined to provide further feedback without engaging with them through the Discretionary Planning Advice service.

As part of this preapplication enquiry the local planning authority consulted with and had a meeting with Cadw. Following the meeting Cadw set out a number of points to be addressed when the full application was submitted. Cadw queried whether so much of the South Pier needed to be removed and rebuilt, especially the northern elevation, and asked that justification be provided. They also queried whether the breakwater would provide additional protection which would allow more stone and less concrete to be used in the reconstruction of the South Pier. The South Pier is in a significant state of disrepair and at risk of imminent collapse. The pierhead has been subject to multiple phases of repair and rebuilding due to storm damage. Reconstructing it using precast concrete units is necessary to ensure the pier can withstand future storms. The addition of the breakwater to the Scheme does not alter the requirement for concrete in the reconstruction of the pierhead. Masonry salvaged from the pier will be used to reconstruct collapsing sections of stone wall on the south and north elevations of the pier where possible. Consolidation of the historic pier fabric by grouting it with lime cement will make the masonry stable and to fill any voids inside it. The surviving masonry to the southeast of the pierhead would be retained.

Other points from Cadw are listed below and how those points have been addressed follows in the brackets:

- An assessment of what impact the breakwater will have on any nearby listed buildings and structures needs to be included. (See Atkins, Heritage Impact Statement);
- Consideration should be given to including direct access from Quay Parade onto North Pier – the existing wall and stop logs will be replaced by a tilt barrier;
- Tilt barriers should be black or grey painted steel. (The tilt barriers will be made of a dark grey painted metal frame. As the barriers will be walked on when not in use the surface will be colour-matched to the surrounding ground surface);
- Details or cross sections were requested for the proposed walls and glass to be used (see Drawing No. 5182114-ATK-MAR-GEN-DR-L-5003 - Quay Parade Elevations; Drawing No. 5182114-ATK-MAR-GEN-DR-C-3002 - River Aeron Wall Sections and Drawing No. 5182114-ATK-MAR-GEN-DR-C-9001 - Proposed Glass Wall Typical Details);

- Detail was request for the pedestrian crossing points (tilt barrier locations and widths are shown on Drawing No. 5182114-ATK-MAR-GEN-DR-L-5000 – General Arrangement Plan and a cross section is shown on Drawing No. 5182114-ATK-MAR-GEN-DR-L-5003 - Quay Parade Elevations); and
- Details requested for the proposed maintenance of the glass (The glass will have a high lead content to provide self-cleaning properties, reducing the level of maintenance required. CCC will also maintain the glass panels, and in particular undertake inspections and cleaning where required after storm events).

A detailed assessment of the Scheme's impact on the historic environment is provided in the Heritage Impact Statement.

Summary

There has been significant pre-application consultation undertaken during the design stage of the Scheme. This has meant the design of the Scheme has been able to be developed in order to take into account the sensitivity of Aberaeron as a Conservation Area and the several listed buildings which will be affected by the works.

Particular consideration has also been given to improving public amenity and enhancing the public's enjoyment of the inner harbour and Pwll Cam area. This means the Scheme will be able to preserve the historic town of Aberaeron from the effects of climate change whilst maintaining uninterrupted access to the harbour so that future generations can enjoy it for years to come.

2.4.3 Regulatory Bodies

In addition to also being consulted via the formal EIA Scoping process described above, consultation with Cadw has been carried out by the Scheme Team due to the heritage conservation interest of the area, in particular the Grade II listed North and South Piers. Discussions have also been held with one of CCC's ecologists, including involving them in team progress meetings. As mentioned above, CCC has recently (March 2021) contacted NRW to inform them of the breakwater and flood gate additions to the scheme design.

2.4.4 Public Consultation

The public consultation was held between 22 September 2020 and 20 October 2020. Due to Covid-19 restrictions the consultation was carried out digitally via a dedicated web page on CCC's website. The consultation period and website address were advertised in the local media including in the Cambrian News.

The consultation process included an online survey asking specific questions about the Scheme, with the opportunity to provide further comments at the end of the survey. A total of 136 responses were made to the survey. The survey results are contained in Appendix C. All questions relating to personal details (age, religion, nationality, further contact details etc) have been removed from the appended version to adhere to data privacy laws. The key results from the survey are summarised in Table 2.1 below. For the majority of questions, the answers that could be selected were:

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- Don't know/prefer not to say

For the question on materials, the word agree/disagree was replaced with like/dislike and for the question on noise, the choice of answers was:

- Very worried
- Slightly worried
- Neutral
- Not worried at all
- Don't know
- No opinion

Table 2-1 Public Consultation Questionnaire Responses

Question	Most common response
Do you agree or disagree with the need to take action to prevent flooding to properties within the town, along the front of South Beach, Quay Parade and Pwll Cam?	Strongly agree
Breakwater and Footpath: Do you agree or disagree with the proposal to construct a rock breakwater as an extension to North Pier?	Strongly agree
Quay Parade and Pwll Cam Inner Harbour: Do you agree or disagree with the plans to construct a new wall to deal with future sea level rise?	Strongly agree
Pwll Cam Inner Harbour: There are three options (1) build a wall along the rear of the harbour (2) build a wall along the edge of the harbour (3) construct a gate to the harbour and a wall along the rock revetment. Which option do you prefer?	Option 3 was the most popular.
Historic South Pier: Do you agree or disagree with plans repair and conserve the heritage pier?	Strongly agree
Artwork, Seating and Picnic Areas: Do you agree or disagree with the plans for artwork, seating and picnic areas?	Agree
Materials: Do you like or dislike the materials that we are proposing to use in the Scheme? For example the stone or glass materials.	Like
Economic Development of the Harbour: Do you agree or disagree with improving and developing the harbour to allow a modern floating marina and create a high quality sailing destination on the west coast of Wales.	Strongly agree
Development of Facilities in and around the harbour: Do you agree that the council should consider other economic or	Strongly agree

community opportunities close to the harbour e.g. space for restaurants, shops or new community facilities?	
Do the proposals provide opportunities to promote and facilitate the Welsh Language?	Neutral
To what extent are you worried about the construction methods, noise or location of the site compound etc.?	Slightly worried (note: this was only 0.87% higher than 'not worried at all')

2.4.5 Local Businesses and Landowners

Members of the Scheme team have been in contact with local businesses and landowners throughout the development of the Scheme, through emails, telephone calls and meetings (prior to Covid-19 restrictions). This has included speaking with landowners between Pwll Cam and the A487 whose properties back on to the river wall that is proposed for raising, including the Monachty Hotel, Toad Hall and Conglfaen. In particular this has been in relation to obtaining agreement from the Monachty Hotel to rebuild the flood wall adjacent to their property to a new higher level, and discussions on the new appearance of the wall raising. Consultation has also been carried out with landowners along Quay Parade to obtain their views on the wall raising in front of their properties, as well as the Harbourmaster Hotel and The Hive restaurant.

Feedback from landowners has been taken into account and influenced details of the design. All of the landowners consulted with have broadly been in support of the scheme.

3 Scheme Description

3.1 Physical Characteristics

The proposed Scheme is made up of five key elements which are interlinked as integral parts of the overall design. Together, the Scheme will form a continuous line of defence around the harbour from Quay Parade to the A487 road bridge. The Scheme elements are described as follows, with drawings of each element contained in Appendix A. Drawing 5182114-ATK-MAR-GEN-DR-C-1000 provides the general arrangement of the whole Scheme. The Scheme elements are:

- 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 the walls.
- Flood wall construction at the following locations:
 - Removal of the existing set back flood wall along Quay Parade/Pen Cei and reconstruction of a new masonry and glass wall, as well as grouting repairs of the existing quayside wall;
 - Raising of the existing River Aeron flood wall between the rear of the Monachty Hotel and the A487 referred to as the River Aeron wall; and
 - Construction of a new masonry and glass wall flood wall between Pwll Cam and the Monachty Hotel (and connecting with the existing adjacent River Aeron 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 and extension of the existing rock revetment; and
 - Beach renourishment.

The Scheme has a 1 in 200 year design return period for wave overtopping within the harbour, with the rock revetment on South Beach having a 1 in 200 year standard of protection. The scheme also provides a 1 in 1,000 year standard of protection against extreme sea levels for the design life (100 years) of the Scheme. The design of the Scheme has been carried out in line with the requirements of the Welsh Government for the development of residential areas in relation to flood risk (TAN15), as well as in line with guidance for flood and coastal erosion risk management and adaptation to climate change (Welsh Government Assembly, 2004 and Welsh Government, 2017).

Coordinates for the Scheme are as follows:

- Southwest end of rock revetment on South Beach: 245107, 262545 and Northeast end of rock revetment on South Beach: 245348, 262809.
- Northeast end of South Beach nourishment between 245400,263035 and southwest end of South Beach nourishment between 245107, 262545.

- Western end of breakwater: 245274, 263073 and eastern end of breakwater: 245503, 263025.
- South Pier: 245400, 263035.
- Start of Quay Parade flood wall: 245503, 263025 and eastern end of River Aeron flood wall: 245810, 262841.

3.1.1 North Pier Breakwater

Physical Characteristics

North Pier is a Grade II listed structure, comprising external masonry walls, a concrete footpath on top and fill beneath and behind the walls.

A rock breakwater will be constructed extending out from the North Pier in a northwest direction and then curving slightly west. In relation to the tidal range, the tip of the breakwater will be approximately 173m offshore from the line of MHWS at South Beach, located on the -3.0mOD depth contour which is about 1.2m lower than MLWS.

The breakwater will be approximately 243m in total length, comprising an initial length of 153m on the main arm protruding from North Pier, plus 90m on the section curving to the west. The top of the breakwater will have a width of around 10m, widening to 47m at its base. The breakwater sides will have a slope of 1 in 3 on the outer seaward side and 1 in 2 on the inner navigational channel side. A 4m wide concrete footpath will run along the full length of the top of the breakwater for amenity use and to provide access for future maintenance. To provide some protection to the footpath, the top of the breakwater will have a varied crest level, with the breakwater being at a higher level of 5.4mOD on the seaward side and 4.2mOD on the navigational side, with the footpath located at 5.0mOD. The overall footprint of the breakwater will be 10,820m².

The breakwater will be constructed of rock and will comprise three layers; an inner rock core comprising of excavated beach material followed by a layer of imported 0.3 - 1 tonne rock and an outer armour layer of larger rock (6-10 tonnes). The volume of rock for the core and the outer rock layer is approximately 25,658m³ and 29,813m³ respectively. The source and type of rock will be dependent on the contractor and availability of the quarry to supply this volume of rock, however a grey colour will be made a requirement in order to be in keeping with existing construction materials on the piers. The rock will be laid upon a geofabric membrane which will be placed on the sea bed prior to placing the rock.

Repair work to the surface slab on top of the existing North Pier head will also be carried out as part of the work (Drawing 5004). These works will stabilise the ground beneath the existing surface and back of the existing walls. At the entrance to the pier from Quay Parade, the existing concrete flood wall will be removed and replaced with a new wall with a tilt barrier included within to allow access onto the pier during construction and for future maintenance access. The tilt barrier will be one of four tilt barriers constructed along Quay Parade. Details of construction of the tilt barriers is contained in section 3.1.3. A tilt barrier is a type of flood gate, which is raised during a flood event. During normal conditions it remains lowered into the footpath.

Once the breakwater has been constructed, navigational markers and navigation lighting will be positioned along the breakwater in agreement with Ceredigion County Council as Harbour Authority, to maintain safe navigation for vessels approaching and leaving the harbour.

Construction Method

Before the breakwater is constructed, some excavation of the shingle seabed is required to 'toe-in' the outer perimeter of the breakwater below the seabed. 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 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). Further details on the beach renourishment and sediment size can be found in section 3.1.7 below.

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, 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 be 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 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 site of 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 as far as is practical and avoiding the intertidal area as much as possible to reduce disturbance to any intertidal habitat and to reduce sediment becoming mobilised into the water and increasing turbidity.

The rocks will be picked up from the stockpile area by a long reach 360 excavator (35-40t) with a grab 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 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 at the entrance to the pier 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.

3.1.2 South Pier Refurbishment

Physical Characteristics

South Pier comprises a historic masonry structure, with the head of the structure formed by precast concrete on the west and southwest faces, and a slightly projecting stone retaining wall against the north face. Similar to the North Pier, the South Pier is also a Grade II listed structure. The pier is a critical asset in the flood defence of Aberaeron Harbour as it retains the shingle material on the South Beach and prevents the navigation channel into the harbour getting obstructed.

The Scheme will require the removal of a 10m section of the collapsing seaward head of the South Pier (as it poses a health and safety risk), and its reconstruction on the same footprint. The material, predominantly concrete, but also consisting of masonry from the demolished section will be removed from site. The reconstructed section of the pier will comprise a new precast concrete semi-circular shaped pier head. This will be attached to circular concrete or steel piles that will be driven into the ground to support the weight of the structure. In front of this, new 6 – 10t rock armour will be placed extending in a seaward direction of its existing footprint by approximately 5m, and of similar width of the existing pier. The rock armour will extend over part of, and either side of, the existing metal and stone crib groyne which extends from the pier. The exposed section of the groyne will remain and be refurbished.

Masonry salvaged from the pier will be used to reconstruct the collapsing section of stone wall where possible on the south and north elevations of the pier. The side of the pier wall on the southern section of the existing pier is in a particularly bad state of repair due to the abrasion from

shingle moved by the exposure to strong waves. This section will be repaired and reinforced with steel sheet piles placed into the ground to provide scour and abrasion protection. The remaining existing masonry section of the pier will remain in its current form. There will also be a need to consolidate the walls by horizontally and vertically drilling holes to grout the pier walls with lime cement to make the masonry stable and to fill any voids inside it.

Construction Method

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 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 drilling and 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 and negative mobile elevated working platforms 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 section 3.1.1 for rock delivery, transport and placement methods.

3.1.3 Flood Wall: Quay Parade

Physical Characteristics

To minimise the risk of wave overtopping during significant storm events, the existing low concrete wall set back from the main harbour wall along the northern side of the harbour, bordering Quay Parade, will be taken down and replaced with a reinforced concrete masonry clad wall topped with glass panels to a crest level of 5.2m AOD. The masonry clad wall section will have a level of 4.5mOD-4.6mOD, with 600-700mm of glass on the top. The existing wall has a crest level ranging between 4.45m and 4.81mOD.

The wall will be constructed in a similar alignment to the existing. To the western end of Quay Parade, between the North Pier and the Harbourmaster Hotel, the new wall will be slightly further inland than existing to allow for a new tilt barrier (described further below) and to create a wider walkway on the harbour side. South of the Harbourmaster Hotel and east along Quay Parade to the Hive restaurant, the wall will be slightly further seaward than existing to accommodate for relocating the existing street lighting to the road side to free up space on the walkway and for potential future road improvements, which CCC may develop with the Highways Authority at a later date. These possible future road improvements are not part of this scheme. The existing 'lay-by' / turning area on the wall opposite Waterloo Street will remain on the existing alignment, to provide maintenance access to existing manhole covers for underground utilities and to allow vehicles to turn down the road opposite.

Reinforced glass panels up to 700mm in height will be incorporated along the top of the new masonry-clad concrete wall; supported by stainless steel columns and new stone piers. The height of the glass panels has been designed so that they withstand the extreme wave and water levels entering the harbour during a storm. The configuration of the wall is such that the stone piers supporting the glass panels will not be directly outside any property windows along Quay Parade so as not to obstruct views. Similarly, the top of the wall has been designed with glass panels, rather than a solid stone wall, in order to reduce any reduction in natural light and views to these properties. CCC will maintain the glass panels, and in particular undertake inspections and cleaning where required after storm events.

As described in section 3.1.1, the existing wall located across the entrance to the North Pier by the turning head will also be removed, including the existing stop logs. This small flood wall does not provide an effective form of flood defence, as water passes through the gap/footway in the wall. This wall will be replaced with a new wall to be located further seaward along the pier and tying-in with the North Pier wall and North Beach sea defence wall. This section of wall will have a tilt barrier to be raised during flood events. The location of the wall across the pier entrance has been located further seaward so that when the tilt barrier is closed, access to the coastal path along North Beach is still possible. Overall, the full length of flood wall along Quay Parade will increase the standard of protection from wave overtopping from a 1 in 5 year standard of protection to a 1 in 200 year standard of protection and will provide a 1 in 1000 year standard of protection against extreme sea levels over the design life (100 years) of the Scheme.

Four tilt barriers will be provided at the following locations along the new wall (with a further barrier at both entrances to the footbridge next to the rear of the Monachty Hotel which is discussed in the section below 'Wall Raising between the Monachty Hotel and the A487').

- At the entrance to North Pier (4m wide)
- Opposite the restaurant of the Harbourmaster Hotel (8m wide)
- Opposite the driveway adjacent to property number 5 (4m wide)
- At the eastern end of Quay Parade at the junction with Cadwgan Place adjacent to the Hive (8m wide)

The tilt barriers are a type of flood gate that will be housed within a recess in the concrete footpath on the promenade. Rather than constructing a solid wall along the full length of Quay Parade, when in a lowered position, the tilt barriers will provide access points through the wall onto the quayside promenade. The tilt barriers will remain lowered and level with the footway, until required during a storm. Prior to a storm event, they will be manually raised via a spring-loaded hinge system (with the key held by CCC) to form a solid wall with the adjacent stone and glass walls. During normal conditions, when lowered, they will provide gaps in the new wall for access from the road onto the promenade. The existing 'up-and-over' steps will be removed when the existing wall is removed and will not be replaced. The gaps in the wall provided by the tilt barriers will provide a new form of improved access, as access will be wider and less steep than the existing steps, as well as providing disabled access.

The tilt barriers will be made of a dark grey painted metal frame and will have differing dimensions dependent on their locations as described in the list above. The tilt barriers will all have a crest level of 5.2mOD, with the tops of the barriers in line with the crest of the flood wall. As the barriers will be walked on by pedestrians when they are not being used, the barriers will have a non-slip epoxy resin bound gravel/sand surface.

The selection of the locations of the tilt barriers took into consideration comments received from the public consultation. At the eastern end of Quay Parade, a barrier has been proposed rather than extending the wall to the Hive café, as a wall would make vehicle and offloading deliveries to the café difficult. At the Harbourmaster Hotel, it was identified that a nearby access point from the hotel to the promenade would be of benefit for this local business as well as being positioned opposite the restaurant windows of the Harbourmaster. The smaller tilt barrier opposite the driveway adjacent to property number 5 was selected as it avoids an access point being located directly outside a private property, and is in the location of the existing steps over the wall. The fourth tilt barrier at the entrance to the North Pier is required to maintain access onto the pier.

There will be a slight change to the 4m wide promenade on the seaward side of the new wall, and to the footway on the landward side. In both locations, the concrete footpath will be reinstated on completion and the cobbled pavement edges of the existing wall will be retained. Lamp posts will however, be relocated in the same location, but onto the highway (landward) side of the wall to improve maintenance access and added protection from water ingress, and to provide for the potential to increase the number of benches that could be provided on the seaward side. A 50mm diameter drainage channel will extend from the recessed area of the tilt barriers to the quay wall, discharging any water in the recessed area into the sea.

There will also be some repairs made to the full length of the quay wall facing into the harbour (Drawing 5004). This will involve horizontal drilling of 35mm holes into the face of the wall in a diamond staggered pattern. Plastic tubes will be inserted into the holes and injected with 1:2 lime/cement grout to stabilise the wall.

Further improvement works on the road area of Quay Parade are not included in this Scheme and will be covered by CCC in a separate scheme in the future. These are likely to include improvements to parking and pedestrian access.

Construction Method

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 on the landward side of the wall following construction. 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 seaward side of 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 between stainless steel columns fixed 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.

3.1.4 Flood Wall: Pwll Cam to the Monachty Hotel

Physical Characteristics

Between the eastern side of Pwll Cam and the Monachty Hotel, a section of rock revetment currently fronts the harbour where there is no flood wall at present. A 55m section of new wall with a level of 5.2mOD will be constructed at the back of the revetment to increase protection from wave overtopping. The wall will be made of concrete with a stone masonry cladding and 700mm high glass on top. To the west of the entrance channel to Pwll Cam, and adjacent to The Hive, a short 10m long section of wall will also be raised to 5.2mOD with glass panels fixed between stainless steel columns. A new flood gate will also be constructed across the entrance to Pwll Cam, and this is discussed in section 3.1.6.

The new flood wall will extend to the east beyond the footbridge adjacent to the River Aeron and up to the A487 road bridge. Where the footbridge creates a 'break' in the wall alignment, a tilt barrier will be erected at the bridge opening on both ends of the bridge, so that a solid defence line is provided during a storm event when the tilt barrier is raised. The tilt barrier will be at least 2m wide with a level of 5.2mOD. Its design will be the same as for the tilt barriers at Quay Parade, that being a grey painted metal frame with a non-slip epoxy resin bound gravel/ sand surface. To the east of the footbridge, the wall will continue and be joined with an existing wall which stretches from the rear of the Monachty Hotel to the A487 road bridge. This stretch of wall will be removed and rebuilt as discussed in the section below.

As noted above, the landward side of the new Pwll Cam wall, improvements to the public realm will be made, including constructing a raised terrace to enable views over the new wall. The current surface level is 3mAOD and part of this will be raised using imported crushed rock fill and concrete to a level of 4.2mOD. From this level, three steps will be constructed down to the existing quayside, with the existing access ramp retained for people with limited mobility who are unable to use the steps. The existing concrete bollards will also be removed. Seating, picnic benches and bins that are removed for the improvements will also be relocated around the harbour.

Construction Method

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 both the entrances 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.

3.1.5 Flood Walls: Monachty Hotel to the A487

Physical Characteristics

The existing wall from the footbridge to the property adjacent to the Monachty Hotel will need to be removed and rebuilt to a higher level. This will require a new piled foundation, with a concrete base and a masonry concrete wall clad with glass panels on top. The design will be consistent with the appearance of the wall along Quay Parade and from the footbridge to Pwll Cam and will have a crest level of 5.2mOD. The wall in front of Toad Hall, which is the property to the east of the Monachty Hotel will be the same construction above ground level, but will require a sheet pile foundation below ground.

The section of existing masonry wall from the property adjacent to the Monachty Hotel up to the A487 road bridge adjacent to the River Aeron will remain in situ, but will be raised from an existing level of 3.8m to 5.2mOD. The wall will be raised by constructing a new reinforced concrete capping beam on to the top of the wall to a level of 4.15mOD, with 1,050mm high reinforced glass panels erected on the top with intermediate stainless steel posts. The western end of the wall will be joined with the new wall being constructed between Pwll Cam and the Monachty Hotel as described in the section above.

The glass will be the same as that used for the wall raising at Quay Parade, the only difference being that the panels will be larger at 1,050mm high compared to 700mm high at Quay Parade. The new finished wall heights will however both be the same at 5.2m AOD. The panels have been made slightly taller than at Quay Parade due to the close proximity of residential properties behind the wall. Some of the views from the ground floor windows of some of the properties is already partially obscured by the wall, therefore avoiding further stone wall raising was a key component of the design process. Also, the glass panels have been selected to raise the wall, rather than a solid stone wall, in order to reduce any reduction in natural light to these properties. CCC will maintain the glass panels, and in particular undertake inspections and cleaning where required after storm events.

Construction Method

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. Attached to the landward side 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 level 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.

3.1.6 Pwll Cam Flood Gate

Physical Characteristics

The inner harbour of Pwll Cam is connected to the main harbour via a stone walled channel. A cill on the channel bed pens water levels in Pwll Cam, maintaining a very shallow water depth at low tide in the inner harbour of several feet.

A new flood gate is proposed to be built across this entrance channel, so that during high spring tides and future storm events the gate can be closed, preventing an increase of water level and ingress of waves within Pwll Cam and subsequent overtopping into the car park and adjacent properties. The gate will be manufactured off site and will comprise of a dark coloured steel structure. A new reinforced concrete wall abutment with masonry facing will be built onto both sides of the existing entrance channel walls to provide a structure on which to attach the gate. These wall abutments will have a level of 5.4m AOD. Beneath the foundation will be a series of concrete or steel piles which will be driven into the seabed through pre-augered holes into the ground. These are required to take the weight and forces involved with opening and closing of the gate and retaining water. The gate will have a defence level of 5.2m AOD and will measure 6m wide. The existing channel wall level is 4.58m AOD on the Hive side and this will require glass panels to be installed into the wall to provide a defence level of 5.2m AOD.

The existing cill will be broken out and constructed in the location of the new gate so that when the gates are open, the dock is maintained at low tide. The cill will however, be lowered from 0.99mOD to 0.6mOD to allow for installation of the gate. This means that the water level in the dock at low tide, will be slightly lower than it is presently.

Construction Method

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 cill at the entrance to Pwll Cam will be removed by excavation using a saw cutter and excavator to remove existing concrete. A new concrete cill 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 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 on the gate and abutment. Further anchor bars will be drilled into the adjacent walls 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 into the harbour, with a crane positioned on the barge 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 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.

3.1.7 South Beach Improvements

Physical Characteristics

The works at South Beach involve the removal and replacement of the dilapidated timber groyne field, as well as the removal, replacement and extension of the existing rock revetment. The beach will also be replenished with shingle re-used from shingle materials excavated from the breakwater location as well as some from the South Beach revetment excavation. It is unlikely that there will be a need to import additional shingle for South Beach, but if this is required this would match the appearance and grading (size) of the existing shingle.

There are known to be three historic fish traps on the beach. These will be physically demarked to highlight their presence on South Beach during the works.

Groynes

The existing 6 timber groynes will be removed and replaced using a similar hardwood timber, on the same alignment. The groynes will have a length of between 45-60m and will extend from the base of the proposed rock revetment. At MLWS the groynes will be entirely exposed, with the majority of the groyne length submerged at MHWS.

The number of vertical posts needed for each groyne varies between 21 and 27 depending on the length of the groyne. Generally, the groynes are longest at the southern end of South Beach, decreasing in length towards the South Pier. Groyne 06 has the smallest number of posts at 21. The distance between each post will be approximately 2.3m. The timber vertical posts will vary in length depending on ground conditions but will generally be 10m long and will be driven to a maximum depth of 8.5m. Once driven into the ground, approximately 1.5m of the height of each post will be visible above the beach surface, however this height will vary depending on the changing beach levels over the different seasons. Timber planks will be attached horizontally to each post to form a solid structure.

Revetment

The existing rock revetment on South Beach extends from the small headland in the south to Groyne 04. The revetment is in a poor condition and is not providing the protection needed to reduce erosion and overtopping of the beach in this location. The existing rock size is also too small (1-4t) and strong waves have displaced many of the rocks, further weakening the function of the structure. The rock imported will be larger, in the 3-6t range.

It is proposed to remove the existing rocks and construct a new revetment on the same alignment with a slight extension up to Groyne 05. There is a short length of flood wall adjacent to Groyne 05 along Beach Parade, which will remain in situ. Similarly, the fish trap adjacent to Groyne 01 will not be disturbed during construction. The revetment will be 360m long and 20m wide at its base. Of the 360m length, 50m comprises the extension from the existing. The revetment will be 3.3m wide at the crest and laid at a 1 in 2 gradient down the beach. The crest of the revetment at the back of the beach will have a crest level of 6.9m AOD before sloping seaward. The toe of the revetment located at 3.35m AOD and will be buried into the existing beach to provide scour protection and account for change in beach levels. The base of the revetment will be covered with shingle recharge (see section below for further details), with only the middle and upper parts of the revetment exposed out of the sand.

Beach Renourishment

Material excavated from the base of the new breakwater will be used to recharge the northern section of South Beach, between the South Pier and parallel to Beach Parade, to Groyne 05. Material excavated from the revetment construction may also be used to recharge the beach from Groyne 05 down to the end of the beach in the south where it meets the headland. The material will be placed at a slope of 1 in 3.3. Sampling of the shingle nourishment has confirmed that it will have a similar appearance and particle size as the existing beach material. The total volume of recharged material is approximately 16,848m³. This comprises 8,848m³ of shingle from the revetment excavation and 8,000m³ from the breakwater excavation.

Construction Method

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 reducing sediment disturbance.

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 and shingle will be stockpiled for re-use, with the existing 1t rocks to be re-used for infilling 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 on-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 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.

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 will spread the material to the required 1 in 3.3 beach profile at low tide.

3.2 Programme and Working Hours

The works are scheduled to commence in winter 2021 and be completed by winter 2022, a total 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, nearly all of the 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 repair work to the surface slab at North Pier. There will be no work over Christmas, New Year and Easter public holiday and Bank Holidays.

3.3 Site Compound and Access Routes

The site compound will be located on a grass field in between Aberaeron Primary School and South Beach. The field is owned by CCC, whose offices are adjacent to the compound. Existing topsoil and grass will be removed in order to construct the compound. A temporary gravel access track will be constructed from the car park of the Ceredigion County Council offices to the compound area. A ramp will also be constructed from the site compound onto the beach to enable machinery to access South Beach. Removal of topsoil and grass in the field for the site compound will be required. Both the site compound and gravel track will be removed following construction, and the area re-turfed and grassed, returning it to its existing condition. The ramp onto the beach will also be removed.

The site compound will be used to store construction materials, plant and machinery, site offices and basic welfare facilities for the contractors (kitchen/toilets). The site compound will be secured by a solid boundary fence comprising hoarding with plywood sheets around its perimeter and will be locked at night. The site office units will also be locked at night. Signs will be erected on the fences of the compound and around the site offices to inform the public of the works.

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.

3.3.1 Construction Traffic

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 as 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 Ceredigion County Council offices. Due to the shared use of the entrance road with Ceredigion County Council, a 10mph speed limit shall be in force and council employees informed of the presence of heavy construction vehicles. Movement of plant to and from the site compound will be carried out between 7am and 7pm.

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, where it will anchor offshore of Aberaeron for approximately 1-2 weeks before setting sail for another load. A shallow draught tipper boat or barge of 1,000-3,000t capacity will travel with the main vessel and the rock armour will be transferred individually from the main ship onto the tipper boat 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 sea bed. There will be no beaching of the boat. It is estimated that 10-20 journeys to and from the main ship will be required. A total of up to 4 return trips are estimated to be required by the main ship to and from the quarry.

As described earlier, for the construction of the new breakwater, South Pier refurbishment and South Beach improvements, plant will transport material and equipment from the site compound to these areas via the beach. The contractors will track across the beach keeping above the line of MHWS as far as is practical in order to reduce disturbance to any intertidal habitat and to reduce mobilisation of sediment into the water.

During construction, access to South Beach will be restricted to maintain public safety. Access to North Beach will be maintained throughout the construction period.

For the harbour wall raising at Quay Parade, materials will be transported from the site compound, along the A487, down Regent Street/Lower Regent Street, then along Tabernacle Street, turning into Cadwgan Place and onto Quay Parade. Once on Quay Parade, vehicles will generally exit the site location in a loop, via Ship Street and turning onto Waterloo Street, then onto Tabernacle Street, before returning to the site compound via Market Street and the A487. Alternatively, they might do a three-point turn and exit via Cadwgan Place. Market Street is currently operating a one-way system, hence only being able to use this route on the return trip to the site compound, as is Regent Street, hence only being able to be used for transport to Quay Parade. These one-way systems are in place as part of CCC's covid-19 Safe Zones to help maintain social distancing. Further details can be found in Section 15.2 in the traffic and transport assessment.

For the wall raising opposite the Monachty Hotel and up to the A487 road bridge, access to this area is likely to be via Market Street and the Harbour carpark.

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 CCC as the harbour authority with regards the need for preparing a Notice to Mariners informing them of this aspect of the works. 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.

3.4 Operation and Maintenance

Following construction, the temporary cofferdams for the Pwll Cam flood gate and any temporary works on the River Aeron flood wall will be removed, as will the temporary access route in Pwll Cam used for the gate construction. The site compound, gravel access track and ramp onto the beach from the compound will also be removed. The field used for the site compound will be re-turfed and grassed and returned to its existing condition.

Navigational markers will be installed around the new breakwater and signage will be provided relating to health and safety public use of the breakwater footpath. CCC will also give consideration to the provision of life rings at appropriate locations.

Following construction, CCC will carry out regular maintenance of all elements of the scheme. CCC will also be responsible for raising and lowering the tilt barriers and operating the flood gate during flood events. The Pwll Cam flood gate will be operated from the control kiosk.

Numerical modelling of the breakwater has indicated that sediment accretion may occur at the distal end of the breakwater and in the harbour channel. Further assessment of this can be referred to in Chapter 12 Coastal Processes. CCC will undertake monitoring of seabed levels following construction, to ensure that navigation into the harbour is maintained and that important habitats are not significantly adversely impacted (reference should be made to Chapter 9 (Ecology) for further details on habitats). Maintenance dredging or removal of sediment would be carried out in consultation with NRW if accretion continued at a pace considered to be detrimental to marine habitats and navigational access.

3.5 Biodiversity Enhancements

The following biodiversity enhancements have been incorporated into the Scheme design. These enhancements have been discussed with ecologists at CCC.

3.5.1 Meadow Species

Prior to construction, seeds from the field proposed for use as the site compound will be collected and stored for re-planting as part of the post-construction reinstatement of the site compound area. To enhance species diversity in the field, additional meadow species will be sourced, increasing biodiversity and habitat potential in the field. CCC is undertaking a species survey in the field this summer, and the results from this survey will help to determine which plant species would complement and benefit biodiversity.

Additionally, some of the seeds collected prior to the site compound being installed, will be set aside for re-planting at other sites within Ceredigion, to help increase biodiversity outside of the Scheme area. These sites will be selected in consultation with CCC ecologists. Site considerations will include verges on highway road schemes, areas along the Wales Coast Path and potentially at old tip sites.

3.5.2 Otter Migration

The Scheme will enhance otter migration by improving connectivity between the River Aeron and the sea, the latter of which provides an important foraging area for otters. This will be done by extending the existing wall ledge on the northern bank of the river further downstream. Currently the ledge stops just upstream of the footbridge, and therefore the proposal is to extend this ledge further downstream of the footbridge to the entrance of Pwll Cam dock. Provision of a ledge will enable otters to better migrate back upstream during periods of high water and reduce them being forced onto dry land and towards busy roads.

3.5.3 Kestrel Box

A replacement landing ledge/stick will be installed on the kestrel box located in the grounds of CCC's office at Penmorfa in Aberaeron. Kestrels are protected under the Wildlife and Countryside Act 1981 (as amended) and in order to assist with the decline in numbers of potential nesting sites, which may be a factor in limiting breeding success, nest boxes have been installed throughout Ceredigion. Fixing this nest box, will help to maintain use of the box for this important species.

3.5.4 Research and Monitoring

CCC is exploring opportunities for a research collaboration Scheme for marine biodiversity enhancement on the piers and breakwater. Whilst this would not necessarily be successful in enhancing biodiversity at Aberaeron (as species colonisation may or may not be successful), the research would contribute towards future understanding of biodiversity enhancement in the marine environment and possible future opportunities for successful biodiversity gain elsewhere.

3.5.5 CO₂ Sequestration

Opportunities for improving CO₂ capture will also be integrated into the Scheme through the planting of trees within Ceredigion, to help towards achieving Welsh targets to reduce greenhouse gas emissions. Discussions will be held with CCC ecologists to identify locations for planting and types of trees.

4 Planning Policy Context

4.1 Introduction

This chapter presents a summary of national and local planning policy relevant to the Scheme and explains how planning policy has framed Ceredigion County Council's approach to identifying the environmental effects of the Scheme and assessing their significance. Section 1.2 sets out the legislative framework that confers a requirement to undertake EIA of the proposed Scheme.

Reference should also be made to the Planning, Design and Access Statement, Atkins, May 2021.

4.2 National Policy

4.2.1 Future Wales - The National Plan 2040

Future Wales – the National Plan 2040 is the national development framework for Wales. It sets the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities.

Chapter 4 - Strategic and Spatial Choices: Future Wales' spatial strategy

The policies established in Future Wales are material considerations to decisions on planning applications. The policies in Future Wales relevant to this Scheme are set out below:

Policy 4 – Supporting Rural Communities

Policy 4 states that sustainable and vibrant rural communities must be supported by recognising the challenges faced, moreover the Welsh Government supports sustainable and vibrant rural communities. Strategic and Local Development Plans should identify their rural communities, assess their needs and set out policies that support them. Policies should consider how age balanced communities can be achieved, where depopulation should be reversed and consider the role of new affordable and market housing, employment opportunities, local services and greater mobility in tackling these challenges.

Policy 5 – Supporting the rural economy

Policy 5 states that the Welsh government supports sustainable, appropriate and proportionate economic growth in rural towns that is planned and managed through Strategic and Local Development Plans. Strategic and Local Development Plans must plan positively to meet the employment needs of rural areas including employment arising from the foundational economy; the agricultural and forestry sector, including proposals for diversification; start-ups and micro businesses. In particular, the Welsh Government strongly supports the broadening of the rural economy base through the development of innovate and emerging technology businesses and sectors, which can be supported with the increasing ability to work from home.

Foundational economic activities remain the backbone of the rural economy. In particular, tourism and leisure is recognised as a major and growing employer and contributor to the Welsh rural economy. Sustainable forms of tourism, including opportunities for active, green and cultural tourism, should be explored. Planning authorities should support new development and opportunities to improve or develop rural supply chains and distribution networks.

Policy 8 – Flooding

Policy 8 states that flood risk management will be used to support sustainable strategic growth and regeneration in National and Regional Growth Areas, prioritising development in Growth Areas with

no flood risk. The Welsh Government will work with Flood Risk Management Authorities and developers to plan and invest in new and improved infrastructure, promoting nature-based solutions as a priority to improve the protection of developed land and opportunities for Growth Areas. Flood management infrastructure investments must maximise social, economic and environmental benefits; and not have an adverse impact on international and national statutory designated sites for nature conservation and the features for which they have been designated.

Policy 9 – Resilient Ecological Networks and Green Infrastructure

Policy 9 emphasises the importance of the enhancement of biodiversity, the resilience of ecosystems and the provision of green infrastructure, alongside the strategic focus of FW on urban growth. This policy states this will be achieved by the Welsh Government working with key partners to:

- Identify areas which should be safeguarded, in Strategic and LDPs, and created as ecological networks or their importance for adaptation to climate change, for habitat protection, restoration or creation, to protect species, or which provide key ecosystems services, to ensure they are not unduly compromised by future development; and
- identify opportunities where existing and potential green infrastructure could be maximised as part of placemaking, requiring the use of nature-based solutions as a key mechanism for securing sustainable growth, ecological connectivity, social equality and well-being.

Natural Resources Wales produces indicative maps illustrating natural resource themes, as illustrated below, and should be used as a starting point for considering the resilient ecological networks and green infrastructures. Area statements should identify the strengths and opportunities to strengthen ecological networks. Any priority areas for action identified in Area Statements are a material planning consideration and development plans should set out appropriate policies to safeguard and connect these areas.

Chapter 5 The Regions

This Chapter recognises that regional planning will play an increasingly important role in the future and is central to the Welsh Government's vision for a three tiered planning system. Wales' four regions provide a focus for Welsh Government policy and future investment. Each region has its own distinctive opportunities and challenges. Embracing these through more effective regional collaboration will lead to better outcomes for all parts of Wales and create a fairer distribution of wealth and opportunity. Aberaeron falls within the Mid Wales Region which covers Ceredigion, Powys and the majority of the Brecon Beacons National Park.

Policy 25 – Regional Growth Areas – Mid Wales

The Welsh Government supports sustainable growth and development in a series of inter-connected towns across the region. Development in these Regional Growth Areas should meet the regional housing, employment and social needs of Mid Wales. The Regional Growth Areas are:

- The Teifi Valley, including Cardigan, Newcastle Emlyn, Llandysul and Lampeter
- Brecon and the Border
- The Heart of Wales, including Llandrindod Wells and Builth Wells
- Bro Hafren, including Welshpool and Newtown
- Aberystwyth

The Welsh Government supports development in all parts of the region in meeting local needs. Strategic and Local Development Plans will determine the most appropriate locations for growth in Mid Wales and should demonstrate how a regional approach has informed decisions on future growth.

Whilst the Aberaeron is not identified as Regional Growth Area, it is recognised as an important tourism, recreation and leisure location. It is also recognised as a key administrative area.

4.2.2 Environment (Wales) Act 2016

The Environment (Wales) Act concerns the sustainable management of natural resources in Wales. It also places a duty on Welsh Ministers to set targets for reducing greenhouse emissions and to set carbon budgets.

The key parts of the act relevant to the Scheme are:

Part 1: Sustainable management of natural resources – enables Wales’ resources to be managed in a more proactive, sustainable and joined-up way. It also helps to tackle the challenges we face and is focused on the opportunities our resources provide.

Part 2: Climate change – provides Welsh Ministers with powers to put in place statutory emission reduction targets. This was amended by Regulations in 2021 to set a 100% reduction target (net zero), supported by Regulations setting out interim targets and carbon budgeting to support this target.

The Biodiversity and Resilience of Ecosystems Duty – Section 6

Section 6 under Part 1 of the Environment (Wales) Act introduced an enhanced duty (the S6 duty) for public authorities in the exercise of functions in relation to Wales.

The S6 duty requires that public authorities must seek to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems. In doing so, public authorities must have regard to the list of species and habitats published under section 7, the State of Natural Resources Report (SoNaRR) and any relevant Area Statement(s).

To follow the S6 duty public authorities should embed the consideration of biodiversity and ecosystems into their early thinking and business planning, including any policies, plans, programmes and Schemes, as well as their day to day activities.

4.2.3 Planning Policy Wales

Planning Policy Wales (PPW) (Edition 10, December 2018) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales.

The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015 and the Well-being of Future Generations (Wales) Act 2015. These goals are set out in Table 4-1.

Table 4-1 Welsh Wellbeing Goals

Goal	Description
A prosperous Wales	An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.
A resilient Wales	A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).

A healthier Wales	A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.
A more equal Wales	A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio-economic background and circumstances).
A Wales of cohesive communities	Attractive, viable, safe and well-connected communities.
A Wales of vibrant culture and thriving Welsh language	A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.
A globally responsible Wales	A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

The policies established in PPW are material considerations to decisions on planning applications. These policies are set out in PPW in paragraphs over chapters 2-6.

Chapter 2 – People and Places: Achieving Well-being Through Placemaking

Creating sustainable places is the goal of the land use planning system in Wales. Sustainable places are the output of the planning system rather than the process of achieving them. All development decisions, either through development plans, policy choices, or individual development management decisions should seek to contribute towards the making of sustainable places and improving well-being.

The key sections of this chapter which relate to the Scheme are set out in Table 4-2.

Table 4-2 Relevant PPW Sections from Chapter 2

Section	Policy
Key Planning Principles	The five Key Principles of Collaboration; Prevention; Long-term Vision; Involvement; and Integration represent a guiding vision for all development plans. These principles support the culture change needed to embrace placemaking and ensure that planning facilitates the right development in the right place.
Planning Policy Wales and Placemaking	At a strategic level, traditional planning policy topics can be clustered around four themes which contribute individually to placemaking: • Strategic & Spatial Choices; • Productive & Enterprising Places; • Distinctive & Natural Places; and • Active & Social Places. These themes draw together the linkages between planning policies to make it clear how individual components contribute to placemaking.

Chapter 3 – Strategic and Spatial Choices

Effective strategic placemaking requires early collective consideration of placemaking issues at the outset, in the formulation of a development plan, or when developing specific proposals. It should be noted that the policy issues should not be considered in isolation from one another. This includes

considering the design of a development and its impacts upon everyday lives as well as thinking holistically about where people might live and work and which areas should be protected. These crucial, early decisions will have the greatest impact on the type of development which is ultimately delivered and its contribution to sustainable development and the environmental, social, cultural and economic well-being of Wales.

The key sections of this chapter which relate to the Scheme are set out in Table 4-3.

Table 4-3 Relevant PPW Sections from Chapter 3

Section	Policy
Placemaking in Action	Good design is fundamental to creating sustainable places where people want to live, work and socialise. Design is not just about the architecture of a building but the relationship between all elements of the natural and built environment and between people and places. To achieve sustainable development, design must go beyond aesthetics and include the social, economic, environmental, cultural aspects of the development, including how space is used, how buildings and the public realm support this use, as well as its construction, operation, management, and its relationship with the surrounding area. Design is an inclusive process, which can raise public aspirations, reinforce civic pride and create a sense of place and help shape its future. For those proposing new development, early engagement can help to secure public acceptance of new development. Existing infrastructure must be utilised and maximised, wherever possible. Where new infrastructure is necessary to mitigate transport impacts of a development and to maximise accessibility by sustainable non-car modes, it should be integrated within the development layout and beyond the boundary, as appropriate.

Chapter 4 – Active and Social Places

Active and Social Places are those which promote social, economic, environmental and cultural well-being by providing well-connected cohesive communities. Places which are active and social contribute to the seven goals of the Well-being of Future Generations Act, these being: a prosperous Wales; a resilient Wales; a healthier Wales; a more equal Wales; more cohesive communities; a vibrant culture and thriving Welsh language; and a globally responsive wales.

The key sections of this chapter which relate to the Scheme are set out in Table 4.4.

Table 4-4 Relevant PPW Sections from Chapter 4

Section	Policy
Moving within and between places	The planning system should enable people to access jobs and services through shorter, more efficient and sustainable journeys, by walking, cycling and public transport. Planning applications for developments, including changes of use, falling into the categories identified in TAN 18: Transport must be accompanied by a Transport Assessment.
Recreational Spaces	Recreational spaces are vital for health, well-being, amenity and can contribute to an area's green infrastructure. Networks of high quality, accessible green spaces and recreation spaces will also promote nature conservation, biodiversity and provide enjoyable opportunities for residents and visitors to participate in a wide range of physical activities. These activities are important for the well-being of children and adults and for the social, environmental, cultural and economic life of Wales.

Chapter 5 – Productive and Enterprising Places

Productive and Enterprising Places are those which promote economic, social, environmental and cultural well-being by providing well-connected employment and sustainable economic development. These places are designed and sited to promote healthy lifestyles and tackle climate change.

The key section of this chapter to this proposal is tourism as this is a key consideration for Aberaeron.

Table 4-5 Relevant PPW Sections from Chapter 5

Section	Policy
Productive and Enterprising Placemaking and Well-being	The key issues relating to the Scheme in this theme include: - capitalising on distinctive tourism offer to promote Wales to the world, creating high quality jobs in this sector which enhance skills and provide employment year-round; - responding to the challenges of supporting and enabling adaptation in the built environment to embed circular economy principles into design choices, site selection, treatment and associated construction practices.
Economic Infrastructure	Infrastructure, be it physical, electronic or digital, plays a pivotal role in maintaining the economic well-being of Wales. It enables people to connect and interact with each other, either in person or electronically, to increase prosperity.
Tourism	Much of the existing provision of facilities and accommodation for tourism occurs in urban locations, including historic and coastal towns and cities. There will be scope to develop well-designed tourist facilities in urban areas, particularly if they help bring about regeneration of former industrial areas. The sensitive refurbishment and re-use of historic buildings also presents particular opportunities for tourism facilities in all areas Planning authorities should provide a framework for maintaining and developing well-located, well designed, good quality tourism facilities. They should consider the scale and broad distribution of existing and proposed tourist attractions and enable complementary developments such as accommodation and access to be provided in ways which limit negative environmental impacts as well as consider the opportunities to enhance biodiversity.

Chapter 6 – Distinctive and Natural Places

The Distinctive and Natural theme covers environmental and cultural components of placemaking. These components are complementary to those of the Active and Social and Productive and Enterprising themes and collectively the three themes come together to contribute towards the national sustainable placemaking outcomes.

Table 4-6 Relevant PPW Sections from Chapter 6

Section	Policy
The Historic Environment	The historic environment comprises all the surviving physical elements of previous human activity and illustrates how past generations have shaped the world around us. It is central to Wales's culture and its

Section	Policy
	character, whilst contributing to its sense of place and identity. It enhances quality of life, adds to regional and local distinctiveness and is an important economic and social asset. The historic environment is made up of individual historic features which are collectively known as historic assets. Examples of what can constitute an historic asset include: • Listed buildings; • Conservation areas; and • Townscapes.
Listed Buildings	The demolition of any listed building should be considered as exceptional and require the strongest justification.
Conservation Areas	There should be a general presumption in favour of the preservation or enhancement of the character or appearance of conservation areas or their settings. Positive management of conservation areas is necessary if their character or appearance are to be preserved or enhanced and their heritage value is to be fully realised.
Green Infrastructure	The Environment (Wales) Act 2016, provides a context for the delivery of multi-functional green infrastructure. Its provision can make a significant contribution to the sustainable management of natural resources, and in particular to maintaining and enhancing biodiversity and the resilience of ecosystems in terms of the diversity between and within ecosystems and the extent, condition and connectivity of ecosystems and their ability to adapt.
Landscape	All the landscapes of Wales are valued for their intrinsic contribution to a sense of place, and local authorities should protect and enhance their special characteristics, whilst paying due regard to the social, economic, environmental and cultural benefits they provide, and to their role in creating valued places.
Coastal Areas	Climate change exacerbates the challenges faced in coastal places resulting in losses of protected habitat, through 'coastal squeeze', or the loss of features which protect against inundation, such as sand dunes, as well as consequential effects on recreational beaches, people and property.
Water and Flood Risk	Climate change is likely to increase the risk of flooding as a result of sea-level rises, increased storminess and more intense rainfall. Flooding as a hazard involves the consideration of the potential consequences of flooding, as well as the likelihood of an event occurring. The continued construction of hard engineered flood defences to protect development in areas of floodplain is not sustainable. Government resources for flood and coastal defences are directed at

Section	Policy
	protecting existing developments and are not available to provide defences in anticipation of future development. Development should reduce, and must not increase, flood risk arising from river and/or coastal flooding on and off the development site itself. The priority should be to protect the undeveloped or unobstructed floodplain from development and to prevent the cumulative effects of incremental development.

4.2.4 Welsh National Marine Plan (November 2019)

The Welsh National Marine Plan (WNMP) is the first marine plan for Wales and represents the start of a process of shaping the country's seas to support economic, social, cultural and environmental objectives. Marine planning will guide the sustainable development of Wales's marine area by setting out how proposals will be considered by decision makers.

The WNMP is a marine plan for the inshore and offshore Welsh marine plan regions. It was prepared and adopted under the Marine and Coastal Access Act (MCAA) 2009 for the purposes of Section 51 of the MCAA and in accordance with Schedule 6 of the MCAA and in conformity with the UK Marine Policy Statement (MPS). The WNMP and supporting material should be used by applicants to shape proposals and licence applications, public authorities to guide decision making, and other users to understand Welsh Government's policy for the sustainable development of the Plan area. The relevant policies which have been considered in the development of this Scheme are outlined in Table 4-7 below.

Table 4-7 Welsh National Marine Plan Policies

Policy	Policy Overview
GEN_01: Planning policy	There is a presumption in favour of the sustainable development of the plan area in order to contribute to Wales' well-being goals.
ECON_01: Sustainable economic growth	Proposals for economically sustainable activities are encouraged, particularly where they contribute to: - the sustainable management of natural resources thereby supporting ecosystem resilience; - a more resilient economy; - employment opportunities particularly for coastal communities; - protecting and creating employment at all skill levels; - maintaining communities with a high-density of Welsh speakers; and/or - tackling poverty by supporting deprived coastal communities.
SOC_01: Access to the marine environment	Proposals that maintain or enhance access to the marine environment are encouraged.
SOC_02: Well-being of coastal communities	Proposals that contribute to the well-being of coastal communities are encouraged.

Policy	Policy Overview
SOC_05: Historic assets	Proposals should demonstrate how potential impacts on historic assets and their settings have been taken into consideration and should, in order of preference: - avoid adverse impacts on historic assets and their settings; and/or - minimise impacts where they cannot be avoided; and/or - mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Opportunities to enhance historic assets are encouraged
SOC_08: Resilience to coastal change and flooding	Proposals should demonstrate how they are resilient to coastal change and flooding over their lifetime.
SOC_09: Effects on coastal change and flooding	Proposals should demonstrate how they: - avoid significant adverse impacts upon coastal processes; and - minimise the risk of coastal change and flooding; Proposals that align with the relevant Shoreline Management Plan(s) and its policies are encouraged.
SOC_11: Resilience to climate change	Proposals should demonstrate that they have considered the impacts of climate change and have incorporated appropriate adaptation measures, taking into account Climate Change Risk Assessments for Wales. Proposals that contribute to climate change adaptation and/or mitigation are encouraged.
ENV_01: Resilient marine ecosystems	Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference: - avoid adverse impacts; and/or - minimise impacts where they cannot be avoided; and/or - mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.
ENV_02: Marine Protected Areas	Proposals should demonstrate how they: avoid adverse impacts on individual Marine Protected Areas (MPAs) and the coherence of the network as a whole;

Policy	Policy Overview
	• have regard to the measures to manage MPAs; and • avoid adverse impacts on designated sites that are not part of the MPA network. There are a number of site designations outside the MPA network that could potentially be impacted by activities occurring in the marine and coastal environment. Such designations include SSSIs, SACs and SPAs covering a range of protected terrestrial biodiversity and geological features. Under the provisions of the Wildlife and Countryside Act 1981, proposals should consider whether there may be any impacts to SSSIs as a result of works undertaken.

4.2.5 Technical Advice Notes (TAN)

As noted above, the Welsh Government has prepared a series of Technical Advice Notes (TAN) which supplement PPW. The relevant TANs which have been considered are outlined in Table 4-8:

Table 4-8 Technical Advisory Notes

Technical Advisory Note	Policy Overview
TAN 5: Nature Conservation and Planning (2009)	TAN 5 provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity and geological conservation. Where the importance of the development is judged to outweigh the adverse effect upon the integrity of the European site or European offshore marine site, compensatory measures must be taken to protect the overall coherence of the Community-wide network of SPAs and SACs known as Natura 2000
TAN 6: Planning for Sustainable Rural Communities (2010)	The purpose of TAN 6 is to provide practical guidance on the role of the planning system in supporting the delivery of sustainable rural communities. The TAN provides guidance on how the planning system can contribute to sustainable rural economies.
TAN 11: Noise (1997)	TAN 11 provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.
TAN 12: Design (2016)	The purpose of TAN 12 is to equip all those involved in the design of development with advice on how 'Promoting sustainability through good design' and 'Planning for sustainable building' may be facilitated through the planning system.

Technical Advisory Note	Policy Overview
TAN 13: Tourism (1997)	TAN 13 outlines the importance of tourism to the Welsh economy. It should be noted that the character and setting of Aberaeron make it a desirable and popular place for tourists to visit. This means protecting the town is fundamental to its future and provides resilience to the area into the future.
TAN 14: Coastal Planning (1998)	TAN 14 highlights the complexities that surround coastal zones, particularly with regards to developments which fall outside of the low water mark, in this schemes case, the breakwater. The TAN highlights three specific themes which relate to coastal zones that the planning system should address, these are: i. Proposals for the development; ii. Nature and Landscape Conservation; and iii. Recreation. The TAN highlights that construction of sea defences often leads to increased pressure for development, but such defences only reduce the level of risk. However, the need for this Scheme is to protect a historic town. Moreover, the improved defences will protect the town and will not protect the wider area which could accommodate further development.
TAN 15: Development and Flood Risk (2004)	This TAN provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding. It provides a framework within which risks arising from both river and coastal flooding, and from additional run-off from development in any location, can be assessed.
TAN 18: Transport (2007)	TAN 18 focuses on producing an efficient and sustainable transport system which is a requirement for a modern, prosperous and inclusive society.
TAN 23: Economic Development (2014)	TAN 23 recognises that it is important that the planning system recognises the economic aspects of all development and that planning decisions are made in a sustainable way which balance social, environmental and economic considerations.
TAN 24: The Historic Environment (2017)	TAN 24 provides guidance on how the planning system considers the historic environment during development plan preparation and decision making on planning and Listed Building (LBC) applications. This TAN provides specific guidance on how the following aspects of the historic environment which are relevant to the Scheme should be considered: • Archaeological remains; • Listed buildings; • Conservation areas; and • Historic assets of special local interest. The Planning (Listed Buildings and Conservation Areas) Act 1990 requires any works of demolition, alteration and/or extension which

Technical Advisory Note	Policy Overview
	would affect the character of a listed building to be authorised through the process of listed building consent. It is a criminal offence to carry out such works without consent, which should be sought from the local planning authority. When considering any applications for listed building consent, the local planning authority must have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses.

4.3 Local Policy

4.3.1 Local Development Plan 2007-2022

CCC adopted the Local Development Plan (LDP) in April 2013. The LDP sets out the key issues identified for Ceredigion to 2022. The key issues can be identified within several themes as follows:

1. Level and type of growth;
2. Distribution of growth/development;
3. Form of growth;
4. Community;
5. Welsh Language;
6. Environment and Climate Change; and
7. Infrastructure and Services.

Moreover, Sections 6-8 set out the LDP Strategy for realising the Vision and Objectives along with the policies that underpin and deliver the Strategy. Section 6 'The Strategy' sets out the Plan's Strategy as to how the Ceredigion LDP Vision and Objectives will be achieved. It sets out the broad intention for managing change and indicates the level of provision to be made for the main growth sectors – which in relation to Ceredigion are employment and housing.

Section 6 The Strategy and 'S' Policies

Whilst Section 6 relates to employment and housing, it should be noted that the overall strategy is to improve the sustainability of the County, including protecting and enhancing the County's environment and resources, and to ensure that through change the County is made more resilient economically, socially and environmentally. Growth in Ceredigion will be focused on the Urban Service Centres (USC) of which Aberaeron is one. The relevant policy applicable to the Scheme is listed in Table 4-9.

Table 4-9 Local Development Plan Relevant Policies

Policy	Policy Overview
Policy S02: Development in Urban Service Centres (USCs)	Urban Service Centres provide sustainable locations where development will be permitted which in relation to Aberaeron: a) Contributes to their overall sub-regional role as set out in the Settlement Group Statements; and b) Contributes to their regeneration strategies, where these exist. Development in Aberaeron will be permitted if it is within the defined settlement boundary, accords with the provisions of the Settlement Group Statement and satisfies all other Plan policies.

Section 7 Specific Types of Land Use Proposals (LU Policies)

Section 7 'Specific Types of Land Use Proposals' sets out policies that need to be taken into account in relation to specific types of land use proposals e.g. retail or tourism. The Section is split according to land use type e.g. housing, employment, retail etc.

Tourism is one of the County's main employment sectors. The County's attractiveness as a tourist destination is heavily based on its outstanding natural beauty. It is therefore important that this beauty is sustained. One of the Objectives of the LDP is to sustainably develop its tourism economy. Policies in this section help support this by:

- Encouraging the development of sustainable tourism;
- Assisting in improving the attractiveness of Ceredigion as a year-round tourism destination;
- Ensuring that tourism accommodation is developed in a sustainable manner and appropriately located; and
- Encouraging the provision of further tourism attractions and facilities.

Section 8 Development Management Policies (DM Policies)

Section 8 'Development Management Policies' sets out policy matters that need to be considered in relation to all development regardless of the type of use being proposed. Therefore, the policies in Section 8 can apply to development regardless of whether the application's nature. As such, the key policies relevant to the Scheme can be found in Section 8 of the LDP – Development Management Policies (DM Policies). A full list of policies applicable to the Scheme are listed in Table 4.10.

Table 4-10 Local Development Plan Relevant Policies

Policy	Policy Overview
DM03: Sustainable Travel	Development should minimize the need to travel, provide opportunity for and promote sustainable modes of transport in Ceredigion. A Transport Assessment should be provided at the thresholds set out in Transport Assessment SPG. Where the TA reveals the need for a Transport Implementation Strategy this will need to be secured through a planning obligation.
Policy DM04: Sustainable Travel Infrastructure as a Material Consideration	The protection, enhancement or complementary development of former or existing transport infrastructure with potential to provide for more sustainable travel will be a material consideration in all development.
Policy DM06: High Quality Design and Placemaking	Development should have full regard, and positively contribute to the context of its location and surroundings. Development should reflect a clear understanding of design principles, the local physical, social, economic and environmental context. Development should: • Promote innovative design whilst having regard to local distinctiveness and cultural heritage in terms of form, design and material; • Complement the site and its surroundings in terms of layout, respecting views into and out of the site, producing a cohesive form in relation to the scale, height and proportion of existing built form; • Have reference, where appropriate, to existing layout patterns and densities including changes of levels and prominent skylines; • Retain important natural features along with ensuring the use of good quality hard and soft landscaping and embracing opportunities to enhance biodiversity and ecological connectivity; • Provide a safe environment by ensuring that the design of buildings and associated routes and open spaces consider safety principles; • Contribute to the creation of mixed and socially inclusive communities that provide for the health, education, recreation, community services and facilities, and social needs of all sections of the community; • Protect the amenity of occupiers of nearby properties from significant harm in relation to privacy, noise and outlook;

Policy	Policy Overview
	• Encourage the re-use of materials wherever possible and ensure that new materials where used are sympathetic to the character of the locality; • Where practical, include infrastructure for modern telecommunications and information; and • Have regard to Settlement Group Statements, Supplementary Planning Guidance, Conservation Area Appraisals and any other relevant supporting documents.
Policy DM07: Conservation Areas	Development within Conservation Areas, as designated on the Proposal Map, and any future designated Conservation Areas must demonstrate that regard has been had to Conservation Area Appraisals, where available, and national guidance. This local policy reinforces the need to take into account Conservation Area Appraisal Reports in determining planning applications.
Policy DM09: Design and Movement	Development should be designed to secure a welcoming environment which encourages appropriate through movement. It should: • Be legible, providing a sense of place; • Reflect site function both in relation to its general location and within the site itself; and • Encourage active frontages at ground level where development is non-residential.
Policy DM10: Design and Landscaping	All applications, other than for householder developments, which will have an impact on the landscape should be supported by a landscaping scheme. The landscaping scheme should: • Demonstrate how the proposed development respects the natural contours of the landscape; • Demonstrate how the proposed development respects and protects local and strategic views; • Respect, retain and complement any existing positive natural features, landscapes, or other features on site; • Identify trees, hedgerows, water courses and topographical features to be retained; • Provide justification for circumstances where the removal/loss of existing trees, hedgerows, water courses and topographical features cannot be avoided and provides details of replacements; • Provide details of any proposed new landscaping together with a phased programme of planting; • Demonstrate that any proposed new planting includes plants and trees of mainly native species of local provenance and does not include any non-native invasive species within the landscaping; • Ensure that selection of species and planting position of any trees allows for them to grow to their mature height without detriment to nearby buildings, services and other planting; and • Provide permeable hard surface landscaping.
Policy DM11: Designing for Climate Change	The LDP will help ensure that development addresses the implications of climate change by requiring that: • justified development in the flood zone is resilient and adaptable to the effects of flooding; and • the long-term sustainability of the development has been taken into account.
Policy DM13: Sustainable Drainage Systems	In addition to requirements set out by national guidance, development will be permitted provided that: • Where a site is being developed on a plot-by-plot basis a scheme for an appropriate SUDS for the entire site is put forward as part of the first application;

Policy	Policy Overview
	• If the site is capable of being extended at a future date it should not be developed in such a way that future SUDS systems cannot be implemented; • Non-residential development of 500m² or more is accompanied by a SUDS that is capable of being adopted by the SUDS Approving Body; and • A management scheme is submitted detailing the maintenance of the SUDS scheme. If SUDS cannot be implemented a full written justification should be submitted explaining why this is the case.
Policy DM14: Nature Conservation and Ecological Connectivity	Development will be permitted where it protects and, where possible, enhances biodiversity, geodiversity and ecological connectivity across Ceredigion, including local sites and local priority species and habitats. Where it is appropriate to the scale and location of the development and opportunities exist, development should incorporate nature conservation education and access, providing the site's ecological or geological integrity can be safeguarded. In meeting the LDP's objectives, and its Vision for the County, it is important to preserve and where possible enhance biodiversity and geodiversity.
Policy DM15: Local Biodiversity Conservation	Development will be permitted where: • A step-wise approach is adopted to ensure there will be no significant negative effects to biodiversity and ecological connectivity both on-site and off-site; • Appropriate species, habitats and wildlife corridor/stepping stone enhancements have been incorporated into the development through good landscape and building design, or where applicable will be carried out offsite; • With regard to developments affecting LNRs, sites that meet SINC criteria and priority species and habitats, there is an overriding social, economic or environmental need for the development that outweighs the losses to biodiversity (after mitigation), the development could not reasonably be located elsewhere and these losses can be readily and fully compensated within the local area; and • Where necessary, management plans are produced and agreed with the LPA and developments phased to take into account mitigation and compensation measures.
Policy DM17: General Landscape	Development will be permitted provided that it does not have a significant adverse effect on the qualities and special character of the visual, historic, geological, ecological or cultural landscapes and seascapes of Ceredigion, the National Parks and surrounding area by: • causing significant visual intrusion; • being insensitively and unsympathetically sited within the landscape; • introducing or intensifying a use which is incompatible with its location; • failing to harmonise with, or enhance the landform and landscape; and /or • losing or failing to incorporate important traditional features, patterns, structures and layout of settlements and landscapes.
Policy DM19: Historic and Cultural Landscape	Development affecting landscapes or buildings which are of historical or cultural importance and make an important contribution to the character and interest of the local area, will be permitted where the distinctive appearance, architectural integrity or their settings will not be significantly adversely affected. Where possible development should enhance these qualities and special character.

Policy	Policy Overview
Policy DM20: Protection of Trees, Hedgerows and Woodlands	Development will be permitted providing: • it would not remove, damage or destroy trees, hedgerows or woodlands of visual, ecological, historic, cultural or amenity value unless the need of the proposed development outweighs these values; • it is able to mitigate or if necessary compensate for any negative impacts of the loss or damage; • it would achieve appropriate biodiversity gain; and • compensation and enhancement measures are mainly native species of local provenance and are not non-native invasive species.
Policy DM22: General Environmental Protection and Enhancement	In order to help achieve environmental protection and enhancement, proposed development will be permitted provided that: • It protects and enhances where possible air, soil and the water environment and safeguards water resources, both on and off site; • It does not have a significant adverse effect on noise and light levels, both on and off site; • A step-wise approach is adopted to ensure that it does not have a significant adverse effect on natural processes and ecosystem services, both on and off site, and, where possible, seeks to restore, achieve favourable condition of or enhance associated features.
Policy DM23: Coastal Management	Coastal management schemes will be permitted provided: • They are required for public safety; • They protect the socio-economic interests of the community; • All environmental effects have been considered and it would not contribute to, or transfer the risk of, flooding, coastal or river erosion, coastal inundation and coastal squeeze; • Facilities for recreation and leisure are provided, where appropriate; and • Public access can be provided, where appropriate and maintained where already in existence.

4.3.2 Replacement Local Development Plan (LDP 2 2018 - 2033)

Work on the review of the Ceredigion LDP, which was adopted in 2013, started in 2017. The Preferred Strategy was consulted on from: 28 June - Midday 12 September 2019. The Preferred Strategy is the first formal publication in the preparation process of the Replacement Local Development Plan (LDP2). The LDP2 contains:

- the main issues that the planning system need to address;
- vision for the County that can be delivered by land use planning;
- objectives to deliver the vision;
- the preferred strategy (the preferred approach to dealing with growth in terms of level and location of development); and
- a set of strategic policies which will help deliver the vision and objectives and therefore address the issues.

Due to unforeseen circumstances, the LDP2 appears to have been delayed. This is likely to be related to the COVID-19 pandemic. As a result of this, the document has not been developed at present. The key issues are reflective of the LDP as listed in section 1.3.1.

1. Level and type of growth;
2. Distribution of growth/development;
3. Form of growth;
4. Community;
5. Welsh Language;
6. Environment and Climate Change; and
7. Infrastructure and Services.

Further to the key issues Section 6 'The Strategy and 'S' Policies' have been carried over from the existing LDP. There are currently no other draft policies within the document.

4.4 Material Considerations

The following Supplementary Planning Guidance (SPG) produced by CCC is considered to be relevant to the Scheme. This section provides a brief overview of these documents.

4.4.1 Built Environment and Design SPG (2015)

This SPG aims to provide guidance on the issues that need to be considered when developing various buildings. This document is broken down into separate sections each based on a theme. Some themes can be read independently, others will need to be read in combination with other themes. The sections are as follows:

1. Sustainability;
2. Character;
3. Movement;
4. Landscape;
5. Extensions;
6. Shop Fronts; and
7. Sustainable Drainage Systems.

4.4.2 Transport Assessment SPG (2015)

This SPG is designed to reflect the particular nature of Ceredigion as a geographically large rural area with a legacy of substandard roads, limited public transport and a history of development proposals of a relatively small physical size by comparison with more urban areas of Wales.

The SPG recognises that Ceredigion has a widely dispersed population for whom the primary mode of transport continues to be the private motor vehicle. Therefore, developments which may not trigger concerns for trip generation in more compact urban locations in other Counties may be of concern for their impact in the context of Ceredigion.

4.4.3 Nature Conservation SPG (2015)

This SPG provides specific direction on how biodiversity should be conserved and enhanced throughout the town and country planning process. It demonstrates how to meet national planning policy at a local level as well as policies contained in the Ceredigion Local Development Plan and legal obligations. Biodiversity must be a key consideration in all development proposals as biodiversity conservation and enhancement has an integral part to play in planning for sustainable development.

4.5 Vulnerability to accidents and/or disasters

Disasters, accidents and incidents are not clearly quantified or defined by EIA regulations. It is currently a matter for professional judgement as to whether a potential event may be classified as major and therefore whether there is a need for assessment within EIA.

This section considers the vulnerability of the development to risks of major accidents and/or disasters or the potential for the development itself to result in major accidents or disasters, and the environmental effects of such events.

Major accidents and disasters comprise man-made and natural risks which are considered likely and anticipated to result in substantial harm that the normal functioning of the proposed improvements is unable to cope with/rectify - i.e. risks with the potential to have a significant effect. Major accidents and disasters which could potentially affect environmental receptors during construction or operation of the Scheme are set out below:

- Natural:
 - Extreme weather conditions either heat, drought, cold, rain, snow or high winds;
 - New, extreme or virulent pests, diseases or infestations;
 - Seismic events, earthquake etc; and
 - Major changes to groundwater levels.
- Man-made: Plane crash in the study area;

The Scheme will not include any potentially dangerous operation, such as the use of nuclear or dangerous chemical materials or processes. Some chemicals may be present on-site during construction, though risks associated with such materials will be adequately managed using ordinary construction site management practices.

Some types of civil infrastructure may be considered vulnerable to malicious incident such as a terrorist attack. It is not considered that the Scheme will increase the vulnerability of the coastal defences to a terrorist attack.

Major accidents and disasters that could potentially affect biodiversity resources include events that could result in direct damage of habitats, and injury or killing of individual animals or populations supported by those habitats, such as severe storms, spread of new plant diseases or plane crashes, and other events such as fires or releases that emit air pollutants.

Major accidents and disasters could damage the coastal defences which would then require repair or rebuilding. The severity of the accident or disaster would determine the scale of the required repairs, which would account for the quantity of waste and therefore the effect on the receptors. Any effect would be temporary and considered unlikely to significantly affect regional waste receptors.

Major accidents and disasters have the potential to adversely affect human health and controlled waters receptors, where existing contamination is identified or where future contamination is introduced. During the construction phase, there is greater potential for a major release of contamination to be transported to a source due to the introduction of new pathways, such as pilings or intrusive groundworks.

In summary, the Scheme is considered unlikely to result in a major accident / disaster or increase existing vulnerability to such events. Any environmental effects of such events are unlikely to be significant.

5 Stages of the EIA Process

5.1 Overview

EIA is a systematic process used to identify the potentially significant environmental impacts (both positive and negative) of proposed developments. The process also aims to influence development proposals to ensure that they are sustainable and are acceptable and beneficial to not only the developer, but also the community and the environment. The process ensures that the importance of the predicted effects and the scope for reducing them are properly understood before a development progresses. There are four main stages to the EIA process:

- **Screening:** the determination on whether an EIA is required. The developer can request a formal screening opinion from the relevant authority under the appropriate EIA legislation.
- **Scoping:** the determination of the environmental parameters (environmental receptors) that might be affected by, or have an influence on a development, and that should be considered in the EIA and documented in an Environmental Statement (ES).
 - Scoping should identify the key impacts that need to be considered in the environmental assessment. Part of the process is to scope in parameters that need to be considered and the level of detail at which they should be considered – not all parameters may need to be assessed to the same level of detail or geographic scale. Scoping should also scope out those parameters that do not need to be considered as part of the environmental assessment.
 - EIA legislation enables the developer to seek a formal scoping opinion from the relevant authorities to provide guidance on the information and level of detail to be provided in the Environmental Statement.
- **Impact assessment:** During this stage, consideration is given to each of the environmental receptors identified through the scoping process to see what the impacts of the development might be.
 - The aim of the assessment is to document the likely significant effects of the scheme on the environmental receptors both alone, together (cumulative) and in combination with the effects of other developments in the area. It should seek to determine ways in which adverse (negative) impacts can be identified and then avoided, reduced or mitigated and in which beneficial (positive) impacts can be increased. Any remaining (residual) impacts should also be assessed to determine if they are likely to be significant.
- **Reporting (Environmental Statement):** the output of the EIA process, which documents all that has been carried out as part of the EIA and contains all the information required by the relevant EIA legislation.

5.2 Screening and Scoping

The scope of issues that are addressed in this ES was determined during the screening/scoping stage of the Scheme, which took place in 2019 (refer to section 1.2). The scoping stage of an EIA identifies those aspects of the environment and associated issues that need to be considered when assessing the potentially significant environmental effects of a particular development. Scoping takes account of published guidance, the likely impacts of the type of development under consideration and the nature and importance of the environmental resources and receptors that could be affected. A key objective of the scoping process is to establish which aspects of the environment and associated issues are relevant to a development. Consultation with organisations and individuals with an interest in and knowledge of the Scheme and local area, combined with the professional judgment and experience of the EIA team, are essential to ensure the scoping exercise reaches the correct conclusions. Consultation also enables the Scheme team to confirm that information gathered to inform the forthcoming Environmental Statement is accurate. The results of the Scoping exercise are

reported within an EIA Scoping Report, which forms the basis of the terms of reference for the EIA. The Scoping Report for the Scheme was published in January 2019 and submitted to NRW to support them in the development of their EIA screening and scoping opinions. NRW used the report in their formal consultations with stakeholders.

The scoping exercise documented in the scoping report concluded that the following aspects of the environment could be significantly affected by the Scheme, and require further assessment as part of the EIA. These were:

- Physical environment (i.e. geomorphological processes)
- Ground conditions, soils and contamination
- Ecology and designations
- Historic environment
- Landscape, townscape, seascape and visual
- Noise and vibration
- Air quality
- Tourism and recreation
- Traffic and transportation
- Human health
- Climate change
- Socio-economics

The only aspect to be scoped out completely was Flood Risk and Water Quality.

This scope has been refined and developed following receipt of the scoping opinion, development of the design and further consultation. The final scope of the assessment is presented in Table 5-1.

5.2.1 Amendments made to EIA scope following the scoping consultation

The scoping opinion was received from NRW on 25 April 2019 (Appendix B). On the whole, the scoping opinion concurred with the key scoping decisions made within the Scoping Report and the overall conclusions. The scoping opinion did however disagree with two of the topics that were recommended to be scoped out of the ES in the scoping report, recommending that they should be scoped in for assessment. These were:

- Post-construction changes to beach morphology and sediment transport, and changes to hydrodynamics (waves and currents). The scoping opinion stated that *'it is too early to reach this conclusion since the final design and construction of the scheme has not yet been provided....it is noted that a review of existing modelling work to inform the design of the scheme is to be undertaken. Without the presentation of this evidence it is difficult to reach a conclusion to scope out post construction changes. NRW PS request that these be scoped in'*.
- Subtidal ecology. The scoping opinion stated that *'Currently there is not enough information on the construction methodology to be able to rule out indirect impacts from the works and to scope out subtidal ecology from the assessment and therefore we disagree with the conclusion within the Scoping Report. Particularly given the close proximity of biogenic reef*

feature which may be vulnerable to changes in sediment concentrations or contaminants for example'.

More topic-specific recommendations were made within the scoping opinion that have clarified detailed points to be considered by some of the topics. In summary these recommendations are :

- **Physical environment:** greater detail of the baseline environment for coastal processes should be provided along with more detail on the topography of the intertidal area of South beach and how replenishment of the beach will alter this.
- **Physical environment:** Disturbance and loss of habitat within Cardigan Bay SAC must also be considered in relation to hydrodynamics and sediment transport changes as a result of the scheme.
- **Physical environment:** It would be useful if the topographic surveys of South Beach could be compared to any historic monitoring profiles undertaken on this area if available in order to justify the requirement for shingle redistribution or replenishment.
- **Flood Risk and water quality:** a Flood Risk Assessment should be provided as well as a Flood Consequence Assessment for the planning application.
- **Ground conditions:** a more recent groundwater body classification should be used and the requirements of Planning Policy Wales and the Guiding Principles for Land Contamination (GPLC) should be followed.
- **Ecology and designations:** more information on the Scheme design and methodology is required before reaching any conclusions on whether or not the scheme will have an impact on designated habitat features of the SAC.
- **Ecology and designations:** the impact of the scheme on otters must be included.
- **Ecology and designations:** the impacts on subtidal ecology must be included in the ES, particularly given the proximity of biogenic reef.
- **Ecology and designations:** pre-construction surveys of the site compound habitat and working corridor on the beach should be carried out, particularly given the presence of *Sabellaria alveolata*.
- **Ecology and designations:** information on the site compound and impacts on subtidal ecology and subtidal pollution must be provided.
- **Historic environment:** the assessment should be undertaken in accordance with guidance from the Chartered Institute for Archaeologists.
- **Tourism and recreation:** impacts on shipping and navigation should be considered in the ES. Navigation into the harbour from work in the water and safety hazards must be included. These must be considered under the Harbour's Safety Management System in line with the Port Marine Safety Code. Consideration should be given to producing a risk assessment in order to establish the safety of navigation is not put at risk. This comment has been made in relation to section 7.8.2 in A Guide to Good Practice on Port Marine Operations (DfT, 2018).

As recommended in the scoping opinion letter, a table summarising the scoping opinion comments and how they have been addressed in this ES is provided in Appendix D.

5.2.2 Amendments made to EIA scope following design changes

Subsequent to the Scoping Report and scoping opinion, numerical modelling and further detailed design, resulted in significant changes to the proposed scheme, with the addition of a breakwater and a flood gate at Pwll Cam. As all environmental topics, except water quality and flood risk, had broadly been scoped into the EIA following the scoping assessment, the new design features did not

significantly alter the change in the topics to be scoped into the ES for assessment. The design change did however mean that the impacts on coastal processes from changes to sediment transport and hydrodynamics needed to be included as well as impacts on designated conservation sites and sub tidal ecology. These inclusions were in-line with the response in the scoping opinion that post construction changes to beach morphology, sediment transport, hydromorphology and subtidal ecology be included.

