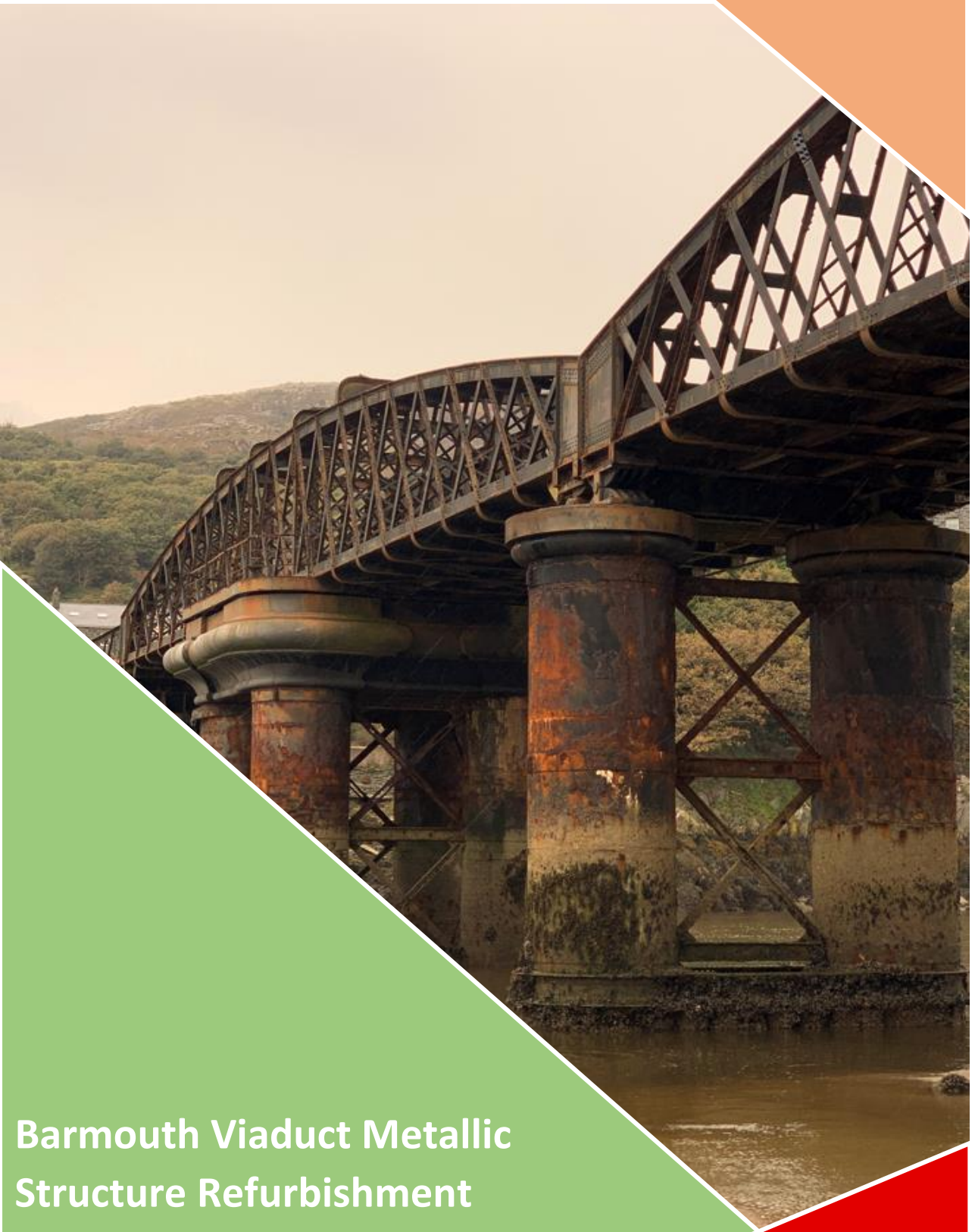
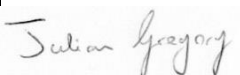
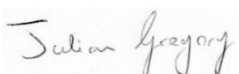




**Barmouth Viaduct Metallic
Structure Refurbishment
Water Framework Directive**



Document Information			
Project	Barmouth Viaduct Metallic Structure Refurbishment		
Location	Barmouth Viaduct No.40, ELR: DJP, Mileage: 99miles 41.5chain, Grid Ref: SH 62441487		
Title	Water Framework Directive Assessment		
Document Ref	J000652.03.WFD.001	Issue / Revision	0.1
File reference	J000651.03.WFD.		
Start Date	23/11/2021		
	Name	Signature	Date
Assessment Undertaken by	Julian Gregory		23/11/2021
Document prepared by	Julian Gregory		23/11/2021
Checked by	Owain Waters		06/12/2021
Authorised by	Julian Gregory		09/12/2021

Document Control		
Rev.	Date	Description



Contents

Contents	2
1. Introduction	5
1.2 Project Background	5
2. Introduction to the Water Framework Directive	6
2.....	6
2.2 Determination of Good Status	6
2.3 Water Framework Directive Assessments.....	6
2.4 Assessment Methodology	7
3. Viaduct Metallic Structure Refurbishment – Objectives, Timing & Locations	8
3.....	8
4. Refurbishment Project Methodology	10
4.....	10
4.1 Viaduct Refurbishment – Access to Structure	10
4.2 Viaduct Refurbishment – Refurbishment Methodology	13
4.3 Methodology Program Outline.....	13
4.4 Compounds Improvements	14
4.5 Cable Diversion.....	15
4.6 Scaffolding installation and Pier Works (Grit Blast & Paint).....	16
4.7 Pre-blockade preparation.....	17
4.8 Blockade Works	19
4.9 Final checks and handover	25
4.10 Demobilisation & Reinstatement	25
5. HRA Methodology Objectives.....	26
5.....	26
6. Baseline Conditions.....	26
6.....	26
6.2 Description of the Study Area	27
6.3 Designated Sites within Proximity to Site.....	27
6.4 Afon Mawddach (SSSI)	28
6.5 West Wales Marine (SAC).....	29
6.6 Llyn Peninsula and the Sarnau (SAC)	30
7. NIRAS Fish Survey Data	31
7.....	31
7.1 Spawning areas and Nurse grounds	31
7.2 Protected Species	31
7.3 Migratory Species	32
7.4 Transient (Vagrant) Species.....	33



7.5	Spawning Areas and Nursery grounds.....	33
7.6	Curent Condition of Waterbodies	35
8.	Water Framework Directive assessment: scoping for activities in estuarine and coastal waters .39	
8.		39
8.2	Section 1: Hydromorphology.....	39
8.3	Section 2: Biology, Habitat & Fish.....	40
8.4	Section 3: Water quality	44
8.5	Section 4: WFD protected areas.....	48
8.6	Section 5: Invasive non-native species (INNS)	49
8.7	Summary of WFD Pre-Assessment findings	50
9.	Proposed Project Mitigation.....	55
9.		55
9.1	Construction Phase Mitigation.....	55
9.2	Operation Phase Mitigation	61
10.	WFD Conclusion.....	61
10.		61
	Appendix A – Biosecurity Management Plan	62
	Appendix B – Grit Blasting Data Sheets.....	63
	Appendix C – Jotum Marathon 550 – Safety Data Sheet	64

Figure 1: Location of proposed compound sites in relation to SAC & SSSI.	9
Figure 2: Site 1 Morfa General Layout	10
Figure 3: Access route to estuary.	11
Figure 4: Images in descending order A, B, C of access route.	12
Figure 5: Project Compounds.	14
Figure 6: Northern Power Cable Diversion.	15
Figure 7: Example of scaffolding above high waterlines.	16
Figure 8: Example of Monarflex sheeting used in an urban setting.	16
Figure 9: Example of pontoon wrapped around pier.	17
Figure 10: Uprated compound to support new metallic sections.	18
Figure 11: Strengthening of old swing gear house.	19
Figure 12: New bridge sections and loading beams driven into space between existing outer frames.	21
Figure 13: Removal of outer steel work and existing decking.	22
Figure 14: Example of metal pontoon platforms.	22
Figure 15: New outer structure supports, and frame widened and new decking raised d fixed into place.	25
Figure 16: Project Location in context to the wider Area.	27
Figure 17: Project Location in relation to SSSI.	28
Figure 18: West Wales Marine site boundaries.	30
Figure 19: Boundary of SAC in relation to project area. West Wales Marine & Afon Mawddach boundaries overlap with Llyn SAC.	31

Table 1: Compounds to be utilised during the works:	8
--	---



Table 2: Sites description in relation to SAC/SSSI proximity and Ecological Sensitivity.	9
Table 3: Estimated Project Program.	13
Table 4: PDO list from NRW Designated Site Finder Tool.	29
Table 5: Annex I & II features of the PLAS SAC.	30
Table 6: Comments on protected fish species from NIRAS report. Included likelihood of occurring within project footprint.	31
Table 7: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity.	32
Table 8: Comments on Migratory fish species from NIRAS report. Included likelihood of occurring within project footprint.	32
Table 9: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity.	33
Table 10: Comments on Transient fish species from NIRAS report. Included likelihood of occurring within project footprint.	33
Table 11: Comments on Spawning Areas and Nursery Grounds from NIRAS report. Included likelihood of occurring within project footprint.	33
Table 12: Summary of the WFD status of the rivers / watercourses flowing into the Mawddach Estuary and connected water bodies.	36
Table 13: Summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.	39
Table 14: Water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.	40
Table 15: Biology.	41
Table 16: Potential fish species at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.	41
Table 17: Water body summary table to find information on phytoplankton status and harmful algae.	44
Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals.	46
Table 19: Assessing whether project falls within mixing zone.	48
Table 20: Location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.	48
Table 21: Risk from INNS.	50
Table 22: Summary of Pre-Assessment Stage Findings.	50
Table 23: Water Framework Directive (WFD) Assessment for the Meirionnydd groundwater waterbody	53
Table 24: Proposed Mitigation Matrix.	55



1. Introduction

- 1.1.1 EcoVigour Ltd were commissioned by Griffiths Rail, on behalf of Network Rail, to undertake a Water Framework Directive (WFD) Assessment for the proposed Barmouth Rail Viaduct Metallic Structure Refurbishment works.
- 1.1.2 The purpose of this report is to assess the impacts of the scheduled refurbishment works associated with the Proposed Scheme against the WFD parameters for the Mawddach Estuary, its associated tributaries, the Cardigan Bay North Coastal Area and the Meirionnydd Groundwater Area. This assessment includes a summary of the current local conditions and, where appropriate, identifies mitigation measures for any likely significant effects (LSE) that may arise as part of the construction and operation of the Proposed Scheme.
- 1.1.3 This WFD Assessment is required to demonstrate that the proposed works will not result in deterioration in the water body status of the Mawddach Estuary and adjoining water bodies or prevent them from meeting their Water Framework Directive objective.
- 1.1.4 Barmouth Rail Viaduct is within the boundaries of the Llyn Peninsula Special Area of Conservation (SAC), and Afon Mawddach Estuary Site of Special Scientific Interest (SSSI). Therefore, the main statutory designated sites which require consideration under the assessment have been identified as:
- Pen Llyn a'r Sarnau / Llyn Peninsula and the Sarnau (PLAS) Special Area of Conservation (SAC).
 - Mawddach Estuary Site of Special Scientific Interest (SSSI).
- 1.1.5 There are several watercourses flowing into the estuary. The principal rivers are the Afon Mawddach from the north, the Afon Wnion from the east. The Gwynant flows into the estuary from the south and the Cwn-Mynach, Cwm-Llechen and Dwynant from the north. All of these enter the estuary upstream of the viaduct.

1.2 Project Background

- 1.2.1 The Barmouth Viaduct Metallic Structure Refurbishment project forms part of the overall Barmouth Viaduct refurbishment. The project concerns the refurbishment of the existing steel structure section of the historic rail asset. Completed in 1867, the structure is a Grade II listed single-track wooden railway viaduct, carrying the Cambrian line across the Afon Mawddach Estuary South of Barmouth, Wales.
- 1.2.2 Network Rail condition surveys have concluded that the metallic structure, comprising 4 steel spans and a public footpath, show significant elements are exhibiting signs of distress. Consequently, requiring the entire 4 span superstructure to be replaced.
- 1.2.3 Refurbishment works to the wooden section of the viaduct have been undertaken during 2020 – 21 and are nearing completion. These works were carried out by Griffiths Rail, who will also undertake the metallic structure refurbishment works. Therefore the metallic structure works will utilise the same compounds, access and storage areas as the contract for the wooden sections.



2. Introduction to the Water Framework Directive

- 2.1.1 The Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000) is a European Union Directive which committed member states to achieve good qualitative and quantitative status of all water bodies by 2015. Under the Directive water bodies are defined as all ground and surface waters, including rivers, lakes, transitional waters and coastal waters (up to one nautical mile from shore).
- 2.1.2 It was not possible to achieve good status of all water bodies by 2015; therefore, outstanding water bodies have objectives set for 2021 or 2027.
- 2.1.3 The WFD is transposed into law in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations). These revoke and replace The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (subject to transitional provisions in article 38 of the 2017 Regulations).

2.2 Determination of Good Status

- 2.2.1 Good status is determined from the ecological and chemical status of surface waters. These statuses are assessed according to the following criteria:
- Biological quality (fish, benthic invertebrates, aquatic flora);
 - Hydromorphological quality (e.g. riverbank structure, river continuity and substrate of the riverbed); and
 - Physical-chemical quality (e.g. temperature, oxygenation and nutrient conditions).
- 2.2.2 The chemical quality refers to environmental quality standards for river basin specific pollutants. These standards specify maximum concentrations for specific water pollutants. The WFD works on a 'one out, all out' basis, so if one such concentration is exceeded, then the water body will not be classed as having a good status. The chemical status of surface waters is therefore classified as good or fail.
- 2.2.3 The ecological status of surface waters is classified as being high, good, moderate, poor or bad, whilst water bodies that have been modified (e.g. canals or contain significant flood defences) are classed as 'Heavily Modified Water bodies' (HMWB) and have to reach at least good potential by their objective year.

2.3 Water Framework Directive Assessments

- 2.3.1 WFD Assessments are undertaken to demonstrate that proposed works (either at strategy level or detailed design/implementation stage) can be undertaken without impacting the status of water bodies or preventing future works to enable the water bodies to achieve good status/potential.
- 2.3.2 Determination of WFD compliance comprises a series of steps intended to establish the potential impacts of the Proposed Scheme (at an appropriate level of detail) and then to examine whether the identified impacts contravene the conditions of the WFD.



2.3.3 The following assessment objectives (derived from the Environmental Objectives of the Directive) are used to determine whether the planned development, in and around the water environment, which is affected by the Proposed Scheme, comply with the overarching objectives of the WFD:

- Objective 1: To prevent deterioration in the status of a surface or groundwater body;
- Objective 2: To prevent the introduction of impediments to the attainment of good WFD status for the water body, or maintaining good status for water bodies which have attained this;
- Objective 3: To ensure that the attainment of the WFD objectives for the water body are not compromised; and
- Objective 4: To ensure the achievement of the WFD objectives in other water bodies within the same catchment are not permanently excluded or compromised.

2.3.4 The assessment process is as follows:

- Screening of the preferred option against the ecological, chemical and quantitative status objectives and elements to determine if the project has any impact on the criteria identified for any water bodies;
- Detailed assessment for those criteria where a potential adverse effect has been identified to determine the effects on quality elements;
- Identified impacts are then considered in relation to the ecological and supporting chemical and hydromorphological status objectives;
- For HMWBs the preferred option is then also assessed against their relevant mitigation measures; and
- Article 4.7 test, if the preferred option is predicted to cause deterioration in water body status or prevent the water body from meeting any of its objectives, then assessment is required against the conditions listed in WFD Article 4.7, all of which must be met for the preferred option to proceed without contravening the WFD. The impact of the scheme on other water bodies within the River Basin District must also be considered (Article 4.8) and protection given by existing Community legislation to any Protected Areas must also be maintained (Article 4.9).

2.4 Assessment Methodology

2.4.1 This WFD Assessment was completed using the following methodology:

- The collection of baseline data to identify the current status, as well as future baseline and ability of the water bodies within and in close proximity to the proposed works to meet the WFD objectives;
- A Consultation with relevant authorities;
- The review of the proposed works and the potential impacts to the identified surface and groundwater bodies; this involves identifying the impacts that could reduce the WFD status and affect the ability of the water bodies to meet the objectives of the WFD;
- The consideration of mitigation that can be included in the design, and
- The provision of an assessment of residual risks.



