

CARDIGAN TIDAL FLOOD RISK MANAGEMENT SCHEME

Volume 1: Environmental Statement Chapter 10: Water Environment

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10. Water Environment

10.1 Introduction

This chapter assesses the likely significant effects from construction and operation of the Scheme, with respect to Water Environment. This chapter details the baseline environment, assessment of likely significant effects, and where necessary, mitigation measures to avoid, reduce or minimise significant effects are proposed.

This chapter is not intended to be read as a standalone assessment, and references should be made to Chapters 1-4. This chapter should be read in conjunction with the following topic chapters due to potential interactions between topics:

- Chapter 6: Biodiversity and Nature Conservation
- Chapter 11: Land Use and Soils

10.2 Competent expert evidence

Technical Lead Jenny Marshall-Evans is an Associate Director with 15 years' experience working in the environment sector, specialising in the water environment. She is a Chartered Environmentalist and a Chartered member of the Chartered Institute of Water and Environmental Management. Jenny is an expert in water quality, water resource management, Water Framework Directive (WFD) and EIA, having worked on large infrastructure projects, flood alleviation schemes and water utilities projects, including authoring and leading the Water EIA chapter for multiple developments.

Technical Author Nick Hill is a Water Environmental Scientist with 8 years' experience within the water environment sector. Nick has previous EIA experience on several DCO projects in the flood risk and renewable energy sector. This includes authoring the Water EIA chapter and two appendices (WFD Compliance Assessment and Geomorphology Baseline Assessment) for a DCO flood alleviation scheme.

10.3 Planning policy and legislative context

This section describes the relevant legislation, policy and guidance that has been considered in developing the Scheme design, and in the assessment of effects with respect to Water Environment. This legislation, policy and guidance has been reviewed and where applicable has informed the assessment through the identification and categorisation of sensitive receptors, requirements for mitigation, and the scope and/or method of assessment.

10.3.1 International and national policy

The Environment Act 1995

The Act made provision for the establishment of the Environment Agency (in England and Wales¹), which is an important consultee for water environment elements of the Scheme. It also sets out the statutory duties of the Environment (in England and Wales) towards the water

¹ Since 2013 the Environment Agency Wales changed to Natural Resources Wales.

environment and conservation. In Wales, many of the Environment Agency's former Welsh functions were transferred to the Natural Resources Body for Wales (known as Natural Resources Wales).

The Environment Act 2021

The Act is a new standalone primary legislation implementing new frameworks and filling post-Brexit gaps to increase and enforce adoption of environmental provisions. Of most relevance is Part 5, which sets out relevant legislation post Brexit for water, including the use of The Water Environment (Water Framework Directive (WFD) (England and Wales)) Regulations 2017 and changes to the priority substances listed. The Act aims to improve water quality and habitats. Scheme construction and operation elements would affect the water environment.

The Water Environment (Water Framework Directive (WFD) (England and Wales)) Regulations 2017

The Regulations require a process to manage, protect and improve the water environment and implements River Basin Management Plans (RBMPs). The Scheme affects WFD surface water and groundwater bodies which are within the Scheme Area. Consequently, a WFD assessment has been undertaken to comply with these regulations and as a requirement of the EIA.

The Water Resources Act 1991, as amended by the Water Act 2003 and the Water Resources (Abstraction and Impounding) Regulations 2006

The Act sets out provisions for the control of pollution of water, abstraction, working in or near watercourses and consent for the erection of temporary and permanent obstructions of watercourses. The Scheme would require all the above.

The Environmental Permitting (England and Wales) Regulations 2016 (as amended)

The Act sets out Regulations for abstraction and impounding licensing and flood risk activity permitting. The Scheme requires planning permission and a marine licence. It is expected that the marine licence would satisfy the needs of flood risk activity permit requirements.

Environmental Targets (Water) (England) Regulations 2022

The Regulations extend to both England and Wales, and impose new legally binding targets on the Secretary of State in relation to water to reduce sediment pollution. The Scheme would affect water quality in construction relevant to those targets.

The Groundwater Regulations 1998

The Regulations focus on the protection of groundwater for domestic or agricultural use. The Scheme has the potential to introduce changes to groundwater quality and quantity, but it has been assessed to ensure compliance with the regulations.

Welsh National Marine Plan (WNMP) (2019)

The WNMP sets out policies for the next 20 years for the sustainable use of Wales' seas. Policies under the plan should be considered in relation to the Water Environment include:

- (a) SOC_03 Marine Pollution Incidents - Proposals should demonstrate how they minimise their risk of causing or contributing to marine pollution incidents.
- (b) ENV_06: Air and water quality - Proposals should demonstrate that they have considered their potential air and water quality impacts and should, in order of preference:
 - (i) avoid adverse impacts; and/or
 - (ii) minimise adverse impacts where they cannot be avoided; and/or
 - (iii) mitigate adverse impacts where they cannot be minimised.

