Method Statement Template

This template is intended to be used in conjunction with a Band 2 Marine Licence application. Please complete each section below following the guidance provided (max 500 words per section). For any queries relating to this template please contact: marinelicensing@cyfoethnaturiolcymru.gov.uk

1. Summary

Please provide a brief summary of the application including location of the works (coordinates - lat/long, decimal degrees). For activities that cover a large area please provide coordinates of the approximate extent of works.

Aberaeron Coastal Defence scheme is required in order to reduce the risks associated with coastal flooding within the town, to provide protection against predicted sea level rise, and to maintain the South Beach defences and Grade II Listed South Pier for the future. The seaward end (head) of South Pier is currently fenced off due to it being unsafe for use and is in need of reconstruction as this is a critical flood defence feature which maintains the shingle on the South Beach. The existing harbour flood walls are too low and need to be raised to provide protection from flooding now and in the future. The proposed scheme is made up of five key elements which are interlinked as integral parts to the flood defence scheme. These are as follows:

1. **South Pier** - Partial reconstruction of the seaward head of the South Pier and improving the durability of the remaining structure by grouting.
2. **Breakwater** - Construction of a rock breakwater extending out from the North Pier
3. **Harbour flood walls** - Raising parts of the set-back flood walls at Quay Parade and Pwll Cam with masonry and glass panels. Incorporating tilt barriers (flood gates) within these walls to maintain access. Improving durability of existing harbour walls by grouting. Raising the existing River Aeron wall with glass panels. Extending and constructing a new wall between the footbridge up to the rear of the Monachty Hotel. Biodiversity enhancements and amenity improvements are also provided.
4. **Pwll Cam gate** - Construction of a flood gate and control kiosk at Pwll Cam to maintain use of the inner harbour area.
5. **South Beach** - Improvements to South Beach in the form of removal and replacement of the existing timber groynes. Replacing and extending the existing rock revetment and placement shingle nourishment.
6. Refer to general arrangement drawing 5182114-ATK-MAR-GEN-DR-C-1000 indicating the main scheme structures proposed. The co-ordinates (Eastings and Northings) of the main structures below are accurate to the nearest 3m.
    - 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

2. Scope of works

Please provide a full description of <u>all</u> proposed works including:

- *Sequence of works (mobilisation, marine works, site remediation (if required))*
- *Estimated timing of works (duration, working hours, day/night, plus contingency)*
- *Plant, machinery or vessel required*
- *Estimated quantities (removals, deposits, construction materials)*

Sequence of the works, mobilisation and marine works
The works will take place as soon as the marine licence is received and following appointment of a suitable specialist contractor. Tenders are being sought for these works in August / September 2021 with a scheme start date in October 2021. Construction will commence with the new rock breakwater with the other scheme elements overlapping over the 12-month period. Access for the works will be required via a temporary access ramp from the site compound and to the South Beach. This will be for the excavators and dumpers to transport the rock to the temporary stockpiles below high water and to the new beach structures. The piling rig for the timber groynes and South Pier will also use this access.

At Pwll Cam there will be a requirement for a temporary access ramp from the existing slipway to allow plant such as a piling rig or crane to construct the new gate works. The gate will either be transported to site by road and use this same access ramp then being lifted by a crane; or will be transported on a floating barge towards the Pwll Cam harbour. The barge will be towed to site by sea and then moored in the harbour both during construction or whilst sheltering from adverse sea conditions. On route the barge may shelter in another appropriate harbour location (e.g. Aberystwyth/Fishguard).

Estimated Timings
The marine licence application requests a start date of October 2021 and an end date of at least October 2023. Works are expected to take around 12 months but an allowance of a further 12 months has been included for programme over-run and/or late construction start. It is possible that a contractor would not start the construction work as planned and commence in Jan to Mar 2022 and also as a result of the challenges of marine construction, adverse weather and tides that a further contingency of 6 months would be needed. The works below high water will take place during low tides and in daylight hours between 7.00am and 7.00pm. It should be noted that these durations are weather dependent and will rely on the contractor appointed and their detailed method statement.