3. Viaduct Metallic Structure Refurbishment – Objectives, Timing & Locations

3.1.1 The Key relevant dates for the upcoming project are outlined below:

- ◆ Obtaining necessary licences and consents – **February-March 2022.**
- ◆ Establishment of site compounds – **March 2022 to June 2022.** The various compounds are established in phases over this period so that they are ready when required.
- ◆ Key date is commencement of site works on **28th March 2022.**
- ◆ Procurement and mobilisation of subcontractors for construction phase – **July 2021 to August 2022.**
- ◆ Pre-blockade works in the compounds including assembly of the steelwork – **April 2022 to August 2022**
- ◆ Rail possession to unload steelwork from train to the Morfa compound – **18th to 19th June 2022** (Overnight)
- ◆ Rail possession to unload steelwork from train to the Marine Parade compound – **25th to 26th June 2022** (Overnight)
- ◆ Substructure refurbishment – **April 2022 to August 2022.** The substructure refurbishment above includes refurbishment of the intertidal sections, which are planned to coincide with the lowest equinoctial spring tide on **14th August 2022.**
- ◆ Rail Blockade for replacement of the metallic spans - **12th September to 12th December 2022.**
- ◆ Snagging and demobilisation – **November 2022 to January 2023**

The existing site compounds and accesses utilised for the refurbishment of the wooden section of the viaduct will also be used for the refurbishment of the metallic structure. These are detailed below:

Table 1: Compounds to be utilised during the works:

Site Description	Purpose	Approximate area required
Site 1, Morfa	Office, welfare & materials store.	150m x10m 200m x 50m
Site 2 Oriental Gardens	Office & welfare	35m x 8m
Site 3 Main car park	Office & car park.	50m x 70m
Site 4 Marine Parade	Main office, welfare & materials store.	160m x 50m
Site 5 Car Park	Car park	160m x 12m

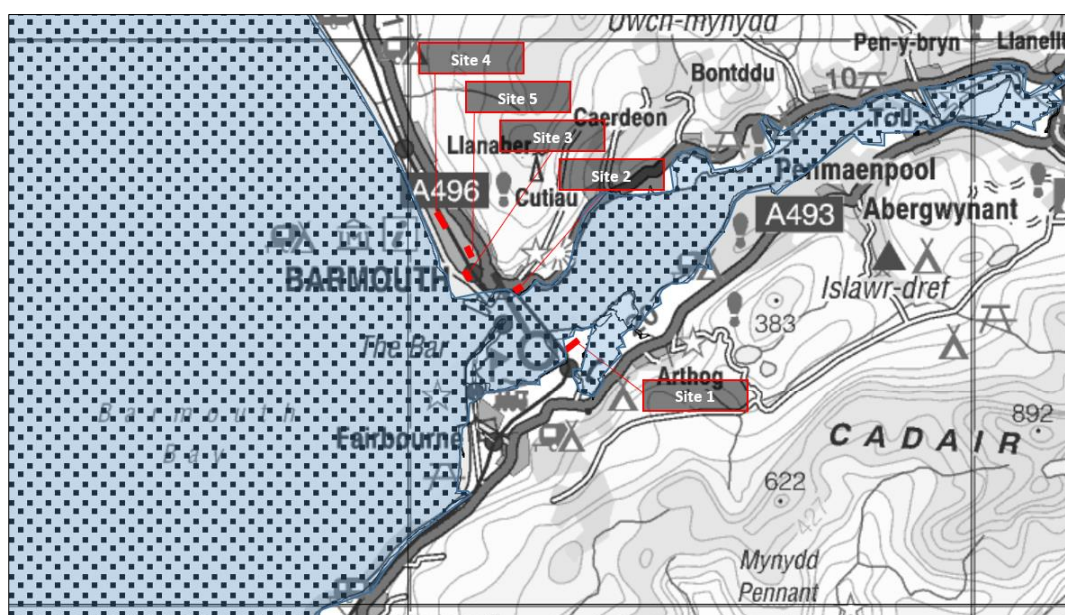


Figure 1: Location of proposed compound sites in relation to SAC & SSSI.

Site	Works Required to Setup	Proximity to SAC/SSSI	WFD Ecological Sensitivity
Site 1- Morfa	Office, welfare & materials store.	Close Proximity to SAC/SSSI: within connected habitat, surrounded by designated site boundaries.	High
Site 2 - Oriental Gardens	Office & welfare	Outside of SAC/SSSI: Within footprint of existing hard standings within public gardens.	Low
Site 3 - Main car park	Office & car park.	Outside of SAC/SSSI: Within footprint of existing small pay and display car park.	Low
Site 4 - Marine Parade	Main office, welfare & materials store.	Outside of SAC/SSSI: Disused hard standing and gravel surface area with existing Road Rail Access Point (RRAP)	Low
Site 5 - Car Park	Car park	Outside of SAC/SSSI: Similar to Site 3, footprint within existing car park area.	Low

3.1.2 For the purpose of this assessment, only the temporary compound at Morfa Mawddach will be considered, as the remainder of the compounds are within areas which have been previously developed, are remote from the estuary and will not require major development works.



4. Refurbishment Project Methodology

4.1 Viaduct Refurbishment – Access to Structure

- 4.1.1 Several methods of access to the rail structure have been discussed between NRW SSSI Assent and Principle Contractor Project Team members.
- 4.1.2 Utilising the risk hierarchy, all other options were eliminated in favour of using the existing track running along the edges of the cliffs to the North East of the Morfa site before joining the shale embankment between the saltmarsh and the beach. OS Mapping indicates this is the remains of the old tram way along the Southern Shore of the Afon Mawddach.
- 4.1.3 The ideal outcome is that little to no additional stone material will be required to modify the surface of the shale bank. Low ground pressure track machines (likely 5t 360 excavator supported by tracked dumper vehicle) will follow the route defined within this plan.
- 4.1.4 Much of the existing road leading up to the shale bank is of modern design with a geotextile membrane present in its construction (appears to be Terram 1000 from observation). Therefore, it is likely this section of road/track is robust enough to carry the limited traffic proposed to undertake the refurbishment.
- 4.1.5 The following illustrations detail the compound locations and proposed access route (Figure 3).

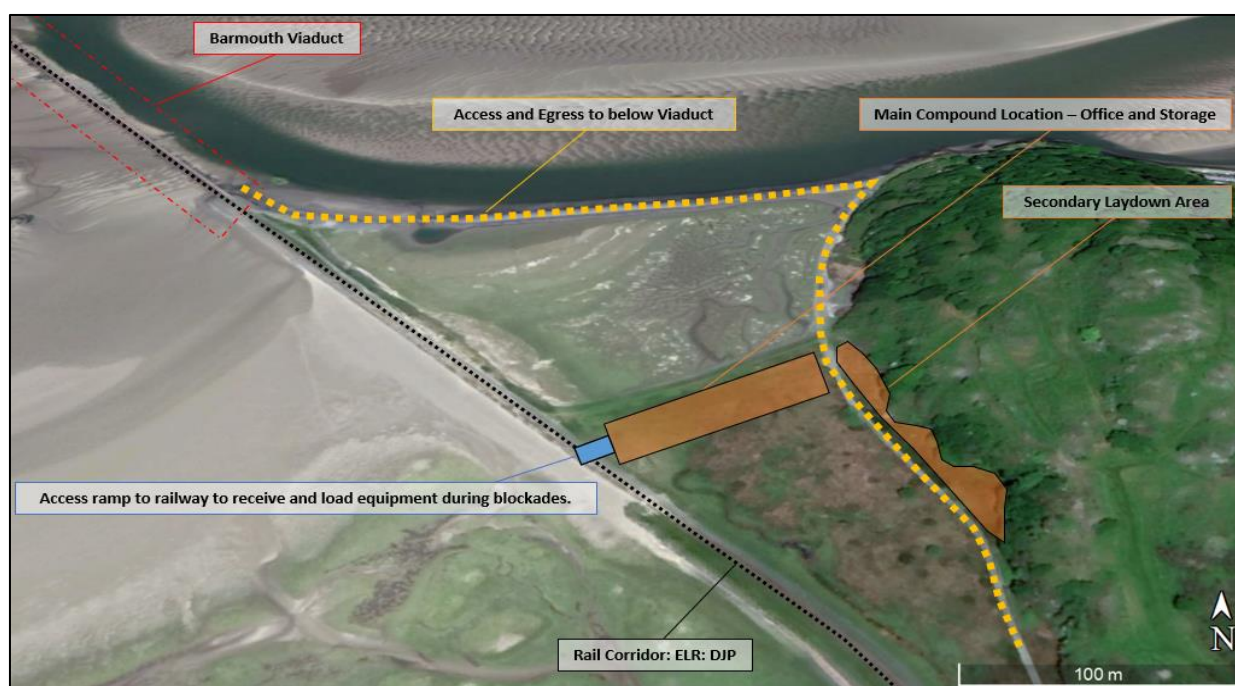


Figure 2: Site 1 Morfa General Layout

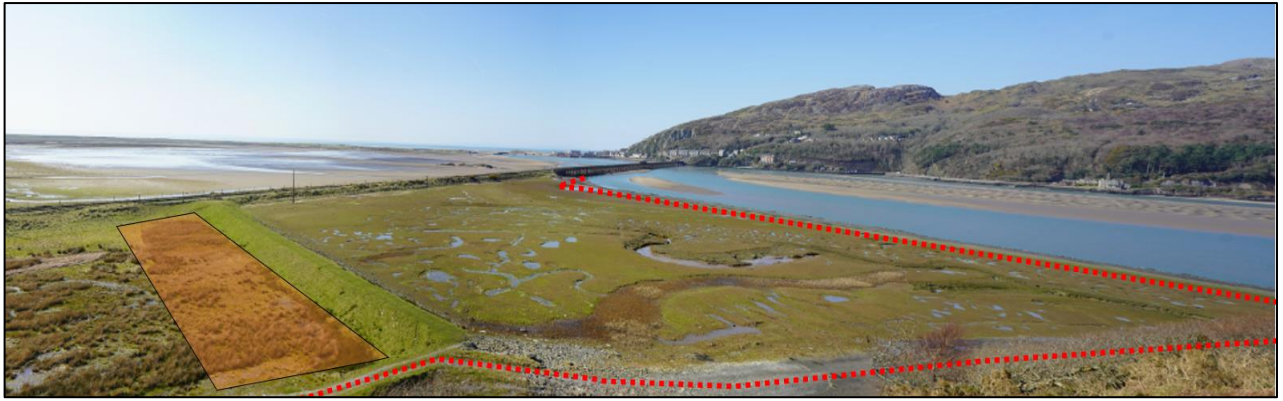


Figure 3: Access route to estuary.

- 4.1.6 There is a low spot within the shale bank which allows water from the estuary to enter the saltmarsh during high tides. Although this is not a lagoon feature it is integral to the gradual drainage of the salt marsh habitat. This drainage feature (highlighted in figure 05b next page) will not be modified as a preferred option.
- 4.1.7 A topographical survey will be undertaken of this feature prior to the commencement of works to ensure its size and level has been recorded. Care will be taken to ensure the current invert level is maintained for the duration of the works. A photographic / video record will be made of the former tramway prior to the commencement of works. This will enable the reinstatement of the tramway / shale bank, including the drainage feature, to its original condition, following completion of the works. If alteration is required, it is likely to take the form of the removal of large boulders which could damage the tracks of plant.
- 4.1.8 Consequently, if movement of vehicles begins to degrade it's function as a drainage route, a temporary crossing will be installed using locally sourced shale and drainage piping or channels installed to the same level as the measured bed / invert level, to maintain the current flow of water while allowing continued vehicle movement outside of the salt marsh habitat.
- 4.1.9 Where possible, the existing shale present along the bank would be used to create any necessary modification to limit or even eliminate the need for importing new material. If any materials are imported, they will be laid on a geotextile separation layer to aid their removal on the completion of the works.



Figure 4: Images in descending order A, B, C of access route.



4.2 Viaduct Refurbishment – Refurbishment Methodology

4.3 Methodology Program Outline

- 4.3.1 The table below highlights the broad program for the metallic works, with further details outlined in the sub sections below. The full unabridged methodology can be found in [Appendix B](#), while the tender video presentation is available in [Appendix F](#) (the tender video illustrates the entire refurbishment process).

Table 3: Estimated Project Program.

Tasks	Years & Months															
	2021		2022												2022	
	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February
Marine License Application																
Compound Improvements																
Cable Diversion																
Scaffolding Installation																
Grit Blasting & Painting																
Pre-blockade preparation																
Main Blockade/ Bridge Replacement																
Final checks and handover																
Demobilisation/ reinstatement.																

Calendars

- 4.3.2 The majority of activities in the main construction programme are on a standard calendar (made project specific) that allows working 5 days /week for 8-10 hours /day with bank holidays and a 2-week period at Christmas as non-working days.
- 4.3.3 Any activities that need to be carried out within a ‘rules of the route’ possession are on a project specific calendar that allows Saturday night working (8 hour shift) only.
- 4.3.4 All activities in the blockade programme are on a calendar that allows working 6 days /week for the duration of the blockade.



4.4 Compounds Improvements

- 4.4.1 The compounds to be used are the same as those used under Marine License CML2016. With the addition of Aberamffra Harbour (location 3, figure 3).



Figure 5: Project Compounds.

- 4.4.2 The compound at the Ornamental Gardens (location 4) has been chosen to be as close to the structure as possible whilst minimising disruption to Barmouth, the additional parking (location 5) has been chosen to avoid having cars parked within the compound area due to lack of available space and the reduced sighting distance when leaving the compound onto the main road.
- 4.4.3 This compound will be utilised for the advanced works, with Aberamffra harbour used to take scaffold, new steelwork and painting equipment to and from the substructure.
- 4.4.4 The Marine Parade (not within map, figure 3) area is located adjacent to the rail track and provides an expansive area for the storage of deck panels and for all components of the bridge. Its location allows the delivery of all these components by Rail.
- 4.4.5 The Morfa Compound (location 1) allows access along straight rail track to the structure, it also allows bridge components to be delivered using trains rather than by road.