If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.

10.3.2 Local policy

Ceredigion County Council Local Development Plan 2007-2022

The Key Issues and Policies relating to this chapter are:

- Key Issue 6: Environment and Climate Change
- KI6.4. The need to ensure the protection and enhancement of ecosystem services as well as air, soil and water quality generally; protection against noise and light pollution and land instability; and to reduce demand for water and protect local geodiversity.
- Policy DM22: General Environmental Protection and Enhancement
- Policy DM23: Coastal Management

The assessment has considered these key issues and policies by addressing the impacts of climate change such as flood risk, whilst using the Scheme as an opportunity to enhance quality and diversity of the existing environment.

Shoreline Management Plan (SMP)

SMP Policy Unit 21 5.14 - St Ann's Head to Great Ormes Head

The SMP sets a long-term strategic approach for managing coastal and estuarine environments. Cardigan is situated within Unit 5.14; the policy is 'Managed Realignment' through set-back defences in the short (2025), medium (2055), and long term (2105), subject to nature conservation interests.

The National Strategy for Flood and Coastal Erosion Risk Management in Wales (FCERM) October 2020 (Welsh Government, 2020)

This publication addresses the increasing risk of flood and coastal erosion due to climate change by establishing long-term policies and actions to reduce the risk to homes, businesses, and the environment in the subsequent decade. The key objectives of this are:

- Risk Management: the strategy promotes a collaborative approach between local authorities and community groups, including to clarify roles and responsibilities to enhance public understanding of flood risks and resilience.

- **Climate Adaptation:** the strategy stresses the need readjust to address the impacts of climate change, such as sustainable drainage systems and revised planning policies to prevent future developments from increasing flood risks.
- **Community Engagement:** the strategy encourages public involvement in discussions about flood risk management to ensure that communities are informed and can participate in decision-making processes.
- **Integration with Planning:** the strategy aligns with new planning guidance and the Wales Flood Risk Assessment Map to inform development and planning decisions.

Natural Resources Wales Flood Risk Management Plan: Mid Wales Place (Natural Resources Wales, 2023)

This plan identifies Cardigan as being at risk for flooding from rivers and the sea, using the example of the January 2014 event where 30 properties were flooded. Cardigan is noted as one of the five communities in this region which are expected to undergo the greatest change in danger from the risk of flooding from the sea. The flood defence works at Cardigan are cited as one of the key delivery highlights for flood risk management activity. Of the 14 priorities listed, the following apply to the Scheme:

- **Priority 1:** Respond to the climate and nature emergencies by seeking innovative practices, promoting adaptation and preparing for future change.
- **Priority 2:** Develop and deliver catchment approaches to reduce flooding and contribute to ecosystem resilience, working with partners and stakeholders where possible and appropriate.
- **Priority 3:** Improve community resilience to current and future flood risk. Work with partners to support communities to become more aware and take action to mitigate their own flood risk.
- **Priority 4:** Seek and take opportunities for enhancement to the health and wellbeing of communities, biodiversity and the environment, and the wider benefits they provide, to support NRW's response to the Nature Emergency.
- **Priority 11:** Prioritise our work on a risk basis in alignment with Welsh Government's National FCERM Strategy and develop our evidence base to secure future investment in flood risk management.

10.4 Assessment guidance

The general guidance used in this assessment is described within Chapter 4: EIA Methodology.

Guidance utilised which is specific to the assessment of Water Environment is listed below:

- GN14 Marine Physical Processes Guidance to inform Environmental Impact Assessment (Natural Resources Wales, 2025a)

10.5 Consultation

Chapter 2: Project Development contains consultations in more detail, and the broader engagement with stakeholders. Section 2.3.2 summarises the outcomes of a workshop held with geomorphological specialists from Ceredigion County Council (CCC) and NRW, during which aspects related to this chapter were discussed.

During the statutory pre-application consultation period, feedback was received from NRW Development Planning Advice Service and this chapter has been updated accordingly. This includes clarity on the development of a surface water quality monitoring plan/ strategy and clarification on hydraulic modelling used to inform the assessment. For full details see the Pre-Application Consultation Report.

10.6 Scoped in receptors and potential effects

The Scoping Opinion received from Ceredigion County Council on 16th October 2025 (following advice from NRW) advised that hydromorphology, physical processes and WFD compliance should all be scoped into this assessment.