5.2.3 Issues covered in this Environmental Statement

The final scope of issues that have been assessed and reported in this ES is summarised in Table 5-1. This has been supported by a range of surveys, GIS-based analysis and numerical modelling.

Table 5-1 Issues Covered by this Environmental Statement

Topic	Final scope of assessment	Cross references and linkages to other chapters
Recreation and Tourism	- Construction impacts on recreation and tourism activities e.g. beach use, walking, fishing, boating. - Construction impacts on car parking and access to the harbour and beach. - Construction impacts on public safety both on land and in the water, including navigational safety. - Operational impacts on navigational safety.	Landscape, noise
Human Health & Socio Economics	Construction impacts on human health relating to the noise, air quality and visual aspects of the construction activities.	Landscape, Noise, Air Quality
Ecology	- Construction and operational impacts on disturbance and/or direct loss of designated sites. - Construction and operational impacts on otters. - Construction impacts on birds. - Construction impacts on fish and marine mammals. - Construction and operational impacts on subtidal and intertidal ecology. - Construction and operational impacts on the area of the site compound. - WFD assessment of construction and operational impacts on relevant waterbodies.	Coastal processes, noise, WFD assessment

Coastal Processes (physical environment)	• Construction and operational impacts on sediment transport processes and hydrodynamics, including beach morphology. • Construction and operational impacts on disturbance and/or direct loss to designated sites resulting from changes in sediment transport processes and hydrodynamics. • Habitats Regulations Assessment of construction and operation impacts on the designated features of the European sites.	Ecology
Ground Conditions, Soils and Contamination	• Construction impacts relating to the release of potential contaminants in the soil, including during temporary works for the site compound and access.	
Historic Environment	• Construction impacts on known and unknown archaeological remains. • Construction and operational impacts on historical buildings and structures. • Construction and operational impacts on the Conservation Area and the historic landscape.	Landscape
Landscape	• Construction and operational impacts on the landscape character. • Construction and operational impacts on views.	Historic Environment
Noise and vibration	• Construction impacts from noisy activities.	
Air Quality	• Construction impacts on construction dust and vehicles emissions generated from machinery.	
Traffic and Transport	• Construction impacts from construction vehicles moving to and from the site compound and along Quay Parade.	
Climate Change	• Construction due to greenhouse gas emissions associated with the Scheme and their contribution to climate change.	
Socio-economics	• Construction impacts resulting in disturbance/disruption to the operation of local businesses. • Operational impacts (beneficial) resulting from improved flood risk management in Aberaeron.	Traffic and transport, noise, air quality, landscape

- Construction and operational impacts on local employment opportunities.
- Construction impacts on movement of people resulting from traffic and transport disturbance.

The Environmental Scoping Report and the scoping opinion received have formed the terms of reference for the assessment stage of the EIA as presented in the table above.

5.2.4 Competent Experts Statement

In accordance with the EIA Regulations, the coordination of the environmental assessment process and specialist assessments have been undertaken by a team of competent and qualified consultants registered with the relevant institutions and/or Chartered. Atkins is EIA Quality Mark registered through the IEMA. Accreditation is based around compliance with a series of EIA commitments, which IEMA regularly independently monitors through an annual review process. The EIA Quality Mark therefore provides registrants with a benchmark for their EIA activities and demonstrates of a commitment to effective practice. Continued registration requires all of Atkins EIA coordinators and practitioners to be aware of the commitments and deliver EIA to a high standard. It also requires volunteers to write short articles, present at IEMA events or webinars and produce case studies as part of the commitment to improve EIA practice and share knowledge across the industry. These specialists work in close collaboration with designers and engineers, as part of an iterative design, consultation and assessment process. This process maximises the opportunity to avoid or reduce adverse environmental effects early in the design process and to identify mitigation measures to address those effects that cannot be avoided or reduced at source.

5.3 Impact Assessment Methodology

5.3.1 Relevant industry guidance

There are a number of topic areas where professional institutions have published specific guidance on impact assessment, and where this guidance is widely accepted as the recognised and preferred methodology for assessment. The guidance documents that have been used in the production of this Environmental Statement are clearly stated in the relevant chapters for each topic under the table headings 'Relevant Policy/Guidance Documents'.

5.3.2 Spatial Scope

The spatial scope adopted for this EIA is defined as the area over which changes to the environment could potentially occur as a consequence of the Scheme (e.g. local, regional, national, international). In practice, the Environmental Statement focuses on those areas where these effects are likely to be significant. In broad terms this is the footprint of the temporary and permanent works, and their immediate surroundings (e.g. within 1km of the site). It must be noted that the spatial scope varies between and even within environmental topic areas due to differing mechanisms and pathways for impact, for example, the influence of altered water quality may extend a for significant distance away from the Scheme within a water body, or, depending on their mobility or habitat requirements, one species may be potentially be affected over a much larger area than another. It is therefore not appropriate to define a single spatial scope for the entire EIA, and spatial scope is defined for each topic within each technical chapter.

5.3.3 General Assessment Methodology

For some receptors / environmental topic areas, there is no existing industry standard or published guidance for environmental assessment. Where this is the case, a general methodology has been applied to the assessment of the effects of the Scheme, which is set out in this section. A stepwise process has been adopted in the Environmental Statement to assess the significance of impacts. This comprises:

1. determining the importance or sensitivity of the attribute or receptor;
2. determining the magnitude and nature of any impacts;
3. determining the significance of the effect by consideration of both the importance/sensitivity of the receptor and the magnitude of the impact;
4. identification and application of mitigation measures to avoid or reduce the magnitude of impact, and incorporating this into the assessment of significance;
5. determining the residual impacts remaining after successful implementation of the identified mitigation measures; and
6. identification of potential cumulative or in-combination impacts.

The sections below describe the general approach used in more detail.

As far as possible, this approach and the associated terminology are used consistently throughout the Environmental Statement. Where this approach or the terminology is not followed, an explanation of the alternative approach used is provided.

Many of the identified impacts or effects are relevant across a number of topic areas. To avoid duplication between topic chapters, the Environmental Statement presents potential impacts within the most relevant topic area. Where this occurs in a chapter, links to the other relevant chapter(s) are clearly indicated.

5.3.4 Evaluation of Receptors

The importance or value of environmental receptors is determined based on a combination of their quality and relative importance/rarity to the natural or human environment. For some receptors, specific definitions used in evaluating the importance or sensitivity of receptors are provided in guidance documents. Where these exist, these have been used to help define the relative importance or sensitivity of a receptor and are detailed in the technical chapter where relevant. Where no such definitions exist, the evaluation is made based on importance criteria assigned by the assessor using professional judgement. The importance or sensitivity of receptors throughout this ES is classified as:

- High
- Medium
- Low; and
- Negligible

5.3.5 Establishing magnitude and nature of impacts

The magnitude of impacts has been predicted using a combination of professional judgement and, in some cases, modelling. Again, specific definitions used to establish the magnitude of impacts are provided in each technical chapter of this ES. The magnitude of impacts throughout this ES are described as:

- High;
- Medium;
- Low; and
- Negligible

The EIA Regulations require consideration of a variety of types of impact or effect, namely direct/indirect, secondary, cumulative/in combination, adverse/beneficial, short/medium/long-term, permanent/temporary, and residual. General definitions for these terms are presented in

Table 5-2. Each impact or effect will have a source originating from the development, a pathway and a receptor. Most predicted impacts will be adverse or beneficial, and will be described as such. An impact which results in a change which is neither adverse or beneficial may be described as 'neutral'.

Table 5-2 Types of Impact or Effect

Type of impact or effect	General definition
Direct (primary) / indirect (secondary)	A direct (or primary) effect may be defined as an effect that is directly attributable to a defined element or characteristic of the proposed development, for example, the loss or removal of an element or feature such as a hedgerow. An indirect (or secondary) effect is an effect that is not a direct result of the proposed development but is often produced away from the site of the development or as a result of a complex pathway or secondary association.
Temporary / permanent Short/medium/long term	Temporary effects are likely to be related to a particular activity, the effect of which will often cease when the activity finishes. Timescales are defined for each topic in individual technical chapters to provide an indication of how long the effect will be experienced for following cessation of the activity, and whether the impact may be considered short, medium or long term. Permanent: effects typically cause an unrecoverable change.
Cumulative (inter-related/ in-combination)	Cumulative effects result from the interactions of a number of impacts upon a particular receptor. These are defined in the following ways: • Intra-Scheme effects are the effects that occur between different environmental topics within the same proposal, as a result of the effects generated by the development alone. • Inter-Scheme effects are where the identified effects of a proposed development interact with the effects of other developments in its vicinity. These other developments may include those already completed, those which are approved by as yet uncompleted, those for which an application has been submitted and a decision is yet to be made, ongoing activities, and plans or Schemes

	which are 'reasonably foreseeable, even if an application has not been made. Both types of cumulative effects may arise from impacts that act in either an "additive" or "synergistic" way: • Additive: two or more impacts of the same type acting to increase the significance of effect on a single receptor (e.g. noise from the proposed development and another, separate sources affecting a nearby residential population) • Synergistic: two or more impacts of a different type acting to create a significant effect on a single receptor (e.g. effects arising from both noise disturbance and habitat loss on a bird population)
Residual	The remaining effect after successful implementation of the identified mitigation measures.

Impacts or effects are generally considered in relation to the following key stages of the development within this assessment:

- Construction: effects may arise from the construction activities themselves, or from the temporary occupation of land. Effects are often of limited duration although there is potential for permanent effects. Where construction activities create permanent change, the effects will obviously continue into the post construction phase.
- Post construction: effects may be permanent, or they may be temporary, intermittent, or limited to the life of the development until decommissioning.

5.3.6 Establishing significance of impacts or effects

The significance of an impact or effect has been determined by considering the magnitude of the impact against the importance of the receptor. A matrix approach has been used, to define the significance of effects, by combining the sensitivity of receptors with magnitude of effects. This is presented in Table 5.3. In determining impact magnitude or effect significance, the professional judgement of the assessor is applied to the impact under consideration where an impact may fall between significance categories. Therefore the tables presented in this section are used as a guide, but not absolute definitions, which may be too restrictive within the assessment. For the purposes of this assessment, the significance of each impact is only described in detail after mitigation measures have been implemented (i.e. the residual impact). A record of the 'unmitigated' impact is retained in a summary table at the end of each technical chapter, which demonstrates how the effectiveness of mitigation measures has been taken into account.

Table 5-3 Establishing the Significance of an Impact or Effect

Sensitivity/ importance of receptor		Magnitude of impact				
		High	Medium	Low	Negligible	No change
	High	Major	Major/ Moderate	Moderate	Minor	Negligible
	Medium	Major/ Moderate	Moderate	Moderate/ Minor	Minor/ Negligible	Negligible
	Low	Moderate	Minor	Minor/ Negligible	Negligible	Negligible
	Negligible	Minor	Minor/ Negligible	Negligible	Negligible	Negligible

Within this assessment, Major and Moderate effects are considered ‘significant’. Minor and Negligible effects are ‘not significant’. The above impacts can also be either adverse or beneficial.

5.3.7 Identification of mitigation measures

Where potentially significant impacts or effects have been identified, mitigation measures to avoid or reduce the magnitude of any adverse impacts have been identified. The mitigation measures are described in each technical chapter.

5.3.8 Determining residual significance

The significance of any residual environmental effects of the Scheme remaining after the successful implementation of the identified mitigation measures, is determined using the process as set out in Sections 5.3.3 to 5.3.6 above. The technical chapters in this ES use the same significance thresholds where possible, unless relevant industry guidance requires an alternative approach.

5.4 Format of this Assessment

The following format has been adopted for the presentation of assessment information in Chapters 6 to 18 of this Environmental Statement:

- Introduction and overview: Setting the scene, defining the spatial scope of the assessment, the nature of the receptors to be considered, how the site development might cause change, and an outline of relevant legislation, policies and guidance.
- Methodology: Describing how receptors were identified, along with the specific methods used for data gathering, predicting effects and evaluating significance of effects.
- Baseline information and existing conditions: Describing the existing condition of the receptors and changes that might in any case be expected in advance of (and in the absence of) the site development being implemented. Any limitations or data gaps are also highlighted.
- Predicted impacts or effects of the site development: Describing the identified impacts and their magnitude, in light of either incorporated design mitigation or additional mitigation identified as necessary. Presentation of the residual effects predicted to remain after successfully implementing the mitigation measures identified.

- Summary of the assessment: Includes information on predicted cumulative effects and a table summarising predicted effects.

5.5 Cumulative Effects

A search of current planning applications (both decided and awaiting a decision) was made on CCC's planning portal and on the marine licence register. The following relevant applications were identified and have been assessed in Section 19.4 of this ES.

Table 5-4 Adjacent Development Proposals

Case Reference	Proposal	Status
Full planning application – (A210065) and Listed building consent (A210257)	The Hive – proposed roof deck above existing fishmonger to include removal of existing flat roof.	In Progress (planning application submitted Jan 2021 and listed building consent in March 2021)
Full planning application (A200805) and amendment (A210048)	Monachty Hotel – extension and alteration to existing hotel to be used in conjunction with the Cellar restaurant to include demolition of balcony terrace and erection of bar and WC building.	Approved Nov 2020

5.6 Data Gaps, Uncertainties and Assumptions

Information relating to the construction of the scheme has been determined using knowledge from the Atkins design team engineers from previous experience on similar schemes. More detailed information will be obtained as the scheme progresses and on appointment of a Contractor.

To undertake the assessments in this ES, any gaps in data that may have affected the assessments, are stated in each of the technical chapters. Where required, uncertainties and assumptions have also been clearly stated.

6 Recreation and Tourism

6.1 Method of Assessment

The assessment of recreational and tourism impacts has been undertaken via a desk-based literature review of available public information, consultation

6.1.1 Assessment Criteria

See Section 5.3.5 and Section 5.3.6 for information on magnitude and significance of impacts Criteria. The main method of assessment of recreation and Tourism at Aberaeron has been through a desk-based review of freely available information.

6.2 Baseline Conditions

6.2.1 Description of Existing Environment

Tourism

Aberaeron is a popular seaside destination along the Ceredigion coast, the main draw being the coastline and beach as well as the picturesque harbour surrounded by brightly painted Georgian townhouses. There are a number of hotels, bed and breakfasts, pubs, cafés and shops within walking distance of the harbour. Of particular note are the Harbourmaster Hotel, the Monachty Hotel, The Hive restaurant and The Cellar restaurant, all of which are located along the edge of the harbour. The Aeron Coast Caravan Park is located at the northern end of the town along North Beach.

Activities enjoyed by visitors include walks along the beach and coastline. Use of the Wales Coast Path which provides a continuous route along the entire Welsh coastline is a popular route for walkers. The coastal waters provide an important area for recreation and nature enjoyment. Cardigan Bay is an important area for marine wildlife and boat trips offer opportunities to observe dolphins and wildlife. Sailing is popular offshore, with Aberaeron Harbour providing a location for mooring boats. For younger visitors, crabbing from the harbour walls is a very popular activity as well as the annual duck count.

Local events are also held throughout the year which attract visitors to the town. These include:

- Mackerel Festival – In 2022 will be held on August bank holiday weekend. Rows of stalls, bands are erected to celebrate the end of the Mackerel season. The festival starts at Harbourmaster Hotel and ends at the Yacht Club on Beach Parade.
- Town Carnival – In 2022 will be held on August bank holiday weekend. Floats and a walking parade from the Quay Parade and ends in Cae Sgwâr.
- Longboat race – annual event which usually takes place during the May bank holiday from the slipway of South Beach;
- Aberaeron Yachting Regatta – a week long event during July;
- Annual Tug of War – the tug of war takes place over the harbour during July
- Feast Aberaeron – monthly pop-up food festival which takes place in the yard of the Yacht Club and just outside the front gates. **It draws big crowds. Pop up restaurants and stalls come from all over Wales.**
- The Festival of Welsh Ponies and Cobs – held annually in August. Owners and breeders of registered welsh ponies; cobs or part breeds showcasing animals in a non-competitive event.

Important winter events include:

- Community Christmas – held annually in November. Includes Christmas stalls and a light parade.

- Winter Fair – held annually in November. Funfair rides and on-street winter market.

Although data covering the last few years relating to tourism at Aberaeron has not been able to be identified in this assessment, data pre-2011 has been obtained from the 2011-2019 tourism and visitor economy strategy for Ceredigion (CCC, 2011) which based its strategy on visitor and tourism operator surveys between 2004 and 2009.

The strategy reported that ‘the coast and beaches are the key strength for the area’, listing Aberaeron as one of them. This statement is reinforced from a more recent report citing that for trips taken in Wales as a whole, the most popular location type was seaside or coastal (43%) (GB Tourist 2019 Annual Report). Table 6.1 shows visitor counts between 2004 and 2009 in Ceredigion at the top five tourism hubs in the county. Throughout these years, Aberaeron features as either the second or third most popular destination in this survey. The strategy also reported that the busiest months for tourism in the county as a whole was reported to be July and August.

Table 6-1 Visitor Counts 2004-2009

	2004	2005	2006	2007	2008	2009
Aberaeron	43,053	43,452	43,167	44,977	40,594	36,232
Aberystwyth	84,813	76,175	66,390	58,981	58,943	60,649
Borth	8,052	8,930	7,818	8,691	4,659	4,855
Cardigan	37,993	41,016	36,642	36,999	35,595	41,290
New Quay	30,221	29,556	34,825	42,330	33,771	32,793
Totals	204,132	199,129	188,842	191,378	173,562	175,819

Tourism is a valuable source of income and employment for the county and to the rest of Wales. The strategy estimated a total spend by day and staying visitors at £268m within the county in 2009. This spending was estimated to support 5,712 jobs (full time equivalent) in and around the county. More recent data taken from a 2018 survey by the ONS (CCC, 2019) estimated Ceredigion’s proportion of jobs in the tourism industry to be slightly less at 12.9% (4,000 people)² county-wide. The overall value of Ceredigion’s economy is relatively low compared to other authorities in South and West Wales (CCC, 2020)².

Recreation

Like many beaches, the shingle beach at Aberaeron is used for walking (including dog walking), sunbathing and swimming. The beach is dissected by the harbour entrance and the presence of the piers, with North Beach located to the north of the piers and South Beach to the south. The beach forms part of the Wales Coast Path, which extends along the full length of the Welsh coastline. Where the route is interrupted by the harbour mouth, the route travels inland around the harbour edge and crossing over the River Aeron to connect with the beach on the other side of the harbour. In some places, the route is aligned with public rights of way footpaths 43/1 (South Beach), 43/21 (Belle Vue Terrace) 43/22, 43/23, 43/24 (Beach Parade car park).

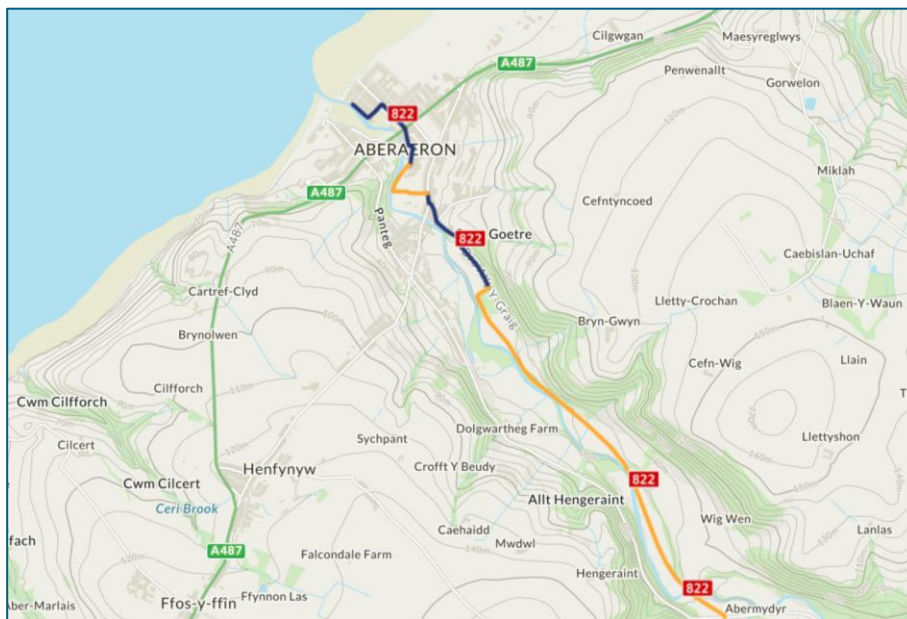
² Ceredigion County Council, 2020, Economic Baseline Report

Figure 6-1 Wales Coast Path



A national cycle route also extends into the harbour (route 822). It extends along Quay, Parade, up Cadwgan Place and along Market Street before crossing over the A487 and heading inland connecting with Llanerchaeron at Abermydyr.

Figure 6-2 National Cycle Route 822



The harbour itself is used for the mooring of boats and sailing and boating is a popular activity. Boats also moor in Pwll Cam and there are two slipways into the harbour, one leading into Pwll Cam dock and the other on the south side of the harbour at Beach Parade. Also located at Beach Parade is the Aberaeron Yacht and Watersports Club, which uses the nearby harbour slipway. The club offers sailing and rowing events throughout the year. The Beach Parade car park is used for boat storage, particularly during the winter months. Boats are generally lifted into the water during April and craned out in October.

The harbour quayside/promenade is a focal point for residents and visitors to the town, with the harbour accessible on all sides, including along the piers, although South Pier is currently closed for safety reasons. The north and eastern sides of the harbour are popular for walking and taking in the sea views, with seating provided along Quay Parade and around Pwll Cam. Picnic tables are also available on the south side of Pwll Cam by the entrance to the dock (next to the river footbridge).

Hotels, restaurants and cafes are also located along Quay Parade and Pwll Cam, catering for visitors. These include the Harbourmaster Hotel along Quay Parade, the Monachty Hotel at Pwll Cam and the Hive and Cellar restaurants.

The south side of the harbour is quieter in comparison, predominantly residential, but a public footpath set back from the water's edge, provides an important link from the harbour down to South Beach. Benches are also located here to enjoy views across the harbour. Where the footbridge crosses the River Aeron, benches and picnic tables have been provided on the grassed southern bank of the River Aeron.

Recreational fishing also takes place from the beach, piers, harbour and within the River Aeron.

6.2.2 Data Gaps and Limitations

The baseline data contained in this assessment precedes the 2020 coronavirus pandemic. The government lockdown restrictions that commenced in March 2020 and which continue to evolve have meant that any tourism statistics that exist for 2020 are not representative of typical conditions. Although restrictions on tourism and recreational activities are still in place at the time of writing this ES, this chapter has assumed that typical conditions will have resumed at the time of construction.

6.3 Likely Significant Effects

6.3.1 Construction

Tourism

Tourists visiting Aberaeron are likely to experience disturbance as a result of the construction, from noise, visual/landscape impacts and the presence and movement of machinery and vehicles around the harbour and beach. Impacts on visitors in terms of noise and visual/landscape impacts are described in sections 16 and 11 respectively. The construction work on the beach and around the harbour will also impact recreational activities enjoyed by tourists (see recreation section below).

The disturbance experienced could cause people to cut short their visits or even be discouraged from visiting. This could have impacts on local tourism businesses, particularly those in the immediate vicinity of the harbour, such as the Harbourmaster and Monachty hotels, and local restaurants such as the Hive and the Cellar. Throughout the design of the scheme, CCC has carried out consultation with these local businesses to identify issues of concern and keep them informed of the design evolution. Access to all local businesses will be maintained throughout construction and businesses within the working area will be informed of working hours and construction access routes. A calendar of local events will be provided to the Contractor in order to reduce disruption to planned activities. For some of the events, adjustments may be required in order to enable the events to go ahead. For example, should the work on Quay Parade still be underway at the time of the Town Carnival, the parade could start at Market Street instead of Quay Parade.

Given that Aberaeron is one of the county's top tourist locations, and with businesses that rely on the income from these visitors in the immediate area of the proposed Scheme, tourists and tourism-related businesses are considered to have a high sensitivity to the construction activities. The impacts generated from nearby noise, visual/landscape impacts and movement of vehicles and plant could therefore be of high magnitude. However, it is noted that the peak tourist season in Ceredigion is July and August, with much lower levels throughout the rest of the year. Impacts are therefore only likely to be high during the months of July and August and medium for the rest of the year. For this reason, the overall significance of effect is determined to be **moderate adverse** for the construction period as a whole.

Recreation

Recreational activities will be affected during construction in the areas on South Beach, around the harbour and offshore. These are discussed as follows.

South Beach will be closed to public access for the majority of the 12 month construction period to ensure public safety. South Beach will not only need to be closed during the beach improvement works, but as South Beach will be the main transportation route for materials from the site compound to the piers for the South Pier refurbishment and North Pier breakwater, the presence of heavy plant and machinery moving along the beach, means it needs to remain closed for these work elements as well. Beach activities will therefore not be able to take place on South Beach during the construction. Access along the Wales Coast Path will remain open, however, and this is discussed further below. There will be no restrictions on North Beach, and therefore this easily accessible area of beach will enable people to still enjoy beach activities during construction. The effect on recreation along South Beach is assessed to be **minor adverse**.

The construction activities taking place around the harbour will cause disturbance to recreational activities in these locations, these being walking and enjoying views of the coast and harbour. This will come in the form of noise, and visual/landscape disturbance from the presence and movement of machinery and plant. Noise and visual/landscape impacts are discussed in sections 16 and 11 respectively. There will also be some impacts resulting from construction traffic and transport. This includes temporary loss of car park spaces in the Harbour carpark, Beach Parade carpark and on-street parking along Quay Parade. This is all discussed in the traffic and transport chapter in Section 15.3.1.

During the work around the harbour, there will be some temporary access restrictions to parts of Quay Parade and Pwll Cam for pedestrians and cyclists. During work to construct the flood wall along Quay Parade, there will be sections of the quayside where access will not be possible. Disruption will be minimised by carrying out work in discrete sections, so that sections where work has not started to take place remains accessible. At Pwll Cam, the eastern side of the quayside will need to be fenced off for construction, including the picnic table area, leaving the remaining area accessible. Although these restrictions will cause some disturbance, they are localised and the majority of the harbour will be accessible at all times. Residents and visitors will still be able to walk along parts of the quayside throughout construction. The River Aeron footbridge will remain open for the majority of construction, however there will be some short periods of temporary closure for the adjacent wall work and tilt barrier installation. The diversion route would be over the A487 road bridge. Although this is a slightly longer route, the road bridge has a wide pavement on both sides with steps leading down to the picnic area on the southern side of the footbridge. The impact on recreation around the harbour is considered to be **moderate adverse** during construction.

Pedestrian access along the Wales Coast Path will be maintained throughout construction, although some localised temporary diversions will be required at the following locations:

- North Pier work - where the path joins Quay Parade from North Beach via the pier. The diversion route from North Beach onto Quay Parade will be diverted via the adjacent toilet block next to the pier, leading back on to Quay Parade. This diversion is already regularly used by walkers. As mentioned above, Quay Parade will remain open during the work for pedestrian access.
- Site compound – there will be a temporary access route from the site compound onto South Beach which will travel across the route of the path. Due to the heavy machinery that will be present, it is proposed to divert the West Coast Path in this location to maintain public safety and access along the path. The route of the diversion will be agreed with CCC, but pedestrians are likely to be diverted across the CCC/police station carpark. The site compound itself will be landward of the footpath, but due to its proximity, the contractors will erect signs along the footpath close to the works and site compound, alerting the public to construction works as well as the diversion route.
- Footbridge – as described above, the footbridge over the River Aeron will be closed for short periods of time for the river wall work and tilt barrier work. A diversion route over the A487 road bridge will be clearly signposted.

The impact on use of the Wales Coast Path is considered to be **minor adverse**.

Navigation

Work scheduled to take place in the sea will have some impact on navigation. This includes work to the South Pier, breakwater construction and installation of the flood gate at Pwll Cam. Use of the harbour for navigation is at its peak over the summer months as most boats are stored on land over winter. Access in and out of the harbour will be maintained throughout construction, although areas around the works will be restricted with navigational markers installed to ensure vessels maintain a safe distance from the marine working area, any temporary deposit of materials and any underwater structures in the process of being built. This also includes during the period of rock deliveries should they be brought to site by sea. A Notice to Mariners will be issued prior to construction commencing. This will be done in liaison with the Harbour Authority and the Aberaeron Yacht and Watersports Club. The harbour's safety management system, in line with the Port Marine Safety Code will be adhered to, as well as Section 7.8 'Regulating Harbour Works' in the Guide to Good Practice on Port Marine Operations (Department for Transport, 2018). The impact on navigation during construction is considered to be **moderate adverse**.

During the work on the Pwll Cam flood gate, boats moored in the harbour will not be able to enter/exit the dock as the entrance will be blocked by a temporary cofferdam for around 9 months which is likely to coincide over the summer season. All boat owners using the harbour will be informed prior to construction to make them aware of the period of time during which they will not be able to access Pwll Cam. Alternative moorings in the main harbour area can be provided but during peak season may require using the space provided for visitor moorings. The slipway into Pwll Cam will also be closed during the flood gate works as the slipway will be used for construction access to the flood gate location. The closure of this slipway will mostly affect boat owners using the Pwll Cam as access from the land into the harbour is available at a second slipway by the yacht club. The impact on boat owners with moorings in Pwll Cam is considered to be **minor adverse**.

Areas for recreational fishing will be reduced during construction. Fishing will not be permitted along South Beach or from the south and north piers during the majority of the 12 month construction period. Fishing from the harbour walls will not be affected. Although fishing can be done from the harbour walls and North Beach, construction in the water and underwater noise could scare fish away affecting catches at sea. Fishing in the River Aeron, upstream of the works is unlikely to be affected. The impact on fishing is considered to be **moderate adverse**.

6.3.2 Operation

Tourism

Following construction, the scheme will provide improved flood defence to the harbour and southern part of Aberaeron. This will significantly reduce the impacts of flooding on the tourism industry, in particular flood damage to local tourist businesses around the harbour. The magnitude of this benefit is considered to be medium. With tourists and tourist businesses assessed to be highly sensitive to impacts at Aberaeron, the Scheme will provide a **moderate beneficial** effect on tourism in Aberaeron.

Navigation

Following construction all recreational activities will be able to resume as existing, although there will be a change in the navigation route in and out of the harbour due to the presence of the new breakwater and South Pier reconfiguration. Navigational markers and lighting will be installed in consultation with the Harbour Authority to maintain safe passage of boats. Access in and out of the Pwll Cam dock will resume as existing. The impacts on navigation following construction will be **negligible**. Sailors and boat owners will, however, benefit from the Scheme through the reduced flood risk to the harbour, with the risk of damage and loss to vessels significantly reduced as a result of the Scheme. The improved protection to boats moored within the harbour is considered to be of **major benefit**.

Recreation

The scheme will generate a number of benefits for recreation, in particular the re-opening of the South Pier for public access following its closure, as well as a new opportunity to enjoy coastline views from the footpath constructed on the top of the new breakwater. Other enhancements incorporated into the design to improve the recreational experience for residents and visitors include:

- New seating along Quay Parade, with options also being considered to fix seating directly onto the seaward side of the flood wall. Five memorial benches that were removed and stored during construction will be returned to their existing position.
- Widening of the promenade on the seaward side of the flood wall along Quay Parade to improve pedestrian access.
- Improved access to the promenade for those with limited mobility by removing the existing 'up and over' steps over the flood wall, with access replaced with gaps in the wall created by the new tilt barrier locations. In consultation with the Harbourmaster Hotel, a tilt barrier has been located directly opposite the hotel in order to improve the experience of their visitors with direct access outside the hotel entrance.
- A new picnic area will be established on the southern side of the harbour adjacent to the river footbridge.

Collectively these enhancements incorporated into the Scheme design are considered to create a **moderate benefit** to recreation in Aberaeron.

7 Human Health

The World Health Organisation defines health as "A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2020). The 2017 EIA Regulations introduced a new requirement to consider Human Health.

This Chapter of the ES considers the potential negative or positive impacts of the Scheme in terms of 'Human Health' in the area of the Scheme. The assessment has taken into account the mitigation already proposed in this ES, using the residual impacts to determine potential impacts on human health. Physical and mental wellbeing is not assessed within the chapter as there currently is no established methodology for assessing these criteria in the context of EIA including no clear way of establishing a baseline from which the change of conditions can be established. Consideration of the Well-being of Future Generations (Wales) Act 2015 is detailed in Chapter 4.

This Chapter is not intended to be read as a standalone assessment and references should be made to Chapters 1-4. In addition, this Chapter should also be read in the context of the other technical chapters, due to the range of environmental issues which can affect human health. In particular, reference should be made to Chapters 6 (Recreation and Tourism), 8 (Socio-Economics), 11 (Landscape and Visual Amenity), 16 (Noise and Vibration) and 17 (Air Quality).

7.1 Method of Assessment

7.1.1 Policy Context

The relevant legislation, policy and guidance are listed below:

- The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017
- Future Wales - The National Plan 2040
- Wellbeing of Future Generations (Wales) Act 2015; and
- The Health and Social Care Act (2012).

The following guidance was reviewed to inform the assessment:

- Health in Environmental Impact Assessment: A Primer for a Proportional Approach (2017); and
- Health Impact Assessment: A Practical Guide Wales (undated)

7.1.2 Scope of Assessment

A request for a Scoping Opinion in relation to the Proposed Scheme was submitted to CCC in early 2019. Since then, changes to the Scheme have been made which are outlined in Section 5.2.1 and 5.2.2. In particular this includes a new breakwater extending from the North Pier and a flood gate at the entrance to the Pwll Cam dock.

The Scoping Report identified the potential for the following impacts to occur during the construction phase of the Scheme:

- Loss in visual amenity in the Harbour and along South Beach causing a negative impact to mental health of residents and visitors.
- Loss of access to residents and visitors to public amenities leading to increased stress and annoyance.
- Impacts to local businesses dependent on tourism and recreation will increase stress and have knock on socio-economic issues.
- Noise and vibration impacts due to construction activities such as piling works. Auditory impacts from noise may include short term or permanent auditory damage. Non-direct impacts may include mental health impacts, performance and sleep disturbance. this is covered in Chapter 16.
- Noise and vibration impacts may arise due to increases in road traffic and movements for delivery of materials, plant and construction staff this is covered in Chapter 15.
- Noise and vibration may negatively affect tourism and recreation – this is covered in Chapter 6.
- Construction and repair works of the Scheme are likely to give rise to local level emissions. See Chapter 17 (Air Quality).
- Exhaust emissions from construction traffic vehicles have the potential to affect local air quality at properties close to haul routes

The following impacts were scoped out:

- Due to the location, scale and duration of the beach replenishment (shingle loading), air emissions associated with the beach re-nourishment will not be of an order to result in measurable health effects and were therefore scoped out.

The scoping opinion received from NRW did not highlight any further issues to be addressed by the EIA.

7.1.3 Assessment Criteria

See Section 5.3.5 and Section 5.3.6 for information on magnitude and significance of impacts Criteria. The main method of assessment of human health at Aberaeron has been through a desk-based review of freely available information.

The assessment describes the effects that are anticipated during construction and operation of the Scheme.

Sensitive receptors

The following constitute the sensitive receptors that have been considered in this chapter.

- Existing residents/businesses in the immediate area surrounding the Scheme; and
- Future residents/businesses in the immediate area surrounding the Scheme.

7.2 Baseline Conditions

The general location and description of the site are set out in Section 1.3 and Section 3. A description of the baseline conditions are provided in Section 7.2.1 below. Specific chapters in this ES provide a baseline scenario relevant to the environmental topic being discussed e.g. noise and vibration. Therefore, the baseline scenario for these topics are not duplicated in this section.

Data Sources

The following key information sources have been used in establishing the baseline conditions in the study area, with information pertinent to this assessment included in this Chapter and related chapters such as Chapter 6: Recreation and Tourism, Chapter 8 Socio-Economics, Chapter 11 Landscape and Visual Amenity, Chapter 15 Traffic and Transportation and Chapter 16: Noise and Vibration.

- StatsWales/Office of National Statistics (ONS);
- UK Census;
- Welsh Index of Multiple Deprivation (WIMD);
- CCC website;
- Ceredigion Local Development Plan (April 2013).

7.2.1 Description of Existing Environment

The following baseline has been identified through a desk-based review of freely available information.

Ceredigion County

Ceredigion is mainly rural and has over 80km of coastline. The county covers an area of 1,783km² and is managed by CCC. There are six main towns; Aberaeron, Aberystwyth, Cardigan, Lampeter, Llandysul and Tregaron. Cardigan Bay, the Cambrian Mountains and the Dyfi and Teifi estuaries form natural outlines of the County's borders.

At the last UK Census (2011), the population of Ceredigion was 75,900, with Aberystwyth being its largest town. The population density in Ceredigion is 40.7 people per km² (ONS, 2019³) compared to 152 people per km² in Wales as a whole⁴. In Aberaeron, this equates to 9 people per hectare (0.09km²) with 1,422 residents (UK Census, 2011⁵).

³ ONS. (2019). Population Density. <https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Density/populationdensity-by-localauthority-year>

⁴ The figures are derived by dividing the mid year population estimates by the latest land area estimates in square kilometres, measured at the mean high water mark, and excluding areas of inland water.

⁵ UK Census Data. (2011). Aberaeron. [Aberaeron - UK Census Data 2011](#)

Table 7-1 Population Percentage in age ranges

	Ages 0-14		Ages 15-29		Ages 30-44		Ages 45 to 64		Ages 65 to 74		Ages >75	
F= Female M = Male	M	F	M	F	M	F	M	F	M	F	M	F
Wales	17	16.2	19.4	17.6	17.5	17.3	26.0	26.6	11.3	11.7	8.4	10.7
Ceredigion	14.3	13.6	24.7	20.9	11.4	12.0	25.4	27.0	13.7	13.8	10.5	12.8

Source: ONS, 2019

Deprivation

The WIMD 2019 for health is used to present inequalities in health across Wales. In accordance with the Index, Aberaeron is categorised as 'Least Deprived' for health and within the '50% least deprived' for small rural areas in Wales. Aberaeron is categorised as 'Most Deprived' for Community Safety' and within the 30-50% for small rural areas in Wales (WIMD, 2019⁶).

Ceredigion has a slightly higher life expectancy for males and females, with men and women expected to live until the ages of 79.9 and 83.9, respectively, compared to 78.2 and 82.2 for Wales (ONS, 2013⁷). In accordance with population statistics as presented within Table 7-2, people in Ceredigion county have generally healthier lifestyles than those typical across Wales, with lower percentages of the population overweight or obese, living more active lifestyles and consuming more fruit and vegetables. However, Ceredigion has slightly higher rates of adults reporting to drink alcohol above the guidelines and binge drink (Hywel Dda University Health Board, 2016).

With a large part of Ceredigion being both rural and coastal, the region attracts high levels of inward migration of people over 65. An increase in the number of older people is likely to show as a rise in rates of chronic conditions such as respiratory and circulatory diseases and cancers in population statistics within the region (WWCP, 2017). In the current economic climate, the rise in a care-dependant and in some cases financially-dependent population, will pose challenges to communities.

Table 7-2 Percentage of adults reporting key health-related lifestyles

Health-related lifestyle		Wales	Ceredigion
Smoking	Average reported	21	18
Daily alcohol consumption	Above Guidelines	41	42
	Binge	25	26
Consumption of fruit and veg	Meets guidelines	32	39
Exercise or physical activity	Active on 5 or more days per week	30	33
	0 active days	34	31
Body mass index	Overweight or obese	58	52
	Obese	22	17

Source: Hywel Dda University Health Board (2016)

It is stated, that on average people living near the coast tend to have better health than those living inland (Wheeler et al., 2012).

The Wellbeing of Future Generations (Wales) Act 2015, requires public sector bodies to come together through a Public Service Board (PSB) for their local areas and undertake an assessment of local well-being. Ceredigion PSB was established in April 2016 and through this formed the Public

⁶ WIMD. (2019). Aberaeron (W01000506). [WIMD - Aberaeron \(gov.wales\)](https://gov.wales/wimd)

⁷ ONS.(2013). [Life expectancy by local authority and gender \(gov.wales\)](https://gov.wales/life-expectancy)

Services Board Executive Group for Health, Social Care and Wellbeing (HSCWB). The HSCWB must work to a specific aim for the health, social care and wellbeing of the population of Ceredigion, and to improve the economic, social, environmental and cultural well-being of Ceredigion by contributing to the achievement of the national wellbeing goals

The results from the wellbeing assessment stated; that the county's landscapes are much appreciated by local people with 49% counting 'landscapes and views' among their most valued natural features. Respondents also identified features such as 'landscape and views' (49%), 'clean air' (37%) and 'places to walk/cycle' (35%) as what they valued most in the Ceredigion environment (Ceredigion Public Services Board, 2018).

Aberaeron is predominantly a Welsh speaking town with approximately 70% of the inhabitants able to speak the language with much of the daily life in shops and businesses conducted in Welsh (visit mid Wales, 2021⁸).

Impact of Flooding on Human Health

Social disruption caused by flooding can have a serious impact on quality of life. Flood events pose a danger to both physical and psychological health. Physical health impacts include shock, gastrointestinal illness (particularly if flood waters are contaminated) and respiratory illness (Hajat et al., 2003). In extreme flooding events, floods can lead to deaths either as a result of drowning or injury or due to secondary impacts in the aftermath of a flood Walker-Springett et al, 2017⁹). Psychological health impacts of flooding (or threat of flooding) include acute stress, clinical depression and anxiety, as well as post-traumatic stress disorder (PTSD) (WHO, 2001). Following flooding events long-term psychological effects may be exacerbated by stresses such as having to move home, cleaning up flood damage and negotiating with insurers (RPA, 2005, UKPHR, 2016¹⁰).

The social disruption caused by floods is negatively contributing to the quality of life of residents in Aberaeron. Historic flood events at Aberaeron are presented in Section 1.4 and 2.1, with flooding most frequently occurring within the Pen Cei area of town. Recent storm events such as Storm Callum in October 2018 caused several thousand pounds worth of damage to the harbour and the loss of nine boats; and Storm Brian later in October 2018 led to the closure of Quay Parade by CCC due to the risk of waves overtopping while water levels were high. South Beach is of significant importance for recreation as it is enjoyed by both tourists and residents (as discussed in Section 6.3.1) and the loss of coastal defences along South Beach will result in the loss of shingle beach and properties behind, and consequently the loss of amenity and property.

Aberaeron

Aberaeron is rural in character but due to tourism there are seasonal variations in population and receptors. Figure 6-1 identifies the potential receptors in the vicinity of the Scheme. Predominantly this includes:

- Residential and Commercial properties along Quay Parade e.g. The Harbourmaster Hotel;
- Residential and Commercial properties around Pwll Cam e.g. The Hive;
- Residential and Commercial properties around Market Street e.g. The Monachty Pub (and beer garden), Toad Hall, 'Chuckies';
- Residents located directly behind South Beach;
- Aberaeron hospital on Princess Avenue;

⁸ Visit Mid Wales. (2021). Aberaeron. <https://www.visitmidwales.co.uk/Aberaeron-Aberaeron/details/?dms=3&venue=1000362>

⁹ Walker-Springett, K., Butler, C., Adger, W.A. (2017). Wellbeing in the aftermath of floods. Health & Place. Vo 43, Pgs 66-74.

¹⁰ UKPHR. (2016). Health Impacts of flooding. [UK Public Health Register – Health impacts of flooding \(ukphr.org\)](https://www.ukphr.org.uk/publications/health-impacts-of-flooding/)

- Min-Y- Môr nursing home in Wellington Gardens; and
- Local schools.

The majority of receptors in the immediate vicinity of the Scheme are residential (green) with a number of commercial (orange) and mixed use (yellow) also present. The figure has been taken from Chapter 16 Noise, with the NSR reference points referring to noise sensitive receptors.

Figure 7-1 Sensitive Receptors



The main medical centres are Tanyfron Primary Care and Aberaeron Hospital, supported by Lloyds Pharmacy and Boots. There is also a dentist located on North Road.

7.2.2 Data Gaps and Limitations

At the time of writing the information on construction and traffic management is indicative and dependent on the approved construction proposals of the appointed subcontractor.

The data and information gathered to inform this chapter is largely based on secondary sources. The data is high-level and does not assess human health for individuals or specific businesses.

At the time of writing the full implications on the physical and mental health of communities as a result of the COVID-19 pandemic are not yet known or fully understood.

It should be noted that this assessment does not take into account COVID-19 statistics in the health baseline. It also does not assess the potential for increased risk to public health as a result of any future COVID-19 outbreaks as it is presumed that government guidance will be adhered to and the proposed Scheme will not go ahead until it is safe to do so.

Data gaps and limitations relating to the EIA specific topics are included in the relevant chapters.

7.3 Likely Significant Effects

The assessment of likely significant effects of the Scheme on human health involved considering the following:

- Landscape and visual;
- Tourism and recreation;
- Noise and vibration; and
- Air Quality.
- Flood risk.

7.3.1 Construction

Landscape and visual

Construction elements and activity will result in loss of visual amenity in the Harbour and along the South Beach, due to increased traffic and presence of construction machinery and site staff (as discussed in Section 11.3).

As the scenery in the area is enjoyed by both residents and tourists, the disturbance of the visual amenity of the area due to construction could have a negative impact to the mental health of residents and visitors as a result of stress caused by the visual impact of the construction works. For businesses, there may be additional stress associated with concern about a loss of trade. However, as construction will be phased and temporary, avoiding peak seasons where possible, impacts are considered to be temporary, reversible with a low magnitude therefore impacts are considered to be of **minor adverse**.

Tourism and recreation

Based on the construction information provided in Section 15.3.1, a maximum of 10 HGV truck movements per hour are estimated to transport rocks to site for the breakwater with all movements going to the site compound to minimise the movement of HGVs through the town as far as reasonably practicable. The construction traffic routes on the local network to the site compound are currently not known and will depend on access arrangement with the quarry providing the materials. There may be the option to transport the rock by sea, therefore this would resolve transportation issues through the town.

There will also be some further movement throughout the Scheme duration for “on demand” items, such as the glazing systems and prefab concrete structures for the top of the sea walls that will utilise Quay Parade. In general, the works are considered to be temporary in nature with works moving sequentially.

Vehicle traffic and road access for the Scheme may reduce available street parking within Aberaeron and could cause inconvenience, stress and annoyance to residents, workers in local businesses and visitors. Businesses may also be concerned about a loss of trade.

Loss of access to South Pier, South beach and Aberaeron Harbour itself, will result in a loss of public amenity to local residents and the potential to discourage tourism, which may further lead to inconvenience, stress and annoyance. Impacts to local businesses dependant on tourism and recreation will also include increased stress due to perceived or actual resulting socio-economic impacts (see Chapter 8).

Lack of access to South Beach and the Wales Coast Path may also impact on mental wellbeing, however it is anticipated that some access to the beach will be available throughout construction.

Aberaeron harbour has a number of recreational vessels. Demolition and repair works to the South Pier, installation of the new breakwater and installation of the floodgates will likely have an impact on

local vessels' ability to navigate in / out of the harbour and has the potential to pose safety hazards. Construction works that may impact on navigational safety will be considered under the Harbour's Safety Management System in line with the Port Marine Safety Code. This will be covered within the CEMP.

Impacts are considered to be temporary, reversible with a low magnitude therefore impacts are considered to be of **minor adverse**.

Noise and vibration

Noise and vibration impacts to human health could arise from various construction activities including delivery and tipping of rock, beach replenishment, piling, installation of the flood gate and demolition and wall construction; and removal and replacement of timber groynes.

It is understood that construction works will mainly be undertaken during the daytime hours of 07:00 and 19:00. The exception to this is the installation of the flood gate during Phase 4 where working may need to extend later into the evening when the gate is lifted in place due to tidal needs. The generator at the site compound that will also need to be active throughout the night. Piling is expected to take 30-60 days however this will not be continuous and is not expected to take place at night.

The generator at the site compound will be enclosed within a noise attenuated housing to ensure impacts are minimised. Works on the breakwaters and South Beach are to be undertaken during low tide, which limits the working hours to a 5 hour period within the 07:00 and 19:00 daytime period.

Further noise and vibration impacts could arise due to increases in road traffic from delivery and movement of materials, construction activities (plant and construction staff, as discussed in Chapters 15 and 16).

Piling operations that may be undertaken during works to the South Pier and drilling to create the silt curtain will produce percussive noise and vibration. Direct auditory impacts as a result of noise include short term or permanent auditory damage from intense or prolonged exposure. Non-direct impacts of noise and vibration include:

- Cardiovascular effects, particularly hypertension as a result of increased adrenaline levels or through stress;
- Annoyance;
- Mental health impacts including anxiety, stress, and effects on psychological well-being;
- Performance (tasks and academic); and
- Night-time effects (sleep disturbance).

Noise and vibration may also negatively affect tourism and recreation, either dissuading people from undertaking activities because of the noise or affecting businesses dependent on tourism and recreation, with the associated impacts described above (reduction in activity / increase in stress for businesses).

Site specific mitigation for noise is detailed in Chapter 15 and in the CEMP, along with further details of mitigation techniques and procedures, community liaison requirements and an environmental monitoring plan.

Impacts are considered to be temporary, reversible with a low magnitude therefore impacts are considered to be of **minor adverse**.

Air Quality

Construction of the Scheme are likely to give rise to local level emissions including dust from construction activities and equipment, movement of materials (including rock tipping), beach replenishment (shingle loading) and vehicle emissions due to increases in vehicle traffic (as discussed in Chapter 17).

Due to the location, scale and duration of the beach replenishment (shingle loading) and construction of the breakwater (rock tipping), air emissions associated with these activities will not be of an order to result in measurable health effects and were therefore scoped out.

Exhaust emissions from construction traffic vehicles have the potential to affect local air quality at properties close to haul routes. Sensitive receptors in close proximity to haul routes include vulnerable occupants such as Aberaeron hospital, Min-Y- Môr nursing home and local schools. The impacts of increases in dust and vehicle emissions include respiratory illness, cardiovascular disease, reduces lung function (especially in children) and in extreme cases mortality. The construction phase of the Scheme has the potential to generate dust and PM₁₀ emissions, which may have a short term adverse impact at nearby human health receptors.

Impacts are considered to be temporary, reversible with a low magnitude therefore impacts are considered to be of **minor adverse**.

7.3.2 Operation

Landscape and visual amenity

Post construction, the Scheme may result in the loss of visual amenity as raising the height of the flood walls may be noticeable from many windows and outdoor seating areas in the harbourside and extension and enlargement of the rock revetment along South Beach could impact views of the beach. The installation of the new breakwater at the end of North pier will also result in loss of visual amenity from both North and South beach but additional views along the coast will be provided from access to the breakwater.

Impacts of loss of visual amenity are expected to be greatest for residents close to or with direct views of the harbour area, including the new breakwater, or South Beach (as discussed in Section 11.3). As the scenery within the area is enjoyed by both residents and tourists, the disturbance to the visual amenity of the area due to the Scheme could have a negative impact to the mental health of residents and visitors as a result of any stress caused.

Impacts are considered to be indirect with a low magnitude therefore impacts are considered to be of **minor adverse**.

Tourism and recreation

Following completion of the Scheme, all areas will once again be accessible to tourists and recreational users, as well as South Pier which has been closed for approximately 11 years (Cambrian News, 2018). The new footpath on the crest of the breakwater will provide additional access for recreation.

Landscaping and installation of picnic benches is proposed to the area at the southern end of the footbridge over the River Aeron, which will have a positive effect on human health and wellbeing.

Impacts are considered to be permanent with a low magnitude therefore impacts are considered to be **moderately beneficial**.

Flooding

Post construction, the Scheme is anticipated to have a significant beneficial impact derived from damages avoided as a result from flood protection and a reduction in stress and illness as a result of flooding. The proposed Scheme is anticipated to benefit properties, both residential and business at risk from flooding from a 1 in 200 year storm event. This will also decrease the adverse mental and physical health impacts of flooding. As the Scheme will act to preserve the coastline at Aberaeron, it will have a positive impact on future generations.

There may be slight alterations to pedestrian routes post construction, however these are expected to be minimal.

Impacts are considered to be permanent with a low magnitude therefore impacts are considered to be **majorly beneficial**.

7.4 Mitigation Measures

Mitigation that is relevant to human health impacts is largely captured in the relevant constituent EIA report topic chapters: Chapters 6 (Recreation and Tourism), 8 (Socio-Economics), 11 (Landscape and Visual Amenity), 16 (Noise and Vibration) and 17 (Air Quality).

8 Socio-Economics

This chapter of the ES considers the potential impacts of the Scheme in terms of ‘Socio-economics’ in the area of the Scheme.

This Chapter is not intended to be read as a standalone assessment and references should be made to Chapters 1-4. In addition, this Chapter should also be read in the context of the other technical chapters, due to the range of environmental issues which can affect Socio-Economics. In particular, reference should be made to Chapters 6 (Tourism and Recreation), 15 (Traffic and Transport) and 16 (Noise and Vibration).

8.1 Method of Assessment

The socio-economic impacts of the Scheme are assessed by comparing the baseline conditions in the area against those that are likely to result during construction and post construction.

The method applied to assessing the impacts is common throughout the ES Report and the criteria on the extent of and significance of impact have been defined in Section 5.3.

8.1.1 Assessment Criteria

The assessment describes the effects that are anticipated during construction and operation of the Scheme.

8.2 Baseline Conditions

The following baseline has been identified through a desk-based review of freely available information as referenced throughout.

8.2.1 Description of Existing Environment

Ceredigion County

See Section 6.2 for information on population in Ceredigion.

Tourism

Tourism and recreation make a substantial economic contribution to the local community in Ceredigion (STEAM, 2017). There have been several strategies aiming to promote and enhance the tourism industry in Ceredigion, including:

- Cardigan Bay Action Plan;
- A pilot Sustainable Rural Development Initiative (focused on the Cambrian Mountains);
- The Welsh Coastal Tourism Strategy;
- Tourism & Visitor Economy Strategy for Ceredigion 2011-2020; and
- Destination Management Plan.

With its sought-after landscapes and location, the tourism industry in Ceredigion is a key economic driver but is predominately seasonal (May-September). Tourism contributes approximately £312 million per year to the Ceredigion economy and supports over 5,401 Full Time Equivalent (FTE) jobs (STEAM, 2017). Tourism supports cross cutting services and infrastructure which also benefit local people for example transportation links, the range of shops and services, restaurants, bars, local heritage and cultural facilities.

There are a number of events which take place in Aberaeron that draw people to the town and act as a focus for economic and community activity. These include the Aberaeron Cardigan Bay Seafood

Festival (normally in July), Aberaeron Mackerel Fiesta (August) Aberaeron Carnival (August Bank Holiday Monday), Aberaeron Regatta (normally July) and the Beer and Cider festival (August)¹¹.

Tourism is a key economic sector for Aberaeron, with visiting for wildlife spotting, angling, visiting independent restaurants, hotels and shops in the town.

Further details on tourism and recreation in Aberaeron are outlined in Section 6.

Fishing

In the nineteenth century Aberaeron was a thriving port with a lucrative herring fishery. Today the port is more heavily invested in tourism, however, there are still two registered full-time commercial fishing vessels at Aberaeron harbour, both below 10m in length. There are also several part-time fishing vessels.

Aberaeron sits within International Council for the Exploration of the Sea (ICES) rectangle 33E5. In 2019, 1,723 tonnes of fish and shellfish were landed from 33E5, with a value of £2,251,057. Species targeted in the area are predominantly scallops, whelks, crab, lobster, cod and bass (GOV, 2018). The majority of 10m and under vessels use potting gear targeting shellfish species. A 200kg lifting davit is provided at Quay Parade, but apart from this there are no large commercial facilities for landing fish in Aberaeron. New Quay is the closest area to Aberaeron (7.5 miles) which has facilities for landing fish and fish processing.

ICES rectangles provide a useful baseline for data such as value of commercial fisheries in the general area, however ICES rectangles have a much larger resolution than the area of the Scheme and are not specific to Aberaeron. The few registered vessels operating from Aberaeron will only contribute to a very small proportion of the landings value and are not a major contributor to the local economy.

The Aberaeron Town Angling Club controls fishing along the River Aeron, with club waters extending two miles upstream from the tidal limit. The club are known to fish within the waters of the town itself (see Section 9.2.1 for information on fish species in the river).

Local Businesses¹²

There are a number of local businesses around the harbour and South Beach, these include a hotels and guest houses, restaurants, cafes, and Aberaeron Yacht Club. Identified businesses along the harbour front and around the immediate area of the Scheme from a desk-based search are:

- Tourist Information Centre, Quay Parade;
- Harbourmaster Hotel, Quay Parade;
- 3 Pen Cei Guest House, Quay Parade;
- Evans & Davis (Lawyers), Quay Parade;
- The Hive Restaurant, Cadwgan Place;
- The Summer Grill, Cadwgan Place;
- Cadwgan Inn, Market Street;
- The New Celtic Restaurant, Market Street;
- Elephants & Bananas Gift Shop, Market Street;
- Naturally Scrumptious, Market Street;
- Zuko's Café, Market Street;
- The Cellar, Market Street;
- Castle Hotel, Market Street;

¹¹ Due to COVID-19 a number of events in 2020 were cancelled. It is currently unclear which events will be able to take place in 2021.

¹² Correct at the time of writing (March 2021) however due to impacts from the COVID-19 pandemic this may change.

- Toad Hall, Market Street;
- The Monachty Pub, Market Street;
- Chuckies, Market Street;
- Aberaeron Yacht Club, South Road;
- Gwelfor holiday flat; and
- Gwelfor, Beach Parade.

Market Street and the A487 are the main shopping, retail and business areas, with multiple shops, pubs, cafes, supermarkets and other services (e.g. pharmacy).

Major employers in the area are:

- Ceredigion County Council;
- Dyfed Powys Police - Aberaeron Police Station
- Min y Môr residential care home
- Ysgol Gynradd Aberaeron Primary School; and
- Ysgol Gyfun Aberaeron Comprehensive School.

There are five car parks that are used by locals and visitors in the area of the Scheme, with details provided in Chapter 15 Traffic and Transport.

Gross Value Added (GVA) and Employment

Ceredigion's economy is heavily reliant on micro, Small and Medium-sized Employers (SMEs) and self-employment. Table 8-1 shows the latest available figures for the size of the economy in Ceredigion as measured by Gross Value Added (GVA) with Table 8-2 showing the latest employment figures by sector (Source: Stats Wales, 2018).

The Labour Market & Curriculum Overview for Ceredigion (CCC, 2015a) states that by 2025 the Residential and Social sector will see significant increases of £7.7 million. The accommodation and food and beverage services sectors (attributed to the Tourism industry) are expected to see increases in GVA of 35.3% and 32% respectively.

The Labour Market & Curriculum Overview for Ceredigion (CCC, 2015a) indicates that the accommodation sector is Schemeed to see an increase of 400 employees (33.3%) by 2025. Similarly, the Food and Beverage Services sector will also see an increase of 400 employees, reinforcing the importance of the tourism to the county.

Ceredigion's unemployment rates match Welsh and British averages (CCC, 2013).

Table 8-1 GVA in Ceredigion and Wales (Source: Stats Wales, 2018¹³)

Area	Gross Value Added (GVA) (£ million)
Ceredigion County	1,342
Mid Wales	3,597
Wales	65,089

Table 8-2 Employment by sector in Ceredigion and Wales

Sector	Ceredigion County		Wales	
Agriculture, forestry and fishing	4,300	12%	40,500	3%
Production	2,100	6%	164,500	12%
Construction	2,100	6%	90,500	6%
Wholesale, retail, transport, hotels and food	8,400	24%	331,500	23%
Information and communication	1,100	3%	58,600	4%
Finance and insurance activities	200	1%	31,900	2%
Real estate activities	400	1%	18,100	1%
Professional, scientific and technical activities; administrative and support service activities	2,600	8%	174,100	12%
Public administration, defence, education and health	11,400	33%	422,400	30%
Other service activities	2,000	6%	83,000	6%
TOTAL	34,600		1,415,100	

8.2.2 Data Gaps and Limitations

The Traffic and Transport assessment detailed in section 15, indicates the effect of construction on traffic and parking. However, data is not available to assess the purposes for which people are travelling to/from Aberaeron to analyse if the effect is more significant for business or tourism.

Regarding disruption to tourism, traffic and access to facilities and businesses, and impacts to commuters going further afield such adverse economic impacts are difficult to quantify and are likely to be subject to discussion between local businesses, residents and the Council as construction of the Scheme progresses;

It should be noted that this assessment does not take into account the economic impact of COVID-19 in the socio-economic baseline. It also does not assess the potential for increased risk to

¹³ StatsWales. (2018). Gross Value Added by measure, Welsh economic region and year. Available Online: <https://statswales.gov.wales/Catalogue/Business-Economy-and-Labour-Market/Regional-Accounts/Gross-Value-Added-GDP/gva-by-measure-welsh-economic-region-year> [Accessed: March 2021]

businesses as a result of any future COVID-19 outbreaks as it is presumed that government guidance will be adhered to and the proposed Scheme will not go ahead until it is safe to do so.

8.3 Likely Significant Effects

8.3.1 Construction

Primary sources of disturbance/disruption to socio-economics resulting from construction will arise from noise and visual disturbance, access issues and increased traffic.

Disturbance/Disruption impacts to businesses/ residents

Local businesses and residents will experience disruption during construction works, both through noise and visual disturbance. This may impact on visitor experience and deter people from visiting.

Noise and air quality have been assessed separately and conclusions are presented in Section 16. Noise impacts are considered to be adverse, temporary, reversible and with a medium magnitude, therefore impacts are considered to be of **moderate adverse** for locations along Quay Parade and Pwll Cam but the impacts are reduced in other locations.

Access issues/alternative route impacts to businesses/residents

Some areas and routes may be temporarily diverted or closed to allow for the safe movement of plant and vehicles during construction. This will affect both vehicle access (for deliveries and visitors) and pedestrian access in the area. This will affect accessibility to shops and facilities for local residents and visitors and have a knock-on effect to local businesses. In addition, for any works being undertaken in summer months, this may impact local events/festivals which draw in people from surrounding areas in addition to tourists. Changes in access routes may also have a knock-on effect to those requiring access to the waterfront such as fishermen and other marine users such as boat users and recreational fishers.

The effect on car parking is covered in section 15.3.1 which could lead to issues for locals and tourists in the area as there is limited parking along the sea front and quayside areas, with knock-on effects on businesses. Tourism levels are lower in winter months, as demonstrated by the seasonal closure of the Beach Parade car park at South beach which is used for over winter storage of vessels. Despite this closure parking demand appears to be met.

Impacts are considered to be adverse, temporary, reversible of with a low magnitude and in line with the assessment for traffic in Section 15 the impacts are considered to be **minor adverse**.

Increased traffic flow

Increased numbers of vehicles for construction workers may reduce available parking spaces for residents and visitors if they are taken up by site staff vehicles.

The A487 Trunk Road (managed by The North and Mid Wales Trunk Road Agent (NMWTRA)) is the main strategic route in this area of West Wales and runs directly through Aberaeron. Throughout construction there may be increased traffic flow which could cause disruption to local businesses and commuters alike. The impacts of this are assessed in the Traffic and Transportation assessment (Section 15).

Impacts are considered to be adverse, temporary, reversible of with a low magnitude and in line with the assessment for traffic in Section 15 the impacts are considered to be **minor adverse**.

Impacts to tourism

Annual festivals may also be affected, however the tourist season is robust without these additional events. However, construction access routes for the North Pier breakwater may prevent the Mackerel Fiesta parade from using its usual location at Quay Parade, but other suitable locations should be possible at other street locations. Most of the construction phase is expected to occur during winter time, therefore limiting the main impacts to the summer tourist season during which most festivals occur to just one season.

Impacts are considered to be adverse, temporary and with a medium magnitude, therefore impacts are considered to be **moderately adverse**.

Impacts to fishing

As there are only two registered vessels operating from Aberaeron these vessels will only contribute to a very small proportion of the landings value and are not a major contributor to the local economy. The lifting davit at Quay Parade may be affected for a short period of time when works take place immediate adjacent. Apart from this facility, there are also no landing facilities in Aberaeron which would be disrupted by construction works.

Construction of the rock breakwater, installation of the floodgates and rebuilding of the seaward head of South Pier will not prevent vessels from navigating out to sea as the contractor will be required to keep navigation routes clear and any obstructions or danger marked.

However, construction activities which will impact local fishermen are relatively short term, such as prevention of access to the lifting davit over a period of days and temporary. Signage and navigation beacons (including electricity cables for lighted beacons) will be installed in consultation with Ceredigion Harbour Authority. Therefore, impacts are considered to be adverse, temporary, reversible and with a low magnitude, therefore impacts are considered to be **minor adverse**.

Potential employment / business opportunities

There may be increased opportunities for local income and employment through the construction phase e.g. provision of accommodation, meals, parking, materials and supply of staff. This could be enhanced through requirements at the procurement stages in order to include community benefits (e.g. the contractor could have a target for sourcing materials / services locally and where feasible, providing training to local apprentices) although due to the size of the Scheme this would be relatively low.

Impacts are considered to be beneficial, temporary and with a low magnitude, therefore impacts are considered to be of **minor beneficial**.

8.3.2 Operation

Flooding

Post construction, the Scheme is anticipated to have a significant beneficial impact the economy and livelihoods derived from damages avoided as a result from flood protection. The proposed Scheme is anticipated to directly benefit properties, both residential and business at risk from flooding from a 1 in 200 year storm event (see Section 1.1.1).

Improvement will occur to the Pwll Cam area as flooding takes place almost monthly at time of spring tides. Without this flooding occurring, additional amenity and recreation space will be gained in Pwll Cam. This could serve as a future market or exhibition space.

The improvements to flood protection would therefore have a permanent, **major beneficial** impact on the local economy.

Tourism and recreation

Following completion of the Scheme, all areas will once again be accessible to tourists and recreational users, as well as South Pier which has been closed for approximately 11 years (Cambrian News, 2018). The new footpath on the crest of the breakwater will provide additional access for recreation.

New seating along Quay Parade, with options also being considered to fix seating directly onto the seaward side of the flood wall, including the retention of 5 Memorial benches and widening of the promenade on the seaward side of the flood wall along Quay Parade will improve pedestrian access.

Improved access will be provided to the promenade for those with limited mobility by removing the existing 'up and over' steps over the flood wall, with access replaced with gaps in the wall created by the new tilt barrier locations. A tilt barrier will be located directly opposite the Harbourmaster Hotel in order to improve the experience of their visitors with direct access outside the hotel entrance.

Impacts are considered to be beneficial, permanent with a medium magnitude therefore impacts are considered to be **moderately beneficial**.

8.4 Mitigation Measures

See Section 6 for specific mitigation measures relating to tourism.

See Section 15 for specific mitigation measures relating to traffic and transportation.

See Section 16 for specific mitigation measures relating to noise and vibration.

9 Ecology

9.1 Method of Assessment

This chapter describes the ecological baseline and evaluates the nature conservation importance of ecological features present in the ecological zone of influence for the Scheme. It also identifies the potential impacts from the Scheme on important ecological features and sets out mitigation measures to reduce any adverse effects. Ecological features include nature conservation sites, habitats and individual species.

The assessment has been carried out through the following activities:

- Desk-top review of the following key data sources:
 - Natural Resources Wales (NRW) website (www.naturalresources.wales) – including departmental briefs, site assessment documents, conservation objectives and impact assessments;
 - Defra's Multi-Agency Geographic Information for the Countryside website (MAGIC) (www.magic.defra.gov.uk);
 - CCC Ceredigion Biodiversity Action Plan (BAP);
 - CCW¹⁴ Phase 1 Intertidal Habitat survey information; and
 - CCC website (www.ceredigion.gov.uk).
- Site visits conducted in October 2018 and July 2020 by Atkins ecologists as part of the preparation of the Scoping Report and ES respectively.
- Biodiversity records search from the West Wales Biodiversity Information Centre (WWBIC): in November 2018 and more recently in May 2021 for the biological records of species within a 1km radius of the South Pier of Aberaeron Harbour (Grid Reference SN453630), including:
 - Protected and Priority Species;
 - Other Species of Conservation Concern;
 - Locally Important Species;
 - All Species; and
 - Wales Biodiversity Partnership Priority Habitats.
- Reptile survey commissioned by CCC of the field proposed for the location of the site compound - Aberaeron Coastal Defence Scheme Reptile Survey Report (CSCC CWIC, 2020).
- Subtidal marine survey undertaken in September 2019 (Eco Marine Consultants, 2019) (Appendix E).

9.1.1 Assessment Criteria

The methodology to assess the significance of impacts on ecological features as a result of the Scheme is based on the methodology described in Chapter 5.3 of this ES and uses the significance terminology in Table 5.3. The assessment of the significance of predicted impacts on ecological features is based on both the 'importance' of a feature and the nature and magnitude of the impact that the Scheme will have on it.

¹⁴ CCW is now part of NRW

The assessment has also followed guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM) in the Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018) document.

A Habitats Regulations Assessment (HRA) has also been carried out due to the presence of European sites located within the immediate area of the Scheme. The HRA is contained in Appendix F of this ES and is described in further detail throughout this Chapter.

9.2 Baseline Conditions

The following ecological receptors are assessed in this Chapter. These receptors were identified in the Scoping Report (Atkins, 2019) as having the potential to be affected from the Scheme and are considered under separate headings in this chapter.

- Protected sites;
- Terrestrial ecology;
- Marine mammals;
- Fish;
- Reptiles;
- Otter;
- Birds;
- Intertidal ecology;
- Subtidal ecology;

The following receptors were assessed in the scoping report as not being affected as a result of the Scheme and were therefore scoped out of further assessment and have not been considered further:

- Rhos Talglas Special Area of Conservation (SAC);
- Bats;
- Water vole; and
- Post-construction impacts to all ecological features, with the exception of:
 - Migratory fish species in the River Aeron;
 - Intertidal and subtidal habitats;
 - Protected Sites; and
 - Otter (although this was recommended in the Scoping Report to be scoped out of further assessment post construction, it has been included in the assessment following discussions with CCC ecologists)

9.2.1 Description of Existing Environment

Protected Sites

A number of European designated sites¹⁵ exist within a 10km search radius of the location of the Scheme. Protected Sites with designated features which are mobile or migratory in nature and have the potential to occur in the area of the Scheme have also been used in this assessment for European sites. A 1km search area has been used for nationally designated sites such as Sites of Special Scientific Interest (SSSI). The protected sites considered are:

¹⁵ Following the changes made to the Conservation of Habitats and Species Regulations 2017 (as amended) by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, SACs and SPAs in the UK no longer form part of the EU's Natura 2000 ecological network and now form part of a UK national site network. In this document they are still referred to as European Sites.

- Special Area of Conservation (SAC) - designated under the Conservation of Natural Habitats and Wild Fauna and Flora 1992 (92/43/EEC) Directive (known as the Habitats Directive). The Directive is transposed into UK law through the Habitats Regulations 2017.
- Special Protection Area (SPA) - designated under the Conservation of Wild Birds 1979 (79/409/EEC) Directive (known as the Birds Directive). This Directive is also transposed into UK law through the Habitats Regulations 2017.
- Ramsar Sites - listed under the Ramsar Convention on Wetlands of International Importance 1972. Government policy is that Ramsar sites are treated in the same way as SPAs and SACs for the purpose of considering development proposals, as set out in Planning Policy Wales (WAG, 2002).
- Site of Special Scientific Interest (SSSI) - designated under the Wildlife and Countryside Act 1981 (as amended).

The list of protected sites used in the assessment are shown in Table 9.1, with the location of the European sites in Figure 9.1 and nationally designated sites in Figure 9.2.

The coastline of Aberaeron lies within the Cardigan Bay / Bae Ceredigion SAC, the West Wales Marine / Gorllewin Cymru Forol SAC and the Aberarth-Carreg Wylan SSSI. Within 10km of the scheme boundary are the following designated conservation sites:

- Rhos Talglas SAC (9km inland)
- Creigiau Aberarth-Morfa SSSI (3km north)

Due to the distance of these sites from the Scheme only the designated features relating to the highly mobile species with the potential to occur in the area of the Scheme have been assessed, but assessment of the sites themselves have been excluded from further assessment:

The designated conservation sites beyond the 10km radius of the Scheme which have migratory or transient qualifying species with the potential to occur in the area of the Scheme, include:

- Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC (18km);
- Northern Cardigan Bay / Gogledd Bae Ceredigion SPA (16km); and
- Cors Fochno and Dyfi Estuary Ramsar and SPA site (33km).

There are no Ramsar sites or SPAs within 10km of Aberaeron Harbour.

Table 9-1 Nature Conservation Sites

Nature Conservation Site	Designation	Features	Distance from Scheme
Cardigan Bay / Bae Ceredigion	SAC	The Cardigan Bay / Bae Ceredigion SAC covers 95,857.06ha in Cardigan Bay. Habitats present as qualifying features of the site (but not a primary reason for selection) include: • Sandbanks which are slightly covered by sea water all the time. • Reefs. • Submerged or partially submerged sea caves.	0km

Nature Conservation Site	Designation	Features	Distance from Scheme
		Species present as qualifying features of the site are: • Bottlenose dolphin (<i>Tursiops truncatus</i>) • Sea lamprey (<i>Petromyzon marinus</i>) • River lamprey (<i>Lampetra fluviatilis</i>) • Grey seal (<i>Halichoerus grypus</i>)	
West Wales Marine / Gorllewin Cymru Forol	SAC	The West Wales Marine / Gorllewin Cymru Forol SAC is located off the coast of Wales from the Llŷn peninsula in the north, to Pembrokeshire in the southwest, covering an area of 737,600ha. The West Wales Marine SAC has been identified as an area of national importance for harbour porpoise (<i>Phocoena phocoena</i>).	0km
Aberarth-Carreg Wylan	SSSI	The Aberarth-Carreg Wylan SSSI covers 988.6ha of coastline extending from Aberarth to of Careg Wylan, encompassing Cardigan Island and a part of the Teifi estuary. The site is of special interest due to its geological and geomorphological features, with a bedrock geology dominated by a sedimentary succession of sandstones, siltstones and mudstones of Silurian to early Devonian age. The cliffs and coastal slopes provide habitat for various bird species, and the sea caves and secluded beaches provide pupping sites for seals. Designated for a wide range of coastal and marine wildlife including: • Bottlenose dolphin (<i>Tursiops truncatus</i>); • Grey seal (<i>Halichoerus grypus</i>); • Honeycomb worm (<i>Sabellaria alveolata</i>); • The nationally rare amphipod crustacean <i>Pectenogammarus planicrurus</i>; • Chough (<i>Pyrrhocorax pyrrhocorax</i>); • Kittiwake (<i>Rissa tridactyla</i>); • Lesser black-backed gull (<i>Larus fuscus</i>); • Rock sea lavender (<i>Limonium britannicum</i> ssp. <i>transcanalis</i>); • Common gromwell plant (<i>Lithospermum officinale</i>); • Smooth cat's ear plant (<i>Hypochaeris glabra</i>); • Pearl bordered fritillary butterfly (<i>Bolaria euphrosyne</i>); and • Small blue butterfly (<i>Cupido minimus</i>).	0km

Nature Conservation Site	Designation	Features	Distance from Scheme
Northern Cardigan Bay / Gogledd Bae Ceredigion	SPA	The Northern Cardigan Bay / Gogledd Bae Ceredigion SPA is located in the North of Cardigan bay, encompassing a total area of 95,857.06ha. The site is designated for its nationally significant wintering population of Red-throated diver (<i>Gavia stellata</i>).	16km North
Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau	SAC	The Llyn Peninsula and the Sarnau / Pen Llyn a'r Sarnau SAC encompasses the north of Cardigan Bay, up to Nefyn in north Wales. The site is designated for a variety of habitat features including the Glaslyn/Dwyrdd, Mawddach and Dyfi estuaries. Species present as qualifying features of the site, with the potential to occur in the area of the Scheme are as follows (other site features have been scoped out as not mobile): • Bottlenose dolphin (<i>Tursiops truncatus</i>); • Otter (<i>Lutra lutra</i>); and • Grey Seal (<i>Halichoerus grypus</i>).	18km North
Cors Fochno and Dyfi Estuary	Ramsar and SPA	The Cors Fochno Ramsar site and Dyfi Estuary SPA are two overlapping designations covering areas of 2492.24ha and 2056.6ha, respectively. The site is comprised of the Dyfi Estuary and associated bog habitat features. The Greenland white-fronted goose (<i>Anser albifrons flavirostris</i>) is present as a qualifying feature of the sites, with the potential to occur in the area of the Scheme. Other habitats and species unlikely to be affected have been excluded.	33km North

Figure 9-1 - Location of European Designated Sites within 10km of the Scheme

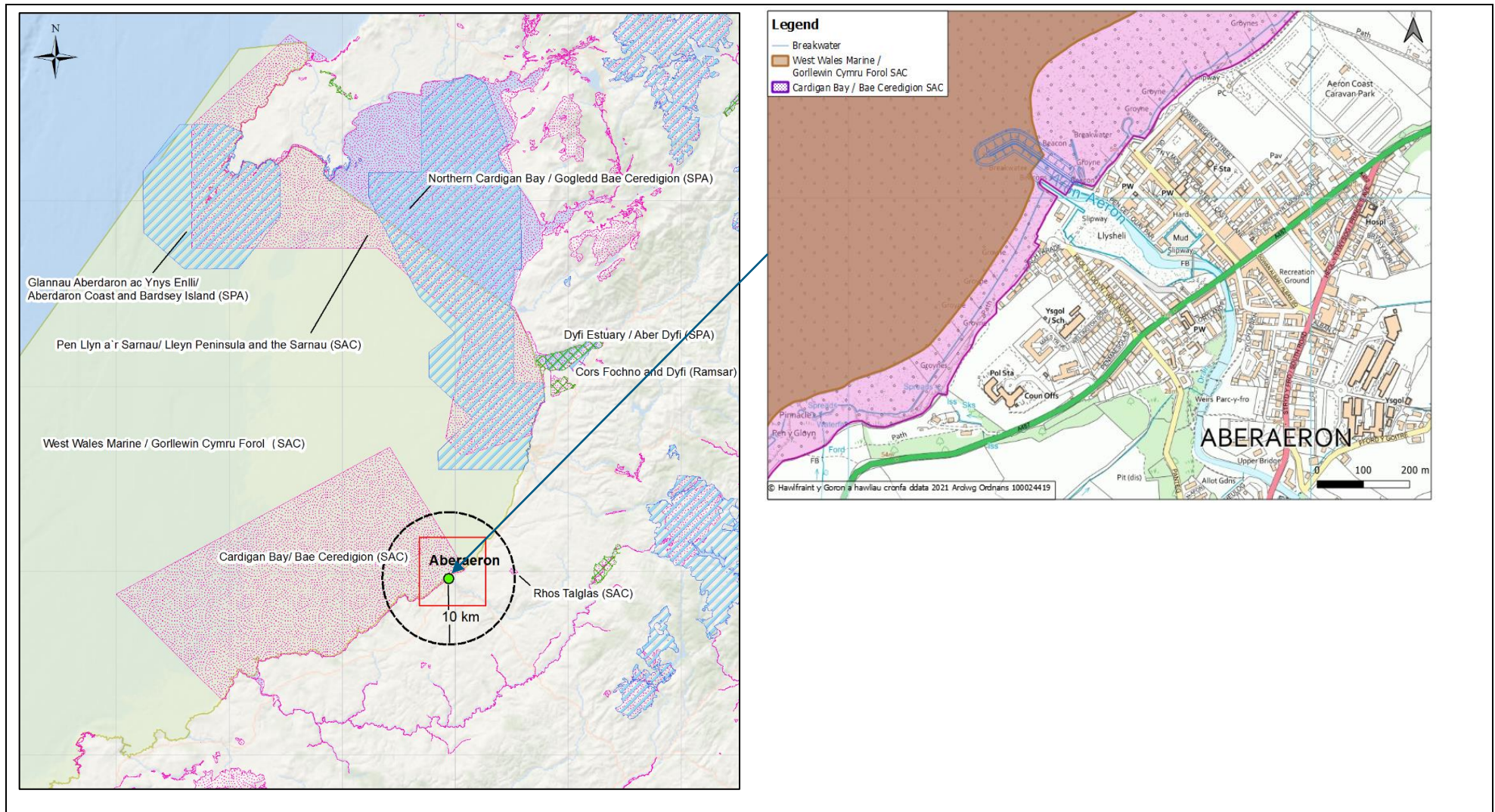


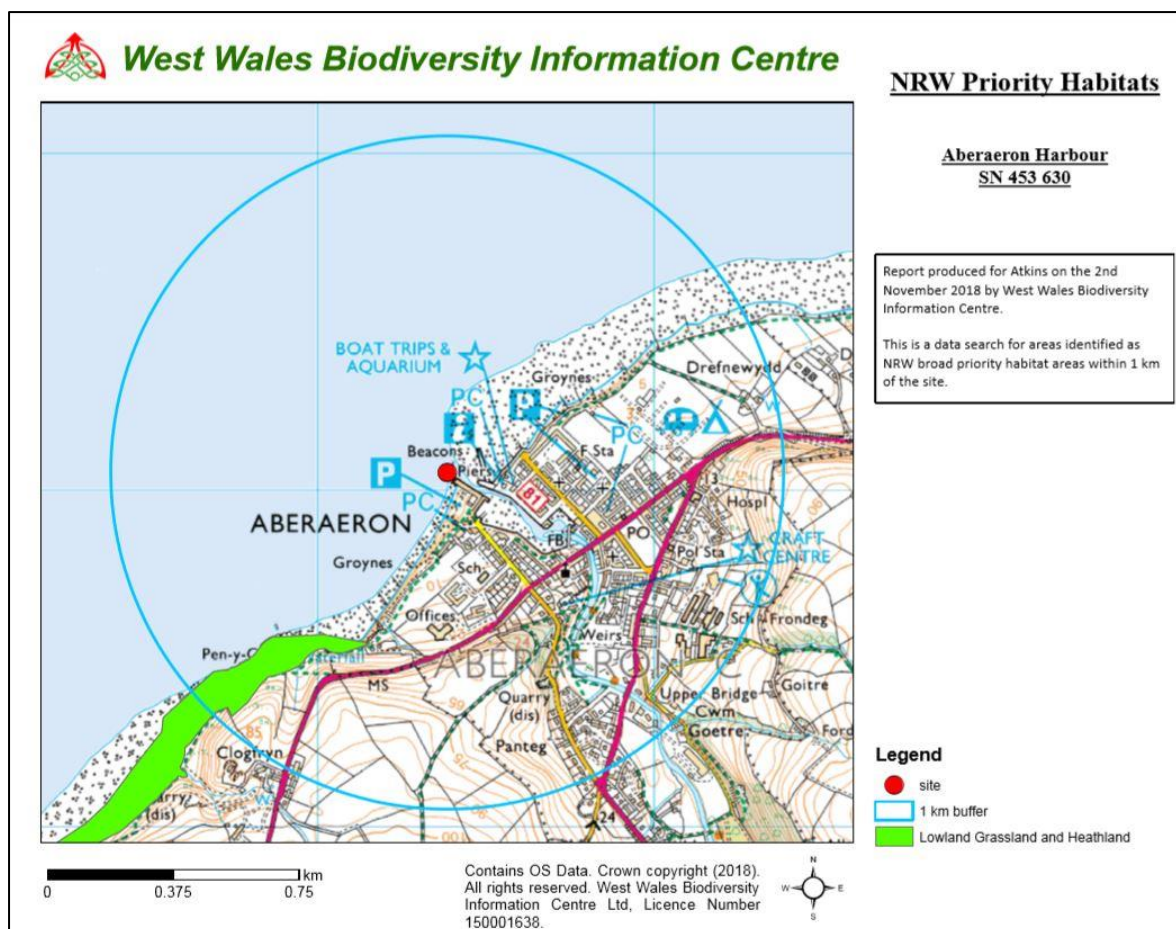
Figure 9-2 - Location of Nationally Designated Sites within 1km of the Scheme



Terrestrial Ecology

The town of Aberaeron is centred around the harbour, with the coastal frontage split into the North Beach and South Beach by two piers located at the harbour entrance. The area around the harbour is predominantly urban, with hardstanding pavement or road. Behind much of the South Beach is an area of coastal meadow which is a rare and priority habitat albeit not designated. The WWBIC has recorded over 60 invertebrates for this grassland, including one species previously unrecorded in Ceredigion. The Wales Coast Path is located along the back of South Beach, between the beach and grassland. The southern end of South Beach is characterised by exposed low lying cliffs as seen in Figure 1-3. The cliff faces of the South Beach are in the NRW priority habitat 'lowland grassland and heathland', the only designated priority habitat within 1km of the Scheme as shown in Figure 9-3. This habitat is considered a priority habitat due to the rich biodiversity that these habitats support.

