

CARDIGAN TIDAL FLOOD RISK MANAGEMENT SCHEME

Appendix 5.2 – Navigational Risk Assessment



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Table of contents

1.	Introduction.....	2
1.1	Background.....	2
1.2	Scope of Assessment	2
1.3	Proposed works	2
2.	Baseline River Traffic	4
2.1	Relevant authorities.....	4
2.2	Vessel access points and restrictions.....	4
2.3	River use.....	5
2.4	Local events	5
3.	Impact of the works.....	7
3.1	Proposed works & Construction methodology.....	7
3.2	Risk Assessment definitions	7
3.3	Risk to Vessels During Construction	7
3.4	Risk to Vessels During Operation.....	9
4.	Summary.....	11
4.1	Overall Risk and Recommendations	11

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1. Introduction

1.1 Background

The Cardigan Tidal Flood Risk Management Scheme is located towards the centre of Cardigan town in west Wales, where the lower quayside areas of Cardigan have previously been inundated by tidal flooding. Low lying residential and commercial properties in the Strand area are affected by a tidal return period of approximately 1 in 1-year annual exceedance probability.

The Scheme is proposed to reduce this risk of property flooding. The permanent works are proposed to be located on the north bank of the Afon Teifi. The Scheme is bound to the west by Castle Street (SN177458) and to the east by Gloster Row car park, as shown indicatively in Figure 1.

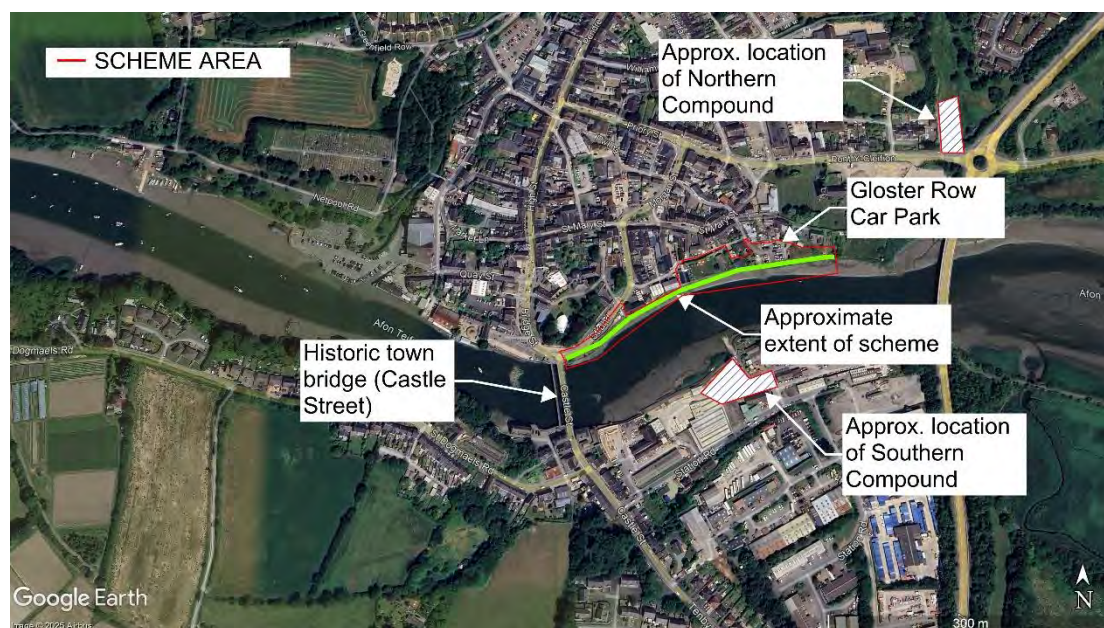


Figure 1 Location of proposed works

1.2 Scope of Assessment

The purpose of this report is to assess the impact of the proposed works on safety of vessels navigating the Afon Teifi, during both the construction and operational stages of the Scheme. It should be noted that the vertical datum referred to within this report is Ordnance Datum, and the levels to Chart Datum will vary from those stated.