The following effects to the Teifi transitional WFD water body were therefore scoped into this chapter:

- Construction - Impacts on hydromorphology, physical process and WFD compliance.
- Operation – Impacts on hydromorphology from permanent channel narrowing and hydrodynamic changes.

The scoping opinion also advised that this chapter should include 'a robust, evidence-based WFD Compliance Assessment supported by a Baseline Geomorphology Technical Note and updated hydraulic modelling.' Both assessments are included within the appendices of this chapter. The scoping opinion also advised that a Flood Consequence Assessment (FCA) is required and findings are to be included within this chapter.

Potential impacts to water quality have been scoped out from detailed assessment in the ES with provision of a Construction Environmental Management Plan (CEMP) as embedded mitigation. This would ensure that any contaminants from soils or construction materials are prevented from entering the water body and potentially deteriorating water quality.

The following receptors have been scoped out of this ES for the water environment, as no impact pathways have been identified to require detailed assessment:

- Piliau - headwaters to confluence with Teifi
- Mwldan river waterbody
- Teifi – Afon Ceri to estuary river waterbody
- Teifi river waterbody
- Teifi and Coastal Ceredigion groundwater body

10.7 Methodology

The purpose of this section is to describe how likely significant effects relating to Water Environment have been assessed. A more general explanation of assessment methodology used throughout the EIA is provided in Chapter 4: EIA Methodology. The individual assessment methodologies are set out within the respective appendices:

- Detailed Water Framework Directive (WFD) Compliance Assessment (Appendix 10.1)
- Baseline Geomorphology Technical Note (Appendix 10.2)
- Flood Consequence Assessment (Binnies Ltd., 2026)
- Cardigan Tidal Flood Risk Management Scheme Hydraulic Modelling Report (Appendix 10.3)

10.7.1 Desk based assessment

The assessment of the Scheme impacts upon the water environment requires an understanding of the baseline condition of the surface water, groundwater and WFD receptor waterbodies within the study area. Data sources that have been used comprise of:

- Baseline Geomorphology Technical Note (Appendix 10.2)
- Natural Resources Wales (NRW) Water Watch Wales interactive mapping (Natural Resources Wales, 2025b)
- DataMapWales (Natural Resources Wales, 2025c)
- British Geological Society (BGS) Geology Viewer (British Geological Society, 2025)

10.7.2 Definition of study area

The study area for this assessment has been determined by:

- The immediate footprint of the Scheme
- The WFD water bodies (surface and groundwater) and any other surface water features within and in proximity to the Scheme
- Identification of hydrological connections that could create a pathway for impacts or effects on any of the surface or groundwater features

Due to the location of the Scheme within a WFD transitional water body on a tidally influenced section of the River Teifi (Afon Teifi), a broad spatial study area has been selected. This encompasses the tidal section of the Afon Teifi within and adjacent to the Scheme, extending out to the upstream and downstream boundaries of the Teifi Estuary WFD Transitional water body. Although the water body limits extend well beyond the immediate project works area, a precautionary approach has been taken to ensure all potential construction and operation impacts upstream and downstream of the works in Cardigan are identified. This study area is shown in Appendix C of Appendix 10.1.

The Zone of Influence (ZOI) for hydromorphological impacts has been defined in the Geomorphology Technical Note (Appendix 10.2) as local to the Scheme footprint and adjacent channel, extending approximately 500m upstream and downstream, with limited potential for wider estuarine hydrodynamic effects.

Adjacent WFD waterbodies (Piliau, Mwldan, and upstream Teifi river water bodies) were considered during scoping but have been excluded from detailed assessment in this chapter due to the absence of plausible pathways for significant impacts on the water environment beyond the defined study area. These waterbodies are, however, referenced in the appended Detailed WFD Compliance Assessment in Appendix 10.1. Potential impacts on fish within these waterbodies are addressed in Chapter 6: Biodiversity and Nature Conservation and not within the scope of this chapter.

10.7.3 Significance

Significance is determined using a combination of sensitivity of the receptor, magnitude of the change and duration of effect. This is outlined within Chapter 4: EIA Methodology. The guidance used to define the criteria of sensitivity and magnitude is defined in section 10.4.

Sensitivity

The criteria used to assess receptor sensitivity is set out in Table 10-1, this includes examples of the types of features used to determine sensitivity.

Table 10-1 Receptor sensitivity criteria

Sensitivity	Criteria
High	Main river or WFD water body with limited modifications or pressures, varied morphological features and largely natural processes ('High' or 'Good' ecological status). For Heavily Modified Water Bodies (HMWB), all identified mitigation measures are 'In Place' ('Good' Ecological Potential). Designated Shellfish or High Status Bathing Waters. Water body (surface or ground) providing drinking water to a large population.