Figure 9-3 NRW Priority Habitats within 1km of the Scheme



Consultation with CCC ecologists has also identified some small areas of vegetated shingle habitat on the southern bank of the River Aeron, just downstream of the river footbridge by the A487 road crossing.

The Scheme is located in the Aberarth-Carreg Wylan SSSI (see Table 9.1) which is designated for the following plant species:

- Rock sea lavender (*Limonium britannicum* ssp. *transcanalis*);
- Common gromwell plant (*Lithospermum officinale*); and
- Smooth cat's ear plant (*Hypochaeris glabra*).

Plant species of conservation importance recorded within 1km of the Scheme was obtained from WWBIC and is presented in Table 9-2. The data set does not show any species protected under the Aberarth-Carreg Wylan SSSI within 1km the Scheme. The majority of plant species of conservation importance are species of moss recorded on the cliff faces of South Beach. It is important to note that the absence of SSSI designated species in the WWBIC data, does not mean they are not present in the Scheme area and could be identified in future habitat surveys.

Two invasive plant species have also been recorded within 1km of the Scheme; Japanese knotweed (*Fallopia japonica*) and Himalayan Balsam (*Impatiens glandulifera*). These are located near the CCC offices at Penmorfa.

Table 9-2 Plant Species of Conservation Importance within 1km of the Scheme

Species	Conservation Status
Common Bent (<i>Agrostis capillaris</i>)	RDB1 [Wales] – LC*

<i>Amblystegium serpens</i> var. <i>serpens</i> (moss)	RDB1 [Wales] - LC
Bird's-claw Beard-moss (<i>Barbula unguiculata</i>)	RDB1 [Wales] - LC
Rough-stalked Feather-moss (<i>Brachythecium rutabulum</i>)	RDB1 [Wales] - LC
Capillary Thread-moss (<i>Bryum capillare</i>)	RDB1 [Wales] - LC
<i>Bryum dichotomum</i> (moss)	RDB1 [Wales] - LC
Pointed Spear-moss (<i>Calliergonella cuspidata</i>)	RDB1 [Wales] - LC
Redshank moss (<i>Ceratodon purpureus</i>)	RDB1 [Wales] - LC
Fern-leaved Hook-moss (<i>Cratoneuron filicinum</i>)	RDB1 [Wales] - LC
Olive Beard-moss (<i>Didymodon tophaceus</i>)	HDir**
Snowdrop (<i>Galanthus nivalis</i>)	RDB1 [Wales] - LC
Crescent-cup Liverwort (<i>Lunularia cruciata</i>)	RDB1 [Wales] - LC
Forked Veilwort (<i>Metzgeria furcata</i>)	RDB1 [Wales] - LC
Swan's-neck Thyme-moss (<i>Mnium hornum</i>)	RDB1 [Wales] - LC
Endive Pellia (<i>Pellia endiviifolia</i>)	RDB2 [UK] – S***
Scots Pine (<i>Pinus sylvestris</i>)	RDB1 [Wales] - LC
Jagged Germanderwort (<i>Riccardia chamedryfolia</i>)	RDB1 [Wales] - LC

*RDB1 [Wales] – LC: Red List for Wales - Least Concern

**RDB2 [UK] – S: Rare and scarce species (not based on IUCN criteria) - Nationally Scarce

***HDir: Habitats Directive

Reptiles

An area of grassland between South Beach and Aberaeron Primary School (NGR SN 454 628), proposed for use as the construction site compound, was identified during consultation with CCC ecologists as having potential to support common reptile species.

A desk and field survey were commissioned by CCC in 2019 to determine likely presence/absence of reptiles at this location. A total of seven survey visits were undertaken between 23rd May to 26th June 2019 by CCC ecologists. No reptiles were detected during the visits, and it is unlikely that reptiles are currently present in the site area. Mitigation for legal reasons in relation to these species is discussed in Section 9.3.

Otter

Otter (*Lutra lutra*) are widespread in all parts of the UK and known to occur in the River Aeron and the coastal areas of Cardigan Bay.

The biodiversity data from the WWBIC contains nine records of otter sightings or spraint (otter droppings) detected within 1km of the Scheme along the River Aeron. Locals in Aberaeron have also noted spraint under the bridge of the A487, indicating this as a potential resting place for otters. CCC ecologists have also confirmed their presence in the area and their use of a ledge on the river wall on the northern bank of the River Aeron, downstream of the A487 road bridge, as a commuting route.

There is potential for the area of the Scheme to be utilised for foraging and commuting by local otter populations. However, it is considered unlikely that the area of the Scheme forms part of any core otter territory with natal holts unlikely to be present in the area the proposed works.

Birds

Ceredigion is a popular destination for bird watching and there are approximately 292 species of bird recorded in the county (www.fatbird.com, accessed 15/04/2021). Data obtained from the WWBIC show there have been 100 species of bird recorded within 1km radius of the Scheme between 1996 to 2017.

The Scheme lies in the Aberarth-Carreg Wylan SSSI which is designated for breeding populations of Chough (*Pyrrhocorax pyrrhocorax*), Kittiwake (*Rissa tridactyla*), and Lesser black-backed gull (*Larus fuscus*).

The Northern Cardigan Bay SAC 16km northeast of the Scheme is designated for Red-throated diver (*Gavia stellata*). Further, the Cors Foncho and Dyfi Estuary Ramsar and SPA lies 33km northeast of the Scheme and is designated for Greenland white-fronted goose (*Anser albifrons flavirostris*) and Common greenshank (*Tringa nebularia*).

The WWBIC data records Kittiwake, Lesser black-backed gull and Red-throated diver within 1km of the Scheme. Table 9-3 presents bird species which have been most frequently recorded in the area of the Scheme.

Table 9-3 Bird species recorded within 1km of the Scheme

Species	Comments
Mallard (<i>Anas platyrhynchos</i>)	Seen all round the coast of the UK. Breed in wetland habitats throughout the year in the UK.
Turnstone (<i>Arenaria interpres</i>)	Seen all round the coast of the UK. Feed on rocky shores, gravel beaches and can be seen feeding on jetties and harbour walls. Does not breed in the UK.
Dunlin (<i>Calidris alpina</i>)	Seen all round the coast of the UK. Breed in the uplands of Scotland, Wales and England.
Ringed plover (<i>Charadrius hiaticula</i>)	Seen all round the coast of the UK. Breed on beaches around the UK coast. There is potential that European populations of Ringed plover winter in the area of the Scheme, as well as resident UK populations.
Red-throated diver (<i>Gavia stellata</i>)	Seen all round the coast of the UK outside of breeding season. Breed in North Scotland.
Oystercatcher (<i>Haematopus ostralegus</i>)	Seen all round the coast of the UK and breed on most UK coastlines.
Little gull (<i>Hydrocoloeus minutus</i>)	Transient species seen all round the coast of the UK from July to April. In late summer and autumn, birds are primarily seen in the north of England, and in spring birds can be seen around the Irish Sea.
Common gull (<i>Larus canus</i>)	Seen all round the coast of the UK during winter. Breed on the coast and inland lakes of Scotland, Northern Ireland and the north of England.
Common scoter (<i>Melanitta nigra</i>)	Spends most of its time at sea and can be found offshore coasts all round the UK, only approaching land to breed. Breed in north and west Scotland.
Curlew (<i>Numenius arquata</i>)	Seen all round the coast of the UK. Greatest breeding populations are in north Wales, the Pennines, North Scotland and the Northern Isles.
Leach's petrel (<i>Oceanodroma leucorhoa</i>)	Spends most of its time at sea, only approaching land to breed and then only at night. Breeds on offshore islands in N and W Scotland.

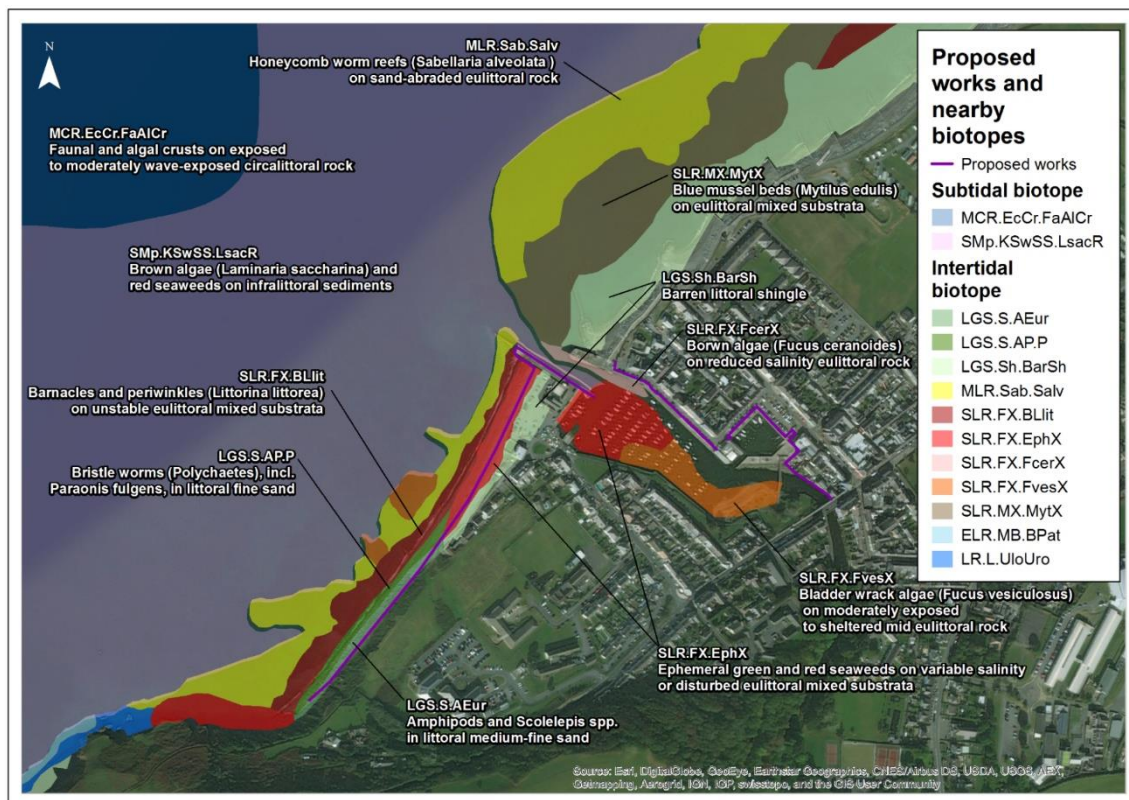
Species	Comments
Golden plover (<i>Pluvialis apricaria</i>)	Seen all round the coast of the UK. Breeds on the moorlands in Scotland, north England, Wales and Devon. Winters on lowland farmland and muddy estuaries around the UK coastline.
Kittiwake (<i>Rissa tridactyla</i>)	Seen all round the coast of the UK and breeds on most UK coastlines.

Intertidal Ecology

The intertidal zone of Aberaeron South Beach is gently sloping, composed of shingle on the upper beach, and sand on the lower beach, which makes it popular with tourists, locals and visitors alike.

The Countryside Council for Wales (CCW, now Natural Resources Wales (NRW)) undertook habitat surveys around the whole of the Welsh coast between 2007 and 2010 known as the HABMAP Scheme. Data from this survey Scheme has been downloaded and the intertidal biotopes in the area of the Scheme are presented in Table 9-4 (<https://naturalresources.wales/about-us/our-Schemes/marine-Schemes/habmap>).

Figure 9-4 Intertidal and Subtidal Habitat Map



The descriptions provided of the biotopes have been taken from the corresponding Marine Nature Conservation Review (MNCR) Marine Habitat Classification on the JNCC website¹⁶. As these surveys were undertaken using previous MNCR classification systems, the biotopes have been converted to the most recent EUNIS (2007) classifications. The biotopes in the area of the Scheme are shown in Table 9-4.

¹⁶ <http://www.jncc.gov.uk/marine/biotopes/hierarchy.aspx>

Table 9-4 Intertidal Biotopes Within the Scheme Area

Biotope (MNCR)	EUNIS classification 2007	Description
LGS.S.AEur	A2.223	Amphipods and <i>Scolecopsis</i> spp. in littoral medium-fine sand
LGS.S.AP.P	A2.2311	Polychaetes, including <i>Paraonis fulgens</i> , in littoral fine sand
LGS.Sh.BarSh	A2.111	Barren littoral shingle
MLR.Sab.Salv	A2.711	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock
SLR.FX.BLit	A2.431	Barnacles and <i>Littorina littorea</i> on unstable eulittoral mixed substrata
SLR.FX.EphX	A2.821	Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata
SLR.FX.FcerX	A1.327	<i>Fucus ceranoides</i> on reduced salinity eulittoral rock
SLR.FX.Fves	A1.313	<i>Fucus vesiculosus</i> on moderately exposed to sheltered mid eulittoral rock
SLR.MX.MytX	A2.721	<i>Mytilus edulis</i> beds on eulittoral mixed substrata
ELR.MB.BPat	A1.1121	<i>Chthamalus montagui</i> and <i>Chthamalus stellatus</i> on exposed upper eulittoral rock
LR.L.UloUro	B3.115	<i>Ulothrix flacca</i> and <i>Urospora</i> spp. on freshwater-influenced vertical littoral fringe soft rock

Intertidal habitat types of conservation importance identified within the area of the Scheme include *Sabellaria alveolata* (Honeycomb worm) reefs on sand-abraded eulittoral rock in the area next to South Pier and along South Beach and extending into the subtidal zone.

The Honeycomb worm (*Sabellaria alveolata*) form littoral biogenic reefs (reefs made of living creatures, in the lower intertidal area and shallow subtidal), which help to stabilise the boulders and cobbles. Other species found in this habitat include barnacles *Elminius modestus* and *Semibalanus balanoides*, mussel *Mytilus edulis*, and whelk *Nucella lapillus*. The crab *Carcinus maenas* and the anemone *Actinia equina* can be present in cracks and crevices of the reef.

Despite *S.alveolata* being identified as present in the HABMAP survey, an ecological walkover survey carried out in summer 2019 by a member of the Scheme team, found no *S.alveolata* reefs or encrustations in the intertidal area along South Beach or around the piers. Mussel beds on North Beach were visible at low tide. Species observed on the wooden groynes and piers included limpets, barnacles and seaweed species. Images taken during the site visit of the head of the South Pier, groyne at the base of the South Pier and a weathered groyne along South Beach Figure 1-5, Figure 1-6 and Figure 1-8) show no evidence of *S.alveolata* reefs. Further discussion of *S.alveolata* in the subtidal zone is discussed in the next section below.

Mussel (*Mytilus edulis*) beds on eulittoral (lower intertidal area) mixed substrates are located along the North Beach of Aberaeron. ‘Mussel mud’ formed by blue mussel waste is an important source of nutrients for animals living within the seabed (JNCC, 2015).

Within the harbour, the southern shoreline is exposed at low tide, with Figure 9.4 showing a habitat type of ephemeral green and red seaweeds as well as bladder wrack algae. The northern shore remains submerged at low tide and comprises a mix of fine river sediment, sand and shingles. The harbour mouth and channel is dredged annually to maintain a navigable depth. The dredged material is recycled onto South Beach.

Subtidal Ecology

Subtidal habitats mapped during the HABMAP 2007-2010 Scheme are also shown in Figure 9-4. The habitats in the area of the Scheme are presented within Table 9-5, with the MNCR biotope classification system converted to the most recent EUNIS (2007) classifications.

Table 9-5 Subtidal Biotopes within the Scheme Area

Biotope (MNCR)	EUNIS classification 2007	Description
CR.MCR.EcCr.FaAlCr	A4.214	Faunal and algal crusts on exposed to moderately wave-exposed circalittoral rock
SS.SMp.KSwSS.LsacR	A5.521	Brown algae <i>Laminaria saccharina</i> and red seaweeds on infralittoral sediments

The subtidal habitats identified from the HABMAP survey show two dominant biotopes. Closer to the shoreline, the subtidal habitat is composed of mixed muddy substrate communities characterised by foliose red algae and the kelp species *Saccharina latissima*. Further from the shoreline, the subtidal habitat is composed of wave-exposed and moderately wave exposed bedrock or boulders, subject to weak to moderate tidal streams. This habitat is dominated by algal (*Corallinaceae*) and faunal (e.g. *Parasmittina trispinosa*) crusts.

A subtidal habitat survey was also carried out in September 2019 by Eco Marine Consultants as part of the Scheme design (Figure 9.5). The survey used a Remotely Operated Vehicle (ROV) or drop-down video to survey the seabed offshore of the harbour entrance. The survey was undertaken to establish the benthic habitats present as well as any species of conservation importance, which would be impacted by the footprint of the proposed breakwater. All ROV footage and image analysis was undertaken with JNCC guidance given in the Marine Monitoring Handbook (JNCC, 2001), the JNCC guidance on assigning benthic biotopes (Parry, 2015) and the NMBAQC and JNCC epibiota interpretation guidelines (Turner *et al.*, 2016). Biotopes recorded were assigned in accordance with the EUNIS classification scheme. The habitat description of each biotope shown in Figure 9.5 is provided in Table 9.6 further below.

Figure 9-5 Subtidal Survey 2019 Biotope Distribution

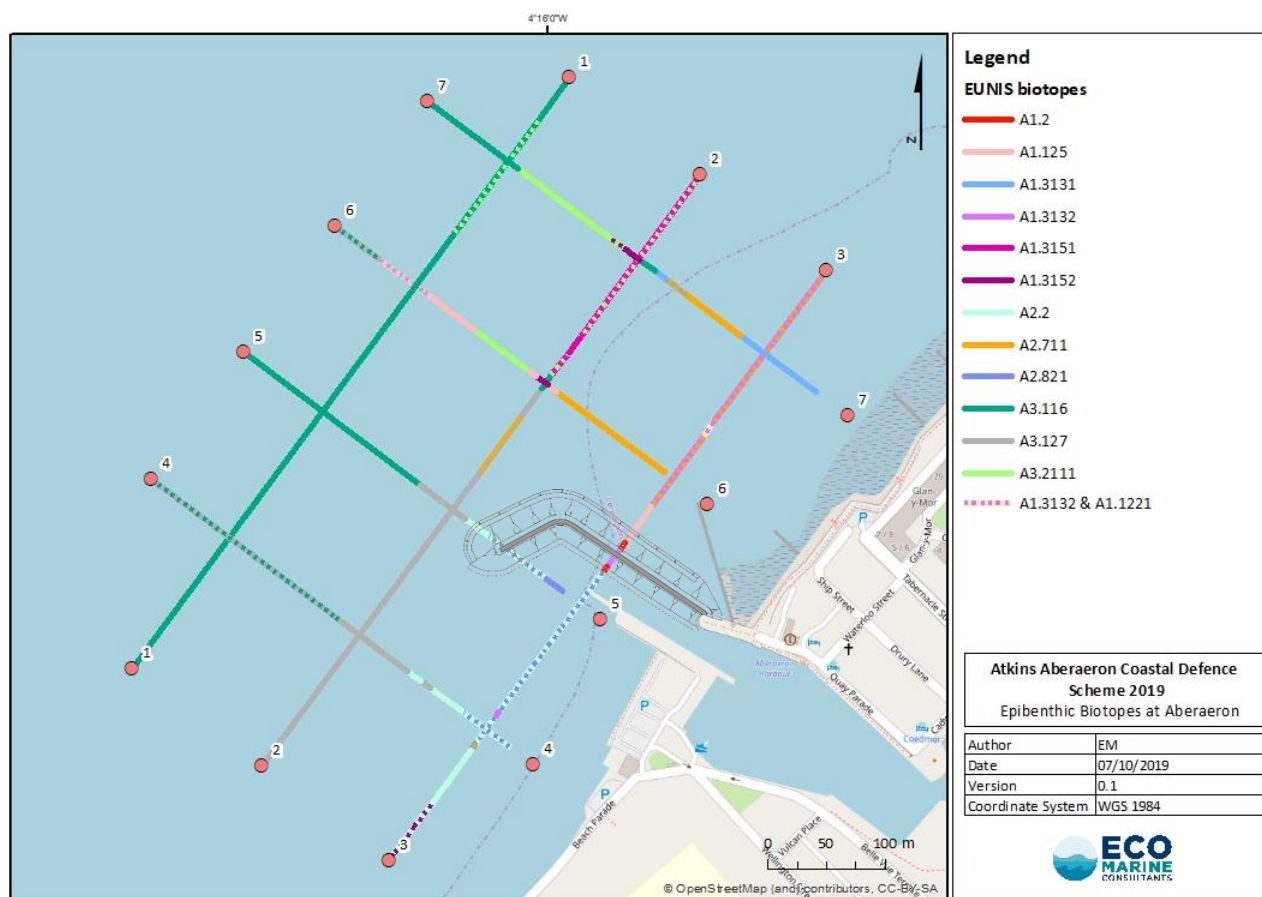


Table 9.6 shows the subtidal biotopes recorded from the survey. A total of 12 intertidal and shallow subtidal biotope complexes were identified suggesting a diverse and ecologically varied site. There were numerous stretches along each of the transects where two habitats were intermittently present, with more than one biotope description fitting the environmental conditions as well as faunal and algal species recorded. Where this was the case, two biotopes have been recorded in 'mosaic' form and are shown highlighted in blue in The subtidal habitats identified from the HABMAP survey show two dominant biotopes. Closer to the shoreline, the subtidal habitat is composed of mixed muddy substrate communities characterised by foliose red algae and the kelp species *Saccharina latissima*. Further from the shoreline, the subtidal habitat is composed of wave-exposed and moderately wave exposed bedrock or boulders, subject to weak to moderate tidal streams. This habitat is dominated by algal (*Corallinaceae*) and faunal (e.g. *Parasmittina trispinosa*) crusts.

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Table 9-6 Subtidal Biotopes from the 2019 Subtidal Survey

Biotope (MNCR)	EUNIS Biotope Complex	Habitat Description	% Coverage

LR.HLR.FR.Mas	A1.125 (Level 5)	<i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very exposed to moderately exposed lower eulittoral rock	3.03
LR.M.LR	A1.2 (Level 3)	Moderate energy littoral rock	0.42
LR.LLR.F.Fves	A1.3131 (Level 5)	<i>Fucus vesiculosus</i> on moderately exposed to sheltered mid eulittoral rock	2.74
LR.LLR.F.Fves and LS.LBR.Sab.Salv	A1.3131 (Level 5) & A2.711 (Level 5)	<i>Fucus vesiculosus</i> on moderately exposed to sheltered mid eulittoral rock and <i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock mosaic	0.68
LR.LLR.F.Fves.X	A1.3132 (Level 6)	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata	0.67
LR.LLR.F.Fves.X and LR.HLR.FR.Coff.Coff	A1.3132 (Level 6) & A1.1221 (Level 6)	<i>Fucus vesiculosus</i> on mid eulittoral mixed substrata and <i>Corallina officinalis</i> and <i>Mastocarpus stellatus</i> on exposed to moderately exposed lower eulittoral rock	0.45
LR.LLR.F.Fserr.FS	A1.3151 (Level 5)	<i>Fucus serratus</i> on full salinity sheltered lower eulittoral rock	0.41
LR.LLR.F.Fserr.X	A1.3152 (Level 6)	<i>Fucus serratus</i> on full salinity lower eulittoral mixed substrata	0.84
LR.LLR.F.Fserr.X and LS.Lsa	A1.3152 (Level 6) & A2.2 (Level 6)	<i>Fucus serratus</i> on full salinity lower eulittoral mixed substrata and Littoral sand	1.80
LR.LLR.F.Fserr.X and IR.MIR.KR.Ldig.Ldig	A1.3152 (Level 6) & A3.2111 (Level 6)	<i>Fucus serratus</i> on full salinity lower eulittoral mixed substrata and <i>Laminaria digitata</i> on moderately exposed sublittoral fringe bedrock mosaic	0.40
LS.Lsa	A2.2 (Level 3)	Littoral sand	3.78
LS.LBR.Sab.Salv	A2.711 (Level 5)	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock	5.11
LS.LBR.Sab.Salv and LR.LLR.F.Fves.X	A2.711 (Level 5) & A1.3132 (Level 6)	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock and <i>Fucus vesiculosus</i> on mid eulittoral mixed substrata	6.98

LS.LBR.Sab.Salv and LR.FLR.Eph.EphX	A2.711 (Level 5) & A2.821 (Level 5)	<i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock and Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata	0.23
LR.FLR.Eph.EphX	A2.821 (Level 5)	Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata	0.55
LR.FLR.Eph.EphX and LS.Lsa	A2.821 (Level 5) & A2.2 (Level 3)	Ephemeral green and red seaweeds on variable salinity and/or disturbed eulittoral mixed substrata and Littoral sand	8.64
IR.HIR.KFaR.FoR	A3.116 (Level 5)	Foliose red seaweeds on exposed lower infralittoral rock	24.34
IR.HIR.KFaR.FoR and IR.HIR.KSed.ProtAhn	A3.116 (Level 5) & A3.127 (Level 5)	Foliose red seaweeds on exposed lower infralittoral rock and <i>Polyides rotundus</i> , <i>Ahnfeltia plicata</i> and <i>Chondrus crispus</i> on sand-covered infralittoral rock	7.49
IR.HIR.KSed.ProtAhn	A3.127 (Level 5)	<i>Polyides rotundus</i> , <i>Ahnfeltia plicata</i> and <i>Chondrus crispus</i> on sand-covered infralittoral rock	13.77
IR.HIR.KSed.ProtAhn and LR.HLR.FR.Mas	A3.127 (Level 5) & A1.125 (Level 5)	<i>Polyides rotundus</i> , <i>Ahnfeltia plicata</i> and <i>Chondrus crispus</i> on sand-covered infralittoral rock and <i>Mastocarpus stellatus</i> and <i>Chondrus crispus</i> on very exposed to moderately exposed lower eulittoral rock	1.65
IR.HIR.KSed.ProtAhn and LS.LBR.Sab.Salv	A3.127 (Level 5) & A2.711 (Level 5)	<i>Polyides rotundus</i> , <i>Ahnfeltia plicata</i> and <i>Chondrus crispus</i> on sand-covered infralittoral rock & <i>Sabellaria alveolata</i> reefs on sand-abraded eulittoral rock	1.86
IR.MIR.KR.Ldig.Ldig	A3.2111 (Level 6)	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe bedrock	4.62
IR.MIR.KR.Ldig.Ldig and LR.LLR.F.Fserr.FS	A3.2111 (Level 6) & A1.3151 (Level 6)	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe bedrock and <i>Fucus serratus</i> on full salinity sheltered lower eulittoral rock	5.90
IR.MIR.KR.Ldig.Ldig and IR.HIR.KFaR.FoR	A3.2111 (Level 6) & A3.116 (Level 5)	<i>Laminaria digitata</i> on moderately exposed sublittoral fringe bedrock and Foliose red seaweeds on exposed lower infralittoral rock	3.66

All of the fauna identified were typical for the intertidal and shallow subtidal habitats and are generally widespread along the coast of west Wales. The epibenthic fauna identified in both the video and stills were diverse for a small area and indicative of a relatively complex community. Notable features included extensive *Sabellaria alveolata* reef which was dominant in the north eastern portion of the site, specifically in the subtidal area off of North Beach and seaward of the proposed limit of the breakwater. No dominant areas of *Sabellaria* were identified along South Beach. Other species of conservation importance recorded during the survey was a small spotted catshark (*Scyliorhinus canicular*) which is listed on the International Union for Conservation of Nature (IUCN) Red List though is categorised as 'Least Concern' with the main threat considered to be fishing and harvesting of aquatic resources (Ellis *et al.*, 2009).

Several commercially valuable species including the European lobster (*Homarus gammarus*), edible crab (*Cancer pagurus*), European bass (*Dicentrarchus labrax*) and European plaice (*Pleuronectes platessa*) were recorded in low abundance. Anchored fishing pots were also observed at several locations in the site boundaries and surrounding areas. Discussion with a locally based skipper revealed that the survey area is well utilised by local fishermen targeting lobster, crab and spider crabs depending on the season.

No invasive non-native species (INNS) were identified from the footage and stills in 2019. However, there are records of an invasive species of seaweed, Japanese wireweed (*Sargassum muticum*) at Pen-y-gloyn, approximately 700m south-west of Aberaeron harbour entrance. It is possible that Japanese wireweed is present closer to the harbour. The species grows on hard substrata and is found in shallow subtidal waters.

Marine Mammals

Welsh waters support internationally important populations of marine mammals (whales, dolphins and seals), which use the area at various stages of their life histories such as feeding and breeding (Baines & Evans, 2012).

Cardigan Bay is one of two areas in the UK known to host a semi-resident population of Bottlenose dolphin (*Tursiops truncatus*). Research undertaken to date suggests Cardigan Bay Bottlenose dolphins represent a mobile and wide-ranging population. Between 127 – 194 individuals of Bottlenose dolphins are known to reside in Cardigan Bay and are observed near the coast in the Cardigan Bay SAC area throughout the year, particularly between August to October (NRW, 2018e; Simon *et al.*, 2010). Research indicates that the coastal area from Aberaeron to Cardigan is of particular importance to Bottlenose dolphin, especially around New Quay headland, 6.8km south-west of the Scheme (Feingold and Evans, 2014). Bottlenose dolphins can breed throughout the year, with peak breeding known to occur between July and September (Feingold and Evans, 2014). There has been no dedicated surveying of Bottlenose dolphin in Aberaeron and National Biodiversity Network (NBN) data and WWBIC data (2018) show no recorded sightings of Bottlenose dolphin within 1km radius of Aberaeron. Consultation with CCC ecologists has confirmed that although sightings off the coast of Aberaeron are rare, they do occur, with the potentially two sightings per summer. Dolphins are also more frequently seen offshore further north and south along the coastline at New Quay and Aberystwyth, evidence that they use the area around Aberaeron.

Harbour porpoise (*Phocoena phocoena*) are a designated feature of the West Wales Marine SAC, which has been identified as in the top 10% of persistent high-density areas for Harbour porpoise in the UK during the summer months. Cardigan Bay has been identified as important for the species during winter months (Heinänen and Skov, 2015). The SAC is estimated to host 9% of the UK population, at approximately 2,500 individuals (NRW and JNCC, 2015). There are no dedicated programmes for monitoring Harbour porpoise in Cardigan Bay and NBN data and WWBIC data (2018) show there are no recorded sightings of Harbour porpoise in a 1km radius of Aberaeron.

The Atlantic grey seal (*Halichoerus grypus*) is a designated feature of the Cardigan Bay SAC. Whilst there are no regularly monitored sites in Cardigan Bay, the population is estimated to be 5,500 individuals (Welsh Wildlife, 2018). The breeding season for Grey seal in Cardigan Bay is between late August and October. There has been no dedicated monitoring of seal populations at Aberaeron and there were no recordings of Grey seal in the WWBIC data (2018). However, the NBN data records one sighting of Grey seal in a 1km radius of Aberaeron (NBN Atlas, 2012). Consultation with CCC

ecologists has confirmed seals are present in the area off of South Beach, with seals using caves further south, and in autumn 2020 a seal pup was seen on South Beach.

Fish

In coastal villages and towns of Cardigan Bay, fisheries provide livelihoods for local commercial fishing and angling vessels. Fishing activities and wildlife watching are increasingly popular, attracting tourism and generating valuable income for coastal communities. Many commercial fishing boats in Cardigan Bay SAC are small, inshore vessels primarily potting for crab, lobster and prawn. Commercial fish species include mullet, tope, black bream, spider crab, bass, dogfish, mackerel, whiting, pollock, turbot and herring (Cardigan Bay SAC, 2018) (see Section 6.13 and 7.21 for more information on commercial fishing and tourism respectively).

Anadromous species (species that breed in freshwater but spend most of their life at sea) found in the area include sea trout (also known as sewin), brown trout, salmon, river lamprey and sea lamprey.

The Cardigan Bay SAC contains two designated fish species; the River lamprey (*Lampetra fluviatilis*) and the Sea lamprey (*Petromyzon marinus*). River lamprey and sea lamprey lay their eggs in clean river gravels and when hatched, the larvae spend several years buried in sandy sediments feeding on organic matter before metamorphosing after 3-4 years (Maitland, 2003). Juveniles of both species migrate to estuaries and inshore waters where they feed parasitically on a range of fish species. Adult river lamprey are predominantly an estuarine and inshore species, whereas adult sea lamprey have a more oceanic distribution (Maitland, 2003). Adult river lamprey migrate through the Cardigan Bay SAC to reach the River Aeron on their spawning migration between October and December. Adult sea lamprey migrate through the site between March and June to reach the River Aeron. Juvenile sea lamprey migrate downstream during the site between December and June (NRW, 2017).

Fish species known to occur in Cardigan Bay with the potential to occur in the area of the Scheme are presented in Table 9-7 below, with species of conservation importance highlighted in dark blue, whilst species features of designated sites are highlighted in a lighter blue.

In accordance with studies undertaken by Cefas (Ellis, 2012; Coull, 1998) several species of fish are known to use Cardigan Bay as nursery or spawning grounds. Species known to use Cardigan Bay as a nursery include the Monkfish (*Lophius piscatorius*), Thornback ray (*Raja clavata*), Spotted ray (*Raja montagui*) and Sole (*Solea solea*). Fish species known to use Cardigan Bay as spawning grounds include Codling (juvenile species of Cod), Plaice (*Pleuronectes platessa*), Whiting (*Merlangius merlangus*), Sandeels (*Ammodytidae*) and Sole (*Solea solea*). It is important to note that for all species listed, Aberaeron is a small area compared to the overall nursery/spawning areas of the species.

The 2019 subtidal survey recorded several fish species including corkwing wrasse (*Symphodus melops*), goldsinney wrasse (*Ctenolabrus rupestris*), and dogfish (*Mustelus mustelus*). Fish species of commercial importance included European bass (*Dicentrarchus labrax*) and European plaice (*Pleuronectes platessa*) which were recorded in low abundance. The small spotted catshark (*Scyliorhinus canicular*) was recorded which is listed on the IUCN Red List though is categorised as 'Least Concern' with the main threat considered to be fishing and harvesting of aquatic resources (Ellis et al., 2009).

Table 9-7 Fish Species around Aberaeron

Tope (<i>Galeorhinus galeus</i>)	Bass (<i>Dicentrarchus labrax</i>)	Monkfish (<i>Lophius piscatorius</i>)	Mackerel (<i>Scomber scombrus</i>)
Thornback ray (<i>Raja clavata</i>)	Codling	Horse mackerel (<i>Trachurus trachurus</i>)	Plaice (<i>Pleuronectes platessa</i>)
Spotted ray (<i>Raja montagui</i>)	Whiting (<i>Merlangius merlangus</i>)	Sandeels (<i>Ammodytidae</i>)	Sole (<i>Solea solea</i>)
Angel Shark (<i>Squatina squatina</i>)	Dogfish (<i>Mustelus mustelus</i>)	Sea lamprey (<i>Petromyzon marinus</i>)	River lamprey (<i>Lampetra fluviatilis</i>)

Migratory salmonids (<i>Salmonidae</i> spp.)	Pollock (<i>Pollachius pollachius</i>)	Mullet (<i>Mugilidae</i> spp.)	Bull huss (<i>Scyliorhinus stellaris</i>)
Sea bream (<i>Acanthopagrus butcheri</i>)	Herring (<i>Clupeidae</i> spp.)	Spurdog (<i>Squalus Acanthias</i>)	Turbot (<i>Psetta maxima</i>)
Dab (<i>Limanda limanda</i>)	Greater Weaver (<i>Trachinus draco</i>)	Lesser Weaver (<i>Echiichthys vipera</i>)	Gurnard (<i>Eutrigla gurnardus</i>)
Corkwing wrasse (<i>Symphodus melops</i>)	Goldsinney wrasse (<i>Ctenolabrus rupestris</i>)	Small spotted catshark (<i>Scyliorhinus canicular</i>)	

Sources: Ellis, 2012; Coull, 1998; Cardigan Bay SAC, 2018; Bass fishing trips (<http://www.bassfishingtrips.co.uk/>)

9.2.2 Data Gaps and Limitations

The baseline developed for the assessment has been supported and informed by several specific studies and surveys to provide an understanding of the ecology in the Scheme area. A habitat survey is being carried out by CCC in June 2021 of the field proposed for use as the site compound area. The results from this survey have therefore not been available at the time of writing this ES. CCC ecologists will provide the results to the Scheme team and should any species of conservation interest be identified that were not known at the time of this ES, an assessment of the impacts of the site compound will be made.

9.3 Likely Significant Effects

A Stage 1 and Stage 2 Habitat Regulations Assessment has been undertaken for the Scheme and is contained in Appendix F. The HRA concludes no likely significant effect from the works.

As detailed above for the baseline conditions, the following receptors identified in the Scoping Report (Atkins, 2019) as having the potential to be affected from the Scheme are considered in this section under the following headings.

- Protected sites;
- Intertidal ecology;
- Subtidal ecology;
- Marine mammals;
- Fish;
- Terrestrial ecology (including invertebrates);
- Reptiles;
- Otter;
- Birds;

This section also considers the effects from construction activities and post construction i.e. the operation of the Scheme.

9.3.1 Construction

Protected Sites/Features

Potential impacts on protected European and national sites and their habitats and species during construction include the following. Areas of permanent loss of the designated sites as a result of the footprint of the scheme on the seabed are discussed in Section 9.3.2 Operation.

- Direct damage to habitats in protected sites from the construction work and movement of plant and machinery.

- Damage to habitats and species from increased turbidity from sediment disturbance during activities including rock dumping, piling, excavation and beach replenishment.
- Damage to habitats and species as features of the designated sites from changes to water quality resulting from pollution caused by spills or leakages.
- Disturbance to species as features of the designated sites (fish, otter, marine mammals and birds) from noise, light and other visual stimuli from operation and movement of machinery, vehicles, vessels and construction workers on the beach and around the harbour. This is discussed in the sections further below for each of the species and is not included in this 'Protected Sites/Features' section.

Works to the flood walls within the harbour and lower river Aeron will be outside of the boundaries of international and nationally designated sites. However, qualifying features of the Cardigan Bay SAC including river lamprey and sea lamprey, and bird species from a number of adjacent designated sites, have the potential to commute or forage within the area of the works in the River Aeron. The assessment of impacts on the qualifying features of the protected sites - fish, birds and marine mammals - are presented in individual sections below.

Effects from Direct Disturbance/Damage

The construction of the Scheme will take place in the Aberarth-Carreg Wylan SSSI, Cardigan Bay SAC and West Wales Marine SAC. Habitat features of these designated sites with the potential to be impacted include areas of *Sabellaria alveolata* and mussel beds. The *Sabellaria* and mussel bed features are predominantly located in the intertidal and subtidal area at North Beach. There will be no construction work taking place on North Beach and therefore there will be no direct disturbance to *Sabellaria* and mussel beds in this area.

There are no areas of *Sabellaria* or mussel beds in the location of the works on South Beach (revetment, groynes, beach nourishment) or around the head of South Pier, and therefore there will be no direct damage to these habitats from these work elements. Survey work described in Section 9.2.1 above, has identified *Sabellaria* to be present close to the location of the proposed breakwater, specifically seaward of the tip of the breakwater as well as to the north-east extending along North Beach. Direct damage to *Sabellaria* is therefore also unlikely to occur during the construction of the breakwater based on the findings of the surveys reported in this ES. Indirect disturbance from sediment disturbance is discussed further below in this Section. As the *Sabellaria* is located close to the breakwater location, the following measures will be put in place:

- As much of the construction of the breakwater as possible will take place from the top of the breakwater itself i.e. building the breakwater seawards and using sections already built as a working platform.
- Prior to construction, a habitat survey of the *S. alveolata* reef will be undertaken on South Beach and in the footprint of the breakwater to confirm that there is no reef present within the working area of South Beach and the piers. Should areas of reef have developed since the 2020 walkover survey, the contractor will avoid unnecessary movement over newly established reef areas.
- There will be no anchoring or beaching of any marine vessels on the reef.
- The contractors will be informed of the presence of the reef and its protected status.

With these measures in place, the impact on *Sabellaria* during construction is considered to be **negligible**.

Small patches of mussel beds are however located within the nearshore footprint of the breakwater and will be disturbed and lost during the breakwater construction. The loss of mussel beds will be localised and small in comparison to the abundance of mussel bed habitat in the area of North Beach.

The total area of mussel bed habitat which will be lost within the footprint of the breakwater is presented in Table 9.8 below. Within 1 km of the Scheme, areas of mussel bed habitats are extensive and the percentage loss of this habitat is small in comparison to the extent of the habitat in the surrounding area.

Table 9-8 Loss of Blue Mussel Beds from the Scheme

Habitat type (Biotope)	Total area within 1km of the Scheme (m ²)	Area taken by breakwater (m ²)	Percentage loss of habitat from the Scheme (%)
Blue mussel beds (SLR.MX.MytX)	49,402	2,942	0.00060%

To reduce damage as much as possible, the construction of the breakwater will take place from the top of the breakwater itself to limit the working area. The contractor will be informed of the protected status of the mussel beds.

The impact on mussel beds during construction is considered to be **minor adverse**.

Effects from Turbidity

During construction, there is a risk that the works could release sediment into the sea, through the movement of construction vehicles on the beach, excavation on the foreshore, tipping of rock from the barge onto the beach, and the storage and placement of rock and shingle on the beach. This could have implications on the reef and mussel beds should suspended sediment become deposited on this habitat. To reduce turbidity, 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 need to take place under water. A geofabric mat will also be positioned onto the seabed in the excavated footprint of the breakwater, which will help reduce the washout of bed material beneath the rocks both during construction and in the future. Construction vehicles will utilise the upper beach as much as possible, to avoid beach materials being washed out into the sea. The tipping of rock from the barge and rock stockpiling on the beach will take place as high up the intertidal zone as possible to reduce wash out of fines into the sea. To ensure that the risk of turbidity are managed and reduced as much as possible, a nominated area will be identified for the rock delivery point on the beach which will be provided to the vessel operators. The specified location will minimise the area of beach affected by potential sediment disturbance from this activity.

With these measures in place, any sediment released into the sea is likely to be in small quantities, which will dissipate within the water column. As a result of these measures the release of sediments into the sea is considered to be **minor adverse**.

Effects from Pollution Risk

Mussel beds are at risk of disturbance by potential pollution incidents and small patches of mussel beds will be directly removed and disturbed during construction of the North Pier breakwater.

Working in the marine environment could also generate risks of pollution incidents from chemical leaks and spills associated with the equipment being used for the works. With the exception of the breakwater, all works for the Scheme in intertidal areas will be carried out at low tide, therefore any pollution is unlikely to enter the water and reach the reefs and mussel beds. Industry best practice measures to control pollution risks will be implemented by the contractor. The risk of damage to the protected sites and the *Sabellaria* and mussel bed habitats is considered to be **negligible**. With these measures in place, direct physical disturbance to the reef in the intertidal and subtidal area during construction will be **minor adverse**.

Intertidal Ecology

This section considers intertidal ecological features that are not features of the protected sites. Intertidal ecology relating to *Sabellaria* reef and mussel beds are contained in the section above on 'Protected Sites/Features'.

The intertidal habitat along South Beach and around South Pier is primarily composed of ephemeral green and red seaweeds on disturbed eulittoral mixed substrata and barren littoral shingle. As described above, no *Sabellaria* has been observed in the intertidal area on South Beach or any other habitats of conservation importance. The South Beach improvement works, which include beach nourishment, and replacement of the existing revetment and timber groynes will have no adverse impact on intertidal ecology. There will be no construction work taking place on North Beach. The impact on intertidal ecology (excluding the assessment of *Sabellaria* and mussel described in the 'Protected Sites/Features' section above) is **negligible**.

Within the harbour, work in the intertidal area will take place in Pwll Cam dock for the installation of the flood gate and on the northern bank of the River Aeron for the new section of wall in between the footbridge and the Monachty Hotel. There will also a scaffold erected in the channel for the wall raising between the Monachty Hotel and the A487 road bridge. A form of mesh or screen would be used to ensure debris from the platform does not fall into the river channel.

For the Pwll Cam flood gate, a temporary cofferdam will be constructed at the dock entrance, with sea water pumped out of the dock into the main harbour, to create a dry working area. The water will be left to settle in a silt buster prior to release into the harbour to reduce excess sediment being deposited. A temporary rock platform will also be constructed from the slipway to the flood gate location to provide access for machinery and plant.

The harbour and river bed comprise sand of little ecological value and impacts are considered to be **negligible** for the harbour and river works on intertidal ecology.

Subtidal Ecology

This section considers subtidal ecological features that are not features of the protected sites. Subtidal ecology relating to *Sabellaria* reef and mussel beds are contained in the section above on 'Protected Sites/Features'.

Part of the breakwater will be constructed in the subtidal area, the area of seabed that is permanently submerged at all tide states. The 2019 marine survey identified no habitats of conservation importance (excluding *Sabellaria* and mussel beds described above), with the most common subtidal habitat to be red seaweed and algae on sand-covered infralittoral rock. The proposed breakwater structure has a footprint of 10,820m², of which 6,727m² of this is below MHWS, resulting in loss of this subtidal area. As described above, no *Sabellaria* has been observed within the footprint of the breakwater. Mussel beds are present within the footprint and these are described in the 'Protected Sites/Features' section above. With no habitats of conservation importance, there will be no adverse impacts on subtidal ecology.

The impact on subtidal ecology (excluding the assessment of *Sabellaria* and mussel described in the 'Protected Sites/Features' section above) is **negligible**.

Marine Mammals

Marine mammals could be disturbed from noise and vibration generated by the scheme. The majority of the marine works will take place at low tide, to avoid working in the water column. However, part of the breakwater construction will be carried out underwater below MLWS. Noisy activities that could disturb mammals include excavation for the breakwater foundations and placement of the geotextile layer and rock, work to the South Pier which includes piling, as well as piling for the timber groynes. The delivery of rock and tipping of the rock from the barge onto the beach would also generate noise. Piling operations will be undertaken at low tide and outside of the water column to reduce the generation of percussive noise in the water and a soft start approach will be used. The construction working hours are 7am to 7pm and therefore underwater night time sound will not be generated. Percussive noise will not be constant throughout the construction period and will be short term for the groynes and South Pier work only. Given the limited work taking place under water and the mitigation

measures in place, the impact on marine mammals from noise is therefore considered to be **negligible**.

The works could also impact on marine mammals through increased turbidity from sediment disturbance caused by the works, including excavation for the breakwater. This could arise from the movement of construction vehicles on the beach, excavation works, tipping of rock from the barge onto the beach, and the storage and placement of rock and shingle on the beach. To reduce turbidity, excavation will be carried out at low tide for the sections of breakwater that will be above MLWS and a geofabric mat will be positioned onto the seabed in the excavated footprint of the breakwater, which will help reduce the washout of bed material beneath the rocks both during construction and in the future. Construction vehicles will utilise the upper beach as much as possible, to avoid beach materials being washed out into the sea. The tipping of rock from the barge and rock stockpiling on the beach will take place as high up the intertidal zone as possible to reduce wash out of fines into the sea. With these measures in place, impacts of turbidity on marine mammals is assessed to be **negligible**.

The movement of vessels to deliver rock for the breakwater to/from the site may present a collision risk to marine mammals. However, the short duration of the rock delivery (approximately 6 weeks) and the low number of regularly reported sightings of marine mammals within close proximity to Aberaeron, means that collision risk is unlikely. The impact is assessed to be **negligible**.

Due to the protected status of marine mammals, the following mitigation measures will also be implemented to reduce potential impacts:

- All vessel operators working on the Scheme will be given a briefing, alerting them to the possible presence of marine mammals in the area, and the guidelines (including the Ceredigion Marine Code of Conduct) for safe vessel operation in the presence of cetaceans. With implementation of this measure, the chance of boat strike resulting in physical injury or mortality of marine mammals will be extremely unlikely. Similarly, by observing the guidelines, vessels will be operated in an appropriate manner so that marine mammals will not be subjected to undue disturbance or harassed.
- Vessel operators will be required to use predefined and regular routes, as these will become known to marine mammals using these waters. This measure will further serve to minimise disturbance to marine mammals due to vessel movements.
- The use of competent observer(s) to spot marine mammals along the Aberaeron frontage during high noise and vibration activities, in particular rock placement and piling operations. If cetaceans are observed, works will be delayed until they have left the area. This measure will ensure the area in the vicinity of works is clear of marine mammals prior to the commencement of works and will serve to reduce any disturbance to marine mammals. The need for marine mammal observers should be agreed with CCC and NRW.
- Prior to construction start, an assessment for use of the beach by seal pups should be assessed with continuing surveillance during August – November. Works are anticipated to start during winter which is in advance of the pupping season. As a result of the ongoing work in the following 12 months it is anticipated that the beaches will not be sufficiently quiet to create a suitable location for pupping. In the event of seal pups being present on the beaches at Aberaeron, there will be a need to wait for seal pups to mature and to have gone to sea.

Fish

The marine works on South Beach, South Pier and for the new breakwater could generate and disturb seabed sediment, leading to increased turbidity in the water column, affecting fish by reducing their foraging efficiency of visual predators and leading to minor gill irritation. The operations that could cause increased turbidity are discussed in the section on Marine Mammals above. As also described above, with the majority of the work taking place at low tide, with the exception of part of the breakwater, and with mitigation measures in place to reduce turbidity, the impact is assessed to be **negligible**.

Fish could also be disturbed by underwater noise and vibration for the marine works along the coastline. As described for Marine Mammals above, the majority of the works will be carried out at low tide, and with mitigation measures in place, the impacts are assessed to be **negligible**.

The River Aeron is a migratory route for river lamprey, sea lamprey and migratory salmonids such as salmon and trout. Works in the river channel include construction of a new section of flood wall and raising the height of the existing flood wall along the northern channel between the river footbridge and the A487 road bridge, and construction of a new flood gate at the entrance to Pwll Cam dock.

For the flood gate work, construction activities including transportation of the flood gate by tug and barge in the harbour, installation of a cofferdam at the entrance to Pwll Cam and construction of a temporary rock platform for machinery access from the slipway to the gate location. Piling into the harbour bed and drilling into the concrete walls will also be carried out creating potential underwater noise and vibration.

Prior to the construction work at Pwll Cam, a fish rescue will be undertaken before the cofferdam is installed and the dock becomes dry. The piling and drilling work will take place within the dock, behind the cofferdam and therefore outside of the water column. This will help to reduce some of the noise that will be generated in the harbour. A soft start approach will also be used for the piling to reduce startling of fish. Pwll Cam harbour is not considered an important habitat for fish. Water will be pumped out of the cofferdam and left to settle in a silt buster prior to release back into the harbour. With mitigation in place and the low numbers and diversity of fish expected to be present within Pwll Cam, impacts to fish from noise during the Pwll Cam works are anticipated to be **minor adverse**.

Installation of the gate is the only aspect of the Scheme that may require some night-time working, which could cause light disturbance to fish. The night time working on the gate is only expected to be for one night, to allow the barge to be brought in on a high tide, offload the gate and wait until the next high tide to leave. The contractor will follow best practice procedures for work at night, including measures to minimise noise and directional lighting. Given the temporary and short-term nature of the activity, any impact of night-time working on migratory fish is considered to be **negligible**.

For the flood wall works, construction will take place from the landward side of the wall where possible as well as from a temporary scaffold platform in the river channel. This working method has been proposed to reduce the amount of working in the river. The work will also include piling for the new section of wall. The piling could generate some underwater noise and vibration. However this will be short term and will take place behind the existing revetment located in front of the existing wall. A slow start approach to piling will reduce the startling effects on fish from noise. The impact is considered to be **minor adverse**.

The temporary working platform could create a barrier to migratory fish. However, the platform will be of a scaffold type and will not span the width of the channel and will therefore not form a barrier to migratory fish or impede migration. The impact on fish migration is therefore considered to be **negligible**.

The river wall work and the working platform could cause some release of sediment into the river. A form of mesh or screen would be used to ensure debris from the platform does not fall into the river channel. The impact on fish from increased turbidity is considered to be **negligible**.

Disturbance impacts to migratory fish cannot be excluded, however migratory routes will not be blocked or impeded as a result of the works. Sensitive periods for fish migration will be programmed into the construction works schedule, with no in-channel works on the river wall work between 15 October and 15 April, as advised by CCC ecologists. Consultation will be held with NRW should any work in this period be required. With mitigation in place to avoid key migratory periods, disturbance impacts to migratory fish is considered to be **minor adverse**.

Terrestrial Ecology

The area of the site compound is located on an area of coastal meadow of local ecological value. An ecological survey being undertaken in June 2021 by CCC will confirm the species present.

During construction the meadow will be directly disturbed by the presence of the site compound and movement of machinery, including invertebrates and insects using the habitat. The existing topsoil and grass will be removed as part of the compound set up and stored for re-planting following construction. Prior to construction and depending on the ecological survey recommendations, the meadow will be harvested by CCC to collect the seeds for re-planting and site re-instatement following

construction. Seeds will also be sourced externally from the site for re-planting to encourage increased biodiversity. The types of seeds sourced will be subject to the ecological survey results.

The impact on the meadow is assessed to be **minor adverse** during construction. Post construction effects resulting from the re-seeding efforts and biodiversity enhancement are discussed in Section 9.3.2 Operation below.

Reptiles

A reptile survey undertaken of the coastal meadow for the site compound location in May to June 2019 did not identify any reptiles to be present. It is recommended that the existing management regime, undertaken by CCC, is maintained to ensure that no suitable habitat features for reptiles are introduced to site before its use as a site compound commences. It is also recommended that during vegetation clearance, works will take place under a Precautionary Method of Working (PMW), including a pre-works survey of the affected area by an appropriately experienced ecologist, to ensure that reptiles which may have colonised the site since the survey do not come to harm.

As a result of the above mitigation and the unlikely presence of reptiles, the impacts to reptiles are anticipated to be **negligible** during construction.

Otter

Otters present in the Lower River Aeron, harbour and along the shore may be disturbed by the works from noise, vibration and potential water quality impacts. Impacts on noise, vibration and water quality are discussed in the sections above and the impacts assessed to be **minor adverse**.

Although resting and breeding sites are unlikely in the vicinity of the scheme, foraging and commuting takes place from the river and out to sea and is of essential importance for the carrying capacity of the catchment. It is important that the scheme maintains their ability to move freely between freshwater and marine habitats. The flood wall works within the River Aeron between Pwll Cam and the A487 road bridge could disturb commuting and foraging, particularly as the lower ledge on the wall in between the road bridge and the footbridge is used as a migration corridor for otters. The construction work on the wall will involve raising the majority of the wall with no direct disturbance to the ledge. A scaffold platform in the channel will be used to carry out the work, therefore causing no obstruction to the ledge. The platform will also not obstruct the river channel for otter movement. Work to construct a new section of wall outside the Monachty Hotel will require the removal of rock revetment in front of the existing wall. However, there is no ledge here and this section of revetment is only approximately 20m in length. General disturbance in the area of the ledge is likely to cause some **minor adverse** impacts on commuting.

Measures to reduce / limit impacts to otter will include the following:

- A suitably experienced ecologist will carry out a daily pre work survey when working in the River Aeron for otter resting places immediately prior to site works.
- Measures to reduce the risk of harm to commuting and foraging otter will include covering open trenches at night or providing a means of escape (such as a plank of wood) at night to prevent mammals becoming trapped, and safe overnight storage of plant, materials and equipment.
- Any lighting of the site during the hours of darkness will also seek to avoid suitable habitats for this species, such as the banks of the River Aeron and adjacent intertidal habitat.
- The Scheme will enhance otter migration by improving connectivity between the River Aeron and the sea, the latter of which provides an important foraging area for otters. This will be done by extending the existing wall ledge on the northern bank of the river further downstream. Provision of a ledge will enable otters to better migrate back upstream during periods of high water and reduce them being forced onto dry land and towards busy roads.

Birds

There is the potential for the work to cause disturbance to birds both in and around Aberaeron through physical disturbance to their habitats and also through noise, light and visual disturbance. The

duration of the construction period is such that the works will take place during breeding and overwintering periods.

Construction activities with the potential to cause noise and vibration disturbance to birds, include percussive piling activities undertaken to install the piles of the new pier head, piling of the wooden groynes posts along South Beach, piling the foundations for the new flood wall in the River Aeron, as well as the flood gate to Pwll Cam. Percussive piling generates vibration levels disruptive to birds, with the potential to generate a flight response as well as avoidance behaviour. Piling operations in Aberaeron will be temporary and short-term, and percussive noise will not be constant throughout the construction period for the works. Disturbance could also be experienced from other aspects of the construction work e.g. movement of machinery, drilling, rock placement.

The works on South Beach will result in a temporary loss of foraging habitat for birds. However, there is ample alternative foraging and loafing habitat available nearby, within 1km and beyond, without these activities significantly affecting foraging for birds.

Aberaeron is a working harbour, as well as a busy town and a popular tourism destination. Any bird species which use the site area as loafing or foraging habitat are likely to be habituated to some level of disturbance, particularly from recreational use of the South Beach by locals and tourists, as well as exercising of dogs along the beach.

The Scheme lies in the Aberarth-Carreg Wylan SSSI which is designated for breeding populations of Chough (*Pyrrhocorax pyrrhocorax*), Kittiwake (*Rissa tridactyla*), and Lesser black-backed gull (*Larus fuscus*). The breeding habitat for these species are as follows:

- Kittiwakes are known to nest in colonies on clifftops and rock ledges (Wildlife Trust, 2021).
- Lesser black-backed gulls nest colonially on islands offshore and within inland freshwater bodies, coastal cliffs, sand dunes, saltmarshes, moorland and on the rooftops of buildings (JNCC, 2020).
- Choughs nest in caves or crevices of cliff faces, typically feeding on short grassland, mainly taking invertebrate prey (Birdlife International, 2012).

Due to a lack of suitable habitat for nesting, these SSSI designated species are unlikely to be breeding within the footprint of the construction works. There is some cliff habitat located in the southern extent of the South Beach, approximately 200m from the construction works.

Measures to reduce noise and visual disturbance will include:

- A pre-construction walkover by an ecologist to check for nesting birds within the construction footprint and advise on any necessary action to avoid disturbance.
- Mitigation measures to reduce the impact of noise are presented in Chapter 16.
- All works, with the exception of installing the Pwll Cam flood gate, will be carried out at low tide and during daylight hours. For the single occurrence for gate installation expected for night-time working, the contractor will follow best practice procedures for working at night, including measures to minimise noise and directional lighting.

The impact on birds during construction is considered to be **negligible**.

9.3.2 Operation

The following post construction effects have been assessed for the receptors below:

- Protected Sites
- Intertidal and Subtidal Habitats
- Migratory Fish
- Otter

Protected Sites/Features

Following construction the effects of the scheme on the following potential impacts are discussed.

- Direct loss of protected sites and their features/habitats from the footprint of the Scheme, specifically the breakwater.
- Damage to protected sites and their features/habitats from changes in coastal processes as result of the Scheme, specifically the breakwater.

Direct Loss of Protected Sites/Features

The Scheme will result in the permanent loss of SAC and SSSI area as a result of the proposed breakwater. The percentage loss of each of the designated sites affected is shown in Table 9.9 below.

Table 9-9 Percentage Loss of Designated Sites from the Breakwater

Designated Site	Total area of site (km ²)	Area of site taken by breakwater (m ²)	Percentage loss (%)
Aberarth-Carreg Wylan SSSI	9.97	3,909	0.04
Cardigan Bay / Bae Ceredigion SAC	1460.35	10,820	0.00074
West Wales Marine SAC	7377.17	6,728	0.00009

For the West Wales Marine SAC, the site is designated for harbour porpoise. Given the very small percentage loss of the SAC from the Scheme and the limited number of sightings of harbour porpoise in Aberaeron, the impact on the West Wales Marine SAC is considered to be **negligible**.

For the areas of Cardigan Bay SAC, the dominant feature is the *Sabellaria* reef. As described in Section 9.3.1. survey results indicate that there is no *Sabellaria* in the immediate footprint of the breakwater. The works will there cause no permanent loss in *Sabellaria* from the footprint of the scheme.

The SSSI is designated for birds and marine wildlife, its habitat for various bird species, and *Sabellaria* habitat. As described above, there is no *Sabellaria* in the footprint of the Scheme and therefore there will be no direct loss as a result of the breakwater. The extensive coastline of Wales provides a large area of habitat for birds and marine wildlife and therefore the small 0.04% loss of the SSSI is considered to be **negligible**.

Damage from Changes in Coastal Processes

Following construction, the scheme could impact on the designated features of the protected sites as a result of changes in coastal processes such as accretion and erosion. Section 12.3.2 in the Coastal Processes chapter details the changes in coastal processes resulting from the new breakwater. Numerical modelling carried out for the design of the Scheme indicates that accretion is likely to occur at the end of the breakwater, along South Beach and North Beach. The patterns of accretion before and after the breakwater are shown in Figures 12.4 and 12.5. All of these locations are areas of *S. alveolata* reef as identified in the 2019 survey. In addition, the area of North Beach is mussel bed habitat. The accretion has the potential to lead to smothering of these habitats which are features of the Cardigan Bay / Bae Ceredigion SAC and Aberarth-Carreg Wylan SSSI.

The areas of accretion following construction are in areas where accretion is already occurring. This is likely due to the result of coast protection measures already in place i.e. the piers, to trap any incoming sediment.

As described earlier, an ecological walkover in summer 2020 and survey data from Eco Marine Consultants in 2019, showed little evidence of any well-established *S.alveolata* reef in the intertidal and shallow subtidal areas on South Beach. Increased levels of accretion are therefore unlikely to cause any smothering of reef on South Beach. Along North Beach, where reef habitat is well established, the numerical modelling shows that the breakwater will not have a significant change on sedimentation patterns that are already occurring as the piers have played a predominant role in controlling sediment transport to the north since their construction over 200 years ago. In addition, very small quantities of natural sediment supply are transported to the Aberaeron frontage and therefore there are limited possibilities for significant accretion to occur. Although the interruption of longshore transport will reduce the volume of feed to the beach to the north of the scheme, the existing quantity of sediment feed is so small that the beaches would not be significantly adversely impacted by any reduction in supply.

Figure 12.5 does show an increased level of accretion at one location along North Beach. However, given that the breakwater will be reducing sediment transport, this accretion is likely to be the result of the influence of existing defence structures and groynes along North Beach causing this modelling result, rather than the Scheme.

On the northern face of the North Pier, is a groyne which extends seaward, creating a 'V' shape area of beach in between this groyne and the North Pier. There is the potential for sediment to build up in this sheltered area and potentially overspill onto the adjacent reef. Given the low sediment supplies to the frontage, accretion here is not likely to be an issue, however sediment monitoring in this location will be included as part of the post construction monitoring programme discussed in the paragraph below.

The modelling also shows the potential for accretion within Aberaeron Harbour. The harbour is already routinely dredged by CCC to maintain navigation and this pattern of management will continue following construction.

Monitoring of bed levels will be carried out following construction, with maintenance dredging taking place to remove excess sediment build up. Monitoring of sediment build up in the 'V' shaped notch between the North Pier and the groyne will also take place, with excess sediment removed and recycled if required. Arisings from existing harbour dredging operations are deposited on South Beach and this method would continue with post-construction maintenance dredging. The large majority of this material is placed at the northern end of the South Beach in the vicinity of the Yacht Club, at the top of the shingle bank, to build up the width of the shingle berm and improve the level of protection against wave overtopping. The material also provides protection against erosion. This has the advantage of retaining materials within the beach rather than removing surplus materials for disposal.

The reef habitat feature is widespread across the designated sites, and any area potentially affected would be very small compared to the total area of reef throughout the Cardigan Bay / Bae Ceredigion SAC and Aberarth-Carreg Wylan SSSI.

The impact of changes in coastal processes, in particular accretion, as a result of the Scheme on the protected sites is considered to be **negligible**.

Intertidal and Subtidal Habitats

The changes in coastal processes described above could also indirectly impact on other intertidal and subtidal habitats. However, with the seabed primarily composed of ephemeral green and red seaweeds on disturbed eulittoral mixed substrata and barren littoral shingle, these impacts are considered to be **negligible**.

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. Additionally, there is potential for epibenthic

communities to settle on the rock breakwater during operation with the added protection from wave exposure. There may be a **minor benefit** from the structure providing habitat for marine species.

Migratory Fish

Operation of the Pwll Cam flood gate has the potential to lead to fish entrapment, and disturbance impacts to migratory fish within the River Aeron. However, the flood gate will only be operated during high spring tides and storm events. Impacts due to entrapment will therefore be temporary and infrequent and are anticipated to be **negligible**.

Otter

Following construction there will be no obstruction to migration from river to sea by otters. The Scheme will enhance the commuting potential for otters by extending the existing river wall ledge downstream of the footbridge to Pwll Cam. Currently the river ledge stops upstream of the footbridge. This will create a **minor benefit** for otters in the local area.

10 Historic Environment

This chapter identifies the potential impacts and effects of the Scheme on the Historic Environment. The Historic Environment is defined as:

All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed. (Cadw, 2011)

For the purposes of this assessment, cultural heritage has been considered under the following sub-topics:

- Archaeology; and
- Historic buildings.

Assessment of impact on the historic landscape was scoped out at scoping stage for this Scheme (Atkins 2019).

Additional information to support this assessment is provided in the following appendices:

- Appendix G - Aberaeron Coastal Defence Scheme Heritage Desk Based Assessment.
- Appendix H - Aberaeron, Ceredigion: Archaeological Foreshore Survey and Watching Brief.

10.1 Method of Assessment

10.1.1 Legislation and policy framework

The legislation, planning policy and guidance governing the treatment of the historic environment have been consulted in preparing this chapter. The relevant portions of these are summarised in Table 10-1.

Table 10-1 Legislation and policy framework for the historic environment

Legislation/Regulation/Policy	Summary of Requirements
Legislation	
The Ancient Monuments and Archaeological Areas (AMAA) Act 1979.	This Act, as amended by the Historic Environment (Wales) Act 2016, provides for the scheduling of any thing or group of things that evidences past human activity. Underwater sites within the 12-nautical-mile limit of territorial waters can be scheduled, as can those up to and above high water. Diving can be undertaken on a scheduled underwater historic asset, however the asset cannot be disturbed without Scheduled Monument Consent.
The Ancient Monuments Order 1994	This Order, which applies to England and Wales, grants Scheduled Monument Consent under section 3 of the Ancient Monuments and Archaeological Areas Act for certain orders or classes of work including agricultural, horticultural and forestry works.

The Planning (listed buildings and Conservation Areas) Act 1990 (and subordinate legislation)	This Act, as amended by the Historic Environment (Wales) Act 2016, is the basic legislation that provides for: • the listing of buildings of special architectural or historic interest • the requirement for planning authorities to have special regard to the desirability of preserving a listed building, its setting or any features of architectural or historic interest which it may possess • the management of change to listed buildings through the requirement for listed building consent to be obtained • action against unauthorised works or deliberate damage to listed buildings, such as listed building enforcement notices and enforcement notices • the prevention of deterioration of listed buildings through urgent works or compulsory purchase • a local planning authority's duty to designate areas of special architectural or historic interest as conservation areas • an authority's periodic formulation and publication of proposals for the preservation and enhancement of their conservation areas • the special attention to be paid to the desirability of preserving or enhancing the character or appearance of a conservation area in the exercise of planning functions • the requirement for conservation area consent from the local authority for the demolition of an unlisted building in a conservation area • urgent works to a building in a conservation area
The Historic Environment Act (Wales) 2016	This makes a number of important amendments to the AMAA Act 1979 and to the Planning Act 1990. This includes placing a duty upon the Welsh Ministers to compile and maintain a historic environment record for each Welsh local authority area. The existing regional historic environment records have been asked to discharge this duty on the Welsh Ministers' behalf. The Act also created a statutory register of historic parks and gardens, and established an advisory panel for the Welsh Historic Environment to advise on environment policy and strategy at a national level.
The Planning Regulations Amendment 2017	This Amendment introduced a requirement for a heritage impact statement to support listed building and conservation area consent applications, replacing a design and access statement.

	A heritage impact statement is the product of a structured heritage impact assessment process. This makes sure that the significance of the historic asset is taken into account when developing proposals for change. It is a core part of the design process, which tests whether the proposals for change are appropriate by assessing their impact on significance. Access issues will still be fully considered unless the proposed works involve a private dwelling.
The Protection of Wrecks Act 1973	This Act protects wrecks below mean high water from interference by unauthorised persons. Section 1 provides protection for wrecks thought to be historically, archaeologically or artistically important, or for any objects contained (or formerly contained) therein. Section 2 of the 1973 provides protection for wrecks that are deemed dangerous because of their contents. A strict exclusion policy is operated with a prohibited area maintained around these wrecks. Undertaking unauthorised works to a designated area without a licence is a criminal offence.
The Merchant Shipping Act 1995	The 1995 Act requires that all wreck material, whether recovered from UK territorial waters or brought into the UK from outside, must be reported to the Receiver of Wreck. The receiver will try to find the owner of the material, or a museum home for any artefacts.
The Wellbeing of Future Generations (Wales) Act 2015	This act was enacted to improve the social, economic, environmental and cultural well-being of Wales, and requires public bodies to consider the long-term impact of their decision making, too carry out sustainable development, and to work towards achieving the seven well-being objectives identified under the Act.
National Planning Policy	
National Planning Policy Wales 2002, updated 2021	Planning Policy Wales sets out the Welsh Government's land use planning policies. Chapter 6, 'Distinctive and Natural Places', explains how the planning system must take into account the Welsh Government's objectives to protect, conserve, promote and enhance the historic environment as a resource for the general well-being of present and future generations. It also sets out the planning policies for the sustainable management of specific categories of historic assets.
Technical Advice Note 12: Design	This technical advice note provides guidance on good design in the context of sustainable development, and provides advice on good design in relation to the historic environment,
Technical Advice Note 24: Historic Environment	This technical advice note provides guidance on how the planning system considers the historic environment during development plan preparation and decision making on planning and listed building consent applications. It provides guidance on how the following types of historic asset should be considered: • World heritage sites • Scheduled monuments

	• Listed buildings • Conservation areas • Historic parks and gardens • Historic landscapes • Historic assets of special local interest • Archaeological remains
Local Planning Policy	
Ceredigion Local Development Plan 2007 - 2022	The following policies are relevant to this chapter: DM06: High Quality Design and Placemaking DM07: Conservation Areas DM19 Historic and Cultural Landscape

This chapter has also been undertaken with reference to the following standards and guidance:

- Conservation Principles (Cadw, 2011);
- The Setting of Historic Assets in Wales (Cadw, 2017a);
- Heritage Impact Assessment in Wales (Cadw, 2017b);
- Managing the Marine Historic Environment of Wales (Cadw 2020);
- Chartered Institute for Archaeologists 2014 (updated October 2020): Standard and Guidance for historic environment desk-based assessment; and
- Chartered Institute for Archaeologists 2014 (updated October 2020): Standard and guidance for nautical archaeological recording and reconstruction.

10.1.2 Study area and data gathering

For the purposes of assessing impacts on the historic environment and based on the recommendations of the Scoping Report (Atkins 2019) and further consultation with Dyfed Archaeological Trust (DAT), two study areas were defined for this assessment. The first study area was defined as the scheme boundary and a 200m buffer around it. For this area, information on all historic assets, designated and non-designated was gathered, for the purposes of characterising the historic environment, informing the understanding of potential impacts, and identifying the potential for as-yet unknown archaeological remains. A second study area extending 1km around the red line boundary of the Scheme was also defined to include designated historic assets in order to help identify potential distant impacts on the more significant assets.

In order to assess the value of historic assets, the Scheme was placed into its archaeological and historic context, through collecting data for a radius of 1km around the Scheme boundary.

Baseline conditions for the cultural heritage topic have been identified from the following sources:

- Cof Cymru National Historic Assets of Wales digital dataset supplied by Cadw for information on designated historic assets;

- Dyfed Archaeological Trust (DAT) for information on non-designated historic assets (monuments), and previous archaeological investigations (events);
- The National Monuments Records supplied by the Royal Commission on the Ancient and Historical Monuments of Wales for information on historic assets;
- British Geological Survey (BGS): Online digital solid and superficial geological data and historic borehole records;
- Historic Ordnance Survey mapping provided by Groundsure;
- Documentary sources: Published histories, site reports, and monographs;
- Archival sources provided by Ceredigion Archives and National Library of Wales;
- Online resources: Web-published material, including local planning authority planning policies, aerial photography;
- Borehole logs;
- LiDAR data supplied by Natural Resources Wales;
- An archaeological foreshore survey (Appendix H); and
- A marine geophysical survey undertaken by Titan Environmental Surveys Ltd.

