

# Clifden Railway Pedestrian and Cycle Bridge

Structures Options Report  
CRWB-ACM-STR-ZZ-ZZ-00-RP-ZZ-0001

Galway City Council


Project Reference: Clifden Railway Bridge  
Project Number: 60656050

1<sup>ST</sup> March 2023

A thick, bright yellow curved line that starts from the bottom left, curves upwards and to the right, and then curves back down towards the bottom right, creating a large, open, upward-pointing shape.

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# 1. Introduction

Galway City Council (GCC), in partnership with the National Transport Authority (NTA) have appointed AECOM as a multi-disciplinary design team to prepare a feasibility study for the construction of a new pedestrian and cycle bridge on the old Clifden Railway Bridge abutments and piers in the River Corrib at Woodquay in Galway City.

The original Clifden Railway Bridge built in 1884, is located 100m north of the Salmon Weir in Galway City. With the closure of the railway line in 1935 the bridge superstructure was removed and sold for scrap for £10. Only the superstructure was removed, and the abutments and piers remained in place unused

The reinstatement of the Clifden Railway Bridge as a pedestrian and cycling crossing point over the River Corrib will be transformational for the people of Galway. The bridge will link places of study, work, retail, and recreation using sustainable modes of transport. The bridge will help to bring a vibrancy and rejuvenation to the surrounding areas creating new areas of public realm to the people of Galway. The proposed bridge will improve the links to key locations in the city centre, and enable access to public transport, walking and cycling routes in the city. In time the bridge could play a significant role in linking proposed greenways including the Dublin to Galway, Galway to Barna and Galway to Clifden greenways.

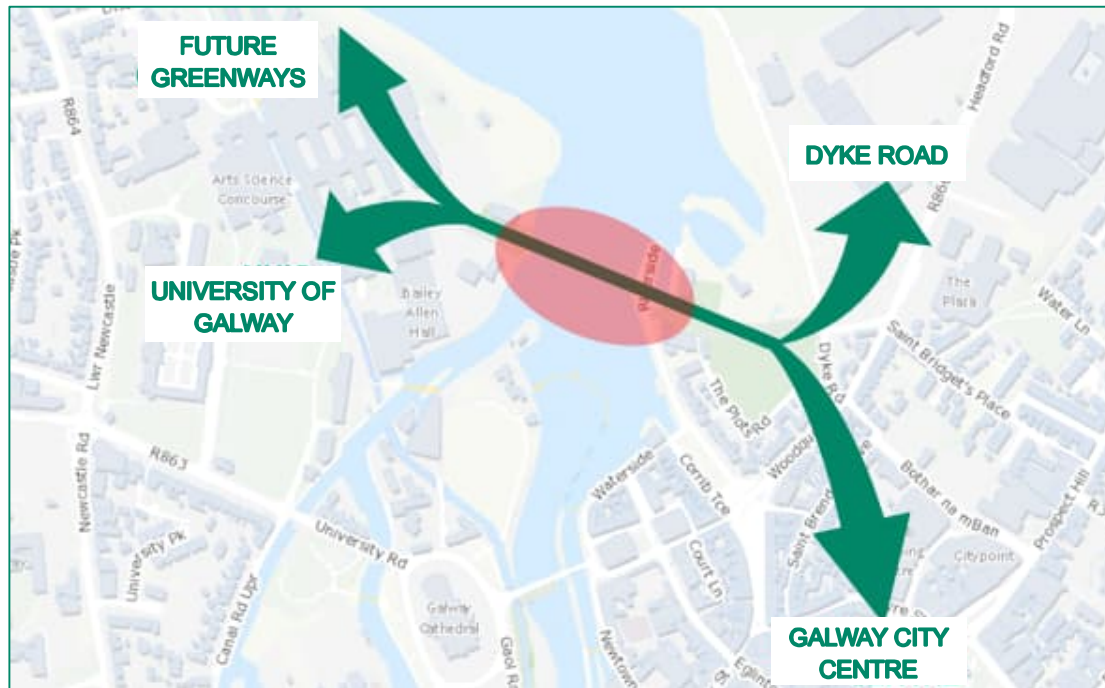
Proposals to construct a bridge in this location have reached various stages of development over the past twenty years. Planning permission was previously granted by An Bord Pleanála (ABP) (Ref. PL 07.ER2012) in 2002 for a bridge at this location as part of the Millennium Project. However, the project failed to progress from the planning stage until recently.