Sensitivity	Criteria
Medium	Main river or WFD water body with some identified modifications or pressures that influence the variety of morphological features present and processes operating ('Moderate' ecological status). For Heavily Modified Water Bodies (HMWB), not all identified mitigation measures are 'In Place' ('Moderate' ecological potential). Good Status Bathing Waters. Water body (surface or ground) providing drinking water to a small population.
Low	WFD water body with 'Poor' or 'Bad' ecological status/potential. Ordinary Watercourse or other non-WFD water body, typically with extensive modifications and limited natural processes
Negligible	Artificial ditches

Magnitude of Change

To determine the magnitude of change, the nature of the change (positive or negative) and characteristics (i.e. whether direct or indirect, secondary, cumulative, short or long-term, permanent or temporary, reversible or irreversible) were assessed and classified as high, moderate, low, very low, or negligible. The magnitude of a change on a receptor reflects consideration of information and analysis relating to the spatial extent (localised/isolated versus widespread with potential secondary effects); the extent (type and quantity of receptor affected); and the duration (short, medium or long-term). Table 10-2 defines these criteria with relation to potential for impact upon the water environment.

Table 10-2 Criteria for the magnitude of change

Magnitude	Criteria
High	Substantial change in hydromorphological, biological or physico-chemical elements at the water body scale, such that a change in WFD classification is possible, or objectives would not be met in the future. For HMWB, the impact would prevent WFD mitigation objectives from being implemented in the future. Positive impacts would substantially contribute to the implementation of HMWB mitigation measures. Substantial change in quality of a Protected Area, resulting in a reduction in classification status. Complete loss of a drinking water, industrial or agricultural water resource.
Medium	Measurable change in hydromorphological, biological or physico-chemical elements at less than the whole water body scale. A change in WFD classification is unlikely but may still need some mitigation or controls for the impacts. Objectives could still be met in the future. For HMWB, positive impacts would contribute to a limited number of HMWB mitigation measures. Measurable change in quality of a Protected Area, but unlikely to result in a change of classification status. Some reduction in quality or availability of a drinking water, industrial or agricultural water resource.

Magnitude	Criteria
Low	Measurable but localised or slight change in hydromorphological, biological or physico-chemical elements of a water body. No risk of change in WFD classification but may still need some mitigation or controls for the impacts. Objectives could still be met in the future. Neutral effects on HMWB mitigation measures – no conflicts, but no positive contribution either. Measurable but localised or slight change in in quality of a Protected Area, but unlikely to result in a change of classification status. Measurable but localised or slight changes in the availability of a drinking water, industrial or agricultural abstraction.
Negligible	No discernible change to a water body or water resource but no measurable loss in quality or availability.
No Change	No measurable change from the current baseline condition would occur.

The assessment of environmental effects has used the criteria as shown in the matrix in Table 10-3. After establishing the sensitivity of the receptor using criteria within Table 10-1 and assessing the magnitude of change using the criteria within Table 10-2, the effect to the receptor has been determined as either significant (major or moderate effects) or not significant (minor or negligible effects).

Table 10-3 Significance of effect matrix

	High Sensitivity	Medium Sensitivity	Low Sensitivity	Negligible
High magnitude	Major (significant)	Major (significant)	Moderate (significant)	Minor
Medium magnitude	Major (significant)	Moderate (significant)	Minor	Minor
Low magnitude	Moderate (significant)	Minor	Negligible	Negligible
Negligible magnitude	Minor	Negligible	Negligible	Negligible
No change	None	None	None	None

10.8 Baseline environment and likely future evolution

The section below describes the baseline environment and its likely future evolution. The current baseline environment scenario refers to the current state of environmental characteristics within

the Scheme Area. A desk-based study was undertaken to develop an understanding of the baseline condition of the surface and groundwater resources.

Further detail on the spatial distribution of the bedrock and superficial geology is set out within Chapter 11: Land Use and Soils.

Surface Water

The Afon Teifi is the dominant surface water feature within the defined study area and is the primary driver for the Scheme. Originating from Llyn Teifi in the Cambrian Mountains, the river flows southwest through predominantly rural uplands before passing through Cardigan and discharging into Cardigan Bay. The catchment is largely rural, with land use comprising agriculture, forestry, and upland moorland.

Within Cardigan itself, the Afon Teifi is transitional, both tidally and fluvially influenced, connecting both the marine and freshwater systems. The tidal limit of the river is located at Llechryd approximately 6.75 km upstream of the Scheme Area in Cardigan.