Where each individual building has been separately listed in a terrace within Aberaeron and these buildings share a common design language and group value, these have been considered as a single terrace for the purpose of this assessment, to provide greater clarity in reporting. There are 30 listed terraces within the study area. Full details of these, and the individual listed buildings which form these, are provided in Appendix G. Numbers 1-8 Market Street (Asset 49) includes two non-designated buildings (the Monachty Hotel and the New Celtic Restaurant) which are of similar date to the designated terrace to the north and hold group value with it. Also of medium value individually, these non-designated buildings have been considered as part of Asset 49.

10.1.3 Assessment Criteria

Chapter 6 of Planning Policy Wales identifies that *‘to enable the historic environment to deliver rich benefits to the people of Wales, what is of significance needs to be identified and change that has an impact on historic assets must be managed in a sensitive and sustainable way’* (para 6.1.3).

Conservation Principles (Cadw 2011) defines significance as *‘the sum of the cultural heritage values’*. For the purpose of this assessment, and to avoid the potential for confusion with the EIA terminology in relation to significance of effect, the term value has been used instead of significance when describing historic assets.

Assessment of value was carried out using professional judgement informed by consideration against the four heritage values, aesthetic, historic, communal and evidential, identified in Conservation Principles¹⁷, with the heritage value generally conforming to the examples set out in Table 10-2 below.

Table 10-2 Criteria for assessment of value of historic assets

Value	Examples of Criteria
Very High	World Heritage Sites Assets of acknowledged international importance Historic landscapes recognised as being of international importance Assets that can contribute to acknowledged international research objectives

¹⁷ Cadw, 2011. Conservation Principles

Value	Examples of Criteria
High	Scheduled Monuments or archaeological sites of schedulable quality Grade I and II* listed buildings Conservation areas with high concentrations of designated historic assets or non-designated assets of national importance Grade I & II* Registered Parks and Gardens Designated Wreck Sites Undesignated historic assets of national importance Undesignated historic landscapes of outstanding interest and national importance Battlefields included on the Inventory of Historic Battlefields in Wales Assets that can contribute to acknowledged national research objectives
Medium	Grade II listed buildings Grade II Registered Parks and Gardens Conservation areas with non-designated assets of regional importance Archaeological notification areas Undesignated historic assets of regional importance (including archaeological sites and wreck sites) Undesignated historic landscapes of regional importance Assets that can contribute to acknowledged regional research objectives
Low	Locally designated historic assets such as locally listed buildings Undesignated historic assets of local importance (including archaeological sites and wreck sites) Historic landscapes of local importance
Negligible	Undesignated buildings, archaeological sites and historic landscapes with little or no importance, or historic interest Highly degraded historic assets that no longer warrant designation or have lost their historic interest
Unknown	The importance of an historic asset cannot be ascertained at this time (e.g. potential areas of archaeological remains)

10.1.4 Assessment of magnitude of impact

The magnitude of impact is determined by identifying the scale of change that the proposed development will have on the aspects that contribute to the value of a historic asset.

Table 10.4 identifies the criteria for establishing the magnitude of impacts on the value of historic assets.

Table 10-3 Assessing the Magnitude of Impact

Magnitude of impact	Description of nature of impact
High	Changes to most or all key elements such that the resource is totally altered, extreme visual effects, gross change of noise or change to sound quality; fundamental changes to use or access; or comprehensive changes to setting resulting in total change to historic character and value of the asset resulting in the substantial loss of value.
Medium	Changes to many key elements, such that the resource is clearly modified. Considerable changes to setting that affect the value of the asset.
Low	Changes to key materials or elements, such that the asset is slightly altered, slight visual changes to few key aspects of historic landscape,

	limited changes to noise levels or sound quality, slight changes to use or access: resulting in limited changes to the value of the asset. Slight changes to setting affecting the value of the asset.
Negligible	Very minor changes to setting or form of the asset.
No change/Neutral	No appreciable change to an asset's heritage value.
Low beneficial	Limited improvement of an asset's heritage value as a result of changes to its physical form or setting.
Medium beneficial	Notable enhancement of an asset's heritage value as a result of changes to its physical form or setting.
High beneficial	Substantial enhancement of an asset's heritage value as a result of changes to its physical form or setting.

10.1.5 Assessment of significance of effect

Significance of effect is determined as the combination of the value of the historic asset and magnitude of impact (change). This is assessed using professional judgement, informed by the matrix provided at Table 10-3 above. Five levels of significance of effect are defined which apply equally to adverse and beneficial effects. The determination of what constitutes 'harm' in terms of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 and Infrastructure Planning (Environmental Impact Assessment) Regulations (2017) is assessed on an individual basis; moderate to very large adverse or beneficial effects are generally considered to be 'significant' in terms of these regulations.

10.1.6 Assessment of Setting

The contribution of setting to the value of historic assets has been assessed in accordance with the guidance published by Cadw (2017), which sets out four stages in assessing the impact of a proposed change or development within the setting of historic assets:

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

10.2 Baseline Conditions

The baseline below is a summary of the evidential baseline prepared for the Desk Based Assessment that was prepared in support of this ES chapter. Full details on the sources for this baseline can be found within the Heritage Desk Based Assessment provided at Appendix G.

Changes to the red line boundary since preparation of the Desk Based Assessment in December 2020, has resulted in revisions to the study areas used in preparation of this assessment. As such, the number of assets identified in the baseline for the ES differs from that presented in the Desk Based Assessment.

10.2.1 Designated Historic Assets

There are no World Heritage Sites, Scheduled Monuments, or Registered Parks and Gardens within the 1km study area.

A total of 248 listed buildings are present within the 1km study area. These comprise:

- 19 grade II* listed buildings
- 229 grade II listed buildings

Of the listed buildings enumerated above, 44 are within the Scheme boundary. This includes five terraces of listed buildings (Assets 13, 18, 31, 32, 49) and five detached listed buildings, the latter of which comprise:

- Weigh House (grade II listed building, Asset 5)
- South Pier (grade II listed building, Asset 7)
- Northwest Quay (grade II listed building, Asset 8)
- North Pier (grade II listed building, Asset 9)
- Northeast Quay (grade II listed building, Asset 14)

The Scheme is partially located within Aberaeron Conservation Area (Asset 92).

Further details about these assets are provided in the Desk-Based Assessment and supporting gazetteer presented in Appendix G. The location of these assets is shown on Figures 1 to 2 of the Appendix.

10.2.2 Non-designated historic assets

A total of 43 non-designated historic assets have been identified within the study area. These assets comprise both archaeological remains and historic buildings. In addition to known archaeological sites, the HER also records archaeological findspots or sites of archaeological remains considered to have been removed or destroyed. These sites are not considered historic assets in themselves, as the physical remains been removed or destroyed, however they provide evidence of the potential for as yet unknown archaeological deposits within the study area.

Of these 43, the following are pertinent to the Scheme:

- Asset 1: Aberaeron Beach. This record relates to several post-medieval breakwaters Schemeing from a section of sea wall to the north-east of the harbour.
- Asset 4: Aberaeron Outer Harbour. This encompasses the entire outer harbour area, including 400m of harbour walling, the south pier, a quay with mooring posts and a slipway.
- Asset 6: Yr Odyn. A post-medieval limekiln possibly historically related to the grade II listed Weigh House.
- Assets 26, 28 and 38, Aberaeron Inner Harbour. The inner harbour retains historically related buildings and mooring rings, and has a modern slipway and jetty built on the eastern side.
- Asset 93: A fishtrap, either of medieval or post-medieval date, of some size, situated on the South Beach close to a groyne.
- Asset 94: A fishtrap, either of medieval or post-medieval date, of some size, situated between two groynes on the South Beach.
- Asset 95: Aberaeron Ferry wreck, which sank in 1852, leading to the drowning of 8 passengers. The precise location of any wreck remains are unknown.
- Asset 97: The Lavinia sank in 1834. The precise location of any wreck remains are unknown.

- Asset 99: a herring fishing boat sank in 1814, leading to the deaths of two fishermen. The precise location of any wreck remains are unknown.

Full descriptions of these assets are provided in Appendix G and their location is shown on Figure 3 of the Appendix.

Of these assets, 15 are recorded to be located within the Scheme boundary, however, the location of a small number of these is uncertain or probably inaccurate.

10.2.3 Description of Existing Environment

Archaeological and historical context

Prehistoric

Aberaeron's coastline did not take its current form until the late Mesolithic, with sea levels reaching modern levels by the early Neolithic. During the Upper Palaeolithic, Aberaeron and its coastline comprised vast estuarine tide flats and marshes with lakes, with the cliff line being 40km out from the modern coastline at the twenty-fathom line. By 12,000bp the intertidal zone began shrinking, with the transition from terrestrial mudflats to marine estuarine environment having been dated to 9540-1050 cal BP (Haynes et al 1977; Richards et al 2014)¹⁸. To the north, at Borth, intertidal and subtidal conditions prevented a marine regression for over two thousand years, resulting in the famous drowned forests at Borth and Ynyslas. This was not true of Aberaeron. Peat beds evidencing the aforementioned transition have been identified 5km off-shore (Haynes et al, 1977) but geotechnical works carried out for this Scheme (Atkins 2018) have not identified any such evidence closer to shore. Consequently, there are no known Palaeolithic nor Mesolithic remains within the Study Area, and there is a Low potential for unknown remains of this date within the Scheme. Any such remains would have the potential to be of high to very high value.

The wider parish contains evidence of use of the landscape during the Bronze Age, with a Neolithic axe head having been found prior to the 1950s, within Aberaeron parish, to the south of the town (Kavenagh, 2019; Richards and Richards, 2014) and a bronze socketed and lopped axe found at Llanddewi Aberarth Upper, in the 1920s (DAT8320). No such remains have been recorded within the Study Area, however, and there is a Low potential for such. Any remains of this date have the potential to be of medium to high value.

There are no known remains dating to the Iron Age, within the Study Area, although there is a denuded hillfort to the north of the town (DAT14244). There is Low potential for remains of this date, and any such remains could be of low to medium value.

Romano-British

There are no recorded remains of this date within the 200m Study Area and very little within 1km of the Scheme. There is a Low potential for unknown remains of this date and any such remains could be of low to medium value.

Early Medieval

There are no recorded remains of this date within the Study Area and a Low potential for unknown remains. Any such remains could be of Low to Medium value.

Late Medieval

There are no known recorded assets dating to the late medieval period within the Scheme boundary. Within the study areas there are fish traps recorded as being of post-medieval date (Assets 93, 94 and 100; see below); these are difficult to date and could be earlier. If found to be of medieval origin, these would be of Medium value. There is a low to medium potential for any unknown remains of medieval date. The foreshore survey undertaken for this Scheme did not identify any new remains

¹⁸ Dates obtained from carbon dating are calibrated using tree ring data to account for changes in atmospheric radiocarbon levels through time. The term *cal BP* means the number of years before 1950 and can be directly compared to calendar years.

or previously unknown characteristics of the recorded fishtraps. Whilst the Foreshore survey was limited to surface visibility, assessment of LiDAR and geophysics results have also identified no further remains. Any unknown remains of medieval date have the potential to be of low to medium value.

Post-medieval to Modern

The study area is characterised principally by historic assets of post-medieval date, associated with the development of the town of Aberaeron under the local landowner Colonel A. J. Gwynne, following the granting of the Harbour Act of 1807.

The North and South Piers (Assets 9 and 7) were constructed by William Green between 1807 and 1811, flanking the entrance to the harbour (Asset 4). Designated as grade II listed buildings, the piers are constructed in coursed rubble with rounded heads, and have been subject to repeated repairs, most significantly with the underpinning and rebuilding of the seaward end of the South Pier (Asset 7) in concrete in the later 20th century. The South Pier remains in very poor condition, with pedestrian access to the head of the pier currently restricted on health and safety grounds. A structural assessment of the South Pier undertaken in 2007 identified the structure to be at risk of failure within the next 5-15 years (Atkins 2007). A further survey undertaken by Hyder Consulting in 2011 showed that further movement of the structure had occurred. Along with the piers, the Northeast Quay (Asset 14) and Northwest Quay (Asset 8) were constructed as part of the development of the harbour in the early 19th century. Also of coursed rubble construction, these quays retain some historic fixtures such as mooring posts and metal ladders. Located to the south of the harbour, the weigh house (Asset 5) is a compact single-storey structure which was used for weighing lime from the adjacent limekilns throughout the 19th century.

The North Pier, South Pier, Northeast Quay, Northwest Quay and Weigh House are designated as grade II listed buildings. These structures derive value from their historic association with the early development of Aberaeron and association with the Reverend Gwynne; following extensive repairs, these assets derive some value from their historic fabric. The setting of these assets at the mouth of the harbour and in relation to the historic town makes some contribution to their value. These four assets have been assessed to be of medium value.

The Harbourmaster Hotel (Asset 12) is sited on the Northeast Quay overlooking the harbour. Constructed contemporarily with the construction of the harbour to provide accommodation for the Harbourmaster, this is a three-storey building is designed in the classical style in character with the historic town of Aberaeron. Designated as a grade II listed building, the Harbourmaster Hotel derives value from its historic association with the early development of Aberaeron, as well as its aesthetic quality and landmark role within the harbour and town. The value of the Harbourmaster Hotel has been assessed to be medium.

Surrounding the harbour, Aberaeron is a planned town which developed principally from the 1830s to 1870s to the designs of the architect Edward Haycock. Now designated as a conservation area (Asset 92), the historic town is characterised by a grid plan of streets of uniform width, lined by terraces of brightly painted classically designed houses of two and three storeys. Although varying in individual architectural detail and design, the historic townscape is unified by the consistent classical proportions of the terraces, repeated regular symmetrical fenestration of buildings, and the use of classical detailing such as moulded rendered window surrounds with Greek ear mouldings and prominent key stones. Views of the historic planned town across the harbour and the reverse of those views contribute to the value of this historic asset. Aberaeron Conservation Area (Asset 92) derives value from its historic association with Reverend Gwynne and the architect Edward Haycock, the architectural and aesthetic quality of its townscape, its varied, largely classical terraces and town planning, and its close association with the Harbour, which the town grew around. The conservation area is a high value asset.

The buildings forming the historic terraces within the conservation area are designated as grade II* or grade II listed buildings, and have been assessed to be of high and medium value respectively in recognition of their architectural and aesthetic quality, and their historic interest as part of the planned development of Aberaeron. Those terraces of particular relevance to this assessment are summarised in Table 10-4 Historic terraces below. More detailed information on these assets is provided in the desk-based assessment presented in Appendix G.

Table 10-4 Historic terraces of relevance to the impact assessment

Asset number	Asset name	Designation	Value	Summary description
13	No.3-11 Quay Parade	Terrace formed by 10 grade II listed buildings	Medium	One of the earliest terraces constructed in Aberaeron, located on the north side of the harbour looking out over the Harbour. Varied terrace of two and three-storey classically designed houses.
23	No.1-8 Belle Vue Terrace	Terrace formed by 8 grade II listed buildings	Medium	Terrace of two-storey houses, many of which feature bay windows under small gablets. Likely to date from the 1850s. Sited in a raised position on the south side of the harbour, with views across the harbour to the north and being highly visible in views from the north of the harbour.
31	No.1-9 Cadwgan Place	Terrace formed by 9 grade II listed buildings	Medium	Terrace of two- and three-storey Classically styled houses incorporating many of the classical architectural features characteristic of Aberaeron. Located on the northwest side of Pwll Cam with principal views to and from the terrace across the inner harbour. Constructed soon after the Harbour in the early 19th century.
32	No.1-10 Tabernacle Street	Terrace formed by 10 grade II listed buildings	Medium	Terrace of two-storey classical style houses constructed soon after the Harbour was rebuilt in the early 19th century. Set back from the harbour with principal views looking towards a terrace on the opposing side of the street.
33	No.1-4 Harbour Lane, Island House	Terrace formed by 5 grade II listed buildings	Medium	Short terrace of two-storey classically styled houses located to the south of the harbour. Possibly dating from the 1850s and Haycock's later work at Aberaeron.
35	No.9-17 Market Street	Terrace formed by 9 grade II listed buildings	Medium	A varied terrace of three- and two-storey houses, of classical design forming the north elevation to Pwll Cam. Constructed soon after the Harbour was built in the early 19th century. Individual treatment of two-storey houses, with more unified design for the three-storey block.
42	No.1-7 Portland Place	Terrace formed by 7 grade II* listed buildings	High	Classical terrace located to east of harbour, includes the imposing three-storey townhouse of Portland House which forms the north end of the terrace. Remainder of the terrace formed by well-detailed double-fronted two-storey houses, all classically detailed. Principal elevation provides views across the harbour towards the sea. Constructed in the mid-19 th century.
47	Bradford House	Grade II Listed Building	Medium	Group of three-storey simple classical townhouses, central of which is double fronted, shop front inserted into northernmost house. Views northwest from principal elevation look across the harbour.
49	No.1-8 Market Street	Terrace formed by 6 grade II listed buildings and 2 non-designated buildings	Medium	Terrace formed by two-storey houses, flanked by three-storey buildings to either end. Constructed soon after the Harbour was rebuilt in the early 19th century. Designed in characteristic classical style, some alteration for insertion of shop fronts at ground level. The principal elevation of the terrace looks to the south, towards the terrace on the opposing side of Market Street.

Aberaeron harbour is formed by Outer and Inner Harbours (Assets 4 and 28). The Outer Harbour was constructed following the 1807 Harbour Act and extends from the River Aeron at Lower Bridge to the North and South Piers. The Inner Harbour (Asset 28), also known by its Welsh name Pwll Cam, is positioned to the north of the Outer Harbour and offers a protective dock for boats to moor that is accessed through a narrow entrance. The current form of the Inner Harbour results from alteration

in the late 20th century, when the wall between the harbour entrance and the footbridge was formed. The Inner and Outer Harbours are both considered to be of Low value.

Situated respectively in the east and west corners of Pwll Cam are the Inner Harbour Buildings (now known as The Hive, Asset 26) and the Inner Harbour Slipway (Asset 38). The Hive was formerly operated as a warehouse and chandlery for the quay. It appears the Inner Harbour may have been used as a coal wharf and the warehouse was used to store the chandlery for the ships. This asset is of Low value. The Slipway is of modern date, likely constructed contemporarily with the current harbour entrance, and has been assessed to be of Negligible value.

Pier Cottage (Asset 92) is a two storey stone structure, positioned to the north of the Harbourmaster Hotel. Although the origin of the building is unknown, it is said to have internal features consistent with a 1750s date. If this date is correct, the building may be one of the oldest in the town of Aberaeron. The historic asset is not listed and is of Low value.

Of those fish traps identified with the Study Area (Assets 93, 94 and 100), Assets 93 and 94 are within the Scheme boundary at the southern end of South Beach. Asset 93 is formed by a wall measuring c.22m in length and running roughly east-west, and curving to the north at its western end. It is formed by a low wall c.0.50m in height which ranges between 2-3m in width, with a probable a further north-south section of walling of similar design and scale located to the north. Asset 94 is formed by a similar linear length (17m long, 0.72m high) of wall, possibly forming a V or U shape. V-shaped fish traps are a very common form, with curved traps of various types having also survived at Aberarth (Dyfed Archaeology 2012).

Intertidal fish traps are placed on the foreshore so that they crown two hours before low tide; their positioning is carefully calculated so that they do not get destroyed by turning tides. They are designed to trap fish that enter the trap on a flood tide, and are usually V or C shaped. Fish traps have been an under-represented resource on the Dyfed Schedule of Ancient Monuments. They have been an important part of the Cardiganshire economy since the 13th century and are very difficult to date without surviving timber. Falling into decline during the late 19th century, their most prolific phase of use was during the medieval period (Vousden 2014).

Given these factors (regional interest, age, evidential value, size) these fishtraps have been assessed to be of Medium value. There is a Low to Medium potential for further unidentified remains of this date and type; the extent of either existing Asset could also be found to be greater than has been observable thus far. These would also be of Medium value.

A total of eight shipwrecks are recorded as being present within the Study Area, two of which (the Aberaeron Ferry of 1852, Asset 95; and The Lavinia, 1834, Asset 97) were identified as being possibly located within the footprint of the proposed breakwater. Precise locations for these wrecks are not known, which is made clear within the HER and NMR entries. Although remains of these wrecks are likely within the area surrounding the given grid references for each wreck, no evidence of them was identified on LiDAR or Geophysics, including sub-bottom profiling sonar, and none were observed during the Foreshore Survey. The potential for associated remains is Low and value would be Medium.

A limekiln (Asset Number 6) draw hole and charging ramp is located opposite the Weigh House (Asset 5), at the entrance to the carpark on Beach Parade. This is of Low value, as it is a poorly preserved example of its type.

Potential for Unknown Archaeological Remains

There is a low to medium potential for unknown archaeological remains to be present within the Scheme footprint both on land and on the foreshore.

There is a limited potential for prehistoric remains both off shore and on land, given the paucity of the local record. There is a medium potential for identification of further fish trap remains, most likely associated with those three already identified (Assets 93, 94 and 100). Given the lack of responses typical of wrecks on either LiDAR or marine geophysics there is low potential for wreck remains to be present. Any such remains would be of Low value.

There is a low potential for remains of any date, landward, within the remainder of the Scheme, such as within the proposed compound area, given both the map evidence and pattern of recorded settlement activity as outlined above. The compound area is shown to have been farmland on the Henfrwy Tithe Map of 1846 and the subsurface will consist largely of ancient topsoil and possibly ploughsoil. Any such remains would be likely to be of medieval or later date, as shown by the map evidence, and prehistoric settlement evidence is scarce in the Study Area. Any such remains are likely to be of Low value and would be present within ploughsoil.

10.2.4 Data Gaps and Limitations

Due to lockdown measures as a result of the COVID-19 pandemic of 2020, no visits to the Ceredigion Archives or to the RCAHM Wales archives were carried out. Remote consultation with archives was possible, however, and the resultant historic mapping gained from them has formed part of this assessment.

Due to the COVID-19 outbreak, and subsequent lockdowns, a site visit was carried out on behalf of Atkins heritage specialists by locally-based environmental specialists, working to the instruction of Atkins heritage specialists. The results of this site visit, including detailed photographic coverage and liaison with the environmental specialists, has been used to inform the preparation of this assessment.

The HER only records known historic assets and cannot on its own predict unknown assets. It is regularly updated and maintained but may be subject to inaccuracies.

10.3 Likely Significant Effects

10.3.1 Construction

Designated Historic Assets

Construction activity associated with the scheme will impact upon the way the Aberaeron Conservation Area (Asset 92), an asset of high value, derives value from its setting for a temporary period. The movement of heavy plant, presence of temporary works such as ramps, noise and visual intrusion from construction activities will affect the Piers, Quay Parade and the Inner Harbour. Access to the piers and the Northeast Quay will also be temporarily interrupted during construction, detracting from the amenity of these key historic assets within the conservation area. Parts of the conservation area set back and screened from the harbour would not, however, be affected. This will constitute a temporary medium adverse impact at construction that will result in a temporary **moderate adverse** effect to the conservation area.

There will be temporary adverse impacts from construction to the South Pier (Asset 7), North Pier (Asset 9) and Northeast Quay (Asset 14), all assets of medium value. Construction activity, such as the presence and movement of construction plant on and around the assets, associated noise and visual intrusion, and temporary interruptions to public access, will alter the way these historic assets are appreciated in their settings for a short period. This will constitute a temporary medium adverse impact at construction that will result in a temporary **moderate adverse** effect on all three assets.

The Scheme will result in temporary adverse impacts to the Harbourmaster Hotel and 3-11 Quay Parade (Assets 12 and 13; medium value). Activity associated with the construction of the flood wall, from the presence and movement of construction plant, and the associated noise and visual intrusion will impact upon the way the historic assets derive value from their settings for a temporary period. This impact will be more pronounced for the Harbourmaster hotel as its setting will also be impacted by the construction work for the breakwater. This will constitute a temporary low adverse impact during construction to No.3-11 Quay Parade (Asset 13) that will result in a temporary minor adverse significance of effect, and a temporary medium adverse impact at construction to the Harbourmaster Hotel (Asset 12) that will result in a temporary **moderate adverse** effect.

The proposed Scheme will result in temporary adverse impacts to Numbers 1-9 Cadwgan Place and Nos. 9-17 Market Street (Assets 31 and 35; medium value). Noise and visual intrusion on the settings of these assets will result from construction activity for the construction of the flood wall, and the erection of the new harbour gate and public realm works in Pwll Cam including the presence of a

temporary ramp within the harbour, and crane and heavy plant operation. This will impact upon the way the historic assets derive value from their settings for a temporary period. The impact to No. 1-9 Cadwgan Place (Asset 31) will be heightened, due to its position closer to the construction works for the proposed flood wall, and as it has less filtered views of the Inner Harbour than No. 9-17 Market Street (Asset 35). This will constitute a temporary low adverse impact at construction to No. 1-9 Cadwgan Place (Asset 31) and a temporary negligible adverse impact at construction to No. 9-17 Market Street (Asset 35), resulting in temporary **minor adverse** significance of effect to No. 1-9 Cadwgan Place (Asset 31) and a temporary **negligible** effect to No. 9-17 Market Street (Asset 35).

Non-designated Assets

The replacement of the groynes on South Beach could result in physical damage to Aberaeron Fish Trap 3 (Asset 93, medium value), which abuts the southeast side of the southernmost groyne. This fish trap was observed during the Foreshore Survey and is identifiable on LiDAR and geophysical survey results. Comprising roughly-shaped stone boulders standing to 0.50m in height, its size is measured within the Foreshore Survey (Appendix H). Damage to the asset could be caused by the removal of the existing groyne, insertion of the new groyne, and by the movement of construction vehicles. Impact could comprise substantial loss of fabric to the easternmost section of Asset 93 as it abuts the groyne, which will reduce legibility of the asset and its evidential value. Given that the asset is constructed of rubble walling, it would be vulnerable to displacement by machines or excavations for the new groyne. Given that this would equate to a permanent loss of legibility and value to an asset type that is of regional importance, this direct physical impact would have a permanent medium adverse magnitude of impact and will result in a permanent **moderate adverse** effect.

There is potential for damage to Aberaeron Fish Trap 1 (Asset 94) as a result of the movement of construction vehicles during replacement of groynes. This impact will not affect a large proportion of the asset due to the distance between it and the groynes, and is likely to be minimal in terms of reduction of legibility. This fish trap is situated approximately 30m from two groynes, between them, and comprises a rubble stone wall 0.75m in height. It was observed and measured during the Foreshore Survey and is present on both LiDAR and geophysics results. In consideration of the relatively limited physical impact on this asset, the magnitude of impact will be permanent medium adverse, resulting in a permanent **minor adverse** significance of effect.

Construction works will be undertaken on the south side of the Inner Harbour (Asset 28) will result in temporary disruption and intrusion on the harbour (Asset 28) and the Hive (Asset 26), and temporary restrictions to public access. The south side of the harbour results from construction in the later 20th century and is of no historic or evidential interest. The construction works will impact upon the way the historic assets derive value from their settings for a temporary period. This has been assessed to be an impact of medium magnitude on these assets of low value, resulting in a temporary **minor adverse** effect.

The temporary access ramp in Pwll Cam will incorporate the existing slipway into the harbour (Asset 38), temporarily obscuring the slipway. This is a modern structure of negligible value which derives limited value from views of the structure. The magnitude of impact has therefore been assessed to be temporary low adverse, resulting in a temporary **negligible** effect.

Construction activity, including plant movement and the associated noise will impact on the value that Aberaeron Outer Harbour (Asset 4) derives from its setting. However, as the asset's setting is characterised by existing busy harbour activity, the scale of impact from construction activity is limited. As a result, this impact will be a temporary adverse negligible impact which will result in a **negligible** effect.

No effects are predicted on the remaining historic assets from construction of the Scheme.

The three shipwrecks (Assets 95, 97 and 99) are recorded by the Dyfed HER within the red line boundary for the Scheme. No evidence for these assets has been identified by the surveys (marine geophysics, foreshore survey, and assessment of LiDAR). Given that there is no evidence to indicate the presence of shipwreck remains within the footprint of the Scheme, no effect is predicted on these assets.

Although located within the red line boundary, no impact is predicted on the following assets from construction of the Scheme as there will be no physical change to these assets, or alteration of the way setting contributes to their value as a result of construction activities:

- An area recorded of common land (Asset 3)
- Yr Odyn lime kiln (Asset 6)
- Nos 1 & 2 Wellington Street (Asset 17)
- Well found at 11 Quay Parade (Asset 20)
- Cadwgan Place (Asset 29)
- Aberaeron (town) (Asset 57)
- The construction of the compound to the west of Aberaeron Primary School, entails a topsoil scrape of up to 300mm, and the placement of a geotextile as a protective layer above the subsoil. This section of land has no associated recorded historic assets and the on-land Study Area suggests limited potential for unknown archaeological remains. The site of the compound area is shown on the Tithe Map of 1846 to be a large field associated with a farm named Bencarreg Fach. There is a low potential for unknown archaeological remains to be present in this area and archaeology is mostly unlikely to survive within the topsoil. Any such remains present within the top 300mm of topsoil would be removed by the topsoil scraping. The value of any such assets is likely to be Low. As such, the expected magnitude of impact on as-yet unknown archaeological remains is likely to be permanent low adverse and the significance of effect permanent **negligible**.

The foreshore is demonstrably relatively rich in historic assets, and whilst no evidence for unknown historic assets was identified during the LiDAR and geophysical survey, or the foreshore survey, ephemeral remains could still be present. Any such unknown assets could be of low to medium value. Damage to such unknown remains during the replacement of the groynes is likely to consist of partial damage through displacement during the movement of machinery across partially submerged features, and is likely to result in a permanent low adverse magnitude of impact, and permanent low adverse significance of effect. Damage to unknown features within the footprint of the breakwater may result in total removal of unidentified remains of low to medium value, and would therefore have a permanent low to medium adverse magnitude of effect and a permanent adverse **low to medium significance** of effect.

10.3.2 Operation

Designated Assets

Northeast Quay (Asset 14)

The Scheme will result in permanent adverse impacts to the Northeast Quay (Asset 14), an asset of medium value. The low concrete wall to the rear of the quay will be removed, and replaced with a flood wall 1.4m in height which incorporates glazed panels 700mm in height along the wall coping. Piers within the flood wall will be aligned with breaks in the building line on Quay Parade to the north. The glazed panels will be constructed of a compound with a high lead content or a coating so that the glass has self-cleaning properties. The new flood wall will be formed by a stone-clad concrete wall, with four tilt barriers arranged along its length. Existing cast iron bollards sited along the south side of the concrete wall will be removed during construction of the new flood wall and reinstated as close to their original position as possible following the works. Benches will be provided along the harbourside of the flood wall, including both free-standing seat and benches attached to the new wall.

The tilt barriers when not raised will lie flat within the concrete surface of the quay; when raised they will tilt towards the road. The rear of the tilt barrier, the side visible when the barrier is not raised, will be finished with a resin-bound aggregate coating that will be colour matched to the concrete surface

of the quay. The fore side of the barrier will be steel; however, this side will only be visible for short periods on the occasions the barrier is needed to be raised for flood defence.

Grouting of the Quay will be undertaken to consolidate voids within the structure in the intertidal range and above. Within the wall face, lime grouting will be used for the pointing of joints, colour matched to the existing fabric. There are also a number of voids within the Quay that will be filled with lime cement/grout. The mixes for the grout will be subject to agreement with the Conservation Officer prior to the works. These works will consolidate the structure of the quay and result in very limited change to its appearance.

Whilst the replacement of the low concrete wall by the new stone-faced and glazed flood wall will have a physical impact on the Quay, available evidence suggests that it is of modern origin and does not have any particular historic interest. Its removal would not detract from the value of the historic asset. The presence of the new flood wall will change the way the Quay is understood in the surrounding townscape as it will form a barrier between the quay and the town, however the provision of openings through the flood wall at four locations will maintain permeability through the structure to some extent, preserving something of the close physical relationship between the harbour and town. The presence of the flood wall will alter the appearance of the Quay in views of the asset from the opposing side of the Harbour, however the incorporation of glazed panels will maintain the visual connection between the Quay and townscape to the north, and reduce the visual impact of the new structure in these views (refer to Drawing 5182114-ATK-MAR-GEN-DR-L-5003). Cladding of the flood wall in siltstone to match the fabric of the quay walls will aid its integration with the historic structure and reduce its visual impact. Grouting of the quay will result in very limited visual impact on the structure and consolidate the structure of the quay.

These impacts will constitute a permanent medium adverse impact, resulting in a permanent **moderate adverse** effect.

The South Pier (Asset 7)

The proposed Scheme would result in permanent adverse impacts to the South Pier (Asset 7), an asset of medium value. The pier comprises a historic masonry structure, with the western pierhead encased by concrete on the west and southwest faces, and a slightly modern stone retaining wall forming the north face of the pierhead. A crib groyne constructed of metal rails filled with rocks is attached to the head of the pier.

The condition and structural integrity of South Pier has been a cause for concern throughout the later 20th and early 21st century, with numerous investigations, assessments and repairs undertaken on the structure, including:

- Reconstruction of the pier head following its partial collapse prior to 1950
- Encasing of the pier head in concrete, laying of a new concrete deck and grouting works in 1966/7
- Stabilisation of the toe of the pier head with sheet piling and concrete fill in 1990

Geotechnical investigations undertaken on the pier (Duvivier 1982; Quantum 2008; White Young Green 2019) have identified the presence of probable historic masonry in a number of core/borehole locations; however evidence of possible voids and loosely compacted material was also identified, suggesting variable survival of historic fabric and poor condition of the pierhead infill.

An assessment of the South Pier undertaken following storm damage in 2007 identified tilting of the concrete walls of the pierhead resulting in cracks in the structure, washout of core material and settlement of the deck slab. The pierhead was identified to have a residual design life of 5 years in the Scheme Assessment Report produced by Hyder in 2013 due to its poor structural condition (Opus 2017, 4), and public access onto the pierhead has been restricted for public safety. Failure of the pier head has the potential to result in loss of the entire structure, and consequent loss of the north end of South Beach, increased risk of flooding to buildings along Beach Parade and loss of access to the harbour.

The Scheme will take down the failing pierhead, including any surviving historic fabric within its core. The removal of fabric will be limited to the concrete head of the structure and projecting stone retaining wall. The head of the pier will then be reconstructed using precast concrete sections on piled foundations, arranged in a bull nose configuration. The pier head will be reconstructed on a bullhead configuration, as compared with the existing slanted form of the structure, and slightly extended from the current structure. Grouting will be undertaken on the north and south faces of the pier. As a critical asset in the protection of Aberaeron Harbour and the South Beach, reconstruction of the pier head, rather than less intrusive options, such as underpinning and grouting, has been identified to be required to ensure that the structure is robust enough to withstand storm damage and in order to deliver a 100 year design life for the pier.

Whilst the Scheme will result in the loss of surviving historic fabric within the pier head, available evidence suggests its preservation to be variable. As the most vulnerable part of the structure to damage from the sea, it is likely that this fabric was subject to repeated repair and rebuilding prior to the erection of the current concrete casing. This fabric is therefore likely to be of more limited value as compared with the historic stonework of the pier to the southeast. Intervention into the listed structure will be restricted principally to the pierhead, and will not result in alteration to the intact historic elevations to the southeast. Historic stonework will be reclaimed where possible during construction, and the reclaimed stone employed for repairs to the south elevation of the pier. A short length of the crib groyne which connects to the seaward end of the structure will be removed to allow the concrete sections to be positioned; however the remainder of the structure will be preserved in situ, with armour stone placed to either side of the groyne around the pierhead. The crib groyne is a relatively modern structure (1970s/80s) and now severely dilapidated.

Reconstruction of the pierhead will alter the form of the South Pier and the way the building is appreciated in views. This will affect fabric which has previously been subject to significant alteration, and will arrest the ongoing degradation of the structure and the risk of structural failure, whilst ensuring the pier can withstand future storms and maintain its vital role in the coastal defences of Aberaeron Harbour and the South Beach. This has been assessed to result in a permanent medium adverse magnitude of impact, and a permanent **moderate adverse** significance of effect to the pier itself.

North Pier (Asset 9)

The proposed Scheme would result in a permanent adverse impact to the North Pier (Asset 9), an asset of medium value. Construction of the breakwater, extending northwest from the pier will result in the careful placement of rock armour against the northwest end of the pier and an opening c.5-10m in width being cut through the concrete wall at the west end of the pier to provide access onto a walkway along the breakwater. This fabric is of modern date and does not contribute to the value of the historic asset. Grouting will also be undertaken through the concrete deck at the western end of the pier using cement / PFA grout. The presence of the breakwater will alter the setting of the pier, forming a prominent feature in views towards the pier from the north and south, and in views from the pier to the west. This will change the way the historic pier is appreciated in views, and its role in defining the entrance to the Aberaeron Harbour. The addition of the breakwater will result in a notable juxtaposition in the appearances of the existing and new structures that will negatively alter the character of the pier and the fortuitous aesthetic value the asset holds. The relationship between the historic and new structures will, however, be readily understood due to the differences in their construction. The provision of a publicly accessible walkway along the breakwater will provide a new way to experience the North Pier, enabling views towards the pier and harbour from the west, and understanding of the development of the harbour into the 21st century. Overall, the Scheme will result in a permanent adverse low impact which results in a permanent **low adverse** significance of effect.

Aberaeron Conservation Area (Asset 92)

The proposed Scheme will result in permanent impacts to Aberaeron Conservation Area (Asset 92), an asset of high value, due to the presence of the breakwater extending from the North Pier (Asset 9) and the new flood wall extending along the north side of the harbour from Quay Parade to Lower Bridge.

The presence of the flood wall along Quay Parade will impinge on the important views of the conservation area across the harbour, and particularly the view towards the landmark building of the Harbourmaster Hotel (Asset 12) to a limited extent. This will impact the value the conservation area

derives from these integral views and, by extension, the value it derives from its setting. The presence of the flood wall will reduce permeability between the harbour and town. The severity of these impacts will, however, be reduced by embedded design measures. The flood wall will be clad in stone to blend with the historic fabric of the existing quay. Views to and from the listed buildings along Quay Parade will be substantially retained, through the use of glazed panels and matching the height of the stone wall below the glazing to the existing concrete wall. Openings through the flood wall will be provided at four locations along its length, enabling access onto the Quay. The presence of the flood wall will alter views between the outer harbour and Pwll Cam, intruding on views into the inner harbour from the south. The current form of the harbour, however results from development in the 20th century, and views of the harbour interior from the south are of limited historic value.

Improvements to the public realm on the south side of Pwll Cam will be undertaken with the construction of a raised terrace and steps down towards the inner harbour which will provide seating. This will replace the existing public realm of limited quality, and enhance the amenity and communal value of the inner harbour with the provision of increased seating around this central space within the conservation area, where views across the inner harbour to the surrounding historic terraces can be enjoyed.

The construction of the breakwater will form a large-scale new element in the setting of the conservation area, its modern rock armour construction contrasting with the historic fabric of the piers and quays. The presence of the breakwater will alter the setting of the harbour, detracting from its aesthetic quality, as well as preventing views to the open sea from the interior of the outer harbour. The relationship of the breakwater to the historic harbour will be clearly understandable due to the difference in form and construction, enabling the continued development of the harbour in the 21st century to be understood and distinguished from earlier phases. The provision of a walkway on the breakwater will provide a new means of experiencing the conservation area, providing a new viewpoint of the harbour and enabling appreciation of the aesthetic qualities of the townscape from a new perspective. Key aspects of the conservation area's character, such as the grid street plan, and the consistency and coherency of its ordered classical design will continue to be understood. Views across the harbour, whilst slightly altered, will be maintained, with key views towards buildings, such as the Harbourmaster Hotel and the tower of Holy Trinity Parish Church and their contribution to the value of the conservation area, retained.

The coastal defences provided by the Scheme will provide increased protection from flooding within the conservation area, improving the long-term amenity and viability of historic buildings within the conservation area. The Scheme will therefore ensure the long-term survival of otherwise threatened historic streets and listed buildings. When considered together, the impacts will constitute a permanent low adverse impact, resulting in permanent **minor adverse** significance of effect on the conservation area.

Historic terraces

The proposed Scheme would result in permanent adverse impacts to the Harbourmaster Hotel and numbers 3-11 Quay Parade (Assets 12 and 13), both of which have been assessed to be of medium value. The presence of the stone-clad and glazed flood wall will permanently alter the way the assets derive value from their settings, as integral views to, from and past the assets that interact with the harbour will be slightly obstructed. The presence of the flood wall will also change the way that the assets are understood in the context of the harbour. However, this impact is somewhat mitigated as the flood wall will still allow views through the glazed panels and the stone wall below the glazed panels will be of similar height to the existing concrete wall. The design of the flood wall, incorporating piers aligned with property boundaries and breaks in the terrace to match the articulation of the streetscape and clad in stone to match the quay, will aid the integration of the flood wall into the assets' townscape setting. The coastal defences provided by the Scheme will provide increased protection from flooding for to the Harbourmaster Hotel and numbers 3-11 Quay Parade, improving their long-term amenity and viability. On balance this has been assessed to have a permanent low adverse magnitude of impact on both assets, which will result in a permanent minor adverse significance of effect for both assets.

The proposed Scheme would result in permanent adverse impacts to Nos. 1-9 Cadwgan Place and Nos. 9-17 Market Street (Assets 31 and 35), both assets of medium value, due to the erection of the glazed and stone wall between the inner and outer harbour, the insertion of a dock gate at the

entrance to Pen Cei and public realm improvements adjacent to this. These works will permanently alter the way the assets derive value from their settings as the integral views out to the outer harbour will be slightly obstructed. This impact will be heightened for Nos. 1-9 Cadwgan Place (Asset 31) as they are positioned much closer to the proposed alterations and have better uninterrupted views of the inner harbour. Numbers 1-9 Cadwgan Place (Asset 31) will also benefit from the increased protection from future flood events that the Scheme will afford. With these considerations taken into account, the proposed scheme will have a permanent low adverse magnitude of impact on Nos. 1-9 Cadwgan Place (Asset 31), resulting in a permanent minor adverse effect; and a permanent negligible adverse impact on Nos. 9-17 Market Street (Asset 35), and a permanent **negligible** significance of effect.

The proposed Scheme would result in permanent adverse impacts to No. 1-8 Belle Vue Terrace (Asset 23) and Nos. 1-4 Harbour Lane (Asset 33), both assets of medium value. The proposed flood wall along the north side of the outer harbour and the addition of the harbour gate to Pen Cei will alter the nature of views to and from the assets across the harbour. However, the two assets do not derive value from this view in the same way. Numbers 1-8 Belle Vue Terrace (Asset 23) derives more value from the view, as it is the key designed view associated with the terrace. The impact on Asset 23 will therefore constitute a permanent adverse low impact, resulting in permanent minor adverse significance of effect. In consideration of the more filtered and oblique view from Nos. 1-4 Harbour Lane (Asset 33), the Scheme has been assessed to result in a permanent negligible operational impact, resulting in permanent **negligible** effect.

The proposed Scheme would result in a permanent adverse impact to Nos. 1-7 Portland Place (Asset 42), an asset of high value. The erection of the flood wall along the north side of the outer harbour and the addition of the harbour gate to Pen Cei will be visible in views out from the principal elevation of the terrace, forming a modern addition to these views. However, although the asset's principal elevation looks out over the harbour, the value of that view is derived from wider views of the Harbour and is not focused on the north side, where much of the work is proposed. The use of glazed panels along the river wall section of the scheme, will minimise the visual impact of the Scheme in proximity to Nos. 1-7 Portland Place. As such, the impact on Asset 42 will constitute a permanent negligible impact, resulting in a permanent **negligible** effect.

The proposed Scheme would result in permanent adverse impacts to Nos. 1-8 Market Street (Asset 49) and Bradford House (Asset 47); both of medium value. The proposed construction of a river wall along the River Aeron will be visible in views out from the assets, although both assets only have filtered views of the river, those from Nos. 1-8 Market Street comprising views from the rear elevation. Nos. 1-8 Market Street will benefit from the reduced flood risk from the Scheme. When this is taken into account the impacts are considered to constitute a permanent adverse negligible operational impact to both assets, resulting in **negligible** effects.

The proposed Scheme will increase protection from future flood events for Nos. 1-10 Tabernacle Street (Asset 32). This will constitute a low beneficial magnitude of impact and results in **minor beneficial** significance of effect.

Although located within the Scheme boundary, no works will be undertaken to the Weigh House (Asset 5) and Northwest Quay (Asset 8) and no impacts are predicted on these assets.

Non-designated historic assets

The proposed Scheme would result in permanent adverse impacts to Aberaeron Outer Harbour (Asset 4). Raising the height of the harbour wall would have a permanent impact on the way the asset derives value from its setting, altering views of the asset, and key sight lines. The Harbour will also be impacted by the changes made to the piers as the nature of the townscape and its relationship with the harbour will be notably changed. The Scheme would also have a beneficial impact caused by the reduction of wave heights within the harbour and increased protection from flood events. Taking this into account, the proposals will constitute a medium adverse impact, resulting in a permanent **minor adverse** significance of effect.

The proposed Scheme would result in permanent alteration of Pwll Cam (Asset 28), comprising the addition of a flood gate at the entrance to the inner harbour, erection of the flood wall between the inner and outer harbours, and changes to the public realm in this area. The south side of the harbour

is a modern construction and its fabric is of no historic or evidential interest. The flood gate, abutments and control kiosk will form new elements within Pwll Cam. The visual impact of these would be reduced as far as possible through the use of stone facing to the flood wall, abutments and kiosk to blend with the surrounding fabric of the harbour and Hive building, and the use of dark coloured steel for the flood gate. The lowering of the cill beam at the entrance to Pwll Cam will enable silts within the Inner Harbour to be flushed out more effectively by the tide, improving its appearance at low tide. The public realm works to the south of the inner harbour, comprising a raised terrace adjacent to the flood wall, with steps down to the existing quayside, will improve the appearance of this area, and enhance the amenity and communal value of the inner harbour through the provision of increased seating where views across the inner harbour to the surrounding historic terraces can be enjoyed. The Scheme would have a permanent impact on the way the assets derive value from their settings, as views will be altered, and key sight lines slightly altered. The proposals will constitute a permanent low adverse impact, resulting in a permanent **negligible** effect.

Works to the southeast elevation of the Hive (Asset 26) would be undertaken with the addition of glass panels to the wall head to raise the crest level to 5.2mOD, and the construction of a stone-clad concrete abutment against the building for the new flood gate in to Pwll Cam. These works would result in limited intervention into the historic fabric of the Asset, and their visual impact has been reduced as far as possible through the use of glass and stone cladding. The presence of the flood wall and gate would form a new element in the setting of the Hive which would be noticeable in views from the south, however the relationship of the building to the Inner and Outer Harbours will continue to be understood. The proposals will constitute a permanent low adverse impact, resulting in a permanent **negligible** effect.

Mitigation

Embedded mitigation

The design of the proposed Scheme has been developed to minimise the impact of the proposals on historic assets, whilst delivering the required standard of protection. Measures to reduce impacts on historic assets have been incorporated into the Scheme and assessed as an integral part of the proposals above. These measures include:

- Reclamation of masonry where possible from the South Pier for use in repair of the south elevation of the structure.
- Incorporation of glazed panels into the proposed flood wall along Quay Parade, reducing the visual impact of the structure, and maintaining views to and from Quay Parade, and visual connection with the harbour. The spacing of the uprights will mirror the location of windows in properties in Quay Parade.
- Cladding of the flood wall along Quay Parade in stone to match the fabric of the harbour walls and matching of the coursing pattern to integrate the new structure with the harbour and surrounding townscape, and to reduce its visual impact.
- Integration of tilt barriers within the wall on Quay Parade to maintain access between Quay Parade and the harbour and North Pier. The tilt barriers will tie in with the appearance of the existing footpath when not engaged and flush with the road. When raised, the visual prominence of the barrier will be minimised by the use of a dark-coloured finish.
- Inclusion of a walkway along the top of the breakwater enabling pedestrian access along the structure, enabling views of the harbour and town.
- Lowering of the existing cill at the entrance into Pwll Cam enabling more effective removal of silts by tidal action, improving the appearance of the inner harbour at low tide.
- Stone cladding of the flood gate abutments and control kiosk at the entrance to Pwll Cam to reduce their visual prominence and integrate them into the surrounding townscape.
- Use of a dark coloured finish to the flood gate at Pwll Cam to reduce its visual prominence.

- Improvements to the public realm at the north end of the footbridge.
- The glazed panels on the flood wall will have self cleaning properties, ensuring key views are maintained.
- A colour matched surface will be applied to the tilt barriers so when they are not in use they will be less distinguishable.
- The new grouting to be added to the North Pier, South Pier and Northeast Quay will be colour matched to the existing grout and the type of grout will be agreed with the planning authority.

Mitigation and compensation measures

Permanent impacts on historic assets, arising at construction as a result of their alteration or removal, can be at least partly compensated for or offset through recording and monitoring exercises.

A written scheme of investigation (WSI) governing an agreed program of mitigation will be prepared and agreed with the Planning Archaeologist for Ceredigion County Council. This is likely to include:

- Archaeological survey and recording of Fish Trap 3 (Asset 93).
- Building recording to Level 2 standards (Historic England 2016) to document the current form and fabric of the South Pier, and monitoring during taking down of the pierhead.
- A photographic survey (Historic England 2016) documenting the current form and fabric of the inner and outer harbours, and general appearance of the conservation area (Asset 92) in this area.
- Archaeological monitoring of the groundworks associated with the installation of the tilt barriers and flood wall along Quay Parade (Asset 14).
- Archaeological monitoring of groundworks within the foreshore area and compound.

Mitigation will include measures to protect assets and prevent damage from construction. These will be identified in a Construction Environmental Management Plan:

- Construction work will be undertaken from the north side of the groyne abutting Fish Trap 3 (Asset 93), in order to avoid damage to the fish trap.
- Construction vehicles will be excluded from the south side of the groyne, and the location of the fish trap and a buffer around it programmed into vehicle GPS devices to prevent access close to or across the assets.
- Fish traps 1 and 3 (Assets 94 and 93) will be marked off by buoys to provide a visual indication of their location for construction vehicles and staff, reducing the risk of accidental damage to the assets from construction plant.
- Protection measures for Fish Trap 3 (Asset 93) will include protection of the potential submerged north-west linear feature recorded within the Foreshore Survey.
- Protection of Asset 94 will take note that there may be further unrecorded stretches submerged on the sea-ward side.

Residual Effects

Residual effects on heritage assets are those effects remaining, as a result of the Scheme, after mitigation has been taken into account. Embedded mitigation, through design, has been considered as an integral part of the Scheme proposals and has therefore already been included in the initial assessment of potential effects in Section 10.3.

The residual effects of the scheme upon Fish Traps 1 and 3 (Assets 94 and 93), after mitigation, will be Negligible.

The additional compensation measures outlined in Table 20-1 and Table 20-2 are not considered to reduce the effects on the affected assets; these measures acknowledge change or loss and evidences this through mechanisms such as building recording, recording evidence of archaeology, designing/integrating heritage interpretation and re-using historic fabric.

11 Landscape and Visual Amenity

11.1 Method of Assessment

This Landscape and Visual Impact Assessment (LVIA) describes the existing landscape and visual baseline context, along with an indication of the potential effects of the proposed scheme on the landscape/townscape and visual amenity of the area. Potential impacts on the landscape and visual amenity are described and, where required, recommendations for mitigation are set out to address adverse effects posed by the Scheme.

The LVIA has been informed through the combination of a site visit, conducted in March 2020, desk-based research and coordination between Atkins Ltd internal teams including Engineering, Heritage and Landscape Architecture disciplines.

LVIA is concerned with two separate but related considerations, landscape assessment and visual assessment.

Landscape assessment is the systematic description and analysis of the physical landscape features and elements (including landform, vegetation cover, settlement and transport patterns, land use, tranquillity, building styles and historical and cultural components) within the landscape and of the landscape character that results from the combination of these features; collectively referred to as the landscape resource. This is followed by an assessment of the effects of the Scheme on this landscape resource.

Visual assessment is the description and analysis of specific views of the landscape and the general visual amenity of the area as experienced by people residing, visiting and travelling through the landscape; collectively referred to as visual receptors. This is followed by an assessment of the effects of the Scheme on these views and on overall visual amenity.

Much of the town of Aberaeron is designated as a conservation area and it contains many listed buildings. Elements of the Scheme lie within this conservation area and adjacent to listed buildings. The architecture of Aberaeron is unusual in this part of rural Wales. It is a planned settlement, constructed around a principal square of elegant Georgian style buildings grouped around the harbour. The ES includes a Historic Environment (Chapter 10) and the landscape and visual assessment work has been coordinated closely to ensure that all potential effects on the historical townscape areas are examined, whilst avoiding any double counting of effects.

11.1.1 Methodology

Landscape is defined as an area as perceived by people, the character of which is the result of the action and interaction of natural and/or human factors, in this case it also refers to townscape.

Visual amenity is defined as the overall pleasantness of views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of people living, working, visiting or travelling through an area.

The methodology for this LVIA follows the principles set out in the Guidelines for Landscape and Visual Assessment, Third Edition, Landscape Institute and Institute of Environmental Management & Assessment, 2013 (GLVIA).

The assessment has been written and reviewed by specialists who are Chartered Members of the Landscape Institute and has been informed by the following sources:

- Heritage Desk Based Assessment, December 2020
- Scoping Report, December 2018

- Site visit conducted on 11th and 12th March 2020;
- Mapping and landscape character data from Natural Resources Wales; LANDMAP;
- Google Earth and Street View;
- Ordnance Survey maps.

11.1.2 Assessment Criteria

The assessment of effects was preceded by a review of baseline information to inform the landscape and visual context. This included also analysis of the planning framework, statutory designations using variety of information sources i.e.: relevant local planning authority documents.

The Guidelines for Landscape and Visual Impact Assessment 3rd edition (GLVIA) state that:

“LVIA must address both effects on landscape as a resource in its own right and effects on views and visual amenity...An assessment of landscape effects should consider how the proposal will affect the elements that make up the landscape, its aesthetic and perceptual aspects, its distinctive character and the key characteristics that contribute to this....An assessment of visual effects deals with the effects of change and development on the views available to the people and their visual amenity.”

Judging landscape and visual effects requires methodical consideration of each effect identified and assessment of the sensitivity of the landscape and visual receptors and the magnitude of the effect on the landscape.

GLVIA3 provides a series of matrices against which to establish value, susceptibility and sensitivity of receptors as well as matrices for assessing potential impacts and effects of a scheme. These tables have been considered, adapted and utilised as set out below. The tables have been used as a guide for the assessor and professional reasoning has been provided where resulting ratings differ to that indicated in the tables.

11.1.3 Assessment of Sensitivity

The GLVIA notes that:

“The determination of the sensitivity of the landscape resource is based upon an evaluation of each key element or characteristic of the landscape likely to be affected. The evaluation will reflect such factors as its quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted...”

Each visual receptor, meaning the particular person or group of people likely to be affected at a specific viewpoint, should be assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views.”

In assessing landscape and visual sensitivity consideration has been given to all the above factors and relative sensitivity has been assessed on a three-point scale as noted in Table 11.1 below:

Table 11-1 Sensitivity Rating

Sensitivity Rating		
Rating	Landscape Sensitivity	Sensitivity of visual receptors
High	Key characteristics of the landscape are fragile and very sensitive to change.	Occupiers of residential properties Recreational users or tourists whose attention may be focussed on the landscape Designated or protected views

Medium	Some key characteristics of the landscape are vulnerable to change, but in general the landscape has the ability to absorb the effects of the development, without a significant change in character.	People travelling through the landscape People staying in hotels and healthcare institutions
Low	The key characteristics of the landscape are generally robust and the landscape may be able to accommodate the development without a significant change in character.	People at work and in educational institutions People engaged in formal sports activities

11.1.4 Magnitude of Impact

The 3rd edition of the GLVIA states, that: “Each of visual effects identified needs to be evaluated in terms of its size or scale, the geographical extent of the area influenced, and its duration and reversibility.”

The impact of the proposed development upon the landscape character and for identified visual receptors has been assessed considering both construction and operation of the scheme. Consideration has also been given to the residual impact following establishment and growth of planting proposed as part of the scheme where appropriate.

The magnitude of impact has been assessed taking account of the scale, extent and duration of any change. The magnitude of impact is rated using the guideline definitions in Table 11.2 below:

Table 11-2 Magnitude of Impact Rating

Magnitude of Impact Rating		
Rating	Landscape Impacts	Visual Impacts
High	Total loss or major alteration to key characteristics of the character and/or setting of the character area. Introduction of elements that substantially alter the character or tranquillity of the area.	Total loss or alteration to key aspects of view. Addition of new features that are highly visible, incongruous or in close proximity.
Medium	Partial loss or alteration to key characteristics of the character and/or setting of the character area. Introduction of elements that noticeably alter the character or tranquillity of the area.	Partial loss or alteration to key aspects of view. Addition of new features that are highly visible, though in keeping with the existing view, or viewed in middle ground /partially screened/viewed obliquely.
Low	Minor loss or alteration to characteristics of the character and/or setting of the character area. Introduction of elements that discernibly alter the character or tranquillity of the area.	Minor loss or alteration to key aspects of view. Addition of new features that are visible, though in keeping with the existing view. Changes to background of view or largely filtered/screened or viewed obliquely.
Negligible	Very minor loss or alteration to characteristics of the character and/or setting of the character area. Introduction of elements that make no perceptible change to the character or tranquillity of the area.	Very minor loss or alteration to key aspects of view. Addition of new features that are inconspicuous and in keeping with the existing view. Changes to background of view or seen as inconspicuous element in wide panorama.

		Almost entirely filtered/screened.

11.1.5 Significance of Effect

The significance of effect on the landscape is defined as the extent of physical changes and subsequent impacts on the landscape and the perception of how the landscape types/sub-types would be affected or whether new ones are established. The significance of visual effect is defined as the extent of change to the existing view.

Such changes may be beneficial (i.e. improve or enhance the character or view) or adverse (i.e. detract from or deteriorate the character or view).

The significance of landscape and visual effects of the scheme has been derived by assessing the sensitivity of the landscape or visual receptor against the magnitude of impact, using the guidance matrix in Table 11.3.

Table 11-3 Effect Matrix

Effect matrix			
	Sensitivity		
Magnitude	High	Medium	Low
High	Major	Major/Moderate	Moderate/Minor
Medium	Major/Moderate	Moderate	Moderate/Minor
Low	Moderate/Minor	Minor	Minor/Negligible
Negligible	Minor/Negligible	Minor/Negligible	Negligible

Major effects are generally considered to be significant, *Moderate* effects may be considered to be significant, *Minor* and *Negligible* effects are generally not considered to be significant.

11.2 Baseline

11.2.1 Planning Policy

A full planning policy review is contained in the Planning Policy chapter of the ES (see Chapter 4); however, this report highlights specific planning policy relevant to landscape and visual amenity aspects.

National Planning Policy

The Scheme will be assessed in the light of Welsh Government Planning Policy Wales (Edition 10, February 2018) and relevant Technical Advice Notes (TANs), in particular TAN 12: Design (March 2016) and TAN 24: The Historic Environment, (May 2017).

Planning Policy Wales: Edition 10 (February 2018) Chapter 6 – Distinctive and Natural Places:

- Recognising the Special Characteristics of Places:
- The Historic Environment;
- Landscape;
- Coastal Areas.

- Recognising the Environmental Qualities of Places;
- Water and Flood Risk;
- Air Quality and Soundscape;
- Unlocking Potential by Taking a De-Risking Approach.

Technical Advice Notes:

- TAN 5 – Nature Conservation and Planning (2009);
- TAN 6 – Planning for Sustainable Rural Communities (2010);
- TAN 12 – Design (2016);
- TAN 14 – Coastal Planning (1998);
- TAN 15 – Development and Flood Risk (2004);
- TAN 16 – Sport, Recreation and Open Space (2009); and
- TAN 24 – The Historic Environment (2017).

Regional Policy

Ceredigion Local Development Plan (April 2013):

The Strategy

- S02: Development in Urban Service Centres.

Development Management Policies

- DM06: High Quality Design and Placemaking;
- DM07: Conservation Areas;
- DM10: Design and Landscaping;
- DM14: Nature Conservation and Ecological Connectivity;
- DM17: General Landscape;
- DM18: Special Landscape Areas;
- DM19: Historic and Cultural Landscape;
- DM22: General Environmental Protection and Enhancement; and

In addition, the following policy documents have been identified as being of relevance:

- Settlement Group statement for Aberaeron;
- Supplementary Planning Guidance – Built Environment and Design, January 2015;
- Supplementary Planning Guidance – Special Landscape Areas (SLA), April 2014;
- SLA 4 Ceredigion Coast - New Quay to Llanrhystud;

- SLA 08 – Aeron Valley.

Shoreline Management Plan (SMP):

The stretch of coastline on which Aberaeron is located falls within the area covered by the West of Wales Shoreline Management Plan 2 (SMP2) which sets out policies for coastal management over a 100-year horizon. In SMP 2, Aberaeron is part of Coastal Area C, Section 4 – New Quay Head to Sarn Gynfelyn. The Scheme itself will be contained within Policy Development Zone 8 (PDZ8) – Aberaeron Plateau.

Table 4-10 sets out the current policies for the Aberaeron Plateau frontage and adjacent stretches of coastline.

Table 11-4 SMP Policies

Area	Policy
Aberaeron Cliffs	Do nothing
Aberaeron South	Hold the line
Aberaeron Harbour	Hold the line
Aberaeron North	Hold the line

Source: West of Wales Shoreline Management Plan, 2012

The two areas of most relevance to the Scheme are Aberaeron Harbour and Aberaeron South, which indicate a policy to Hold the Line.

11.2.2 Proposed Scheme

The proposed Scheme is made up of the elements described in Section 3.1.

11.2.3 Landscape Context and Baseline Character

Sensitivity of landscape receptors

Receptors are selected to describe the likely effects on the landscape resource arising as a result of the Scheme at a range of scales and can include wider landscape character areas / types as well as specific features or elements within the Site and the surrounding area.

Sensitivity is specific to each landscape receptor and reflects a balanced judgement on the value attached to the receptor and its susceptibility to the type of change proposed. The methodology, tables and matrix in 11.1.2 illustrate how sensitivity is determined by a combination of value and susceptibility of the landscape receptor.

The sensitivity of landscape receptors is described using a three-point word scale. Intermediate levels of sensitivity can also be attributed to receptors where relevant. The tables in 11.1.3 to 11.3.5 set out the criteria to determine landscape susceptibility. The criteria identified in the table indicates criteria along the varying scale of their adjacent descriptor, varying from High to Negligible. This list is not considered exhaustive and professional judgement is used to attribute susceptibility with consideration to these criteria. Not all criteria need to be met for a specific value to be attributed to any one receptor.

Context

As set out in the Scoping Report, it is considered that, since Aberaeron is set within a valley with a built-up and enclosed nature to the immediate surroundings, and given the limited scale and massing of the Scheme elements, the effects of the Scheme would be localised. New elements would not be apparent in the landscape when viewed from a distance as they will either be obscured by surrounding buildings and/or topography or will coalesce with the surroundings. As a result, it is considered that a study area of 1 km offset from the Scheme boundary is appropriate to identify and assess effects that may be significant.

Aberaeron is situated on the west coast of Wales in Cardigan Bay, approximately 30km south of Aberystwyth. It is set around the mouth of the River Aeron, embraced by steep and largely wooded valley slopes and coastal cliffs.

As noted in Chapter 10, the architecture of Aberaeron is unusual in this part of rural Wales. It is a planned settlement, constructed around a principal square of elegant Georgian style individual buildings and several continuous terraces of two and three-storey buildings also in a simple classical style designed grouped, many being brightly painted giving a further distinctive character to the area.

The main harbour lies directly at the mouth of the River Aeron with many boats moored using a series of 'fore-and-aft moorings' or 'trot moorings' which leave the 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 cill where shallow draft boats are moored on running moorings to the harbour wall.

The River Aeron runs along the south side of the harbour wall, in the Pen Cei area of town. Quay Parade runs along much of the length of the northern side of the harbour wall. There are several Georgian houses including the Harbourmaster hotel / restaurant and tourist information centre. The Hive café / restaurant / ice cream parlour is at the easternmost end of Quay Parade, where it meets Cadwgan Place.

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 also in a state of disrepair.

South Beach is a mixed shingle and sand beach. There are six timber groynes along South Beach in varying states of repair, and a rock revetment along the upper beach.

Designations

The town of Aberaeron sits within Aberaeron Conservation Area, centred on the harbour and contains many listed buildings.

Aberaeron is located in the Cardigan Bay / Bae Ceredigion SAC, the West Wales Marine SAC and within the Aberarth-Carreg Wylan SSSI.

National and Marine Landscape Character

Aberaeron is located within National Character area 24 Ceredigion Coast and Marine Character Area 16 Cardigan Bay (South)

National Character Area 24 describes the area including the harbour town of Aberaeron as follows;

'This area is of outstanding importance for its marine, intertidal and coastal habitats. There are many quiet sections of the coastline away from the main settlements of Aberaeron, Newquay and Aberporth, all of which have become popular resort centres, with various holiday caravan parks associated with them. Much of the coastline is designated as Heritage Coast'

The National Seascape Character Assessment identifies the area around Aberaeron as MCA 16 – Cardigan Bay South. Those key characteristics with potential relevance to the scale and nature of the Scheme are:

"Diverse coastline of exposed rugged cliffs and rocky headlands punctuated by small coves, sheltered sandy bays and also a few sinuous estuaries fringed by mudflats.

Highly designated stretch of coastline and surrounding waters, with valued sandbanks, reefs and sea caves supporting species such as the bottlenose dolphins.

Rich seas long attracting much fishing activity – otter trawling, set netting, handline fishing, scallop and cockle fishing as well as lobster/crab/prawn potting.

The Coast Path provides access for walkers along the cliff tops and headlands, affording expansive views out to sea across Cardigan Bay.

Strong sense of remoteness and exposure with wind-sculpted trees and a wavelashed shore.

Picturesque fishing villages are a tourism draw and reinforce a strong historic sense of place.”

As set out in the Scoping Report, given the scale of the Scheme it is not considered that there would be a significant impact or effect upon the NCA or MCA thus these are not considered further in this report.

LANDMAP and Local Character Areas

LANDMAP is an all-Wales landscape resource, devised and managed by NRW, where landscape characteristics, qualities and influences on the landscape are recorded and evaluated in a nationally consistent data set. It is a whole landscape approach that covers all landscapes, designated and non-designated. LANDMAP maps and classifies landscapes, describes their characteristics, qualities and components, evaluates their importance from a national to local scale, records their condition & trends and recommends locally appropriate management guidelines.

The Visual and Sensory LANDMAP Aspect Areas are the primary source for landscape character baseline assessment in Wales. These are used as the basis of establishing the distinct local landscape character areas that exist within an LVIA study area. Relevant Cultural and Historic Aspect areas are also studied to provide a greater level of understanding of how these local landscape character areas have evolved and are currently used and perceived. It is not considered that the Geological or Landscape Habitats Aspect areas are directly relevant to this LVIA. The following Aspect Areas lie within and are relevant to the proposed LVIA study area.

- Visual and Sensory Aspect Areas:
- CRDGNVS422 – Aberaeron
- CRDGNVS126 - Coastal plateau north edge
- CRDGNVS725 - Cardigan Bay Cliffs
- CRDGNVS733 - Cardigan Bay Intertidal
- Cultural Aspect Areas:
- CRDGNCL023 Coastal areas
- CRDGNCL015 Aberaeron and Aberarth
- Historic Aspect Areas:
- CRDGNHL051 Aberaeron – Aberarth
- CRDGNHL009 Aberaeron
- CRDGNHL082 Llangrannog
- CRDGNHL064 Ceredigion rural

As described in the Scoping Report, these Aspect Areas have been used to identify four Local Character Areas within the study area. These are set out below and are indicated on the Landscape Character Area Plans in Figure 11-1 below:

Local Character Area (LCA) 1 – Aberaeron Townscape (*relates to LANDMAP aspect area CRDGNVS422*): This character area covers the majority of the study area and the Scheme area itself.

Much of the town falls within the Aberaeron Conservation area and contains many listed buildings. The key characteristics of this LCA are:

- The formal pattern and sense of unity and coherence created by the planned history of this settlement, which has resulted in a strong pattern of formal terraces and a unified Georgian character of many of the buildings;
- The enclosed nature of the town created by the steeply rising ground to the north, east and south, contrasting with the openness of the ocean to the west;
- The strong maritime character focused around the harbour area;
- The town's outstanding overall LANDMAP assigned value due to its "Regular and ordered collection of traditional buildings set intimately around the harbourside, with a clear and highly distinctive character throughout." (NRW, 2004a).

It is considered that this LCA would have a *High* sensitivity to the proposed scheme. This is due to the location being in a conservation area and in proximity to a number of listed buildings, both of which create a desirable destination for tourists and pleasant area to reside.

Local Character Area 2 – Coastal Plateau North Edge (*relates to LANDMAP aspect area CRDGNVS126*): This LCA has been scoped out of the report due to no direct effects and lack of visual connections, and will not be considered further in relation to this development.

Local Character Area 3 - Cardigan Bay Cliffs (*relates to LANDMAP aspect area CRDGNVS126*): This LCA lies to the south of Aberaeron, largely along the cliff zone forming the backdrop to the beach in this area. It has an overall LANDMAP evaluation of outstanding and the value description states that it is a "*Highly distinctive and dramatic landform with a backdrop of open sea and sky. Un-spoilt stretches of coast forming landscape is of considerable attraction to tourists and informal recreation uses. Many stretches appear unspoilt.*" (NRW, 2004b). The Scheme itself does not lie within this LCA and there would therefore be no direct effects. However there are distant and close proximity views hence the assessment will focus on the setting of this LCA, and the large-scale sense of wildness and remoteness created by the dramatic topography and open aspect across Cardigan Bay; although, as set out in the Scoping Report, this will only cover the Construction period.

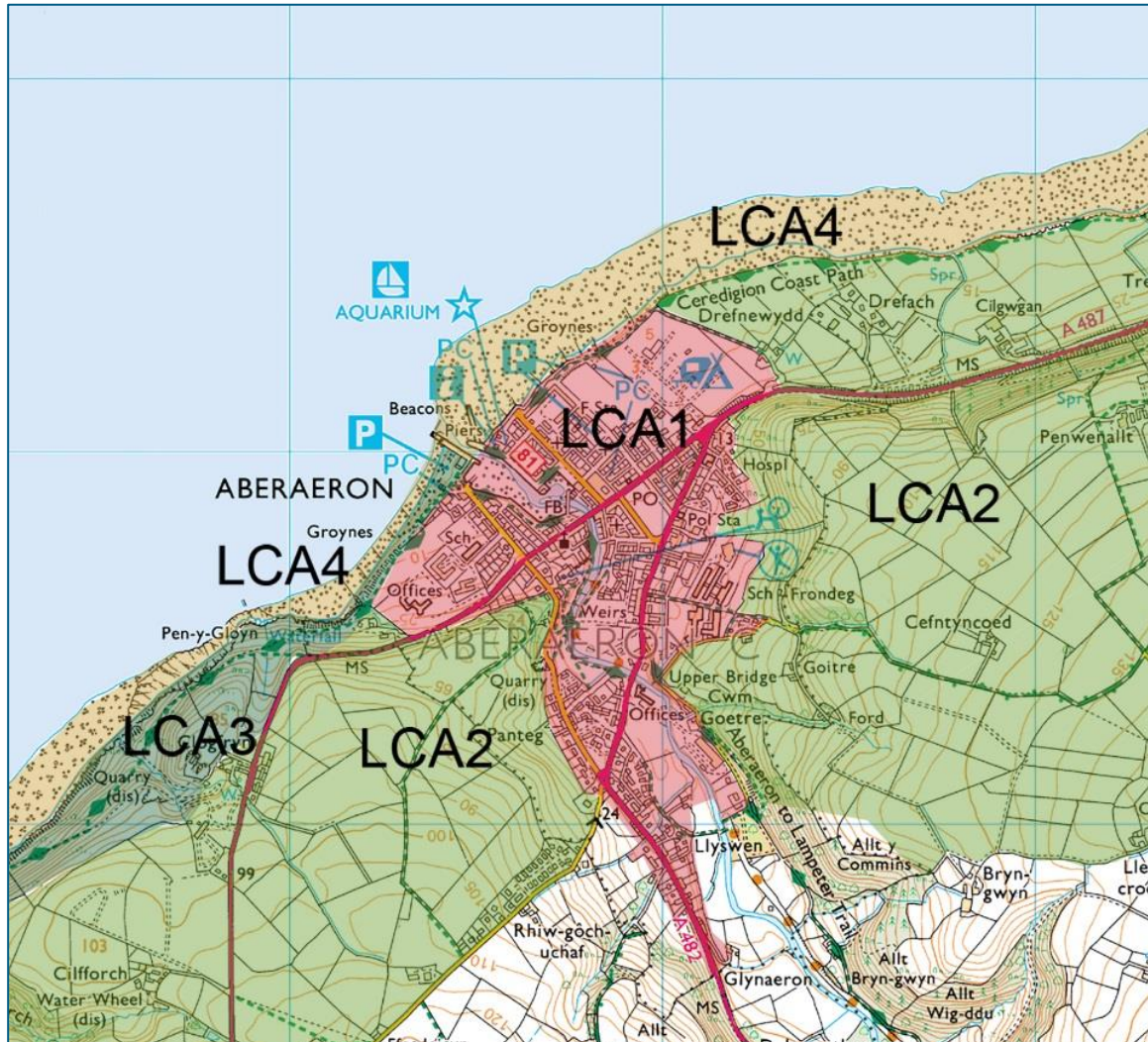
The development proposals with an impact to this LCA includes the South Beach improvements and rock breakwater. This LCA has a *Medium* sensitivity in relation to the proposed scheme, although the value is outstanding it is considered that the type of development should be able to be absorbed into the landscape and proposed materials are similar to current elements within the vicinity.

Local Character Area 4 - Cardigan Bay Intertidal Area (beaches) (*relates to LANDMAP aspect area CRDGNVS733*): This LCA comprises the beach areas either side of Aberaeron Harbour (North Beach and South Beach). This LCA has an overall LANDMAP evaluation of 'High' due to its varied but distinctive character. South Beach is a mainly pebble/shingle beach with expanses of sand at low tide. The character of the northern section of South Beach is strongly influenced by the urban area of Aberaeron; the beach is backed in this location by houses along Beach Parade, a large car park and buildings associated with Aberaeron Yacht Club. Further south, the beach character becomes less urban. The beach is backed by the rising ground of the adjacent Cardigan Bay Cliffs LCA and has more of the wild and remote qualities highlighted in the LANDMAP summary description. The north beach in the vicinity of the north pier is similar to the character found at the south beach; residential properties and a caravan park are located immediately adjacent the beach. Recent development with an improved sea wall hides the beach from the coastal path in this location and obscures the built form when on the beach. The key characteristics of this LCA are:

- The large scale of the LCA created by the low horizon and wide, open skies of Cardigan Bay contrasting with the sense of enclosure created by rising ground behind;
- The visually distinctive mix of rocky, wave cut platforms, pebbles, shingle and sand.

It is considered that this LCA would have a *Low* sensitivity to this type of development. The south beach and breakwater elements having the largest impact to this LCA but being existing features. These elements over time will weather into the surrounding context and sit comfortably within the character of a coastal setting.

Figure 11-1 Baseline Landscape Character – Local Character Areas



11.2.4 Visual Amenity Baseline

The visual amenity baseline information is described together with the potential impacts section 11.3.3 for ease of reading.

11.2.5 Data Gaps and Limitations

The assessment of impacts on landscape and visual amenity has been carried out without any limitations or gaps in data affecting the quality of the assessment.

11.3 Likely Significant Effects

11.3.1 Potential General Impacts

The proposed flood defence elements will be located in four main locations of the Aberaeron town: South Beach, North Pier, Quay Parade and Pwll Cam harbour. Mitigation measures have been

considered throughout the design development and are therefore inherent in the current design proposals as described below.

The proposed breakwater will be an extension from the North Pier and constructed with natural stone/rocks with an accessible path connecting directly to the North Pier. This feature will play a key role in reducing the incoming water into the harbour.

The new sea defence wall along Quay Parade, Pwll Cam and alongside the River Aeron, will be constructed from concrete and faced with stone, complementing the existing materials found in the immediate area. The wall will be topped with a glass element to retain key views through the taller structure for residents and visitors. Similar glass balustrading can be found in nearby restaurants in Pwll Cam. The location of the wall will be slightly offset from the current position with the largest change near the Tourist Information Centre. The wall in this location will extend to allow a permanent access to the Wales Coast Path during high tide events.

A new harbour gate is proposed for Pwll Cam and with this comes a small control building. This will be located adjacent the new gate on the higher level of the harbour walkway. The proposals for this are yet to be finalised, however it is recommended that this building should reflect the existing vernacular and will likely be clad in stone similar to nearby surrounding buildings.

The breakwater will be visible from the coastal path when approaching from the south, however with the added amenity value of an accessible path on the breakwater will create a destination and focal point for walkers approaching Aberaeron.

The following key aspects of the flood defence scheme are anticipated to potentially affect the landscape character and visual amenity of the area, either adversely or beneficially:

- Temporary introduction of prominent and uncharacteristic construction plant and equipment;
- Temporary movement and activity associated with the construction works;
- Temporary presence of security fencing;
- Rebuilding of seaward head of South Pier;
- Improvements to South Beach;
- Removal and installation of new harbour wall along Quay Parade, Pwll Cam and alongside the River Aeron, including harbour gates, tilts gates and access steps;
- Construction of new rock breakwater and walkway extending from the North Pier;
- Creation of picnic area to south of footbridge;
- Construction of new harbour gate control building
- Loss of grassed areas for construction site compound and access route;
- Temporary diversion of coastal path.

The above impacts have been considered in the following sections of this report.

11.3.2 Landscape Character Impacts

LCA 1 Aberaeron Townscape

The landscape character of the harbour town will be temporarily affected during the construction stages of the proposed works, with some diminishing effects on the historic character of the harbour and decrease in the sense of tranquillity. Therefore, during construction the presence and scale of

prominent and uncharacteristic plant and activities together with security fencing is likely to have a High Impact of change on the character of the area, which when combined with the High sensitivity of the LCA is likely to result in a **Major Adverse** effect. This may be regarded as significant, however, this effect would be temporary for the duration of the construction works only.

Upon completion, it is considered that the proposals would be in keeping with the existing key aspects of this character area. Finishes to walls and structures have been carefully chosen to reflect materials already present within the area. The new wall will be faced with stone matching surrounding finishes. Where possible, the metal structural elements will be painted to help blend with the surroundings and reduce their presence. The glass top is present in neighbouring restaurant external seating areas and wouldn't detract from the character of this area. It is therefore considered that upon completion, the impact would be Low resulting in a **Minor Adverse** effect and not significant. Over time the introduced elements would weather further into the landscape and this impact may reduce further.