Estimated Quantities
The main materials for the works below high water are the rock required for the breakwater. The approximate volume of rock required for the scheme is 88,000t which equates to 25 round trips per day over a period of 6 to 9 months to deliver the rock by road using heavy goods vehicles (HGVs). Alternatively, it is possible that some of this rock could be delivered by sea from Europe which would be loaded and transported by a barge. There will be a requirement for further imported materials i.e. timber groynes, masonry and concrete for the works but these quantities and transport movements are much less. 12,916m^3 of Shingle nourishment is sourced from excavated materials within the breakwater and 8,848m^3 from the area of the South Beach rock revetment – all within the works and does not require use of the public road network.

Plant, machinery and vessel required
The plant and machinery that will be used for the works includes: tracked excavators for digging holes, excavators with grab attachments for placing rock and laying geotextile, dumpers for transporting rock and shingle along the beach, dozers for spreading shingle, a piling rig for driving the timber piles required to the groynes on the south beach, a separate piling rig for driving the piles required for the South Pier, Pwll Cam gate and new walls required to the rear of the Monachty Hotel. For the grouting works a combination of scaffolding, negative Mobile Elevated Working Platforms (MEWP's), cranes with baskets and rope access teams to ensure as much as possible is carried out from the top of the walls. A barge with a crane will be required for the new Pwll Cam gate. Other plant will be brought in by road and will be working on the harbour bed at low tide (in the dry). Refer to section 5 for additional details and photos of the plant described above.

3. Access and working areas

Please provide details of access to the site and working areas. This should include:

- *Attached map of the access/egress route and working areas (annotated aerial image and/or OS map)*
- *Predicted plant/vehicle movements*
- *Storage areas for plant, equipment and materials (if required)*
- *Risks to navigation*

Access/egress route and working area
The site access and egress routes and red line boundary indicating the working area is shown on general arrangement drawing 5182114-ATK-MAR-GEN-DR-C-1000. Furthermore, drawing 5182114-ATK-MAR-GEN-DR-C-2001 indicates the Pwll Cam and River Aeron accommodation works which shows the temporary access ramps that are required to construct the works. A temporary cofferdam is proposed at Pwll Cam to enable work to be carried out in the dry.

Predicted plant/vehicle movements
The main materials for the works below high water are rock required for the breakwater. The approximate volume of rock required for the scheme is 88,000t which equates to 25 round trips per day over a period of 6 to 9 months to deliver the rock by road using heavy goods vehicles (HGVs). Alternatively, it is possible that some of this rock could be delivered by sea from Europe which would be loaded and transported by a barge. For the breakwater footpath which will be formed of concrete, it is estimated that there will be 4 deliveries to site per day over a period of 1 month, approximately 100 round trips. There will be a requirement for further imported materials i.e. timber groynes, masonry and concrete for the works, but these quantities and transport movements are much less. Shingle nourishment is sourced from excavated materials within the works and does not require use of the public road network.

Storage areas for plant, equipment and materials
The site accommodation and all plant will be stored in the site compound area which is situated above the high-water mark. All plant will be stored above high water after each shift. The site compound area is shown on drawing 5182114-ATK-MAR-GEN-DR-C-1000.

For materials, the rock for the scheme will initially be delivered to the site compound area above high-water mark. This rock will be transported to the South Beach and organised into temporary stockpile areas below high water prior to placement within the beach structures. Drawing 5182114-ATK-MAR-GEN-DR-C-2000 indicates the site compound area, beach access routes and temporary stockpile areas below high water. All other material will be stored above high water in the site compound area. However, there will be a need for rock armour to be placed temporarily adjacent to the existing footprint of the South Pier whilst it is being removed in order to act as a temporary flood defence.