The following watercourse within the study area is scoped into this assessment and is designated as a WFD water body:

- Teifi Estuary transitional waterbody (GB511006206900)

The transitional waterbody is currently achieving “Moderate” overall status in Cycle 3. It is not designated as a heavily modified waterbody (HMWB) and its morphology status is “High”. Due to this, the sensitivity of the Teifi Estuary transitional waterbody receptor is deemed to be High.

Two key tributaries enter the Teifi within the study area but are not defined as receptors for this assessment:

- Afon Piliau, entering the Teifi approximately 180 m upstream on the left bank just upstream of Pont Y Priordy
- Afon Mwldan, entering approximately 290 m downstream on the right bank downstream of Cardigan bridge

Several minor drains and small watercourses also discharge into the Teifi within Cardigan, both upstream and downstream of the Scheme footprint.

Hydromorphology

Please refer to the Baseline Geomorphology Technical Note (Appendix 10.2) for a comprehensive baseline of the Afon Teifi morphology, informed by a site walkover.

Under the WFD, the Teifi Estuary transitional waterbody, is currently at ‘High’ status for morphology status and is not designated as a HMWB. The hydrological regime has not been assessed.

The Teifi is macrotidal and has a significant fluvial input. Tides are asymmetric and flood dominant, although it is noted that this can change during instances of increased fluvial discharge. Upstream of Cardigan Bridge, tidal influence remains, however fluvial processes are dominant (Halcrow, 2002).

The Scheme area already has significant bank protection which spans nearly the full length of each side of the river and is comprised of a mix of stone walls and gabions. This restricts natural processes, reducing the ability of the channel to migrate and limits morphological diversity of the intertidal zone.

The site walkover has reported that the substrate consists primarily of fine sediments forming mudflats, with some areas of dense and continuous saltmarsh along the right bank through Cardigan.

Based on the High morphology status WFD classification, and the presence of estuarine habitats such as mudflats and saltmarsh, hydromorphology sensitivity for this assessment is considered High.

Hydrogeology

The bedrock geology of the study area is dominated by sedimentary mudstones, which are generally characterised by low permeability and limit groundwater movement (British Geological Society, 2025). Beneath the Scheme footprint lies the Nantmel Mudstones Formation, while to the west, the geology transitions into several other formations, including the Dinas Island Sandstone and Mudstone Formation, the Cwm Degwel Mudstone Member, and the Net Pool Mudstone Formation. These lithologies are classified as Secondary A aquifers which support only minor groundwater resources. The groundwater-surface water connection is therefore expected to be low with flows restricted primarily to fractures and thin sandstone layers

Above the bedrock, the superficial geology comprises of alluvial and tidal deposits of clay, silt and sand and gravels (British Geological Society, 2025). These deposits are more permeable and have potential to hold shallow groundwater in proximity to the Afon Teifi. Outside of the Scheme footprint and further away from the river, other superficial deposits comprise of alluvium, glacial till and head deposits which are likely to influence shallow groundwater dynamics.

Flood risk

Several significant flood events have occurred in Cardigan between 2000 and 2020. The lowest lying residential and commercial properties in Strand area have a threshold level below 3.1m AOD and potentially impacted most years. The 0.5% Annual Exceedance Probability still water tidal level for the town, including 100 years of climate change, is estimated at 4.75m AOD, which is well above the existing ground levels at several locations, and the lowest properties are vulnerable to significant depths of flooding.

Tidal flooding represents one of the most significant sources of flood risk in Cardigan. The online NRW long term flood risk flood map includes flood extents for tidal flood risk. The lower quayside is an area of 'high' risk, which has a 3.3% AEP or greater risk of flooding. This area is inundated by the tide, which affects the lower Strand and the Cattle Market areas. Low-lying residential and commercial properties are affected by a tidal event that can be expected to occur every year.

There is a 'high' risk of fluvial flooding on the north bank of the Afon Teifi at Strand, which has a 3.3% AEP flood or greater risk of flooding. There is also 'high' risk of flooding upstream of Priory bridge, to the south of the A484. For surface water, most of the town is at 'very low' risk, which has less than 0.1% AEP risk of flooding.

The entire study area (behind the proposed flood defence wall) is currently classified as Flood Zone 3 for rivers and the sea. Further information is available in the Flood Consequence Assessment (Binnies Ltd., 2026)

10.9 Assessment of effects

This section describes the outcomes of the assessment, identifying the likely significant effects on Water Environment for the scoped in receptors. Where likely significant effects are reported, additional mitigation is described in Section 10.10 with the residual effects described in Section 10.11.

Construction

During construction, impacts on hydromorphology, physical process and WFD compliance could occur from:

Impacts to structure and substrate of the river bed from direct adaptation to habitat.