1.3 Proposed works

The proposed Scheme will comprise a continuous flood defence structure designed to fit within the various constraints along the Afon Teifi frontage between Cardigan Bridge (Castle Street) and Gloster Row car park (approximately 300 to 400m in length). The flood defences will need to achieve a consistent level of 4.95mAOD to provide the scheme design standard of 1 in 200 years annual exceedance probability (AEP) with allowance for climate change.

The defence will be composed of sheet piles with masonry cladding, which will be set into the river from the existing walls by 1.5 m. This will be supported on the riverside by a lower toe berm (embankment/ revetment). The height of the revetment will be 3mAOD and will therefore

be emergent at ordinary tide levels. A cross-section of the river channel indicating the approximate area of the proposed works is shown in Figure 2. Further details of the works and construction methodology are included in Section 3.1.

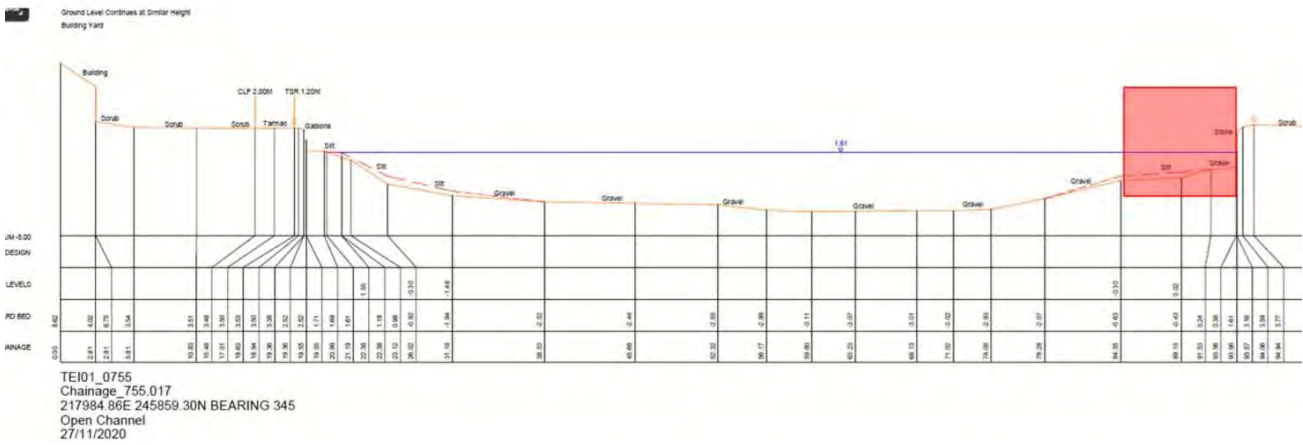


Figure 2 Cross-section of existing river near to Gloster Row car park, with approximate extent of proposed works indicated by red rectangle

2. Baseline River Traffic

2.1 Relevant authorities

The first stage of this assessment was to gather the relevant baseline information on vessel traffic on the Afon Teifi at the works area. This was carried out primarily by consulting with the relevant authorities who manage the use of the river. Through discussions with Afon Teifi Fairways Ltd (ATFL) and information provided by the Harbour Manager for Ceredigion Council, it was established that control of all matters relating to the vessel navigation on the Afon Teifi is the responsibility of ATFL. This arrangement is via a sub-lease from Ceredigion Council, who in turn lease it from Crown Estates. The baseline information presented in this section was therefore obtained through consultation with ATFL.

2.2 Vessel access points and restrictions

There are a number of access points to the river at Cardigan, including Prince Charles Quay in the town centre, two private slipways on the north bank, and one on the south bank. Upstream of the town, there are several slipways, the two closest of which are indicated in Figure 3 **Error! Reference source not found..** Pedestrian access to the riverside is also possible via an access path at the eastern end of the works area, although it is not thought that there is any vessel access from this location and there is no Public Right of Way (PROW). Downstream of the town bridge (Castle Street), the mooring area at Netpool is the only deep water mooring for the whole of the river, and the deep channel extends up to the town bridge, according to the ATFL website. Although the navigation channel is demarcated by navigation buoys along stretches of the river downstream of Cardigan, this does not extend to the area adjacent to the works.