This Structures Option Report (SOR) will focus on various options which could be developed for the proposed bridge crossing. The bridge will follow the same alignment as the original Clifden Railway Bridge and utilise the existing piers and abutment. The objective of the report is to determine the feasibility of bridge construction in this location, to identify a preferred bridge option and to aid Galway City Council to secure funding for the next stage of project development, namely preliminary design, and environmental evaluation. The format of the report has been based on the requirements of DN-STR-03001 Technical Acceptance of Road Structures on Motorways and Other National Roads as published by Transport Infrastructure Ireland (TII). To this end, three bridges have been considered and assessed with a multi criteria analysis used to determine the most appropriate option to be progressed.

## 2. Site and Location

### 2.1 Introduction

The bridge will be located to the north of Galway City Centre approximately 100m north of the Salmon Weir. The bridge will span the River Corrib connecting the University of Galway (UG) campus to the City Centre via Riverside and Woodquay. In addition, the bridge will create linkages to proposed redevelopment areas along the Headford and Dyke Roads respectively. The coordinates of the proposed bridge are 529,608.741 E and 725,874.938 N (ITM)



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Figure 2-1 Indicative Bridge Location (red) and Linkages

### 2.2 Clifden Railway Bridge

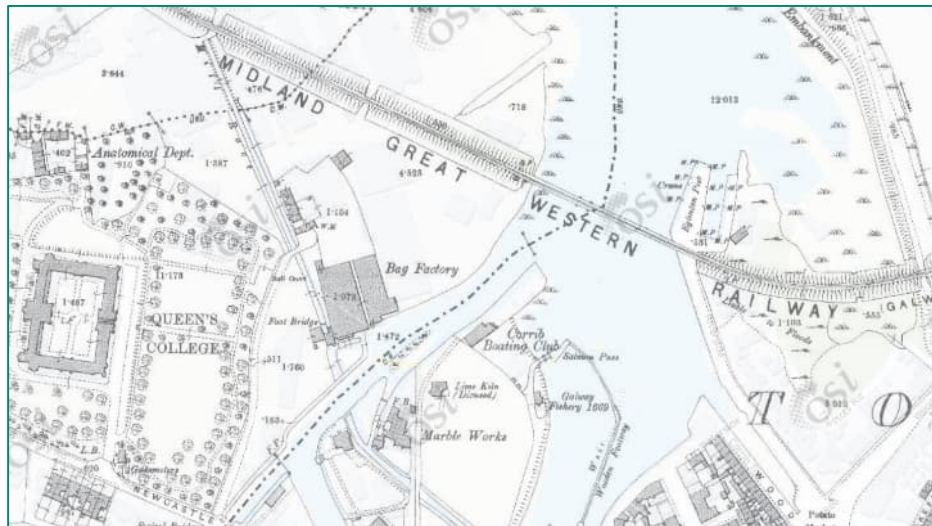
The original Clifden Railway Bridge formed a major river crossing of the River Corrib on the Midland Great Western Railway (Galway to Clifden Branch). The 78km railway carrying passengers and goods was first opened in 1895 connecting Ceannt Station in Galway City Centre to Clifden via Moycullen, Oughterard, Recess and Ballinahinch. The railway was subsequently closed in 1935 due to dwindling usage brought about by an increase in private car ownership and increase in heavy goods vehicles.