The Baseline Geomorphology Technical Note (Appendix 10.2) details that the existing substrate of the Teifi Estuary at the Scheme location is dominated by fine sediments with locations of rubble, possibly historic barge ballast, along the margins. During construction, there would be temporary impacts to both the structure and substrate of the bed due to the direct adaptation of the habitat; direct impacts and changes would occur as the haul road is constructed and used along the foreshore. The haul road would later be modified to form the engineered riverbank and as such the adaptation of existing habitats remains through operation as the design of the engineered riverbank would be formed of rock rolls, allowing intertidal habitat to develop and support biodiversity. The impacts are localised and minor in scale when compared to the size of the Teifi Estuary water body.

Prior to construction, a CEMP would be developed to ensure that environmental impacts are avoided and minimised during construction. The CEMP would detail mitigation measures specific to the construction phase and help to demonstrate the Scheme's commitment to environmental protection and sustainability. Standard good practice for working in or near water would be applied and would likely include measures to avoid sediments entering the water and measures to minimise the area of bed impacted by the works.

In relation to the impacts to structure and substrate of the river bed from direct adaptation of the habitat, impact would result in a slight, but measurable change to the hydromorphology in the local area. The magnitude of change is therefore considered as low, resulting in a moderate (significant) effect, that is negative, temporary, and direct.

Impacts to the intertidal zone from direct adaptation to habitat.

As mentioned previously, existing structure of the intertidal zone of the Teifi Estuary at the Scheme location is dominated by fine sediments with locations of rubble, possibly historic barge ballast along the margins, hard engineered banks and small sections of intertidal vegetation. During construction, there would be temporary impacts to the structure of the intertidal zone due to the direct adaptation of the habitat. Direct impacts and changes to the habitat would occur during the construction phase as the haul road is constructed and used along the foreshore, along with construction of the new flood defence wall.

Prior to construction, a CEMP would be developed to ensure that environmental impacts are avoided and minimised during construction. The CEMP would detail mitigation measures specific to the construction phase and help to demonstrate the Scheme's commitment to environmental protection and sustainability. Standard good practice for working in or near water as set out in the Guidance for Pollution Prevention 5: Works and maintenance near water (Natural Resources Wales, 2018) would be applied and would likely include measures to avoid sediments entering the water and measures to minimise the area of bed impacted by the works.

In relation to the impacts to the intertidal zone from direct adaptation to habitat, the impact would result in a slight, but measurable change to the hydromorphology in the local area. The magnitude of change is therefore low, resulting in a moderate (significant) effect, that is negative, temporary, and direct.

WFD Classification (surface and Groundwater bodies)

The Detailed WFD Compliance Assessment (Appendix 10.1) has considered the construction impacts of the Scheme against the Teifi Estuary transitional waterbody and has found that the Scheme would not result in deterioration of any water quality elements for this waterbody. The magnitude of change is therefore considered as negligible, resulting in a negligible (not significant) effect, that is negative, permanent and direct.

Operation

During operation, impacts on hydromorphology, physical process and WFD compliance could occur from:

Impacts to hydrodynamics from direct, permanent changes to river cross-sectional geometry and reduction in tidal prism.

Changes to the cross-sectional geometry have the potential to affect hydrodynamics. One-dimensional hydraulic modelling was undertaken; Table 10-4 details the modelled velocities at Node TE01_0755. This node is located at an existing narrow point in the channel, and where the engineered river bank is proposed, and as such is expected to show the most significant changes in velocities. All velocities for Q50 and Q1 inflows have a minor increase in velocities due to the Scheme. The results indicate that at Q50 to Q1 flows, the Scheme would not result in a change to the structure and substrate of the Estuary as the Hjulston-Sundborg diagram (Hjulström, 1939) details no change to erosion, transportation or deposition of fine sediment. During the QMED simulations, there is a modelled increase of 0.041 m/s in velocities during a High Astronomical Tide (HAT). Hjulston-Sundborg diagram (Hjulström, 1939) indicates that this increase in velocities would result in the erosion of coarse granules to fine pebbles as defined by the Wentworth classes. It would also result in the transportation of coarse pebbles and fine cobbles. As the sediments locally are dominated by fines, and there are no predicted changes to fine sediment dynamics, the modelling indicates a low risk of changes to the quality, structure and substrate due to hydrodynamic changes based on alterations of the cross-sectional geometry.