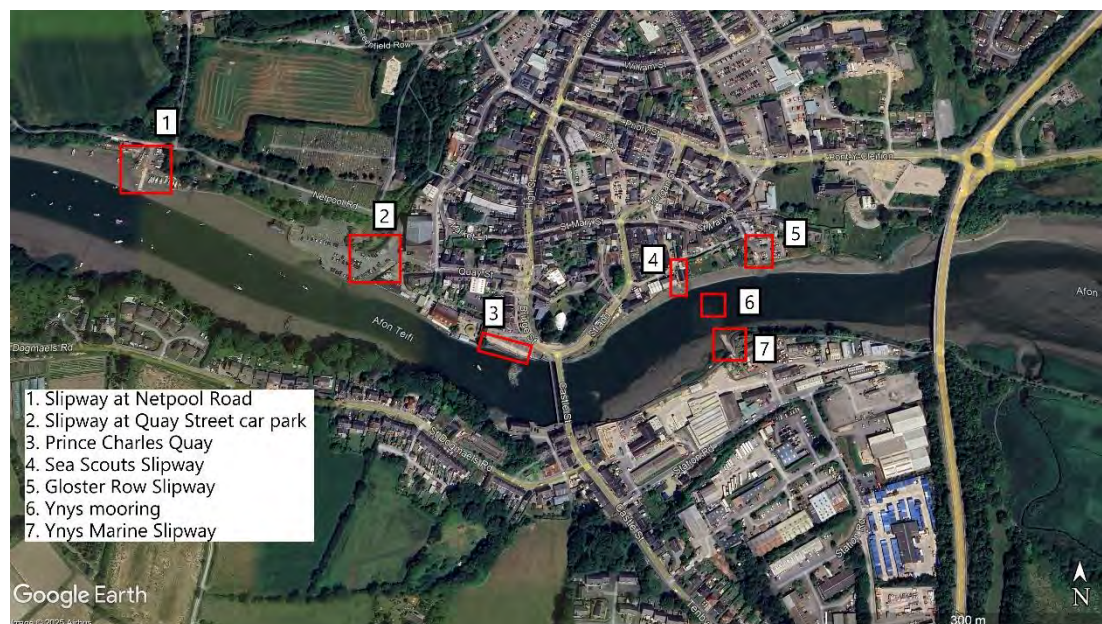


Figure 3 Locations of vessel access points and moorings along Afon Teifi North bank at Cardigan

According to the restrictions on the ATFL website, the maximum vessel draft that can safely enter the estuary from the bay is 1.8m, although vessels passing upstream of the historic town bridge are required to have “*shallow draft and low headroom*”. The maximum clearance under the bridge is 3m at low tide (reducing at high tide), and access for all vessels except canoes and kayaks is possible only through the central arch of the bridge (see Figure 4). At low tides, the water depth beneath the bridge is estimated by ATFL to be approximately 1m.



Figure 4 Photograph of the town bridge, looking south across the Afon Teifi, taken during site visit, June 2024

2.3 River use

From discussion with ATFL, the river is used primarily for leisure and tourism and therefore biased to warm summer months, with lower levels of traffic expected during the rest of the year. There are a number of activity groups, including the Sea Scouts and Adventure Beyond, who use the river for canoeing and kayaking. Use of the slipways between the town bridges are largely limited to these smaller vessels.

Larger vessels, including those used for tourist boat trips depart from the Prince Charles Quay. These usually travel downstream towards the bay, but there is a tour operator whose preferred route is upstream and past the works area. Vessels are a mix of powered and non-powered. During the summer months, it is estimated that there are approximately 50 vessels per week using the river, although this is mainly downstream of the Town Bridge.

This means that during the busiest months, daily traffic through or adjacent to the works area is anticipated to be light and is limited to small leisure craft, with a maximum possible draft of 1.8m and maximum air draft of 3m.

ATFL have confirmed the Gloster Row Slipway is not used by emergency services, who instead use the slipway at Quay Street Car Park to launch when necessary.