4.5 Cable Diversion

- | | |
|-------|--|
| 4.5.1 | Prior to site set up at Morfa the 33kV cable running between the compound and the track will be diverted underground, this will need to be included within the access agreement with the landowner. |
| 4.5.2 | To ensure the risk to power lines as a result of large material movement between Morfa and the structure is mitigated. Scottish Power have agreed to divert the 33kV Overhead Cable. This will be carried out in advance of any proposed siteworks. |
| 4.5.3 | SP have confirmed that a period of 4months is required to plan the works and that the works will be carried out during the summer months of 2021 to take advantage of the lower power usage. Scottish Power will arrange its own consents to sanction the works and are responsible for consulting with Natural Resources Wales. |

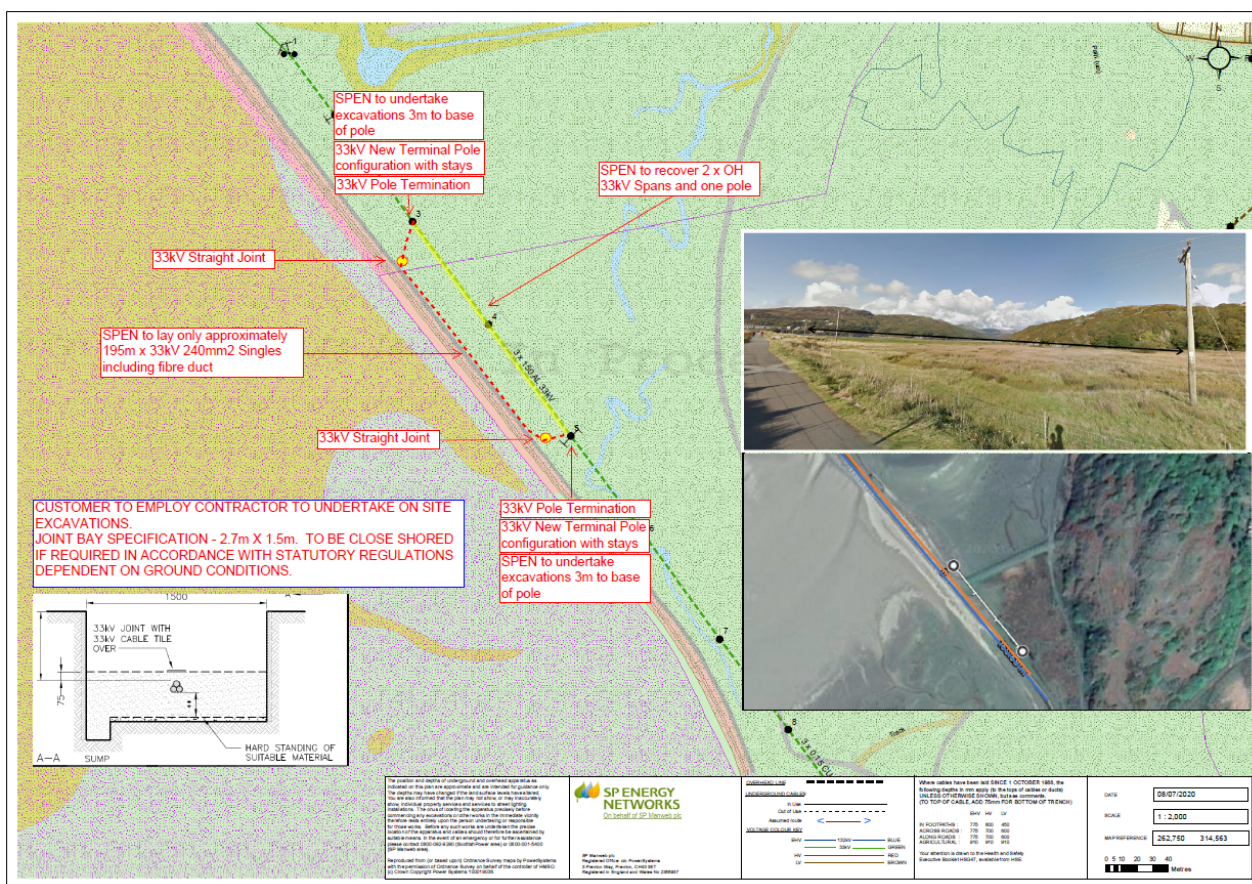


Figure 6: Northern Power Cable Diversion.



4.6 Scaffolding installation and Pier Works (Grit Blast & Paint)

- 4.6.1 During the summer of 2022 the substructure will be painted and repaired. The works will consist of grit blasting (please refer to Appendix C for grid blasting technical information) above the tidal splash zones i.e. above MHWS with access gained via scaffolding fixed to the cylinders using shear plates.



Figure 7: Example of scaffolding above high waterlines.

- 4.6.2 The upper section of this scaffolding will include encapsulation and plastic sheet, lined ply boarding to catch spent grit. The encapsulation will likely be of a Monarflex design or equivalent (see figure below for example)



Figure 8: Example of Monarflex sheeting used in an urban setting.



- 4.6.3 The lower scaffold will not be encapsulated and will be specifically designed to allow tidal water to pass over and through and will include steel 'haki' boards. The pontoons will be 'wrapped' around the piers and will rise and fall with the tide. Blasting will utilise either a mechanical removal (scraping, wire brushes) of degraded paint or vacuum blasting techniques.



Figure 9: Example of pontoon wrapped around pier.

- 4.6.4 The blasting will follow the tide and will be planned to end around the Lowest equinoctial spring tide which will be 0.47m on 14 Aug 2022. The paint system used will be Jotun Marathon 550 or similar Network Rail approved equivalent (please refer to Appendix B).
- 4.6.5 The works will include repairs as per the detailed design for the substructure, the higher (non-tidal sections) will be carried out from a scaffold system supported from the pier. This scaffolding will remain in place to facilitate the reconstruction during the blockade. The new components will be delivered on pontoons from the old Barmouth harbour.
- 4.6.6 The scaffold which will be designed for both the preparation works and the main works will include access to the top of the abutment to facilitate the installation of the new components.

4.7 Pre-blockade preparation

On site fabrication within Morfa compound

- 4.7.1 Following the fabrication, the bridge components will be transported from Darlington via Rail and delivered to Morfa within a Saturday night possession by DB Schenker. The train will be unloaded using an all-terrain crane positioned in the Morfa compound. This will be carried out early summer 2022,



Figure 10: Upgraded compound to support new metallic sections.

- 4.7.2 The loads will be arranged in construction order so that as each load arrives it is able to be added to the trusses and minimises the required construction footprint.
- 4.7.3 Once all components have been erected, the bolted connections as well as any other areas requiring touch-up will receive their final coats of paint ready prior to installation during the blockade.

Slew Ring Mechanism Preparation Works

- 4.7.4 Using the pier top access, advance works to the caisson tops will be carried out consisting of the installation of in-situ concrete and temporary works.
- 4.7.5 Prior to this being installed, the deck plates above the slew ring will be removed and FRP open mesh panels installed with a hinge and lock mechanism for easy access and the introduction of air flow. In addition, sections of the cowling will be removed to allow greater access, alter the area to remove the confined space risk and to allow installation of permanent steelwork within the blockade.

Installation of Concrete to Slew Ring

- 4.7.6 Following the erection of access and removal of sections of cowling, which will be carried out during rules possessions, the formwork for the concrete will be constructed. This can be carried out in dayshift with access via the scaffolding and from the pedestrian walkway through the pre-installed locked gate.
- 4.7.7 The concrete will be installed in a series of rules possessions, an RRV with concrete skip will gain access at Morfa, and will be loaded with concrete in the compound under controlled conditions.

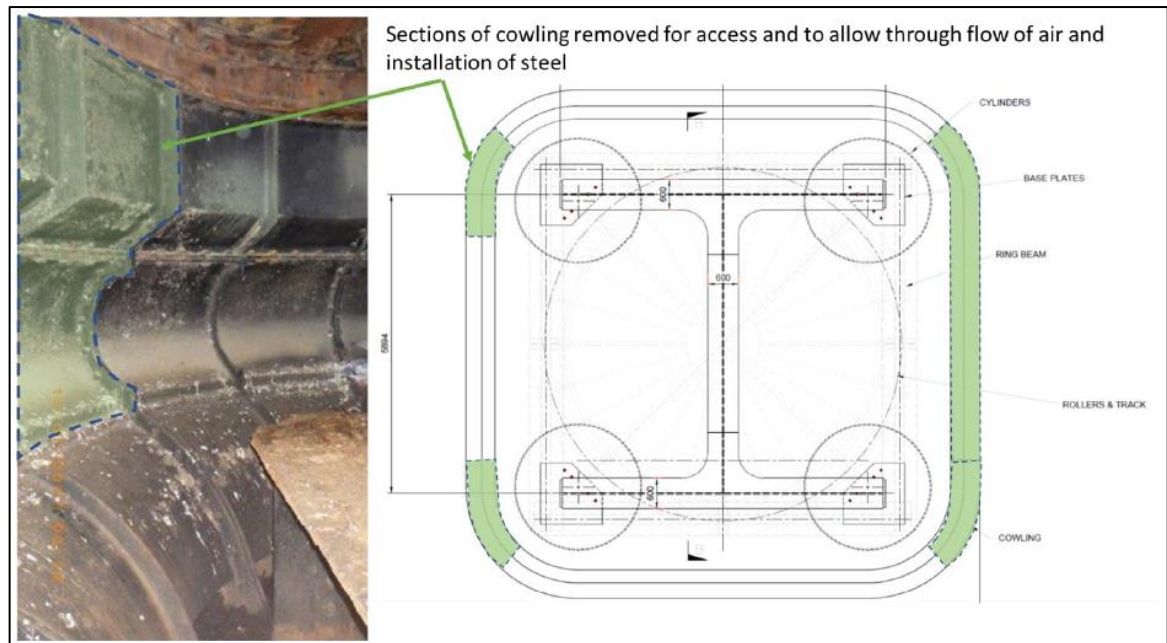


Figure 11: Strengthening of old swing gear house.

- 4.7.8 The (Road Rail Vehicle) RRV will then travel to the structure and pour concrete within the formwork. It should be noted that, in order to ensure correct bond with the existing steel and to ensure no early cracking from the passage of trains the concrete will include an accelerator.

Installation of Temporary Support Beams

- 4.7.9 Following the curing of the concrete, specially designed temporary support beams will be installed on the top flange of the existing grillage and anchor bolts will be drilled through into the new concrete to secure a fixing.
- 4.7.10 Should it be deemed necessary following detailed inspection, sections of the existing slew ring will be cut away to allow installation. These will be cut using burning equipment into manageable sections. It should be noted that these sections are not load bearing as they are outside the cross-girder support zone. This work will be carried out within possessions accessing through deck and via scaffold access as required.

4.8 Blockade Works

- 4.8.1 The programme has been developed such that there is 2 weeks float between all preparation work being completed and the start of the blockade. By the time the blockade starts the following will be in place:

- ◆ Scaffold access will be in place at pier heads
- ◆ Piers will have been painted
- ◆ Repairs to piers will have been completed
- ◆ Sections of the cowling to the swing span mechanism will have been removed
- ◆ Deck plates above the swing span will have been replaced with FRP open mesh
- ◆ Existing elements to be retained will have been removed, repaired and painted
- ◆ Temporary works will have been installed within swing span mechanism and pier heads
- ◆ New temporary wind bracing installed at higher level with existing wind bracing removed
- ◆ New beams for fixed and swing span will be complete within the Morfa compound
- ◆ Temporary Mabey Hire MU boxes for swing span and fixed span constructed



- 4.8.2 A 500T crawler crane will be set up within the Morfa compound ahead of the start of the blockade and trial lifts of key components carried out. This is based on detailed discussions we have had with the suppliers to provide the required radius from compound to track of circa 36m with a 40tonne maximum lift weight, and the ability to lift from the compound over the footpath and to the rail line.
- 4.8.3 At the start of the blockade a Unimog will be on tracked at the RRAP near Morfa station, 8No 20T trailers will be loaded onto the track and connected to the Unimog. The configuration will be tracked by the Unimog to the compound at Morfa with the trailers facing towards Barmouth.
- 4.8.4 Starting with the cess girders, both girders will be placed either side of the truss on the jacking system and connected to the MU truss. Once the main beams are secured to the MU truss the jacking system will be lowered off such that the weight of the main beams and MU truss is taken by the trailers.

Removal of Wind Bracing.

- 4.8.5 In order to facilitate the use of gantry system the wind bracing will be removed. Working from the MU truss, which will be boarded out with required handrails to the ends. the overhead bracings will be unbolted, placed on skates on the gantry rails and moved to the North end of the structure.
- 4.8.6 From here they will be removed using an RRV and taken to the Northern site compound. This will give the advantage that we will have full access across the structure at all times.
- 4.8.7 Once the fixed span new beams are positioned this will create a full-length gantry rail system. The fixed span overhead bracing will be removed in the same manner as the swing span and will be moved to the North end and removed with the RRV.
- 4.8.8 The fixed span main beams will arrive with 2No gantry systems already in place on the gantry rails, the Northern gantry will be moved to the swing span as the rails will be connected together.

Dismantling of Existing Bridge

- 4.8.9 The existing spans will then be cut into pre-determined sections (generally 3-4m depending on nodal positions). As the sections are fully supported all cutting can be carried out from the deck without the need for open edge working.



Figure 12: New bridge sections and loading beams driven into space between existing outer frames.

- 4.8.10 The new beam will be protected from the cutting operation using fire resistant sheeting and shielding. The steel pontoons have the additional benefit of being able to stop any debris falling into the estuary whilst ensuring other vessels don't venture into the area. The support vessels will also ensure that safe passage is maintained. Back-to-back radios with the cutting team will ensure that if required the operation can be ceased at short notice.
- 4.8.11 Once a section is ready to be lowered the overhead gantry winches will be attached to agreed locations within the section and the support system unbolted. The section will then be lowered to an awaiting steel pontoon.
- 4.8.12 We have allowed for 4No steel pontoons in order to ensure that sections can be lowered without waiting for removal of a loaded pontoon. Both spans will be dismantled simultaneously in a predetermined sequence as to ensure a balanced transfer of loading onto the new girders.



Figure 13: Removal of outer steel work and existing decking.

- 4.8.13 One section of cross girder behind the temporary new beam support system cannot be removed in this manner and will therefore be cut into smaller sections of approximately 1m in size, prior to being slid using a tirlor to the outside edge of the structure, lifted with the gantry system and then lowered on to pontoons.
- 4.8.14 The sections within the central area of the swing span and the swing span mechanism will be removed sideways from either side of the Mabey support beam located between two cross girders prior to lowering on to awaiting pontoon.

Pontoons

- 4.8.15 The pontoons will consist of 9 No (4.2m x 2.1m) NATO pontoons bolted together to form a 12.6m x 6.3m stable pontoon with solid handrail capable of holding 25 tonnes. This will then be moved to the old harbour using two small vessels each acting as redundancy to the other should any issues occur. Using these methods will provide the benefit that we can work at almost all states of tide due to the low draft.



Figure 14: Example of metal pontoon platforms.



- 4.8.16 Once the pontoons are positioned against the harbour wall the bridge sections will be cut down into manageable sections and lifted off the pontoon using a HiAb wagon on the harbour – this activity is not tide dependant as the pontoons have the ability to be able to be beached as the tide drops.
- 4.8.17 It should be noted that the pontoons are road deliverable and will be constructed off the old harbour ahead of the blockade. They have a maximum height of 770mm with a draft of 570mm fully loaded ensuring that they can work at all locations of the structure even at low tide. The proposed support craft have drafts of 0.45 and 0.6m again ensuring that work can continue on all but the lowest of tides.
- 4.8.18 There will be no disruption to Barmouth or Barmouth harbour as the pontoons and supportcraft will run between the structure and the old Aberamffra Harbour. This methodology also minimises any impact to pleasure craft using the upper reaches of the estuary.

Initial Reconstruction

- 4.8.19 Following the removal of all wind bracing using an RRV from the Northern approach the dismantling of the bridge can commence.
- 4.8.20 The scaffold system giving access to the underside of the structure will also act as a propping system to pier 2 to remove the risk of articulation. Prior to lifting, the bridge will be jacked up to ensure its release from the foundations and also to act as a check on the structure's weight.
- 4.8.21 Working off the full scaffold system the cross girders, bearers and deck plates will be cut and lifted up through the deck using the TXM monster crane positioned on the structure.
- 4.8.22 Following the removal of all decking, the TXM crane will lift the individual main beams off and pass to RRV and trailers behind the crane.
- 4.8.23 Once span 1 has been removed, the scaffold will be removed with just the scaffolding around the Northern pier remaining. The above procedure will then be repeated for the removal of Span 2 (Northern span).
- 4.8.24 Once completed the TXM machine will leave site . The track and top of abutment will then be removed at the Northern abutment, this will be carried out using the Griffiths RRV.
- 4.8.25 An extended in-situ concrete run on slab will be formed, this will also be designed for and act as an outrigger foundation for the Road Rail AC55 T crane. The road rail crane will access the track at Barmouth level crossing or an installed temporary RRAP at the Marine Parade compound.
- 4.8.26 Once in position the crane will lift in the new impost units, these will be in two sections, one under the track and another beneath the footpath to reduce weight for lifting.
- 4.8.27 Following the removal of the existing crosshead the new crosshead will be installed in the same manner, this will be designed in sections to suit lift capacity of the crane.



- 4.8.28 As with all bridge components these will be brought to site on RRV trailers loaded by separate crane at the trackside compound.
- 4.8.29 Following the installation of the main beams the cross girders, bearers and deck panels will be installed. The design of these elements has been developed to allow installation in panel format, from above, and also to suit the crane capacity.
- 4.8.30 Once the first span has been completed the AC55T crane will derig and leave site. The bearings will be grouted, and the span fully completed and signed off as ready to use. The track will then be reinstated up to and including the span with a stop block installed at the end of the span.
- 4.8.31 At this stage the TXM monster crane will return to site, again accessing at Barmouth level crossing or RRAP within the site compound.
- 4.8.32 Whilst the first span work and track reinstatement works to the North are being carried out, the crossheads will be replaced on pier 2. Following installation of new crossheads the scaffold to the span will be reinstated.
- 4.8.33 The TXM crane will be positioned at the very end of the new span, the new beams will be installed followed by installation of cross girders, bearers and deck panels.