LCA 3 Cardigan Bay Cliffs

The Cardigan Bay Cliffs landscape area is considered to have a High sensitivity value. This is due to the presence of the Wales Coast Path traversing much of this character area. The outlook along the route varies and meanders with the topography

During construction of the Scheme, proposals to the South Beach and rock breakwater extending from the north pier, together with the presence of the site compound and associated security fencing, are likely to have a Medium impact of change for this character area. The Wales Coast Path is included with this character area and when approaching from the south, and from the point Aberaeron becomes visible along this route, includes views of the Cardigan Bay SSSI. Given the High sensitivity of this LCA, this would result in a **Moderate Adverse**, and temporarily significant, effect

The construction activities, plant and associated compound would be removed upon completion of the works and any grassed/vegetative areas would be reinstated to their original state. The proposed works to the beach area would blend into the existing landscape and remove the dilapidated look of groynes and rock revetment and it is anticipated that the overall proposed works would have a **Negligible** effect with no significance on the character of the area upon completion and in the longer term, this is likely to reduce further and become a **Minor Beneficial** effect.

LCA 4 Cardigan Bay Intertidal Area (beaches)

For ease this character area will be split into two; North Beach and South Beach, as the impact to each is not the same; the main difference occurring during the construction stages. This character area is considered to have a High sensitivity value, for clarity, this rating applies to both beaches.

During the construction stages including the introduction of security fencing, construction plant and their associated activities, the impact to the North Beach LCA is considered to be Low. It is considered that this would result in a **Minor Adverse** effect with no significance during construction. The construction period is temporary and all affected land would be returned to its original state reducing the impact to this character area. Upon completion this effect will become **Negligible** and not significant. The main development feature being the rock breakwater in this area, consideration has been given to the materials used and these would weather over time and sit comfortably within the wider coastal beach context.

South Beach would experience additional impacts due to the presence of the main haul route from the site compound to the beaches to carry out the construction works of the rock breakwater. The Wales Coast Path passes adjacent this beach and may be subject to a temporary diversion to bypass the site compound. These construction activities are likely to have a Medium impact to the South Beach. This would result in a **Moderate Adverse** effect which may be considered significant. The construction stage is temporary and as with the North Beach, the land used during construction will be returned to its original state restoring the character area to its previous form.

As with the North Beach, upon completion impacts to South Beach will reduce to Negligible, as the proposed groynes replace existing groynes and the breakwater reflects existing structures and materials in the area. The resulting effect is considered to be **Negligible** and not significant and over

the longer term the works would weather in to match large rocks located in the vicinity of the beach and River Aeron.

Summary of landscape impact

Overall given the scale and type of development and the carefully located and chosen finishes of the proposed features specified partly in response to the Conservation Area status of the site, it is considered that the effect on the Landscape would be **Moderate Adverse** and temporarily significant during construction, reducing to **Negligible** upon completion and not significant.

11.3.3 Visual Amenity

It is anticipated there will be impacts on the visual amenity for the receptors in Table 11-5 below and referenced in the plan in Appendix J.

Photographs of key views from the site visit carried out on 11th and 12th March 2020 are included in Appendix I and described below.

These views have been chosen to represent a range of receptors from various locations in the harbour and coastal path. Views were chosen following a review of topographical information, where a view was likely to be available. Below is the location of each viewpoint and the associated receptor types:

The location of the site compound is limited due to the requirement to access South Beach and main road. The selected location is away from the main centre of the harbour town, limiting the impact to tourists and residents in Aberaeron. Alternative locations were considered and discounted to avoid residential streets and community assets.

Table 11-5 Viewpoint/Receptor Analysis

Viewpoint / Receptor	Baseline View and Value	Impact
The Landscape Character Areas have been assessed separately above (ref chapter 11.3.2), consideration to the views was taken into account as part of the character area assessment. The below viewpoints have been identified with likely impacts from the development.		
Viewpoint 1 - Coastal path, approaching from the south. Dist. – approx... 700m away	This viewpoint location offers long distance views towards the town of Aberaeron and of the coastline, including South Beach and Aberarth - Carreg Wylan SSSI in Cardigan Bay. Views into the harbour are restricted by the built form of the town. This viewpoint is considered to have a High sensitivity due to the long-distance views across the coast and status placed on the bay.	The proposed breakwater structure will be visible as it extends from the North Pier. During the construction phase it is anticipated there will be a Low impact to the view from this location. The construction work will be focused to the foreground specifically the north and south beaches and won't detract from the wider long-distance view available here. The construction activities within the harbour will be obscured by residential properties from this location. The resulting effect

Viewpoint / Receptor	Baseline View and Value	Impact
		here is considered to be Minor Adverse and not significant due to the temporary nature of the construction phase. Considering the materials proposed, the appearance of the groynes and breakwater would be in-keeping with character and views from this location. The impact will reduce upon completion of the scheme with a Negligible impact and a Negligible effect with no significance. The proposals in the harbour areas will not impact this viewpoint location.
Viewpoint 2 - Coastal path, near South Beach and Council offices Dist. – approx... 350m away	This viewpoint location is taken from the Wales Coast Path nearer to Aberaeron and has more direct views of the South Beach. The North Pier, North Beach and main harbour area is obscured by residential properties. This viewpoint is considered to have a High sensitivity due to the middle-distance view of the south beach and Cardigan bay.	The proposals to South Beach and the majority of the breakwater will become visible from this location. This section of the coastal path will receive a Medium impact with direct views of the site compound and construction activities on the South Beach and implementation of the breakwater. This has a resulting Moderate Adverse effect to this location. This effect would be temporary, then upon completion, while reinstatement grasslands becomes established on the compound site, but otherwise the Scheme would have a Negligible impact on this view. The resulting effect is considered to be Negligible with no significance. The materials used for the breakwater will weather into the wider beach and coastal context and the timber groynes replace existing features which are now in disrepair. There are limited views between residential properties of Quay Parade and Pwll Cam and the development proposals here haven't been considered influential to the outlook in this location.
Viewpoint 3 - Harbour Master and Harbour from the end of Harbour Lane Dist. – approx... 120m away	This viewpoint is located at the southern end of Harbour Lane near the entrance to a car park. Views of the Harbour Master public house and central harbour area are visible. The terraced housing along Quay Parade is a key feature and focal point here. South	Throughout the construction stage the view of Quay Parade will have a Medium impact with a Moderate Adverse effect. From this location the view towards the coloured terraces on Quay Parade will still be visible and construction activities will be focused nearer the ground plane. There will be occasions of construction plant navigating through the view, this will be temporary and

Viewpoint / Receptor	Baseline View and Value	Impact
	Beach is obscured by the rock revetment and various residential properties and the yacht club buildings. This location is considered to have a High sensitivity value due to the proximity and visual connection to the listed buildings and numerous character features in Aberaeron.	during the construction phase. Upon completion the new wall with the glass top will blend into the setting and not overly detract from the coloured terraces and harbour setting. The initial impact is considered to be Low with a Minor Adverse effect to the view in this location. Over the longer term the new features would become weathered to even better integrate into the view.
Viewpoint 4 - Harbour Lane, looking towards Harbour Master hotel Dist. – approx... 100m away	This viewpoint is taken at the opposing end of Harbour Lane to Viewpoint 3. The outlook here is open to the central harbour including the coloured terrace housing on Quay Parade. The view extends to Pwll Cam and adjacent the amenity space/informal gardens near the River Aeron. This location is part of the Coastal path and considers the perspective from residents along Harbour Lane and tourists navigating around the immediate space. Neither of the beaches are visible from this location, obscured predominately by residential properties. Considering the proximity to the above-mentioned features creating the character of the conservation area, this viewpoint has a High sensitivity rating.	This view will be altered during the construction phase with a High impact and a Major Adverse effect to the outlook here. Once construction of the wall is complete however, the terrace housing would remain visible as the top section of wall is proposed to be glass with stainless steel columns and stone piers located in the breaks of the terrace housing. The lower section of wall is proposed to be clad in stone matching nearby material finishes. The initial impact is considered to be Low with a Minor Adverse effect to the view in this location. Over the longer term the new features would become weathered to even better integrate into the view. The introduction of additional seating is proposed in this space with interpretation boards outlining the BAP habitat on the beach and a temporary board describing the construction elements for this scheme. This offers a new outlook for visitors and residents to the area with a location to enjoy the views across the harbour.
Viewpoint 5 - View of Pwll Cam from Pedestrian footbridge. Dist. – approx... 50m away	Crossing the pedestrian bridge offers an elevated view of Pwll Cam harbour and common land, dominated with the car park on Market Street. There are views across the central harbour towards the mouth of the main harbour. The main harbour is enclosed with coloured terrace housing on both sides and beyond the above-mentioned car park.	The construction stages will have a High impact to this view resulting in a Major Adverse and temporarily significant effect. From this location, the new harbour wall will restrict some views into Pwll Cam, however the glass top section will retain a large visual connection. The wall construction being partially glass would retain visual connectivity when crossing the footbridge.

Viewpoint / Receptor	Baseline View and Value	Impact
	Neither of the beaches are visible from this location, obscured predominately by residential properties. This location and associated views are considered to be of High value.	A new control structure is likely to be visible next to the new gate. The proposals for this are yet to be finalised the aspiration is for a stone cladding to the sides with more visual prominence. Once all construction work is completed the outlook here will have a Low impact resulting in a Minor Adverse effect in the long term.
Viewpoint 6 - View of pedestrian bridge from Pwll Cam. Dist. – within development area	This is the opposite location to Viewpoint 5 and is taken from the corner of the car park looking towards the pedestrian bridge, A487 road, residential properties and Holy Trinity Church. Pwll Cam offers some seclusion and enclosed short distance views and is surrounded with numerous coloured terraces and stone clad finishes to the built form. Neither of the beaches are visible from this location, obscured predominately by residential properties. This outlook has a baseline rating of High.	The construction of the new flood defence around Pwll Cam would have a High impact and a Moderate Adverse effect during the works period. The new flood defence wall proposed in this section would restrict views to the amenity space on the opposing side of the bridge. However, views of the built form and nearby Holy Trinity Church would be maintained and visible through the glass section of the wall. Upon completion of the construction the outlook is considered to have a Low effect and Minor Adverse impact with no significance.
Viewpoint 7 - View of Quay Parade looking towards harbour entrance. Dist. – within development area	The view here is directly along Quay Parade towards the tourist information building. The main focus is over the River Aeron and into the main harbour with a small view of Cardigan Bay through the harbour entrance. The coloured terraced housing along Harbour Lane forming the backdrop to the water in the foreground. Neither of the beaches are visible from this location, obscured predominately by residential properties. This location considers the views from residents, tourists and visitors. This viewpoint has a <i>High</i> sensitivity baseline rating.	During the construction stages this location will likely have limited public access for health and safety purposes resulting in a High impact to the outlook here. The resulting construction stages are considered to be Moderate Adverse temporarily significant effect. Upon completion the new wall in this section and partial view of the proposed breakwater as it extends across the entrance to the harbour would have a Low effect of the views from this location resulting in a Minor Adverse impact with no significance.
Viewpoint 8 - View of	This section of the Coastal	During construction the view in this

Viewpoint / Receptor	Baseline View and Value	Impact
north pier from the Coastal path approaching from the north. Dist. – approx... 50m away	path has undergone some recent construction work and the main views of the beach are obscured with a new concrete sea defence wall. Quay Parade and the harbour are blocked from sight with residential properties and only become visible near the tourist information building. The baseline view here is considered to be High.	location is anticipated to have a Low impact resulting in a Minor Adverse with no significance impact. Once construction has been completed, the view from this location is considered to be Negligible with Negligible , non-significant effect to the outlook. The sea defence wall in this location restricts views to the north beach and associated breakwater.

Summary of Visual Impact

Overall given the scale and type of development and the carefully located and chosen finishes of the proposed features specified in response to the sensitivity and conservation elements found in the immediate area, it is considered that a worst case effect on the visual amenity of the study area above would be **Major Adverse** and during construction, reducing to **Minor Adverse** upon completion and not significant. For the majority of views however effect is likely to be **Negligible** and potentially **Minor Beneficial** over the longer term.

Summary of effect on Character and Setting

The main effect on the character and setting to Aberaeron will be during the construction phase.

The location of LCA 1 and its proximity covering a number of the construction zones results in a worst-case impact of High to the character and setting within a conservation area. The impact reduces to Low and a **Minor Adverse** effect upon completion of the Scheme, since the proposals are in keeping with the existing landscape character and, over time, the carefully chosen materials used will further weather into their surroundings.

The remaining two-character areas LCA 3 and LCA 4 will be susceptible to a lesser extent given the changes proposed by the Scheme are even more in line with existing features. The greatest effects would be during construction and the intrusive qualities of the construction activities.

In terms of visual amenity the greatest adverse effects are again expected during the construction stage. Viewpoints four, five, six and seven are expected to have a High impact from the Scheme, due to the proximity of the viewer and intrusive nature of construction activities (residents, visitors and tourists into the town). Once completed however, the visual impact of the new sea defences is expected to reduce to Low with a **Minor Adverse** effect as the Scheme is expected to sit comfortably within the view.

Viewpoints two and three have a Medium impact during construction, reducing to Low upon completion with **Negligible** effect. The impact to these views come from the construction compound and movement routes on the beach.

Both viewpoints one and eight, considering their distance from the proposed scheme, have a Low impact during the construction stages, reducing to **Negligible** upon completion. Viewpoint one offers a long-distance outlook over Cardigan Bay with Aberaeron in the foreground. Viewpoint eight is constrained by recent improvements to the sea defences fronting the north beach and sight to the other scheme elements aren't visible from this location.

As summarised above the landscape and visual effects during the construction phases are likely to be higher compared to the post-construction lifespan of the proposals. This is due to the scale and movement of required plant machinery to implement the defence proposals. Overall, upon completion it is anticipated that the Scheme would, as a worst-case scenario, have a **Minor Adverse** effect upon the landscape and visual amenity of the area, but also may potentially be seen to have **Minor**

Beneficial effects over the longer term as the sea defences weather into their surroundings and proposals for the picnic area become established.

12 Coastal Processes

12.1 Method of Assessment

The assessment of coastal processes has been carried out through a desk-based review of existing literature, numerical sediment transport modelling (MIKE21 software), and the following survey work:

- Bathymetric/seabed survey undertaken by Eco Marine Consultants Ltd (2019). This survey included the use of a subtidal remote operated vehicle (ROV) to obtain video footage of the seabed just offshore from Aberaeron Harbour.
- WYG, A111150-2 Aberaeron Coastal Defence Scheme: Ground Investigation Factual Report (2019)
- Quantum Ground Investigation Factual Report – Q0377/FR.01 (2021)

12.1.1 Assessment Criteria

The criteria that has been used throughout the assessment to determine the magnitude of the effect are outlined in Chapter 5.3. These criteria have been determined by Atkins from our expertise in undertaking EIAs and has been adapted for the assessment of potential impacts associated with this Scheme.

12.2 Baseline Conditions

12.2.1 Description of Existing Environment

Overview

Aberaeron is located within a large embayment known as Cardigan Bay, which stretches approximately 100km from the Llyn Peninsula in the north to St. David's Head to the south. The coastline is characterised by a series of smaller bays interspersed with headlands of harder rock, fronted by the Irish Sea.

The coastline at Aberaeron comprises a stretch of shingle beach separated into two sections by the mouth of Aberaeron Harbour; North Beach and South Beach. The harbour entrance is marked by two concrete piers; North Pier and South Pier. The River Aeron flows through the town and discharges to the sea via the harbour entrance. The tidal limit of the River Aeron is approximately 60m south of the A487 road bridge which runs through Aberaeron. The harbour has no water level control structures and at low tide, the seabed within the harbour is exposed. The exception to this is the small dock of Pwll Cam, which retains a shallow water level at low tide due to the presence of a cill at the entrance to the dock. The coastline and harbour is backed by residential housing, gradually becoming more rural as the coastline extends further north and south.

The coastline experiences erosion and flooding and has a long history of coastal management intervention. In 2009, a coast defence scheme was constructed on North Beach comprising timber and rock groynes, a rock revetment, beach nourishment and new concrete flood defence wall. South Beach currently has a number of timber groynes and a rock revetment but these are in a state of disrepair. The seaward end of South Pier is also severely degraded and at risk of collapse. Inside the harbour, a small flood wall set back from the edge of the quay wall at Quay Parade provides some defence against flooding.

Geology

The bedrock geology of the Cardigan Bay area is dominated by a sedimentary succession of sandstones, siltstones and mudstones of Silurian to early Devonian age. Glacial and glaciofluvial

sequences were deposited on local bedrock during several major phases of ice-sheet glaciation that culminated approximately 18,000 years ago.

A subtidal video survey of the seabed along the Aberaeron coastline, undertaken for this Scheme in 2019 (Eco Marine Consultants, 2019) identified a dominant presence of mixed sediments of bedrock, boulders, cobbles and coarse gravel in the subtidal area, with occasional patches of sand. The nature of the sediment type is patchy across the site though sand was largely restricted to the south western portion and a gradient from sand to coarser sediment was evident from shore to sea.

The coastline is dominated by soft boulder clay cliffs, and mudstone outcrops and headlands. The hard points along the coast of New Quay head, Llanina Point, Aberaeron Harbour, Morfa Mawr, the mouth of the Afon Wyre, Carreg Ti Pw, Allt Wen, Aberystwyth Harbour, Castle Hill, Constitution Hill and Sarn Gynfelyn have created a stepped coastline, where the shore is eroding back in shallow bays (Atkins, 2018).

Protected Sites and Habitats

The Scheme lies within the Aberath-Carreg Wylan SSSI, designated for its geological, geomorphological and biological interest. The geology and geomorphological processes have enabled a wide range of marine and coastal wildlife to exist along this stretch of coastline, including a large extent of *Sabellaria alveolata* reef (refer to Chapter 9 Ecology for more details). The SSSI extends from the Afon Arth at Aberarth in Ceredigion, south to Carreg Wylan near Ceibwr Bay in north Pembrokeshire. At Aberaeron, the reef is visible at low tide on the lower foreshore along North Beach. A walkover survey carried out by a marine ecologist in summer 2020 did not identify any visible reef area at low tide along South Beach.

The locations named within the SSSI for geological features (Cwmtudu (cliffs and foreshore), Traeth Penbryn (cliffs), Mwnt (cliffs) and Poppit (shore platform)) (NRW, 2002) are all south of Aberaeron beyond the extent of the works to be undertaken (Cwmtudu is the closest at 11km south of Aberaeron).

There are no Regionally Important Geological and Geomorphological Sites (RIGS) in the vicinity of the works. The closest site is south of the scheme at New Quay; the New Quay Coastal Section and Frondolau Old Quarry.

The site also lies within the Cardigan Bay SAC and the West Wales Marine SAC. The Cardigan Bay SAC is primarily designated for its sandbanks, reef and submerged or partially submerged sea cave habitat. Of relevance to Aberaeron is the presence of reef along the foreshore, particularly at North Beach. The SAC is also designated for bottlenose dolphin, sea lamprey, river lamprey and grey seal. The West Wales SAC is designated for its populations of harbour porpoise.

Water Levels

The normal spring tidal range is approximately 4m, ranging from -1.79m (AOD) Mean Low Water Springs (MLWS) to +2.52m (AOD) Mean High Water Springs (MHWS). Extreme water levels can be up to an additional 1.5m higher. As stated earlier in this chapter, there are no water level control structures within the harbour and the harbour bed is exposed at low tide.

Waves

Wave climate data (Met Office hindcast data, 2020) over a period of 40 years has been used to determine representative wave conditions. This shows a wide range of wave directions from the southwest and northwest. The dominant wave direction is from the southwest to west, however waves from the northwest can also be significant during storm conditions.

The SMP1 (as referenced to in Royal Haskoning, 2011c) also demonstrated that there can be variation in net wave direction on a decadal scale such that in any period of time there may be a slight shift around the normal southwest to west dominance at the shoreline (Royal Haskoning, 2011c).

During north-westerly storms, waves are generated, which despite the presence of the two piers at Aberaeron, are able to enter the harbour. The shape of the harbour entrance means that wave heights

increase as they are funnelled through the entrance and move through the entrance channel of the harbour (Posford Duvivier, 1995 and Hyder Consulting, 2013a).

Waves from a north-westerly direction enter the harbour and run along the harbour wall on the north side of the harbour, which results in waves overtopping the harbour wall and the secondary wall too (Hyder Consulting, 2013a).

Sediment Transport

The stepped nature of this coast, with headlands and bays, demonstrates that the processes shaping the coastline are the dominant wave direction and the geology i.e. erosion and landward retreat of the coastline has occurred in the areas of softer geology, with the harder rocks remaining prominent as headlands. Without current coastal management measures, continued landward retreat would be expected. Increased sea level rise will tend to narrow the intertidal area, and allow larger waves to attack the cliffs, accelerating the recession. Some erosion of the clay cliffs at Aberaeron South Beach is occurring and this could over time allow a breach into a lower-lying area behind, adjacent to the southern flank of the harbour.

Sources of beach sediment are limited along this stretch of coastline, predominantly due to the presence of headlands reducing the longshore sediment transport to adjacent bays, as well as the more-resistant hard rock cliff outcrops which are less susceptible to erosion. Erosion of the clay cliffs at Aberaeron South Beach contain little beach supply material and do not have a significant impact on sediment supply (Royal Haskoning, 2011).

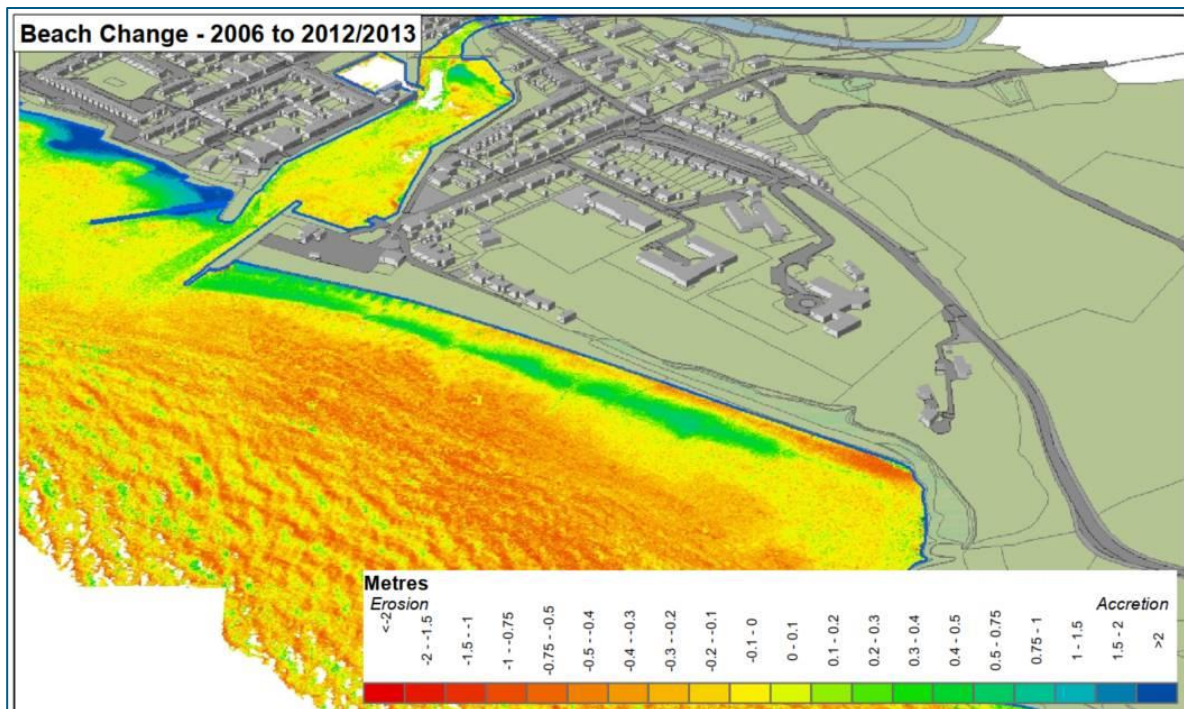
Longshore sediment transport processes are in a north-easterly direction. However, the amount of sediment transported is considered to be limited due to the limited supplies of sediment. There is very little movement of material offshore.

South Pier has a significant influence on the coastal processes of the North and South beaches at Aberaeron. The presence of the South Pier retains a significant amount of material that is being transported in a northerly direction by the prevailing longshore drift processes, enabling a channel to be maintained into Aberaeron Harbour. Although it acts as a barrier to drift along the frontage to the north, some nearshore movement beyond the influence of the pier is indicated, although this is limited to finer sediment. This has led to a reduction in material being deposited on North Beach. As stated above, the construction of new groynes and beach nourishment at North Beach as part of a coast defence scheme in 2009 along with regular beach maintenance, has improved the beach volumes here.

The presence of South Pier artificially maintains a wide beach crest at the northern end of South Beach, reducing the occurrence of tidal flooding and erosion of the land behind the beach. However, despite the sediment retention role provided by South Pier, as South Beach does not receive a large natural supply of sediment, timber groynes have been installed on the beach to help retain the limited sediment supplies. Additionally, a rock revetment at the southern end of the beach provides protection to the rear of the beach from landward erosion.

Beach monitoring has been undertaken on an annual basis at Aberaeron between 2009 and 2012 and a Beach Profile Monitoring report was produced by Royal HaskoningDHV in October 2012. This report indicated that the southern end of Aberaeron South Beach has eroded, with accretion at the northern end of the beach, towards the South Pier. Further, a LiDAR comparison between 2006 and 2010 indicated that there is evidence that the southern end of South Beach is retreating, while to the northern end it is accreting (see Figure 12.1). This reflects the dominant wave direction from the south west. It is recognised, however, that if this beach is subject to waves from the northwest, then there is likely to be a tendency for the material to return southwards again. As well as general accretion at the northern end of South Beach, the report indicated that there is evidence of some steepening of the beach; with a narrow strip of erosion in line with and perpendicular to the end of the South Pier. In contrast, erosion to the south is tending to flatten the beach. The general pattern of change highlights the importance of the Pier as the main control feature, holding the northern section of South Beach.

Figure 12-1 Beach Changes 2006 to 2012/2013



Source: Royal HaskoningDHV 2012

A further comparison of beach sections using LiDAR data from 2009 with latest dataset dated 2015 (Lle.gov.uk) has also been undertaken as is shown in [Appendix K](#). Over this period there was very little difference in measurements showing a discernible pattern of retreat or steepening. Drawing 5182114-ATK-MAR-GEN-DR-C-8001 shows a comparison between 2015 LiDAR and a 2019 topographic survey. Sections E and F on the drawing show that some local increase of the shingle has occurred. These sections are to the northern extent of the South Beach, supporting the previous observations that shingle accretes in this area.

Within the harbour, sediment is brought in from both the sea and from upstream river flows. Accretion in the harbour is, however, limited, particularly due to the limited offshore sediment supplies along the Aberaeron coastline and the presence of the two piers. Bed levels vary between the north and south side of the harbour. The River Aeron channel runs along the northern side of the harbour. Here, the bed level is lower as the river flows prevent accumulation of sediment, whereas on the southern side of the harbour bed levels are higher where sediment has accumulated (Posford Duvivier, 1995). As a result, the harbour is dredged in March (usually on the last Spring tide before the end of March). The dredging is timed to coincide with the start of annual summer use of the harbour moorings. Boats are removed from the harbour at the end of October for storage over winter (due to the risk of storm damage) and returned to the harbour at the end of March. Pwll Cam is not dredged. The arisings are deposited on South Beach.

12.2.2 Data Gaps and Limitations

The model has been used to predict patterns and trends of sediment transport but would not be able to fully quantify the volumes of deposition or erosion likely without detailed understanding of offshore bedforms, spatial distribution and thickness of sediments. Some of this data was able to be inferred from sub-tidal surveys and nearshore ground investigations to build into assumptions used in the model. As detailed above previous studies have evidenced that sources of sediment are limited along this section of coast and therefore the risk of excessive sediment build up above that forecast in the model is considered low.

River Aeron flows were not a part of the model assessment. Using professional judgement, the flows from the River Aeron are likely to be beneficial in terms of keeping the navigation channel free from deposition.

12.3 Likely Significant Effects

12.3.1 Construction

Geology

As there are no geological features of conservation interest in the area of the proposed Scheme, the construction will have **no adverse impact** on geological features.

Intertidal and Subtidal Areas

During construction, work will take place on South Beach and around the ends of the piers. There will be no construction work and no movement of plant and machinery on North Beach.

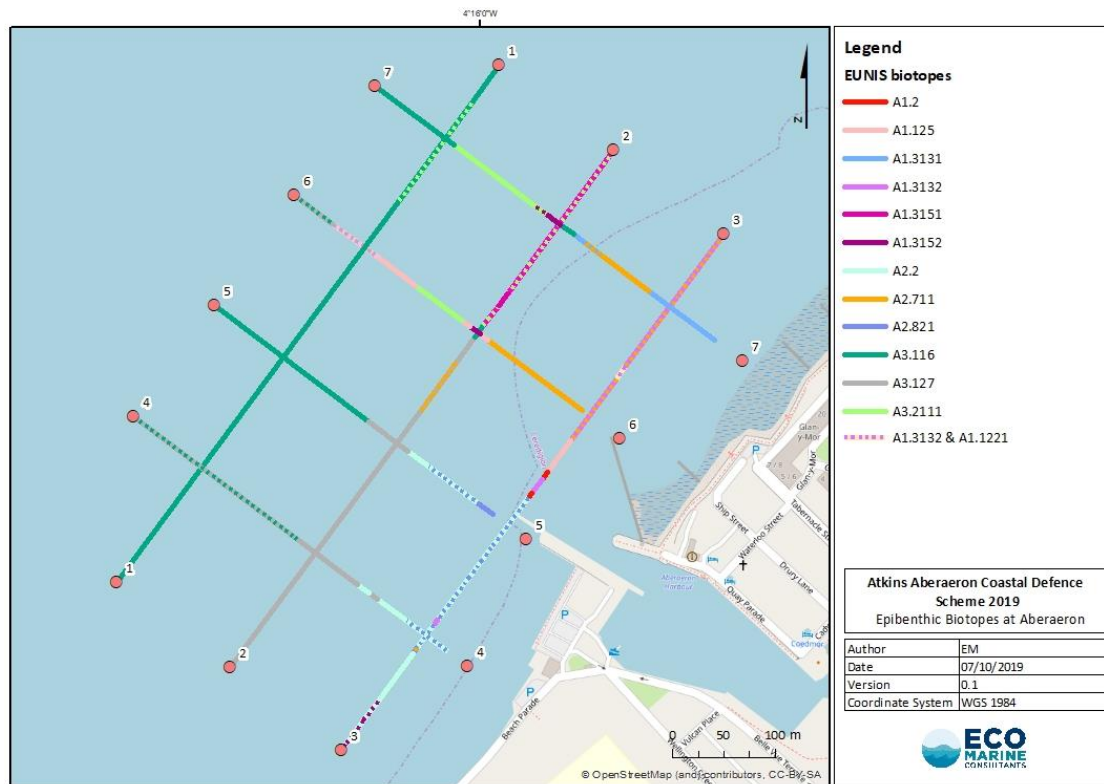
The construction work will cause disturbance to the intertidal area of South Beach, as well as the nearshore subtidal zone in the vicinity of the two piers, with the work taking place within the SSSI and SAC boundaries (see Chapter 9 Biodiversity). This disturbance will be from the improvement works taking place directly on South Beach (timber groynes, revetment and beach nourishment) and from the re-building of the end of South Pier and construction of the new breakwater. There will also be construction vehicles moving across South Beach transporting materials from the site compound as well as storage areas of rock on the beach for the breakwater and revetment.

A subtidal marine survey carried out for the Scheme in 2019 and an ecological walkover survey in summer 2020 determined that there was no established reef area within the intertidal zone on South Beach or at the ends of both piers. Areas of reef are however located close to the location of the new breakwater. Information taken from the Welsh Government Planning Portal (Welsh Government, 2020) and reproduced in Figure 12.2, shows the general location of the reef in the context of the breakwater. There are also areas of reef close to the intertidal zone on South Beach. The 'other protected area' shown in the figure includes biotopes of mussels, red and green seaweed and wrack. Figure 12.3 shows the survey transects from the 2019 subtidal marine survey (Eco Marine Consultants Ltd, 2019). Biotope A2.711, colour coded in orange, represents locations of *S.alveolata* reef, which confirms the reef area to be located beyond the extent of the breakwater. A detailed discussion of the impacts of the construction phase of the Scheme on the SSSI and SAC sites, as well as on the *S.alveolata* reef is discussed in Chapter 9 Ecology.

Figure 12-2 Sabellaria Alveolata General Reef Extent



Figure 12-3 *Sabellaria Alveolata* Subtidal Survey Transects



The following measures will be implemented to reduce adverse effects on the seabed during construction. Impacts following construction, are discussed in Section 12.3.2 below.

- There will be no construction work on North Beach.
- As much of the construction of the breakwater as possible will take place from the top of the breakwater itself i.e. building the breakwater seawards and using sections already built as a working platform.
- Prior to construction, a habitat survey of the *S. alveolata* reef will be undertaken on South Beach and in the footprint of the breakwater to confirm that there is no reef present within the working area of South Beach and the piers. Should areas of reef have developed since the 2020 walkover survey, the contractor will avoid unnecessary movement over newly established reef areas.
- Construction vehicles will restrict their movements to the upper areas of the beach as far as is practicable to reduce sediment mobilisation in the lower intertidal area.
- There will be no anchoring or beaching of any marine vessels on the reef.
- The contractors will be informed of the presence of the reef and its protected status.

With these measures in place, direct physical disturbance to the reef in the intertidal and subtidal area during construction will be **minor adverse**.

Release of Sediments

During construction, there is a risk that the works could release sediment into the sea, through the movement of construction vehicles on the beach, excavation on the foreshore and/or the storage

and placement of rock and shingle on the beach. This could have implications on marine ecology and the reef should suspended sediment become deposited on marine habitats. To reduce turbidity, 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 need to take place under water. A geofabric mat will also be positioned onto the seabed in the excavated footprint of the breakwater, which will help reduce the washout of bed material beneath the rocks both during construction and in the future. Construction vehicles will utilise the upper beach as much as possible, to avoid beach materials being washed out into the sea.

With these measures in place, any sediment released into the sea is likely to be in small quantities, which will dissipate within the water column. As a result of these measures the release of sediments into the sea is considered to be **minor adverse**.

Coastal Processes

During construction, the methods proposed will not cause any adverse changes to the coastal processes in terms of the hydrodynamics and sediment transport processes. Changes to coastal processes following construction are discussed in section 12.3.2 below.

12.3.2 Operation

Intertidal and Subtidal Areas

Following construction, the footprint of the breakwater will create a permanent loss of seabed and as a result loss of SAC and SSSI habitat. The area of loss of the designated sites is provided below with further discussion on the impacts to the conservation features in Chapter 9 Ecology:

- Cardigan Bay SAC: 0.00074%
- West Wales Marine SAC: 0.00009%
- Aberarth-Carreg Wylan SSSI: 0.04%

The breakwater will also cause a small loss of area currently shown to be *S.alveolata* reef. As described above and shown in Figures 12.2 and 12.3, the breakwater is located close to the reef on North Beach and therefore permanent loss of reef habitat is unlikely to result from the Scheme footprint. As described above, a habitat survey to confirm that the reef has not grown and extended into the breakwater footprint will be carried out prior to construction.

The Scheme will not cause any permanent loss of the reef on South Beach as the revetment, groynes and beach nourishment will not extend into the reef area shown on Figures 12.2 and 12.3.

Permanent disturbance to the seabed has been assessed to be **minor adverse**.

Hydrodynamics

Water Levels

The beach recharge will result in a small adjustment to the location of MHW, pushing it slightly further seaward. The material will be placed at a slope of 1 in 3.3 and will move the high water mark to approximately 10m from the back of the beach. The new line of MHW will mean that a slightly larger area of beach will be maintained at high tide than existing. This is beneficial in terms of reducing the risk of wave overtopping and is considered to be a **moderate beneficial** impact.

Waves

The new breakwater has been designed to reduce waves entering the harbour from a north-westerly direction and causing flooding. The breakwater will reduce the height of waves during storms, however during extreme events, waves within the harbour would still be sufficiently high to cause overtopping within the harbour, hence the integration or raised flood wall works further into the

harbour as part of the overall scheme design. The scheme as a whole will be of **major benefit** in reducing flood risk at Aberaeron.

The breakwater is also likely to cause some localised change in local wave direction and the creation of some secondary currents, where waves will diffract around the end of the structure. These changes are not considered to be significant or cause any changes to coastal processes, nor impact on the adjacent *S.alveolata* reef. A **negligible** impact is therefore anticipated.

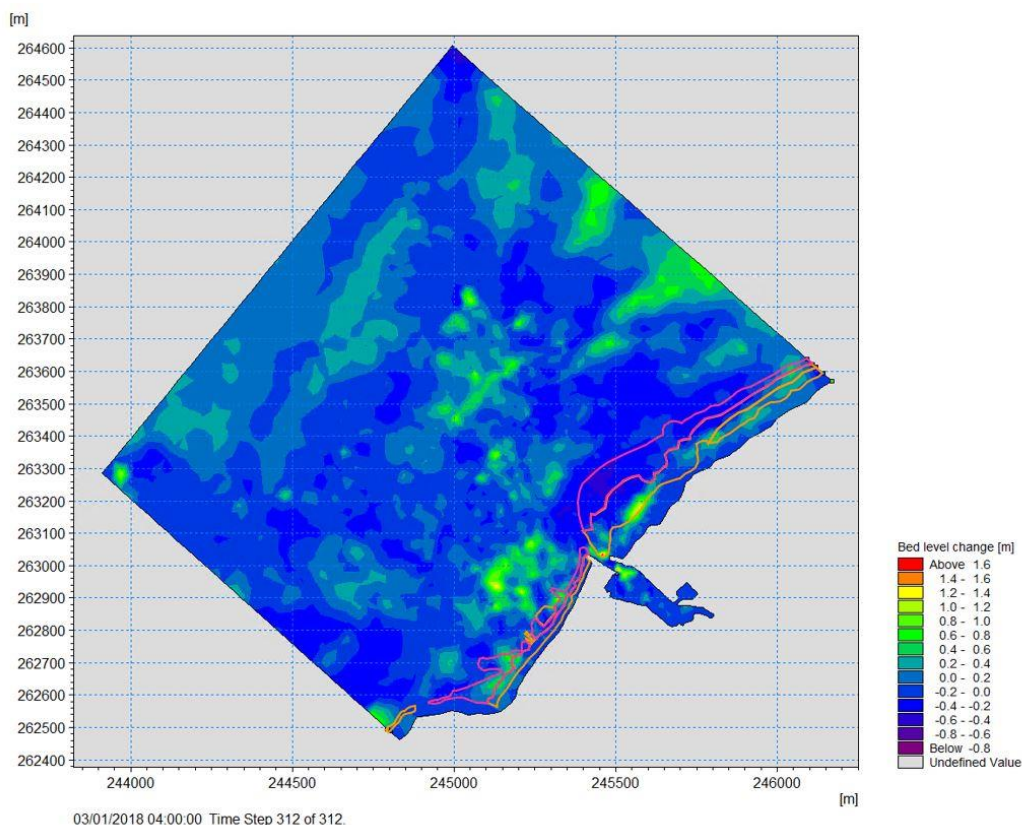
Sediment Transport

Longshore Transport

The presence of the breakwater will cause some interruption to the predominant north-west longshore sediment transport. This is already seen from the presence of South Pier, in the lee of which sediment has accreted, with this part of the beach being wider than that in the south. Over the years, North Beach has been affected by low sediment input as a result of the piers. Although sediment interruption is already occurring as a result of South Pier, the extension of the breakwater further seaward will cause more sediment to be prevented from north-east transport.

Numerical modelling has been undertaken to assess the change in sediment processes from the present day scenario to a scenario with the breakwater. The plots are shown in Figures 12.4 and 12.5 below and show bed level change over a period of one theoretical year. Figure 12.4 shows that accretion is already occurring offshore of South Beach, in the harbour mouth and along North Beach. The bed level change over one year is estimated to be up to +1.2m in places. The accretion along North Beach is the result of coast protection measures already in place to trap any incoming sediment.

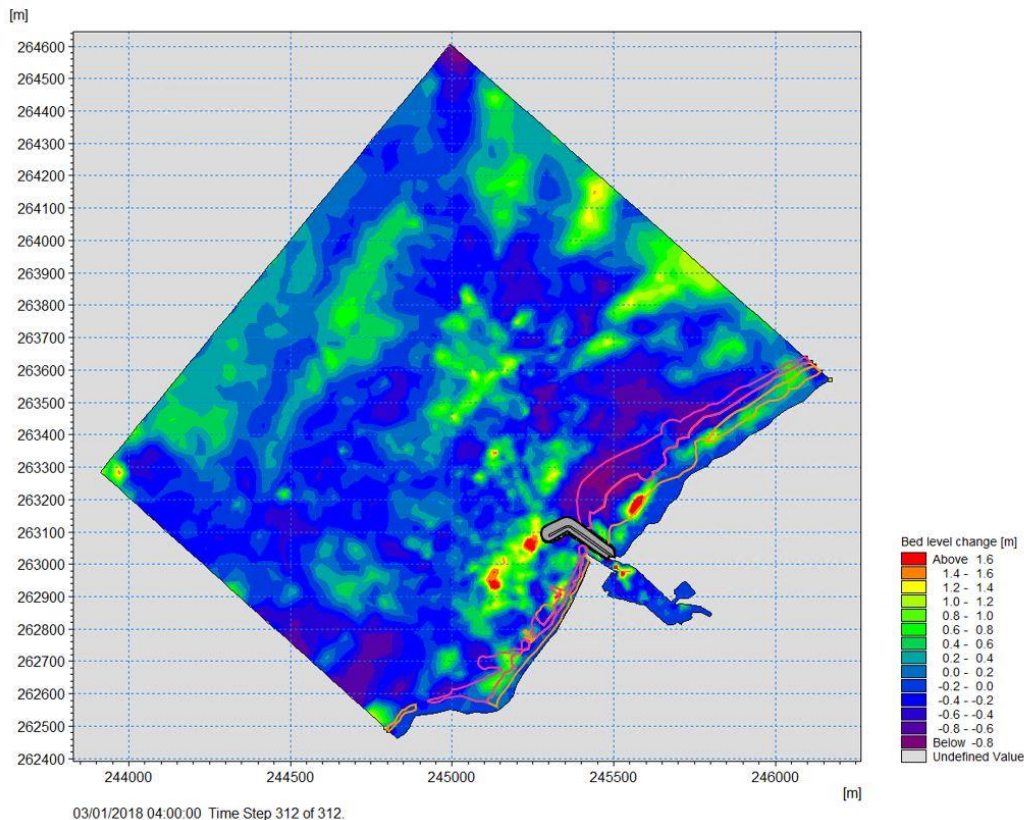
Figure 12-4 Bed Level Change without Breakwater



By comparison, figure 12.5 shows bed level change over one year with the breakwater in place. The figure shows a similar pattern of accretion in terms of location, but with a higher rate of accretion, up to above 1.6m over the course of one year. It is important to note, however, that the model did not

include fluvial flows from the River Aeron, which will play a significant role in dispersing sediment in the mouth of the harbour. The model was also not calibrated against real-time data and therefore these values should be used to infer a trend towards accretion, rather than actual quantities. Should accretion be greater than the existing situation, a build-up of sediment could have implications for seabed habitat as well as navigation in and out of the harbour mouth.

Figure 12-5 Bed Level Change with Breakwater



As described earlier in Section 12.3.1, there is little evidence of any *S.alveolata* reef in the intertidal area on South Beach. Increased levels of accretion are therefore unlikely to cause any smothering of large areas of reef on South Beach. Along North Beach, where reef habitat is well established, the numerical modelling shows that the breakwater will not have a significant change on sedimentation patterns that are already occurring as the piers have played a predominant role in controlling sediment transport to the north since their construction over 100 years ago. In addition, very small quantities of natural sediment supply are transported to the Aberaeron frontage and therefore limited possibilities for significant accretion to occur. Although the interruption of longshore transport will reduce the volume of feed to the beach to the north of the scheme, the existing quantity of sediment feed is so small that the beaches would not be significantly adversely impacted by any reduction in supply.

Figure 12.5 does show an increased level of accretion at one location along North Beach. However, given that the breakwater will be reducing sediment transport, this accretion is likely to be the result of the influence of existing defence structures and groynes along North Beach causing this modelling result, rather than the Scheme.

On the northern face of the North Pier, is a groyne which extends seaward, creating a 'V' shape area of beach in between this groyne and the North Pier. There is the potential for sediment to build up in this sheltered area and potentially overspill onto the adjacent reef. Given the low sediment supplies to the frontage, accretion here is not likely to be an issue, however sediment monitoring in this location will be included as part of the post construction monitoring programme discussed in the paragraph below.

The modelling also shows the potential for accretion within Aberaeron Harbour. The harbour is already routinely dredged by CCC to maintain navigation and this pattern of management will continue following construction.

Monitoring of bed levels will be carried out following construction, with maintenance dredging taking place to remove excess sediment build up. Monitoring of sediment build up in the 'V' shaped notch between the North Pier and the groyne will also take place, with excess sediment removed and recycled if required. Arising from existing harbour dredging operations are deposited on South Beach and this method would continue with post-construction maintenance dredging. The large majority of this material is placed at the northern end of the South Beach in the vicinity of the Yacht Club, at the top of the shingle bank, to build up the width of the shingle berm and improve the level of protection against wave overtopping. The material also provides protection against erosion. This has the advantage of retaining materials within the beach rather than removing surplus materials for disposal.

Although sediment accretion is predicted by the model to occur, these locations are already showing patterns of accretion. With monitoring proposed and removal of excess sediment able to take place if sediment is not naturally dispersed by waves and tides, the impact is considered to be **negligible**.

Erosion

Following construction, the improvements to the rock revetment, timber groynes and beach recharge, will provide improved coast protection from erosion on South Beach. As the works on South Beach are improvements to coast protection structures already in place (revetment and groynes), the improvements in erosion reduction are assessed to be of **moderate benefit**.

Flooding

The Scheme will provide Aberaeron with greater protection from flooding by increasing the standard of protection to 1 in 200 years (from a combined wave and water level event). The scheme will therefore have a **major beneficial** impact in reducing flood risk from overtopping.

13 Water Quality

13.1 Method of Assessment

13.1.1 Scope of issues assessed

This chapter assesses the potential impacts of the proposed Scheme on water quality during both the construction and operational phases. A Water Framework Directive (WFD) Compliance Assessment has been completed for the Scheme. The report is provided in Appendix L. As described in Chapter 1.2.2, the WFD originates from the EU but has been retained in UK law following the UK's exit, via The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, as amended. For the purposes of this ES, the assessment of the Scheme in relation to the Water Environment Regulations is continued to be referred to as a WFD Assessment.

The Scoping Report (Atkins, 2019) identified that the Scheme was unlikely to generate significant adverse impacts on water quality. However, since the scoping phase, a breakwater extending off the North Pier and a new flood gate at the entrance to Pwll Cam dock have been included into the design. The location of these elements within the water environment has resulted in consideration of water quality impacts being scoped back into the assessment.

The scoping opinion response received from CCC in April 2019, highlighted the following additional items to be addressed specifically by the ES:

- Updates to the baseline groundwater body classification; and
- Baseline evidence should be supplemented by a Flood Consequence Assessment (FCA). An FCA has been produced and will be submitted with the planning application.

The assessment of the Scheme on water quality has been undertaken by reviewing existing available data, particularly WFD monitoring data (Natural Resources Wales, 2020) for designated waterbodies in the vicinity of the Scheme. Table 13.1 summarises the main elements relating to the water environment that have been included in this assessment.

Table 13-1 Scope of Water Quality Assessment

Receptor	Scope of the Water Quality Assessment
Hydromorphology	Operation only – Potential changes to local morphological conditions. Potential increase of flood risk upstream of River Aeron due to flood gate and harbour wall raising.
Water quality	Construction – Potential disturbance and re-mobilisation of contaminated sediments during installation of the North Pier Breakwater and Pwll Cam floodgate. 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.
WFD classification and Bathing Waters	Construction and operation – the implications of the Scheme as a whole, and the potential issues identified above will also be considered in relation to any potential implications for the status of WFD waterbodies.

13.1.2 Spatial Scope of Assessment

The study area for this assessment has been determined by:

- The immediate area of the proposed Scheme;
- The presence of any WFD water bodies (including groundwater), other surface water features, and actual or theoretical hydrological connections within the Scheme area and immediate adjacent area; and
- The potential for connections that could create a pathway for impacts or effects on any of these water features.

Due to the nature of the water environment, and the possibility of impact pathways extending over sometimes uncertain distances, a broad spatial study area has been adopted for this assessment. For surface waters, this covers the extent of the Cardigan Bay Central coastal water body and the River Aeron water body. The underlying Teifi and Coastal Ceredigion groundwater body has also been considered in line with WFD requirements. Groundwater conditions have also been considered and assessed in Section 14 – Soils and Ground Conditions.

13.1.3 Relevant legislation, policies, and guidance

The legislative instruments which are specific to the protection and management of ground and surface waters are summarised in Table 13-2.

Table 13-2 Surface and Groundwater Legislation and Policies

Scale	Policy Document	Key Considerations for the Scheme
European	EU Water Framework Directive 2000/60/EC	The Water Framework Directive 2000/60/EC is a European Directive. 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).
	2006 Groundwater Daughter Directive 2006/118/EC	2006 Groundwater Daughter Directive 2006/118/EC establishes specific measures as provided for in Article 17(1) and (2) of Directive 2000/60/EC in order to prevent and control groundwater pollution. These measures include in particular: • Criteria for the assessment of good groundwater chemical status; and • Criteria for the identification and reversal of significant and sustained upward trends and for the definition of starting points for trend reversals. This Directive also complements the provisions preventing or limiting inputs of pollutants into groundwater already contained

		in Directive 2000/60/EC, and aims to prevent the deterioration of the status of all bodies of groundwater.
	The Environmental Quality Standards Directive 2008/105/EC	The Environmental Quality Standards Directive 2008/105/EC sets out a list of substances that pose a threat to our water-bodies (which include rivers, lakes and groundwater). These 'priority substances' should stay below levels that are safe for water-bodies and human health. There's a sub-set of the 'priority substances' list called the 'priority hazardous substances list.' All EU members must stop any discharge of these substances by 2020.
National	Environmental Protection Act 1990	The Environmental Protection Act 1990 makes provision for the improved control of pollution to the air, water, and land by regulating the management of waste and the control of emissions. Key provisions of the Act impose a duty of care on any business or person who produces, carries, keeps, treats, disposes of or imports controlled waste to do so safely. The Act also contains provisions addressing statutory nuisances, litter and the control of genetically modified organisms and certain other substances.
	Water Resources Act 1991	The Water Resources Act 1991 aims to prevent and minimise pollution of water. Under the Act it is an offence to cause or knowingly permit any poisonous, noxious, or polluting material, or any solid waste to enter any Controlled Water. The Act also regulates water resources, water quality and pollution, and flood defence.
	Water Act 2003	The Water Act 2003 introduced several changes to further the compliance with the Water Framework Directive in relation to the abstraction and impounding licensing system developed under the Water Resources Act 1991. It made changes to the corporate structure of economic regulation and extended the scope for competition in the industry to large users.
	Water Environment (Water Framework Directive) (England and Wales) Regulations 2017)	These regulations transpose the requirements of the Water Framework Directive into national legislation.
	Welsh Government Assembly, 2004. TAN 15, Technical Advice Note 15: Development and Flood Risk	This Technical Advice Notes makes specific provisions in relation to development advice in relation to flood risk.

	Welsh National Marine Plan (2019)	The WNMP sets out policies for the next 20 years for the sustainable use of Wales seas. Policies under the plan that should be considered in relation to the Scheme include: SOC_03: Marine Pollution Incidents Proposals should demonstrate how they minimise their risk of causing or contributing to marine pollution incidents. ENV_06: Air and water quality Proposals should demonstrate that they have considered their potential air and water quality impacts and should, in order of preference: a) avoid adverse impacts; and/or b) minimise adverse impacts where they cannot be avoided; and/or c) mitigate adverse impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised, or mitigated, proposals must present a clear and convincing case for proceeding.
Guidance	Clearing the Waters for All (2016)	The assessment of the proposed Scheme on WFD quality elements and overall water quality has been based on current Environment Agency published guidance on undertaking WFD Assessment; "Clearing the Waters for All" (2016, updated November 2017, and available at: www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters). The broader assessment of water quality has used guidance contained within the Environment Agency's internal document "Assessment and reporting manual – Section 5 Reporting" (Operational Instruction 636_14).
	Pollution Prevention Guidelines (PPGs)	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. For works in England, regulatory guidance is available from GOV.UK instead.
	CIRIA documents	The CIRIA documents are a series of publications developed by the Construction Industry Research and Information Association. Each document is targeted at a particular type of business or activity and covers environmental good practice to minimise pollution. Particular attention should be given to CIRIA C532 (Control of water pollution from construction sites, 2001). The CIRIA publications also refer to environmental legal obligations and are available from: http://www.ciria.org/CIRIA/Resources/Resource_overview/Res

ources/Resources_overview.aspx?hkey=a80608d2-a045-4d72-8bb9-5ecf23f8d761

13.1.4 Method of Assessment

The methodology used for the assessment of effects on the water environment follows the overarching EIA methodology presented in Section 5.3 of this ES, using combinations of defined sensitivity of water receptors against a consideration of impact magnitude to determine the significance of the effects of the Scheme. The presence and sensitivity of receptors at risk from changes in the water environment can be assessed by consideration of the following:

- Current and surrounding land uses, based on mapping and existing planning designations;
- Proposed end-use, based on the nature of the proposed works;
- Type of construction and proximity to potential receptors;
- Geology, hydrogeology and hydrology of the site and its surrounding area; and
- The requirements of the WFD.

Table 13-3 sets out how the importance or sensitivity of receptors has been defined, and Table 13-4 sets out definitions of the magnitude of potential impacts. By combining the two, the significance of effects on the water environment is derived. The significance of effects, after the sensitivity and impact magnitude has been established, has been assessed using the matrix presented in Table 5.3 of Chapter 5.

Table 13-3 Defining Importance or Sensitivity of Receptors for Water Quality

Importance or sensitivity of receptor	Examples
High	Main river or WFD water body with limited modifications or pressures, varied morphological features and largely natural processes ('High' or 'Good' ecological status). For Heavily Modified Water Bodies (HMWB), all identified mitigation measures are 'In Place' ('Good' Ecological Potential). Designated Shellfish or High Status Bathing Waters. Water body (surface or ground) providing drinking water to a large population.
Medium	Main river or WFD water body with some identified modifications or pressures that influence the variety of morphological features present and processes operating ('Moderate' ecological status). For Heavily Modified Water Bodies (HMWB), not all identified mitigation measures are 'In Place' ('Moderate' ecological potential). Good Status Bathing Waters. Water body (surface or ground) providing drinking water to a small population.
Low	WFD water body with 'Poor' or 'Bad' ecological status/potential. Ordinary Watercourse or other non-WFD water body, typically with extensive modifications and limited natural processes.

	Water body (surface or ground) providing agricultural or industrial water supplies.
Negligible	Artificial ditches or balancing ponds.

Table 13-4 Defining the Magnitude of Impacts for Water Quality

Predicted Magnitude of Impact	Examples
High	Substantial change in hydromorphological, biological or physico-chemical elements at the water body scale, such that a change in WFD classification is possible, or objectives would not be met in the future. For HMWB, the impact would prevent WFD mitigation objectives from being implemented in the future. Positive impacts would substantially contribute to the implementation of HMWB mitigation measures. Substantial change in quality of a Protected Area, resulting in a reduction in classification status. Complete loss of a drinking water, industrial or agricultural water resource.
Medium	Measurable change in hydromorphological, biological or physico-chemical elements at less than the whole water body scale. A change in WFD classification is unlikely but may still need some mitigation or controls for the impacts. Objectives could still be met in the future. For Heavily Modified Water Bodies, positive impacts would contribute to a limited number of HMWB mitigation measures. Measurable change in quality of a Protected Area, but unlikely to result in a change of classification status. Some reduction in quality or availability of a drinking water, industrial or agricultural water resource.
Low	Measurable but localised or slight change in hydromorphological, biological or physico-chemical elements of a water body. No risk of change in WFD classification is unlikely but may still need some mitigation or controls for the impacts. Objectives could still be met in the future. Neutral effects on HMWB mitigation measures – no conflicts, but no positive contribution either. Measurable but localised or slight change in in quality of a Protected Area, but unlikely to result in a change of classification status. Measurable but localised or slight changes in the availability of a drinking water, industrial or agricultural abstraction.
Negligible	Discernible change to a water body or water resource but no measurable loss in quality or availability.
No change	No measurable change from the current baseline condition will occur.

The evaluation and assessment of the proposed Scheme on WFD quality elements and overall water quality has been based on current Environment Agency published guidance on undertaking WFD Assessment; "Clearing the Waters for All" (Environment Agency, 2016).

13.1.5 Data Sources

The assessment has used a number of surveys and assessments that have been carried out to inform the development of the Scheme, existing information relating to water quality, and existing data relating to the water body classification of the surrounding water bodies under WFD using NRW's Water Watch Wales interactive mapping (Natural Resources Wales, 2020). The following additional GIS sources have also been used:

- Defra MAGIC map (<https://magic.defra.gov.uk>)
- Lle A Geoportal for Wales (Welsh Government, 2021); and
- For a list of all sources referenced in this chapter, please refer to the reference list.

13.2 Baseline Conditions

13.2.1 Surface Water

Aberaeron Harbour is under both tidal and fluvial influence from Cardigan Bay and the River Aeron respectively. Cardigan Bay (an area encompassing three designated WFD water bodies) is a popular tourist destination partly due to its Blue Flag beaches and the potential for spotting local populations of Bottlenose dolphin, which are a designated feature of the Cardigan Bay Special Area of Conservation (SAC) (Visit Wales, 2021a). Please see further details relating to European designated areas in Chapter 9 Ecology.

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

Under the River Basin Management Plan (RBMP), Aberaeron is located within the Western Wales River Basin District (RBD). In this area, the following designated surface water bodies have the potential to be impacted by the Scheme.

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

Cardigan Bay Central (ID: GB651009030000) is a designated coastal water body covering an area of 104km². Upstream from the harbour mouth at Aberaeron is the River Aeron. The River Aeron is 12.15km in length. Works to increase the height of the existing flood walls is proposed along an approximate 125m section of the northern bank of the lower tidal Aeron between the A487 road bridge and the entrance to Pwll Cam dock. The Aeron waterbody is therefore included in this assessment and also because of its hydrological connection with the Cardigan Bay Central waterbody.

Based on the current water body classification of the Cardigan Bay Central and the Aeron water bodies, the sensitivity of surface water receptors is deemed to be 'high' and 'medium' respectively.

Figure 13-1 below shows the location of the surface water bodies in relation to the Scheme location.

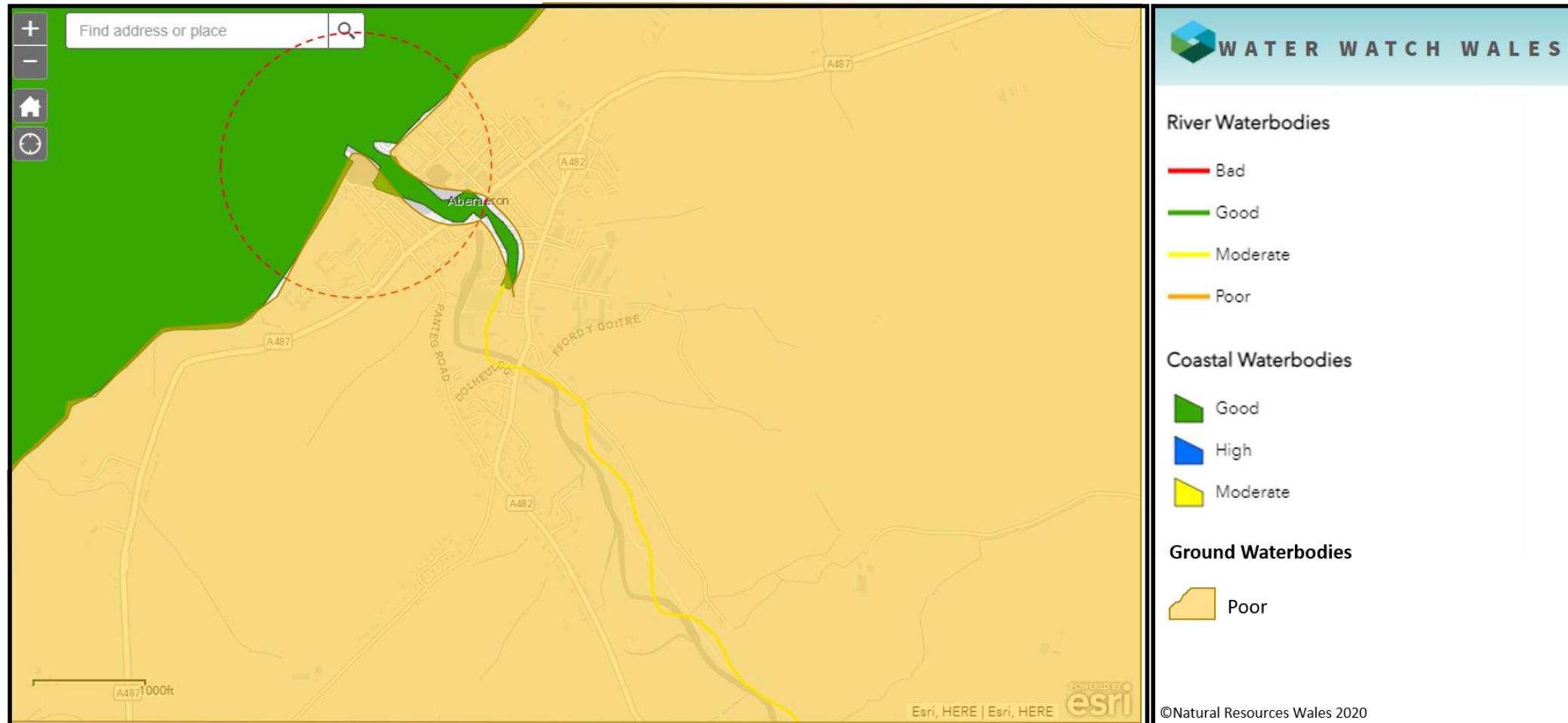


Figure 13-1 Surrounding Surface and Groundwater Bodies (NRW, 2020)

Water Quality

For the purposes of this ES, water quality is determined by temperature, salinity, dissolved oxygen (DO), nutrients and contaminants.

Water quality monitoring data is limited for Aberaeron Harbour as there are no designated Bathing Waters. However, the WFD water body status classification has classified Cardigan Bay Central as achieving 'Good' overall status with 'Good' ecological and 'Good' chemical status. Phytoplankton, macroalgae, DO and dissolved inorganic nitrogen (DIN) is described as 'High'. All assessed metals were classified as 'Good'. The temperature and pH of the water body has not yet been assessed.

The River Aeron's 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. There are local targeted measures to control diffuse pollution led by NRW. Additionally, on the 1st April 2021, The Control of Agriculture Pollution Regulations came into force to tackle rural diffuse pollution in relation to water quality. Under the WFD, temperature, pH, dissolved oxygen, and ammonia have been assessed as 'High'. Phosphate has been assessed as 'Good'. Most metals have not been assessed.

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 surrounding designated WFD surface water bodies is provided in Table 13-5 below.

Table 13-5 WFD Classifications for Surface Water Bodies Close to the Scheme

Name	Type	Hydromorphological designation	Waterbody ID	Area (km ²)	Protected Area Designation	Overall Status Cycle 1	Objective	Overall Status Cycle 2
Cardigan Bay Central	Coastal	High	GB651009 030000	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	GB110063 041450	12.15km ² (Length)	Not Designated	Moderate	Good by 2015	Moderate

Hydromorphology

To prevent duplication in the ES, details on coastal processes are contained in Chapter 12, with details on groundwater hydrology in Chapter 14.

Under the WFD classification for Cardigan Bay Central, morphology has been classified as 'High', whilst the hydrological regime has not yet been assessed. The River Aeron's hydrological regime for the river is assessed as 'High' and the morphology 'Supports Good'.

Ground investigation (GI) works were undertaken in the harbour and coastline as follows:

- 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.
- Quantum in 2021 (Quantum Geotechnical, 2021) - the extent of which included the harbour area.

Samples taken included those in the location of the proposed breakwater. Laboratory testing for Particle Size Distribution (PSD) was completed. The results determined that the South Beach material analysed was of a similar grade ranging between 40-100mm, classified as sand/gravel/cobble. Sediment at South Beach was determined to have a slighter rounded appearance due to the influence of the tide. Maintenance dredging of the harbour, which CCC recycles to replenish South Beach under an existing marine licence, has shown that the material is rounded over a short time, around 3-6 months. Hydromorphology is considered to have a high sensitivity given the linkages with ecology.

13.2.2 Water Quality Protected Areas

The following water quality protected areas are located near the Scheme.

Table 13-6 WFD Protected Areas and Sensitive Habitats

WFD Protected Areas	Location in relation to the Scheme
Bathing Waters	One bathing water approximately 10km north of the Scheme and three designated Bathing Waters south of the Scheme near New Quay. The closest of the three, is approximately 7km from the Scheme.
Drinking Water Protected Area	The closest Drinking Water Protected Area is over 17km east of the Scheme.
Shellfish Water Protected Area	The closest Shellfish Water Protected Area is located over 30 km north of the Scheme.

Aberaeron is not a designated bathing beach. The closest designated bathing waters are Llanrhystud in the north and three at New Quay in the south. The closest Bathing Water - Traeth Gwyn New Quay is approximately 7km away. All were classified as 'Excellent' or 'Sufficient' in 2017 (NRW, 2018).

Based on the most recent bathing water quality classifications, the sensitivity of these protected areas is considered to be 'high'.

The closest Shellfish Water Protected Area is over 30km and the closest Drinking Water Protected Area (DWPA) is approximately 20km from the Site. Due to the distance of these protected areas from the Site they are not being considered further in the assessment.

13.2.3 Groundwater

Additional information on groundwater conditions can also be found in Chapter 14.

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), which is located approximately 20km away. The 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.

The Teifi and Coastal Ceredigion groundwater body's overall status was classified as 'Poor' in 2018 with objectives to achieve 'Poor' overall status by 2027 (Natural Resources Wales, 2020), due to heavy concentrations of mining waters restricting improvements in this waterbody. The groundwater chemical status was assessed as 'Poor' whilst Quantitative status and Drinking Water protected status were both assessed as 'Good' (Natural Resources Wales, 2017). The RBMP determined specific sources that may impact on groundwaters reaching 'Good' status as discussed above. Figure 13-1 shows the location of the groundwater body in relation to the Scheme location.

Hydrogeology

Preliminary ground investigation (GI) works have taken place within the Scheme area. 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 by activities taking place in the intertidal area. Furthermore, as part of these GI works, soil, leachates, and ground water samples were taken and analysed. Results determined that the risk of contaminants present is low. Further details can be found in the WFD assessment in Appendix L.

Based on the data provided and the most recent water body classification of the Teifi and Coastal Ceredigion, the sensitivity of ground water receptors is deemed to be 'medium'.

Table 13-7 WFD Classifications for Groundwater Bodies Close to the Scheme

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

13.2.4 Data Gaps and Limitations

The baseline developed for the assessment has been supported and informed by several specific studies and surveys/technical investigations to provide a better understanding of the relevant conditions in the Scheme area. However, there are some identified information gaps in the baseline data as follows:

- No specific water quality monitoring data has been collected for Aberaeron Harbour, Cardigan Bay, or the River Aeron. However, this is not considered to be a limitation for the assessment; and
- Limitations associated with the numerical modelling work that has helped to inform this assessment are described in Chapter 12 Coastal Processes.

13.3 Likely Significant Effects

13.3.1 Construction

Surface Water

During construction, impacts on water quality could occur from pollution arising from general construction activities, disturbance of sediment and re-mobilisation contaminated sediment into the water column. These impacts could occur from the following activities:

- Movement of plant and machinery along South Beach.
- Construction of the breakwater – excavation, rock placement, deliveries of rock by boat and storage on the beach.
- Re-building of South Pier pier-head – piling.
- Removal and replacement of timber groynes on South Beach.
- Beach renourishment on South Beach.
- Installation of the flood gate at Pwll Cam within the harbour.
- New section of flood wall and wall raising along the north bank of the River Aeron between the footbridge and the A487 road bridge, which will involve work from within the river channel to access the wall.

Sediment Disturbance

The activities listed above could release sediment into the water affecting water quality through salinity and clarity. As part of the GI works (WYG, 2019) (Quantum Geotechnical, 2021) PSD testing 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 limit the turbidity when excavation is taking place due to the lack of fine sediments present.

To reduce turbidity, 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 need to take place under water. A geofabric mat will be positioned onto the seabed in the excavated footprint of the breakwater, which will help reduce the washout of bed material beneath the rocks both during construction and in the future. Construction vehicles will utilise the upper beach as much as possible, to avoid beach materials being washed out into the sea. The tipping of rock from the barge and rock stockpiling on the beach will take place as high up the intertidal zone as possible to reduce wash out of fines into the sea.

With these measures in place, any sediment released into the sea is likely to be in small quantities, which will dissipate within the water column. As a result of these measures the release of sediments into the sea is considered to be **minor adverse**.

There could also be a risk that disturbed sediments released into the water could contain contaminants, releasing them into the water. However, analysis for leachates which were tested as part of GI works taken along the foreshore and in the harbour, determined a low risk of contaminants present. Further details can be found in the WFD assessment in Appendix L. Therefore, it is unlikely that any additional contaminants will be mobilised during construction and the effect is assessed to be **negligible**.

Effects from Pollution Risk

Working in the marine environment could also generate risks of pollution incidents from chemical leaks and spills associated with the equipment being used for the works. With the exception of the breakwater, all works for the Scheme in intertidal areas will be carried out at low tide, reducing the risk of water pollution. Grouting works around the South Pier will include the use of additives in the mixture to reduce material falling into the water. For the flood gate work, a cofferdam will be in place and a geotextile mat used within the area of the cofferdam. Debris that has fallen onto the mat during the work will be collected and removed from site, along with the geofabric mat, before the cofferdam is removed and water allowed back into the Pwll Cam dock. For the flood wall walk in the River Aeron, a scaffold platform will be erected in the river channel with work on the wall taking place from the platform. A net will be placed under the scaffold to prevent materials falling into the water during the work.

Industry best practice measures to control pollution risks will be implemented by the contractor. This includes adherence to the Guidance on Pollution Prevention (GPPs) and the Construction Industry Research and Information Association (CIRIA) guidance on the control of water pollution from construction sites (as listed in Section 13.1.3). These detail good practice advice for undertaking works which may have the potential to cause water pollution. The Contractor will also be expected to produce a method statement detailing pollution prevention measures and timing of works, specifically in relation to working near water.

Potential pollution effects are expected to be minimal, highly localised and will occur within the context of an already highly dynamic coastal environment. This will result in a **negligible** magnitude of impact, and a **negligible** significance of effect.

Protected Areas (Bathing Waters)

The Scheme will not result in any discharges during construction that could affect bacterial loading and temporary welfare units in the site compound, which are located in a field away from the beach, will be self-contained. There will therefore be no impacts on these protected areas as a result of the Scheme. The impact is assessed to be **negligible** on these Protected Areas.

Groundwater

The construction work could impact on groundwater quality through pollution from chemical leaks and spills from machinery as well as risks of increased saline intrusion to the groundwater body during material excavation. 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 any existing saline intrusion from the Cardigan Bay Central coastal water body, which has a tidal limit up to approximately the A487 road bridge and therefore includes any construction works taking place along the River Aeron.

Pollution risks during construction will be managed by good construction planning and management practices as described in the section above on 'Effects from Pollution Risk'.

It is not anticipated that the construction works will have the capacity to alter the quality elements of the groundwater body. Any local changes 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. Consequently, this will result in no change to the ground water body, and a **negligible** effect.

WFD Classification (Surface and Groundwater Bodies)

The WFD Compliance Assessment (Atkins, 2021) (Appendix L) has considered the likely construction impacts of the Scheme against the quality elements of the Cardigan Bay Central and River Aeron waterbodies, as well as the Teifi and Coastal Ceredigion groundwater body. The Scheme will not result in deterioration to any water quality elements for these waterbodies as described in the sections above on surface water and groundwater. The Scheme is deemed to therefore have a **negligible** effect.

13.3.2 Operation

Surface Water

During operation, the Scheme could impact on morphological conditions from the presence of the new breakwater, which in turn could affect water quality.

Chapter 12 Coastal Processes details the changes in coastal processes that are expected to occur following construction, specifically in section 12.3.2. These changes have been determined from numerical modelling work carried out for the Scheme design, and which shows accretion is expected to occur at the end of the new breakwater, offshore of South Beach and within the harbour as a result of the breakwater capturing sediment being transported in a predominant north-east direction. There is also an area of accretion along North Beach but given that this location is in the lee of the breakwater, this is likely to be accretion that is occurring naturally as a result of the coast defence structures along North Beach.

Figures 12.4 and 12.5 show seabed levels before and after construction. The figures show that accretion is already occurring in these areas and that this pattern will continue following construction. Similarly, accretion occurs within the harbour and it is dredged on an annual basis to maintain a navigable depth. Fluvial flows were not included in the model and it is likely that some of this accretion will be mobilised and transported out to sea. The new breakwater is not expected to cause any significant erosion to the north, as the Aberaeron coastline already receives limited natural sediment supplies and the presence of the existing piers have interrupted sediment transport for many years. The Scheme is considered to have a low magnitude of impact on morphology due to the accretion that might occur and the impacts that this could then have on marine ecology, which is discussed in Chapter 9 Ecology.

Monitoring of bed levels will be carried out following construction, with maintenance dredging taking place to remove excess sediment build up. The harbour is already routinely dredged by CCC to maintain navigation and this pattern of management will continue following construction. Arising from existing harbour dredging operations are deposited on South Beach and this method would continue with post-construction maintenance dredging.

With mitigation measures in place, and due to the localised nature of the impacts, the proposed Scheme is considered to have a **negligible** effect on morphology.

The work on the harbour/river wall raising and installation of the new flood gate at Pwll Cam, could potentially lead to changes in loss of flood storage and potential for increased water levels upstream. Numerical modelling and assessment undertaken for the Flood Consequence Assessment, has shown no increase in water levels upstream. The Scheme will therefore have a **negligible** effect.

Water Quality

During operation, material washed into the sea from the beach nourishment could impact on turbidity, however this is considered unlikely as the sediment size will be similar to existing and will comprise sand/gravel/cobble sized material. Beach nourishment also takes place annually through recycling of dredged arisings from the harbour. The beach material has also been assessed to have a low risk of contaminants given the sediment size.

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.

Therefore, any potential changes during operation are expected to be low, highly localised and will occur within the context of an already highly dynamic coastal environment. This will result in a **negligible** effect.

Groundwater

Once the works are complete, no changes to groundwater quality elements are expected. Consequently, this will result in a **negligible** effect.

WFD Classification (Surface and Groundwater Bodies)

The WFD Compliance Assessment (Atkins, 2021) (Appendix L) has considered the likely operation impacts of the Scheme against the water quality elements of the Cardigan Bay Central and River Aeron waterbodies and the Teifi and Coastal Ceredigion groundwater body. The Scheme will not result in deterioration to any water quality elements of these waterbodies and is considered to have a **negligible** effect.

14 Soils and Ground Conditions

14.1 Method of Assessment

This chapter of the Environmental Statement comprises an assessment of the impacts on physical geology, soil resources, generation of waste soils, soil re-use and land contamination from the Scheme during construction and operational phases.

The Government's Good Practice Guide for Environmental Impact Assessment (EIA)¹⁹ (Department for Communities and Local Government, 2006) outlines the potential environmental effects that should be considered for ground conditions including:

- a. Physical effects of the development; e.g. changes in topography, soil compaction, soil erosion, ground stability, etc;
- b. Effects on geology as a valuable resource; e.g. mineral resource sterilisation, loss or damage to Local Geological Sites (formerly known as Regionally Important Geological Sites (RIGS)), geological Sites of Special Scientific Interest (SSSIs), etc;
- c. Effects on soil as a valuable resource; e.g. loss or damage to soil of good agricultural quality;
- d. Effects associated with ground contamination that may already exist on site; e.g. introducing/changing pathways and receptors;
- e. Effects associated with the potential for polluting substance used (during construction/operation) to cause new ground contamination issues on site; e.g. introducing/changing the source of contamination and/or pathways; and
- f. Effects associated with re-use of soils and generation of waste soils; e.g. re-use of site-sourced materials on- or off-site, disposal of site-sourced materials off-site, importation of materials to the site, etc.

This chapter assesses the physical effects of the Scheme (a); the effects on soil as a valuable resource (c); the potential for contamination to be introduced to the environment or mobilised from the works (d, e); and effects associated with the re-use of soils and generation of waste soils (f).

Effects on geology as a valuable resource (b) was scoped out at Scoping stage (Atkins Ltd, 2018), as the Scheme was classified as being unlikely to impact on any Local Geological Sites or mineral resources.

14.1.1 Realistic Worst Case

The details of the primary infrastructure are presented within the plans and drawings forming the application. However, the design of the Scheme may be subject to minor changes. Therefore, current plans and data have been used to inform the 'reasonably likely worst case' impact (the 'Rochdale Envelope' approach (The Planning Inspectorate, 2018)) in the assessment and sought to be mitigated.

For the assessment of effects associated with ground conditions and land contamination, the 'reasonably likely worst case' scenario has therefore been to assume:

- The design of the Scheme may change the existing ground level and slope as part of the sea defence structures (as shown in Drawing 5182114-ATK-MAR-GEN-DR-T-001 P02) may

¹⁹ It should be noted that this document has been withdrawn; however, it still constitutes good advice and should be referred to in the absence of alternative guidance documents

fluctuate. Thus, construction and operational activities and subsequent ground disturbance, could occur anywhere within the sea defence areas of the Scheme;

- Construction of the Scheme will likely take place with several features being constructed concurrently;
- Tracking of large material moving machinery will occur across beach and harbour;
- A site compound will be required during the construction phase, situated in the space by Ysgol Gynradd Aberaeron Primary School;
- There will be areas used for the storage of materials, waste and containers during the construction phase. Where storage / stockpiling of materials occurs, the material will stay within the Site; and
- Inherent mitigation will be included into the design of the Scheme as detailed in Section 13.7.

For the assessment of physical effects and effects on soil as a valuable resource, the 'realistic worst case' scenario is to assume that ground disturbance could be anywhere within the Site boundary.