Figure 2-2 Photograph of Clifden Railway Bridge as viewed from Salmon Weir



The bridge formed the largest structure on the railway at a total length of approximately 154m spanning from “Waterside” on the eastern side of the River Corrib to the current day UG lands on the western side. The approaches were constructed on fill embankments providing a minimum vertical clearance of approximately 4.6m above road level along Waterside. At the time of construction, the bridge and approach embankments were constructed in predominantly greenfield lands prior to large scale development of Galway City. Historic 25-inch mapping from 1888 to 1913 indicates that the eastern approach was constructed on lands liable to flooding on the River Corrib flood plain. The western approach was built close to an industrial area with Bag Factories and Lime Kilns recorded. In addition, the area was in close proximity to Queens College (now UG).



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**Figure 2-3 Historical 25-inch mapping (dated 1888-1913)**

The superstructure of the bridge was formed in rivetted wrought iron and composed of four spans; three 48m lattice/warren truss structures and one 10m opening bascule span which allowed navigation to and from Lough Corrib. The substructure was formed of three instream piers and two abutments. The piers were formed of wrought iron plated cofferdams lowered to bedrock and backfilled with a limestone and granite granular material. A coursed ashlar masonry cladding was then constructed in front of the wrought iron plates. The abutments are formed in Portland cement with a coursed ashlar masonry cladding. With the closure of the railway the bridge superstructure was removed, and the material was sold for scrap. The piers and abutments were retained and to date have remained unused within the river.

The piers and abutments have been listed as protected structures in the Galway City Development Plan 2023-2029. The National Heritage Inventory of Architectural Heritage (NIAH) records the descriptions and appraisal of the structure (reg no. 30309001) as follows.

*“Remains of former railway bridge and embankment-built c.1895, rails and bridge superstructure now removed. Comprises earthen embankments running approximately east-west on both banks of River Corrib and terminating in rock-faced ashlar limestone construction abutments with oversailing block coping courses and coped parapet. Three rock-faced ashlar limestone piers in river having rounded ends and with coping in same style as abutments and west-most piers having Romanesque-style arrangement of arches with rock-faced voussoirs and springer blocks.”*



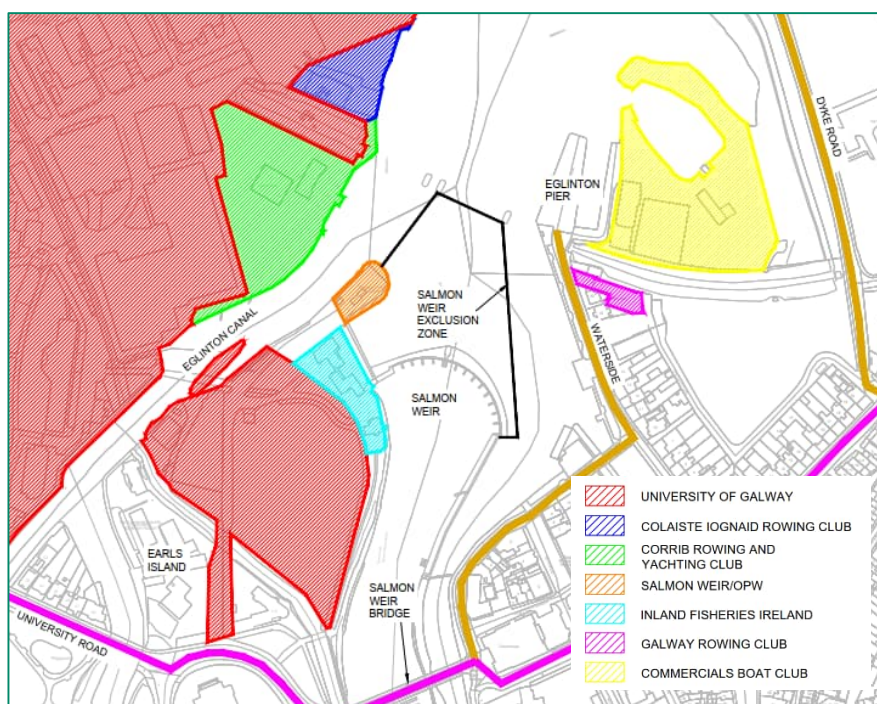
**Figure 2-4 Current view of bridge piers in the River Corrib**

Today the area is unrecognisable with significant development occurring since construction. The eastern approach has largely developed into a residential, retail and recreation area with some amenity green areas also present. The western approach has been developed by UG with significant numbers of education buildings and car parking present. Significant portions of the western embankments have also been removed as part of this development.