Full Construction of Bridge

- 4.8.34 Prior to the start of the reconstruction of bridge spans, the crossheads and bearings to pier 2 be replaced. The new main beams and gantry rails will include a cantilevered section and, following the removal of span 1 and the removal of scaffold, the crossheads will be replaced.
- 4.8.35 Once all of the existing bridge has been removed, including the swing span mechanism and existing bearings, the new bearings will be installed. The gantry will lift these up individually from the pontoon and place on prepared area, they will be bolted and grouted as stipulated in the design.
- 4.8.36 Once all bearings are correctly in position, including new crossheads to pier 2, the new beams will be slid into their final locations.
- 4.8.37 The gantry cranes will be taken to the south end of the structure and lifted off using the TXM crane, these will be returned to the Morfa yard and extended to suit the final width of main beams, once the beam expansion has been completed they will be returned to the structure and lifted back onto the gantry rails.
- 4.8.38 The main beams move will be carried out one beam at a time using jacks against the MU truss. Stainless steel and PTFE will be placed at the interface between the bottom flange and the temporary support/new bearings.
- 4.8.39 Once the main beams are secured into their final position the extended gantries will be reinstalled, using the TXM monster crane at the south end of the fixed span. Once in position the new deck panels complete with viper base plates and slave rail will be lifted from pontoons and secured to the deck.



Figure 15: New outer structure supports, and frame widened and new decking raised and fixed into place.

- 4.8.40 The new deck panels will include a suspended scaffold deck below as they are lifted which will connect to the scaffold in place at pier heads. This gives the benefit of continuous access for bolting up and touch up paintwork.
- 4.8.41 Once all deck panels have been installed the previously installed temporary wind bracing system will be removed in the reverse order, i.e the RRV will bring to components to the North end of the swing span and place these on skates on the gantry rails. They will then be pushed along both spans and installed in similar positions to that on original spans. This bracing will be adapted to bolt to the sections of the gantry rail system.
- 4.8.42 During the track installation works the bolted joints (cross girder to main girder and deck splice plates) below the deck will be receive their final coats of paint using the scaffold access installed during deck panel installation. Once completed this scaffold will be lowered to pontoons and removed – note this has the benefit that it can be carried out post blockade if required.

4.9 Final checks and handover

- 4.9.1 Following final inspections, the bridge will be handed back to Network Rail and opened for traffic and pedestrians.

4.10 Demobilisation & Reinstatement



- 4.10.1 Demobilisation of the sites will be carried out and the areas returned to their former status. The reinstatement will follow the same agreements within marine license CML2016. This is due to the CML2016 license works scheduled being extended to March 2022, as to allow the reinstatement stage on both licenses to match and avoid schedule conflict.

5. HRA Methodology Objectives

- 5.1.1 Habitats Regulation Assessment is an assessment of the potential effects of a proposed project / maintenance activity on a European site(s) (alone and/or in combination with other plans and projects). The Habitats Regulations promotes a hierarchy of avoidance, mitigation and compensatory measures. First, the project should aim to avoid significant adverse effects by identifying potential measures to avoid these effects.
- 5.1.2 Where adverse effects remain, mitigation measures should be applied to a point where these effects are no longer significant. If sufficient mitigation measures cannot be applied, the project should not be taken forward in its current form. In such a scenario, the project will require an assessment to identify alternative solutions that deliver the project in a form that avoids any significant adverse effects.
- 5.1.3 Where significant adverse effects remain, compensatory measures will be required if the project is to proceed. However, the application of such measures will only be permitted if no alternative solutions exist and the project is required for imperative reasons of overriding public interest (the 'IROPI' test).

6. Baseline Conditions

- 6.1.5 This assessment has been prepared following WFD screening/scoping assessment guidance provided by the Environment Agency / NRW.
- 6.1.6 There are nine WFD surface waterbodies in the proximity of the proposed scheme: Mawddach Estuary (GB511006407100) but there are six rivers / watercourses flowing into the estuary. The Mawddach Lower (GB110064048710) from the north, the Afon Wnion (GB110064048800) from the east. The Gwynant (GB110064048660) flows into the estuary from the south and the Cwn-Mynach (GB110064048820), Cwm-Llechen (GB110064048810) and Dwynant (GB110064048700) from the north. Works will only be undertaken within the Mawddach Estuary and impacts on the other waterbodies are unlikely.
- 6.1.7 Table 12 (below) presents summary information on the current WFD status of each of the constituent quality elements of the waterbodies under consideration. This information has been obtained from the Water Watch Wales website. Each of the quality elements will be assessed to determine whether the proposed scheme has the potential to adversely affect their status.
- 6.1.8 Only one groundwater waterbody, the Meirionnydd (GB41002G203200), is located within the project area. It has a Quantitative Status of Good and a chemical status of Poor, giving it an overall status of Poor. The potential for the proposed scheme to impact groundwater is considered in Section 8.



6.2 Description of the Study Area

- 6.2.1 The Barmouth Viaduct Refurbishment project is situated between the North and South shores of the Afon Mawddach Estuary (Grid Ref: SH 61961 15478 & SH 62443 14865 respectively). Several site compounds will be setup to service the scheme with office and welfare facilities, carparking and materials storage. The majority of the compounds will be situated within Barmouth remote from the estuary and the sea front and hence these will not be considered further by this assessment.
- 6.2.2 However, one site compound will be located to the South of the viaduct in Morfa Mawddach, West of Fegla Fawr (Grid Ref: SH 62736 14623). The presence of this compound has potential to impact the estuary and coastal waters, therefore will hence be assessed.

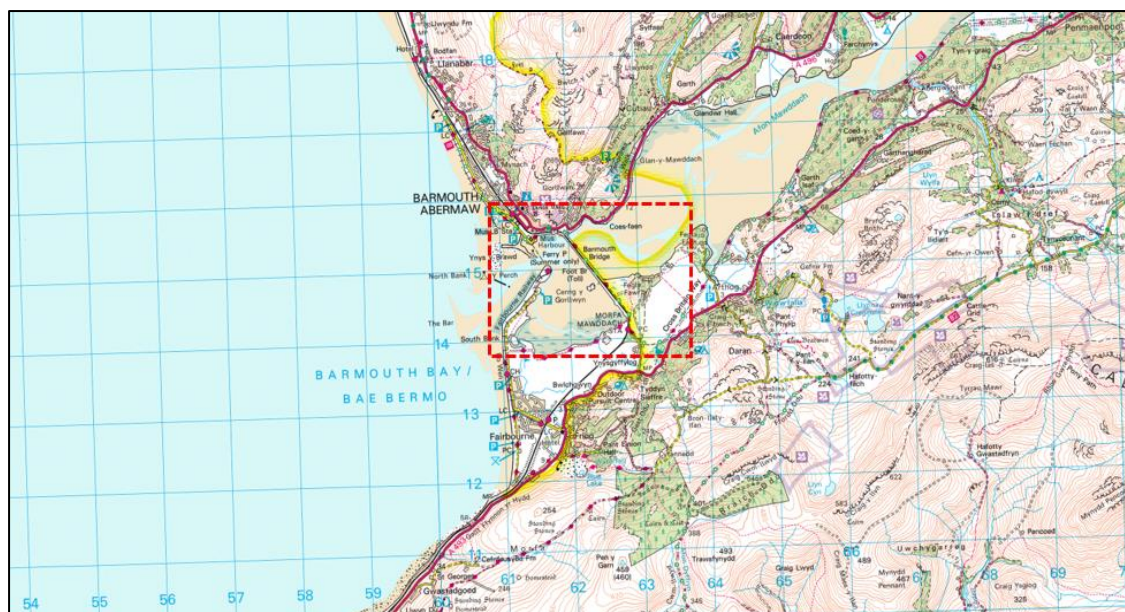


Figure 16: Project Location in context to the wider Area.

- 6.2.3 flowing into the estuary. The Afon Mawddach from the north, the Afon Wnion from the east. The Gwynant flows into the estuary from the south and the Cwn-Mynach, Cwm-Llechen and Dwyntant from the north. All of these enter the estuary upstream of the viaduct.
- 6.2.4 Mawddach Estuary is designated as a SSSI due to its diverse biological features. Situated west of Dolgellau in Meirionnydd, the site includes the Mawddach estuary itself, a large shallow estuary draining south westwards into Cardigan Bay, and adjacent habitats.
- 6.2.5 The estuary is wide with extensive sandflats throughout its length, areas of muddy sediments and large areas of saltmarsh. The mouth of the estuary is protected to the south by Fairbourne Spit, a sand and shingle spit, and on the north side is the small town of Barmouth.

6.3 Designated Sites within Proximity to Site

- 6.3.1 Afon Mawddach Site of Special Scientific Interest:
- 6.3.2 Special Areas of Conservation:
- Llyn Peninsula and the Sarnau (SAC)
 - West Wales Marine (SAC)



6.4 Afon Mawddach (SSSI)

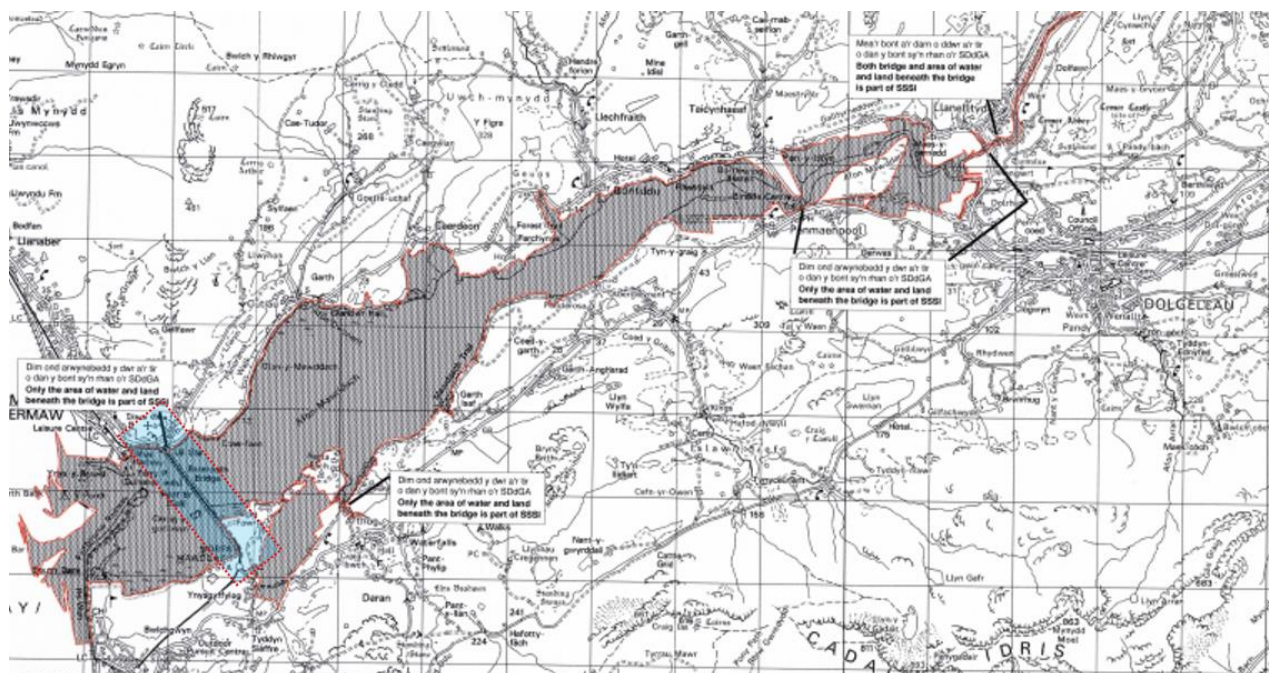


Figure 17: Project Location in relation to SSSI.

- 6.4.1 The special features of the site are the estuarine habitats, particularly muddy sediments, saltmarshes, reed beds and raised mire. There is also a substantial species interest, including breeding wading birds, scarce vascular plants, bryophytes and invertebrates
- 6.4.2 Within the Site Management Statement (SMS), the features below are listed which form the overall status of the designated site:
- The estuary
 - Intertidal muddy gullies
 - Bog
 - Salt marsh
 - Coastal fen
 - Swamp
 - Wet woodland
 - Rare plants
 - Otter
 - Redshank and snipe
 - River shingle invertebrates
 - Rare liverwort
 - Salmon
- 6.4.3 From the extended Phase I survey, the relevant habitat from the SMS in relation to the project area remaining are:
- The estuary
 - Intertidal muddy gullies
 - Salt marsh



- 6.4.4 There is a list of potential damage vectors to the designated site highlighted within the SMS Potentially Damaging Operations (PDO) list. Below are the activities considered relevant to the proposed project (Table 4 below).

Table 4: PDO list from NRW Designated Site Finder Tool.

SMS Ref No:	Type of operation
11.	Destruction, displacement, removal or cutting of any plant or plant remains, including tree, shrub, herb, hedge, dead or decaying wood, moss, lichen, fungus, leaf-mould, turf or peat.
12.	Tree and/or woodland management, the introduction of tree and/or woodland management and alterations to tree and/or woodland management including planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition and removal of fallen timber.
21.	Destruction, construction, removal, rerouting, or regrading of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and rock exposures.
22.	Storage of materials.
23.	Erection of permanent or temporary structures or the undertaking of engineering works, including drilling or the laying, maintenance or removal of pipelines and cables, above or below ground.
24.	Modification of natural or man-made features (including cave entrances) and clearance of boulders, large stones, loose rock or scree and the battering, buttressing or grading of geological exposures.
26.	Use of vehicles or craft.

- 6.4.5 The rare plant species reference in the SMS (e.g. lesser marshwort, lesser bulrush, cyperus sedge) were not found during the Phase I Habitat survey, this is not to suggest that these species are conclusively absent from the area, but the likelihood of encounter is lower.
- 6.4.6 *Grimmia Arenaria* and *Pallavicinia lyellii* moss and liverwort features appear to be highly localised to their described locations which are outside of the project footprint.
- 6.4.7 Mitigation measures for animal species such as otter which overlap SAC, Redshank, Snipe, River shingle invertebrates and Salmon are discussed further in section 13.

6.5 West Wales Marine (SAC)

- 6.5.1 Designated in February 2019, the site is now at full SAC status. The Conservation Objectives (COs) and Advice on Activities (AoA) are set out for the West Wales Marine, Annex II (reason for designation) species harbour porpoise (*Phocoena phocoena*).
- 6.5.2 The site covers both inshore (within 12 nautical miles of coast) and offshore (beyond 12 nautical miles of coast) waters where Natural Resources Wales (NRW) and the Joint Nature Conservation Committee (JNCC) have respective advisory responsibilities.
- 6.5.3 The boundary of the SAC has been defined based on population modelling and habitat mapping. The range is based from winter and summer population movements.
- 6.5.4 As the boundary is based on the general range of the species it is unlikely that this species will be encountered and in turn impact the defining feature of this SAC.
- 6.5.5 The mitigation measures to be set in place regarding other Cetaceans within the PLAS SAC will be sufficient to infer protection to this species.