Navigation
Navigational safety and lighting will be required for some of the works below high water, namely the breakwater as the harbour will still be in use. The works to the breakwater, South Pier, South Beach and Pwll Cam in the harbour area will be limited to daylight hours 'in the dry' i.e. during low tides only. This will prevent interference with harbour navigation access. For the gate to be transported by sea, this will be undertaken using a barge. The vessels will be lit and marked appropriately conforming to relevant code, including the MCA requirements. The harbourmaster will be notified of the dates of works, in advance.

In the unlikely event of an emergency the Harbourmaster will be contacted so that a Notice To Mariners can be raised and / or lighting or buoying installed if required to limit further damage, nuisance or incidents occurring. In the unlikely event that plant becomes trapped and has to be abandoned, the harbourmaster will be alerted, so that a notice to mariners can be raised. Depending on location and if deemed necessary, requirements to mark or light the obstacle until it is removed can be agreed with the harbourmaster. Conditions of contract will be placed to ensure that the contractor is responsible for the removal of any obstructions to navigation caused by abandoned plant.

4. Environmental mitigation

Please list appropriate mitigation measures to minimise impacts on the marine environment these may include:

- *Pollution prevention and control procedure (guidance available at: http://www.netregs.org.uk/media/1304/gpp-5-works-and-maintenance-in-or-near-water.pdf)*
- *Spill response kits*
- *Minimise plant traffic*
- *Designated access and egress routes, marking features such as historic fish traps on South Beach*
- *Storage of materials (fuel, chemicals, construction waste)*
- *Biosecurity (guidance available at http://www.snh.gov.uk/docs/A1294630.pdf)*

Note: To assist you, the following mitigation statements will be used as conditions within the licence. By signing this method statement you will be agreeing to adhere to these restrictions. If you are unable to do this, the application will not qualify as Band 2.

- Refer to Chapter 20 of the ES for a summary of all construction mitigations considered for the Scheme. General measures include:

✓ All equipment, temporary structures, access tracks, waste and/or debris associated with the works will be removed on completion of the works.

✓ Bunding, storage facilities and spill kits will be employed to contain and prevent the release of fuel, oils and chemicals associated with the plant, refuelling and construction equipment into the marine environment.

✓ Plant, vehicles and machinery will not be refuelled on the foreshore.

✓ Coatings and treatments will be suitable for use in the marine environment and are used in accordance with best environmental practice.

✓ All equipment, materials, machinery and PPE used will be in a clean condition prior to their arrival on site, and upon removal from site, to minimise risk of introducing non-native species into the marine environment.

✓ Visual detection of marine mammals will be carried out prior to works commencing and will not begin if marine mammals are present.

Please list your bespoke mitigations here:

✓ The conditions of contract will require that the contractor has arrangements for the emergency removal of plant and equipment which may need to be abandoned due to tides.

✓ Works will commence in daylight hours to enable marine mammal detection.

✓ The works in the harbour entrance will be undertaken in daylight hours and during low tides only which will prevent interference with harbour users.

✓ Sub tidal camera surveys have been undertaken of the sea-bed in advance of the works. The structures have been positioned using these surveys to identify impacts on biodiversity / protected sites.

Measures to minimise risk to the environment

Underwater Noise

The offloading and placing of rock will generate noise (above and below water). Also the piling and foundation works at South Pier, Pwll Cam gate, South Beach timber groynes will generate noise.

Fish

On the basis of best practice guidelines for assessing the effects of underwater noise on fish species (i.e. Popper *et al*., 2014), together with the magnitude of the noise likely to be generated as a result of the works, the risk to all fish species from mortality and potential mortal injury as a result of underwater noise, even in close proximity to the source is considered to be low. The most likely scenario is that during construction operations, fish present nearby would avoid the area during periods of elevated noise levels. The works are taking place relatively near shore in an area that allows fish to easily move away from the source of noise.