The area is also extensively used for amenity and leisure uses with a large number of rowing and yachting clubs occupying the riverbanks and utilising the River Corrib. Historical records and local reports indicate that the existing bridge piers are used as a diving location into the River Corrib. The piers are normally accessed by swimming from the riverbanks and climbing the pier. Diving usually takes place from Pier No.1 due to the depth of water (estimated at 6m) and diving is normally in a northern direction to avoid reported debris in the riverbed on the southern side of the pier. Records also indicate that the original bridge superstructure was also used for diving prior to its removal.

## 2.3 Receiving Environment

The receiving environment on the eastern and western banks of the River Corrib are largely developed into residential, retail, educational and leisure facilities with substantial existing infrastructure.



**Figure 2-5 Receiving Environment**



## 2.3.1 Infrastructure

### 2.3.1.1 Waterside

Waterside is a predominately residential road running directly to the south of the bridge and provides a connection between Eglinton Pier and the Headford Road/Galway City Centre. The road is bounded on its western side by the River Corrib and a masonry quay wall and a small green area. A large concrete slipway is also present allowing access to the river.

### 2.3.1.2 Dyke Road

Dyke Road runs in a north south direction and follows the eastern edge of the River Corrib flood plain. The road connects Terryland to the north with Galway City Centre on the south. The road is typically a narrow single carriageway with limited cycle facilities present. Pedestrian footways are noted along both sides of the road however they are not continuous with areas with no footways present.

### 2.3.1.3 Existing Salmon Weir Bridge

The existing Salmon Weir Bridge is a road bridge located approximately 300m to the south of the proposed bridge. The bridge is one of the main arteries over the River Corrib and carries single lane carriageways and two narrow pedestrian footpaths in an east west direction. This bridge provides the main connectivity between UG and the city centre. A new shared pedestrian and cycle bridge is proposed to be constructed parallel to the existing bridge to provide increased connectivity.

### 2.3.1.4 Eglinton Canal

The Eglinton Canal is approximately 1.5km long and is located to the south west of the bridge. The canal was constructed between 1848 and 1852 by the Commissioners of Public Works to improve water flow to mills in the city. The route contained five hand operated swing bridges which allowed navigation and transport of goods between Lough Corrib and Galway Bay. Today the route is unnavigable for larger vessels with each of the swing bridges having been replaced with fixed bridges in the 1950s.

### 2.3.1.5 Eglinton Pier

Eglinton Pier was constructed in 1845 as part of the Eglinton Canal. The pier was constructed to allow transfer of heavy goods from Lough Corrib to Galway Bay via the canal. The pier is a protected structure by the NIAH (reg No. 30309003) and is described as follows:

*'Rectangular plan dock-built c. 1845, of limestone block construction. Pecked limestone block coping stones to sides, and roughly coursed rubble stone slipway. Limestone mooring posts to east and west, with modern paving. Cast-iron gate/loading winch located to east side.'*

*'Sited in a prominent position on the east bank of the River Corrib, this dock displays fine workmanship in its construction. Clearly intended for very heavy loads, its presence is testament to the maritime heritage of the city, especially prior to the development of rail links. The dock now performs a social function as a mooring area for pleasure boats and tourist cruise boats.'*

The Corrib Princess currently uses Eglinton Pier as its departure point for cruises of Lough Corrib.