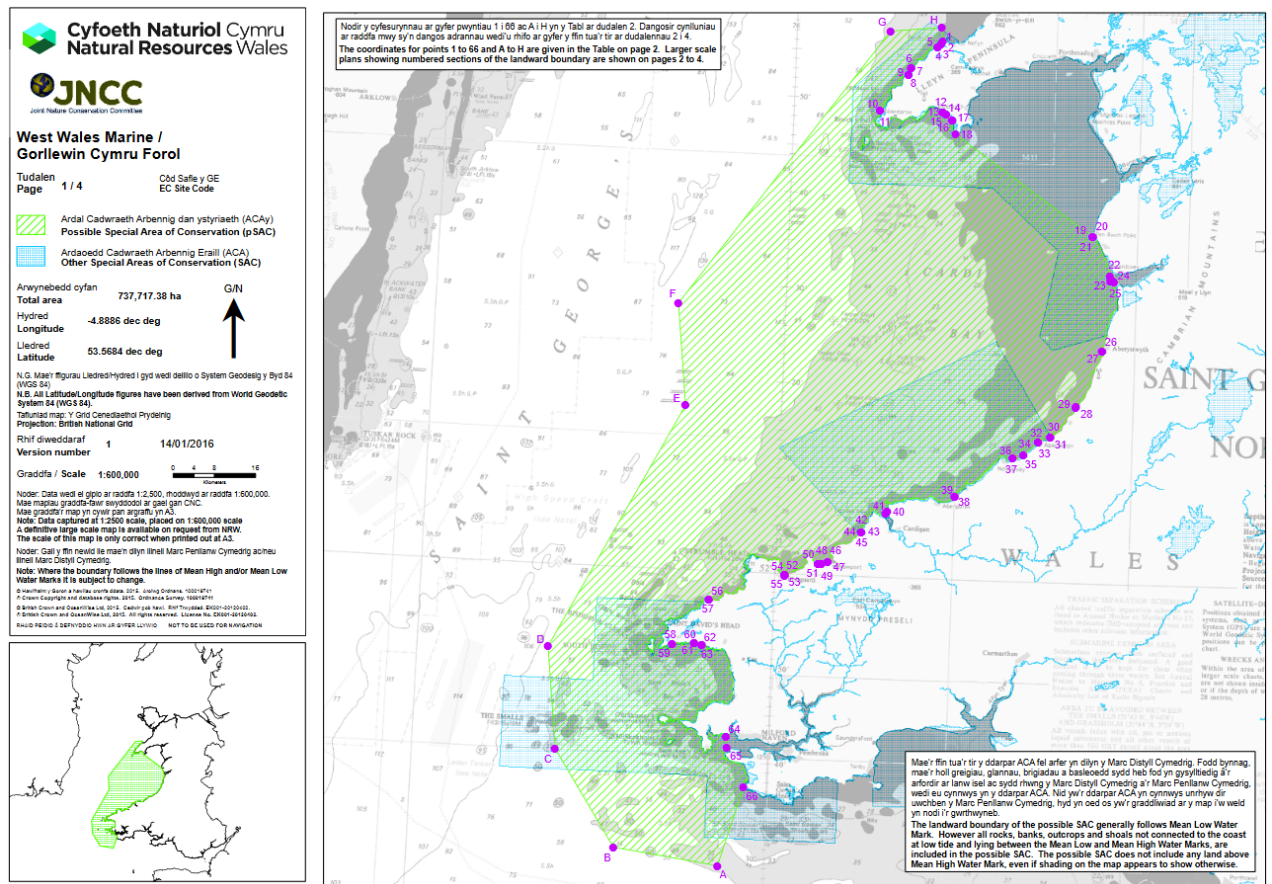


Figure 18: West Wales Marine site boundaries.

6.6 Llyn Peninsula and the Sarnau (SAC)

6.6.1 The Llyn Peninsula and the Sarnau SAC is comprised of sea, coast and estuary that supports a wide range of marine habitats and dependant wildlife. The nature of the seabed and coast including the range of environmental conditions present vary throughout the SAC. (See figure 3 for project location in relation to the SAC boundary). For the qualifying habitats and species listed in the table below (table 4), the Llyn Peninsula and the Sarnau SAC is one of the best areas in the United Kingdom.

Table 5: Annex I & II features of the PLAS SAC.

EU Code	Feature
Annex I habitats that are a primary reason for selection of this site	
1110	Sandbanks which are slightly covered by sea water all the time
1130	Estuaries
1150	Coastal lagoons (* Priority feature)
1160	Large shallow inlets and bays
1170	Reefs
Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site	
1140	Mudflats and sandflats not covered by seawater at low tide
1310	Salicornia and other annuals colonizing mud and sand
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritima)
8330	Submerged or partially submerged sea caves
Annex II species present as a qualifying feature, but not a primary reason for site selection	
1349	Bottlenose dolphin (Tursiops truncatus)



EU Code	Feature
1355	Otter (<i>Lutra lutra</i>)
1364	Grey seal (<i>Halichoerus grypus</i>)

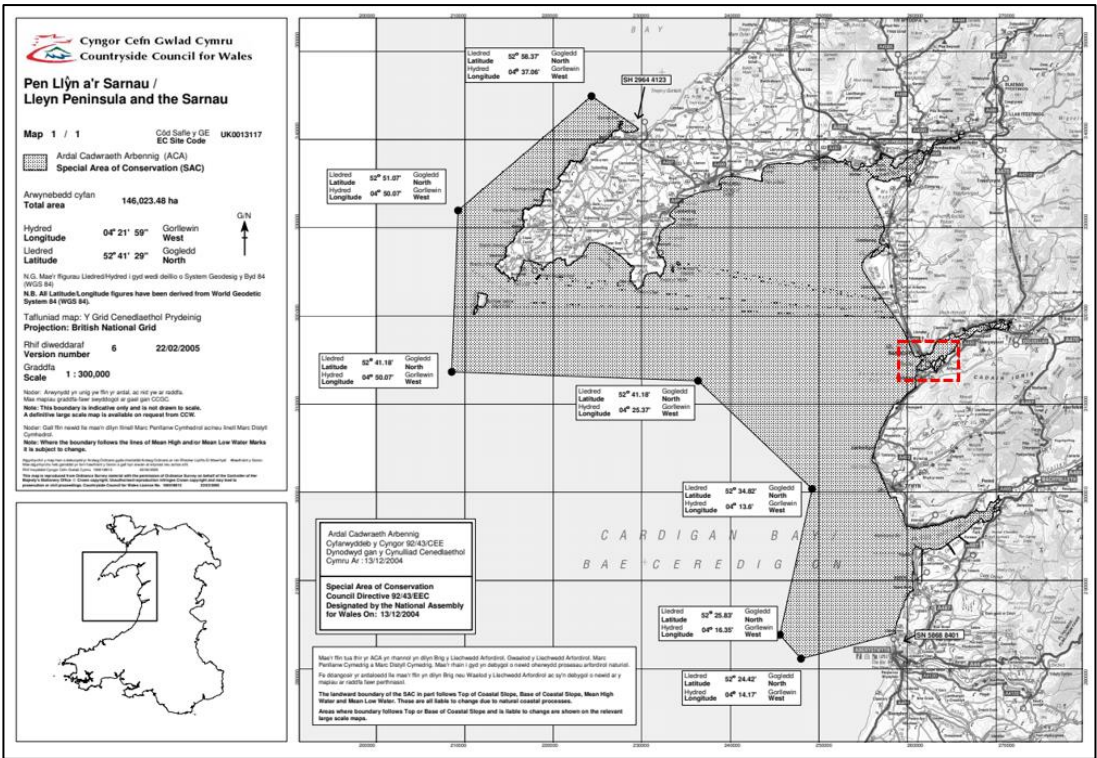


Figure 19: Boundary of SAC in relation to project area. West Wales Marine & Afon Mawddach boundaries overlap with Llyn SAC.

7. NIRAS Fish Survey Data

7.1 Spawning areas and Nurse grounds

7.1.1 This section outlines data from the NIRAS Fish Ecology Survey. The survey assesses commercial and protected fish species. Although not Annex II species within the SAC designation, they are supported by the Annex I habitats. This section mirrors that within Barmouth Viaduct HRA EV200213.HRA.001.

7.2 Protected Species

7.2.1 The table below features extracts from the Fish Ecology Report. The descriptions are summarised by a high low probability of an individual species likelihood of proximity to the project.

Table 6: Comments on protected fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Common and sand goby,	Both the common goby and sand goby will likely be present in the vicinity of the Project site.	✓	
Allis and twaite shad	According to the JNCC (2018), there is no significant presence of allis and twaite shad occurring in the vicinity of the Project site.	✓	



Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Smelt,	This species is listed as UK BAP Priority Species and a species of principal importance for the purpose of conservation of biodiversity under the Natural Environment and Rural Communities Act (2006). Smelt are not commonly found in the Mawddach Estuary or local vicinity (JNCC, 2018).		✓
Sea lamprey	River, Brook and Sea lampreys are not commonly observed in the Project site (JNCC, 2018). However, the Teifi river on the Southern part of Cardigan Bay does support a large population of the river lamprey <i>Lampetra fluviatilis</i> (JNCC, 2018).	✓	
Common Skate	The North Wales coast is known to have ideal conditions for skates and rays and this includes the benthic habitat of the Project Site and common skate is recorded as present in the Sarnau of Cardigan Bay (CEFAS tech report no 147).	✓	
Angel Shark	Angel sharks prefer sandy habitats which are close to rocky reefs, as recorded within the Pen Llyn a'r Sarnau SAC. Further information on distribution of this species includes sightings concentrated around Harlech, in particular Shell Island (Pen Llyn a'r Sarnau Liaison Group, Meeting Minutes, 2017) located to the north of the Project site.		✓
Basking shark	Although Cardigan Bay is not a recognised hot spot for basking shark it is quite likely that they do frequent local coastal waters (although unlikely to occur within the estuary itself), if not feeding at the surface then transiting between favoured areas north (e.g. Isle of Man) and south (the Celtic Sea) (Scottish Natural Heritage Report No 908).		✓

7.2.2 Species indicated as high likelihood require further assessment. The table below illustrates the general spawning period of these species.

Table 7: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sand Goby												
Allis shad												
Twaite shad												
Sea lamprey												
Common Skate												

7.2.3 From the table above it is evident that the vast majority of these species spawning period occurs outside of the project window. Works within the estuary itself would occur in July as indicated in the methodology above. While the blockades utilising vessels are later in the year and further less likely cause disturbance.

7.3 Migratory Species

Table 8: Comments on Migratory fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Salmon	Salmon concentrate on the mouth of the Mawddach Estuary during settled weather between October and the end of March, although the peak activity takes place between November and January, awaiting rising river levels to make their way upstream. This indicates that the poor catchments of freshwater tributaries	✓	
Sea trout	Trout fry densities have improved in the Mawddach estuary compared to previous spatial surveys undertaken in 2010. Several sites across the catchment had the highest densities on record during the NRW 2017 survey while other sites remained consistent with the historic data. Trout parr have also improved across the catchment and numbers are expected to increase in the coming years due to the improved fry densities.	✓	
European eel	European eels have been recorded in the Mawddach Estuary in the vicinity of the Project site in a 4-year programme to establish the status and stocks in England and Wales. Eel stocks in the	✓	



	Mawddach Estuary are thought to be still at or near to carrying capacity with male-dominated populations (Bark et al., 2007).		
--	---	--	--

Table 9: Spawning periods (blue highlight) of fish species indicated as occurring within project vicinity.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salmon												
Sea trout												
European eel												

- 7.3.1 The migratory species above will be spawning during the Phase II blockade. However, at this stage the vast majority of works requiring estuary access will be completed, although the resting of the barge at high tide and some machine access will continue. The overall level of sediment disturbance will be reduced in comparison to the gabion/reno mattress works proposed for Phase I.
- 7.3.2 As the portion of the estuary that remains flowing during low tide will not be impeded upon at any stage, it is unlikely that these species will find their natural range reduced. Vessel traffic will occur during the works, however this will not be dissimilar to current water traffic around Barmouth docks and will only be undertaken during periods when the tide is high enough for access.

7.4 Transient (Vagrant) Species

Table 10: Comments on Transient fish species from NIRAS report. Included likelihood of occurring within project footprint.

Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Sunfish	This species feeds on jellyfish, plankton, brittle stars, molluscs and crustaceans. It is found in warm and temperate regions of the Pacific and Atlantic oceans (Froes & Pauly, 2011). Sunfish have been reported in the vicinity of the Project site about one mile off the coast situated between Harlech and Barmouth in Cardigan Bay (JNCC, 2018).	✓	
Pilotfish	There appears to be no accounts of it being recorded in the vicinity of the Project site. It may travel with sharks or other large marine animals or sometimes along with large ships (Froese & Pauly, 2011).		✓

- 7.4.1 Although it is possible Sunfish may be in the vicinity of the project, the proposed works methodologies are unlikely to impact the species feeding habits.

7.5 Spawning Areas and Nursery grounds

Table 11: Comments on Spawning Areas and Nursery Grounds from NIRAS report. Included likelihood of occurring within project footprint.



Species	Comments relating to proximity to project	Likelihood of Proximity to Project	
		High	Low
Anglerfish	Anglerfish spawning grounds are located outside Cardigan Bay and outside of the Project site. As such, no spawning ground maps for Anglerfish have been drawn. Nursery grounds on the other hand are ubiquitous located throughout Cardigan Bay, including the Project site and the Mawddach Estuary.		✓
Cod	Cod spawning grounds are located in Cardigan Bay and the Project site, including part of the Mawddach Estuary. Nursery grounds on the other hand are limited to Anglesey and about 75km west of Cardigan Bay in the Irish Sea. Therefore cod nursery grounds are not present in the vicinity of the Project site.		✓
Ling & Mackerel	Ling spawning grounds are limited to 25km west off the Pembrokeshire coast and not in the vicinity of the Project site. Likewise, Mackerel spawning grounds are located north of Cardigan Bay and not in the vicinity of the Project site. No Nursery grounds for either species have been identified close to Cardigan Bay and as such, nursery grounds for the species have not been drawn.		✓
Norwegian prawn,	Both the spawning and nursery grounds of Nephrops are located in the central Irish Sea to the north west of the Cardigan Bay and not in the vicinity of the Project site		✓
European Plaice	Plaice spawning grounds include most of the coastal eastern Irish Sea including Cardigan Bay, the Project site and part of the Mawddach Estuary. The main nursery grounds for juvenile plaice have been identified along the coastal waters of North Wales (Ellis et al., 2012) including the Project site, where the newly benthic-orientated juveniles spend between 1 and 3 years before migrating offshore into deeper water (Fox et al., 2007).	✓	
Sandeel	Sandeel spawning grounds are located in Anglesey and Cardigan Bay, including the Project site and most of the Mawddach Estuary. Nursery grounds on the other hand are limited to Anglesey and further west of Cardigan Bay, about 75km west into the Irish Sea. Sandeel nursery grounds are therefore not present in the vicinity of the Project site.		✓
Sole	Sole spawning grounds are located mainly in the shallow water of the eastern Irish Sea including Cardigan Bay (Symonds et al., 1995) and the project site, spreading as far as out as 50km from the Project site. Sole nursery grounds are not located within Cardigan Bay and are restricted to the north eastern Irish Sea (Liverpool Bay and the Fleetwood coasts). As such, sole nursery grounds are not located in close proximity to the Project site.	✓	
Sprat	Sprat spawning grounds are located about 25km from the Project site to the west of Cardigan Bay towards the central Irish Sea and North towards Anglesey but not in the vicinity of the Project site. Nursery grounds are not located in the vicinity of Cardigan Bay and as such, no nursery grounds maps have been drawn.		✓
Spotted Ray	Given the lack of data available, no spawning grounds maps have been drawn for spotted ray as the data is either not available or the spawning grounds are outside the Project area. Nursery grounds on the other hand are located throughout Cardigan Bay and Anglesey, including the Project site and the Mawddach Estuary.	✓	
Thornback	As such, no spawning data is available, and no spawning maps have been drawn for this species. With regards to the nursey grounds however, Cardigan Bay is considered an area of importance to juvenile thornback rays (CEFAS Technical Report No 147). Nursery grounds are recorded around Anglesey and Cardigan Bay, including the Project site and Mawddach Estuary.	✓	
Tope Shark	Tope shark nursery grounds are located in the south of Cardigan bay off the Pembrokeshire coast and north of the Project site off the north coast of the Llyn peninsula and the coast of Anglesey. Nursery grounds are not located in the vicinity of the Project site		✓
Whiting	Whiting nursery grounds spread as far as 75km offshore from the Project site and again include most of the eastern Irish Sea.	✓	

7.5.1 From table 16 above the assessment notes that European Plaice, Sole, Spotted Ray, Thornback and Whiting nursery and spawning encompasses areas in which the Viaduct resides. However, from the available information the habitat below the structure does not appear to be a directly essential area for these species listed below, but as a component of a much wider range.



- 7.5.2 The scale and duration of impact on the habitat below the structure is limited and relatively short in duration. The likelihood of substantial impact to the population dynamics of these species above is low when considering their continued presence in an otherwise busy estuary.
- 7.5.3 The mitigations in relation to pollution and bio security measures in the sections below will ensure that the project does not cause a reduction in the vitality of these fish species population.