Marine Mammals

Bottlenose dolphin (*Tursiops truncatus*) and Grey seal (*Halichoerus grypus*) are designated features of the Cardigan Bay SAC. In addition, Harbour porpoise (*Phocoena phocoena*) are a designated feature of the West Wales Marine SAC. As the works will be undertaken in / near the Cardigan Bay SAC and West Wales Marine SAC, there may be noise disturbance to marine mammals during borehole drilling. In order to mitigate these potential impacts the following measures will be taken:

- The contractor will scan a radius no less than 100m (called the mitigation zone) around the location prior to works commencing.
- Works will not commence if marine mammals are detected in the mitigation zone or until 20 minutes after the last visual detection.
- The contractor will maintain a daily diary of any marine mammal observations along with a photographic record of any sightings with approximate positions.
- Soft start procedures will be used where possible. Activities will be built up gradually until full operational activity is achieved. The duration of the soft start procedures should not be less than 20 minutes. This is to allow for any marine mammals in the vicinity to move away from the noise source.
- Following the soft start, there is no requirement to reduce power if a marine mammal is detected in the mitigation zone.
- For each area, works will commence during daylight hours to ensure visual examination of the mitigation zone can be undertaken.

Habitat

The works have been planned and positioned to provide protection for the coastal defence scheme. We have undertaken sub tidal camera surveys of the seabed in the area of the proposed investigation to provide information on the subtidal habitats present in and around the area of the investigations and the coastal defence scheme. *S.alveolata* reef and rocky reefs are designated features of the Cardigan Bay SAC. The seabed of the Cardigan Bay SAC is patchy forming a mosaic of seabed types, however the reef (see Figure 1) is located primarily in the intertidal and shallow subtidal environment near to where the rock breakwater is to be constructed, see 5182114-ATK-MAR-GEN-DR-C-1000 for the works.

The breakwater is located on or near SLR.MX.MytX (*Mytilus edulis* beds on eulittoral mixed substrata) and SLR.Fx.FcerX (*Fucus ceranoides* on reduced salinity eulittoral mixed substrata). The South Pier works will be undertaken adjacent to MLR.Sab.Salv (*Sabellaria alveolate* reefs on sand-abraded eulittoral rock). The transport routes may be on or adjacent to these.