2.4 Local events

There are two local events that take place in the vicinity of the works which may be affected. The first is the annual Cardigan River and Food festival, which takes place in and around the Quay Street Car park to the west of the works area in August. This includes the following river activities which may be impacted by the proposed works:

- Boat Trips
- Coracle Demonstrations

- RNLI Rescue Demonstration
- Duck Race

The second local event is the Mermaid Race, which is a rowing race involving approximately 80 boats. The race launches at the Ynys Marine Slipway on the southern bank (adjacent to the Ynys moorings shown in Figure 3), and the route continues downstream through the town bridge to Cardigan Island and back to the bridge. This event is held annually, usually in June or July.

3. Impact of the works

3.1 Proposed works & Construction methodology

The proposed works consist of new sheet pile walls set into the river channel by 1.5m from the existing riverside wall. The sheet piles will be clad with masonry in a similar style to the existing historic town walls. The sheet piles will be supported along the majority of the defence length by a revetment which will have a maximum crest level of 3m AOD and extend approximately 6m out into the river channel from the sheet pile wall. This revetment will be constructed of granular fill topped by open stone riprap, with a 1V:2H slope. It is hoped this will become vegetated with estuarine plants over time. The river level at mean high water springs (MHWS) is 2.4m AOD, which means that the top of the revetment will remain exposed at ordinary tide levels. At low tides, the river level will be below the toe of the revetment.

It is anticipated that the first stage of construction will be installation of a temporary platform constructed from granular fill within the footprint of the proposed revetment. This will be constructed to a higher level than the revetment and installation of the sheet piles will be carried out from this platform. Once these works are complete, the platform will be trimmed back and topped with riprap to form the revetment. Construction and maintenance works, including transport of materials, will be carried out from the land.

3.2 Risk Assessment definitions

The risks during construction and operation of the scheme are assessed in the sections below, according to the following criteria. A severity and likelihood score is given to each hazard according to the categories in Table 1, and the results are multiplied to provide an overall risk score, as in Table 2. Where the risk score is deemed unacceptable, mitigation measures are proposed. The risk is then reassessed, considering these mitigation measures, and residual risk score for each hazard is calculated.

Table 1 Risk score definitions

Definitions:		
Score	Severity	Likelihood
1	Minor Injury	Very Unlikely
2	1st Aid Required	Unlikely
3	Serious (3-day off work)	Likely
4	Major (Requires Hospital)	Very Likely
5	Fatal	Almost Certain
Overall Risk Score:		
1-5 LOW	6-10 MEDIUM	12-25 HIGH

Table 2 Risk score matrix

Risk Matrix						
		Likelihood				
		1	2	3	4	5
Severity	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

3.3 Risk to Vessels During Construction

The following table outlines the risks to vessels and mariners imposed by the Scheme during the construction stage. The residual risk scores, for this stage, vary between 3 and 6, which are

low-medium. It is recommended that engagement with ATFL be continued throughout the construction phase of the works, in order to ensure that the mitigation measures noted in Table 3 are implemented effectively, in particular with regard to local events, such as the Cardigan River and Food Festival and Mermaid Race.

Table 3 Impact of the scheme on navigational risks during construction

Hazard	Initial risk score			Mitigation measures	Residual score		
	Likelihood	Severity	Score		Likelihood	Severity	Score
Vessel/ public on board vessel collision struck by construction plant	2	5	10	Set up exclusion zone around working area with temporary markers. Close northern arch of the bridge to prevent canoes and kayaks from entering the works area. Engage with ATFL to issue notice to mariners. Engage with local groups to ensure awareness of the works. Contractor to implement appropriate monitoring of the river during construction activities and cease plant movement if vessels enter the exclusion zone.	1	5	5
Vessel collision with temporary submerged structures – especially during conditions of low visibility (darkness or fog) or where strong currents are present.	3	3	9	Set up exclusion zone around working area with temporary markers to warn mariners. Engage with ATFL to issue notice to mariners. Engage with local groups to ensure awareness of the works. Vessel traffic is low even during peak summer months and it is therefore unlikely that vessels will be using the river during low visibility conditions.	2	3	6
Vessel navigation in low visibility conditions leading to collisions with the works area.	2	4	8	Vessel navigation adjacent to the works during low visibility conditions is unlikely as traffic within this area is limited to leisure and tourism. Existing, in-channel obstacles, such as bridge piers, present a more significant risk of collision during low visibility than the works. Engage with ATFL to issue notice to mariners. Engage with local groups to ensure awareness of the works. No plant movement should be carried out in low visibility	1	4	4