7.6 Current Condition of Waterbodies

- 7.6.1 Table 17 below records the condition of the Mawddach Estuary, in which the works will be undertaken and other waterbodies up and down stream of this, which have potential to be impacted by the proposed works. Data has been gained from the NRW Water Watch Wales Data Base and Interactive Mapping.

Table 12: Summary of the WFD status of the rivers / watercourses flowing into the Mawddach Estuary and connected water bodies

Waterbody name, ID, Type, Management Catchment, River Basin District.	Hydro-morphological designation	Current overall status & objectives	Biological elements	Physico-chemical elements	Water body Protected Area Links
Mawddach (GB511006407100) Type: Transitional (Estuary) Man Catchment: Meirionnydd Transitional Coastal RBD: Western Wales Area Name: WA North	Not designated as heavily modified Morphology = Not High Hydrological Regime = Not High	Current overall status = Moderate; Objective = Good by 2021 Current ecological status = Good; Objective = Good by 2021 Current chemical status = Fail; Objective = Good by 2021	Fish = Not assessed Macroalgae = High Phytoplankton = Not assessed Opportunistic Macroalgae = High Invertebrates = Good Infaunal Quality Index = Good	Dissolved oxygen = High Dissolved Inorganic Nitrogen – Good Annex 8 Chemicals = High Copper = High Zinc = High Cadmium = High Brominated diphenylether (BDPE) Calc = Moderate Hexachlorobutadiene = High Hexachlorobenzene = high Mercury = High Fluoranthene = High Lead = High Nickel = High	Protected Area = Yes Bathing Waters = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No Shellfish Water = Yes
Cardigan Bay North (GB621009600000) Type: Coastal Man Catchment: Western Wales TraC RBD: Western Wales Area Name: WA North		Current overall status = Moderate; Objective = Good by 2021 Current ecological status = Good; Objective = Good by 2021 Current chemical status = Fail (TBT); Objective = Good by 2021	Fish = Not assessed Macroalgae = High Phytoplankton = High Rocky Shore Macroalgae = High Opportunistic Macroalgae = High Invertebrates = Good Infaunal Quality Index = Good Imposex = Good	Dissolved oxygen = High Dissolved Inorganic Nitrogen – Good Annex 8 Chemicals = High Arsenic = High Copper = High Iron = High Zinc = High Cadmium = High Brominated diphenylether (BDPE) Calc = Moderate Hexachlorobutadiene = High Hexachlorobenzene = high Mercury = High Fluoranthene = High Lead = High Nickel = High	Protected Area = Yes Bathing Waters = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No Shellfish Water = Yes
Mawdach Lower (GB110064048710) Type: River Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North	Not designated as heavily modified. Morphology = Not High	Current overall status = Good; Objective = Good by 2021 Current ecological status = Good; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021	Macrophytes and Phytobenthos = Good Macrophytes Sub Element = Good Phytobenthos Sub Element = Good	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen – Good Ammonia (Phys-Chem) = High BOD = High Phosphate = High Annex 8 Chemicals = High	Protected Area = Yes Bathing Waters = No Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes

Waterbody name, ID, Type, Management Catchment, River Basin District.	Hydro-morphological designation	Current overall status & objectives	Biological elements	Physico-chemical elements	Water body Protected Area Links
	Hydrological Regime = Not High		Fish = Not assessed Macroalgae = High Phytoplankton = Not assessed Opportunistic Macroalgae = High Invertebrates = High Infaunal Quality Index = Good	Arsenic = High Copper = High Iron = High Zinc = High Manganese = High Benzo (b) and (k) fluoranthene = High Benzo (ghi) perelyene and indeno (123-cd) pyrene = High Cadmium = High Fluoranthene = High Lead = High Nickel = High Aldrin, Dieldrin, Endrin & Isodrin = High para - para DDT = High Temp = High	Nitrate Vulnerable Zone = No Shellfish Water = No
Wnion Lower (GB110064048800) Type: River Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North	Not designated as heavily modified	Current overall status = Good; Objective = Good by 2021 Current ecological status = Good; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021	Special Area of Conservation Fish = Good Phytoplankton = Moderate Invertebrates = High	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen – Good Ammonia (Phys-Chem) = High Phosphate = High Annex 8 Chemicals = High Arsenic = High Copper = High Iron = High Zinc = High Manganese = High Benzo (b) and (k) fluoranthene = High Benzo (ghi) perelyene and indeno (123-cd) pyrene = High Cadmium = High Fluoranthene = High Lead = High Nickel = High Aldrin, Dieldrin, Endrin & Isodrin = High para - para DDT = High Temp = High	Protected Area = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No
Gwynant (Mawddach Estuary) (GB110064048660) Type: River	Not designated as heavily modified	Current overall status = Good; Objective = Good by 2021	Special Area of Conservation Fish = Not assessed	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen – Good	Protected Area = Yes Special Protection Area = No

Waterbody name, ID, Type, Management Catchment, River Basin District.	Hydro-morphological designation	Current overall status & objectives	Biological elements	Physico-chemical elements	Water body Protected Area Links
Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North		Current ecological status = Good; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021		Ammonia (Phys-Chem) = High Phosphate = High Annex 8 Chemicals = Not assessed Temp = High	Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No
Cwn-Mynach (GB110064048820) Type: River Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North	Not designated as heavily modified	Current overall status = Good; Objective = Good by 2021 Current ecological status = Good; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021	Special Area of Conservation Fish = Not assessed	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen = High Ammonia (Phys-Chem) = High Phosphate = High Temp = High	Protected Area = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No
Cwm-Llechen (GB110064048810) Type: River Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North	Not designated as heavily modified Morphology = Good	Current overall status = Good; Objective = Good by 2021 Current ecological status = Moderate; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021	Special Area of Conservation Fish = Not assessed	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen = High Ammonia (Phys-Chem) = High Phosphate = High Temp = High	Protected Area = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No
Dwynant (GB110064048700) Type: River Man Catchment: Meirionnydd RBD: Western Wales Area Name: WA North	Not designated as heavily modified	Current overall status = Good; Objective = Good by 2021 Current ecological status = Moderate; Objective = Good by 2021 Current chemical status = Good; Objective = Good by 2021	Special Area of Conservation Fish = Not assessed	Dissolved oxygen = High pH = High Dissolved Inorganic Nitrogen = High Ammonia (Phys-Chem) = High Phosphate = High Temp = High	Protected Area = Yes Special Protection Area = No Drinking Water Protected Area = No Special Area of Conservation = Yes Nitrate Vulnerable Zone = No
Meirionnydd (GB41002G203200) Type: Groundwater Man Catchment: Meirionnydd Ground Water RBD: Western Wales Area Name: WA North		Current overall status = Poor; Current Quantitative status = Good Current chemical status = Poor.			Protected Area = Yes Special Protection Area = Yes Drinking Water Protected Area = Yes Special Area of Conservation = Yes Nitrate Vulnerable Zone = No

8. Water Framework Directive assessment: scoping for activities in estuarine and coastal waters

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

8.2 Section 1: Hydromorphology

8.2.1 The first stage is to consider if there is hydromorphology at risk from your activity.

Table 13: Summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

Consider if your activity:	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	For the permanent works, sections of the viaduct will be replaced on a like for like basis, with no change to the structure below the MHW level, beyond, grit blasting and painting and the replacement of significantly corroded sections, which will be cut out, with new sections either bolted, riveted or welded into position. During the works, scaffold will be erected onto the structure, which will be below water during high tides. This is due to be erected in April 2022 and removed in December 2022. There is potential that sections of this will be removed or amended prior to this and to provide alternative access to the structure during the works. Any amendments will be designed to the same criteria of minimising resistance to the flow of water through the estuary. It is not proposed to use machinery along the bed of the estuary, all works will be completed from the bridge deck utilising rail mounted cranes and the Maybey Jig Crane. The only physical interaction with the estuary bed will be during the low tide periods where pontoons will essentially beach on areas of sand / silt below the structure (not rocky areas, see below) while material is loaded from the viaduct, before being transported to the nearby Aberamffra Harbour. As the pontoons will be required to remain level to operate safely, it is unlikely that they will impact exposed outcrop features as the pontoons will be moved before waters become too low, and thus cause instability on the pontoon surface. It is unlikely that the beaching of pontoons on sandy areas of the estuary bed, beneath the structure would cause damage, however, the NIRAS intertidal survey suggests that habitat associated within the estuary below the structure, if disturbed, would re-established readily. Long term, the project will not present any change in the hydromorphological status of the estuary.
Could significantly impact the hydromorphology of any water body	Please see above - No impacts on any other water bodies.

Consider if your activity:	Hydromorphology risk issue(s)
Is in a water body that is heavily modified for the same use as your activity	The estuary is heavily modified by the presence of the viaduct, but the works do not make this situation any better or any worse as elements of the viaduct will be replaced like for like. The viaduct has been in situ for over a century. Current hydromorphology has become localised around the structure.

8.3 Section 2: Biology, Habitat & Fish

8.3.1 The second stage is to consider if habitats, Biology and Fish Species are at risk from your activity.

Table 14: Water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Habitats with potential to be impacted by the scheme are discussed in Sections 6 and 7 and extensively within the Habitat Regulations Assessment EV200213/001.

Higher sensitivity habitats ²	Lower sensitivity habitats ³
Chalk reef – No identified impact	Cobbles, gravel and shingle – The only potential impact is the pontoons resting on areas below the viaduct, which will be very low impact. Please refer to Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. for impact assessment and proposed mitigation for works within the estuary.
Clam, cockle and oyster beds – Mawdach Sheelfish Waters are within 2km of the site, please refer to Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. for impact assessment and proposed mitigation.	Intertidal soft sediments like sand and mud – No excavation is proposed within the Limited excavation will be required within the bed of the estuary. This process is described within Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. which also assesses the potential impacts from this work and proposed mitigation.
Intertidal seagrass – No identified impact	Rocky shore – Pontoons will be used around the bridge pier against the northern rocky shore. Pontoons will not be allowed to settle against the shore, as there is potential for this to damage the shoreline and the pontoons and would make the pontoons unstable.
Maerl – No identified impacts.	Subtidal boulder fields – No identified impact
Mussel beds, including blue and horse mussel - Mawdach Sheelfish Waters are within 2km of the site, please refer to Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. for impact assessment and proposed mitigation.	Subtidal rocky reef – There are no identified impacts on subtidal rocky reefs

Higher sensitivity habitats ²	Lower sensitivity habitats ³
polychaete reef – No identified impacts.	Subtidal soft sediments like sand and mud – At low tide, there is potential for pontoons to settle onto the bed of the estuary around the base of the viaduct piers. This is unlikely to cause damage to the estuary bed.
Saltmarsh – Mawdach Estuary SSSI Saltmarsh will be crossed, using the track along the eastern edge of the salt marsh as part of the project. Impacts on this are fully assessed in the Habitat Regulations Assessment – Doc Ref: EV200213/HRA-001	
Subtidal kelp beds – No identified impact	
Subtidal seagrass – No identified impact.	

² Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.

³ Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.

Table 15: Biology.

Consider if the footprint ⁴ of your activity is:	Biology habitats risk issue(s)
0.5km ² or larger	The total deck area of the section of viaduct to be worked on is 0.2km ² and the area of the pontoons within the estuary are significantly smaller. The footprint of the works is therefore less than 0.5km ² .
1% or more of the water body's area	The estuary covers an area of approximately 780ha. The section of the viaduct in question covers an area of 2,200m ² i.e. 0.5ha. The footprint of the works is therefore less than 1% of the estuaries area.
Within 500m of any higher sensitivity habitat	Works will be undertaken within the Afon Mawddach SSSI and Llyn Peninsula and the Sarnau (SAC). Impacts from the works will be temporary as sections of the viaduct structure are being replaced on a like for like basis. The impact of the works on the SSSI and SAC are considered in the sections below.
1% or more of any lower sensitivity habitat	The construction compounds will be located on lower sensitivity land adjacent to the estuary but not within the tidal reach of the estuary or within the SSSI / SAC. The impact of the construction of these has been considered as part of the Habitat Regulations Assessment for the scheme.

⁴ Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area.

Table 16: Potential fish species at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if your activity:	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or	Please refer to Section 7 – NIRAS Fish Survey Data.

prevent fish entering it or could affect fish migrating through the estuary

Works within the estuary will be undertaken within the fish migratory season, except for salmon and sea trout.

There will be no physical blocks to fish migrating through the estuary. The scaffold system will extend below water level at high tide but this will be limited to around the abutments and piers, leaving clear passage through the bridge. During high tide the entire width of the estuary will be available for use by migrating / foraging fish.



Scaffold around Metallic Section piers and swing section.

Pontoons will be used around the piers, which will rise and fall with the tide. A barge will be used to transport materials for a portion of the works but this will be located either alongside or between the piers of the viaduct. These will allow free passage for fish beneath the pontoons.

Key impacts on fish will therefore be noise and vibration from works on the upper sections of the structure. The structure is currently in use by rail vehicles and pedestrians, with trains and persons walking along the structure in a semi regular fashion.

Should an activity be required that causes an elevated level of disturbance then the mitigation for such impacts will take the form of the following:

- During such works which have potential to produce elevated levels of noise and vibration such as the cutting of steelwork the movement of rail vehicles along the viaduct, the craning out of sections of the viaduct using the jig system, breaks of 30 minutes will be taken in each 2 hour period of work to allow fish to pass (this will not be possible during some operations i.e. crane lifts and the work period may need to be extended but a suitable break will be taken at the end of the work period).

	- A bespoke lifting jig is to be used to lift large sections of the viaduct deck. This will reduce the requirement for the removal of small sections of the viaduct deck at a time to enable replacement of the cross heads. This will reduce the project programme. - None of the works will be undertaken over the main river channel, which flows beneath the steel section of the viaduct. This is where most of the fish passage is likely to occur. - For mitigation on impacts on water quality / chemistry, please refer to Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals.
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	Please refer to information above.
Could cause entrainment or impingement of fish	No identified impacts.

8.3.2 Please refer recorded findings for biology habitats and fish in previous sections.

8.4 Section 3: Water quality

8.4.1 Stage 3 - Consider if water quality is at risk from your activity.

Table 17: Water body summary table to find information on phytoplankton status and harmful algae.

Consider if your activity:	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	Use of Hydrocarbons: All plant machinery movement will occur within the confines of the rail corridor. No movement of plant machines along the estuary bed is required to support the metallic works. Pedestrian access may be required during the erection of scaffolding, but this will be limited to short duration, during low tide. No refuelling of plant machinery or equipment will occur within the estuary habitat. All items of static plant will be placed within a plant nappy when not in use. Fuelled equipment will be checked for defects and leaks prior to the start of each shift. Within the compound, a refuelling procedure will be implemented, whereby plant nappies will be placed beneath fuelling apertures during fuelling and refuelling will only be undertaken by designated, trained individuals using equipment specifically designed for that purpose. Network Rail have a spillage plan and specialised contractor in place to respond to and clean up spills. Use of Concrete: Concrete will be used to fill sections of the swing gear slew ring, but use of concrete and its pouring will only occur within the controlled environment of the rail corridor and within the now defunct swing gear cavity within the central steel super structure. The integrity of shuttering will be checked by the Section Engineer prior to commencing the pour and the SE will regulate the pour rate to ensure the shutter does not become overloaded. Washout facilities will be provided at the Morfa and Barmouth compounds, remote of the estuary. No concrete in relation to these works will be exposed to the wider environment. Grit Blasting: Grit vacuum blasting and conventional grit blasting will be undertaken using a blend of stone grit and iron silicate grit. This method of blasting contains all blast materials within the nozzle of the blasting gun. Conventional grit blasting may need to be used to reach into corners and sections of profile steel where the vacuum blasting gun cannot reach. The scaffolding around the structure will be fully encapsulated, with a containment deck on working levels. This will be sealed using heavy duty plastic sheeting and the overall scaffold encapsulated using Monoflex sheeting or similar (refer to Section 4.6 Scaffolding and Encapsulation) Grit blasting will result in the release of old paint and rust from the structure. This will be retained within the encapsulation system.