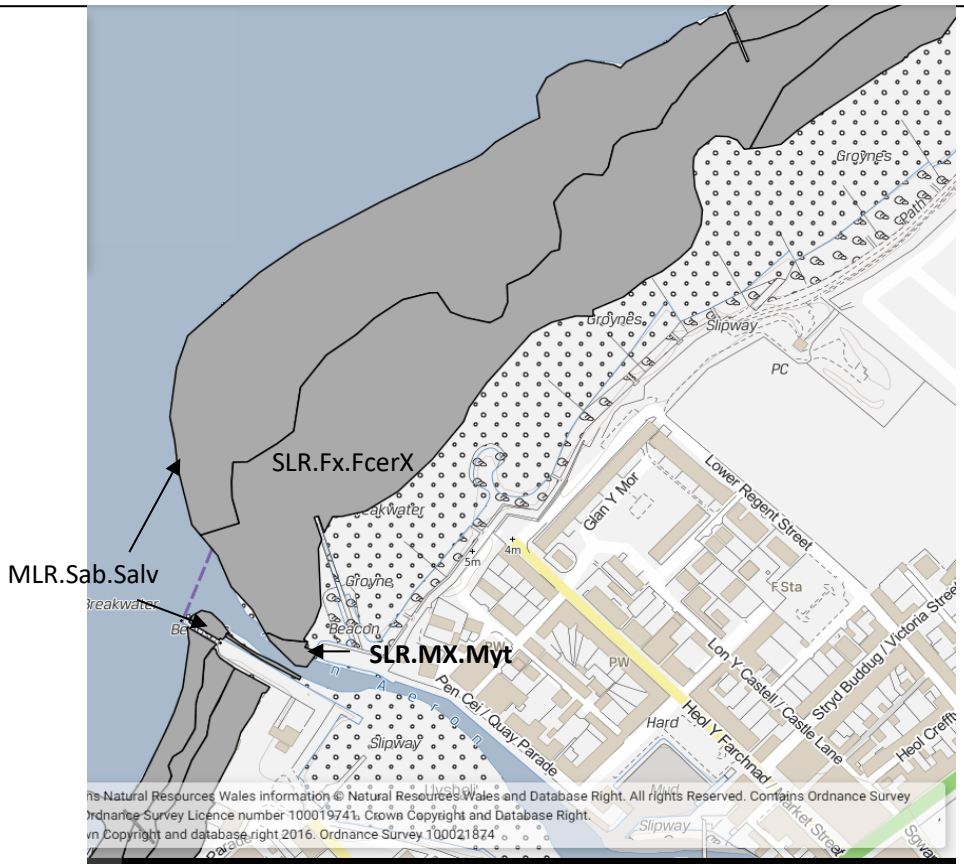


Figure 1: SAC Designated Habitats (Source: lle.gov.wales/map [Accessed 27/11/2019])

There is no data on the area of the individual features (the SAC as a whole covers a total area of 960km^2). The map in Figure 1 indicates that both Mytillus and Sabellaria reefs extend for a significant area north of Aberaeron, along the coast. The location of the works is at the southern edge of this particular section of reef feature.

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 SAC is 0.0000113% and SSSI is 0.04%. A walkover survey in the summer 2020 and the subtidal video survey confirmed there is no established Sabellaria reef area currently present in the footprint of the breakwater. The total area of mussel bed habitat which will be lost within the footprint of the breakwater is 2942m2 which is 0.00060% loss of habitat. Therefore, the impact of permanent habitat loss is assessed as minor adverse.

Please list any additional information that may help with the application:

- *Consents/permissions required*
- *List of plans or drawings attached to method statement*
- *Emergency procedures*
- *Contact details*

5. Additional Information

The following additional information is provided separately in addition to the application form and method statement:

List of drawings and additional documents

For a detailed method statement for each individual aspect of the works please refer to section 5.1

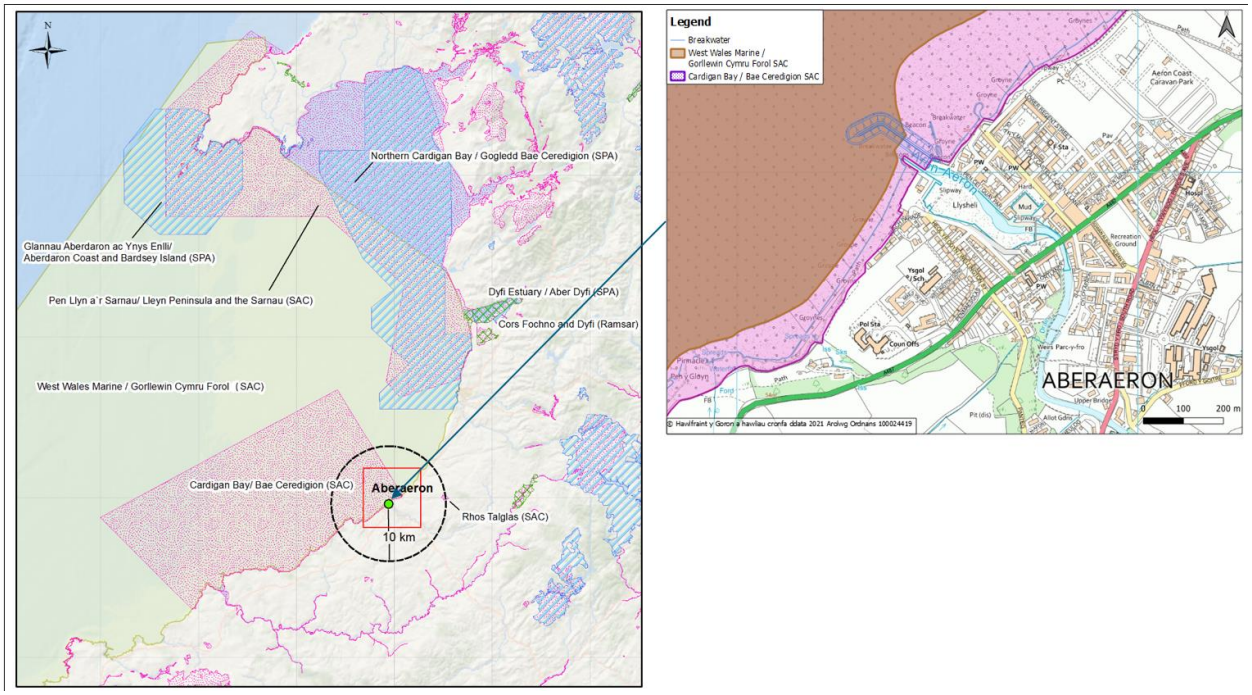
Consents and Permissions required
Planning and Listed Building Consents are required for the scheme