### 2.3.1.6 Salmon Weir

The current Salmon Weir located directly to the south was constructed in 1851 to replace an existing weir in the same location. The main purpose of the weir was to help improve drainage, reduce winter water levels in areas of Galway City prone to flooding, improve navigation and to regulate and improve water flow to the numerous mills located in the city. During construction the upstream riverbed between the weir and the Clifden Railway Bridge was blasted and dredged to allow for easier passage of salmon upstream and downstream. In addition to the weir a salmon ladder was installed to allow migration of salmon up and down the River Corrib. Today the weir is managed by the Office of Public Works (OPW). A large exclusion zone on the upstream side of the weir has been created by installing floating bollards to prevent unauthorised access. Inland Fisheries Ireland has a regional office covering the Western River Basin District located to the south of Salmon Weir, beside the Salmon Weir/OPW operations.

## 2.3.2 Education

### 2.3.2.1 University of Galway

Founded in 1849, UG (then known as Queens College) is the major third level institution in Galway City and occupies a large land holding on the western banks of the River Corrib. At the time of founding the college was located in a predominately rural/agricultural area on the western edge of Galway City. Today this area has been largely developed and urbanised with a number of educational buildings and residential areas. As part of this development large areas of the approach embankments to Clifden Railway Bridge were removed to facilitate construction. The area directly to the south and west of the existing embankment are occupied by the Orbsen

Building, Mail Services Building and the Students Union Building. In addition, there are numerous internal access roads and a campus car parking area to the west of the embankment.

### 2.3.3 Leisure

A large number of rowing, yachting and boat clubs are present in the area surrounding the bridge. At the bridge location the navigable channel of the River Corrib is between Pier No. 2 and the western riverbank and between Pier 3 and the eastern riverbank only. The area between Pier No.2 and No.3 is unnavigable due to the presence of the Salmon Weir exclusion zone.

#### 2.3.3.1 Corrib Rowing and Yachting Club

The Corrib Rowing and Yachting Club was founded in 1864 as is recognised as one of the oldest clubs in Ireland. The club own a large area of land directly to the south of the western approach embankment to the bridge. The lands are occupied by the club house, parking facilities, mooring facilities, and a slipway in the River Corrib. In addition, the club landownership includes a small area directly to the front of the existing western abutment of the bridge. This area of land is believed to have been originally owned by the Coláiste Iognáid Rowing Club and was traded between the two clubs in the past. Vertical clearance at the bridge will be a concern for the club particularly for sailing boats. However, it should be noted that the vertical clearance at the Clifden Railway bridge will be greater than the clearance at the Quincentenary Bridge directly to the north which limits the height of boats passing from Galway City to Lough Corrib.

#### 2.3.3.2 Coláiste Iognáid Rowing Club

Coláiste Iognáid Rowing Club (locally known as the Jes Rowing Club) was founded in October 1934. The school have ownership of lands directly to the north of the western approach embankment. The lands include the club house, parking areas and mooring facilities.

#### 2.3.3.3 Commercial Boat Club

The Commercial Boat Club was founded in 1875. The club is located at Steamers Quay directly to the north of the eastern approach embankment. The club own a large area of land in this location which includes a club house, car park, mooring facilities, and a slipway/quay. Vehicular access to the club is currently via Waterside with an unrestricted vertical clearance. Development of the bridge will need to consider the continued access requirements to the club with a restricted clearance and if required alternative access may be considered directly from Dyke Road.

#### 2.3.3.4 Galway Rowing Club

The Galway Rowing Club, originally called the Hibernian Rowing Club, was founded in 1910 in Woodquay. The club boat house is located along Waterside parallel to the eastern approach embankment to the bridge. Rowers access the river via the slipway located along Waterside. Access will need to be maintained to Waterside and the slipway for club members as part of the bridge development.

## 2.4 Planning Policy Context

### 2.4.1 Introduction

This section considers the pertinent policy documents publicly available which may impact bridge development. The policy documents assessed in this section include a high-level review of planning guidance on a National, Regional, and Local level for the purposes of this options report. An overview of the hierarchy of these policy documents is listed below.