Consider if your activity:	Water quality risk issue(s)																														
	Application of Paint Systems: The paint system used will be Jotun Marathon 550 or similar approved and will be applied using predominantly spray painting but also brush painting – Please refer to Appendix B for Jotun Technical information. The paint system if released into the environment by accident is noted for its potential to be "Very toxic to aquatic life with long lasting effects." Consequently, control on how the system is applied is essential. <table><tr><th>Substrate temperature</th><th>5 °C</th><th>10 °C</th><th>15 °C</th><th>23 °C</th><th>40 °C</th></tr><tr><td>Surface (touch) dry</td><td>15 h</td><td>11 h</td><td>9 h</td><td>4 h</td><td>1.5 h</td></tr><tr><td>Walk-on-dry</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dry to over coat, minimum</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dried/cured for service</td><td>14 d</td><td>10 d</td><td>10 d</td><td>7 d</td><td>3 d</td></tr></table> Within the technical sheet extract above, the curing rate, will require the paint system to be applied at earliest opportunity as the tide recedes, allowing for the recommended curing times to be achieved. As the works are occurring during the spring/early summer, is it highly likely that the paint will have cured to a level that would be unlikely to leach its toxic properties readily into the environment (e.g., dry to the touch). Additionally, painting won't occur during high winds as to avoid drift and unnecessary loss of paint into the environment. Furthermore, visual inspection of the paint system as the tide gradually covers the recently painted areas will be required, with photographic evidence taken and reported to the project environmental clerk of works. This process will also be required to support the quality management system for the project and demonstrate correct application of the paint system. Impact Assessment – To assess the potential impacts of these activities, the following should be considered: Construction plant will be used on the viaduct within the estuary and hence there is a heightened risk of hydrocarbon release due to leaks of fuels and oils. Mitigation has been put in place for the use of this equipment within the project Environmental, Social Management Plan (ESMP). This document has been developed using guidance from GPP 2: Above ground oil storage tanks, GPP 5: Works and maintenance in or near water and PPG 6: Working at construction and demolition sites, GPP 7: Safe storage – The safe operation of refuelling facilities, GPP 21: Pollution incident response planning, GPP 22: Dealing with spills, GPP26: Safe storage – drums and intermediate bulk containers. This includes controls for the operation of plant using biodegradable hydraulic oil (where this is within the manufacturers permitted specification), the re-fuelling of plant and equipment, inspection and maintenance routines for plant to identify defects which could result in the release of liquids, biosecurity protocols, silt mitigation procedures, waste management procedures. The ESMP also includes details on incident response and reporting, including hydrocarbon spills, remediation and reporting to NRW.	Substrate temperature	5 °C	10 °C	15 °C	23 °C	40 °C	Surface (touch) dry	15 h	11 h	9 h	4 h	1.5 h	Walk-on-dry	26 h	18 h	14 h	8 h	3 h	Dry to over coat, minimum	26 h	18 h	14 h	8 h	3 h	Dried/cured for service	14 d	10 d	10 d	7 d	3 d
Substrate temperature	5 °C	10 °C	15 °C	23 °C	40 °C																										
Surface (touch) dry	15 h	11 h	9 h	4 h	1.5 h																										
Walk-on-dry	26 h	18 h	14 h	8 h	3 h																										
Dry to over coat, minimum	26 h	18 h	14 h	8 h	3 h																										
Dried/cured for service	14 d	10 d	10 d	7 d	3 d																										

Consider if your activity:	Water quality risk issue(s)
	Use of concrete and its pouring will only occur within the control environment of the rail corridor and within the now defunct swing gear cavity within the central steel super structure. No concrete in relation to these works will be exposed to the wider environment. Use of vacuum blasting across the majority of the structure will minimise the release of grit and paint into the scaffolding enclosure. Where this is not possible, grit and paint will be captured within the enclosure system and will be vacuumed up and removed, prior to the scaffold being dismantled. Paint will be used within the manufacturers guidelines to minimise the exposure to the environment of liquid and sem-cured paint. Conclusion: Provided detailed mitigation plans are developed as part of the Task Specific Method Statements, in line with the broad guidance above, risks to water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns have therefore been assessed as low.
Is in a water body with a phytoplankton status of moderate, poor or bad	N/A
Is in a water body with a history of harmful algae	N/A

Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Chemicals which will be taken into the estuary as part of the works will be: - Hydrocarbons and coolants within plant and machinery. - Cementitious materials, as concrete to infill sections of the swing gear cavity within the central pier of span 2, to prevent water gathering. - Unknown chemicals within historic paint removed from the structure - Grit vacuum blasting and conventional grit blasting will be undertaken using a blend of stone grit and iron silicate grit. This method of blasting contains all blast materials within the nozzle of the blasting gun. Conventional grit blasting may need to be used to reach into corners and sections of profile steel where the vacuum blasting gun cannot reach. The scaffolding around the structure will be fully encapsulated, with a containment deck on working levels. This will be sealed using heavy duty plastic sheeting and the overall scaffold encapsulated using Monoflex sheeting or similar (refer to Section 4.6 Scaffolding and Encapsulation) Grit blasting will result in the release of old paint and rust from the structure. This will be retained within the encapsulation system. - A paint system, which is likely to be Jotum Marathon 500, this contains benzene at a concentration of <0.1%. Benzene is on the list of Freshwater and Estuaries and Coastal Waters, Priority substances, priority substances and other pollutants, Environmental Quality Standards (EQS) and xylene at a concentration of $\leq 10\%$. Xylene appears on the list of Freshwater and Estuaries and Coastal Waters,

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Water quality risk issue(s)
	Specific Pollutants and Operational Environmental Quality Standards (EQS). A Material Safety Data Sheet for Jotun Marathon 500 is provided in Appendix B Conclusion: Provided the project complies with the measures set out within the ESMP, which in turn contains guidance from the relevant GPPs, the risk of release of hydrocarbons and cementitious materials is low. Use of vacuum blasting and containment and shrouding systems as part of the scaffolding, the release of historic paint from the viaduct is low. Due to the way the paint reacts and cures, provided this paint is not released into the environment in its liquid form, the environmental availability of these substances is negligible.
It disturbs sediment with contaminants above Cefas Action Level 1	No sediments will be disturbed as part of the works.

Table 19: Assessing whether project falls within mixing zone.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Water quality risk issue(s) /Assessment of Risk / Mitigation Proposals.
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	No discharge pipeline or outfall is proposed as part of the works.

⁵ Carry out your impact assessment using the Environment Agency's surface water pollution risk assessment guidance, part of Environmental Permitting Regulations guidance.

8.5 Section 4: WFD protected areas

8.5.1 Stage 4 is to consider if WFD protected areas are at risk from your activity. These include:

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

Table 20: Location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is: Within 2km of any WFD protected area ⁶	Protected areas risk issue(s)
- Llyn Peninsula and the Sarnau (SAC) and access will be required through the Afon Mawddach SSSI.	The works will be undertaken within the Llyn Peninsula and the Sarnau (SAC) and access will be required through the Afon Mawddach SSSI. This is considered within the following sections and also in the Habitat Regulations Assessment for the scheme. There are two intertidal reefs that are believed to be below the wooden section of the viaduct structure. These will not be impacted by the proposed works.
Barmouth Designated Bathing Waters	There is potential for impacts from the works due to the following: - Hydrocarbon release from plant and equipment – Where possible, plant will be operated with biodegradable hydraulic oil. All plant will be less than 3 years old with the exception of the tracked loader. - Hydrocarbon release from plant and equipment - A strict process for the inspection, maintenance and re-fuelling of plant has been included within the Environmental and Social Management Plan (ESMP). This also includes an Emergency Preparedness and Response process to be implemented in the case of an incident. This includes clean up and reporting of hydrocarbon spillage. Bulk fuel will be stored overnight in the main compound, remote from the estuary. This will be transported to the estuary worksite in a small bowser. - Cementitious materials, as concrete to infill sections of the swing gear cavity within the central pier of span 2, to prevent water gathering.

Consider if your activity is: Within 2km of any WFD protected area ⁶	Protected areas risk issue(s)
	- Unknown chemicals within historic paint removed from the structure - Grit vacuum blasting and conventional grit blasting will be undertaken using a blend of stone grit and iron silicate grit. This method of blasting contains all blast materials within the nozzle of the blasting gun. Conventional grit blasting may need to be used to reach into corners and sections of profile steel where the vacuum blasting gun cannot reach. The scaffolding around the structure will be fully encapsulated, with a containment deck on working levels. This will be sealed using heavy duty plastic sheeting and the overall scaffold encapsulated using Monoflex sheeting or similar (refer to Section 4.6 Scaffolding and Encapsulation) Grit blasting will result in the release of old paint and rust from the structure. This will be retained within the encapsulation system. - Chemical Release - A paint system, which is likely to be Jotun Marathon 500, this contains benzene at a concentration of <0.1%. Benzene is on the list of Freshwater and Estuaries and Coastal Waters, Priority substances, priority substances and other pollutants, Environmental Quality Standards (EQS) and xylene at a concentration of $\leq 10\%$. Xylene appears on the list of Freshwater and Estuaries and Coastal Waters, Specific Pollutants and Operational Environmental Quality Standards (EQS). A Material Safety Data Sheet for Jotun Marathon 500 is provided in Appendix B - Reference has been made to GPP 2: Above ground oil storage tanks, GPP 5: Works and maintenance in or near water and PPG 6: Working at construction and demolition sites, GPP 7: Safe storage – The safe operation of refuelling facilities, GPP 21: Pollution incident response planning, GPP 22: Dealing with spills, GPP26: Safe storage – drums and intermediate bulk containers in the preparation of the ESMP. - Use of additional watercraft to support barge and pontoon.
Fairbourne Designated Bathing Waters	Impacts and proposed mitigation will be the same as for the Barmouth Designated Bathing Waters area, above.
Mawddach Shellfish Waters	Impacts and proposed mitigation will be the same as for the Barmouth Designated Bathing Waters area, above.

⁶ Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.

8.6 Section 5: Invasive non-native species (INNS)

8.6.1 Stage 5 is to consider if there is a risk your activity could introduce or spread INNS.

8.6.2 Risks of introducing or spreading INNS include:

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

Table 21: Risk from INNS

Consider if your activity could:	INNS risk issue(s)
Introduce or spread INNS	A Biosecurity Management Plan has been prepared for the project, which assesses the risk from INNS and proposes mitigation for this. Please refer to Appendix A.

8.7 Summary of WFD Pre-Assessment findings

Table 22: Summary of Pre-Assessment Stage Findings.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Elements of the viaduct will be replaced on a like for like basis. During the works, scaffold will be erected onto the structure, which will be below water during high tides. This is due to be erected in April 2022 and removed in December 2022. There is potential that sections of this will be removed or amended prior to this and to provide alternative access to the structure during the works. Any amendments will be designed to the same criteria of minimising resistance to the flow of water through the estuary. It is not proposed to use machinery along the bed of the estuary, all works will be completed from the bridge deck utilising rail mounted cranes and the Maybey Jig Crane. The only physical interaction with the estuary bed will be during the low tide periods where pontoons will essentially beach on areas of sand / silt below the structure (not rocky areas, see below) while material is loaded from the viaduct, before being transported to the nearby Aberamffra Harbour. As the pontoons will be required to remain level to operate safely, it is unlikely that they will impact exposed outcrop features as the pontoons will be moved before waters become too low, and thus cause instability on the pontoon surface. It is unlikely that the beaching of pontoons on sandy areas of the estuary bed, beneath the structure would cause damage, however, the NIRAS intertidal survey suggests that habitat associated within the estuary below the structure, if disturbed, would re-established readily. As the constriction imposed by the presence of the scaffolding is low as a proportion of the overall estuary cross section and this will not cause impediment to fish species migrating along the estuary, we have assessed the impact due to this as being low.	Mitigation to be put in place to minimise impacts – Please refer to Table 24 for proposed mitigation.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
	Scaffolding will be a temporary measure, we do not believe that this impact requires further consideration. Long term, the project will not present any change in the hydromorphological status of the estuary.	
Biology: habitats	Minor short-term impacts on marine habitats during construction, due to presence of scaffolding extending into water during high tide and additional marine craft and pontoons.	Mitigation to be put in place.
Biology: fish	Please refer to Section 7 – NIRAS Fish Survey Data. Works within the estuary will be undertaken within the fish migratory season, except for salmon and sea trout. There will be no physical blocks to fish migrating through the estuary. The scaffold system will extend below water level at high tide but this will be limited to around the abutments and piers, leaving clear passage through the bridge. During high tide the entire width of the estuary will be available for use by migrating / foraging fish.  Scaffold around Metallic Section piers and swing section.	Mitigation to be put in place.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
	Pontoons will be used around the piers, which will rise and fall with the tide. A barge will be used to transport materials for a portion of the works but this will be located either alongside or between the piers of the viaduct. These will allow free passage for fish beneath the pontoons. Key impacts on fish will therefore be noise and vibration from works on the upper sections of the structure. The structure is currently in use by rail vehicles and pedestrians, with trains and persons walking along the structure in a semi regular fashion. Should an activity be required that causes an elevated level of disturbance then the mitigation for such impacts will take the form of the following: - During such works which have potential to produce elevated levels of noise and vibration such as the cutting of steelwork the movement of rail vehicles along the viaduct, the craning out of sections of the viaduct using the jig system, breaks of 30 minutes will be taken in each 2 hour period of work to allow fish to pass (this will not be possible during some operations i.e. crane lifts and the work period may need to be extended but a suitable break will be taken at the end of the work period). - A bespoke lifting jig is to be used to lift large sections of the viaduct deck. This will reduce the requirement for the removal of small sections of the viaduct deck at a time to enable replacement of the cross heads. This will reduce the project programme. - None of the works will be undertaken over the main river channel, which flows beneath the steel section of the viaduct. This is where most of the fish passage is likely to occur. For mitigation on impacts on water quality / chemistry, please refer to Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals.	
Water quality	Potential impacts to water quality has been assessed in Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. This has identified that without appropriate mitigation there is potential for impacts during construction due to the removal of historic paint from the structure, which contains unknown chemicals. This paint has been exposed to the environment for many years and hence, there is a low risk of chemicals within the paint being released to the environment. Controls to be put in place as described in Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals. Spillage or overspray during the application of paint to the structure. Table 18: Assessing whether water quality is at risk from your activity through the use, release or disturbance of chemicals.	Mitigation for these potential impacts is described within Table 24.
Protected areas	Works will be undertaken within the Afon Mawddach SSSI and Llyn Peninsula and the Sarnau (SAC)	Working procedures and mitigation to be put in place to minimise potential for sediment

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
		release and hydrocarbon release. Mitigation described in Table 24.
Invasive non-native species	INNS have been identified in proximity to the project footprint. A Biosecurity Management Plan has been developed for the project, which includes INNS. Please refer to Appendix A.	Please refer to Biosecurity Risk Assessment

8.7.1 The WFD guidance stipulates if a pre-assessment has not identified any receptors at risk during scoping, you don't need to continue to the impact assessment stage and your WFD assessment is complete.

8.7.2 However, if the pre-assessment identifies one or more receptors at risk during scoping, you should continue to the impact assessment stage.

Table 23: Water Framework Directive (WFD) Assessment for the Meirionnydd groundwater waterbody

WFD elements	Assessment
Chemical status	<u>Temporary impacts during construction</u> No interaction with groundwater during construction. No predicted impacts. <u>Permanent effects during operation</u> No predicted impacts from the operation of the rail structure. <u>Assessment outcome</u> No adverse effects on the chemical status of the groundwater body have been identified and therefore this is scoped out of further assessment.
Quantitative status	<u>Temporary impacts during construction</u> No interaction with groundwater during construction. <u>Permanent effects during operation</u>

WFD elements	Assessment
	No predicted impacts from the operation of the rail structure. <u>Assessment outcome</u> Effects to the quantitative status of the groundwater body have been scoped out of further assessment.

9. Proposed Project Mitigation

9.1 Construction Phase Mitigation

9.1.1 In Table 23 below, measures have been set out detailing mitigation to be implemented to minimise the potential project impacts.