Contact Details

- The contact details for the Customer are shown is Section 6.
- The contact details for the contractor are to be confirmed, pending tender and award of contract

Additional Environmental Information

Figure 2 - Locations of Environmental Sensitivity.



Section 5.1 – Additional detailed method statement

The section below provides a detailed method statement of the works required at each structure.

North Pier Breakwater

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

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

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

The rock will be transported from the site compound to South Beach via dump trucks which will use a temporary access ramp formed out of rocks leading from the site compound onto the beach. These dump trucks will then transport the rock along South Beach to the breakwater. The transportation of rock from the site compound to the stockpile areas will continue for approximately 6 - 9 months (movement of approximately 6no. 20t dumpers per day). The dumpers will be required to reduce their footprint on the beach by keeping vehicle movements to the upper beach area and avoiding the intertidal area as much as possible to reduce sediment becoming mobilised into the water and increasing turbidity. Although South Beach forms part of the SSSI and there is a high presence of Sabellaria alveolata along the coastline, generally this habitat is absent from the intertidal area at South Beach. Further assessment of potential impacts can be seen in the Ecology chapter in this ES.

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

seaward. This will allow machinery constructing the parts of the breakwater in the subtidal zone to work from the top of the newly constructed portions of the breakwater.

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

A shallow draught tipper boat or smaller barge of capacity 1,000-3,000t will travel with the main vessel and the rock armour will be transferred individually from the main ship onto the tipper boat or barge using an on-board excavator equipped with a hydraulically operated grab. The tipper boat will transport the rock to the site of the breakwater or South Beach at high tide and tip the rock onto the seabed. At low tide this will be sorted into sizes and placed in the breakwater footprint using the excavator and grab.

At no time will there be any beaching of boats on the beach. The tipper boat or barge will shuttle to and from the main ship transferring rock to the breakwater site. It is estimated that 10-20 journeys to and from the main ship will be required. Once the main ship has been unloaded, it will return to collect more rock from the quarry. A total of up to 4 return trips are estimated to be required to transport the rock.

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

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

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

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

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

South Pier Refurbishment

The seaward end of the South Pier will be demolished using machine mounted breakers, grabs and hand tools. Machinery and equipment will be located on the beach. Sections of concrete, masonry and other arisings will be removed from site by dumpers. There is the potential for some of the masonry to be salvaged and recycled. The demolition work will take place during low tides for ease of access by the contractor. Working at low tide will help to reduce the amount of debris falling into the water. To further reduce this, a geotextile layer, or similar, will be placed on the seabed to help capture falling debris for removal from site before the tide rises. The contractor may also decide to build a level temporary working platform at the base of the pierhead, which is built out of imported rock materials that will be eventually used for the rock breakwater. In this scenario geotextile will be used to ensure separation between imported and indigenous materials so that total removal of the working platform can take place on completion.