Level	Document	Period
National	National Planning Framework National Development Plan	2018-2040 2018-2027
Regional	Northern and Western Region – Regional Spatial and Economic Strategy	2020-2032
Local	Galway City Development Plan Galway Transport Strategy	2023-2029 2016-2036

Table 2-1 Overview of Policy Documents

## 2.4.2 National Policy

### 2.4.2.1 National Planning Framework 2018-2040

The National Planning Framework (NPF) was published in 2018 and replaced the National Spatial Strategy. The NPF sets out a vision and a set of National Policy Objectives (NPO), and when combined with governance arrangements and aligned with capital investment, collectively, will form an overall national strategy that will deliver desired National Strategic Outcomes (NSO).

The NPF is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040, released in tandem with the NDP which sets out the budget for national infrastructure investment for the next 10 years. The NPF has emphasised shared goals for the country, of particular relevance the following NSO's would be considered to support the bridge development.

#### NSO 1 - Compact Growth

*"Improve accessibility to and between centres of mass and scale and better integration with their surrounding areas;"*

#### NSO 4 – Sustainable Mobility

*"Develop a comprehensive network of safe cycling routes in metropolitan areas to address travel needs and to provide similar facilities in towns and villages where appropriate."*

#### NSO 7 - Enhanced Amenities and Heritage

*"Implementation of planning and transport strategies for the five cities and other urban areas will be progressed with a major focus on improving walking and cycling routes, including continuous greenway networks and targeted measures to enhance permeability and connectivity."*

*"The Rural and Urban Regeneration and Development Funds will support transformational public realm initiatives to give city and town centre areas back to citizens, encouraging greater city and town centre living, enhanced recreational spaces and attractiveness from a cultural, tourism and promotional perspective."*

*"We will conserve, manage, and present our heritage for its intrinsic value and as a support to economic renewal and sustainable employment. "*

*"Open up our heritage estates to public access, where possible."*

*"Invest in and enable access to recreational facilities, including trails networks, designed, and delivered with a strong emphasis on conservation, allowing the protection and preservation of our most fragile environments and providing a wellbeing benefit for all."*

Consequently, the principle of the proposed bridge is considered to be supported by the overarching planning framework in the country.

### 2.4.2.2 National Development Plan 2018-2027

The National Development Plan 2018–2027 (NDP) will drive Ireland's long term economic, environmental, and social progress across all parts of the country over the next decade. The NDP 2018-2027 is fully integrated with the NPF and sets out the significant level of investment which will underpin the NPF for the period 2018-2027. The NDP, has, among its priorities, investment in regional growth potential. The NDP will support the achievement of more balanced development for the three regions in Ireland; the Northern and Western Region; the Southern Region; and the Eastern and Midland Region.

Under the NDP The Department of Housing, Planning, and Local Government are responsible for managing and implementing the Urban Regeneration and Development Fund (URDF) which has an allocation of €2 billion up to the year 2027. The fund is aimed at supporting compact growth and sustainable development of Ireland's cities including Galway. GCC have previously applied and received approval for €53.24 million under the URDF for the development of targeted projects within Galway City. Included within this funding is €40.30 million for the GCC *Transport Connectivity Project* which includes the development of the Clifden Railway Pedestrian and Cycle Bridge.

The NDP has also outlined that significant investment will also be undertaken in relation to Ireland's historic environment, in addition, it aims to *"revitalise the vital historic cores of our cities, towns and villages, bringing historic buildings back into use and contributing to urban and rural revitalisation"*. In this regard, the proposed bridge would be considered to be of relevance for potential future investment.

## 2.4.3 Regional Policy

### 2.4.3.1 Northern and Western Region – Regional Spatial Economic Strategy 2020-2032

The Regional Spatial Economic Strategy (RSES) for the Northern and Western Region (NWR) sets out the goals, priorities, and actions relevant to all parts of the region over the medium to long term. The RSES will help implement the strategic planning framework set out in the NPF.

The RSES includes a co-ordinated Metropolitan Area Strategic Plan (MASP) for the Galway Metropolitan area that provides a framework for development plans and investment prioritisation. A primary objective of the MASP is to present a strong policy focus on preserving and enhancing the city centre. This is further emphasised with protection and enhancement of the historic core with upgrades to the city centre public realm, that aims to boost the vitality and vibrancy of the city centre.