Table 10-4 - Baseline Velocities adjacent to Scheme at Node TE01_0755

Fluvial Inflow	Tide	Baseline Velocity (m/s)	Scheme Velocity (m/s)	Difference (m/s)
Q50	High Astronomical Tide (HAT)	0.989	1.003	0.014

	Mean High Water Spring (MHWS)	0.969	0.973	0.004
	Mean Low Water Spring (MLWS)	0.969	0.973	0.004
Q1	High Astronomical Tide (HAT)	1.417	1.446	0.029
	Mean High Water Spring (MHWS)	1.416	1.445	0.029
	Mean Low Water Spring (MLWS)	1.416	1.445	0.029
QMED	High Astronomical Tide (HAT)	1.639	1.680	0.041
	Mean High Water Spring (MHWS)	1.639	1.680	0.041
	Mean Low Water Spring (MLWS)	1.639	1.680	0.041

The Scheme is located in the upper estuary, where the tidal prism is relatively small. A minor reduction in tidal prism can be expected due to the Scheme from the new flood defence wall alignment, increased wall height and engineered riverbank at the toe of the flood defence wall. Additionally, the creation of new intertidal habitat in Area 4 would result in a minor increase in tidal prism. Minor changes are expected to the tidal prism due to the relatively small volume lost by the engineered riverbank and flood defence wall alignment. Changes in flood defence wall height are above the modelled water levels under the QMED and HAT scenarios, and as such, only impact the tidal prism during significant flood events. Also, the area of adapted intertidal habitat would mitigate the loss of tidal prism by the engineered riverbank and new flood defence wall alignment. Based on this, there are no anticipated impacts to the tidal regime associated with the Scheme in both construction and operation.

As there is no discernible change to the hydrodynamics of the waterbody due to the Scheme, the magnitude of change to hydrodynamics is therefore negligible, resulting in a minor (not significant) effect, that is negative, permanent, and direct.

Permanent loss of existing habitat and geomorphological features from flood wall.

Direct impacts and changes would occur during the construction phase as the haul road is constructed and used along the foreshore, along with construction of the new flood defence wall resulting in impacts on geomorphological features including salt marsh and the intertidal zones, as discussed above. However, this will be temporary in nature, because once operational the haul road would be modified to form the engineered riverbank, which will be constructed with rock rolls. This will allow intertidal habitat to develop which will enhance geomorphological diversity, in addition to supporting biodiversity. Due to the sloped nature of the engineered riverbank, the resulting area available for intertidal habitat to develop will also be marginally larger. Furthermore, the slope enables the habitat to migrate upwards in accordance with rising sea levels, meaning it is more resilient to climate change than the current habitats, which are backed with restrictive vertical walls.

Additionally, Area 4 (see Chapter 3: Project Description) would set back flood defences, allowing a new area of intertidal habitat to develop. The design approach incorporates habitat niches targeted to replicate natural estuarine features. This will mitigate for the loss of intertidal habitat

from the footprint of the flood defence wall and the space between the existing wall and the new flood defence wall. It is anticipated that the area of the new habitat would be of the same size as the area lost, with improved quality. The exact composition of the intertidal habitat will be down to natural river processes after creation.

Therefore, the overall operational magnitude of change from permanent loss of existing habitat from the flood wall is negligible, resulting in a minor (not significant) effect, that is positive, permanent, and direct.

WFD Classification (surface and groundwater bodies)

The Detailed WFD Compliance Assessment (Appendix 10.1) has considered the operational impacts of the Scheme against the Teifi Estuary transitional waterbody and has found that the Scheme would not result in deterioration of any water quality elements for this waterbody. The magnitude of change is therefore considered as negligible, resulting in a negligible (not significant) effect, that is negative, permanent and direct.

Flood Risk

The Flood Consequence Assessment (Binnies Ltd., 2026) summarises that the Scheme will reduce both tidal and fluvial flood risk, without causing detrimental flood risk elsewhere. Modelling results have advised that the Scheme will provide protection up to the 0.5% AEP tidal event, accounting for climate change, which will not negatively impact peak flood levels, extents, or velocities outside of the Scheme's footprint. Where increases in water levels or velocities have been observed, these are shown to be minor and highly localised, and still satisfy the requirements of TAN15. There is one exception, for the 0.1% AEP fluvial flood with climate change – however, the results for this are uncertain, and overall do not detract from achieving the requirements for TAN15. As such, the magnitude of change is major, resulting in a major (significant) effect, that is positive, permanent, and direct.

10.10 Mitigation measures

The following embedded mitigation measures have been adapted into the Scheme to reduce negative impacts:

- The legally binding avoidance measures shown in Table 5 of the Detailed WFD Compliance Assessment (Appendix 10.1) are included within the proposal. These include a Construction Environmental Management Plan (CEMP) and the use of silt curtains under a Pollution Prevention Plan.
- The design of the engineered riverbank, formed by rock rolls, provides the opportunity for intertidal habitat to establish and improve. Additionally, Area 4 would set back flood defences, allowing a new area of intertidal habitat to develop, mitigating the habitat lost during construction. This will have long term benefits by directly improving habitat quality in addition to enhancing climate change resilience such as to sea level rise due to the sloped riverbank profile which will allow habitat migration.
- The design has been shown to mitigate flood risk in Cardigan, including having accounted for the impacts of climate change and rising tidal levels, which has been built into the design.