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

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

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

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

South Beach Improvements

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 take have to take place at low tide to gain access and this has the benefit of avoiding 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 will be stockpiled for re-use, with the existing 1-4t rocks to be re-used for the making up for low spots in the ground along the location of the proposed defence. Some of the existing shingle around the existing structure will be temporarily removed to construct the new revetment and will then be reinstated around the completed revetment on completion. The intention is to use all reclaimed rock and shingle within the South Beach works. Non-indigenous material which may include hitherto undiscovered concrete, steel or other non-natural debris will be removed to an off-site tip.

An excavator on the beach will excavate the area where the new revetment will be placed. Approximately 8,848m^3 (5,550t) of shingle will be excavated, with all excavated material reused as nourishment. The excavated shingle material will be stockpiled within the beach above MHWS before it is needed for re-use, although this is not critical and shingle can be temporarily located immediately seaward of completed sections of revetment, before being relocated to its final position.

A geofabric separation membrane will then be laid onto the excavated surface prior to the placement of new rock for the revetment. The imported rock for the scheme will be transported to the site compound and stored there initially. The rock will then be transported to the beach by dumpers and tipped onto the beach. At this point the excavator with the grab will sort the rock into stockpiles for temporary storage on the beach before placing into the revetment. Rock will be placed to form the revetment using an excavator with a grab one rock at a time. This work will be undertaken at low tides. The volume of imported rock required for the revetment is estimated to be 14,534m^3.

Beach Renourishment

As described in the above sections, the material for the beach nourishment will be stockpiled on the beach following the breakwater and revetment excavation work, ready for re-use on the beach. It is unlikely that shingle material will also need to be imported, but if required, this would be brought from the site compound via dump trucks. A bulldozer (see photo 5) will spread the material to the required 1 in 6 beach profile at low tide.

Flood wall: Quay Parade

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

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

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

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

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

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

Flood Wall: Pwll Cam to Monachty Hotel

The construction of this section of wall will follow a similar methodology to that at Quay Parade. Excavation will be carried out to a depth of 1m into the quayside for the wall footings using disc cutters, excavators and 3T dumpers. The lower masonry portion of the wall will be constructed by erecting temporary timber formwork (moulds) to form the wall foundation and wall by pouring concrete between the formwork (moulds). Once concrete is set the temporary formwork will be removed leaving the shape of the new wall. The wall will be clad with the same stone masonry as the new wall at Quay Parade, to provide a finish that is similar to existing quay walls, and that will be in keeping with the existing surrounds. The glass panels, will be transported to site from a factory, and will be fixed to the top of the wall by attaching them to steel columns fixed on top on the wall.
To the west of the entrance to Pwll Cam, and adjacent to The Hive, a short 10m long section of wall will also be raised with concrete and masonry cladding to 5.2mOD with glass panels.

A tilt barrier will be constructed at the entrance to the footbridge over the River Aeron. The tilt barriers will be manufactured off site for installation. A recess will be formed within the newly constructed

terrace area to a depth of 500mm to house the tilt barrier into the footway. The tilt barriers are spring loaded and will be operated with a key held by CCC. The installation of the barrier should take approximately 1 week.

Biodiversity enhancements are being implemented which include improving connectivity for otters from the river to the marine environment as it provides an important foraging area for them. This will be done through modifying / extending the existing ledge on the river revetment between the A487 road bridge and the Pwll Cam harbour entrance. Additional ledges will be constructed at a higher level and fixed to the walls to provide access for otters at all flood levels.

Flood Wall: Monachty Hotel to A487

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

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

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

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

As detailed above, biodiversity enhancements are being implemented which include improving connectivity for otters from the river to the marine environment as it provides an important foraging area for them. This will be done through modifying / extending the existing ledge on the river revetment between the A487 road bridge and the Pwll Cam harbour entrance. Additional ledges will be constructed at a higher level and fixed to the walls to provide access for otters at all flood levels.

Pwll Cam Flood gate

There will be a need to create a temporary sheet pile cofferdam at the entrance of Pwll Cam (dock) 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. Any sludge from within the dock will be removed offsite to prevent pollution to the river. Prior to constructing the cofferdam, a fish rescue will be undertaken in the dock. The cofferdam will be constructed at low tide.