Other, conservative assumptions are highlighted throughout this chapter, which ensure a robust approach to the assessment.

14.1.2 Relevant Planning Policy & Legislation

Legislative policy and guidance considered within this assessment is summarised in Table 14-1 below, this is in addition to the legislation already considered throughout this ES which is explained in detail in Chapter 4. The list is not intended to be exhaustive but includes the main documents relevant to the assessment of the potential physical geology, soil resources, soils re-use and land contamination impacts associated with the Scheme. The requirements of Planning Policy Wales and the Guiding Principles for Land Contamination (GPLC) have also been considered.

Table 14-1 Policy overview

Scale	Policy Document	Key Considerations for the Scheme
National	Part 2A (United Kingdom Parliament, 1990) of the Environmental Protection Act 1990 (United Kingdom Parliament, 1990)	The Environmental Protection Act (EPA) 1990 defines, within England, Wales and Scotland, the fundamental structure and authority for waste management and control of emissions into the environment. Part 2A of the EPA 1990 introduced a statutory regime for the identification and remediation of 'Contaminated Land'. It introduced, for the first time in the UK, a statutory definition of 'Contaminated Land' based on significant harm or the likelihood of significant harm or the pollution or likely pollution of controlled waters (all groundwater, inland waters and estuaries, excluding water perched above the zone of saturation). – Local authorities are the primary regulators under the Part 2A regime, with a duty to identify whether the land in their area is 'Contaminated Land', although provision is made for consultation and co-ordination with the Environment Agency in situations where pollution of controlled waters is an issue.
	Welsh Government Contaminated Land Statutory Guidance 2012 (Welsh Government, April 2012)	The principal objectives of the Contaminated Land Statutory Guidance are to: – Identify and remove unacceptable risks to human health and the environment; – Seek to ensure that contaminated land is made suitable for its current use; and – Ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable

Scale	Policy Document	Key Considerations for the Scheme
		and compatible with the principles of sustainable development. These three objectives underlie the 'suitable for use' approach to the assessment and remediation of 'land contamination'. This approach recognises that the risks presented by any given level of land contamination will vary greatly according to the use of the land and a wide range of other factors, such as the sensitivity of the underlying geology and the receptors which may be affected. The 'suitable for use' approach consists of three elements: – Ensuring that land is suitable for its current use; – Ensuring that land is made suitable for any new use; and Limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land.
	Land Contamination Risk Management Report (LCRM) (Environment Agency, Oct 2020) and the Guiding Principles for Land Contamination (GPLC) (Environment Agency, March 2010)	– Primary guidance for assessing and managing land contamination is presented in LCRM and GPLC. These documents provide a technical framework for the identification and remediation of contamination through the application of a risk management process.
	Environment Agency report R&D66 (2008) (National House Building Council and Environment Agency, 2008) and CIRIA C552 (2001) (CIRIA, 2001)	Report R&D66 provides guidance on the development and application of the consequence and probability matrix and guidance on conducting a risk assessment based on information from CIRIA C552. This consequence and probability matrix is used as part of the assessment of potential impacts and assessment of likely significant effects in Appendix N.
	TAN 6: Planning for Sustainable Rural Communities (2010)	This states that for planning applications, specific consultations with the Welsh Government in relation to BMV agricultural land. These are for non-agricultural development proposals that are not consistent with an adopted local plan and involve the loss of 20 hectares (ha) or more of BMV land.
	The Water Resources Act (WRA) 1991 (as amended) (United Kingdom Parliament, 1991 (as amended))	The WRA regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwaters. The WFD implements goals to improve water quality (surface water and groundwater) and drives sustainable use of water.
	Water Framework Directive (WFD) 2000 (European Parliament, 2000)	The WFD establishes a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. It requires: – Environmental objectives be set to ensure that good status of groundwater is achieved and that its deterioration

Scale	Policy Document	Key Considerations for the Scheme
		is avoided. This includes that any upward sustaining trend in the concentration of a pollutant must be identified and reversed; – A good status of groundwater requires early action and stable long-term planning of protective measures, owing to the natural time lag in its formation and renewal; and Monitoring programmes should cover monitoring of the chemical and quantitative status of groundwater.
	River Basin Management Plans (RBMP) 2009 (Natural Resources Wales, 2015)	The RBMP is designed to protect and improve the quality of the water environment. It includes consideration of the following topics: – Plans for the protection and improvement of the water environment; – Future plans that may affect the infrastructure sector and its obligations; – Development proposal considerations regarding the requirements of the RBMP; and Environmental permit applications.
	The Control of Substances Hazardous to Human Health Regulations 2002 (as amended) (COSHH Regulations) (United Kingdom Parliament, 2002 (as amended)) Construction (Design & Management) Regulations 2015 (CDM Regulations) (United Kingdom Parliament, 2015)	– The Contaminated Land regime, as implemented through Part 2A and planning, does not address the risks to construction or maintenance workers or other occupations which may have direct exposure to contaminated land. The risks to these human receptors are managed through health and safety legislation, such as the COSHH Regulations and the CDM Regulations which require the employer to carry out an assessment of the risks associated with exposure to hazardous substances and then to prevent those risks, and, if this is not reasonably practicable, to adequately control such exposures.
	Waste Framework Directive 2008 (European Parliament, 2008) and Waste Management Regulations 2016 (as amended) (UK Government, 2016)	The Waste Framework Directive 2008 establishes the legislative framework for the management, recovery and disposal of waste. It also provides a definition of waste as 'any substance or object which the holder discards or intends or is required to discard.' The Waste Framework Directive is transposed in England and Wales through the Waste Management (Amendment) Regulations 2016 which state that excavated material generated by the development of land may be subject to waste regulatory controls to ensure that waste does not harm human health or the environment. Where uncontaminated soils and other natural materials (for example, rock) are excavated during earthworks and it is proposed to re-use them in the construction of the Proposed Development, then these materials would fall outside the definition of waste and so outside the waste management regime.
	Landfill (England and Wales)	Soils that are surplus to requirements or need to be discarded (e.g. due to engineering properties or contamination) are

Scale	Policy Document	Key Considerations for the Scheme
	Regulations, 2005 (UK Government, 2002) and Hazardous Waste (England and Wales) Regulations 2005 (United Kingdom Parliament, 2005 (as amended))	strictly classified as waste and should be disposed of in accordance with waste duty of care requirements, including the Landfill Regulations, Hazardous Waste Regulations.
	The Environmental Permitting (England and Wales) Regulations 2016 (United Kingdom Parliament, 2016 (as amended))	Re-use of soils within the Proposed Development can be managed through either the Environmental Permitting Regulations 2016 or in accordance with the Contaminated Land: Applications in Real Environments (CL:AIRE) Code of Practice Definition of Waste: Code of Practice (CoP) (CL:AIRE, 2011). Under the CL:AIRE CoP, materials excavated within the Proposed Development are not deemed to be waste if it can be demonstrated that they are suitable for re-use within the Proposed Development, subject to appropriate assessments, preparation of Materials Management Plan and declaration by a Qualified Person.
	Building Regulations (2010) (United Kingdom Parliament, 2010)	Any construction work from the creation of a structure is subject to Building Control under the Building Regulations (2010). Requirement C1. (2) states '<i>reasonable precautions shall be taken to avoid danger to health and safety caused by contaminants on or in the ground covered, or to be covered by the building and any land associated with the building</i>'. Contamination in the ground has the potential to attack and weaken building materials. The following approach is prescribed to address ground contamination: – Ground investigation should be carried out to determine the extent and nature of any contamination; – Any ground covered by a building must be free from any material that might damage the building or affect its stability; – Reasonable precautions must be taken to avoid danger to health and safety caused by contaminants on or in the ground covered by a building or any land associated with that building; and Precautions must be taken against ground gases such as landfill gases, radon, vapours etc.
Regional/ Local	Ceredigion Local Development Plan (LDP1) - 2007 - 2022 (Adopted 2013) (Ceredigion County Council, 2021)	The Ceredigion Local Development Plan (LDP1) was adopted in 2013 and will be updated to LDP2 in 2022. The Local Development Plan sets out a long-term vision for how Ceredigion will respond to challenges and meet its growth needs over the period 2007 to 2022 including a long-term strategy for the delivery of new homes over the period and the designation of new areas of land for strategic urban extensions to meet housing shortages.

14.1.3 Other Guidance Documents

The following additional guidance documents relevant to physical geology, soil resources, soils re-use and land contamination have been considered when undertaking this chapter:

- The Design Manual for Roads and Bridges (2008) Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Highways England , August 2008);
- DMRB (1993) Volume 11, Section 3, Part 11 Geology and Soils (Highways England, June 1993);
- Department of the Environment (DoE) (1995) Industry Profiles for previously developed land, Environment Agency (Environment Agency, 1995);
- Construction Industry Research and Information Association (CIRIA) C552 (2001) Contaminated Land Risk Assessment – A Guide to Good Practice (Construction Industry Research and Information Association, 2001);
- CIRIA C665 (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007);
- British Standards (2015) BS 8485 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (British Standards, 2015);
- CIRIA C681 (2009) Unexploded Ordnance (UXO) – A Guide for the Construction Industry (CIRIA , 2009);
- CIRIA C733 (2014) Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks (CIRIA , 2014);
- CIRIA C682 (2009) The Volatile Organic Contaminants Handbook (CIRIA, 2009); and
- British Standards (2015) BS 5930 – Code of practice for ground investigations (British Standards , 2015);
- British Standards (2013) BS 10175 – Code of Practice for Investigation of Potentially Contaminated Sites (British Standards, 2013).

14.1.4 General Approach

The approach taken by the assessment follows the general principles outlined in the IEMA guidelines for EIA (Institute of Environmental Management and Assessment, 2005). The method complies with the requirements of the Government's Good Practice Guide for EIA (Department for Communities and Local Government, 2006).

Risk and impact assessments have been undertaken for the construction and operational phase of the Scheme. Environmental impacts are likely to be greatest during construction, with reduced impacts likely during operation due to the contamination and physical risks being mitigated through the detailed design.

The approach to the assessment comprises:

- Establishing the baseline conditions for the study area with respect to geology, soil and mineral resources, ground stability, hydrology, hydrogeology, contaminated land (including the potential for unexploded ordnance and ground gases) and historical uses. Supplemented in some areas by intrusive investigation;
- Identification of potential impacts on identified resources and receptors from the construction and operation of the Scheme;
- Assessment of the significance of likely effects from the Scheme; and
- Identification of any residual effects.

14.1.5 Data Sources

The following information sources have been used in establishing the baseline conditions within the study area, with information pertinent to this assessment included within this Chapter and supporting appendices:

- British Geological Survey (BGS) online mapping resource (British Geological Survey, 2021);
- UK Soil Observatory website (British Geological Survey, 2021);
- Agricultural and BMV Land Classification Maps (Natural England, 2010);
- Cadw Lle A Geo-Portal, Listed Buildings (Cadw, 2021);
- The Coal Authority website (British Geological Survey, 2021);
- Multi-Agency Geographic Information for the Countryside (MAGIC) website (Department for Environment, Food and Rural Affairs, 2021);
- Natural Resources Wales, Regionally important geological and geomorphological sites (Natural Resources Wales, 2021);
- Zetica UXO Pre-desk study assessment (ZeticaUXO, February 2020);
- Quantum Geotechnics Limited, Aberaeron Harbour Factual Report (Quantum Geotechnical, 2008); and
- Landmark Information Group, Aberaeron Envirocheck Report (Landmark Information Group, 2018).

14.1.6 Assessment Criteria

Physical Effects

An impact assessment of the potential physical effects of the Scheme on geology has been undertaken using a qualitative approach considering the effects on topography, soil compaction, soil erosion and ground stability from the construction works and operation of the Scheme.

This approach requires an understanding of the construction works required to complete the Scheme including, but not limited to, site clearance requirements, ground improvement proposals, earthworks including temporary stockpiles, cut/fill balance and proposed landscaping, foundation design for structures and construction methods. Details relating to the proposed construction and operation of the Scheme, including long-term management, are provided in Chapter 3.

The baseline information in relation to ground conditions of the study area has been reviewed and considered in the context of construction and operation of the Scheme and methods to determine if impacts are likely. These impacts have then been assessed using the value of the receptors and magnitude of impact to consider the significance of the effect as discussed further below.

Effects on Soil as a Valuable Resource

The Scheme is not situated on agricultural land and therefore this aspect will not be assessed further.

Land Contamination

The assessment of the potential impacts of the Scheme on land contamination, soils re-use and waste soils is undertaken over two stages including:

- Stage 1 – a land contamination risk assessment; and
- Stage 2 – a land contamination impact assessment.

Stage 1 Risk Assessment

The approach for the land contamination risk assessment is based on the guidance document LCRM (Environment Agency, Oct 2020). This document is considered as key guidance in the United Kingdom, and provides a technical framework for the application of a risk management process through the following steps:

- **Develop a Preliminary Conceptual Site Model (pCSM).** A desk study review has been undertaken of available documentary information to develop the pCSM, which describes the linkages between potential contamination hazards/sources, pathways and receptors relevant to the Scheme. Where all three are present or considered likely to be present, these are described as a potential contaminant linkage (PCL) which can then be subject to the risk assessments process.
- **Gather site specific information.** A previous ground investigation has been undertaken within the harbour and beach areas of the Scheme. The available information has been used to assess the potential for existing contamination.
- **Risk Assessment.** A generic quantitative risk assessment (GQRA) for human health and controlled waters has been carried out on existing data available at the time of writing and is presented within this chapter using the available desk-based and ground investigation information. The level of risk will be ascertained by the estimation of probability and consequence of the risk in accordance with C552 (CIRIA, 2001) and the Environment Agency Report R&D66 (National House Building Council and Environment Agency, 2008). Using the information from the GQRAs, the pCSM will be updated to include an estimation of the level of risk of each PCL identified during the baseline, construction, operation and decommissioning. Where risks are identified, consideration is given as to whether these would be appropriately mitigated through design and/or the development of a remediation strategy and its subsequent validation, as necessary. The residual risks will be determined and assessed based on estimation of likelihood and consequence.

A preliminary desk study contaminated land risk assessment has been undertaken as part of this chapter to develop a pCSM.

The risk assessment applies the principles given in the National House Building Council (NHBC) and Environment Agency report R&D66 (National House Building Council and Environment Agency, 2008) and CIRIA C552 (CIRIA, 2001) Contaminated Land Risk Assessment – A Guide to Good Practice which provide guidance on the development and application of the consequence and probability matrix (as presented in Table 14-2) for contaminated land risk assessment.

Table 14-2 Estimation of the level of risk by comparison of consequence and probability

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

The potential risk to a receptor is a function of the probability of, and the consequence of a PCL being realised. Probability (likelihood of an event occurring) takes into account both the presence of the hazard and the receptor and the integrity of the exposure pathway. Consequence takes into account both the potential severity of the hazard and the sensitivity of the receptor.

A pCSM has been produced based on the information available at the time of writing and considering the potential sources, pathways and receptors present during the baseline, construction and operational phases. The pCSM has been characterised using the above method and taking into account probability, consequence and levels of risk. This pCSM was then used to inform the baseline,

construction phase, and operational phase CSMs, which consider the current site conditions and predictions relating to the construction and operational phases.

In addition to the above, a value has been assigned to each of the contaminated land receptors with respect to its value and/or sensitivity. The definition of each of these is given in Table 14-3 below. The value of a receptor in terms of land contamination is considered when determining consequence of an effect in the risk assessment.

Table 14-3 Criteria for classifying the value and/or sensitivity of resources/ receptors

Value/ Sensitivity	Criteria	Examples
Severe	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor. Attribute has a very low capacity to accommodate the proposed change.	Principal aquifer providing potable water to a large population, within an inner or outer groundwater source protection zone (Source Protection Zone (SPZ) 1 or SPZ 2). WFD high status water body (surface water) providing potable water to a small population. Sensitive human receptors, e.g. young children. Buildings, including services and foundations but of high historic value or other sensitivity e.g. Statutory designations, schools, residential dwellings. Ecological statutory designations with high sensitivity e.g. SSSI, Local Nature Reserve (LNR), Special Protection Area (SPA), RAMSAR etc.
Medium	Attribute possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor. Attribute has a low capacity to accommodate the proposed change.	Principal aquifer beyond a SPZ, or secondary aquifer. Secondary aquifer providing abstraction water for agricultural or industrial use or Secondary aquifer without abstraction. WFD good status water body (surface water). Buildings, including services and foundations. Less sensitive human receptors, e.g. construction workers using personal protective equipment (PPE).
Mild / Minor	Attribute only possesses characteristics which are locally significant. Attribute has some tolerance to accommodate the proposed change.	Unproductive strata. WFD moderate - poor status (surface water). Infrastructure (roads, bridges, railways). Non-statutory designated sites of regional importance that are not highly sensitive to damage from change. No sensitive human receptors.

Stage 2 Impact Assessment

The land contamination impact assessment requires comparison of the baseline with the potential impacts that the Scheme will have during the construction phase and operation phase. This approach enables changes in the impact to receptors during the construction and operational phases to be identified, an assessment of the effect of the Scheme to be made and appropriate mitigation measures specified. The impact assessments have therefore been undertaken by comparing the baseline CSM with the construction phase CSM and operational phase CSM. The significance of identified effects for land contamination is then determined based on Table 14-4.

14.1.7 Assessing Effects and Defining Significance for Physical Effects, Land Contamination and Soils as a Valuable Resource

After developing an understanding of the baseline conditions, the significance of identified physical effects and land contamination on soil and ground conditions as a valuable resource is determined based on the methods described above. The classification of significance of effects is based on the criteria defined in Table 14-4.

Table 14-4 Classification of significance

Significance	Effect
Major adverse	Complete permanent change in topography which impacts the local community. Significant soil erosion, soil compaction or ground instability that is permanent in nature. An increase in contamination impacts from the existing baseline conditions of 4 or 5 risk levels in the risk matrix, e.g. land that has a very low contamination risk in the baseline becomes a high or very high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part 2A. The generation of significant volumes of soils classified as hazardous waste requiring off-site disposal to appropriate landfill.
Moderate adverse	Partial long term (> 10 years) change in topography which impacts the local community. Moderate soil erosion, soil compaction, or ground instability that is either permanent or long term in nature. An increase in contamination impacts from the existing baseline conditions of 2 or 3 risk levels in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate or high risk. Land that does not meet the statutory definition of Contaminated Land in the existing baseline becomes capable of being determined under Part 2A. The generation of a moderate volume of waste requiring off-site disposal.
Minor adverse	Limited medium term (5 to 10 years) change in topography which impacts the local community. Limited medium-term soil erosion, soil compaction, or ground instability. An increase in contamination impacts from the existing baseline conditions of 1 risk level in the risk matrix, e.g. land that has a low contamination risk in the baseline becomes a moderate/low risk. The generation of a minor amount of waste soils.
Negligible	No measurable impact on topography, soil erosion, soil compaction, or ground instability or impacts that are only temporary in nature (< 5 years). Negligible change in contamination impacts. No generation of waste soils as part of the development, materials are used sustainably.
Minor beneficial	Limited medium term (5 to 10 years) change in topography which has a positive impact on the local community. Limited medium-term reduction in existing soil erosion, soil compaction, or ground instability issues. A reduction in contamination impacts from the existing baseline conditions of 1 risk level in the risk matrix, e.g. land that has a moderate/low contamination risk in the baseline becomes a low risk. A minor amount of materials reuse as part of the development limiting the offsite disposal of waste soils.

Significance	Effect
Moderate beneficial	Partial long term (> 10 years) change in topography which has a positive impact on the local community. Moderate permanent or long term reduction in existing soil erosion, soil compaction, or ground instability issues. A reduction in contamination impacts from the existing baseline conditions of 2 or 3 risk levels in the risk matrix, e.g. land that has a high contamination risk in the baseline becomes a moderate/low or low risk. Land that meets the statutory definition of Contaminated Land in the existing baseline is no longer capable of being determined under Part 2A. A moderate amount of materials reuse as part of the development limiting the offsite disposal of waste soils.
Major beneficial	Complete permanent change in topography which has a positive impact on the local community. Significant permanent reduction in existing soil erosion, soil compaction or ground instability issues. A reduction in contamination impacts from the existing baseline conditions of 4 or 5 risk levels in the risk matrix, e.g. land that has a very high contamination risk in the baseline becomes a low or very low risk. Land that meets the statutory definition of Contaminated Land in the existing baseline is no longer capable of being determined under Part 2A. Sustainable use of material including recycling/reusing on site material. No offsite disposal of waste soils to landfill.

The effects of the Scheme identified are described as adverse/negative or beneficial/positive, major, moderate, minor or negligible, on the basis of the value of the receptor, area over which the effect may occur, whether the effect is direct or indirect, the duration of the effect (short or long term), and whether the effect is permanent or temporary.

Following the classification of an effect, a clear statement is made as to whether the effect is 'significant' or 'not significant'. As a general rule, major and moderate effects are significant and minor and negligible effects are not significant, in accordance with standard EIA practice. However, professional judgement is also applied to the circumstances of the effect, where appropriate.

14.1.8 Cumulative Developments

Potential inter-Scheme cumulative and synergistic impacts may occur from interaction with other developments near the Scheme. Two committed developments have been identified within the area surrounding the Site. One new residential build and one fishmongers roof conversion into a terrace, further information available at Ceredigion County Council's Planning Portal Webpage (Ceredigion County Council, 2021).

Developments which are within 500m of the Scheme and have the potential to impact the Scheme during construction works or during operation, have been included in the assessment. Developments which will be completed prior to the commencement of the Scheme have been included as potential receptors in the impact assessment.

14.1.9 Assessment Assumptions and Limitations

The following assumptions have been made for the assessment:

- As design will not be finalised for all elements of the Scheme until post consent, the likely 'reasonably likely worst case' impact has been assumed in the assessment and is sought to be mitigated as detailed in Section 14.1.1;
- Members of the public will have transient, if any, access to the study area during construction and operation of the Scheme;
- Construction best practice will be adhered to at all times during the works;

- This chapter does not address risks to construction or maintenance workers, as the assessment presented herein relates to the long-term (chronic) risk posed by contamination, not short-term exposure (acute risk) which is applicable to construction workers and which will be managed through the application of suitable health and safety assessments and working methods; and
- The assessments presented within this chapter provide some information which can be used by contractors for the development of the construction workers' risk assessments and method statements to mitigate potential risks.

The following limitations were encountered during the process of collating baseline information and undertaking the subsequent assessment:

- The scope of investigation environmental leachate and groundwater sampling was not comprehensive;
- Environmental statutory data ordinarily included in the site Envirocheck report was not available for review at this time; and
- The risk assessment and impact assessments have been carried out using third party reports and publicly available desk-based information, i.e. a qualitative assessment.

14.1.10 Study Area

To consider the physical effects and effects on soil as a valuable resource of the Scheme the study area is defined as the area within the red line boundary (herein referred to as 'the Site'). The study area for effects associated with ground contamination (including risks to human health, controlled waters, and property receptors) comprises the site and land immediately beyond it to a distance of 500 m.

14.2 Baseline Conditions

14.2.1 Description of Existing Environment

The following sections provide a summary of baseline conditions within the study area.

14.2.2 Topography

The topography of the site is varied, the village and harbour area is flat at approximately 5m above Ordnance Datum (m AOD). The topography slopes towards the north-west down from the beach parade to sea level.

14.2.3 Geology and Soils

Mapped Geology

Superficial deposits recorded on the site include:

- Alluvium (clay, silt, sand and gravel) beneath the harbour, river channel, the centre of the village to the north of the harbour and the South Pier area. The superficial deposits are mapped as comprising
- Marine Beach Deposits (sand and gravel) (British Geological Survey, 2021) on the beach areas of the site.

No superficial deposits are mapped in the area of the proposed site compound. Glacial till appears on the surface approximately 500m east of the site.

Bedrock underlying whole of the site is recorded as the Mynydd Bach formation which comprises sandstone and mudstone (British Geological Survey, 2021).

No BGS borehole logs were available within 500m of the site (British Geological Survey, 2021).

Ground Investigation Summary

Quantum 2008

An intrusive ground investigation was undertaken by Quantum (Quantum Geotechnical, 2008) in 2008, the extent of which covered the boundaries of the inner and outer harbours including the North and South Piers. The investigation within the site boundary comprised two trial pits, and 17 boreholes in the harbour area.

Trial pits were excavated to a maximum depth of 3 m below ground level (bgl) and backfilled upon completion. A combination of cable percussion and rotary boreholes were completed.

Made Ground was encountered in all boreholes located within the harbour area to a maximum depth of 8.8m bgl. No visual or olfactory evidence of contamination was recorded within the Made Ground or natural strata. The base of the superficial deposits (Alluvium or Glacial Till) was not proven; the maximum depth achieved was 20m bgl.

Environmental soil samples were tested from Made Ground of Trial Pit locations approximately 250m north-east of the site only. These were tested for potential contaminants including; heavy metals, boron (water soluble), chromium (hexavalent), total cyanide, free cyanide, Thiocyanate, total sulphate, sulphide, pH, total polycyclic aromatic hydrocarbons (PAH), phenols, elemental sulphur, total sulphur, and asbestos. No asbestos was detected from 10 samples taken between 0.20 and 2.30 m bgl. Zinc was the heavy metal of the highest concentration (380mg/kg) sampled from location NTP5. The maximum PAH concentration was 170mg/kg sampled from location NTP8, with the lowest below detection limit.

Soil samples were also collected for geotechnical purposes and tested for moisture content, Atterberg Limit testing and particle size distribution testing. One falling head permeability test was completed within borehole NBH14 (250m north-east of the site, northern corner of the caravan site) within the natural superficial deposits.

Groundwater monitoring, consisting of depth to water measurements only, was carried out on five borehole locations: NBH2R, NBH4R, NBH7R, NBH9R, and NBH11R.

WYG 2019

An intrusive ground investigation was undertaken by WYG (**WYG, 2019**) in 2019, the extent of which covered the northern edge of the harbour, South Pier and the entire length of the southern beach. The investigation comprised of nine boreholes, nine hand dug inspection pits and 17 machine excavated trial pits.

The boreholes were completed to a maximum depth of 20m bgl, hand dug trial pits were dug to a maximum depth of 1.20m bgl, and machine trial pits were excavated to a maximum depth of 2.40m bgl.

Made Ground was encountered to a maximum depth of 14.50 m bgl in BH10 located on the South Pier. Alluvium was encountered in eight locations (all in the harbour area) between 7.6 and 16.1m bgl. In five of these eight boreholes the base of the strata was not proven over 20mbgl. Glacial Till was encountered at 16m bgl in three locations (BH1, BH2, and BH3 at the seaward end of the harbour) underlying the Alluvium. No bedrock strata was proven. Trial pits along the beach all encountered Marine Beach Deposits to the base of the excavation (maximum depth 2.40m bgl).

The composition of the Made Ground across the site is predominantly reworked natural material of gravel and cobbles, Alluvium comprises silt, sand, gravel and occasional cobbles, and the Glacial Till is described as Glacial Till.

There were 21 soil samples collected and analysed, eight soil leachate samples and six groundwater samples were also tested by ALS (UKAS and MCERTS certified). No visual or olfactory evidence of contamination is evident within the site investigation locations.

Groundwater was recorded in three of the eight borehole locations with resting groundwater levels between 1.47m bgl (BH9, by the foot bridge screened at the interface between the Made Ground and the Alluvium) and 2.90m bgl (BH2, on the north harbour wall screened the same as BH9).

Quantum 2020

An intrusive ground investigation was undertaken by Quantum in 2021 (**Quantum Geotechnical, TBC, 2021**), the extent of which included the core harbour area. The investigation comprised seven boreholes, and ten machine excavated trial pits. The boreholes were completed to a maximum depth of 20.5m bgl, and the machine trial pits were excavated to a maximum depth of 3.3m bgl.

Made Ground was encountered to a maximum depth of 4m bgl in BH101 located on the outer wall of the inner harbour close to the foot bridge. Alluvium was encountered in all borehole locations (except BH103 at the end of North Pier) between 0.0 and 20.0m bgl. Glacial Till was encountered only in BH102 at the eastern end of South Pier between 9.5 and 20.5m bgl. Marine Beach Deposits were encountered in BH103 and BH105 at the western ends of North and South Pier between 1.0 and 20.0m bgl. No bedrock strata was proven. Trial pits all encountered alluvium throughout except in TP112 adjacent to North Pier, and TP113 adjacent to South Pier, between 2.3 and 3.30m bgl.

The composition of Made Ground is predominantly reworked natural material of sand and silt. The Alluvium comprises of silt, sand, gravel and cobbles throughout. The Glacial Till is characterised as gravel and clay. Finally, the Marine Beach Deposits are characterised as gravelly sand with cobbles.

Geo-environmental samples were collected and sent to ChemTest (UKAS and MCERTS certified) to be tested. Eight soil samples and four leachate samples were tested. No visual or olfactory evidence of contamination was detected during the site investigation.

Groundwater data is currently not available on the draft logs provided by Quantum.

Identified Geological Hazards

No faults are indicated to be present within 500m of the site (British Geological Survey, 2021).

The site is located within a radon affected area. However, no Radon protection measures are required because only between 1 and 3% of properties are above the action level (Public Health England, 2021).

Potential for Unexploded Ordnance

Reference to the Zetica Unexploded Ordnance (UXO) Risk Assessment Document (ZeticaUXO, February 2020) indicates a low risk of encountering UXO within the Scheme area and within a 500 m radius.

Important Geological Sites

No Local Geology Sites or geological SSSIs have been identified within 500 m of the site (Natural Resources Wales, 2021).

Mining / Mineral Resources.

Reference to the Coal Authority online records indicates that the site does not lie within an area affected by coal mining (British Geological Survey, 2021). The Scheme is in an area not marked for any mineral deposits, given the site constraints mineral extraction is unlikely to be viable.

Soils and Agricultural Land

BMV agricultural land is classified as land within ALC Grades 1, 2 and 3a, as Agricultural Land Classification of England and Wales: Revised criteria for grading the quality of agricultural land (MAFF, 1988)

According to the UK Soil Observatory webmap (British Geological Survey, 2021) the Site area is defined as either urban or sub-urban. The soils underlying the Site are indicated to comprise Stagnosols (slowly permeable seasonally wet acid loamy and clayey soils) throughout the harbour

and village area, and Cambisols (freely draining slightly acid loamy soils) in the southern site compound and beach defence development area (British Geological Survey, 2021). Reference to Agricultural Land Classification maps (Welsh Government, 2021) and Likelihood of BMV Maps (Natural England, 2017) indicates that the Site is classified as Urban with surrounding Grade 4 (severe agricultural limitations) land, therefore the site area is not classified as BMV land.

14.2.4 Hydrogeology

Groundwater Conditions

During the Quantum ground investigation in 2008 (Quantum Geotechnical, 2008) groundwater strikes were encountered during drilling within the Made Ground at depths of 3.0 to 4.3 m below ground level (bgl). Groundwater strikes were recorded in the superficial Alluvium (boulders, gravels, sands and clays) between 9 and 16 m bgl. Within the Gravel portions (variably at 6.0 to 16.2 m bgl) of the alluvium fast flow was recorded, within the clay strata (variably at 4.0 to 6.0 m bgl) slow flow was recorded.

Subsequent to the completion of the Quantum 2008 ground investigation groundwater monitoring of five wells was undertaken on eight different occasions between 28 March and 21 May 2008. During the monitoring of wells, groundwater was encountered between the depths of 2.07m (location NBH4R) and 7.09m bgl (location NBH7R) within the superficial Alluvium and Glacial Till strata. Groundwater are shown to vary due to tidal processes.

Aquifer Designations

The Alluvium beneath the majority of the site is designated as a Secondary A aquifer (British Geological Survey, 2021). The Glacial Till is designated as a secondary undifferentiated aquifer.

The Mynydd Bach Formation bedrock beneath the entire site area is designated as a Secondary A Aquifer.

Secondary A Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Groundwater Vulnerability

Reference to online maps (Natural Resources Wales, 2021) indicates that there are no groundwater Source Protection Zones (SPZ) within 500m of the site.

The Alluvium beneath the site is designated as a high vulnerability aquifer (British Geological Survey, 2021).

The Mynydd Bach Formation beneath the south of the harbour is designated as a medium vulnerability aquifer; the Mynydd Bach Formation across the remainder of the site is designated as a high vulnerability aquifer (British Geological Survey, 2021).

Licensed Groundwater Abstractions

No data is available regarding local licensed groundwater abstractions.

Discharge Consents to Groundwater

No data is available regarding local discharge consents to groundwater.

14.2.5 Hydrology

Hydrological and Drainage Information

The River Aeron flows through the centre of the proposed Scheme area. Engineered drainage covers the urban areas of the site (Department for Environment, Food and Rural Affairs, 2021).

At the very southern end of the Site by the southernmost groyne on the beach there runs a small un-named stream roughly 150m in length, passing to the south of the council offices and police station (90m south of site). An off-site un-named stream flows into the River Aeron around Cylch Aeron Road this stream is approximately 600 m in length and the confluence with the River Aeron is location 100 m off-site.

The River Aeron flows in an east to west direction, feeding the Irish Sea which is located adjacent to the western boundary of the Site.

Flood Risk

The site is not currently benefiting from flood defence systems according to Natural Resources Wales (NRW) (Natural Resources Wales, 2021). An area from the eastern boundary of the Site to 180 m upstream of the Aeron River is benefiting from current flood defences. The centre of Aberaeron around the harbour is known to have flooded in the past this is reflected in the NRW Geocortex Viewer (Natural Resources Wales, 2021) Development Advice Map which marks the flood risk category Zone C2 (at risk of flooding). The Flood Risk Assessment Wales Map (Natural Resources Wales, 2021) specifies that this area is at risk of high to low flood risk from the sea in the streets closes to the beach and the harbour.

Licensed Surface Water Abstractions

No data is available regarding local licensed surface water abstractions.

Discharge Consents to Surface Water

No data is available regarding local discharge consents to surface water.

14.2.6 Historical and Ecologically Important Sites

Every building fronting the harbour and the existing North and South Piers are Grade II listed (Cadw, 2021). The area of the proposed site compound has no listed buildings. There are no Grade I listed buildings within 500 m of the site.

There are no coastal ecological statutory designated sites located within 500 m of the Site. According to designations on the DEFRA MAGIC Maps site (Department for Environment, Food and Rural Affairs, 2021) wading birds and wildfowl are known to inhabit the area around the North Pier, their numbers peaking in Autumn.

14.2.7 Site History

A review of the historical land use of the site, and the surrounding area within 500 m of the Envirocheck Report (Landmark Information Group, 2018) boundary of the Site (current proposed boundary as shown in Drawing 5182114-ATK-MAR-GEN-DR-C-1000, has been undertaken to identify the nature and location of potentially contaminative activities.

Historical maps between 1889 and 2018 at 1:10,560 and 1:10,000 scales and between 1899 and 2000 at 1:2,500 scale are presented within the Landmark Envirocheck Report (Landmark Information Group, 2018) included in Appendix M. A summary of the key aspects of the site history is provided in Table 14-5.

Table 14-5 Summary of Historical Land Uses

Date	On Site	Off Site
1889	North and South Pier, inner and outer harbours and harbour front buildings already in existence. Proposed site compound and southern sea defence area appears to be grass land (perhaps for agriculture). Adjacent to the south of South Pier, two	The central part of the town (outside the site boundary) is similar to present day bounded roughly by Tabernacle and Victoria streets, with small fields to the North. (Approx. 80m northeast)

Date	On Site	Off Site
	Limekilns and a Saw Mill are present, 50m back from the low tide mark.	
1905	Breakwaters added to the beach north of Aberaeron harbour. A tank at the back of the Saw Mill is shown and its associated buildings appear to have been extended. The Limekiln is now named as an "Old Limekiln".	Breakwaters added to the beach further north of Aberaeron also. (Approx. 150m northeast)
1953	No significant changes shown.	No significant changes shown.
1963	No significant changes shown.	No significant changes shown.
1974	Breakwater added to the North Pier.	Town undergoing expansion with a school and town hall built on the grassland to the south of the harbour. (Approx. 130m south) New terraced housing, tennis courts, bowling green to the south-east of the site. Housing expanded to the north and fields converted into sports ground. (Approx. 160m northeast)
1977	Breakwaters added to the beach south of Aberaeron harbour.	No significant changes shown.
1989	U-shaped building of unknown use added to southern area of open fields.	No significant changes shown.
1992-1993	Inner harbour walls extended	Council office and police station located to the east of the southern beach. (Approx. 70m southeast)
1995	Footbridge added crossing the River Aeron at the inner harbour.	No significant changes shown.
2006	No significant changes shown.	Council offices further extended. (Approx. 70m southeast)
2018	No significant changes shown.	No significant changes shown.

14.2.8 Other Environmental Issues

Waste Management Sites / Landfill Sites

There are no current waste management sites or operational landfill sites located within 500m of the site (Natural Resources Wales, 2021).

There is one historical landfill located within 500m of the site (Natural Resources Wales, 2021). It covers the area to the north of the town centre, which is now used as a sports field, approximately 170 m from the closest part of the site. No historical landfill name or contents information is available.

Potentially Contaminative Current Land Uses

Potentially contaminative current land uses identified within 500m of the site are summarised in Table 14-6. These have been identified using the desk study information summarised above.

Table 14-6 Contemporary potentially land contaminative land uses

Process / Land use	Location	Contaminant Groups potentially present On-Site
Aberaeron Yacht Club	8 South Rd, Aberaeron SA46 0DP	Petroleum hydrocarbons, petrol additives, diesel and other organic compounds. Paints and varnishes.
High-Voltage Car charging station	Penmorfa, Aberaeron SA46 0BR	A range of inorganic and organic contaminants including metals, fuels / oils from electricity transformers.
Current Harbour use	Centre of the site	potential source of metals, organics, and inorganics including and hydrocarbons from leaks and spillages
Operational car parking	By harbour edges	potential source of coal tars from the tarmac construction and localised TPHs from leakages and spillages

14.2.9 Preliminary Conceptual Site Model

The pCSM identifies the potential or known source of contamination, receptors and the pathways between the two. Where all three are present, or are likely to be present (source – pathway – receptor linkage), they are called a PCL.

Three pCSMs (baseline, construction and operational) have been prepared for the Scheme using the baseline information summarised in the preceding sections. The PCLs have been identified for the current baseline and the construction and operational phases and a potential risk rating for each PCL has been assigned, through consideration of the potential consequence and likelihood of exposure occurring. The pCSMs and risk assessment are included in Appendix N.

A summary of potential contamination sources, pathways and receptors identified within the pCSM are provided in the following sections. On-site is considered to be within the red line boundary of the Scheme and off-site is considered to be within the study area (500 m buffer).

Potential Contamination Sources

Potential sources of contamination within the Scheme area have been identified from the current and historical land use summarised in the baseline. A summary is provided in Table 14-7.

Table 14-7 Potential Sources of Contamination

	Potential source of contamination	Potential contaminants
On-site	Yacht club	Petroleum hydrocarbons, petrol additives, diesel and other organic compounds. Paints and varnishes.
	High voltage car charging station	A range of inorganic and organic contaminants including metals, fuels / oils from electricity transformers.
	On site Made Ground	Material of unknown provenance used for the construction of the harbour, piers and breakwaters which may include metals, inorganics, total petroleum hydrocarbons (TPHs), polycyclic aromatic hydrocarbons (PAHs), asbestos and ground gas.
	Historic harbour use	Potentially contaminated Made Ground / natural strata or sediment from the historical operation of the harbour which included the exportation of lead ore and ship building / maintenance. Possible contaminants may include metals, tributyltin, inorganics, total petroleum hydrocarbons (TPHs),

	Potential source of contamination	Potential contaminants
		volatile and semi-volatile organic compounds (VOCs and SVOCs), and polycyclic aromatic hydrocarbons (PAHs)
	Current harbour use	Potential source of metals, organics, and inorganics including and hydrocarbons from leaks and spillages
	Operational car parking	Potential source of coal tars from the tarmac construction and localised TPHs from leakages and spillages
	Former lime kilns	Potential source of alkalinity in soils and PAHs associated with the process
	Former saw mill and tank	Contaminants from the process may include metals, total petroleum hydrocarbons (TPHs), polycyclic aromatic hydrocarbons (PAHs) and wood treating agents (creosote, solvents)
Off-site	Made Ground associated with Historic Landfill	Potential source of a leachable organic and inorganic contaminants and ground gas.

Potential Contamination Receptors

A summary of the receptors relevant to the current and future land use of the construction and operation of the Scheme are summarised in Table 14-8.

Table 14-8 Potential receptors to contamination

Receptor Group	Baseline	Construction	Operation
Human health (on-site)			
Members of the public walking the beach and the harbour side (proposed development area)	Present	Not Present	Present
Occupants of existing residential properties and visitors to those properties	Present	Present	Present
Human health (off-site)			
Members of the public accessing the surrounding area	Present	Present	Present
Occupants of nearby residential, commercial properties and visitors	Present	Present	Present
Controlled waters: groundwater (on site and off site)			
Groundwater in Secondary A Aquifers (superficial and bedrock)	Present	Present	Present
Controlled waters: surface waters (on site)			
River Aeron	Present	Present	Present
Un-named stream at southern end of sea defences	Present	Present	Present
Irish Sea	Present	Present	Present
Controlled waters: surface waters (off site)			
Un-named tributary of the River Aeron	Present	Present	Present
Property and services (on site)			
Proposed sea defence infrastructure	Not present	Not present	Present

Existing on-site infrastructure	Present	Present	Present
Property and services (off site)			
Existing residential and commercial properties	Present	Present	Present

Appraisal of risks from acute exposure to construction or maintenance workers will be assessed through Contractor risk assessments and method statements, and these receptors are therefore not considered further within this assessment.

Potential Exposure Pathways

Potential exposure pathways between the sources of contamination and receptors identified above are outlined in Table 14-9.

Table 14-9 Potential exposure pathways

Receptor	Potential exposure pathway
Human Health Receptors (on and off site)	– Dermal contact with and / or ingestion of contaminants in soils, soil-derived dusts and water; – Inhalation of soil derived dust, and fibres; – Dermal contact with and/or ingestion of contaminants in windblown soil-derived dusts and water that may have migrated off site; and – Inhalation of windblown soil derived dust, and fibres which may have migrated off site.
Controlled Waters Receptors: Groundwater	– Leaching / migration of contaminants in soil to groundwater in underlying aquifers; and – Migration of contaminated water through preferential pathways such as underground services, pipes and granular material to groundwater in underlying aquifers.
Controlled Waters Receptors: Surface waters	– Lateral migration of contaminated groundwater with discharge to surface watercourses as base flow; and – Discharge of contaminants entrained in groundwater and/or surface water run-off followed by overland flow to surface water.
Property Receptors: buildings and services (on Site and off Site)	– Direct contact of contaminants in soil and/or groundwater with existing and proposed structures and buried services; and – Migration of contaminated groundwater, ground gas and/or vapours along strata and preferential pathways such as service routes or differentially permeable strata.

14.3 Likely Significant Effects

The following section presents an assessment of the potential impacts of the construction and operation of the Scheme associated with physical geology, land contamination, soils reuse and waste soils.

It identifies likely significant effects that are predicted to occur and presents a summary of the mitigation and / or monitoring measures that are proposed to minimise adverse significant effects where necessary. Further details are provided in the following sections and mitigation measures are provided within Section 14.3.3.

14.3.1 Construction

Physical Effects

A qualitative approach has been undertaken to assess the likely effects of the Scheme on soil compaction, soil erosion and ground stability. The effects have then been categorised in accordance with the methodology outlined in the sections above and confirmed as either temporary or permanent, adverse or beneficial and significant (moderate or major impacts) or not significant (minor or negligible).

The Scheme may cause physical effects associated with beach excavation for construction of sea defence foundation, bulk earthworks to construct sea defences, temporary stockpiling of materials and tracking of large vehicles across the beach. These are discussed in more detail below.

Soil Erosion

There is likely to be increased temporary beach erosion due to changes in sea defence morphology and tracking of heavy plant across the beach, possible watercourse management, general earthworks, and temporary stockpiling. There is also the potential for increased turbidity during earthworks carrying a high sediment load to affect surface water receptors. However, the mitigation measures proposed as part of the Scheme design and during the construction works will reduce potential impacts from soil erosion. Areas required for temporary works will also be reinstated. Consequently, the effect on soil erosion is considered to be temporary, short term and direct. The value / sensitivity of the receptor is classed as low in accordance with Table 14-2 and the magnitude of the impact is considered to be negligible in accordance with Table 14-3. The overall effect is therefore considered to be negligible and classed as not significant.

Soil Compaction / Ground Stability

Ground subsidence, shrinking and swelling hazards and compressible ground hazard are designated as moderate within the Scheme area. Running sand hazards are designated as low risk within the Scheme and landslides and collapsible rock hazards are designated as low. The Scheme is not located within an area affected by coal mining. Any excavated soils which are re-used within the Scheme will require appropriate geotechnical placement and will also have a potential effect on ground stability.

Further assessment of the ground conditions and incorporation of mitigation/remedial measures will be undertaken as part of the detailed design to reduce impacts from ground instability, compaction and settlement. If and where required, the Scheme will incorporate ground stabilisation/improvement, which will reduce ground hazards and permanently improve ground stability and compaction. Therefore, the effect on ground stability and ground compaction is considered to be permanent, long term, beneficial and indirect. The value / sensitivity of the receptor is classed as low in accordance with Table 14-2 and the magnitude of the impact is considered to be negligible in accordance with Table 14-3. The overall effect is therefore considered to be negligible and classed as not significant.

Topography

The Scheme is likely to have an effect on the existing beach area of the site topography, as the construction works will involve earthworks and stockpiling of material into sea defensive structures. The effects on topography are therefore considered to be permanent, long term and direct. The value / sensitivity of the receptor is classed as moderate in accordance with Table 14-2 and the magnitude of the impact is considered to be medium in accordance with Table 14-3. The overall effect is therefore considered to be moderate beneficial.

As outlined above, with inherent mitigation, impacts in relation to physical effects are assessed to be moderate beneficial.

Effects on Soil as a Valuable Resource

Agricultural land use is not present on site and therefore the effect of the Scheme on soil as a valuable resource will be negligible.

Effects associated with Land Contamination, Waste Soils and Soil Re-use

Land Contamination

The construction impact assessment is undertaken by comparing the baseline land contamination risks to those predicted during construction, while considering any new sources and pollution pathways introduced by construction activities.

It should be noted that, given the information known at the time of writing, professional judgement has sometimes been applied to adjust the significance of the effect where the introduction or removal of a receptor has automatically triggered a minor adverse or minor beneficial effect.

No visual or olfactory evidence of contamination was discovered during the Quantum 2008, WYG 2019, and Quantum 2021 ground investigations. The Scheme may potentially expose unexpected sources of contamination during excavations in the beach sediments. Construction activities may introduce new pathways for migration of unknown contamination sources such as excavation and exposure of contaminated soil, remobilisation of contaminants through soil disturbance and the creation of preferential pathways for surface water flow pathways. Potential changes to the baseline situation creating PCLs, which have been assessed within this chapter are:

- Potential for mobilising contaminants by excavation and relocating of beach material, increasing the risk to controlled water receptors through leaching and run-off. Earthworks could provide opportunities for run-off to contain suspended solids if not managed properly; and,
- Potential for exposure of human receptors by generation of potentially contaminated dust and vapours released by the construction works;

Risks identified during the construction phase for human health, controlled waters and property receptors are assessed as very low to low. Compared to the existing baseline, the level of risk to receptors has remained generally the same due to the mitigation measures for the prevention of impacts from contamination. The impacts on land contamination are therefore considered to be permanent, long term and direct. An overall negligible effect has been predicted, which is classed as not significant.

The assessment of land contamination effects during the construction phase is summarised in Table 14-10 below:

Table 14-10 Land contamination construction phase effects for the Scheme

Receptor	Value/ Sensitivity	Baseline risk	Construction risk	Effect
Human Health	High	Very low	Very low	Negligible
Controlled waters (groundwater)	Medium	Low	Low	Negligible
Controlled waters (surface water)	Medium	Low	Low	Negligible
Property (existing and future structures and services)	Medium	Very low	Very Low	Negligible

Waste Soils and Soil Re-use

Waste soils will be generated during construction through excavations and during installation of sea defences. There is the potential that waste soil generated from the earthworks, ground stabilisation and foundation construction may be classified as unsuitable for reuse on site or hazardous, requiring removal from the site. Materials will be managed as part of the proposed inherent mitigation for the construction works through a Materials Management Plan (MMP) in accordance with the CL:AIRE Definition of Waste: Code of Practice (DoWCoP) (CL:AIRE, 2011), to allow the re-use of suitable soils during the construction of the Scheme. The design will seek, as far as reasonably practicable, to reuse and recycle materials on site, to reduce the amount of materials of a hazardous nature where

viable and to manage materials suitably including off-site disposal of waste (if required) in accordance with relevant legislation. Therefore, the impacts on waste soils and soil re-use are considered to be temporary, short term and direct and are assessed to be minor adverse and classed as not significant.

14.3.2 Operation

Physical Effects

Impacts in relation to physical effects are considered to be related to the construction phase. During operation, there will be limited impacts of soil erosion, ground stability and soil compaction. Suitable design and subsequent construction works will also minimise physical effects and the Scheme will be operated in accordance with the relevant regulations and Best Practicable Measures (BPM).

Therefore, impacts in relation to physical effects are assessed as negligible and are classed as not significant.

Effects on Soil as a Valuable Resource

Not considered due to no agricultural soils being present.

Effects associated with Ground Contamination, Waste Soils and Soil Re-use

Land Contamination

The operation impact assessment is undertaken by comparing the baseline land contamination risks to those predicted during operation, while considering any new sources and pollution pathways introduced by operational activities.

The operation of the Scheme is not expected to introduce new sources of contamination. Large sea defence structures will be present during operation that were not present at baseline. However, all parts of the Scheme will be operated in accordance with the relevant regulations, best practice guidance and pollution prevention.

The impact assessment has identified that risks associated with human, controlled waters and property receptors during operation are assessed as very low. Compared to the existing baseline, the level of risk to receptors has remained generally the same. An overall negligible effect has been predicted and this is considered to be not significant.

The assessment of land contamination effects during the operational phase is summarised in Table 14-11.

Table 14-11 Land contamination operational phase effects for the Scheme

Receptor	Value/ Sensitivity	Baseline risk	Operation risk	Effect
Human Health	High	Very low	Very low	Negligible
Controlled waters (groundwater)	Medium	Low	Low	Negligible
Controlled waters (surface water)	Medium	Low	Low	Negligible
Property (existing and future structures and services)	Medium	Very low	Very Low	Negligible

Waste Soils and Soil Re-use

The Scheme is not expected to generate any waste materials during operation. The Scheme will be operated in accordance with the relevant regulations, best practice guidance and pollution prevention.

Therefore, the impacts on waste soils are assessed to be, long term and indirect and are assessed to be negligible and classed as not significant.

14.3.3 Mitigation Measures

The above comments are based on our assumption that gross contamination is not present at this location. If, during development, gross contamination is found to be present at the site, consultation with NRW will be carried out.

As outlined above, the following mitigation measures will be incorporated into the design, construction and operation of the Scheme to reduce impacts of physical effects, impacts associated with land contamination, soil waste and soil re-use.

14.3.4 Construction

Mitigation measures to be incorporated into the construction process, as set out in the CEMP, will include (but not be limited to):

- Minimising the area and duration of soil exposure and timely reinstatement of vegetation or hardstanding to prevent soil erosion and reduce temporary effects on topography and soil compaction;
- Stockpile management (such as water spraying, hydro-seeding and avoiding over stockpiling to reduce compaction of soil and loss of integrity) to reduce soil erosion, windblown dust and surface water run-off;
- Undertaking health and safety risk assessments, method statements and appropriate PPE for the protection of construction workers in accordance with the COSHH Regulations (United Kingdom Parliament, 2002 (as amended));
- Implementation of appropriate dust suppression measures to prevent migration of potentially contaminated dust;
- Implementation of working methods during earthworks, and ground stabilisation works to manage appropriately groundwater and surface water and ensure that there is no uncontrolled run-off from the works, any material / waste stockpiles, and storage containers into adjacent surface watercourses;
- Implementation of appropriate pollution incident control e.g. plant drip trays and spill kits;
- Implementation of appropriate and safe storage of fuel, oils and equipment during construction;
- Implementation of an appropriate MMP in accordance with the CL:AIRE DoWCoP (CL:AIRE, 2011) to document how excavated materials will be managed. The management plan will include on-site testing and assessment of materials, a verification plan and methodology to identify what, if any, remedial actions will be undertaken and how such actions will be validated and recorded if unexpected contamination is encountered during the works and a verification plan to record the placement of materials;
- Implementation of a site waste management plan (SWMP) to detail the appropriate destination for waste, if required;
- Where waste soil is generated, it will be dealt with in line with the Government's waste hierarchy which is a guide to sustainable waste and material resource management and in accordance with CL:AIRE DoWCoP;
- Remediation of soil/groundwater contamination (e.g. source removal, treatment or capping) will be undertaken if unexpected contamination is encountered and further investigation and risk assessments deem necessary;

- Further quantitative risk assessment and the incorporation of mitigation/remedial measures in the design to reduce impacts from ground instability, soil compaction/settlement and contamination as required; and
- Ground stabilisation, if further assessment confirms it is required, to manage potential physical effects of the proposals and ensure appropriate bearing capacity.

14.3.5 Operation

It is assumed for the purposes of this assessment that those mitigation measures identified for the construction will be undertaken and will improve the condition of the Scheme (for contamination and physical effects) and will mitigate the risks during operation.

It is assumed that the Scheme will be operated in accordance with the relevant regulations, best practice guidance and pollution prevention (CIRIA, 2014) (Environment Agency, 2017).

14.3.6 Residual Effects

Construction

Residual effects relate to those impacts which remain following the implementation of inherent mitigation measures. Negligible effects are mainly anticipated during construction. These effects are assessed as not significant.

Consequently, allowing for the proposed mitigation measures, there are anticipated to be no residual adverse impacts.

A summary of residual effects following mitigation for construction is provided Table 20-1.

Operation

Negligible effects are mainly anticipated during the operation with implementation of the proposed mitigation measures. These effects are assessed as not significant.

Consequently, allowing for the proposed mitigation measures, there are anticipated to be no residual adverse impacts.

A summary of residual effects following mitigation for construction is provided in Table 20-2.

14.3.7 Cumulative Effects

Potential cumulative impacts may occur from interaction with other proposed (committed) developments located near the Scheme.

Cumulative effects in relation to ground conditions could occur through:

- An increase in the amount of dust generated through a larger construction area, affecting human health receptors;
- An increase in the mobilisation of contaminants in the air, ground and groundwater through the disturbance of a larger area of potentially contaminated ground mobilising contaminants; and
- Destabilisation of ground in close proximity to adjacent developments.

Two committed developments have been identified within 500m of the Scheme (Ceredigion County Council, 2021). Developments over 500m from the site are considered unlikely to have cumulative impacts in relation to ground conditions and have been screened out of the assessment. Further details of the committed developments which may cause potential cumulative impacts are summarised in Table 14-12.

Table 14-12 Summary of Committed Developments

Development	Application Reference	Development Description	Location
Building Alteration	A210065	New roof deck	The Hive Cadwgan Place, Aberaeron
Building Alteration	A200805 and amendment A210048	Extension and alteration to existing hotel.	Monachty Hotel, Aberaeron

14.3.8 Construction

The construction of these developments is likely to be concurrent with the construction of the Scheme. However, due to the small scale, and unintrusive/ superficial nature of these developments they are not expected to cause significant cumulative impacts. The developments will be subject to planning regulation and will require mitigation and control measures to be adopted during the construction through CEMPs to reduce impacts to the environment including dust generation and potential mobilisation of contaminants. The detailed design will also take into consideration any impacts associated with destabilising the ground due to construction activities close to the Scheme. Therefore, it is considered that there would be no significant adverse cumulative effects during the construction phase.

14.3.9 Operation

The committed developments include residential houses, and commercial property extensions and these are yet to be completed so will therefore be potential receptors for the operation of the Scheme. Receptors are unlikely to be affected during the operation of the Scheme. The Scheme will be operated in accordance with granted consents and the relevant regulations and best practice guidance. No physical cumulative impacts are considered likely during operation. Therefore, it is considered that there would be no significant adverse cumulative effects during operation.

15 Traffic and Transport

15.1 Method of Assessment

This assessment comprises a high level quantitative and qualitative assessment using Automatic Traffic Count (ATC) survey data obtained in April 2019, to establish baseline traffic flows for the purpose of this Scheme. The ATC data was collected over a three week period between the 3rd April 2019 and 23rd April 2019 at five locations, which are described in section 15.2.1 below. A Transport Assessment has not been produced and was not identified as a requirement in the scoping opinion response.

The following guidance documents have also been used throughout this assessment:

- Technical Advice Note (TAN) 18: Transport (Welsh Government, 2013)
- IEMA Guidelines for the Environmental Assessment of Road Traffic (IEMA, 2018)

The following assumptions have been made throughout this assessment:

- Bulk material deliveries to site:
 - For materials arriving by road, the majority of materials will be delivered in the first instance to the proposed site compound e.g. rock, timber.
 - Materials are delivered by 20 tonne lorries.

- Site operational hours and deliveries will be between 0700 and 1900 Monday to Sunday.
- The same route to / from the delivery site is used (i.e. not a circular route) along the A487. It is assumed that 50% of deliveries will travel from/to the Aberystwyth direction and 50% from/to the Cardigan direction.
- An equal number of HGVs will be generated per working day over the delivery period.
- An equal number of HGVs will be generated per hour throughout the working day.
- Delivery of materials takes place over the whole 12 month construction period (including site closure and removal of waste materials e.g. old timber groynes).
- Employee traffic assumptions:
 - Approximately 30 employees will be required on site each day throughout the construction period.
 - Arrival and departure takes place at peak am and pm traffic periods.
 - An even split between the use of cars and minibus / vans by employees to get to / from the site.
 - 50% will travel to / from the Aberystwyth direction and 50% from the Cardigan direction.
- Plant movement during construction:
 - South Beach, South Pier and the breakwater works - materials are transferred between the proposed site compound and these sites via South Beach. There will also be some materials transported from the site compound to Beach Parade via Wellington Street.
 - Quay Parade and Pwll Cam works - materials are transferred between the proposed site compound via the A487 and Market Street by smaller 'dumper' type trucks of approximately six tonnes.
 - Site operations will occur during Monday to Sunday between 7am and 7pm
 - An equal number of Operational Construction Vehicles (OCVs) will be generated per working day over the delivery period
 - An equal number of OCVs will be generated per hour throughout the working day

15.1.1 Assessment Criteria

The approach to determining the significance of effects is in accordance with the standard guidance for preparing EIAs contained within the IEMA guidelines described in section 15.1. The significance of the effect reflects the combination of the sensitivity (or importance) of the receptors affected and magnitude (or scale) of the change on the receptors.

The sensitivity of the receptors affected has been evaluated based on the proximity and size of residential populations and other relevant sensitive receptors to each road. Although the IEMA Guidelines do not provide specific criteria for evaluating sensitivity, for the purposes of this assessment, categories of receptor sensitivity have been defined from the principles set out in the IEMA guidelines, as summarised in Table 15.1.

Table 15-1 Sensitivity of Traffic Receptors

Sensitivity	Receptors

Low	Public open space Churches Residential areas with adequate footways
Medium	Hospitals, surgeries and clinics Parks and recreation areas Shopping areas and community centres Roads used by pedestrians with narrow footways Congested junctions
High	Educational institutions Retirement / care homes Roads used by pedestrians with no footways Road safety “black spots”

The magnitude of the impacts has also been assessed in line with IEMA guidelines, with the magnitude of traffic impacts a function of baseline traffic flows against the percentage increase due to the proposed Scheme, both during and after construction. The IEMA Guidelines identify thresholds for impact magnitude based on percentage change in traffic levels. The magnitude of impacts arising from the increase in traffic volumes is categorised as follows:

- High: above 90% increase in traffic levels
- Medium: between 60% and 90% increase in traffic levels
- Low: between 30% and 60% increase in traffic levels
- Negligible: under 30% increase in traffic levels

For pedestrians and cyclists, the magnitude of impact is based on the change in total vehicle movements or HGV flows with an increase greater than 30% reflecting an impact. Given that a Transport Assessment has not been prepared as part of this ES, only a high-level quantitative and qualitative assessment has been undertaken of changes in traffic flows.

In order to determine the significance of the effect, the interaction of the sensitivity of the receptor and the magnitude of the impact is taken into account as summarised in Table 15.2 below. Where an effect is described as ‘negligible’ this means that the level of any effect is so small as to be of no significance. ‘Moderate’ and ‘major’ effects are considered to be significant in terms of EIA guidance and apply to both beneficial and adverse effects. Where significant impacts have been identified, mitigation measures have been proposed where possible.

Table 15-2 Significance of Effect

Receptor Sensitivity	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
High	Neutral	Minor	Moderate	Major	Major
Medium	Neutral	Minor	Minor	Moderate	Major
Low	Neutral	Minor	Minor	Minor	Moderate
Negligible	Neutral	Neutral	Neutral	Neutral	Neutral

15.2 Baseline Conditions

15.2.1 Description of Existing Environment

Key Characteristics

Aberaeron is located on the A487, which is the main strategic route in this area of West Wales, linking Cardigan in the south with Aberystwyth in the north (see Figure 1-1). The A487 runs through Aberaeron town centre, crossing over the River Aeron via a road bridge. In the north of the town, there is a junction with the A482, close to Aberaeron Hospital, connecting Aberaeron with Lampeter to the south-east. Access to the harbour and seafront of Aberaeron is either via Regent Street and Market Street to the North Beach carpark or via Market Street to the Harbour carpark. Market Street is the main high street through Aberaeron, with shops and cafes lining both sides. South Beach is accessed via Wellington Street.

The road of Quay Parade which runs along the northern side of the harbour, is where some of the flood wall works will take place. Quay Parade is a narrow residential road, which terminates at the entrance to North Pier by the Harbourmaster Hotel. The road then bends round to the north along a narrow single lane route bordered by residential property walls, with no pavement separating the road from the edge of the buildings. Waterloo Street also exits off of Quay Parade, before the Harbourmaster Hotel, again a narrow single lane road, before widening as it travels further inland. The Harbourmaster Hotel has a private car park for guests to the rear of the building. Due to the 'termination' of the road at North Pier, vehicles use an area by the pier near the public toilets as a turning circle, or they exit via the narrow part of Quay Parade next to the Harbourmaster Hotel and then on to Ship Street and then Tabernacle Street.

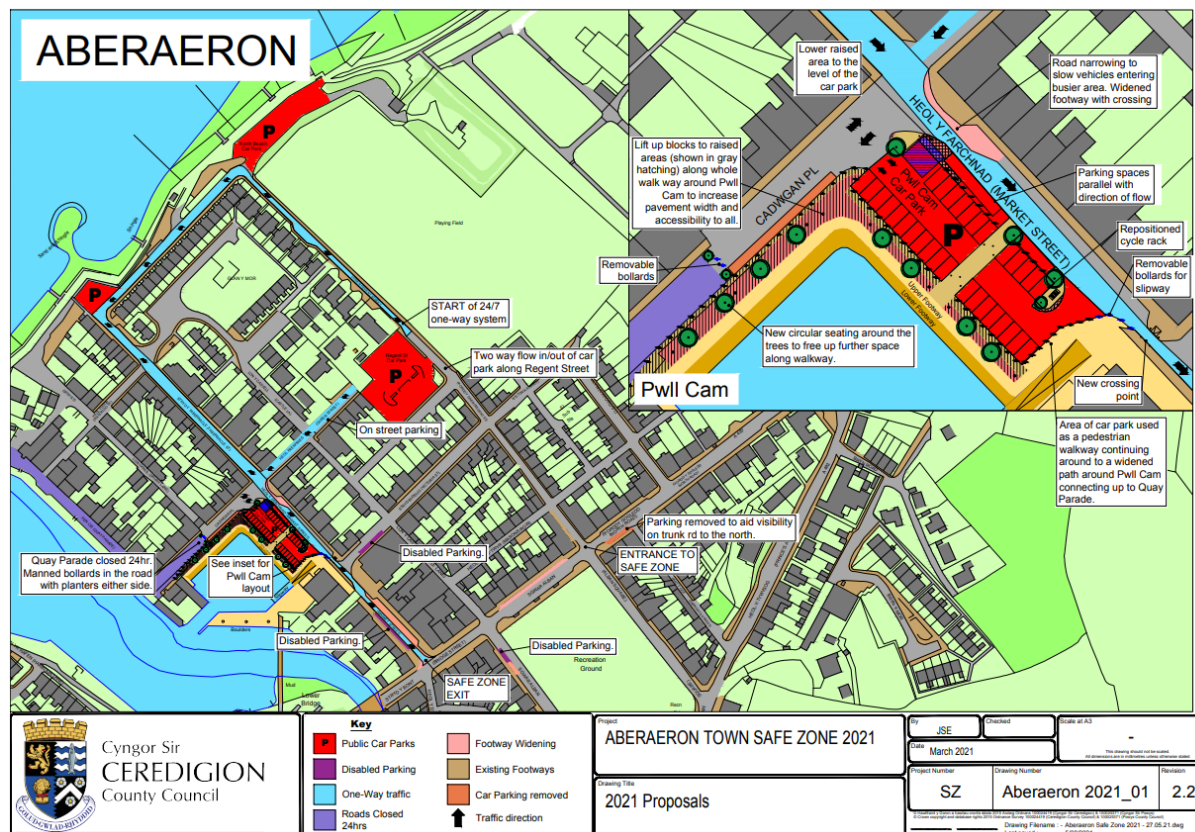
There are no road markings along Quay Parade and on-street parking occurs along one side of the road next to the flood wall. Residential properties line the other side of the road, with front doors opening directly onto the road and with only a very narrow and low level pavement of approximately 0.75m separating front doors from the road edge.

Since July 2020, CCC introduced Safe Zones across the county, including in Aberaeron to ensure public safety from coronavirus infection during the re-opening of the town centres, including helping to maintain social distancing in public areas. These Safe Zones have been implemented via CCC's emergency powers. Figure 15-1 shows the Safe Zone, with the traffic orders that are still in place as follows (www.ceredigion.gov.uk/SafeZones):

- Alban Square - Existing widened footway to remain.
- North Road - Parking removed to the front of 30-31 North Rd, to aid visibility on trunk road to the north.
- Regent Street - 24hr one way system entry from Alban Square remains. Footway to be widened to allow safer higher volume pedestrian footfall from car parks.
- Tabernacle Street - 24hr one way system remains.
- Queen Street - Parking remains removed along Queen St due to 24hr Fire Engine access.
- Cadwgan Place – On-street car parking removed to allow for widened footway. Also entry and exit into Harbour car park via Cadwgan Place.
- Quay Parade - Quay Parade remains closed 24hr. Manned bollards in the road with planters either side.
- Pwll Cam - Reconfiguration of the Harbour car park layout. Existing access from Market Street closed off with entry and exit via Cadwgan Place. Lift up blocks to raised areas (shown in gray hatching on plan) along whole walk way around Pwll Cam to increase pavement width and accessibility to all. This will create a continuous pedestrian walkway from Market Street around Pwll Cam connecting up to Quay Parade. Temporary loss of 5 car park spaces to achieve this.

- Market Street - 24hr one way system remains. Additional pedestrian crossing introduced from the opticians across to the extended footway to the front of Celtic. Car parking reintroduced outside 13-17 Market Street.
- Bridge Street - 24hr one way system exit from Market Street.
- Disabled Parking - Remains opposite Cost Cutters and along Alban Square. New allocated spaces introduced on Victoria Street.

Figure 15-1 Aberaeron Safe Zone



Traffic Flows

Automatic Traffic Count (ATC) data has been collected for the Scheme in 2019 following the scoping phase of the EIA. Given the recent Covid-19 pandemic in 2020/2021, more recent data has not been collected as traffic flows have been significantly reduced throughout Wales as a result of lockdowns and social distancing. The 2019 ATC data is therefore considered to be relevant to pre-pandemic 'typical' conditions, with volumes likely to be significantly higher than at present. The ATC data is therefore considered to be sufficient for this assessment, as more recent data would not represent 'typical' conditions.

The ATC data was collected over a 3 week period in April 2019 to establish baseline traffic flows (Wednesday 3rd April 2019 – Tuesday 23rd April 2019). The third week of data fell over the Easter school holidays, with Easter Sunday on the 21st April 2019. The ATC data was collected at the following 5 locations and as shown in Figure 15.1:

- ATC1: A487 (opposite the turning to the Council Offices)
- ATC2: Wellington Street (North of Penmaesglas)
- ATC3: Wellington Street (North of Wellington Gardens)
- ATC4: Market Street (close to the Monachty Hotel)

- ATC5: A487 North Road (just east of the junction with Regent Street)

Figure 15-2 Traffic Count Locations



Table 15.3 shows the average weekday (5 day) traffic flows over a 24hr period for the 3-week survey. For each location, except for ATC 2 (Wellington Gardens near Penmaesglas), there is a rise in average traffic flows in the third week of sampling. This traffic increase is highly likely to be due to the Easter period, with the last week of data taking place during the school holidays and more vehicles on the roads during that time with visitors travelling to the area. Of all the traffic count locations, the A487 had the highest weekday means which was expected due to this being the main coastal route connecting Cardigan to Aberystwth. The decrease in traffic during the Easter holidays at ATC2 Wellington Street, is likely due to this road being the main access to Aberaeron Primary School, and therefore less traffic occurring here during the school closure over Easter.

Table 15-3 Average Weekday Vehicle Flow

ATC Location	Vehicle Flow (2-way) 5 DAY MEAN
ATC 1 – A487 (junction with CCC office)	
Week 1	7360
Week 2	7950
Week 3	8785
ATC 2 – Wellington St (North of Penmaesglas)	
Week 1	1218
Week 2	1113
Week 3	901
ATC 3 – Wellington St (north of Wellington Gardens)	
Week 1	356

Week 2	496
Week 3	664
ATC 4 – Market St (near to the Monachty Hotel)	
Week 1	2913
Week 2	3094
Week 3	3241
ATC 5 – A487 (east of junction with Regent St)	
Week 1	6642
Week 2	7011
Week 3	7896

The ATC data was also analysed to identify the peak weekday average flow times. These are shown in Tables 15.4 to 15.9, with the peak times shaded for ease of reference. Note that the hours in the tables are 'hours ending'. For all ATC locations, although week 3 is shown in the tables, it has not been considered in the assessment of peak weekday average flow times. This is due the Easter period and peak flow times being significantly different at some of the ATC locations compared with weeks 1 and 2. A summary of the peak weekday flows is as follows.

- A487 (opposite the turning to the Council Offices):**

On the northbound carriageway (towards Aberystwyth) traffic starts to noticeably increase from 7am reaching a peak between 8-9am (with a peak flow during week 1 of 412 vehicles travelling north compared to 203 going south) with flows remaining high up until midday. On the southbound carriageway (towards Cardigan) the peak flows are between 4-6pm (with a peak flow in week 2 of 442 vehicles travelling south compared to 266 going north). The am and pm peak times appear to coincide with the working day commuting times.
- Wellington Street (North of Penmaesglas)**

The peak flow times in both an east and west direction are between 8-9am (with a peak flow during week 1 of 80 vehicles travelling east and 107 west) and 3-4pm (with a peak flow during week 1 of 97 vehicles travelling east and 84 west). These times coincide with school drop off and pick up times for the primary school located along Wellington Gardens.
- Wellington Street (North of Wellington Gardens)**

The peak time is between 3-4pm (with a peak flow during week 2 of 41 vehicles travelling north and 30 south). Although the peak time is similar to the afternoon peak time further south along Wellington Street near Penmaesglas as described above, the flows are much lower. During week 1 for example, the average 5 day peak flow in both directions between 3-4pm had 66 fewer vehicles than near the Penmaesglas ATC location. This is likely to be due to the ATC being located beyond the Wellington Gardens turning to the local primary school and not subject to as much traffic.
- Market Street (close to the Monachty Hotel)**

Along Market Street, traffic starts to build from 8am in both directions, with flows noticeably higher along the westbound carriageway (entering into the town centre) at this time e.g. during week 1 between 9-10am there were 125 vehicles travelling west compared to 80.6 travelling east. Throughout the day, flows remain relatively consistent with little fluctuation from the peaks observed; these being 144 vehicles between 1 and 2 pm during week 2 on the westbound carriageway and 145 between 4 and 5pm during week 2 on the eastbound carriageway. Flows reduce significantly after 7pm, reducing to below 90 vehicles, and from 8pm to below 60 vehicles.
- A487 North Road (just east of the junction with Regent Street)**

Flows start to increase from 7am in both directions. Between 8am and 1pm flows are higher on the northbound carriageway (towards Aberystwyth). However, from 1pm onwards, this pattern reverses, with the flows recorded being higher on the southbound carriageway, with

the southbound peak during week 1 (321) and week 2 (318) occurring at 6pm. Peak flows in the northbound direction varied, with the peak at 10am (266) during week 1 and 1pm (301.6) during week 2. Flows are relatively consistent all day with little deviation from the peak flows. Flows do not start to decline until after 7pm.

Table 15-4 ATC1 Weekday Peak Flow Times (A487 near Council Offices)

Blue cells indicate peak 5 day average flows

Hour Ending	Week 1		Week 2		Week 3	
	5 Day Average		5 Day Average		5 Day Average	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
1	8	9.6	7.2	8.6	11.8	16.4
2	5.2	6.2	5.6	9.8	9.4	10.6
3	2.6	4.6	3.2	4.4	6.2	6.4
4	5.4	3.8	9	6.6	7.2	6.8
5	13.2	5.8	15.4	8.6	15	8
6	20.4	16.6	28.6	18.8	26.4	17
7	79.6	37.8	92	46.2	72.8	37.6
8	267.6	135.4	255.6	136.6	167.8	94.4
9	412.4	203	385.2	220.2	264.8	168.2
10	313.4	191.8	321.6	219	315.8	224
11	294.4	194.8	336.6	225	338.6	231.8
12	293.2	219	333.4	255.6	456.8	322.4
13	268.2	263	252.8	220	394.8	354.6
14	236.6	282	282.8	303.4	336.2	361.8
15	230.8	296.6	264.8	342.8	339.8	397.2
16	261.4	377	253.8	387.4	303.8	425
17	224.8	372.2	273	431.2	315.8	434.4
18	241.4	414.2	266	442.2	312.2	423.8
19	178.2	249.6	216.4	272.2	248.8	294.6
20	108.8	165	129.4	178.2	168	207.8
21	72.4	112.4	78.4	126.2	103.2	161.6
22	47.2	91.6	43.2	94.4	62.6	124.4
23	31.2	43.6	36.4	56.6	45	76.4
24	21.4	26.6	17.6	27.6	23	34.2

Table 15-5 ATC 2 Weekday Peak Flow Times (Wellington St. north of Penmaesglas)

Blue cells indicate peak 5 day average flows

Hr Ending	Week 1		Week 2		Week 3	
	5 Day Average		5 Day Average		5 Day Average	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	0	0	0.4	0.2	0.6	0.4
2	0.8	0.2	1	0.2	1	0.4
3	0	0	0.2	0.2	0.6	0.4
4	0	0	0	0	0.2	0
5	0	0	0	0	0.2	0.2
6	0.2	0.2	0	0.2	0.4	0.4

7	2	3.2	3.2	5.6	3	3.6
8	9.8	33.6	12.6	26.4	8.6	18.2
9	80.2	107	63.6	80	17	14.8
10	45	36.4	38.6	35.4	21.6	28
11	23	29	34	38.6	29.6	25.8
12	40.4	46	41.2	42.6	43.2	49
13	41.2	44.8	34.2	40.8	42	46.8
14	37.8	41.4	46.4	39.8	44.6	39.8
15	36.2	43.4	47.6	43	49	39.2
16	97.4	83.8	86.4	58	50.2	31.2
17	52.2	42.6	56.8	37.6	45.4	29.4
18	50.2	45	45.4	37.4	44.6	28.8
19	21.6	23.8	22.2	17.2	30.6	22.2
20	28.6	19	17.4	14.4	21.4	15.6
21	11.2	12.6	11.8	9	18.8	11.6
22	10.4	6.8	8.4	5	8.6	3.4
23	4.6	3.6	3	3	3.8	3.8
24	1.2	1.4	1.2	2.6	2.2	1

Table 15-6 ATC 3 Weekday Peak Flow Times (Wellington St. north of Wellington Gardens)

Blue cells indicate peak 5 day average flows

Hr Ending	Week 1		Week 2		Week 3	
	5 Day Average		5 Day Average		5 Day Average	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	0	0	0.4	0	0.6	0
2	0	0	0	0	0	0.2
3	0	0	0.2	0	0.4	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0.2	0.2	0.2
7	1	0.4	1	1.6	0.8	0
8	3.4	2.4	3.2	3.4	2.8	2.8
9	13.6	16.8	14.8	18.6	8.6	5.6
10	10	7.4	13	12.4	14	16
11	8.2	7.6	16.8	17.4	22.4	20.8
12	9.8	12.6	19.6	19.4	28.4	42
13	24.4	20	21.6	25	30	38.2
14	19.8	18.8	30.8	25.4	36.2	32.2
15	18.6	15	31.2	25.4	40	28.2
16	31.2	27.2	41	29.6	48.4	29.2
17	15.8	9.4	26	15.4	41.2	23.8
18	10.8	10.4	14.6	12.4	32.2	20.4
19	6.4	4.8	12.2	8.4	22.8	14.2
20	11.2	5	9.8	7.6	15.8	10.4
21	3.2	2	7.4	3	17	5.6
22	3.8	2	2.6	0.4	4.8	2

23	2.2	0.6	1.6	0.8	2.6	1.6
24	0.4	0.2	1	1.2	1.2	0.6

Table 15-7 ATC 4 Weekday Peak Flow Times (Market Street)

Blue cells indicate peak 5 day average flows

Hr Ending	Week 1		Week 2		Week 3	
	5 Day Average		5 Day Average		5 Day Average	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
1	1.4	1.6	1	1.8	4	1.6
2	1.8	1.8	1.2	2.2	1	2.2
3	0.4	0.2	0.4	0.4	0.6	0.4
4	0.2	1	1.4	1.4	1	1.6
5	0	0.6	0	0.6	2.2	2
6	3	4.8	3	5	3	4.8
7	12.4	13.6	10.6	12.2	11.4	16.2
8	27.8	41.4	30.8	43.6	21.8	37.4
9	55.4	123.2	57.2	120.4	46.6	99.4
10	80.6	125.4	75.6	115.4	65	97.8
11	83.4	118	88.2	136.4	79	127.8
12	98	126.2	105	129	75.8	118.2
13	100.8	128.2	85.4	126.2	98.4	160
14	109.2	130.4	115.8	144	113.2	164.4
15	115.2	125.6	125.2	140.2	122.6	145
16	120.2	135.4	119.6	137.6	126.2	153.6
17	118.8	120.8	145.4	136.8	136	155.6
18	119	118	135	135.8	141	159.4
19	84.4	100.4	101.8	128.8	109.2	149.4
20	62.6	87	69.2	82.2	93.8	112
21	52	46.4	55.4	47.8	75.8	60.4
22	36.8	24.8	46.8	22.6	49	27.6
23	21	11.2	21	13.2	27.4	14.8
24	14.6	8	10	5.2	15.8	9.4

Table 15-8 ATC 5 Weekday Peak Flow Times (A487 near Regent Street)

Blue cells indicate peak 5 day average flows

Hr Ending	Week 1		Week 2		Week 3	
	5 Day Average		5 Day Average		5 Day Average	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
1	7.6	10	9.8	10.6	11.4	12.6
2	6.4	5.6	4.8	5.8	8.2	7
3	2.2	4.2	4.4	2.8	6.8	5.2
4	5.6	3.2	9.6	6	5.4	5
5	11.2	5.4	15.2	7.6	11.6	7.4
6	15.6	16.2	29	11.6	25.2	15
7	75.6	40.4	78.8	41	63.6	35.8

8	236.8	140.2	195.2	124.8	144.4	95.4
9	262.4	235.4	212.4	213.8	188.4	176
10	266.4	214.2	247.8	221.6	252.4	222
11	262.6	200.8	274.4	239	356.4	282.6
12	260.6	212.2	299.2	262.6	383	308.8
13	242.8	238.8	301.6	250.8	319.6	316.8
14	222.2	252.6	273.6	293.2	301.2	315.8
15	212.4	268	260.2	285.6	300.4	322.4
16	250.2	311.8	235.6	307.2	278.4	351.8
17	241.2	307.6	266.8	312.4	303.2	363.2
18	250.4	321.2	259.6	318.2	298.8	335
19	158.2	219.4	187	225	243.2	279.4
20	107.8	139.6	116.4	152.4	166.8	184.6
21	75	91.4	94.8	101.6	128.6	129.4
22	50.2	69	58.8	64.6	66.8	95.2
23	32.2	36.4	38.2	40.4	46.4	68
24	22	21.2	20	18.8	22.6	28.8

Parking

There are four public car parks in Aberaeron. These are:

- Harbour Carpark located on Market Street, to the rear of Pwll Cam dock (43 spaces)
- Aberaeron Car Park located on North Beach via Lower Regent Street (55 spaces)
- Lower Regent Street (85 spaces)
- Beach Parade next to Aberaeron Yacht Club (72 spaces)

On-street parking for visitors is available along a number of roads within the town. Of relevance to the seafront, this includes along Quay Parade, Cadwgan Place and Lower Regent Street where it runs parallel to the beach. The parking along Lower Regent Street is displayed via marked parking bays. There are also 8 spaces opposite the public toilets along Beach Parade. All of this street parking appears to be free.