10.11 Significance and duration of residual effects

Table 10-5 summarises the significance and duration of residual effects for each scoped in effect.

Table 10-5 - Summary of significance and duration of residual effects.

Scoped in Effect	Significance	Duration
Impacts to structure and substrate of the river bed from direct adaptation to habitat.	Construction The magnitude of change is considered as low, resulting in a moderate (significant) effect, that is negative, temporary, and direct. As this is unavoidable, the magnitude of change therefore remains low, resulting in a moderate (significant) effect, that is negative, temporary, and direct.	Short-term (construction phase)
Impacts to the intertidal zone from direct adaptation to habitat.	Construction The magnitude of change is low, resulting in a moderate (significant) effect, that is negative, temporary, and direct. As this is unavoidable, the magnitude of change therefore remains low, resulting in a moderate (significant) effect, that is negative, temporary, and direct.	Short-term (construction phase)
Impacts to hydrodynamics from direct, permanent changes to river cross-sectional geometry and reduction in tidal prism.	Operation The magnitude of impacts is negligible, resulting in a minor (not significant) effect, that is negative, permanent, and direct.	Permanent (operation phase)
Permanent loss of existing habitat from flood wall.	Operation The magnitude of change from permanent loss of existing habitat from the flood wall is therefore negligible, resulting in a minor (not significant) effect, that is positive, permanent, and direct.	Permanent (operation phase)
WFD Classification (surface and Groundwater bodies)	Construction and operation The magnitude of change is considered as negligible, resulting in a negligible (not significant) effect, that is negative, permanent and direct.	N/A

10.12 Monitoring

The Detailed WFD Compliance Assessment (Appendix 10.1) has identified that monitoring surface water quality should be undertaken during construction as a standard good practise measure. This is likely to include the use of automated river water quality instruments

(measuring several parameters at short intervals such as turbidity, dissolved oxygen, and temperature) both upstream and downstream of the works area with trigger limit alerts to determine whether construction activities are negatively impacting the Afon Teifi estuary. If limits are exceeded, then works in the river should be suspended until conditions recover. The intervals for water quality monitoring and associated trigger levels will need to be determined as part of a later monitoring plan and agreed with the local planning authority (as part of an anticipated planning condition (see also Chapter 11: Land Use and Soils, Sections 11.12).

10.13 Difficulties and uncertainties

The baseline developed for the assessment has been supported by and informed by specific studies and surveys to provide a better understanding of the relevant conditions in the Scheme area. It is assumed that the information held within the consulted datasets is sufficiently accurate for the purpose of assessing impacts on the water environment.

To date, the WFD Compliance Assessment has been based on 1D hydraulic modelling only, not 2D modelling. This is less detailed and does not fully represent factors such as full flow paths. However, the level of detail provided by the 1D modelling has been determined to be sufficient for the Scheme's requirements at this stage.

The 1D hydraulic model and reporting was suitable for the geomorphological assessment at the time it was carried out and this remains the case. Flood flows have changed along with climate change allowances, which will impact the assessment of flood risks and this will be captured in the latest modelling. However, the geomorphological risks are considered low and MHWS and exceedance flows have not changed; the 1D hydraulic model results are therefore considered suitable for the geomorphological assessment and there is no benefit to updating the results using the most current model.

10.14 Summary of assessment

This assessment has drawn on the findings of the Detailed WFD Compliance Assessment (Appendix 10.1), the Baseline Geomorphology Note (Appendix 10.2), the Flood Consequence Assessment (Binnies Ltd., 2026), and the Hydraulic Modelling Report (Appendix 10.3) to identify the significance of the impacts of the Scheme on intertidal habitats and channel structure. It has found that the impacts to the structure and substrate of the river bed and to the intertidal zone due to direct adaptation to habitat during construction are low, resulting in a moderate (significant) effect, that is negative, temporary, and direct. Impacts to hydrodynamics during operation are negligible, resulting in a minor (not significant) effect, that is negative, permanent, and direct. The permanent loss of existing habitat from the flood wall during operation is negligible, resulting in a minor (not significant) effect, that is positive, permanent, and direct. Impacts to the overall classifications of WFD waterbodies is considered negligible (not significant), negative, permanent and direct.

10.15 References

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