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

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

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

Piling (see photo 6) will be required below the abutment walls and cill to provide the foundations for the wall abutments to resist the force of the water at high tide and during storm events. A total of 12 concrete or steel piles will be inserted into the harbour bed across the channel entrance underneath the footprint of the new gate. The piling will take place of 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. Steel tension anchor bars for each abutment measuring 20mm in diameter, will also be drilled into the ground below the seabed to provide further resistance against the resultant forces of on the gate and abutments. Further anchor bars will be drilled into adjacent wall to provide additional structural restraint.

The flood gate will be manufactured off-site and is likely to be brought to site via a barge due to its size and the limited quayside access. A tug-boat will guide the barge (see photos 11 and 12) 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 (photo 11) or adjacent to the slipway which will be used for ancillary activities.

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

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

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

Photographs of the plant described above

Photo 1 - Tracked excavator with bucket for excavation

Photo 2 – Tracked excavator placing geotextile

Photo 3 – Tracked excavator with a grab to pick up and place rock

Photo 4 - Wheeled Dumper transporting rock

Photo 5 - Dozer to spread out the shingle

Photo 6 - Piling Rig

Photo 7 - Scaffolding for south pier and wall repairs

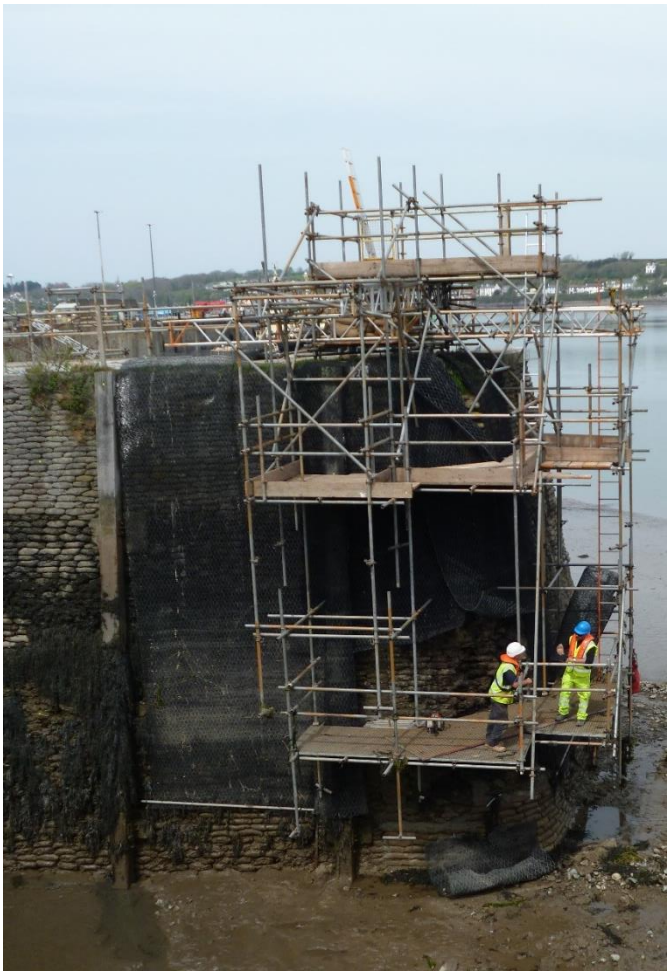


Photo 8 - Negative Mobile Elevated Working Platforms (MEWP’s) to repair walls from above high water

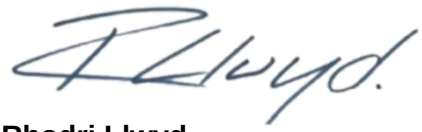
Photo 9 - Crane and basket to carry operatives for wall repairs

Photo 10 - Repointing and wall repairs by rope access

Photo 11 – Barge, Tug, Crane and Gate at Milford Marina

Photo 12 – Barge, Crane and Gate at Milford Marina

Customer details

Signature: 

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