				conditions unless sufficient illumination is provided.			
Temporarily restricted channel width increasing likelihood of vessel collisions	1	3	3	Footprint of the temporary works and exclusion zones will be minimal in comparison to the width of the river. Given low river traffic with small vessels, impact of works is negligible, and no mitigation required.	1	3	3
Vessel collision with debris from construction.	3	3	9	Selection of competent contractor to implement appropriate waste management and storage systems.	2	3	6
Dust from works area causing obscured vision and subsequent vessel collisions.	3	3	9	Any cutting or other activities that may generate dust to be carried out on the landward side of the defence line. Appropriate dust management measures, as detailed in the Environmental Action Plan (EAP), should be followed.	2	3	6
Prevention of access to river by emergency services due to closure of the slipways.	2	4	8	The slipway at Gloster Row is confirmed not to be used by the emergency services. The Sea Scouts Slipway is privately owned and unlikely to be used for emergency access due to the narrow roads and limited access behind the slipway itself. Access for emergency services is provided from the Quay Street Carpark slipway, which will remain unaffected by the works.	1	4	4

3.4 Risk to Vessels During Operation

The following table outlines the risks to vessels and mariners imposed by the Scheme during the construction stage. The residual risk score vary between 3 and 6, which are low-medium. It should be noted that the risks identified above for the construction phase may also be present during maintenance of the flood defence structures, and the relevant mitigation measures noted above should be implemented as required.

Table 4 Impact of the scheme on navigational risks during operation

Hazard	Initial risk score			Mitigation measures	Residual score		
	Likelihood	Severity	Score		Likelihood	Severity	Score
Vessel collision with permanent submerged structures – especially during conditions of low visibility (darkness or fog) or where strong currents are present.	3	3	9	Footprint of the works will be minimal in comparison to the width of the river, therefore risks are comparable to the existing condition. Engage with ATFL to issue notice to mariners. Engage with local groups to ensure awareness of the works.	2	3	6
Permanently restricted channel width increasing likelihood of vessel collisions	1	3	3	Footprint of the works will be minimal in comparison to the width of the river. Given low river traffic with small vessels, impact of works is negligible, and no mitigation required.	1	3	3
Prevention of access to river by emergency services due to closure of the slipways.	2	4	8	The slipway at Gloster Row is confirmed not to be used by the emergency services. The Sea Scouts Slipway is privately owned and unlikely to be used for emergency access due to the narrow roads and limited access behind the slipway itself. Access for emergency services is provided from the Quay Street Carpark slipway, which will remain unaffected by the works.	1	4	4

4. Summary

4.1 Overall Risk and Recommendations

From discussions with the relevant authorities, vessel traffic within the section of the river affected by the works will be light and limited to small leisure craft and activity groups. The risk to these users is low, providing the following measures are taken during the construction stage:

1. Establish an exclusion zone around working area, using temporary markers.
2. Close the northern most arch of the bridge to prevent canoes and kayaks from entering the exclusion zone.
3. Engage with ATFL to issue a notice to mariners, warning of the works and the temporary exclusion zone.
4. Engage with local groups such as Adventure Beyond to ensure their awareness of the works and measures in place.
5. Selection of competent contractor to implement appropriate waste management and storage systems, to implement dust management measures in accordance with the EAP, and to implement appropriate monitoring of the river during construction activities and cease plant movement if vessels enter the exclusion zone.

To address the risks during the operation stage, the following recommendation is made:

1. Engage with ATFL to issue a notice to mariners, warning of the changes to the northern bank and potential for a partially submerged structure (depending on the tide level).
2. Engage with local groups such as Adventure Beyond to ensure their awareness of the change.

It is recommended that engagement with ATFL be continued throughout the construction phase of the works, in order to ensure that the mitigation measures are implemented effectively, in particular with regard to local events, such as the Cardigan River and Food Festival and Mermaid Race.