Table 24: Proposed Mitigation Matrix

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
Estuarine habitat - Loss of habitat from project activities.	Loss of habitat will be restricted to the submerged sections of scaffold at high tide and the presence of pontoons around the viaduct piers. For the permanent works, sections of the viaduct will be replaced on a like for like basis, with no change to the structure below the MHW level, beyond, grit blasting and painting and the replacement of significantly corroded sections, which will be cut out, with new sections either bolted, riveted or welded into position. During the works, scaffold will be erected onto the structure, which will be below water during high tides. This is due to be erected in April 2022 and removed in December 2022. There is potential that sections of this will be removed or amended prior to this and to provide alternative access to the structure during the works. Any amendments will be designed to the same criteria of minimising resistance to the flow of water through the estuary. It is not proposed to use machinery along the bed of the estuary, all works will be completed from the bridge deck utilising rail mounted cranes and the Maybey Jig Crane. The only physical interaction with the estuary bed will be during the low tide periods where pontoons will essentially beach on areas of sand / silt below the structure (not rocky areas, see below) while material is loaded from the viaduct, before being transported to the nearby Aberamffra Harbour. As the pontoons will be required to remain level to operate safely, it is unlikely that they will impact exposed outcrop features as the pontoons will be moved before waters become too low, and thus cause instability on the pontoon surface. It is unlikely that the beaching of pontoons on sandy areas of the estuary bed, beneath the structure would cause damage, however, the NIRAS intertidal survey suggests that habitat associated within the estuary below the structure, if disturbed, would re-established readily. Long term, the project will not present any change in the hydromorphological status of the estuary.	Negligible likelihood of significant impacts.
Salt marshes (also part of estuarine habitat) - Loss of habitat from project activities.	No loss of habitat is projected to occur as all site access takes place along the existing road surface and shale bar along the estuary edge. No vehicle or pedestrian access into the saltmarsh SSSI. This requirement is to be briefed as part of the site induction and as part of method statements for works within the estuary. Signage will be erected excluding pedestrian and vehicular traffic from the SSSI.	Negligible likelihood of impacts, with suitable mitigation in place.
Release of contaminative chemicals from	Chemicals which will be taken into the estuary as part of the works will be: - Cementitious materials, as concrete to infill sections of the swing gear cavity within the central pier of span 2, to prevent water gathering	Negligible likelihood of impacts with

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation																														
sediments within the estuary	- Unknown chemicals within historic paint removed from the structure - Grit vacuum blasting and conventional grit blasting will be undertaken using a blend of stone grit and iron silicate grit. This method of blasting contains all blast materials within the nozzle of the blasting gun. Conventional grit blasting may need to be used to reach into corners and sections of profile steel where the vacuum blasting gun cannot reach. The scaffolding around the structure will be fully encapsulated, with a containment deck on working levels. This will be sealed using heavy duty plastic sheeting and the overall scaffold encapsulated using Monoflex sheeting or similar (refer to Section 4.6 Scaffolding and Encapsulation) Grit blasting will result in the release of old paint and rust from the structure. This will be retained within the encapsulation system. - A paint system, which is likely to be Jotum Marathon 500, this contains benzene at a concentration of <0.1%. Benzene is on the list of Freshwater and Estuaries and Coastal Waters, Priority substances, priority substances and other pollutants, Environmental Quality Standards (EQS) and xylene at a concentration of ≤ 10%. Xylene appears on the list of Freshwater and Estuaries and Coastal Waters, Specific Pollutants and Operational Environmental Quality Standards (EQS). A Material Safety Data Sheet for Jotun Marathon 500 is provided in Appendix B Grit Blasting: Grit vacuum blasting and conventional grit blasting will be undertaken using a blend of stone grit and iron silicate grit. This method of blasting contains all blast materials within the nozzle of the blasting gun. Conventional grit blasting may need to be used to reach into corners and sections of profile steel where the vacuum blasting gun cannot reach. The scaffolding around the structure will be fully encapsulated, with a containment deck on working levels. This will be sealed using heavy duty plastic sheeting and the overall scaffold encapsulated using Monoflex sheeting or similar (refer to Section 4.6 Scaffolding and Encapsulation) Grit blasting will result in the release of old paint and rust from the structure. This will be retained within the encapsulation system. Application of Paint Systems: The paint system used will be Jotun Marathon 550 or similar approved and will be applied using predominantly spray painting but also brush painting – Please refer to Appendix B for Jotun Technical information. The paint system if released into the environment by accident is noted for its potential to be "Very toxic to aquatic life with long lasting effects." Consequently, control on how the system is applied is essential. <table><tr><th>Substrate temperature</th><th>5 °C</th><th>10 °C</th><th>15 °C</th><th>23 °C</th><th>40 °C</th></tr><tr><td>Surface (touch) dry</td><td>15 h</td><td>11 h</td><td>9 h</td><td>4 h</td><td>1.5 h</td></tr><tr><td>Walk-on-dry</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dry to over coat, minimum</td><td>26 h</td><td>18 h</td><td>14 h</td><td>8 h</td><td>3 h</td></tr><tr><td>Dried/cured for service</td><td>14 d</td><td>10 d</td><td>10 d</td><td>7 d</td><td>3 d</td></tr></table> Within the technical sheet extract above, the curing rate, will require the paint system to be applied at earliest opportunity as the tide recedes, allowing for the recommended curing times to be achieved.	Substrate temperature	5 °C	10 °C	15 °C	23 °C	40 °C	Surface (touch) dry	15 h	11 h	9 h	4 h	1.5 h	Walk-on-dry	26 h	18 h	14 h	8 h	3 h	Dry to over coat, minimum	26 h	18 h	14 h	8 h	3 h	Dried/cured for service	14 d	10 d	10 d	7 d	3 d	mitigation in place.
Substrate temperature	5 °C	10 °C	15 °C	23 °C	40 °C																											
Surface (touch) dry	15 h	11 h	9 h	4 h	1.5 h																											
Walk-on-dry	26 h	18 h	14 h	8 h	3 h																											
Dry to over coat, minimum	26 h	18 h	14 h	8 h	3 h																											
Dried/cured for service	14 d	10 d	10 d	7 d	3 d																											

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
	As the works are occurring during the spring/early summer, is it highly likely that the paint will have cured to a level that would be unlikely to leach its toxic properties readily into the environment (e.g., dry to the touch). Additionally, painting won't occur during high winds as to avoid drift and unnecessary loss of paint into the environment. Furthermore, visual inspection of the paint system as the tide gradually covers the recently painted areas will be required, with photographic evidence taken and reported to the project environmental clerk of works. This process will also be required to support the quality management system for the project and demonstrate correct application of the paint system.	
Contamination of the estuary from spillage of hydrocarbons during refuelling of plant and equipment or due to equipment failure.	Plant/Machinery will only operate in low tide conditions and will be removed from the estuary ahead of the rising tide. Provision will be made to remove broken down plant / vehicles or plant and vehicles which become bogged down. No refuelling of plant machinery or equipment will occur within the estuary habitat. All items of static plant will be paced within a plant nappy when in use or being stored. Plant will be checked for defects and leaks prior to the start of each shift. Bulk fuels will be stored in a bowser with secondary containment. This will be located in the site compound. Within the compound, a refuelling procedure will be implemented, whereby plant nappies will be placed beneath fuelling apertures during fuelling and refuelling will only be undertaken by designated, trained individuals using equipment specifically designed for that purpose. Network Rail have a spillage plan and specialised contractor in place to respond to and clean up spills. The Contractor will develop and implement an Emergency Awareness and Response Plan. This will describe how spills will be contained and cleaned up. The emergency plan will appoint an Incident Coordinator, define roles and responsibilities during an incident, detail response procedures and contain an inventory of response equipment to be maintained on site. Plant will also be available to remove contaminated ballast from site if required. All machinery entering the estuary will undergo regular checks and only use approved biodegradable oils. If oil leaks or damage to hydraulic hoses is noted, plant and machinery will be removed from the site and isolated within the site compound with containment measures beneath the leak, until it has been repaired and signed off by a competent fitter. The contractor will develop and emergency response plan in the event a machine becomes standard in the estuary from mechanical failure. Equipment will be available to syphon the fuel from the disabled machine in order to reduce the potential release of hydrocarbons into the estuary.	Negligible likelihood of impacts with mitigation in place.

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
Contamination of the estuary from release of concrete.	Concrete will be used to fill sections of the swing gear slew ring, but use of concrete and its pouring will only occur within the controlled environment of the rail corridor and within the now defunct swing gear cavity within the central steel super structure. The integrity of shuttering will be checked by the Section Engineer prior to commencing the pour and the SE will regulate the pour rate to ensure the shutter does not become overloaded. Washout facilities will be provided at the Morfa and Barmouth compounds, remote of the estuary. No concrete in relation to these works will be exposed to the wider environment. No concrete / cementitious materials will be stored in areas within the tidal range of the estuary or in areas liable to flooding.	Negligible likelihood of impacts with mitigation in place.
Amendments to the hydromorphology of the estuary	Elements of the viaduct will be replaced on a like for like basis. No mitigation is required for this.	Negligible likelihood of impacts with mitigation in place.
Aggregations of non-breeding birds such as Red Shank & Snipe Noise disturbance / Visual Disturbance / Habitat Destruction.	Project activities will create a source of light and noise over 6-10 hours during the day. Times will vary due to the variation in the tide. As working hours are not continuous there will be periods where birds are not disturbed by site activities. However, it is likely that local bird populations are habituated to a level of disturbance from human activities, due to large numbers of pedestrians walking across the viaduct and trains crossing the viaduct. The Saltmarsh habitat adjacent to the access route/compound is heavily grazed and thus does not provide an abundance of nesting locations. Consequently, the project is unlikely to impact these species nesting sites.	Negligible likelihood of impacts with mitigation in place.
Individual wintering birds - Noise disturbance / Visual Disturbance / Habitat Destruction.	Works within the estuary are programmed to be undertaken between April and December 2022, with the main blockade where large sections of the viaduct superstructure are replaced from August to November 2022. It is anticipated that the majority of the works will be completed within the early stage of the blockade but works will be undertaken during the early winter. Wintering birds within the estuary will be habituated to levels of noise and human presence due to the operation of the viaduct but construction noise and human presence is likely to exceed this. Works are not programmed around the clock and therefore there will be periods when there are no works within the estuary.	Impact on Wintering Birds has been assessed as low.
Otter - Noise disturbance / Visual Disturbance / Habitat Destruction.	Toolbox Talks will inform site personnel on identifying the Annex II Species. No otter holts have been noted to date within proximity to the structure, access route or Morfa Compound area. The project does not represent a hard boundary preventing access to the wider estuary by this species. Should an Otter be encountered during works, personnel will temporarily stand down until the animal has vacated the immediate area under its own volition. The contractor will abide by the Gwynedd Marine Code of Conduct. Salmon, which are a prey of Otter will not be prevented from travelling up the estuary during the project. Although there will be an elevated human presence around the	Impact Not Likely to be Significant, with appropriate mitigation

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
	structure, it is unlikely that this will present an impassable barrier to salmon migrating to spawn. Directional lighting measures as with those proposed for bat species will be implemented for Otter population to limit disturbance. Night shifts will generally be limited to a Saturday night.	
Bottle Nose Dolphin - Noise disturbance / Visual Disturbance / Habitat Destruction.	See above. It is likely that this species is habituated to a level of marine traffic along this section of estuary as a result of the nearby fishing dock. Additionally, as the bridge is an active railway and pedestrian route, consistent levels of vibrations, noise and visual disturbances are already emitted from this area. There is potential for disturbance from the use of barges, particularly at night. These activities will be occasional however and short in duration. These sorts of activities have been shown to be of interest to animals but be perceived as non-threatening. The principal contactor will adopt the Gwynedd Marine Code regarding Bottlenose Dolphins, Porpoises & Seals in relation to project and distribute a copy of the code to the work force	Impact Not Likely to be Significant, with appropriate mitigation
Grey Seal - Noise disturbance / Visual Disturbance / Habitat Destruction.	See above.	Impact Not Likely to be Significant, with appropriate mitigation
Fish Assemblage – Pollution and water quality impacts.	Pollution control and Biosecurity measures implemented as described above will minimise water quality impacts on fish species.	Impact Not Likely to be Significant, with appropriate mitigation
Fish Assemblage - Noise disturbance / Visual Disturbance / Habitat Destruction.	Works within the estuary will be undertaken within the fish migratory season, except for salmon and sea trout. There will be no physical blocks to fish migrating through the estuary. The scaffold system will extend below water level at high tide but this will be limited to around the abutments and piers, leaving clear passage through the bridge. During high tide the entire width of the estuary will be available for use by migrating / foraging fish. Pontoons will be used around the piers, which will rise and fall with the tide. A barge will be used to transport materials for a portion of the works but this will be located either alongside or between the piers of the viaduct. These will allow free passage for fish beneath the pontoons. Key impacts on fish will therefore be noise and vibration from works on the upper sections of the structure. The structure is currently in use by rail vehicles and pedestrians, with trains and persons walking along the structure in a semi regular fashion. The viaduct is currently used by trains and a significant number of pedestrians. This implies that fish within the estuary are habituated to noise and vibration from the	Works have potential to cause a Minor Significant impact.

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
	structure. Noise and vibration during the works will be of a greater magnitude and longer duration, particularly during the 2022 late summer / autumn blockade (August to November 2022). Complete mitigation of these impacts will be difficult but best practice will be used in terms of the construction methodology to limit this i.e. no site radios, modern well silenced plant, use of the Maybey Bridge Temporary Works System to lift sections of the bridge intact to reduce the need for disassembly of elements of the structure and minimise the duration of the works, use of hydraulic cutters as opposed to disc cutters. During works which have potential to produce elevated levels of noise and vibration such as the cutting of steelwork the movement of rail vehicles along the viaduct, the craning out of sections of the viaduct using the jig system, breaks of 30 minutes will be taken in each 2 hour period of work to allow fish to pass (this will not be possible during some operations i.e. crane lifts and the work period may need to be extended but a suitable break will be taken at the end of the work period) Night works are likely during rail blockade and as part of Saturday Night possessions. Task lighting will be designed to illuminate the works area but limit light spill into the estuary. This will be achieved through the use of LED flat glass luminaires set at a low level to the viaduct.	
Fish Assemblage - Contamination of the estuary from spillage	See comments under estuarine habitat	Impact Not Likely to be Significant
Biosecurity	A detailed Biosecurity Plan has been prepared for the project. This includes the following: - All site personnel and site visitors will be informed if any INNS are known to be present on site and that they are jointly responsible for preventing their spread/impacts. They will be made aware of what these species look like so they can avoid it where possible and take appropriate actions. - All site personnel and visitors will be inducted in good biosecurity practices. This will include adoption of the CHECK-CLEAN-DRY campaign (NNSS, 2015). - The CHECK-CLEAN-DRY poster will be displayed in the site office as a reminder of good biosecurity practices: - http://www.nonnativespecies.org/checkcleandry/ - All equipment, tools, vehicles and personal protective equipment (PPE) used on site will be checked for seeds originating from any identified INNS before leaving the area. If seeds from identified invasive species are identified, the items will be cleaned and removed seeds will be destroyed. - The spread of waterborne diseases will be limited through the adoption of the CHECK-CLEAN-DRY campaign. This would entail the use of a suitable disinfectant e.g. Virkon® S Aquatic to decontaminate all machinery and PPE prior to it entering site and upon leaving site. Following application of a suitable disinfectant, machinery and PPE will be allowed to fully dry for at least 72 hours before being used on another aquatic site. The Biodiversity Management Plan can be found in Appendix A.	Impact Not Likely to be Significant

Potential Hazard	Mitigating Circumstances / Mitigation Measures	Likelihood of Impact with Mitigation
Blue Mussels - Contamination of the estuary from spillage and increased sediment loading.	See comments under use of chemicals, cementitious materials and hydrocarbons.	

9.2 Operation Phase Mitigation

- 9.2.1 The replacement of sections of the structure will be undertaken on a like for like basis. The paint system specified offers and improvement in potential for the leaching of damaging chemicals over the current system.
- 9.2.2 No Operational Phase Mitigation is proposed, beyond controls currently in place by Network Rail to deal with potential pollution events due to accidental release of fluids from trains and emergency situations.

10. WFD Conclusion

- 10.1.1 Due to the nature and scale of the works to be undertaken during the Barmouth Rail Viaduct Metallic Structure Refurbishment project, providing the mitigation outlined within this document and within the project Environmental and Social Management Plan is implemented, this project will not prevent any of the water bodies associated with the project from meeting their Water Framework Directive objectives.

Appendix A – Biosecurity Management Plan

Appendix B – Grit Blasting Data Sheets

Appendix C – Jotum Marathon 550 – Safety Data Sheet