Adjacent to the proposed site compound location is a staff car park for the offices of CCC and the police station. Recently, CCC has permitted the use of some of the car park for school traffic to help relieve congestion along Wellington Gardens and Wellington Street related to Aberaeron Primary School. A footpath from the car park has been constructed connecting it to Wellington Gardens, where the school is located.

The majority of residential parking close to the seafront and around the harbour is on the roadside. The properties along Quay Parade have private garage parking to the rear of the properties, accessed via Drury Lane.

Pedestrian and Cycle Infrastructure

Aberaeron has good footpath provision surrounding the harbour and along the seafront. A promenade extends along the northern edge of the harbour from Quay Parade all the way around the Pwll Cam dock. A footbridge over the River Aeron connects the eastern side of the dock with community grassland on the southern side of the river. The Aberaeron coastline, forms part of the Wales Coast Path, which extends along the full length of the Wales coastline. The path runs along

seafront, and where it is interrupted by the two piers, it moves inland around the harbour from Quay Parade to Pwll Cam, crossing over the footbridge onto Belle Vue Terrace before connecting with South Beach along Beach Parade. At Beach Parade, the footpath is located on the seaward side of the properties, but retreats inland onto grassland as it continues its route further south.

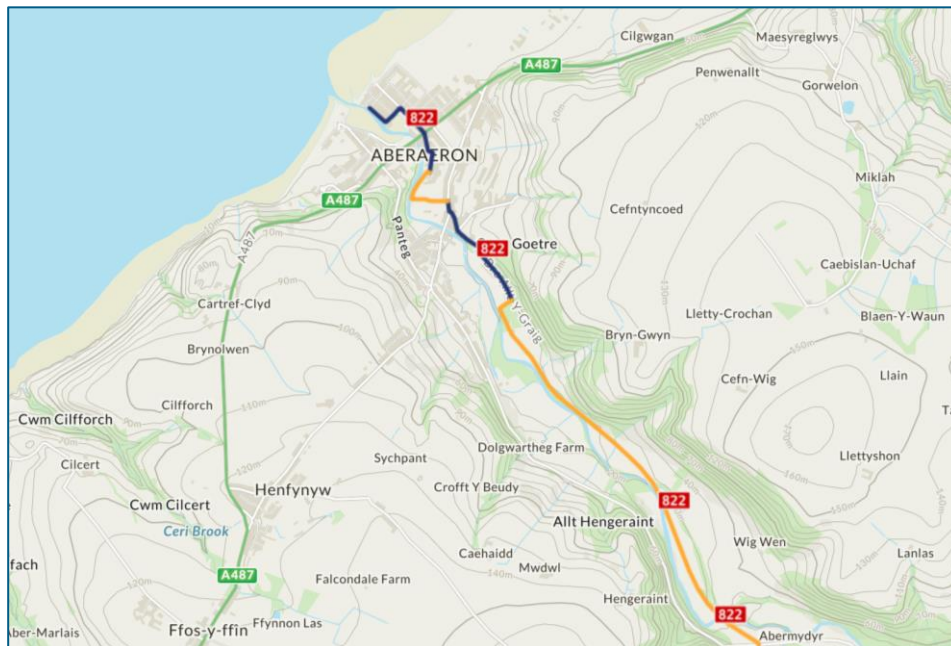
Figure 15-3 Wales Coast Path



A public right of way is located along the southern end of the harbour running parallel in between the water's edge and Belle Vue Terrace. The footpath connects to Harbour Way in the west and to a non-designated footpath running through a landscaped area next to the footbridge over the River Aeron in the east. A further public right of way is located by the harbour slipway along Beach Parade, extending into Beach Parade carpark. As mentioned above, a new footpath has been constructed from the CCC office car park near the site compound area, connecting to Wellington Gardens. This footpath has been specifically designed for access to Aberaeron Primary School.

National cycle route 822 connects Aberaeron and Llanerchaeron at Abermydyr. The route is still under development and is proposed to extend further, but currently only the section between Aberaeron and the National Trust property at Llanerchaeron is open. It extends along Quay Parade, up Cadwgan Place and along Market Street before crossing over the A487 and heading inland along a mix of off-road and road routes.

Figure 15-4 National Cycle Route



Source: <https://osmaps.ordnancesurvey.co.uk/>

As described above, Safe Zones have been introduced into Aberaeron as a public health and safety response to Covid-19. Improvements to pedestrian space around Pwll Cam dock have been made, with 5 car park spaces temporarily removed in the Harbour carpark to allow pedestrian space to be widened. Raised blocks have also been placed next to existing pavements to widen the pavement widths. Footpath widening has also taken place along parts of Market Street and Cadwgan Place. A Safe Zone is also in place along Quay Parade, with the road closed. The promenade remains open for pedestrian access, with the road closure enabling pedestrians to use the road for walking, thus enabling social distancing.

Public Transport

Bus stops located closest to the Scheme area are located on the A487. The closest one being located on the junction of the A487 with the unnamed road leading to the offices of Ceredigion County Council. These are serviced by the T1 (Carmarthen to Aberystwyth) and T5 (Haverfordwest to Aberystwyth) hourly service.

Personal Injury Collision (PIC) Data

Personal Injury Collision (PIC) data was obtained in 2018 from CCC for Aberaeron, incorporating the proposed areas of the Scheme. The data was collected for the EIA scoping assessment.

The PIC data reported a total of 13 PICs, classified as ten slight and three serious (no fatal PICs were reported). A recent report in the Cambrian News documented an incident on 15 September 2020, just before 9am, involving a pupil from Ysgol Gynradd Aberaeron involved in a collision with a motor vehicle whilst crossing the road to go to school.

15.2.2 Data Gaps and Limitations

The Covid-19 pandemic has significantly changed the volume of traffic on roads throughout Wales as a whole. Lockdowns and social distancing has reduced the number of journeys being made. The ATC data used for this assessment was collected in 2019 and is relevant to pre-pandemic 'typical' conditions, with volumes likely to be significantly higher than at present. The ATC data is therefore considered to be sufficient for this assessment, as more recent data would not represent 'typical' conditions. With the Covid-19 pandemic still prevalent, it is not yet known whether any pandemic restrictions will continue to be in place at the time of construction e.g. Safe Zones.

15.3 Likely Significant Effects

15.3.1 Construction

As described in the construction methodology in Chapter 3, construction materials will be delivered to site by land and possibly also by sea. An assessment of the impacts of both of these methods on traffic and transport is discussed in the following sections, with the assessment of land-based impacts discussed first.

Traffic Flow Generation - Bulk Deliveries to and from Site Compound

Bulk deliveries of materials will be delivered to the site compound via the A487 and then along an unmarked entrance road to the CCC offices and the police station. Deliveries will take place between 0700 and 1900 Monday to Sunday. However, as deliveries will not be constant during this time, for the purpose of this assessment it has been assumed that material deliveries will occur five days per week and over a ten-hour working day. This assumption has been used to estimate trip generation for delivery of materials to the site compound and is considered to be robust as it assumes a higher number of generated delivery and construction vehicles per hour than would be generated over a 12 hour Monday to Sunday scenario.

The following calculations of trip generation considers deliveries coming via the A487 to the site compound. This is a combination of material delivery vehicles and employee vehicles. It is assumed that all bulk material deliveries and employee vehicles will travel directly to the site compound via the A487.

The time periods for deliveries of materials are on the basis of discussions with the internal design team and information within the scheme programme. The following assumptions have been made:

- Delivery vehicles will be in the order of 20 tonne type tipper trucks;
- An equal number of HGVs will be generated per working day over the delivery period;
- An equal number of HGVs will be generated per hour throughout the working day;

Vehicle movement timescales for delivery of materials and removal of materials for each element of the scheme is detailed in Table 15.9 below.

Table 15-9 Delivery Periods

HGV Delivery Periods	Weeks
Number of weeks for setting-up site & plant delivery	2
Number of delivery weeks for rock for breakwater and rock revetment	26
Number of delivery weeks for concrete for breakwater walkway	6
Number of delivery weeks for disposal of old concrete sea defence wall, old surfacing to make way for new wall	26
Number of delivery weeks for masonry and concrete for new sea defence walls, replacement pavings, new surfacing and fill	26

Number of delivery weeks for delivery of glass panels for new sea defence walls	4
Number of delivery weeks for concrete and piles for South Pier	8
Number of delivery weeks for removing old timber groynes	1*
Number of weeks for closing down site - plant removal	2

* The extraction of timber groynes is estimated to take place over 4 weeks but it is assumed that the timber groynes will not be removed by HGVs until the final week of the 4 week removal period, therefore a 1 week delivery period has been assumed.

The quantity of material to be transported to and from site is provided in Table 15.10 below.

Table 15-10 Tonnage of Material Required

Material	Total Tonnage
Breakwater and South Beach rock revetment	126,000
Breakwater concrete	4,300
Disposal of old concrete sea defence wall, old surfacing to make way for new wall	2,000
Masonry and concrete for new sea defence walls, replacement pavings, new surfacing and fill	3,000
Removal of old timber groynes	*Approx. 140 timber posts

*Assumes 6 long groynes (approx. 24 timber posts each)

The hourly generated 2-way HGV movements for each scheme element has been derived using the assumptions in tables 15.9 and 15.10 above. The estimated total hourly 2-way HGV movements for each sub-phase are shown in Table 15.11 below.

Table 15-11 Number of HGVs Generated

Sub-Phase	Number of HGVs Per Day	Total Tonnage per Day	Number of HGVs Per Hour	Total 2-way movements per hour
Setting-Up Site - Plant Delivery	5	N/A	1	2
Breakwater	49	969	5	10
Breakwater concrete	8	143	1	2
Disposal of old concrete sea defence wall, old	1	15	1	2

surfacing to make way for new wall				
Masonry and concrete for new sea defence walls, replacement pavings, new surfacing and fill	2	23	1	2
Removal of old timber groynes	1	200 Timber Posts per HGV	1	2
Concrete and piles for South Pier	2	N/A	1	2
Closing down site - plant removal	5	N/A	1	2

The estimates show that the delivery of the breakwater rock generates the highest number of HGVs with 10 two-way movements per hour throughout the day. It is possible that this work could be concurrent with disposal the old concrete sea defence wall and also the work on the South Pier. Therefore, a figure of 14no. 2-way movements per hour should be assumed as a worst-case scenario.

Hourly peak flows along the A487 from the 2019 traffic counts have been used to estimate the percentage increase in hourly flows for the transportation of the breakwater rock to the site compound. The hourly peak flows for the A487 at the junction with CCC offices, and for the A487 at the junction with Regent Street (taken from tables 15.4 and 15.8 respectively) are presented in table 15.12 below along with the change in flows resulting from the breakwater rock deliveries using the assumption of 14 two-way movements per hour. The table shows that for both traffic count locations along the A487, the percentage increase in flows in both directions is no greater than 4.6%. Therefore although there will be some increase in flows, it will be of a very small magnitude. Table 15.2 has also assumed a worse-case scenario by selecting the peak hourly flows. Bulk deliveries to site will not necessarily be at these peak times, and therefore increases in traffic flows may be even less at other times of the day.

With the sensitivity of users of the A487 considered to be 'medium' due to the road being a main strategic link in the county and passing through the town centre of Aberaeron, and the magnitude of the impact assessed to be 'negligible' (as the increase in traffic flows is less than 30%), the significance of the effect is determined to be **minor adverse**. For further discussion on the impacts of the deliveries on the car park and access road to the site compound, this is made further below under the sub-heading 'CCC Office/Police Station Carpark'.

Table 15-12 Change in Hourly Flows from Breakwater Rock Deliveries

ATC Location	Peak Hourly Flow (Northbound)	% Increase in Hourly Flows (Northbound)	Peak Hourly Flow (Southbound)	% Increase in Hourly Flows (Southbound)
ATC1	414	3.4%	442	3.2%

ATC5	302	4.6%	321	4.4%

Traffic Flow Generation - Employee Traffic

Employee traffic is assumed to arrive in the AM peak and depart in the PM peak. It is assumed that the majority of general labourers and plant operators will arrive in 'gangs' by mini-bus organised by the contractor. Specialist contractors will probably arrive by van accompanied by co-workers and there may be some individual car journeys made by the site foreman and design team. Therefore, the assessment assumes an even split between cars and minibus/vans.

It is assumed that there may be approximately 30 employees on site each day and Table 15.13 illustrates the total number of employee vehicles generated, that being an estimated 17 vehicles per day.

Table 15-13 Generated Daily Employee Vehicles

Employee Type	Employees Per Vehicle	Number of Vehicles (per day)	Number of Employees
Contract Manager/Foreman/Quantity Surveyors	1	5	5
Specialist Sub-contractor	3	5	15
Design Team	4	1	4
Labourers/Plant Operators	8	2	16
Total		17	30

As with the impact assessment for bulk deliveries to site, the percentage increase in hourly flows resulting from employee vehicles has been undertaken by looking at the peak hourly flows along the A487 from the 2019 traffic count data at ATC1 and ATC2. It has been assumed that employee vehicles arriving and departing the site will be to/from the site compound via the A487. The peak AM commuting time to site is assumed to be between 8-9am and the peak PM time between 5-6pm. The assessment therefore considers 17 vehicles arriving in the AM peak hour and 17 vehicles departing in the PM peak.

Table 15.14 below shows that for both traffic count locations along the A487, the percentage increase in flows in both directions is small. At peak AM times, the flow increase is less than 6.5% and at peak PM times is less than 5.3%.

With the sensitivity of road users along the A487 assessed as 'medium' and the magnitude of the impact of employee vehicles on existing traffic flows assessed to be 'negligible' (as the increase in traffic flows is less than 30%), the significance of the effect is determined to be **minor adverse**.

Table 15-14 Change in Hourly Flows from Employee Traffic

ATC Location	Peak Hourly Flow AM (Northbound)	% Increase in Hourly Flows (Northbound)	Peak Hourly Flow PM (Southbound)	% Increase in Hourly Flows (Southbound)
ATC1	412	4.1%	442	3.8%

ATC5

262

6.5%

321

5.3%

Traffic Flows – On-site Construction Vehicles

Once employees and the bulk materials have arrived at the site compound, there will be vehicle movements within the working area i.e. movements between the site compound and the works locations, these being predominantly to the areas of Quay Parade, Pwll Cam and Beach Parade. Where possible materials will be delivered directly to these work locations to save generating additional traffic from the site compound. Movement of plant within the working area will be carried out between 7am and 7pm Monday to Sunday. Traffic movement to these locations is as follows:

- Quay Parade: movements will be from the site compound, along the A487, down Regent Street/Lower Regent Street, then along Tabernacle Street, turning into Cadwgan Place and onto Quay Parade. Once on Quay Parade, vehicles will generally exit the site location in a loop, via Ship Street and turning onto Waterloo Street, then onto Tabernacle Street, before returning to the site compound via Market Street and the A487. Due to the Safe Zones in place, Market Street is currently operating a one-way system, hence only being able to use this route on the return trip to the site compound.
- Pwll Cam: transport of materials from the site compound will be via the A487 and Regent Street (as described in the bullet point above) to the Harbour Carpark at Pwll Cam dock due to the Safe Zones in place. The return journey to the site compound will be via Market Street and the A487.
- Beach Parade: access along Beach Parade will be needed for some of the work at the northern end of South Beach. Vehicles will access Beach Parade from the site compound on to the A487 and down Wellington Road. Wellington Road is a residential road with no road markings and a pavement on only one side.

An estimate of the number of vehicle movement to/from the site compound to/from these working areas are as follows in Table 15.5 below. The construction periods are on the basis of discussions with the design team and information within the scheme programme, and the following assumptions have been made:

- On-site construction vehicles (OCV) will be in the order of 6 tonne type tipper trucks;
- An equal number of OCVs will be generated per working day over the delivery period;
- An equal number of OCVs will be generated per hour throughout the working day;
- The construction periods for each sub-phase are detailed in Table 15.9.

Table 15-15 Number of OCVs Generated

Sub-Phase	Number of OCVs Per Day	Number of OCVs Per Hour	Total 2-way movements per hour
Via Regent Street / Tabernacle Street/ Cadwgan Place / Market Street (access to Pwll Cam, Quay Parade and river walls)	20	2	4
- Disposal of old concrete sea defence wall, old surfacing to make way for new wall			

Via Regent Street / Tabernacle Street/ Cadwgan Place / Market Street (access to Pwll Cam, Quay Parade and river walls)	40	4	8
- Masonry and concrete for new sea defence walls, replacement pavings, new surfacing and fill			
Via Wellington Street	20	2	4
- Demolition materials removed from South Pier, fill materials, concrete and piles for South Pier			

It is possible that two of the activities could occur concurrently and that a maximum of 12 two-way movements per hour be taken as the maximum forecast of OCVs throughout the day and this figure will be used in the analysis.

The percentage increase in hourly flows resulting from OCVs using the 2019 traffic count data is shown in table 15.16 below. The data has been compared against the peak count at each traffic count location, regardless of traffic/carriageway direction, to obtain the worse-case scenario. A maximum of 12 two-way movements per hour has been assumed at all the traffic count locations, except for Wellington Road as this is the only route that will be used for some of the South Pier work. The work on Quay Parade and Pwll Cam will not be accessed via this route. The assessment for Wellington Road therefore assumes a maximum of 4 two-way movements per hour for OCVs.

Table 15-16 Change in Hourly Flows from Employee Traffic

ATC Location	Peak Hourly Count	% Increase in Hourly Flows
ATC1 (A487 near CCC offices)	442	2.7
ATC2 (Wellington St (North of Penmaesglas)	107	3.7
ATC3 Wellington St (North of Wellington Gardens)	41	9.8
ATC4 (Market Street)	145	8.3
ATC5 (A487 near Regent Street)	321	3.7

The results show that the increase in traffic flows generated by OCVs moving between the site compound and the working areas is very small. The greatest increase is 9.8% along Wellington Street. Wellington Street is the main access route to Aberaeron Primary School, which is located on Wellington Gardens. There is no designated school car park and therefore Wellington Gardens and Wellington Street become significantly congested during school drop off and pick up times, with cars parked along both roads. Given that this road becomes busy during morning school drop off and afternoon pick up, the contractors will be instructed to avoid using Wellington Street during these peak times of 8-9am and 3-4pm. The presence of the school makes this route a highly sensitive area, but with the magnitude of impact considered to be negligible as the increase in flows is less than 30%, the significance of the effect along Wellington Gardens is assessed to be **minor adverse**.

Market Street is estimated to have an 8.3% increase in traffic flows from OCVs. Market Street is considered to be of medium sensitivity due to the presence of shops and pavements for pedestrians. With the flows in traffic changing by less than 30%, the overall significance of effect is determined to

be **minor adverse**. The significance of effect on the A487 is also assessed to be **minor adverse**, with these sites showing the lowest change overall in traffic flows from OCVs.

A traffic management plan will be produced by the contractor to manage deliveries to the site compound as well as to manage movements of construction vehicles throughout the working area.

Parking

The works will impact on parking at the following locations.

CCC Office/Police Station Carpark

A temporary access track will be constructed across part of the car park servicing these offices, linking the existing entrance road to the carpark with the site compound. There will be a loss of approximately 15 car park spaces, potentially impacting on parking availability for council and police staff. It is estimated there are approximately 100 car park spaces in total in the car park. The loss of these spaces could also impact on spaces recently designated for school traffic at peak morning and afternoon school pick up drop off times.

The carpark is considered to be of high sensitivity as it is used by employees, has recently had a change in use to accommodate school parking and therefore children will be in the vicinity, and is adjacent to assisted living accommodation. The proposed Wales Coast Path diversion route will also cross the carpark during works to South Beach. Despite the sensitivity of users of the carpark, only a small area of parking will be affected, the impact is considered to be of negligible magnitude and therefore of **minor adverse** significance.

In addition to the loss of carpark spaces, there will also be some impacts on road users and pedestrians from use of the entrance road and car park for construction vehicles accessing the site compound. Estimates of the number of construction vehicles entering the site compound has been made in Tables 15.11, 15.13 and 15.15 above. The additional construction traffic entering the carpark off the A487 could cause some temporary congestion or slowing down of traffic entering and existing the car park. As this area is considered to have a high sensitivity as mentioned earlier, the contractor will be expected to have a traffic management plan in place that considers the sensitivity of this car park. This will include clear signs for the public alerting them to the presence of heavy machinery and plant in the area, adherence to a 5mph speed limit as well as a temporary pedestrian crossing across the contractor's access route to the site compound. During school pick up and drop off, the contractor should consider placing a marshal at the crossing to ensure the safety of school children at this peak time. The contractor should also inform CCC, the police station and the primary school of their management plan for the car park. The contractor will also inform construction employees about the sensitivity of the site.

Given the increase in construction vehicles using the car park and access road, and the duration of the works lasting 12 months, it is likely that the increase in traffic use of the car park (bulk deliveries, construction employee vehicles and on-site construction vehicles) will exceed 30% at times. The magnitude of the impact is therefore low. Given the high sensitivity of the car park users, the significance is determined to be moderate adverse, however with the mitigation measures proposed, the residual effect will be **minor adverse**.

Harbour Carpark

Approximately 5 carpark spaces at the Harbour Carpark will be needed for the works around Pwll Cam and the River Aeron walls. This reduction in capacity could impact on visitor parking in Aberaeron, particularly as the harbour is a focal point for tourists and visitors. Similar to Quay Parade, the Harbour Carpark is currently included in CCC's Safe Zone scheme and 5 parking bays have been reconfigured for pedestrian use to increase pavement width to help with social distancing measures. No secondary parking issues have been identified by CCC resulting from the loss of these spaces, although it is noted that visitor numbers are much lower than 'typical' conditions pre-pandemic.

The Harbour Carpark is considered to be a high sensitive area as it is in a central town location used by pedestrians. However, given that only a small area of parking is estimated to be affected, the impact is considered to be of negligible magnitude and therefore of **minor adverse** significance.

Beach Parade Carpark

Some of the carpark space will be needed to temporarily stockpile deliveries of materials and plant for the South Pier work. Consultation will be undertaken with Aberaeron Yacht Club with regards the location and number of spaces that could be used. The car park is used by the yacht club in the winter for storage of boats and this will need to be taken into consideration during the consultation. It is estimated that approximately 17 spaces will be needed.

This parking area is considered to be of low sensitivity due to its quieter location nestled between the beach and the harbour mouth, with only a few residential properties at Beach Parade on its southern side. Given that only a small proportion of the car park will be needed for the works and with consultation with the yacht club over winter boat storage, the impact is considered to be of negligible magnitude and therefore of **minor adverse** significance.

Quay Parade On-Street Parking

During the works along Quay Parade, access and on-street parking along this road will be affected. This impact will be experienced by non-residents of Quay Parade as residents have parking at the rear of their properties along Drury Street. The Harbourmaster Hotel also has parking to the rear. Access to these properties and the hotel will therefore not be affected.

Currently, Quay Parade is closed as part of the covid-19 Safe Zone measures described in section 15.2.1 and no issues relating to congestion or lack of parking space has been observed by CCC. Should the Safe Zone measure be relaxed prior to construction, temporary closure of the road will be mitigated by carrying out work on the flood wall in discrete sections, so that parking along sections of the wall where work has not started to take place is available. Quay Parade is considered to be a medium sensitive area as the presence of the promenade makes this a popular area for pedestrians. However, given that no adverse impacts have been reported following the current closure of Quay Parade, and given that only a small area of parking is estimated to be affected should the road be re-opened, the impact is considered to be of negligible magnitude and therefore of **minor adverse** significance.

Pedestrian and Cycle Routes

The works will impact on pedestrian and cycle access (National Cycle Route 822) along the promenade at Quay Parade and around Pwll Cam as sections are fenced off whilst work is taking place. Along Quay Parade, disruption will be minimised by carrying out work in discrete sections, so that sections where work has not started to take place remains accessible. At Pwll Cam, the eastern side of the quayside will need to be fenced off for construction, leaving the remaining area accessible. Access to the footbridge over the River Aeron will be maintained for the majority of construction, however there will be some short periods of temporary closure for the adjacent wall work and tilt barrier installation. The diversion route would be over the A487 road bridge. Although this is a slightly longer route, the road bridge has a wide pavement on both sides with steps leading down to the picnic area on the southern side of the footbridge.

Access along the Wales Coast Path will be maintained throughout construction, although some localised temporary diversions will be required at the following locations:

- North Pier work - where the path joins Quay Parade from North Beach via the pier. The diversion route from North Beach onto Quay Parade will be diverted via the adjacent toilet block next to the pier, leading back on to Quay Parade. This diversion is already regularly used by walkers. As mentioned above, Quay Parade will remain open during the work for pedestrian access.
- Site compound – there will be a temporary access route from the site compound onto South Beach which will travel across the route of the path. Due to the heavy machinery that will be

present, it is proposed to divert the West Coast Path in this location to maintain public safety and access along the path. The route of the diversion will be agreed with CCC, but pedestrians are likely to be diverted across the CCC/police station carpark. The site compound itself will be landward of the footpath, but due to its proximity, the contractors will erect signs along the footpath close to the works and site compound, alerting the public to construction works as well as the diversion route.

- Footbridge – as described above, the footbridge over the River Aeron will be closed for short periods of time for the river wall work and tilt barrier work. A diversion route over the A487 road bridge will be clearly signposted.

Impacts on pedestrians using the carpark at the CCC office/police station is assessed under the heading 'CCC Office/Police Station Carpark' above.

For the purpose of this assessment, the magnitude of impact on pedestrians/ cyclists, is based on the change in total vehicle movements with an increase greater than 30% reflecting an impact, as detailed in Section 15.1.1. For all proposed construction traffic routes for this Scheme, the change in traffic flows is estimated to be below 30%, which equates to a negligible magnitude of impact. With the magnitude of impact being negligible, regardless of the sensitivity of the receptor, the magnitude of impact will result in either a minor or neutral significance of effect (see Table 15.2). Given that pedestrians and cyclists are present in the area, the impact has been determined to therefore be **minor adverse**.

Delivery by Sea

Should the rock for the breakwater and revetment arrive by sea, the amount of traffic generated by the construction will be much lower than that outlined above for delivery by land. Nevertheless, some road traffic will be generated, in the main through movement of employee vehicles. It is assumed that the same number of employees will be needed whether materials are delivered by road or sea. As such, the number of employee vehicles and on-site vehicle movements set out in Table 15.13 and Table 15.15 above is relevant to this delivery option as well as the significance of the effect.

The delivery method by sea is set out in Section 3. Both the delivery of materials and the construction of the scheme from sea could impact on existing navigation routes of fishermen and recreational boat users. However, due to the limited number of vessels that will be used during the construction (rock carrying ship, tug and barge) and the low volume of recreational and fishing vessels in the waters off of Aberaeron, the increase of vessels in the water is considered to be negligible. Access to and from the harbour will be maintained during construction. There will be some disruption to access to the dock of Pwll Cam during the work for the flood gate construction, including temporary closure of the Pwll Cam slipway, however this is discussed and assessed in the recreation chapter of this ES, Section 6.

With the magnitude of impact being negligible, regardless of the sensitivity of the receptor, the magnitude of impact will result in either a minor or neutral significance of effect (see Table 15.2). Given that vessels are present in the area, the impact has been determined to therefore be **minor adverse**. A Notice to Mariners will be issued to inform recreational vessel users and fishermen of work in the water and harbour. Signs will be erected by the slipways informing boat users of the presence of the works. The contractor will also liaise with the Harbour Authority and Aberaeron Yacht Club with regards programming of marine activities.

15.3.2 Operation

Following completion of the works, traffic flows and routes will return to existing levels, as well as pedestrian and cycle access, including along the Wales coast path.

The flood wall work along Quay Parade will result in some changes to the existing road width. To the western end of Quay Parade, between the North Pier and the Harbourmaster Hotel, the new wall will be slightly further inland than existing to allow for the new tilt barrier and to create a wider walkway

on the harbour side. South of the Harbourmaster Hotel and east along Quay Parade to The Hive, the wall will be slightly further seaward than existing to accommodate for relocating the existing street lighting to the road side to free up space on the walkway and for potential future road improvements, which CCC may develop with the Highways Authority at a later date and are not part of this scheme. None of these changes will impact on access or traffic flows with the effect considered to be **neutral**.

In all locations, parking access, as well as pedestrian and cycle access will be reinstated following construction. This includes the removal of the temporary access track to the site compound. The works will result in some improvements to pedestrian access along Quay Parade from the widening of the promenade as well as the removal of the 'up and over' steps over the existing wall, with access to the promenade replaced with gaps in the wall created by the new tilt barrier locations. As these improvements will not result in any changes in traffic flows, the magnitude of impact is considered to be negligible. With pedestrians and cyclists present in the area and a medium sensitivity assumed, the effect has been determined to therefore be **minor beneficial**.

16 Noise and Vibration

16.1 Method of Assessment

The human ear responds to a wide range of sound pressures, from 0dB (the threshold of hearing) up to about 130dB (approximating to the threshold of pain).

Table 16.1 below shows indicative noise levels associated with different noise sources. They are intended to give an appreciation of noise levels commonly experienced in various situations.

Table 16-1 Typical dB(A) Noise Levels

Noise Source	dB(A) Level
Rural night-time background	20-40
Quiet country bedroom at night	30-35
Quiet library	40
Quiet office, air conditioner	50
Car at 40mph at 100m	55
General office or supermarket	60
Conversational speech at 1m	60-65
Car at 25 mph at 7.5m	70
Pavement of busy street	85
Hand held hydraulic breaker (20kg) at 7m	95
Jet aircraft at 250m	105

The noise level response of the human hearing system is logarithmic rather than linear in nature, and able to detect a noise level difference of about 1 dB(A) between two steady sounds, when they are presented in rapid succession under controlled laboratory conditions. The smallest change in environmental noise that is generally noticed by an individual is about 3dB(A). A 10dB(A) change approximates to a subjective doubling or halving of loudness.

This section outlines the relevant policies and methodology used in this assessment.

The scoping report and scoping opinion for the Scheme scoped out the need for an assessment of impacts following construction. However, the design has evolved since the scoping report to include a hydraulically operated flood gate across the entrance to the Pwll Cam dock. This post-construction impacts of the gate on noise has therefore been included in this assessment.

16.1.1 Policy Context

Policy documents for Wales and Ceredigion relevant to noise and vibration are summarised below.

- Planning Policy Wales (Edition 10, 2018) provides guidance for development in respect of noise.
- Technical Advice Note 11: Noise (TAN11) sets noise bands for residential development.
- Ceredigion Local Development Plan (April 2013) provides guidance for development in respect of noise.

Planning Policy Wales

Section 6.7 of Planning Policy Wales, sets out that noise should be reduced as far as possible.

“Clean air and an appropriate soundscape, contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible.”

Furthermore, section 6.7.6 of the policy indicates that in proposing new development, planning authorities and developers must consider any relevant Noise Action Planning Priority Areas.

TAN 11

In TAN 11, under the heading ‘Development Control – Noise Generating Development’, Paragraph 8 states:

“Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.”

Ceredigion Local Development Plan

The Local Development Plan is currently in the process of being updated and therefore the 2013 version remains the current version. Policy ‘DM22: General Environmental Protection and Enhancement’ outlines that proposed developments will be permitted provided that it does not have a significant adverse effect on noise both on and off site.

16.1.2 Assessment Criteria

Construction Noise

Noise from construction activities is of a different character to that experienced in the general environment, being different from road traffic noise and from noise in rural or suburban areas. People may be able to hear noise from construction activities at some distance from the source, even if there is no measurable change in noise level.

The ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’ (BS 5228:2009+A1:2014), provides a database of measured noise levels from typical construction plant items together with a methodology for predicting noise levels at receptors based on the source of the noise levels and taking into account the noise attenuation due to distance, ground absorption and screening.

Within this code of practice, ‘Part 1, Annex E ‘Significance of noise effects’, presents various methods of determining the significance of noise effects due to construction works. This includes the ABC method detailed in Annex E.3.2, where noise limits are set using baseline noise levels, and which is shown below in Figure 16.2.

Table 16-2 Example Threshold of Significant Effect at Dwellings

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB $L_{Aeq,T}$)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night (23:00 – 07:00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
Daytime (07:00 – 19:00) and Saturday (07:00 – 13:00)	65	70	75
NOTE 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. NOTE 3: Applied to residential receptors only.			
A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values. D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

Table Source: BS 5228:2009+A1:2014 Part 1, Annex E.3.2

The ABC method has been used to assess the noise impacts of the construction activities for this Scheme. Using this method, the impact of an activity has the potential to be significant if the noise levels from the construction activities are shown to exceed the relevant threshold value. The consideration of significance then also needs to take into account the duration of the activity along with the characteristics of the existing noise climate. In line with common practice on similar construction schemes, a “significant time period” for the effects shown in Table 16-3 to be considered to cause a significant adverse effect is:

- a period of 10 or more days of working in any 15 consecutive days during construction; or
- for a total of 40 days or more in any 6 consecutive months during construction.

For consistency with the other assessments in this ES, a significant effect is described as being Major or Moderate, with effects that are not significant described as Minor or Negligible. These definitions are taken from Table 5.3 in Section 5.3.

Construction Vibration

The ‘Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration’ (BS 5228:2009+A1:2014), provides a database of measured vibration levels from typical construction plant items together with equations for predicting vibration levels from the most significant vibration generating sources.

The significance of vibration on human receptors will be assessed using significance criteria shown in Table 16-3 below.

Table 16-3 Guidance on Effects of Vibration Levels

Vibration level Effect	Vibration Level Effect
0.14 mm·s ⁻¹	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm·s ⁻¹	Vibration might be just perceptible in residential environments.

Vibration level Effect	Vibration Level Effect
1.0 mm·s ⁻¹	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm·s ⁻¹	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

The consideration of significance then also needs to take the duration of the activity into account. In line with common practice on similar construction schemes, a “significant time period” for the effects shown in Table 16-3 to be considered to cause a significant adverse effect is:

- a period of 10 or more days of working in any 15 consecutive days during construction; or
- for a total of 40 days or more in any 6 consecutive months during construction.

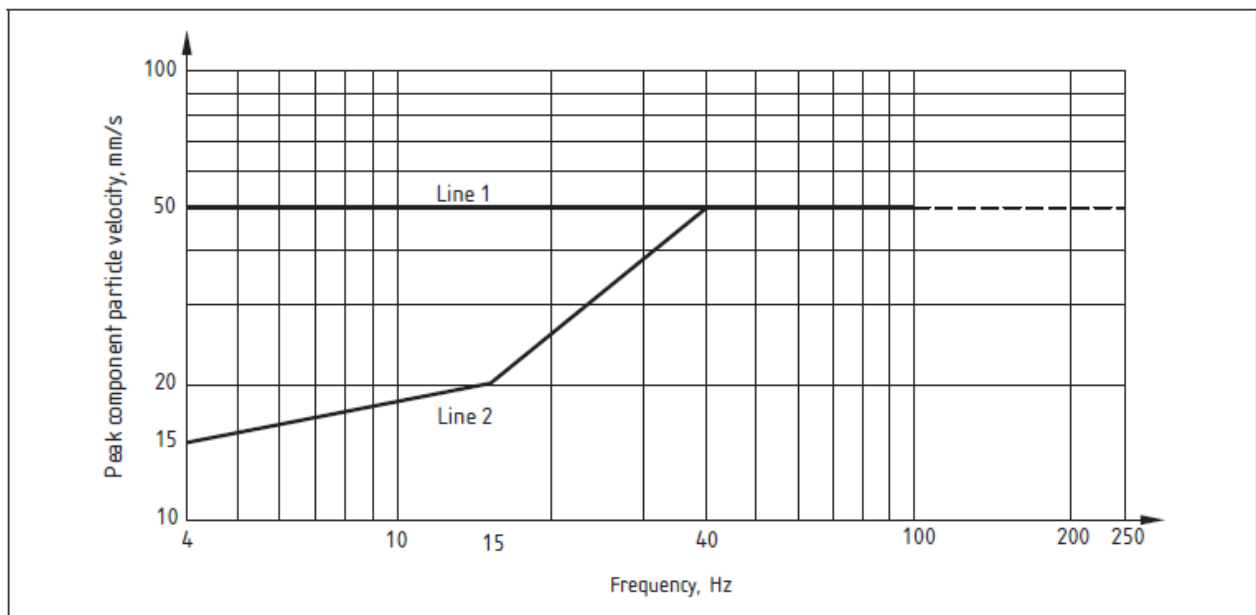
Further to the above criteria for human perception to vibration, the vibration and potential for building damage will be assessed using the criteria shown in Table 16-4.

Table 16-4 Transient Vibration Guide Values for Cosmetic Damage

Line (see Figure B.1)	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
2	Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
NOTE 1 Values referred to are at the base of the building.			
NOTE 2 For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.			

Figure 16.1 below shows the vibration response curves for buildings. The figure has been taken from BS5228: Part 2, Figure B.1.

Figure 16-1 Transient Vibration Guide Values for Cosmetic Damage



As described above in the section for construction noise, a significant effect is described as being Major or Moderate, with effects that are not significant described as Minor or Negligible. These definitions are taken from Table 5.3 in Section 5.3.

16.2 Baseline Conditions

16.2.1 Description of Existing Environment

The following baseline has been identified through a desk-based review of freely available information.

Aberaeron is a town located within a rural setting on the coast. However, due to its attraction as a tourist destination, it sees seasonal variations in noise levels. Aberystwyth is the closest large town, approximately 25km to the north. Background noise levels include those generated by local traffic and sounds associated with coastal settlements (winds, waves, birds and amenity users (including dogs and boats)). Potential Noise Sensitive Receptors (NSRs) in the vicinity of the works have been identified to include:

- Residential and commercial properties along Quay Parade e.g. the Harbourmaster Hotel;
- Residential and commercial properties around Pwll Cam e.g. The Hive, Monachty Hotel and Toad Hall;
- Residents located directly behind South Beach;
- Residential and commercial properties close to the site compound;
- Min-Y- Môr nursing home; and
- Local schools e.g. Aberaeron Primary School.

The different receptor areas are shown in in Figure 16-2.

Figure 16-2 Noise Sensitive Receptors



The Environmental Noise Directive 2002/49/EC, is intended to define a common approach to avoid, prevent or reduce the harmful effects from exposure to environmental noise. Under the Environmental Noise (Wales) Regulations 2009, Welsh Ministers have an obligation to produce noise maps to determine the number of people exposed to noise levels at certain limits from major roads, railways, airports and in large urban areas. The lowest predicted noise levels for these noise maps are 55 dB(A). A desktop review of the Welsh Noise Mapping identified no available noise map data for Aberaeron. This indicates no major road traffic or major transportation such as airports within the local area. Due to this and the nature of the area it is unlikely baseline noise levels for Aberaeron will exceed the 55dB_{L_{Aeq,16hr}}. Due to the Covid-19 pandemic and existing traffic flows not likely to be representative of typical conditions, a baseline noise survey has not been undertaken to confirm this.

16.2.2 Data Gaps and Limitations

Due to the global Covid-19 pandemic and the resulting non-representative traffic flows, a baseline noise survey has not been undertaken for this assessment. A baseline noise survey will be needed prior to construction commencing.

16.3 Likely Significant Effects

The Scheme description in Section 3 of this ES identifies five main elements of the proposed works. For the purposes of the noise assessment, the elements have been expanded to seven in order to better be able to distinguish the effects on different noise sensitive receptors. The construction programme is estimated to be 12 months overall.

1. Construction of a new rock breakwater extending out from the North Pier - (estimated duration 12 month). These works will include the removal of a concrete flood wall to provide permanent access to the new breakwater, preparation of the sea bed for construction, placement of rocks for the new breakwater and installation of ancillaries such as navigation markers.

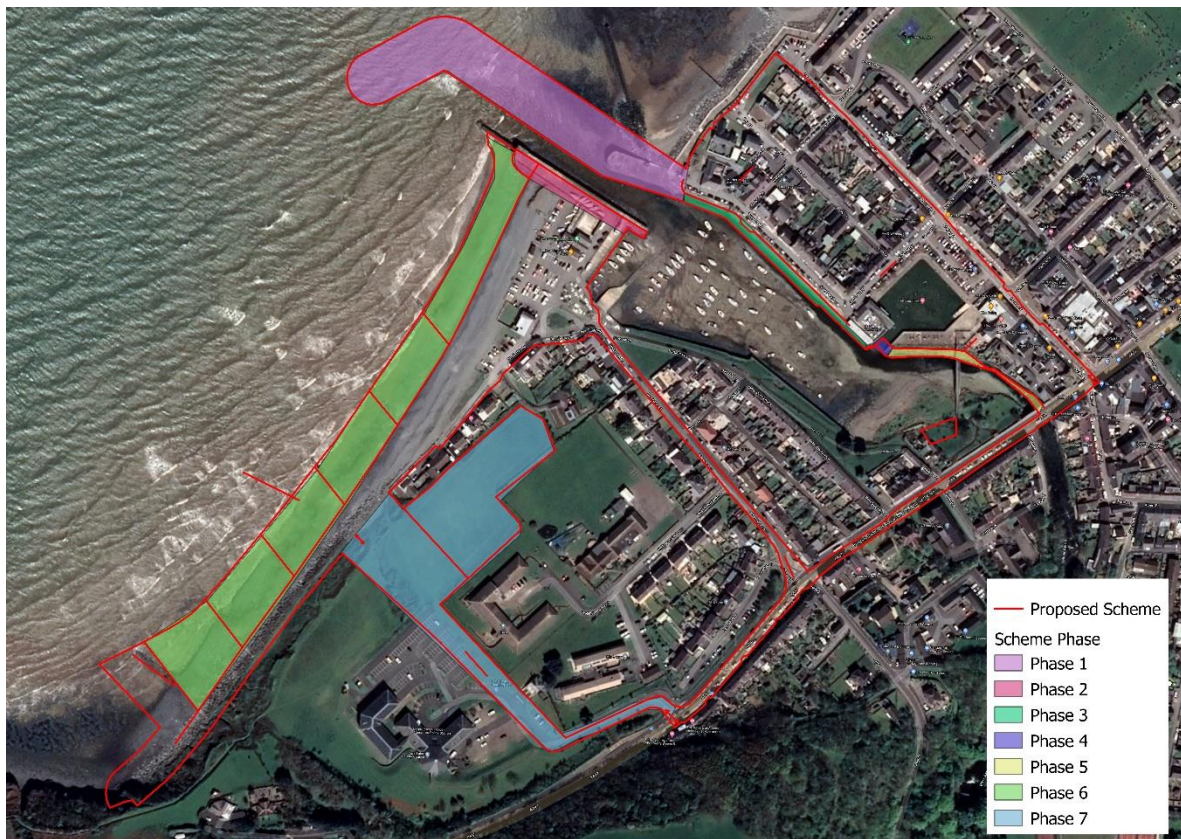
2. Refurbishment and re-building of the pier head, including grouting repairs of the walls - (estimated duration 6 months). Work will include the demolition of dilapidated parts of the existing pier, installation of foundations for rebuilding of the new pier, construction of the new pier head and grouting of the remaining length of the existing pier.
3. Flood wall construction at Quay Parade and Pwll Cam - (estimated duration 6 months):
 - Removal of the existing back flood wall along Quay Parade and reconstruction of a new masonry and glass wall, as well as grouting repairs of the existing quayside wall; and
 - Construction of a new masonry and glass wall flood wall between Pwll Cam and the Monachty Hotel (and connecting with the existing adjacent River Aeron flood wall between the Monachty Hotel and A487).

These works will include the removal and reinstatement of existing street furniture and the installation of tilt barriers.

4. Construction of a flood gate at Pwll Cam - (estimated duration 9 months). This phase of the works will include the installation of supporting piles and abutments for the flood gate and installation of the flood gate itself. A new control kiosk will also be constructed, which will take around 1 month to be installed.
5. Flood wall construction - raising of the existing River Aeron flood wall between the rear of the Monachty Hotel and the A487 referred to as the River Aeron wall - (estimated duration 6 month). This work will involve piling and installation of glass panels on top of the existing wall.
6. Improvements to South Beach - (estimated duration 9 months). The improvements to South Beach will include earthworks, removal and replacement of the existing timber groynes, rock placement for the revetment and shingle nourishment.
7. Site compound - (estimated duration 12 months). To enable the works a temporary site compound will be constructed on grassland adjacent to Aberaeron Primary School with a temporary site road being installed from the entrance road to the CCC/police station carpark. A plywood hoarding will be installed around the site compound for security reasons.

The approximate location of the phases is shown in Figure 16-3. It should be noted that multiple phases will be constructed simultaneously and not in the order numbered.

Figure 16-3 Construction Phases



16.3.1 Construction Noise

The construction noise assessment is based on the plant details in Appendix O, which has been derived from discussions with the design team. Relevant noise data has been taken from BS5228-1:2009+A1:2014.

Based on the information provided, predictions of construction noise likely to be derived from the Scheme have been made, to provide an understanding of the potential construction noise impacts at various distances from the proposed works, as shown in Table 16-5. These calculations do not take into account shielding provided by intervening ground or structures. Noise levels shown in orange in the table are considered to have the potential of generating significant effects during the daytime period; those shown in green are considered unlikely to have the potential of generating significant effects.

It is understood that construction works will mainly be undertaken during the daytime hours of 07:00 and 19:00. The exception to this is the installation of the flood gate during Phase 4 which may require night-time working for one night due to length of time needed to install it. Throughout the 12-month contract, a generator will be active in the site compound including during night-time hours. The generator will be enclosed within a noise attenuated unit to ensure noise impacts are minimised. For some of the marine works, the working hours will be determined by the tide times. The South Beach improvement works and South Pier works will be carried out at low tide during the 07:00 and 19:00 working period, with no night-time tidal working after 19:00. The initial work on the new breakwater will also require low tide working during the seabed preparation and commencement of rock placement. Once the breakwater level is above the tide level, tidal working will not be needed.

Table 16-5 Predicted Construction Noise Levels by Distance

Phase/Activity	Noise levels at distance (dBA)									
	10m	20m	30m	40m	50m	75m	100m	150m	200m	300m
1. Construction of a rock breakwater extending out from the North Pier										
Removal of concrete wave wall to provide permanent access to the new breakwater.	88	82	79	76	75	71	68	65	62	59
Excavation of seabed	78	72	69	66	64	61	58	55	52	49
Placing geotextile mat on seabed	70	64	61	58	56	53	50	47	44	41
Placing large rocks	87	81	78	75	73	70	67	64	61	58
Placing core rock – medium size rock	87	81	78	75	73	70	67	64	61	58
Concrete works for footpath	71	65	61	59	57	53	51	47	45	41
Ancillaries – lighting, navigation markers	78	72	69	66	64	61	58	55	52	49
2. Rebuilding and refurbishment of the seaward head of South Pier										
Demolition of dilapidated parts of existing pier	92	86	83	80	78	75	72	69	66	63
Piling	82	76	72	70	68	64	62	58	56	52
Piling – sheet piling	88	82	78	76	74	70	68	64	62	58
Wall grouting	83	77	73	71	69	66	63	59	57	53
Building new pier	71	65	61	59	57	53	51	47	45	41
3. Flood Wall Construction along Quay Parade and part of Pwll Cam										
Removal of existing street furniture	72	66	63	60	58	55	52	49	46	43
Removal of existing wall at Quay Parade	85	79	75	73	71	67	65	61	59	55
Concrete works for new wall elements	71	65	61	59	57	53	51	47	45	41

Installing glass wall elements	75	69	65	63	61	57	55	51	49	45
Tilt barriers	86	80	77	74	72	69	66	63	60	57
Reinstalment of street furniture and lighting	75	69	65	63	61	57	55	51	49	45

4. Construction of a flood gate at Pwll Cam

Piling	87	81	77	75	73	69	67	63	61	57
Wall strengthening	83	77	74	71	69	66	63	60	57	54
New concrete gate abutments	83	77	74	71	69	66	63	60	57	54
Mechanical and engineering works	86	80	77	74	72	69	66	63	60	57
Structural work to install flood gate	76	70	66	64	62	58	56	52	50	46

5. Flood wall construction – Pwll Cam to A487 road bridge

New flood wall at Monachty hotel – on piles (10m section)	81	75	72	69	67	64	61	58	55	52
Concrete shuttered wall with masonry cladding	85	79	75	73	71	67	65	61	59	55
Install concrete capping to existing wall	85	79	75	73	71	67	65	61	59	55
Drill in anchor rods into existing wall	83	77	73	71	69	65	63	59	57	53
Installing glass wall elements	75	69	65	63	61	57	55	51	49	45

6. Improvements to South Beach

Earthworks – excavation to place new rock armour	87	81	78	75	73	70	67	64	61	58
Rock placement for revetment	87	81	78	75	73	70	67	64	61	58
Removal of timber groynes	85	79	75	73	71	67	65	61	59	55
Pile drive groyne posts	84	78	75	72	70	67	64	61	58	55
Fix timbers to groynes	75	69	65	63	61	57	55	51	49	45

Deposit shingle arisings from excavations from breakwater	84	78	74	72	70	66	64	60	58	54
Placing large rocks with grab excavators	87	81	78	75	73	70	67	64	61	58
Placing core rock – medium size rock	87	81	78	75	73	70	67	64	61	58

7. Site compound

Enabling works and compound fencing	85	79	75	73	71	67	65	61	59	55
On site equipment	68	62	59	56	54	51	48	45	42	39

A number of key Noise Sensitive Receptors (NSR) areas – areas potentially sensitive to noise and vibration from the Scheme - have been identified, with an estimate made of noise levels that could be experienced from the Scheme. Each NSR represents a “realistic worst case” noise level that may be experienced at a number of receptors in the vicinity.

These calculations assume hard ground corrections. Intervening barriers and structures have been considered by including a correction of -5dB or -10dB depending on the angle of view where appropriate.

Both the lowest and highest predicted noise levels presented in Table 16-6 are “realistic worst case” predictions. However, for the different activities within each phase i.e. removal of concrete wall, excavation of seabed etc for Phase 1 (breakwater), this means that there will be periods of significantly lower noise levels when plant is working further away within this large working area. This is similar for Phase 6 (South Beach improvement works).

Noise levels shown in orange in the table are considered to have the potential of generating significant effects during the daytime period. Those shown in green are considered unlikely to have the potential of generating significant effects.

Table 16-6 Predicted Construction Noise Levels at Representative NSRs

Receptor ID ¹	Estimated ambient noise levels (L _{Aeq} , dB)	Phase 1 (Breakwater)		Phase 2 (South Pier)		Phase 3 (Flood wall: Quay Parade/Pwll Cam)		Phase 4 (Flood gate)		Phase 5 (Flood wall: Pwll Cam/A487 bridge)		Phase 6 (South Beach)		Phase 7 ² (Site compound)	
		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)		Construction noise levels (L _{Aeq} , dB)	
	Day	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest
NSR1	<65	31	51	30	52	50	65	56	67	57	67	35	47	24	41
NSR2	<65	52	76	48	70	61	75	40	51	39	49	48	61	30	47
NSR3	<65	36	56	47	69	48	63	50	61	43	53	53	65	48	69
NSR4	<65	43	61	45	67	33	49	36	47	34	44	75	87	50	67
NSR5	<65	33	51	35	56	33	48	36	47	35	45	59	71	64	91
NSR6	<65	28	47	29	51	30	46	35	46	34	44	38	51	49	75
NSR7	<65	40	58	41	63	41	56	45	56	44	54	56	68	55	81
NSR8	<65	31	50	32	53	33	49	38	49	37	47	43	55	55	81
NSR9	<65	31	51	32	53	37	53	42	53	41	51	37	50	35	61
NSR10	<65	41	60	41	62	36	51	41	52	40	50	38	50	35	52
NSR11	<65	45	65	45	66	51	66	54	65	52	62	52	64	36	53
NSR12	<65	42	62	42	64	52	67	56	67	56	66	47	60	33	50
NSR13	<65	29	49	32	54	37	52	43	54	42	52	35	47	30	47
NSR14	<65	40	60	40	61	51	66	58	69	59	69	34	47	29	46
NSR15	<65	38	58	38	60	47	61	53	64	69	79	42	55	36	53
NSR16	<65	39	59	39	60	48	63	55	66	75	85	43	56	37	54
NSR17	<65	44	64	42	64	50	66	54	65	52	62	46	59	38	55
NSR18	<65	46	67	45	66	77	92	64	75	56	66	49	62	41	58

Note 1: NSRs as shown on Figure 16-2.

Note 2: The highest noise levels for the site compound will be during periods of the initial earth works, before the erection of solid boundary fence.

In general, the works are considered to be temporary in nature with works moving sequentially. Through discussions with the design team it is unlikely that Phases 1, 2, 6 and 7 will exceed the significance criteria for 10 or more days within 15 days, or 40 days in over 6 months. There is the potential that for Phases 3, 4, and 5, there will be 40 days in a 6 month period, particularly at the eastern end of Market Street (NSR 16) and Quay Parade (NSR 18).

Should rock deliveries come by road (rather than by sea), a maximum of 49 truck movements per day are estimated to transport rocks to the site compound (see Table 15.11 in the Transport chapter). Rock will then be transported from the site compound via the beach to the breakwater. This will reduce the movement of HGVs through the town as far as reasonably practicable. The construction traffic routes from the quarry to the site compound are currently not known and will depend on the quarry selected by the contractor.

There will also be some further movement throughout the Scheme duration for “on demand” items, such as the glazing systems and prefab concrete structures for the top of the sea walls that will utilise Quay Parade.

It has been identified that Best Practicable Means (BPM) will be implemented to minimise noise impacts as far as reasonably practicable on the Scheme. The contractor shall be instructed to ensure this shall be enforced when on site. These general management measures as suggested in BS5228-1 are summarised in Appendix O for reference.

The following site-specific BPMs have been identified for each Phase of works:

1. **Construction of a rock breakwater extending out from the North Pier** - Vibration piling to be used where possible when installing piles for lighting and navigation structures.
2. **Rebuilding of the seaward head of South Pier** - Auger and vibration piling methods to be used where possible. Material from the site compound to be transported via the beach as much as possible, to reduce the need for use of Wellington Street.
3. **Flood wall construction along Quay Parade and part of Pwll Cam** - The existing flood wall will be removed in sections of approximately 5m in length rather than working along the full length of wall all at once. This will help to confine noisy activities in discrete locations and reduce the length of time that residents are affected by noise directly outside their property.
4. **Construction of a flood gate at Pwll Cam** - When installing the piles and anchors required for construction of the flood gate abutments, the contractor shall use vibratory or rotary piling methods where possible.
5. **Flood wall construction Pwll Cam to A487 road bridge** - Vibration piling to be used where possible to minimise noise impacts at nearby noise sensitive receptors.
6. **Improvements to South Beach** - As far as possible arisings from other activities such as the excavation of shingle from the seabed shall be used to minimise the amount of materials being transported or disposed from the site.
7. **Site compound and access road** - The site compound shall be enclosed within a solid plywood hoarding system to provide noise mitigation to noise sensitive receptors. The site compound access gate will be to the southwest away from sensitive receptors. The compound generator shall be enclosed within a noise attenuating unit to minimise noise impacts associated with continuous operation and shall be located as far from noise sensitive receptors as reasonably practicable.

The construction noise calculations would be reviewed following receipt of the contractor’s method statement. Measures to reduce construction noise will be detailed in the Construction Environment Management Plan (CEMP), along with further details of community liaison if required and an environmental monitoring plan.

With these BPMs in place, the significant effects shown in Table 16.6 in orange are considered to be reduced to **minor adverse** significance, with the exception of the noise sensitive receptors along Quay Parade, Pwll Cam and behind the River Aeron flood wall. Noise impacts for these receptors are considered to be **moderate adverse**, due to the proximity of the receptors and the construction methods taking place. Liaison with residents at these locations will be carried out to inform them of noisy activities and timescales.

16.3.2 Construction Vibration

Construction activities and plant that has the potential to cause significant vibration levels are summarised in Table 16-7 below. BS5228-2 includes measured vibration levels at different distances from significant vibration activities such as piling and ground compaction. Table E.1 of BS5228-2 also gives formulas for vibration as a function of distance for these sources. Based on the information provided in BS5228-2, representative peak particle velocity (PPV) vibration levels at 10m, 20m and 30m from the identified vibration generating activities are presented in Table 16-7.

Best Practical Means (BPM) with respect to vibration generating activities will be incorporated into the construction methods. These are described as follows.

- It has been assumed that percussive piling will be avoided and lower vibration generating rotary/auger and vibration piling will be the preferred method.
- Concrete saws will be utilised to remove the flood wall along Quay Parade to minimise the use of a hydraulic breaker where possible.
- Where piling is required in close proximity with existing stone walls, a condition survey and continuous vibration monitoring should be undertaken by the contractor to ensure no structural damage to the existing wall.

Table 16-7 Construction Vibration Levels

Phase/Activity	Plant	Vibration level PPV (mm/s)		
		10m	20m	30m
1. Construction of a rock breakwater extending out from the North Pier				
Removal of concrete wave wall to provide permanent access to the new breakwater.	Breaker mounted on wheeled backhoe	2.5	1.0	0.6
Ancillaries – lighting, navigation markers	Vibratory piling	3.0	1.2	0.7
2. Rebuilding of the seaward head of South Pier				
Demolition of dilapidated parts of existing pier	Breaker mounted on wheeled backhoe	2.5	1.0	0.6
Piling for foundation	Rotary auger piling	< 1.0	< 0.5	< 0.3
Piling for reinforcement on the side of existing pier	Vibratory sheet piling	3.0	1.2	0.7
3. Flood wall construction along Quay Parade and part of Pwll Cam				
Removal of existing flood protection wall.	Breaker mounted on wheeled backhoe	2.5	1.0	0.6
	Concrete saw	< 0.3	n/a	n/a
4. Construction of a flood gate at Pwll Cam				
Piling foundation under flood gate	Vibratory piling	3.0	1.2	0.7
	Breaker mounted on wheeled backhoe	2.5	1.0	0.6

5. Flood wall construction Pwll Cam to A487 road bridge

New flood wall at Monachty Hotel – on piles (10m section)	Vibratory piling	3.0	1.2	0.7

6. Improvements to South Beach

Pile drive groyne posts	Vibratory piling	3.0	1.2	0.7

7. Site compound and access road

Ground compaction	Road roller	2.9	1.2	0.7

Note: Vibration levels shown in orange are likely perceptible and may cause complaints; those shown in green are considered unlikely to cause complaints. All vibration levels are below those with potential to cause building damage.

The potential impacts at receptors adjacent to each of the seven phases are discussed below:

- 1. Construction of a rock breakwater extending out from the North Pier** - The nearest sensitive receptors are more than 50m away from any of the vibration generating activities and there are no anticipated vibration impacts. There are also no adjacent structures with the potential for structural damage.
- 2. Rebuilding of the seaward head of South Pier** - The nearest sensitive receptors are more than 50m away from any of the vibration generating activities, including Aberaeron Yacht Club, and no vibration impacts are anticipated. The adjacent harbour walls are not considered to be at risk of structural damage due to their distance from the pier head.
- 3. Flood wall construction along Quay Parade and part of Pwll Cam** - The nearest sensitive receptors and buildings are approximately 8m away from the works, except for The Hive restaurant which is immediately adjacent to the working area. In order to minimise the use of a hydraulic breaker, a concrete saw will be used to break down the wall in smaller segments prior to the breaker being used. There may still be perceptible levels of vibration above 1.0 mm/s PPV. However, the flood wall will be removed and rebuilt in discrete sections at a time, with the breaking out of concrete along each section anticipated to last for one day. The potential for perceptible vibration would only be for the removal of flood wall directly in front of a receptor, this means each receptor along Quay Parade and part of Pwll Cam would only have potential impacts for one day and therefore no significant adverse effects are expected. The vibration levels are below the criteria for the potential of structural damage.
- 4. Construction of a flood gate at Pwll Cam** - The flood gate abutment is connected to the stone wall that also forms part of The Hive restaurant. During the piling there will likely be perceptible vibrations above 1.0 mm/s PPV and significant impacts on the restaurant occupants. The piling work could occur over a period of 30 days with significant adverse effect. The contractor will be required to produce a method statement for the piling technique (vibratory or auger) including measures to reduce vibration impacts where possible in order to reduce the risk of structural damage. The contractor will undertake a building condition survey before the start of work and vibration monitoring should be undertaken during work to ensure vibration levels in the stone wall are kept below the structural damage criteria.
- 5. Flood wall construction Pwll Cam to A487 road bridge** - The nearest receptors are within 20m the piling works for the flood wall and there may be perceptible vibration levels at around 1.0 mm/s PPV. These receptors include residential properties behind the wall, the Monachty Hotel beer garden, Toad Hall and Conglfean. The piling work is estimated to be for less than 10 days and therefore no significant adverse effects are anticipated. The vibration levels at the nearest receptors are below the criteria for potential of structural damage. However, where the piling ties in with the existing stone wall a condition survey prior to construction as well as vibration monitoring during construction are recommended, to ensure vibration levels in the stone wall are kept below the structural damage criteria.

6. **Improvements to South Beach** - The nearest sensitive receptors are more than 50m away from any of the vibration generating activities and there are no anticipated vibration impacts. There are also no adjacent structures with the potential for structural damage.
7. **Site compound and access road** - The nearest receptor to the site compound is Min-Y- Môr nursing home approximately 20m away, followed by Aberaeron Primary School and the CCC/police station offices at approximately 85m. There is a potential for short term perceptible vibration levels during the construction of the access road and site compound. It is recommended that along the north-western site compound fence line “dead weight” rolling is utilised rather than vibratory rolling during ground preparation, to minimise potential vibration impacts. With this measure in place, and due to this aspect of the work to be of short duration, no significant adverse effects are anticipated. Vibration impacts from rock stockpiling is not considered to be significant as the rocks will be placed individually when offloaded from the HGV.

The above assessment shows that there are predicted short term vibration impacts during daytime hours at sensitive receptors adjacent to some of the work areas. However, these receptors will not be exposed to vibration impacts over a significant time period (10 or more days in any 15 day period) and no significant adverse effects are anticipated. The effects are assessed to be **negligible**. There are two locations, however, where piling will be required close to existing stone walls and BPM, as outlined above, will be required to ensure no structural damage is caused. These locations are The Hive during the flood gate work and the properties behind the river flood wall between Pwll Cam and the A487 road bridge. The effects at these receptors are considered to be **minor adverse**.

16.3.3 Operation

Following construction, there will be some operational noise in respect of the flood gate. The operating equipment which includes hydraulic actuators driven by electric motors will be located above MHWS in a kiosk building. The noise impact is mainly to those in close proximity to the control kiosk (which also mitigates noise as it is enclosed inside the kiosk), but the noise is fairly typical of hydraulic installations. There may be some noise of the gate closing and locking, but this is expected to be very infrequent as the gate closes on just the one occasion in advance of a flood tide and then once again after the flood recedes. It is not operating repeatedly as a lock gate would for instance and therefore the effects are not considered to be significant (**negligible**).

17 Air Quality

17.1 Method of Assessment

This air quality assessment considers the potential impacts identified in the Scoping Report (2019), these being construction phase vehicle emissions and construction phase dust particulates generated from the construction activities and movement of materials. All other aspects, including during the operational phase, were considered to have a negligible effect upon air quality and have therefore not been considered further in this assessment.

Since the publication of the Scoping Report, the design of the Scheme evolved to include a breakwater extending off the North Pier and flood gate across the entrance to Pwll Cam dock. These additions to the Scheme are not considered to materially change the potential effects identified in the Scoping Report. As such, this assessment comprises the following:

- A review of local air pollutants (NO₂, PM₁₀ and PM_{2.5}), local air quality management and regulatory / policy context;
- A summary of baseline conditions, including any measured ambient concentrations, in the vicinity of the Scheme and a comparison with the relevant air quality criteria;
- A qualitative assessment of the potential particulate matter and dust effects during the construction phase;
- A comparison of the changes in traffic flows on the local road network during the operational phase of the Scheme with the criteria for an air quality assessment; and
- Recommendations for mitigation to prevent or reasonably minimise any potentially significant effects.

17.1.1 Legislation, Policy and Guidance

Air Pollutants

In most urban areas in the UK, the main local source of air pollutants is road traffic. Emissions from vehicle exhausts contain a complex mixture of pollutants including oxides of nitrogen (a mixture of nitrogen dioxide and nitric oxide – dominated by the latter), particulate matter (PM), carbon monoxide, and hydrocarbons (including benzene and 1,3 butadiene). The quantities of each pollutant emitted depend upon the vehicle type, quantity and type of fuel used, engine size, speed of the vehicle and abatement equipment fitted. In recent years, the local air pollutants of greatest concern have been nitrogen dioxide and fine particulate matter (PM₁₀ and PM_{2.5}). In addition to these air pollutants from construction traffic, dust may be generated during the construction phase. Further information is provided below.

Nitrogen Dioxide

Nitrogen dioxide (NO₂) is generally produced by the oxidation of nitric oxide (NO) in ambient air (i.e. it is not formed directly and as such is known as a secondary pollutant). The pollutants NO and NO₂ are collectively termed oxides of nitrogen (NO_x). One third of UK NO_x emissions are from road transport²⁰ while a quarter are from other forms of transport. The majority of NO_x emitted from vehicles is in the form of NO, which oxidises rapidly in the presence of ozone (O₃) to form NO₂. In high concentrations NO₂ can affect the respiratory system, whereas NO does not have any observable effect on human health at the range of concentrations found in ambient air. High concentrations of NO_x can have an adverse effect on vegetation, including leaf or needle damage and reduced growth.

²⁰ http://naei.beis.gov.uk/overview/pollutants?pollutant_id=6 (accessed February 2021)

Deposition of pollutants derived from NO_x emissions contribute to acidification and/or eutrophication of sensitive habitats.

Particulate Matter

Particulate matter in vehicle exhaust gases consists of carbon nuclei onto which a wide range of compounds are absorbed. These particles have an effective aerodynamic diameter of less than 10 micrometres (µm). Particles in this size range are referred to as PM₁₀. Diesel engines produce the majority of particulate emissions from the vehicle fleet. Approximately 12 percent of PM₁₀ emissions in the UK are derived from road transport²¹. Particulate matter is associated with a range of symptoms of ill health including effects on the respiratory and cardiovascular systems, on asthma and on mortality. There is evidence that exposure to a finer fraction of particles (PM_{2.5}, which typically make up around two thirds of PM₁₀ emissions and concentrations) has a significant contributory role in human all-cause mortality and in particular in cardiopulmonary mortality²².

Dust

Dust is defined within the Institute of Air Quality Management (IAQM)'s "Guidance on the assessment of dust from demolition and construction" (IAQM Construction Dust Guidance)²³ as solid particles that are suspended in air or that have settled out onto a surface after having been suspended in air. It includes particles that give rise to soiling (deposited dust) and to human health and ecological effects.

The IAQM Construction Dust Guidance states that there is evidence that, without effective mitigation, major construction sites can lead to an increase in annual mean PM₁₀ concentrations and the number of exceedances of the short term 24 hour objective for PM₁₀. In addition, construction activities have the potential to cause higher than normal levels of dust deposition in the surrounding area. Dust emissions from a construction site may be mechanically generated due to land preparation (e.g. demolition, land clearing and earth moving) or released from site plant and from the movement of road vehicles on temporary roads, open ground and haul routes.

Air Quality Legislation

UK Legislation

There are two types of air quality legislation that apply in Wales:

- The EU (Withdrawal Agreement) Act 2020 which implements the European Union limit values; and
- Regulations implementing national air quality objectives: Air Quality (Wales) Regulations 2000 (SI 2000 No. 1940) and Air Quality (Wales) (Amendment) Regulations 2002 (SI 2002 No. 3182)^{24 25}.

Limit Values

The EU (Withdrawal Agreement) Act 2020 implements the air quality limit values that are included in the EU Directive on ambient air quality and cleaner air for Europe (2008/50/EC) and were previously included in air quality regulations (SI 2010 No.1433)²⁶. The relevant limit values in the context of this

²¹ http://naei.beis.gov.uk/overview/pollutants?pollutant_id=24 (accessed February 2021)

²² Air Quality Expert Group (AQEG) Fine Particulate Matter (PM_{2.5}) in the UK (2012), https://uk-air.defra.gov.uk/assets/documents/reports/cat11/1212141150_AQEG_Fine_Part particulate_Matter_in_the_UK.pdf (accessed February 2021)

²³ Institute of Air Quality Management (IAQM) (2014). Guidance on the assessment of dust from demolition and construction. <http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf> (Assessed February 2021)

²⁴ The Air Quality (Wales) Regulations 2000. Available at: <http://www.legislation.gov.uk/ukSI/2000/1940/contents/made> (Assessed February 2021)

²⁵ The Air Quality (Wales) (Amendment) Regulations 2002. Available at: <http://www.legislation.gov.uk/ukSI/2002/3182/contents/made> (Assessed February 2021)

²⁶ The Air Quality Standards Regulations 2010. Available at: <http://www.legislation.gov.uk/ukSI/2010/1001/contents/made> (Assessed February 2021)

assessment for the protection of human health for NO₂ and fine particulate matter are presented in Table 17-1.

Local authorities should contribute to achieving national air quality criteria through local action plans designed to reduce pollution levels in Air Quality Management Areas (AQMA), and through the recent targeted feasibility studies, including clean air zones where appropriate, to supplement the government's air quality plan for nitrogen dioxide in the UK²⁷.

National Air Quality Strategy

The 2007 Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland sets out the national air quality standards and objectives for a number of local air pollutants. The standards are set by expert organisations with regard to scientific and medical evidence on the effects of the particular pollutant on health, and define the level of pollution below which health effects are expected to be minimal or low risk even for the most sensitive members of the population. The objectives are targets for air pollution levels to be achieved by a specified timescale, which take account of the costs and benefits of achieving the standard, either without exception or, for certain short term averaging period standards, with a permitted number of exceedances. Local authorities have a responsibility (under Part IV of the Environment Act 1995, see below) to review and assess local pollution levels against these objectives.

It should be noted that the AQS objectives only apply in locations likely to have 'relevant exposure' i.e. where members of the public are exposed for periods equal to or exceeding the averaging periods set for the standards. For this assessment, locations of relevant exposure include building façades of residential premises, schools and public buildings; places of work (other than certain community facilities) are excluded.

In January 2019, the UK Government published its Clean Air Strategy²⁸, which sets out actions proposed by the Government to improve air quality by reducing pollution from a wide range of sources. Within the strategy, the Government sets an ambitious target to reduce the population exposed to concentrations of PM_{2.5} above 10 µg/m³ by 50% by 2025.

Local Air Quality Management

Under Part IV of the Environment Act 1995 all local authorities are responsible for Local Air Quality Management (LAQM), the mechanism by which the Government's AQS objectives are to be achieved. As part of this LAQM role, local authorities are required to periodically review air quality in their area and to assess present and likely future air quality against the objectives defined in Regulations. Where a local authority anticipates an objective is expected to be breached within their area, they must designate an Air Quality Management Area (AQMA) and develop an action plan to improve pollution levels and work towards achieving the AQS objectives. Under the current LAQM regime, a local authority is responsible for regular review and assessment of local air quality, reports on which are published following public consultation and review by the Department for Environment, Food and Rural Affairs (DEFRA).

Local authorities have no responsibility for achieving the national air quality criteria, although they should contribute to this through local action plans designed to reduce pollution levels in AQMAs.

Air Quality Criteria

The relevant statutory air quality criteria for the protection of human health are outlined in Table 17-1.

²⁷ DEFRA, UK plan for tackling roadside nitrogen dioxide concentrations, July 2017, Available at: <https://uk-air.defra.gov.uk/library/no2ten/index> [Accessed February 2021]

²⁸ Assets.publishing.service.gov.uk. 2019. [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/770715/clean-air-strategy-2019.pdf [Accessed February 2021].

Table 17-1 Statutory Air Quality Criteria for Relevant Air Pollutants

Pollutant	Objective
NO ₂	Hourly mean concentration should not exceed 200 µg/m ³ more than 18 times a year Annual mean concentration should not exceed 40 µg/m ³
PM ₁₀	24-hour mean concentration should not exceed 50 µg/m ³ more than 35 times a year Annual mean concentration should not exceed 40 µg/m ³
PM _{2.5}	UK (Except Scotland) annual mean concentration should not exceed 25 µg/m ³ † Exposure reduction^ (UK urban areas): target of 15% reduction in concentrations at urban background between 2010 and 2020*

† UK AQS objective is 25 µg/m³ to be met by 2020. limit value is 25 µg/m³ to be met by 2015, with a requirement in urban areas to bring exposure down to below 20 µg/m³ by 2020.

^ limit value exposure reduction target of 20% reduction between 2010 and 2020.

* 25 µg/m³ is a cap to be seen in conjunction with 15% reduction.

Dust

There are no national standards or guidelines for dust deposition currently set in the UK, or by any international organisation. This is mainly due to the difficulty that any standard set would need to relate to dust being a perceptual problem, rather than being specifically related to health effects. Typically, dust monitoring is undertaken with regard to Site Action Levels (i.e. the level above which mitigation may be required to reduce the likelihood of adverse impacts). In residential areas, the IAQM recommends Site Action Levels of a PM₁₀ concentrations of 190 µg/m³, measured as a 1-hour mean, or a dust deposition rate (as measured using a passive 'Frisbee-type' dust deposition gauge) of 200 mg/m²/day or greater.

Air Quality Planning Policy

National Planning Policy Framework

The Welsh Government's planning guidance of general relevance to air quality is found within the Planning Policy Wales document²⁹. It sets out the land use planning policies of the Welsh Government and ensures that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales. Section 6.7 refers to air quality:

"6.7.4 The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so."

"6.7.5 In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable."

²⁹ Welsh Government, Planning Policy Wales, December 2018, from: <https://gov.wales/sites/default/files/publications/2019-02/planning-policy-wales-edition-10.pdf>

“6.7.6 In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- not create areas of poor air quality or inappropriate soundscape; and*
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.*

“6.7.7 To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.”

Ceredigion Local Development Plan (LDP) 2007- 2022

The Ceredigion LDP was adopted in April 2013 (LDP1) and is a statutory plan which sets out policies and specific proposals for the development and use of land in Ceredigion for the 15 year period up to 31 March 2022. The document sets out the county’s planning objectives in relation to the protection and enhancement of the environment. These include the following policies and statements relevant to air quality:

“Objective 14: To protect and manage Ceredigion’s ecosystem services and natural resources, including soil, air, water and geodiversity, in order to maintain and enhance their value today and for future generations.”

“Policy DM22: General Environmental Protection and Enhancement. In order to help achieve environmental protection and enhancement, proposed development will be permitted provided that:

- 1. It protects and enhances where possible air, soil and the water environment and safeguards water resources, both on and off site;...”*

“8.202 The policy seeks to deliver the aims of Objectives 9 and 14 by ensuring that any new development does not negatively impact water, air and soil and does not lead to increased light and noise pollution.”

Non-Statutory Guidance

Development Control

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)’s ‘Land-use Planning and Development Control: Planning for Air Quality’ (2017) guidance (EPUK/IAQM Planning Guidance)³⁰ sets out to ensure that air quality is adequately considered in the land-use planning and development control processes. It comprises an initial screening stage to determine the need for an air quality assessment. If further assessment is required, a number of more stringent criteria are provided to help establish the need for further work, which may be either qualitative or quantitative, simple or detailed, depending on the impact of the development on, for instance, traffic flow. It also provides a framework for describing the magnitude of changes in local air pollutant concentrations at individual receptors (the impact) and gives advice on how overall significance may be assessed using professional judgement (the effect).

Construction Dust

The IAQM Construction Dust Guidance²³ provides a framework for a risk-based approach to the assessment of dust emissions from demolition and construction land development schemes and

³⁰ Environmental Protection UK and Institute of Air Quality Management (2017), ‘Land-Use Planning & Development Control: Planning for Air Quality’, <http://iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf> (Assessed February 2021)

outlines options for mitigation depending on the level of 'dust risk' identified for a site through the assessment process.

17.1.2 Method of Assessment

As already stated in Section 17.1, operational impacts are not considered in this assessment. Once constructed, the Scheme will operate passively with regards air quality and will require minimal ongoing works for repair or maintenance. There are therefore no potential sources of air quality impacts from the operation of the Scheme.

The IAQM Construction Dust Guidance³¹ provides a framework for a risk-based approach to the assessment of dust emissions from demolition and construction. The assessment of dust emissions during construction of the Scheme is considered in the context of the overall scale and nature of the development under consideration and the potential sensitivity of neighbouring land uses. The quantity and distribution of dust emissions varies according to type, duration and location of activity, weather conditions and the effectiveness of suppression (mitigation) measures. Good practice control measures that are "highly recommended" or "desirable" for dust control for the various dust risk categories are recommended.

Construction Dust Risk Assessment

Assessment of the potential impact of the construction phase of the Scheme on air quality with regards dust and PM₁₀ emissions has been carried out with reference to the four step process described in the IAQM Construction Dust Guidance³¹. These steps are summarised below:

- Step 1 (screening) – Identification of the number of human receptors within 350 metres of the boundary of the Site and/or within 50 metres of the route(s) used by construction vehicles on the public highway up to 500 metres from the Site entrance. Ecological receptors should also be identified within 50 metres of either the boundary of the Site and/or of the route(s) used by construction vehicles on the public highway up to 500 metres from the Site entrance. No further assessment is required if there are no receptors.

'Human' receptors include residential dwellings and other premises that may have a particular sensitivity to dust deposition or to the health effects of PM₁₀ e.g. vehicle showrooms, museums, long-term car parks, hospitals, schools and residential care homes. 'Ecological' receptors include sites with statutory designations e.g. Ramsar sites, Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI), as well as non-statutory sites such as local wildlife sites and/or locations with very specific ecological sensitivities e.g. horticultural operations.

- Step 2 – Assessment of the risk of dust effects by considering the area around the Site in the context of potential dust impacts and distances to nearby receptors in relation to proposed activities in terms of demolition, earthworks, construction, and trackout. Trackout can be defined as the deposition of dust and dirt from a construction site onto a public road network where it may then be re-suspended in the air by vehicles using the road network.

Dust emission magnitude classes of 'large', 'medium' and 'small' are used to define the level of risk arising from each activity depending on the nature and scale of operation.

The sensitivity of the area is defined as 'high', 'medium' or 'low' for dust soiling effects, human health impacts, and ecological impacts separately, taking into account the sensitivity of receptors, distance and number of receptors from dust generating activities, and other site specific factors (defined in the IAQM Construction Dust Guidance). In addition, for the effect on human health, background PM₁₀ concentrations are taken into account. The definitions are provided in Tables 2, 3 and 4 of the IAQM Construction Dust Guidance³¹.

- Step 3 – Site specific mitigation in terms of the identified risks is identified.

³¹ Institute of Air Quality Management (IAQM) (2014). Guidance on the assessment of dust from demolition and construction. <http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

- Step 4 – Assessment of the significance of the residual dust risk, after the application of the site-specific mitigation.

Tables 6 to 9 of the IAQM Construction Dust Guidance³¹ are used to define the risk of impact based on the dust emission magnitude and sensitivity of area. These are reproduced in Table 17-2 to 17-4 below.

Table 17-2 Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 17-3 Risk of Dust Impacts – Earthworks and Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 17-4 Risk of Dust Impacts - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Construction Vehicle Emissions

The need for an assessment of the effect of construction vehicle emissions on local air quality has been evaluated against criteria given in the EPUK/IAQM Land-Use Planning and Development Control Guidance³². An air quality assessment would be required where there is a change of Heavy Duty Vehicle (HDV) flows of more than 100 per day measured as an annual average daily traffic flow (AADT), or more than 25 within an Air Quality Management Area (AQMA).

From inspection of Table 15-11 in Chapter 15, it is unlikely that the threshold requiring an assessment would be exceeded for a Scheme of this size. No AQMA exists at Aberaeron. Furthermore, any effect on air quality from construction traffic will be temporary.

As such, no further assessment of construction vehicles on the local road network is required.

Construction Plant Emissions

The proposed development does not include any on site combustion sources which require a permit to operate or of a scale likely to cause significant impacts. This will be limited to small scale and low

³² iaqm.co.uk. 2017. [online] Available at: <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf> [Accessed February 2021].

numbers of construction plant and small scale generators to power electrical equipment and lighting where mains electricity is not a practical option.

Emissions from these small generators are likely to be minimal and unlikely to cause an impact at any on or offsite location. Very local impacts will be minimised by, wherever possible, siting the equipment away from receptors.

As such, no further assessment of construction plant within the Scheme boundary is considered.

17.2 Baseline Conditions

17.2.1 Description of Existing Environment

Local Air Quality Management (LAQM) & Air Quality Management Areas (AQMA)

The Scheme is within the boundary of Ceredigion County Council (CCC). CCC conduct an annual review process of air quality within the County, in accordance with Local Air Quality Management (LAQM) obligations, and present an annual update on progress.

The local authority currently does not have any declared AQMAs^{33,34}.

Air Quality Monitoring

CCC undertakes air quality monitoring as part of their commitment to LAQM. The monitoring network focusses on areas which are most likely to be exposed to elevated pollution levels, namely principal roads through urban areas.

There are no monitoring locations in the vicinity of the Scheme or Aberaeron. The CCC monitoring network includes eight locations, five within Aberystwyth, individual urban high street locations in Lampeter and Cardigan and an urban background location in Pendam. NO₂ concentrations at all locations (2013 to 2017 as presented in the most recent CCC LAQM report³³) were below the relevant AQS objective for annual mean NO₂, with the highest concentration recorded as 28.2 µg/m³ at the High Street, Lampeter. Monitored urban background NO₂ concentrations ranged from 3.3 to 4.3 µg/m³.

Pollutant concentrations within Aberaeron are likely to be lower than those measured by CCC, with little risk of an exceedance of an objective.

DEFRA Mapped Background Concentrations

Estimates of current year background pollutant concentrations in the UK are available on the DEFRA UK-AIR website³⁵. The background estimates, which are a combination of measured and modelled data, are available for each one-kilometre grid square throughout the UK for a reference year of 2018³⁶ and future year estimates up to 2030. These background estimates include contributions from all source sectors, e.g. road transport, industry and domestic and commercial heating systems.

Estimated annual mean background NO_x, NO₂, PM₁₀ and PM_{2.5} concentrations for the one-kilometre grid square appropriate for the Scheme location for the current year (2021) are presented in Table 17-5. The data indicate that background concentrations for NO₂, PM₁₀ and PM_{2.5} are well below³⁷

³³ Ceredigion.gov.uk. 2018. [online] Available at: <https://www.ceredigion.gov.uk/media/6110/air-quality-progress-report-2018-final.pdf> [Accessed February 2021].

³⁴ DEFRA UK Air – Air Information Resource. Available at <https://uk-air.defra.gov.uk/aqma/> [Accessed February 2021].

³⁵ Uk-air.defra.gov.uk. Background Mapping Data for Local Authorities - Defra, UK. [online] Available at: <https://ukair.defra.gov.uk/data/laqm-background-home> [Accessed February 2020].

³⁶ Projections in the 2018 reference year background maps and associated tools are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these tools do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns

³⁷ Defined as <75% of the air quality objective in footnote 6 to Table 6.3 IAQM Land – Use Planning Guidance

relevant AQS objectives for human health and that background concentration for NO_x are below the annual mean AQS objective for the protection of vegetation of 30 µg/m³.

Table 17-5 DEFRA 2021 Mapped Background Concentrations in the Scheme area (µg/m³)

Grid Square	Mapped Concentrations (µg/m ³)			
	NO _x	NO ₂	PM ₁₀	PM _{2.5}
245500,263500	4.0	3.3	8.8	5.6
245500,262500	5.2	4.2	9.4	6.0

Pollution Climate Mapping (PCM)

DEFRA's PCM model provides estimates of roadside concentrations of annual mean NO₂, which are used for reporting to the EU to demonstrate compliance with limit values. The model provides projected roadside concentrations of pollutants, for the years 2019-2030 inclusive, based on a 2018 reference year.

There are no PCM links in the vicinity of the Scheme. Two PCM links are located within the CCC area (A4120 and A44) however all were modelled as being compliant with the EU Air Quality Directive in 2021 and beyond.

Summary

A review of baseline air quality information indicates that the Scheme is not within an AQMA, there are no exceedances of AQS objectives at sensitive locations in the wider area and background concentrations are well below their respective AQS objectives.

Existing air quality at sensitive receptor locations in the vicinity of the Scheme can therefore be considered to be relatively good.

17.2.2 Data Gaps and Limitations

There is no air quality monitoring in the vicinity of the Scheme given that local air quality monitoring takes place in areas of potentially elevated pollutant concentrations. However, this is unlikely to lead to any limitations of the assessment.

17.3 Likely Significant Effects

17.3.1 Construction

Screening

In accordance with IAQM Construction Dust Guidance³¹, an initial screening assessment was carried out using Ordnance Survey base mapping and DEFRA's mapping website "Magic"³⁸ to determine the location and number of sensitive receptors within relevant distances of the Scheme.

The assessment identified more than one hundred human health receptors located within 350 metres (m) of the site (and within 50m of routes to be used by construction vehicles). Ecological receptors were also identified within 50m of the site (and within 50m of routes to be used by construction vehicles). These include the Cardigan Bay SAC, West Wales Marine SAC and the Aberarth – Carreg Wylan SSSI.

Screening Result – impacts at human and ecological receptors are required to be considered further.

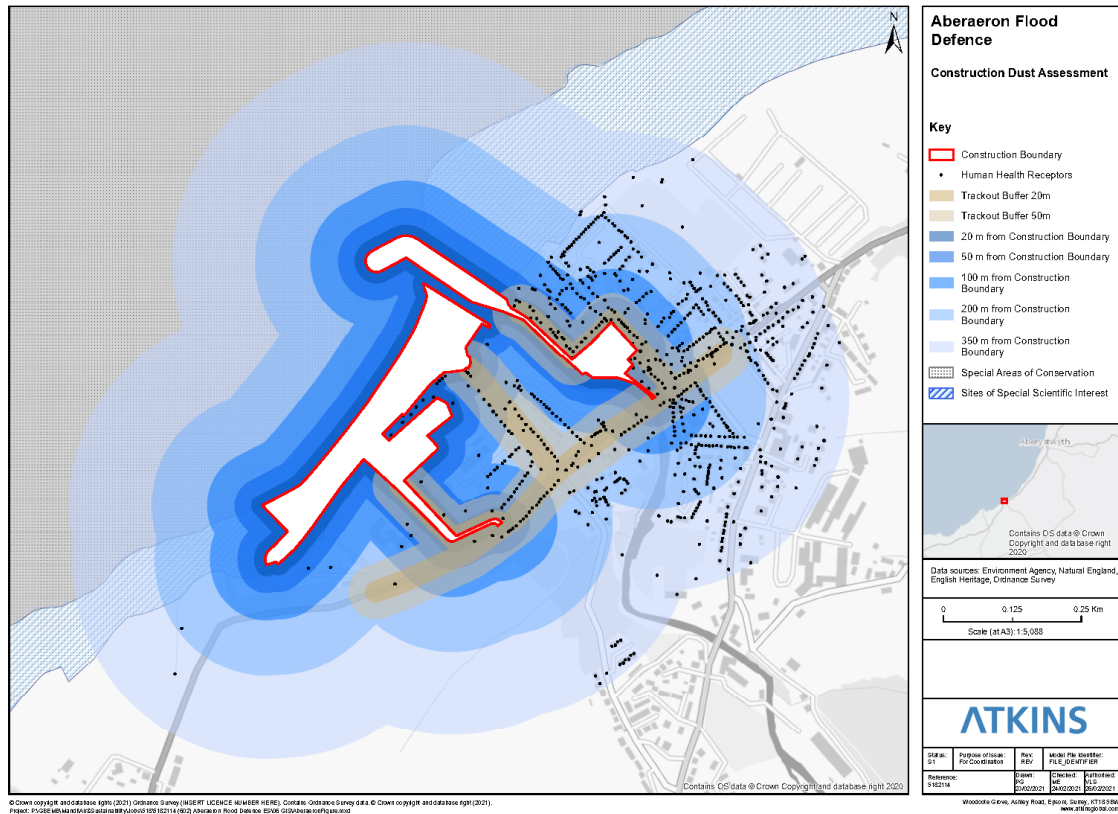
Assessment

In accordance with the selected assessment methodology, construction dust risk buffers were established at prescribed distances from the Scheme area. A diagram of the construction buffers

³⁸ Magic.defra.gov.uk. MAGIC. [online] Available at: <https://magic.defra.gov.uk/> [Accessed February 2021].

and locations of human and ecological receptors is presented in Figure 17-1. It should be noted that the planning application boundary differs slightly from this figure and includes the harbour entrance. This difference does not affect the buffer zones. The buffers include the main areas where construction activities would be taking place. Access routes such as the A487 and Wellington Lane are considered under trackout activities.

Figure 17-1 Construction Dust Assessment – Construction Risk Buffers



The following dust emission magnitudes were assigned and have been based on professional judgement:

- Demolition - a “small” dust emission magnitude is assigned.
 - Limited to the demolition of the head of the existing pier head.
 - Demolition activities will involve a total structure volume of less than 20,000m³.
- Earthworks – a “medium” dust emission magnitude is assigned.
 - Includes small amounts of backfill.
 - Assumes that there is no requirement for dredging activities that result in the storage of material on land within the considered Scheme area.
 - The total area of the Scheme is greater than 10,000m² classifying the site as “large”, however after consideration of the limited areas of earthworks and the other earthworks’ criteria, e.g. number of earth moving vehicles, soil type, formation of bunds <4m in height and total amount of material moved, are classified as ‘medium’ or below.
 - Given that the Scheme is likely to be completed in phases in a staged manner, the overall earthworks dust mitigation magnitude was classified as ‘medium’.

- Construction – a “medium” dust emission magnitude is assigned.
 - Includes construction of the harbour walls, Inner harbour gates and north beach breakwater.
 - Construction activities are categorised as “medium” due an estimated total building volume of between 25,000 to 100,000m³.
- Trackout – a “medium” dust emission magnitude is assigned.
 - As a conservative assumption, total outward HGV vehicle movements during the construction period could be, as a peak value, between 10 to 50 HGV outwards movements per day.

The following receptor sensitivity classifications were assigned:

- Dust Soiling – A “high” sensitivity was assigned
 - More than 100 sensitive receptors were identified inside the construction area and within 20m of the RLB and trackout areas.
- Human Health – A “medium” sensitivity was assigned
 - More than 100 residential receptors were identified inside the construction area and within 20m of the RLB.
 - annual mean PM₁₀ concentrations are below 24 µg/m³ in the area (see Table 17-5)
- Ecological Receptors – A “high” sensitivity was assigned
 - Statutory designated ecological receptors are located within the Scheme area.

The potential risk of dust soiling, human health and ecological impacts, given the dust emissions magnitudes and sensitivities described above, are summarised in Table 17-6. The assessment conclusion is that, if no mitigation measures were applied, a Medium Risk of impacts may be expected to occur.

Construction dust mitigation measures, proportionate to the risk of impacts, are discussed in Table 17-6 below.

Table 17-6 Summary of Expected Dust Risk

Activity	Receptor Sensitivity			Emission Magnitude	Summary of Dust Risk		
	Soiling	Human Health	Ecological		Dust Soiling	Human Health	Ecological

Demolition	High	Medium	High	Small	Medium Risk	Low Risk	Medium Risk
Earthworks	High	Medium	High	Medium	Medium Risk	Medium Risk	Medium Risk
Construction	High	Medium	High	Medium	Medium Risk	Medium Risk	Medium Risk
Trackout	High	Medium	N/A	Medium	Medium Risk	Low Risk	N/A

Mitigation

Construction works associated with the Scheme have the potential to generate dust emissions, which will require effective control/minimisation for the duration of the construction Scheme through a Construction Environmental Management Plan (CEMP) or similar.

Selected mitigation measures given in the IAQM Construction Dust Guidance²³ which are applicable to a “medium risk” construction site, such as this, are described below. Suggested measures include:

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Keep site fencing, barriers and scaffolding clean using wet methods;
- Ensure all vehicles switch off engines when stationary – no idling vehicles;
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- Impose and signpost a maximum speed limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- Use water-assisted dust sweepers on the access and local roads, to remove any material tracked out of the site;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;

- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable); and
- Access gates to be located at least 10 metres from receptors where possible.

Stakeholder communication is recommended, with community engagement both before and during work on site and the clear display of contact details for those responsible for dust issues on site. Any complaints and exceptional incidents should be logged along with the appropriate measures taken to reduce emissions.

Daily site management of emission control measures should be undertaken, with visual inspections of activities and control measures carried out especially during dry conditions. This should include recording of activities, controls, weather (wind direction, precipitation) and ground conditions, and observations of surface dust deposits at and beyond the site boundary near sensitive receptors.

With appropriate mitigation measures in place, any adverse effects resulting from the construction works should be minimised such that there is no significant residual effect on nearby receptors.

17.3.2 Operation

Operational impacts were scoped out of the ES during the EIA scoping assessment. There are no significant operational air quality impacts as a result of the scheme.

18 Climate Change

18.1 Method of Assessment

This section considers the potential contribution of the scheme construction and operation to climate change (primarily through emissions and energy consumption) and secondly the vulnerability of the scheme to climate change, including climate-related natural hazards. In terms of climate vulnerability and natural hazards, flooding is considered to be the key climate-related and natural hazard risk of relevance to the Scheme.

This assessment has been undertaken via a review of existing desktop information and considering the following relevant policies and guidance:

- IEMA Guide to Climate Change Resilience and Adaptation (IEMA, 2015);
- The Wellbeing of Future Generations (Wales) Act 2015; and
- The Environment (Wales) Act 2016.

The method of assessment of the significance of effects uses the methodology described in Section 5.3.

18.2 Baseline Conditions

18.2.1 Description of Existing Environment

Climate change is a large-scale, long-term shift in the Earth’s weather patterns and average temperatures, primarily as a result of anthropogenic greenhouse gas emissions (GHG). Some of the impacts of climate change include increased storminess, more frequent extreme weather events, sea level rise (SLR) and ocean acidification.

For Aberaeron the damaging effects of sea level rise and coastal erosion can be seen through the various flooding events which have impacted the town as discussed in Section 1.4. Evidence from tide gauges and most recently satellite data clearly shows that sea levels have risen since the start of the 20th century. In accordance with the Welsh Government guidance for adapting to climate change (Welsh Government, 2017), developments should allow for predictions in sea level rise as presented within Table 18-1. The table also provides the H++ scenario as presented in the UK Climate Change Projections 2009 (UKCP09) marine report, in order to show estimates of sea level rise beyond the likely range, but which may still be possible. UKCP09 has recently been updated in UKCP18 data and projections, however, the H++ scenario for marine climate change has not been updated and CP09 projections remain valid (Fung and Gawith, 2018).

Sea level rise may be further exacerbated by the movements in land masses since the last glacial period. For example, Cardigan Bay is sinking by approximately 0.4mm/year, in turn leading to higher relative rises in sea level for South Wales (HR Wallingford, 2012). Sea level rise predictions within Table 18-1 include predicted landmass movements.

Table 18-1 Predicted Mean Sea Level Rise in Wales

Sea level rise (mm/yr)	Period (years)			
	2017 - 2025	2026 - 2055	2056 - 2085	2086 - 2116
H++ Scenario	6	12.5	24	33

Annual change (mm/yr)	3.5	8.0	11.5	14.5

Source: Welsh Government, 2017

To provide a greater understanding of climate change predictions, the UKCP09 provides an overview of climate change in the UK. Under a medium emissions (A1B) scenario, regional summer mean temperatures in Ceredigion are projected to increase by between 0.9 – 4.5°C by the 2050s compared to a 1961-1990 baseline. Regional winter precipitation totals are projected to vary between -2% to +31% for the same scenario (Ceredigion Public Services Board, 2017). Impacts on human activity and the natural environment will depend on the more detailed climatic effects in particular locations (which adds more variability and complexity to forecasts), and on the nature of the man-made and the natural environment in those locations.

Welsh weather is dominated by Atlantic weather systems marked by a westerly or south-westerly air flow (especially pronounced for Ceredigion), with warm and damp summers and mild winters, and lower temperatures in uplands and inland areas away from the warming influence of the sea (Paris, 2016). As climate change progresses, Wales is expected to see more intense rainfall, more flooding in low-lying coastal areas as well as hotter, drier summers. The projections also foresee more milder and wetter winters with less snowfall and frost as well as lower ground water levels (NRW, 2018f).

UKCP18 data and projections were published at the end of November 2018 and are due to be published in new Welsh Government guidance in April 2021. The scheme has been designed on the current guidance (predating the release of this new guidance).

18.2.2 Data Gaps and Limitations

As detailed above the data is based on scientific advice and policy. Projections are assumptions of future change but will be updated by future guidance.

18.3 Likely Significant Effects

18.3.1 Construction

The construction stage of the Scheme will involve the consumption of natural resources to build the new structure, and the generation of GHG emissions during the production of construction materials, their transport to the scheme location and construction activities. Although the construction activities are relatively large for works in a small town like Aberaeron, the Scheme itself is relatively small scale and its construction is unlikely to significantly add to climate change through the generation of emissions or the use of resources. CCC procurement policies and Welsh Government policies and guidance, including actions under the Well-being of Future Generations Act, require consideration of sustainability and climate change. Where possible, local and sustainable material choices will be considered, and transport options will consider climate impacts. No formal climate calculations have been carried out.

The Scheme has integrated sustainable management of resources where possible, in line with the Sustainable Management of Natural Resources in Wales. This includes recycling material excavated for the breakwater and revetment onto the beach for the shingle recharge, and re-using some of the demolition material from South Pier in the re-construction of the pier-head. A Site Waste Management Plan will also be developed prior to construction, which will set out how waste and materials will be managed on site during the construction process.

Impacts on climate change as a result of the construction phase will be **negligible**.

18.3.2 Operation

Consideration of future climate change, and adaptation to climate change have been incorporated into the design of the Scheme, which will be designed in accordance with the guidance 'Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales

(2017)' in which new development should consider measures to help reduce effects related to climate change and to build resilience to the measures (mitigation and adaption). The design of the Scheme will further adhere to the 'Ceredigion Local Development Plan (2013) DM11: Designing for Climate Change' guidance.

The purpose of the proposed Scheme is to improve climate change adaptation and resilience by reducing the risk of flooding to Aberaeron. The heights of the structures have taken into account predictions of future climate change and flood risk over the life of the Scheme.

Operation of the Scheme will be passive and will not require any power, apart from operation of the Pwll Cam gate during times of flood. Post construction, there will be no need for large scale repair or maintenance works for several years and any are likely to be small scale in nature and are not anticipated to result in significant generation of GHG or other emissions. Therefore, there will be no significant impacts (**negligible**) on climate change as a result of the long-term operation of the Scheme.

19 Cumulative Effects

19.1 Introduction

The EIA Regulations require consideration of the potential cumulative impacts of a development within an EIA. Cumulative effects are not specifically defined within the EIA Regulations, but can refer to either intra-project (interactions within the proposed Scheme) or inter-project (interactions with other proposed developments) effects. For the purposes of this assessment the following definitions of cumulative effects have been used, as set out in Table 5-2 of the overarching EIA methodology:

- Intra-project effects: The potential interactive effects of several different types of impacts arising from the proposed development all acting on the same receptor; and
- Inter-project effects: The potential in-combination (or additive) effects of different developments acting on the same environmental receptors within a specific area.

These two types of cumulative effects are addressed separately by this Chapter.

19.1.1 Scope of issues assessed

The scope of intra-project effects has been defined through the assessment process documented in each of the technical Chapters (Chapters 6 to 18). The residual impacts identified in each Chapter are used as the basis for the assessment of potential intra-project effects. Two references were made to potential intra-project cumulative effects in relation to coastal processes/physical environment and ecology within the scoping opinion received from NRW (Appendix B). This was:

- *'Changes to the physical environment may or may not have a 'probable significant effect' on the environment under the EIA Regulations. However, this does not necessarily mean that they will not have an impact on designated habitat features of European Marine sites under the Habitats Directive'.*
- *'We note that the disturbance and direct loss to designated features within Aberarth-Carreg Wylan SSSI has been considered during the construction of the Scheme. Disturbance and loss of habitat within Cardigan Bay Special Area of Conservation (SAC) must also be considered. This is because at this stage there is not enough information to be able to conclude that there will not be changes to hydrodynamics and sediment transport as a result of the scheme which may have an impact on the features of the SAC. Particularly given that increases in suspended sediment and changes to hydrodynamics have been scoped in to the assessment'.*

The scoping opinion also provided a list of data sources that could provide useful information on other developments for the assessment of cumulative effects:

- Nationally Significant Infrastructure Projects Register;
- Developments of National Significance Register;
- Planning Policy e.g. Local Development Plans, Transport Plans (national and local) and National Policy Statements; and
- An up to date list of marine licensable developments.

A search of potential developments to be considered for the inter-scheme effects assessment was undertaken using all the references provided above. In addition, developments and activities that were potentially relevant to the Scheme were searched for on CCC's planning portal and searches of marine licence applications.

Searches of the CCC planning portal was made for planning applications validated and approved within the last three years (refer to Table 19-1). Not all developments listed on the planning portals were automatically included. Minor household applications were discounted as they are considered too small in scale to result in any significant effects. Major developments that required an EIA, and major non-EIA developments were included, although any applications that had been refused by CCC were discounted.

19.2 Assessment Methodology

19.2.1 Intra-Project Effects

The assessment of intra-project effects starts with the impact assessments contained within each technical Chapter of this ES. Each residual effect reported within the technical chapters of this ES has been considered for potential interactive effects with other environmental topics. This includes residual effects that have been judged to be non-significant (minor, negligible), as consideration should be given to whether a non-significant effect may become significant when considered cumulatively with other relevant effects (e.g. a risk of pollution that has been mitigated, but still exists and cannot be completely discounted). Where it has been concluded that an effect is non-significant because it has been avoided entirely (negligible only), for example where the timing of works means that a migratory species will not be present and cannot be impacted, it is discounted from consideration. Professional judgement is then used to consider the suite of residual effects taken forward for cumulative assessment, to identify the potential for interactions between different environmental topics and receptors. Where there are no potential interactions, a residual effect is scoped out and not considered further.

19.2.2 Inter-Project Effects

The methods used to identify other relevant developments for consideration of inter-project effects is documented in Section 19.1.1. The resulting list of developments and licensable activities is presented in Table 19-1. Professional judgement has been used to decide whether a development should be included for inter-scheme effects. This judgement is based on the scope of the individual environmental topic assessments within this ES, the understanding of the residual impacts of the Scheme, and supporting environmental information about these developments that was publicly available.

19.3 Intra-Project Effects

This section considers the potential for intra-project effects, where aspects of the Scheme may act together to generate multiple effects upon a particular receptor. The potential linkages between effects identified for different environmental receptors have been taken into account, where relevant, in each of the technical chapters (Chapters 6 to 18). The potential areas where interactive effects may occur during both the construction phase and the operational phase is discussed as follows.

There are potential pathways for intra-project effects in respect of the following:

- Coastal processes
 - Potential intra-project effects on ecological receptors, which may arise from changes in sediment transport processes causing potential accretion on areas of *S.alveolata* reef and mussel beds.
 - Potential intra-project effects on water quality, arising from changes in sediment transport processes.
- Water Quality:
 - Potential intra-project effects on ecological receptors, which may arise from changes to water quality and/or hydromorphology.

- Recreation and Tourism:
 - Potential intra-project effects associated with reduction in visitors to Aberaeron during the construction work leading to impacts on socio-economics.
 - Potential intra-project effects on human health from reduction in areas for recreation during the work.
- Historic Environment:
 - Potential intra-project effects from changes in landscape and views during construction and operation on the way historic features and the Conservation Area derive value from their setting.
- Landscape and Visual Amenity:
 - Potential intra-project effects on tourism and recreation, and socio-economics, from visitors potentially put off from visiting Aberaeron due to presence of construction work.
- Noise and Vibration:
 - Potential intra-project effects on recreation and tourism from noisy activities, which in turn could affect the socio-economics.
 - Potential intra-project effects on human health from disturbance.

The potential intra-project effects between the receptors above were all discussed in their respective chapters, with the impacts considered to be either negligible or minor adverse. In conclusion, there are predicted to be no significant intra-project effects as a result of the Scheme.

19.4 Inter-Project Effects

A search of the NRW public register identified no marine licence applications in close proximity of the Scheme. A search of CCC's planning portal identified two planning applications within 500m of the Scheme. These are shown in Table 19.1 below.

Table 19-1 Planning Application of Relevance to the Scheme

Development	Summary of relevant aspects	Potential interactions
Ceredigion County Council Full planning application – (A210065) and Listed building consent (A210257) The Hive – proposed roof deck above existing fishmonger to include removal of existing flat roof. Status – In Progress (planning application submitted Jan 2021 and listed building consent in March 2021)	The work would take place within The Hive's property boundary, with the proposed roof deck a replacement of the existing. A heritage impact assessment was carried out for the listed building consent due to the listed status of the quay wall. The new roof deck would be on raised stainless steel stilts with a glass balcony wall and is of modern appearance. View would be across the harbour from the deck.	This work will not affect the wall to the east of the Hive where raising of the wall with glass panels is proposed. The appearance of the roof deck has similar visual features to the proposed glass panels of the raised flood wall. No adverse interactions are anticipated.
Full planning application (A200805) and amendment	The work would take place on the seaward side of the hotel,	The works includes a glass screen along the boundary

(A210048)

Monachty Hotel – extension and alteration to existing hotel to be used in conjunction with the Cellar restaurant to include demolition of balcony terrace and erection of bar and WC building.

Status – Approved Nov 2020

which faces into the harbour and is backed by a flood wall along the River Aeron. Although the application has been approved, the applicant was advised in the decision notice to incorporate flood resilience measures into the design given the location of the site in a flood risk area.

common with the proposed glass panels of the flood wall raising.

CCC has initiated discussions to inform the applicant that CCC will need to construct the wall so that it would then become a flood asset which can then be maintained in the public interest.

There is potential for the developments when combined with the proposed Scheme to contribute to the magnitude of impacts on the following receptors:

- Ecology – disturbance to otters using the wall ledge on the river wall by the footbridge.
- Noise and vibration – disturbance from increased noise and vibration.
- Traffic and Transport – transportation of plant, materials and workforce to/from the sites.
- Landscape and Visual Amenity – disturbance from multiple construction projects around the harbour.
- Recreation and Tourism – disturbance from increased construction work around the harbour.

The two developments are not considered to be major construction projects. The amount of material, plant and staff required to undertake the works are relatively small. Once completed, the appearance of both developments will be similar in terms of the glass panels being used for the Scheme. CCC has been liaising with the owners of both development sites and will continue to do so in the future. In conclusion, there are predicted to be no significant inter-project effects as a result of the Scheme.

20 Conclusions

20.1 Purpose of the Scheme

Ceredigion County Council (CCC) has been developing a Scheme to provide increased protection to the town of Aberaeron from coastal flooding. The Scheme comprises the construction of a new breakwater, re-building of the dilapidated head of South Pier, raising of flood walls around the harbour, installation of a flood gate at Pwll Cam dock, and improvements to South Beach (replacement of the timber groynes and rock revetment, as well as beach recharge).

The Scheme has a 1 in 200 year design return period for wave overtopping within the harbour, with the rock revetment on South Beach having a 1 in 200 year standard of protection. The Scheme also provides a 1 in 1,000 year standard of protection against extreme sea levels for the design life (100 years) of the Scheme. The design of the Scheme has been carried out in line with the requirements of the Welsh Government for the development of residential areas in relation to flood risk (TAN15, Welsh Government 2014), as well as in line with guidance for flood and coastal erosion risk management and adaptation to climate change (Welsh Government, 2017).

20.2 Purpose of the Environmental Statement

This Environmental Statement has been prepared in relation to the Environmental Impact Assessment (EIA) of the Aberaeron Coastal Defence Scheme. A planning application for the Scheme will be submitted to CCC, as the local planning authority for the area. As parts of the works will also take place below the level of Mean High Water Springs, a Marine Licence must also be obtained from NRW. The ES will be submitted as a supporting document to both applications.

20.3 Design Evolution

Throughout the Scheme development there has been consideration of measures to avoid, reduce or mitigate potentially significant effects, and addressing issues highlighted by consultees (see Chapter 2.4). This has resulted in an iterative design process that has sought to 'design out' as many environmental impacts as possible.

Further recommendations have also been made during the Scheme development and within this Environmental Statement to ensure that the methods of construction also avoid or reduce potential impacts wherever possible.

20.4 Environmental Impacts and Proposed Mitigation

Through the EIA process, a number of beneficial (i.e. positive) and adverse (i.e. negative) likely significant environmental impacts have been identified. Wherever possible, and as a first course of action, measures have sought to reduce the significance of any adverse impacts during the development of the scheme designs. This has included altering or adapting the design of the scheme where necessary. However, where adverse impacts are still predicted, further measures (mitigation measures) have been identified to reduce their impact. The significance of the impact that remains after these mitigation measures are successfully implemented has then been determined (i.e. the residual significance). Table 20-1 and Table 20-2 present a summary of the environmental impacts of the scheme during and after construction. The recommended mitigation measures are set out in the relevant technical chapters of the Environmental Statement and are also included in the summary tables. A Construction Environmental Management Plan (CEMP) will be provided to the contractor containing these mitigation measures.

The primary residual impact of the Scheme is assessed as a beneficial one in that the scheme will significantly reduce flooding to Aberaeron and provide major benefits in terms of socio-economics, human health, and recreation and tourism.

During construction three significant but temporary short-term impacts have been identified. These are all short term and related to the impact of construction works. As these effects are fundamentally related to the presence of the construction works, there are no additional mitigation measures available that will reduce their significance. These impacts are on the historic Aberaeron Conservation Area from noise and visual intrusion of the construction activities, as well as the historic piers, quayside, and along Quay Parade and one of the fish traps; landscape and views around the harbour and beach caused by the construction work taking place; and noise impacts to residents and visitors along Quay Parade, Pwll Cam and behind the River Aeron flood wall due to the proximity to the construction taking place.

During the operational stage the Scheme will have significant long term adverse effects on the historic environment in relation to the quayside walls around the harbour in terms of the wall raising changing the way the quay is understood in the townscape and altering its appearance. There will also be a significant effect from the removal of surviving historic fabric from South Pier during the pier-head reconstruction. Given that these structures would be lost over time from flood and erosion damage without the Scheme, the effects are considered acceptable.

20.5 Cumulative Effects

The potential cumulative environmental effects of the Scheme have been considered, both within it, and with other relevant proposed developments.

Although there are pathways for intra-project effects to occur, none of the cumulative effects identified are significant. All potential interactions and influences have been addressed within the specific topic assessment chapters.

A search has been made of CCC's planning portal and the marine licence register. Two developments have been deemed necessary for further consideration in relation to inter- project cumulative effects. Both of these are located in the harbour area within 500m of the works and neither are considered to generate cumulative impacts with the Scheme.

Following further assessment of the relevant details of this scheme, no significant cumulative impacts have been identified.

20.6 Conclusions of the Assessment

This ES documents the EIA of the proposed Scheme, and a summary of the results of the assessment is provided in Tables 20.1 and 20.2.

A range of mitigation measures are identified in this ES, which have reduced the significance of adverse impacts to acceptable levels of residual effect. These measures will be included in a CEMP, which will form part of the project works information for the Contractor, thus ensuring that they are successfully implemented.

Overall, it is concluded that if all of the actions identified within this ES are taken forward, the Scheme can be implemented without very limited significant adverse environmental effects and with a range of significant positive environmental effects.

Table 20-1 Summary of Effects During Construction

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Recreation and Tourism					
Local Businesses, visitors	Tourists disturbed from noise and visual/ landscape impacts	High	Temporary, moderate adverse	Effect limited as the tourist season peaks over July and August	Moderate adverse
Visitors and residents	Access to South Beach prevented	Moderate	Temporary, minor adverse	Maintain access to North Beach and other recreational locations	Minor adverse
Visitors and residents	Tourists disturbed from noise and visual/ landscape impacts and short periods of restricted access	High	Temporary, moderate adverse	Ensure access restrictions are short duration and maintain access to majority of harbour quayside routes.	Moderate adverse
Visitors and residents	Localised diversions to walking routes	Moderate	Temporary, minor adverse	Ensure access restrictions are short duration, provide well marked diversionary routes	Minor adverse
Visitors and residents	Impact on navigation from the main harbour due to construction	Moderate	Temporary, moderate adverse	Issue Notice to Mariners and mark and buoy working areas	Moderate adverse
Visitors and residents	Impact on navigation from Pwll Cam due to construction	Low	Temporary, minor adverse	Provide alternative mooring locations.	Minor adverse
Visitors and residents	Fishing from South Beach and Piers prevented during construction	Moderate	Temporary, moderate adverse	Provide alternative mooring locations.	Moderate adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Human Health					
Local residents/ businesses	Loss of landscape and visual amenity	High	Temporary, minor adverse	See landscape and visual amenity.	Minor adverse
Local residents/ businesses/ Visitors	Potential to 'put off' tourists due to disruption, noise, restricted access to South Beach	High	Temporary, minor adverse	See recreation and tourism.	Minor adverse
Local residents /businesses	Noise impacts from construction activities	High	Temporary, minor adverse	See recreation and tourism.	Minor adverse
Local residents/businesses	Air quality impacts such as dust risk and emissions.	High	Temporary, minor adverse	See air quality.	Minor adverse
Socio-Economics					
Local Businesses/residents	Disturbance/Disruption impacts - activities such as noise and visual	High	Temporary, moderate adverse	See noise and vibration.	Moderate adverse
Local Businesses/residents	Access issues/alternative route impacts	High	Temporary, minor adverse impact	See traffic and transport.	Minor adverse
Local Businesses/residents	Increased traffic flow and disturbance to transportation and access	High	Temporary, minor adverse	See traffic and transport.	Minor adverse
Local Businesses/residents	Impacts to tourism such as festivals and other events	High	Temporary, minor adverse	See recreation and tourism.	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Local fishermen	Impacts to fishing	Medium	Temporary, minor adverse	See ecology and traffic and transport.	Minor adverse
Local Businesses/residents	Potential local employment opportunities	High	Temporary, minor beneficial	N/A	Minor beneficial
Ecology					
<i>S.alveolata</i> reef	Direct disturbance and damage from breakwater construction.	High	Temporary, minor adverse	As much of the construction of the breakwater as possible will take place from the top of the breakwater itself i.e. building the breakwater seawards and using sections already built as a working platform. Prior to construction, a habitat survey of the <i>S. alveolata</i> reef will be undertaken on South Beach and in the footprint of the breakwater to confirm that there is no reef present within the working area of South Beach and the piers. Should areas of reef have developed since the	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				2020 walkover survey, the contractor will avoid unnecessary movement over newly established reef areas. There will be no anchoring or beaching of any marine vessels on the reef. The contractors will be informed of the presence of the reef and its protected status.	
Mussel beds	Direct damage and disturbance during breakwater construction	High	Permanent, minor adverse	To reduce damage as much as possible, the construction of the breakwater will take place from the top of the breakwater itself to limit the working area. The contractor will be informed of the protected status of the mussel beds.	Minor adverse
<i>S.alveolata</i> reef and mussel beds and intertidal/subtidal ecology	Smothering from turbidity caused by work in the sea, harbour and river.	High	Temporary, minor adverse	Excavation will be carried out at low tide for the sections of breakwater that will be above MLWS.	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				For sections of the breakwater below MLWS, excavation is to take place under water. Geofabric mat to be positioned onto the seabed in the excavated footprint of the breakwater, to reduce washout of bed material beneath the rocks both during construction and in the future. Construction vehicles to utilise upper beach as much as possible, to avoid beach materials being washed out into the sea. Tipping of rock from the barge and rock stockpiling on the beach to take place as high up the intertidal zone as possible to reduce wash out of fines into the sea, with a nominated area identified for the rock delivery point on the beach which will be provided to the vessel operators Silt buster to be used before water from Pwll	

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				Cam is pumped into the harbour during cofferdam installation.	
Intertidal and subtidal ecology including <i>S.alveolata</i> reef and mussel beds	Pollution from spills and leaks from machinery for work in the sea, harbour and river.	High	Temporary, minor adverse	Best practice industry guidance to be followed by the Contractor.	Negligible
Fish	Entrapment from cofferdam during flood gate work in Pwll Cam dock	Medium	Temporary, minor adverse	Fish rescue to take place by a suitably qualified ecologist before water is pumped out of the dock.	Negligible
Marine mammals and fish	Noise and visual disturbance from marine works.	High/medium	Temporary, minor adverse	Piling operations will be undertaken at low tide and outside of the water column to reduce the generation of percussive noise in the water and a soft start approach will be used. The construction working hours are 7am to 7pm and therefore underwater night time sound will not be generated. Percussive noise will not be constant throughout the construction period and will be short term for the groynes and South Pier work only	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Marine mammals and fish	Turbidity from marine works	High/medium	Temporary, minor adverse	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 is to take place under water. Geofabric mat to be positioned onto the seabed in the excavated footprint of the breakwater, to reduce washout of bed material beneath the rocks both during construction and in the future. Construction vehicles to utilise upper beach as much as possible, to avoid beach materials being washed out into the sea. Tipping of rock from the barge and rock stockpiling on the beach to take place as high up the intertidal zone as possible to reduce wash out of fines into the sea, with a nominated area identified for the rock delivery point on the beach which will be	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				provided to the vessel operators.	
Marine mammals	Risk of collision from vessels delivering rock.	High	Permanent, minor adverse	The following mitigations will be implemented to reduce potential impacts: All vessel operators working on the Scheme will be given a briefing, alerting them to the possible presence of marine mammals in the area, and the guidelines for safe vessel operation in the presence of cetaceans. With implementation of this measure, the chance of boat strike resulting in physical injury or mortality of marine mammals will be extremely unlikely. Similarly, by observing the guidelines, vessels will be operated in an appropriate manner so that marine mammals will not be subjected to undue disturbance or harassed.	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				Vessel operators will be required to use predefined and regular routes, as these will become known to marine mammals using these waters. This measure will further serve to minimise disturbance to marine mammals due to vessel movements. The use of competent observer(s) to spot marine mammals along the Aberaeron frontage during high noise and vibration activities, in particular rock placement and piling operations. If cetaceans are observed, works will be delayed until they have left the area. This measure will ensure the area in the vicinity of works is clear of marine mammals prior to the commencement of works and will serve to reduce any disturbance to marine mammals. The need for marine mammal observers should be	

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				agreed with CCC and NRW. Prior to construction start, an assessment for use of the beach by seal pups should be assessed with continuing surveillance during August – November. In the event of seal pups being present on the beaches at Aberaeron, there will be a need to wait for seal pups to mature and to have gone to sea.	
Fish	Noise and vibration from piling for Pwll Cam flood gate and South Pier work	Medium	Temporary, negligible	A soft start approach will also be used for the piling to reduce startling of fish.	Negligible
Coastal meadow habitat, species and invertebrates	Disturbance from presence of site compound on coastal meadow.	Medium	Temporary, minor adverse	The existing topsoil and grass will be removed as part of the compound set up and stored for re-planting following construction. Prior to construction and depending on the ecological survey recommendations, the meadow will be harvested by CCC to collect the	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				seeds for re-planting and site re-instatement following construction. Seeds will also be sourced externally from the site for re-planting to encourage increased biodiversity.	
Reptiles	Disturbance from presence of site compound on coastal meadow habitat.	High	Temporary, negligible	Existing management regime, undertaken by CCC, is maintained to ensure no suitable habitat features for reptiles are introduced to site before its use as a site compound commences. During vegetation clearance, works will take place under a Precautionary Method of Working (PMW), including a pre-works survey of the affected area by an appropriately experienced ecologist, to ensure that reptiles which may have colonised the site since the survey do not come to harm.	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Otters	Impacts from noise, vibration and changes in water quality, as well as potential obstruction to migratory routes from work in the river.	High	Temporary, minor adverse	A suitably experienced ecologist will carry out a daily pre work survey when working in the River Aeron for otter resting places immediately prior to site works. Measures to reduce the risk of harm to commuting and foraging otter will include covering open trenches at night or providing a means of escape (such as a plank of wood) at night to prevent mammals becoming trapped, and safe overnight storage of plant, materials and equipment. Any lighting of the site during the hours of darkness will also seek to avoid suitable habitats for this species, such as the banks of the River Aeron and adjacent intertidal habitat.	Minor adverse
Birds	Disturbance from noise, visual disturbance, light disturbance, and loss of	Medium	Temporary, negligible	A pre-construction walkover by an ecologist to check for nesting birds	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	habitat for feeding and nesting.			within the construction footprint and advise on any necessary action to avoid disturbance. Mitigation measures to reduce the impact of noise are presented in the section on noise. All works, with the exception of installing the Pwll Cam flood gate, will be carried out at low tide and during daylight hours. The contractor will follow best practice procedures for working at night, including measures to minimise noise and directional lighting.	
Historic Environment					
Aberaeron Outer Harbour (Asset 4)	Temporary adverse impact on setting from construction works.	Low	Temporary negligible	None	Negligible
South Pier (Asset 7) (grade II listed building)	Temporary adverse impact to the asset as a result of noise and visual intrusion, and restrictions to access associated with construction activity.	Medium	Temporary moderate adverse	None	Moderate adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
North Pier (Asset 9) (grade II listed building)	Temporary adverse impact to the asset as a result of noise and visual intrusion, and restrictions to access associated with construction activity.	Medium	Temporary moderate adverse	None	Moderate adverse
Harbourmaster Hotel (Asset 12) (grade II listed building)	Temporary adverse impact to the value the building derives from its setting from construction activity associated with the breakwater and the flood wall along the quay, resulting in noise and visual intrusion which could affect the way the Harbour is appreciated in its setting.	Medium	Temporary moderate adverse	None	Moderate adverse
No.3-11 Quay Parade (Asset 13) (terrace of 10 grade II listed buildings)	Temporary adverse impact to the value the building derives from its setting from construction activity associated with the breakwater and the flood wall along the quay, resulting in noise and visual intrusion which could affect the way the Harbour is appreciated in its setting.	Medium	Temporary minor adverse	None	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Northeast Quay (Asset 14) (grade II listed building)	Temporary adverse impact to the asset as a result of noise and visual intrusion, and restrictions to access associated with construction activity.	Medium	Temporary moderate adverse	None proposed	Moderate adverse
Building complex at entrance to Aberaeron Inner Harbour (Asset 26)	Temporary adverse impact to the asset as a result of noise and visual intrusion, from construction activity.	Low	Temporary minor adverse	None	Minor adverse
Aberaeron Inner Harbour (Asset 28)	Temporary adverse impact to the asset as a result of noise and visual intrusion, and restrictions to access associated with construction activity.	Low	Temporary minor adverse	None	Minor adverse
No.1-9 Cadwgan Place (Asset 31) (terrace of 9 grade II listed buildings)	Temporary adverse impact to the value the terrace derives from its setting due to noise and visual intrusion resulting from construction activity at Pwll Cam and the Northeast Quay.	Medium	Temporary minor adverse	None	Minor adverse
No.9-17 Market Street (Asset 35) (terrace of 9 grade II listed buildings)	Temporary adverse impact to the value the terrace derives from its setting due to noise and visual intrusion resulting from construction activity	Medium	Temporary negligible	None	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	at Pwll Cam and the Northeast Quay.				
A Slipway in Aberaeron Inner Harbour (Asset 38)	Incorporation into temporary access ramp.	Negligible	Temporary negligible	None	Negligible
Aberaeron (Asset 92) (Conservation Area)	Temporary adverse impact to the value the conservation area derives from its setting as a result of construction activity taking place within and in proximity to the asset	High	Temporary moderate adverse	None	Moderate adverse
Aberaeron Fish Trap 3 (Asset 93)	Damage during replacement of groynes	Medium	Permanent moderate adverse	Archaeological survey and recording Protection during construction	Negligible
Aberaeron Fish Trap 1 (Asset 94)	Damage during replacement of groynes	Medium	Permanent minor adverse	Recording Protection during construction	Negligible
Landscape and Visual Amenity					
LCA 1 Aberaeron Townscape	Historic character diminished by the presence of construction	High	Temporary, Major Adverse	N/A	Major adverse
LCA 3 Cardigan Bay Cliffs	Construction will be visible including temporary fencing will diminish character	Medium	Temporary, Moderate Adverse	Screening of the site compound for security will also hide plant, equipment and site cabins.	Moderate adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
LCA 4 Cardigan Bay Intertidal Area (beaches) – North Beach	Construction will be visible including temporary fencing will diminish character	Low	Temporary, Minor adverse	Screening of the site compound for security will also hide plant, equipment and site cabins.	Minor adverse
LCA 4 Cardigan Bay Intertidal Area (beaches) – South Beach	Construction will be visible including temporary fencing will diminish character	Medium	Temporary, Moderate Adverse	N/A	Moderate adverse
Viewpoint 1 - Coastal path, approaching from the south. Dist. – approx... 700m away	The construction work will be focused specifically the north and south beaches and won't detract from the wider long-distance view available here. The construction activities within the harbour will be obscured by residential properties from this location.	High	Temporary, Minor Adverse	Screening of the site compound for security will also hide plant, equipment and site cabins.	Minor Adverse
Viewpoint 2 - Coastal path, near South Beach and Council offices Dist. – approx... 350m away	The proposals to South Beach and the majority of the breakwater will become visible from this location, with direct views of the site compound and construction activities on the South Beach and implementation of the breakwater.	Medium	Temporary, Moderate Adverse	Screening of the site compound for security will also hide plant, equipment and site cabins.	Moderate Adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Viewpoint 3 - Harbour Master and Harbour from the end of Harbour Lane Dist. – approx... 120m away	From this location the view towards the coloured terraces on Quay Parade will still be visible and construction activities will be focused nearer the ground plane. There will be occasions of construction plant navigating through the view.	High	Temporary, Moderate Adverse	N/A	Moderate Adverse
Viewpoint 4 - Harbour Lane, looking towards Harbour Master hotel Dist. – approx... 100m away	This view will be altered during the construction phase as it overlooks the construction work	High	Temporary, Major Adverse	N/A	Major Adverse
Viewpoint 5 - View of Pwll Cam from Pedestrian footbridge. Dist. – approx... 50m away	There will be an elevated view of Pwll Cam harbour and the construction taking place	High	Temporary, Major Adverse	N/A	Major Adverse
Viewpoint 6 - View of pedestrian bridge from Pwll Cam. Dist. – within development area	There will be a view of the construction work from the corner of the car park looking towards the pedestrian bridge, A487 road, residential properties and Holy Trinity Church.	High	Temporary, Moderate Adverse	N/A	Moderate Adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Viewpoint 7 - View of Quay Parade looking towards harbour entrance. Dist. – within development area	The view here is directly along Quay Parade towards the tourist information building and will overlook the construction works.	High	Temporary, Moderate Adverse	N/A	Moderate Adverse
Viewpoint 8 - View of north pier from the Coastal path approaching from the north. Dist. – approx... 50m away	The main views of the beach are obscured with an existing concrete sea defence wall.	High	Temporary, Minor Adverse	N/A	Minor Adverse
Coastal Processes					
<i>S.alveolata</i> reef	Physical disturbance and damage during construction of the breakwater.	High	Temporary, minor adverse	No construction work is to take place on North Beach. As much of the construction of the breakwater as possible will take place from the top of the breakwater itself i.e. building the breakwater seawards and using sections already built as a working platform. Prior to construction, a habitat survey of the <i>S. alveolata</i> reef will be	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				undertaken on South Beach and in the footprint of the breakwater to confirm that there is no reef present within the working area of South Beach and the piers. Should areas of reef have developed since the 2020 walkover survey, the contractor will avoid unnecessary movement over newly established reef areas. Construction vehicles are to restrict their movements to the upper areas of the beach as far as is practicable to reduce sediment mobilisation in the lower intertidal area. There will be no anchoring or beaching of any marine vessels on the reef. The contractors will be informed of the presence of the reef and its protected status.	
<i>S.alveolata</i> reef	Sediment disturbance from machinery and construction works,	High	Temporary, minor adverse	Excavation to be carried out at low tide for the sections of breakwater	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	releasing seabed and beach sediments into the water column.			that will be above MLWS. For sections of the breakwater below MLWS, excavation is to be carried out under water. Geofabric mat to be positioned onto the seabed in the excavated footprint of the breakwater, to reduce the washout of bed material beneath the rocks both during construction and in the future. Construction vehicles to restrict movement to the upper beach as much as possible, to avoid beach materials being washed out into the sea.	
Water Quality					
Surface water quality	Pollution from chemical leaks and spills	High/Medium	Minor adverse	Adherence to GPPs and CIRIA guidance. Contractor to produce a method statement detailing pollution prevention measures.	Negligible
Surface water quality	Sediment disturbance and release of sediment into the water column	High/Medium	Minor adverse	Use of geo-fabric mats in the breakwater footprint and within the Pwll Cam cofferdam. Construction	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				vehicles to use the upper area of the beach where possible. Tipping of rock from boat to be as far up the intertidal zone as possible to reduce fines being washed into the sea.	
Surface water quality	Sediment disturbance and release of contaminated sediments into the water column	High/Medium	Negligible	N/A	Negligible
Bathing Waters	Risk of discharges from the site compound	High	Negligible	N/A	Negligible
Groundwater	Pollution from chemical leaks and spills from machinery and risks of increased saline intrusion to the groundwater body during excavation.	Medium	Minor adverse	Adherence to GPPs and CIRIA guidance. Contractor to produce a method statement detailing pollution prevention measures.	Negligible
Soils and Ground Conditions					
Physical Effects (Ground conditions)	Soil Erosion Soil compaction and ground stability Impacts of topography	Low	Not significant/Negligible	Undertake further ground investigation to define risks and undertake ground improvement works to reduce impacts, if required.	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				Incorporate mitigation measures into the construction process, including the adoption of working methods to manage appropriately soil erosion and compaction, surface water runoff and groundwater during construction.	
Land Contamination (Human Health, controlled water and property receptors)	Contamination from unidentified sources	Medium	Not significant/Negligible	Undertake further ground investigation to define risks and undertake ground improvement works to reduce impacts, if required. Incorporate mitigation measures into the construction process, including the adoption of working methods to manage appropriately soil erosion and compaction, surface water runoff and groundwater during construction.	Negligible
Waste Soils and Soil Re-use:	Generation of waste soils	Low	Not significant/Negligible	Test any excavated materials and set re-use criteria. Minimise offsite disposal	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Traffic and Transport					
Road users	Increased traffic flows on A487 for bulk deliveries to site compound	Medium	Temporary, minor adverse	Traffic management plan to be produced to manage deliveries to the site compound	Minor adverse
Road users	Increased traffic flows from employee traffic travelling to/from Aberaeron	Medium	Temporary, minor adverse	Traffic management plan to be produced to manage movements of employees travelling to site	Minor adverse
Road users	Increased traffic flows from on-site construction vehicles moving within the working area	Medium	Temporary, minor adverse	Construction vehicles to avoid using Wellington Gardens during school drop off and pick up times of between 8-9am and 3-4pm. Traffic management plan to be produced to manage movements of construction vehicles throughout the working area	Minor adverse
Road users	Construction traffic moving to/from site compound in close proximity to CCC/police station carpark	Medium	Temporary, minor adverse	5mph speed limit to be implemented CCC/police station employees to be informed of the presence of construction vehicles.	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Road users	Temporary loss of car park spaces	Medium	Temporary, minor adverse	Consultation to be undertaken with Aberaeron Yacht Club to agree contractor use of the car park, particularly during winter due to use of the car park for winter boat storage.	Minor adverse
Pedestrians/Cyclists	Access along the Wales Coast Path temporarily restricted at North Pier, River Aeron footbridge and South Beach	Low	Temporary, minor adverse	Diversion routes to be provided and clearly signposted. Due to the proximity of the site compound to the Wales Coast Path, signs will be erected alerting the public to the presence of the site compound and heavy machinery in the vicinity	Minor adverse
Pedestrians	Increased traffic movements in CCC carpark and on entrance road, impacting on the safety of pedestrians and school children.	High	Temporary, moderate adverse	Contractor to have a traffic management plan in place that considers the sensitivity of this car park. This will include signs alerting the public to the presence of heavy machinery and plant in the area, adherence to a 5mph speed limit as well as a temporary pedestrian crossing across the contractor's access route	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				to the site compound. During school pick up and drop off, the contractor should consider placing a marshal at the crossing to ensure the safety of school children at this peak time. The contractor should also inform CCC, the police station and the primary school of their management plan for the car park. The contractor will also inform construction employees about the sensitivity of the site.	
Pedestrian/Cyclists	General disruption to access along Quay Parade and Pwll Cam due to areas being fenced off during construction	Medium	Temporary, minor adverse	Areas of work to be fenced off in discrete sections with adjacent areas to remain accessible for pedestrians along Quay Parade and Pwll Cam.	Minor adverse
Boat users	Navigation disturbance from construction vessels both offshore and within the harbour	Medium	Temporary, minor adverse	Notice to mariners to be issued. Signs to be erected at slipways. Contractor to liaise with Harbour Authority and Aberaeron Yacht Club	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				regarding programming of marine activities.	
Noise and Vibration					
Properties in close proximity to North Pier	Noise from piling operations for work to install lighting and navigation beacons on North Pier	High	Temporary, minor adverse	Vibration piling to be used where possible.	Minor adverse
Properties in close proximity to South Pier	Noise from South Pier works	High	Temporary, minor adverse	Auger and vibration piling methods to be used where possible. Material from the site compound to be transported via the beach as much as possible, to reduce the need for use of Wellington Street.	Minor adverse
Properties along Quay Parade and The Hive	Noise impacts from removal and rebuild of flood wall along Quay Parade	High	Temporary, moderate adverse	Flood wall to be removed in sections to help confine noisy activities in discrete locations and reduce the length of time that residents are affected by noise directly outside their property. Contractor to liaise with property owners where considered necessary in	Moderate adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				advance of noisy activities.	
Properties along Quay Parade, around Pwll Cam and The Hive	Noise from piling work for flood gate installation	High	Temporary, moderate adverse	Vibratory or rotary piling methods to be used where possible. Contractor to liaise with property owners where considered necessary in advance of noisy activities.	Moderate adverse
Properties along the River Aeron flood wall	Noise impacts from removal and rebuild of flood wall including piling work between Pwll Cam and the A487 road bridge	High	Temporary, moderate adverse	Vibration piling to be used where possible. Contractor to liaise with property owners where considered necessary in advance of noisy activities.	Moderate adverse
Properties close to the site compound e.g. Min-y-Môr	Noise from movement of construction vehicles to and from the site compound, movement within the site compound and the generator.	High	Temporary, minor adverse	Site compound to be enclosed within a solid plywood hoarding system. Site compound access gate to be located to the southwest away from sensitive receptors. Site compound generator to be enclosed within a noise attenuating unit and located as far from noise	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				sensitive receptors as reasonably practicable. Contractor to liaise with property owners where considered necessary.	
Quay Parade	Vibration impacts from flood wall removal	High	Temporary, minor adverse	Concrete saw to be used to break up the wall into smaller segments as much as possible in order to minimise the use of a hydraulic breaker. Removal of wall to be carried out in discrete sections at a time.	Negligible
The Hive	Vibration impacts from piling for flood gate	High	Temporary, minor adverse	Method statement to be produced for the piling technique (vibratory or auger) and measures to reduce impacts where possible. Pre-construction building condition survey to be carried out of The Hive. Vibration monitoring to be carried out during the piling work to monitor vibration levels in the stone wall are kept below the structural damage criteria.	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Min-y-Môr	Vibration impacts from site compound ground compaction works	High	Temporary, negligible	Dead weight rolling to be used where possible along the north-western site compound fence line rather than vibratory rolling during ground preparation.	Negligible
River Aeron flood wall structure	Vibration impacts where the piling ties in with the existing stone flood wall	High	Temporary, minor adverse	Condition survey to be carried out prior to construction as well as vibration monitoring during construction to ensure vibration levels in the stone wall are kept below the structural damage criteria.	Minor
Air Quality					
Human Health and Ecological	Impacts from Construction Dust	High	Significance should only be assigned to the effect after considering the construction activity with mitigation. Temporary. Not significant.	As described in Section 17.1	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Human Health and Ecological	Increase in HGV movements during the construction programme	High	Negligible. Temporary. Not significant.	None	Negligible, not significant
Human Health and Ecological	Use of construction plant within the Scheme area	High	Negligible. Temporary. not significant.	None	Negligible, not significant
Climate Change					
Natural Resources	Use of natural resources	High	Permanent, minor adverse	Consider source of materials used in the construction (e.g. whether from a source specifically identified for this scheme, or from a re-use of surplus material).	Negligible
Greenhouse gas emissions	Generation of GHGs	High	Permanent, minor adverse	Consider the choice of materials for any required ancillary structures, and the embodied emissions within them. Consider transport distances and emissions from vehicles used	Negligible

Table 20-2 Summary of Effects During Operation

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Recreation and Tourism					
Local Businesses, visitors	Improved flood protection preventing effects on tourism	Medium	Permanent, moderate beneficial	N/A	Moderate beneficial
Visitors and residents	Effect on navigation of the harbour and Pwll Cam	Medium	Permanent, negligible change	N/A	Negligible
Visitors and residents	Safety for boats and avoidance of damage	Medium	Permanent, major benefit	N/A	Major beneficial
Local Businesses, visitors and residents	Improved recreational benefits from seating, promenade and picnic area.	Medium	Permanent, moderate beneficial	N/A	Moderate beneficial
Human Health					
Local residents /businesses/ Visitors	Loss of visual amenity due to raised flood defence walls	Medium	Permanent, minor adverse	See landscape and visual amenity.	Minor adverse
Local residents/businesses/ Visitors	Landscaping and installation of picnic benches, new footpaths	Medium	Permanent, Moderate Beneficial, permanent	N/A	Moderate beneficial
Local residents/businesses	Reduced flood risk through improved flood protection (main aim of the scheme)	High	Permanent, Major Beneficial, permanent	N/A	Major beneficial

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Socio-Economics					
Local Businesses/residents	Improved flood protection (main aim of the Scheme)	High	Permanent, major beneficial	N/A	Major beneficial
Local Businesses/residents/visitors	Damage to tourism and recreation assets protected from the Scheme.	Medium	Permanent, moderate beneficial	N/A	Moderate beneficial
Ecology					
SAC and SSSI designated sites and features	Permanent loss of SAC and SSSI habitat	High	Permanent, negligible	N/A	Negligible
<i>S.alveolata</i> reef and mussel beds	Potential for smothering of reefs from accretion at tip of breakwater, along South Beach and in the 'V' shaped notch between North Pier and the terminal groyne on North Beach.	High	Temporary, negligible	Monitoring of seabed changes, with maintenance dredging if needed.	Negligible
Intertidal and subtidal ecology	Potential for increase in composition and abundance of epibenthic communities from colonisation of the new breakwater rocks.	Medium	Permanent, minor benefit	N/A	Minor benefit

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	Potential for breakwater to provide shelter for lobster and crabs.				
Otters	Improvement in commuting distance from extension of river wall ledge.	High	Permanent, minor benefit	N/A	Minor benefit
Coastal meadow habitat	Supplementing the stored seed stock collected from the field before construction with additional seeds to enhance biodiversity.	Medium	Permanent, minor benefit	N/A	Minor benefit
Historic Environment					
Aberaeron Outer Harbour (Asset 4) (HER 32541)	The presence of the flood wall a would have a permanent impact on the way the asset derives significance from its setting, as views will be altered, and key sight lines slightly impaired. The asset will also be impacted by the changes made to the piers and quay as the nature of the	Low	Permanent minor adverse	None	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	harbour and the way it is understood will be altered.				
South Pier (Asset 7) (grade II listed building)	Permanent adverse impact from the replacement of existing pierhead with concrete pre-cast panels and removal of any surviving historic fabric with in the pierhead. The fabric of the triangular crib groyne connected to the pier will also be damaged where it is cut to make room for the concrete pre-cast units.	Medium	Permanent moderate adverse	Historic building recording Monitoring during taking down of the pierhead	Moderate adverse
North Pier (Asset 9) (grade II listed building)	Permanent adverse impact from the construction of a breakwater extending from the pier, altering its setting and views of the structure.	Medium	Permanent minor adverse	None	Minor adverse
Harbourmaster Hotel (Asset 12) (grade II listed building)	Beneficial impact from increased protection from flooding. Permanent adverse impact on the value	Medium	Permanent minor adverse	None	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	that the asset derives from setting due to presence of new wall to Northeast Quay. .				
No.3-11 Quay Parade (Asset 13) (terrace comprising 10 grade II listed buildings)	Beneficial impact from increased protection from flooding. Permanent adverse impact on the value that the asset derives from setting due to presence of the flood wall to the Northeast Quay.	Medium	Permanent minor adverse	None	Minor adverse
Northeast Quay (Asset 14) (grade II listed building)	Permanent adverse impact from the presence of the wall 1.4m height along rear of the quay, changing the way the quay is understood in the townscape and altering its appearance.	Medium	Permanent moderate adverse	None	Moderate adverse
No.1-8 Belle Vue Terrace (Asset 23) (terrace comprising 8 grade II listed buildings)	Presence of the flood wall along Quay Parade and at the Inner Harbour would have a permanent adverse impact on the way the terrace	Medium	Permanent minor adverse	None	Minor adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	derives value from its setting, as principal views to and from the terrace across the harbour would be altered.				
Building complex at entrance to Aberaeron Inner Harbour (Asset 26) (HER 32536)	Raising the height of the south wall and constructing a harbour gate would have a permanent adverse impact on the way the asset derives significance from its setting, as views will be altered, and key sight lines slightly impaired.	Low	Permanent negligible	None	Negligible
Aberaeron Inner Harbour (Asset 28) (HER) 32535	Raising the height of the harbour wall and constructing a harbour gate would have a permanent adverse impact on the way the asset derives significance from its setting, as views will be altered, and key sight lines slightly impaired.	Low	Permanent negligible	None	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
No.1-9 Cadwgan Place (Asset 31) (terrace comprising 9 grade II listed buildings)	Beneficial impact from increased protection from flooding. Permanent adverse impact to the value the building derives from its setting from the changes to Pwll Cam and the Northeast Quay.	Medium	Permanent minor adverse	None	Minor adverse
No.1-10 Tabernacle Street (Asset 32) (terrace comprising 10 grade II listed buildings)	The proposed scheme will reduce the risk of flooding from future flood events.	Medium	Permanent minor beneficial	None	Minor beneficial
No.1-4 Harbour Lane, Island House (Asset 33) (terrace comprising 5 grade II listed buildings)	Presence of the flood wall along Quay Parade and at the Inner Harbour would have a permanent adverse impact on the way the terrace derives value from its setting, as views to and from the terrace across the harbour would be altered.	Medium	Permanent negligible	None	Negligible
No.9-17 Market Street (Asset 35) (terrace comprising 9 grade II listed buildings and two non-designated buildings)	Permanent adverse impact on the way the terrace derives value from its setting resulting from	Medium	Permanent negligible	None	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	alteration of between the terrace and outer harbour from presence of the new wall.				
No.1-7 Portland Place (Asset 42) (terrace comprising 7 grade II* listed buildings)	Presence of the flood wall around the Inner Harbour would have a permanent impact on the way the terrace derives value from its setting, as principal views to and from the terrace would be altered to a limited extent.	High	Permanent negligible	None	Negligible
Bradford House (Asset 47) (grade II listed building)	Presence of the flood wall around the Inner Harbour would have a permanent adverse impact on the way the building derives value from its setting, as views to and from the building would be altered to a limited extent.	Medium	Permanent negligible	None	Negligible
No.1-8 Market Street (Asset 49) (terrace formed by 6 grade II listed buildings and 2 non-designated buildings)	Beneficial impact from the new flood defences protecting the building from flood events in the future. Presence of the flood	Medium	Permanent negligible	None	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	wall would have a permanent adverse impact on the way the terrace derives value from its setting, as views from the rear elevation across the harbour would be altered to a limited extent.				
Aberaeron (Asset 92) (Conservation Area)	Beneficial impact from increased protection from flooding for the historic townscape to the north of the harbour. Permanent adverse impact from the presence of the breakwater and the stone-clad and glazed wall along the north side of the harbour altering the appearance of the conservation area and its setting, and altering key views.	High	Permanent minor adverse	Photographic survey	Minor adverse
Landscape and Visual Impact					

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
LCA 1 Aberaeron Townscape	Historic character diminished by the construction	High	Permanent, Minor Adverse	Finishes and materials selected to match those already present.	Minor adverse
LCA 3 Cardigan Bay Cliffs	Reinstatement of areas and removal of dilapidated beach structures will restore appearance	Medium	Permanent, Minor Beneficial	N/A	Minor beneficial
LCA 4 Cardigan Bay Intertidal Area (beaches) – North Beach	Reinstatement of beach to previous condition will restore appearance	Low	Permanent, Negligible	Selection of rock and form for breakwater matches those of other similar rock structures in vicinity	Negligible
LCA 4 Cardigan Bay Intertidal Area (beaches) – South Beach	Reinstatement of beach to previous condition will restore appearance	Medium	Permanent, Negligible	N/A	Negligible
Viewpoint 1 - Coastal path, approaching from the south. Dist. – approx... 700m away	Completion of the permanent works	High	Permanent, Negligible	The selection of materials in keeping of the character of the area will restore the views	Negligible
Viewpoint 2 - Coastal path, near South Beach and Council offices Dist. – approx... 350m away	Completion of the permanent works	Medium	Permanent, Negligible	The selection of materials in keeping of the character of the area and reinstatement of land will restore the views.	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Viewpoint 3 - Harbour Master and Harbour from the end of Harbour Lane Dist. – approx... 120m away	Completion of the permanent works	High	Permanent, Minor Adverse	The selection of materials in the new flood wall along with glazed panels will not overly detract from the character of the area. Weathering of materials with time.	Minor Adverse
Viewpoint 4 - Harbour Lane, looking towards Harbour Master hotel Dist. – approx... 100m away	Completion of the permanent works	High	Permanent, Minor Adverse	The selection of materials in the new flood wall along with glazed panels will not overly detract from the character of the area. Weathering of materials with time.	Minor Adverse
Viewpoint 5 - View of Pwll Cam from Pedestrian footbridge. Dist. – approx... 50m away	Completion of the permanent works	High	Permanent, Minor Adverse	The selection of materials in the new flood wall along with glazed panels, screening of the control structure with masonry will not overly detract from the character of the area.	Minor Adverse
Viewpoint 6 - View of pedestrian bridge from Pwll Cam. Dist. – within development area	Completion of the permanent works.	High	Permanent, Minor Adverse	Views of the built form and nearby Holy Trinity Church would be maintained and visible through the glass section of the wall.	Minor Adverse

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Viewpoint 7 - View of Quay Parade looking towards harbour entrance. Dist. – within development area	Completion of the permanent works	High	Permanent, Minor Adverse	N/A	Minor Adverse
Viewpoint 8 - View of north pier from the Coastal path approaching from the north. Dist. – approx... 50m away	Completion of the permanent works	High	Permanent, Minor Adverse	N/A	Minor Adverse
Coastal Processes					
Loss of SAC and SSSI habitat.		High	Permanent, minor adverse	Habitat survey to confirm that the reef has not grown and extended into the breakwater footprint will be carried out prior to construction.	Minor adverse
High Water Mark	The beach recharge will result in a small adjustment to the location of MHW, pushing it slightly further seaward by approximately 10m from the back of the beach. The new line of MHW will mean that	High	Permanent, Moderate beneficial	N/A	Moderate beneficial

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	a slightly larger area of beach will be maintained at high tide than existing. This is beneficial in terms of reducing the risk of wave overtopping.				
Wave heights	Significant reduction in wave heights as a result of the Scheme will reduce flood risk at Aberaeron.	High	Permanent, Major benefit	N/A	Major beneficial
Sediment transport	Interruption of longshore sediment transport from the new breakwater and accretion at the end of the breakwater, within the harbour and between the North Pier and groyne on North Beach.	High	Permanent, Minor adverse	Monitoring of bed levels to be carried out following construction, with maintenance dredging to remove excess sediment build up. Monitoring of sediment build up in the 'V' shaped notch between the North Pier and the groyne to also take place, with excess sediment removed and recycled if required.	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
Erosion	Improved protection from erosion on South Beach.	High	Permanent, moderate beneficial	N/A	Moderate beneficial
Flooding	The scheme will provide Aberaeron with greater protection from flooding by increasing the standard of protection to 1 in 200 years (from a combined wave and water level event).	High	Permanent, Major benefit	N/A	Major beneficial
Water Quality					
Hydromorphology (coastal)	Changes to local morphological conditions	High	Minor adverse	Monitoring of bed levels will be carried out following construction, with maintenance dredging taking place to remove excess sediment build up. The harbour is already routinely dredged by CCC to maintain navigation and this pattern of management will continue following construction. Arising from existing harbour	Not significant (Negligible)

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				dredging operations are deposited on South Beach and this method would continue with post-construction maintenance dredging.	
Hydromorphology (fluvial)	Work on the harbour/river wall raising and installation of the new flood gate at Pwll Cam, could potentially lead to changes in loss of flood storage and potential for increased water levels upstream.	High	Negligible	N/A	Negligible
Water Quality	Material washed into the sea from the beach nourishment could impact on turbidity.	High/medium	Negligible	N/A	Negligible
Soils and Ground Conditions					
Physical Effects (Ground conditions)	Soil Erosion Soil compaction and ground stability Impacts of topography	Low	Not significant/Negligible	Mitigation measures identified for the construction will be undertaken and will improve the condition of the Development with	Negligible

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
				regards to ground conditions for the operational phase. The Proposed Development will be operated in accordance with the relevant regulations	
Land Contamination (Human Health, controlled water and property receptors)	Contamination from un-identified sources	Medium	Not significant/Negligible	Mitigation measures identified for the construction will be undertaken and will improve the condition of the Development with regards to ground conditions for the operational phase. The Proposed Development will be operated in accordance with the relevant regulations	Negligible
Waste Soils and Soil Re-use:	Generation of waste soils	Low	Not significant/Negligible	Not applicable - waste soil generation is not anticipated to be part of the operational phase of the development	Negligible
Traffic and Transport					
Pedestrians/Cyclists	Improvements to pedestrian access	Medium	Permanent, minor beneficial	N/A	Minor beneficial

Receptor	Summary of impact	Sensitivity of receptor	Significance of effect before mitigation e.g. temporary/permanent, adverse/beneficial	Mitigation measures	Significance of residual effect after mitigation
	along Quay Parade from the widening of the promenade as well as the removal of the 'up and over' steps over the existing wall, with access to the promenade replaced with gaps in the wall created by the new tilt barrier locations.				
Noise and Vibration					
None	No impacts identified.	N/A	N/A	N/A	N/A
Air Quality					
None	No impacts identified.	N/A	N/A	N/A	N/A
Climate Change					
Local Businesses, visitors	Improved flood protection and resilience due to completion of the Scheme	High	Temporary, major beneficial	N/A	Major beneficial

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22 Abbreviations

Table 22-1 Definitions of Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Trips
AEP	Annual Exceedance Probability
AQMA	Air Quality Management Areas
AQS	Air Quality Strategy
ATC	Automatic Traffic Count
BAP	Biodiversity Action Plan
BPM	Best Practicable Means
BTO	British Trust for Ornithology
CBC	Common Bird Census
CCC	Ceredigion County Council
CEMP	Construction Environmental Management Plan
CERMAG	Coastal Erosion Risk Management Appraisal Guidance
CIRIA	Construction Industry Research and Information Association
CoP	Code of Practice
DEFRA	Department of Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EAP	Environmental Action Plan
EclA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
ES	Environmental Statement
EU	European Union
FCERM	Flood and Coastal Erosion Risk Management in Wales
FRAP	Flood Risk Activity Permit
GIS	Geographical Information Systems
GPPs	Guidance for Pollution Prevention
GQRA	Generic Quantitative Risk Assessment
GVA	Gross Value Added
ha	Hectares
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
HMWB	Heavily Modified Water Bodies
HRA	Habitats Regulations Assessment

HSCWB	Health, Social Care and Wellbeing
IAQM	Institute of Air Quality Management
IAQM	Institute of Air Quality Management
ICES	International Council for the Exploration of the Sea
INNS	Invasive non-native species
LAQM	Local Air Quality Management
LCRM	Land Contamination Risk Management Report
LDP	Local Development Plan
LDV	Light Duty Vehicle
LHA	Local Highway Authority
LNR	Local Nature Reserve
LVIA	Landscape and Visual Impact Assessment
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MHWS	Mean High Water Springs
MLT	Marine Licensing Team
MLWS	Mean Low Water Springs
NBN	National Biodiversity Network
NERC	National Environment Research Council
NMWTRA	North and Mid Wales Trunk Road Agent
NPPF	National Planning Policy Framework
NRW	Natural Resources Wales (Cyfoeth Naturiol Cymru)
NVC	National Vegetation Classification
OCV	Operational Construction Vehicles
ONS	Office of National Statistics
PAH	Polycyclic Aromatic Hydrocarbons
PCL	Potential Contaminant Linkage
PCM	Pollution Climate Mapping
pCSM	Preliminary Conceptual Site Model
PDZ	Policy Development Zone
PIC	Personal Injury Collision
PPGs	Pollution Prevention Guidelines
PPW	Planning Policy Wales
RIGS	Regionally Important Geological and Geomorphological Sites
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SINC	Site of Importance for Nature Conservation
SMP	Shoreline Management Plan
SPA	Special Protection Areas

SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVOC	Semi Volatile Organic Compounds
TANs	Technical Advice Notes
THLS	Trinity House Lighthouse Service
TPH	Total Petroleum Hydrocarbons
UK	United Kingdom
USC	Urban Service Centres
UXO	Unexploded Ordnance
VOC	Volatile Organic Compounds
WCA	Wildlife and Countryside Act
WFD	Water Framework Directive
WIMD	Welsh Index of Multiple Deprivation
WWBIC	West Wales Biodiversity Information Centre

Appendices



Appendix A – Figures

Appendix B – NRW Scoping Opinion

Appendix C – Public Consultation Survey Results

Appendix D – Integration of Scoping Opinion Comments into ES

Appendix E - Aberaeron Seabed Survey 2019

Appendix F – Habitats Regulations Assessment

Appendix G – Aberaeron Coastal Defence Scheme Heritage Desk Based Assessment

Appendix H – Archaeological Foreshore Survey and Watching Brief

Appendix I – Landscape Viewpoints Photographs

Appendix J – Landscape Constraints Plan

Appendix K – Historic LiDAR data Comparisons – South Beach

Appendix L – Water Framework Directive Assessment

Appendix M – Landmark Envirocheck Historical Maps

Appendix N – pCSMs and Risk Assessment

Appendix O – Construction Plant Noise Data

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