Of relevance, the RSES has outlined key transportation components of new river crossings proposed for the MASP, specifically outlining;

*“A new link from the Headford Road area to NUIG campus via a bridge on the piers of the old rail line and a new crossing linking Newtownsmyth with Gaol Road.”*

In regard to the above, the proposed bridge would unreservedly satisfy this objective of the RSES.

## 2.4.4 Local Policy

### 2.4.4.1 Galway City Development Plan 2023-2029

As per Section 27(1) of the Planning and Development Act 2000 (as amended), every planning authority in Ireland is required by law to provide a County/City Development Plan (CDP) that sets out the overall strategy for the proper planning and sustainable development for the area.

The primary aim of a CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout the county. With the general emphasis to enhance the quality of life, environment, community, and economy that supports the sustainable development of each county. The relevant national and regional objectives have been developed further and are translated into local objectives through the CDP.

The CDP includes an overall strategic vision for Galway City, the core strategy explicitly states;

*“The vision for Galway City is to be a successful, sustainable, competitive, regional city that creates prosperity, supports a high quality of life and maintains its distinctive identity and supports a rich cultural experience. A city that is environmentally responsible, mobilised to combat climate change and resilient to challenge. A city that can develop, attract and retain talent and skills and fosters innovation and creativity. An inclusive, diverse city where civic engagement is valued, and a shared vision is pursued through good governance and leadership. A city that offers sustainable choices in housing, work, transport and lifestyle opportunities.”*

The realisation of the vision for Galway City will be supported through various strategic goals that will aim to guide the CDP in achieving these set targets.

The CDP has referred to the need to provide safe access and improved permeability through a number of new river crossings, in particular;

*“Safe access and improved permeability will also be secured through a number of new river crossings. These include the pedestrian and cycle bridge south of the Salmon Weir Bridge, which commenced construction in 2022. This new bridge will facilitate an opportunity for a safer and higher quality crossing for the 9,000 pedestrians and cyclists who currently use the existing Salmon Weir Bridge. The proposed pedestrian and cycle bridge on the piers of the old Clifden Railway line from Woodquay to University of Galway will link places of study, work, retail and recreation by sustainable modes of transport, bringing vibrancy and new areas of public realm.”*

The CDP has set out specific objectives in regard to walking, of importance the proposed bridge is explicitly referred to, outlining the aim to;

*“Provide a new pedestrian and cycle bridge on the piers of the Old Clifden Railway Line from the Headford Road Regeneration area to University of Galway Campus.”*

In regard to the above, the proposed bridge is considered to satisfy this objective of the CDP.

#### 2.4.4.2 Galway Transport Strategy 2016 - 2036

The Galway Transport Strategy (GTS) was developed by Galway City Council & Galway County Council, in partnership with the National Transport Authority to provide an Integrated Transport Strategy for Galway City & Environs. The GTS builds upon the existing transport facilities identified in the Galway Metropolitan Area Bus and Network Plan. The GTS sets out a series of actions and measures, covering infrastructural, operational and policy elements to be implemented in Galway over the next 20 years and sets out a framework to deliver the projects in a phased manner. Appendix F of the GTS provides insight on the existing and future proposals for the cycle network within the city. This cycle network has been subdivided into three route types as follows:

- Primary Routes – acting as the main distribution network and leisure route through and around the city.
- Secondary Routes – connecting the primary network to main residential areas and key trip destinations.
- Feeder Routes – cycle friendly advisory routes where traffic calming, and management measures allow cyclists and motorists to mix safely.

Within the GTS a route connecting Dyke Road on the east with Newcastle Road on the west via the Clifden Railway Bridge has been identified as forming part of the proposed secondary cycle network connecting primary routes along the Headford Road and Newcastle Roads respectively. The GTS proposes

*“to construct a pedestrian bridge across the existing piers of the former Clifden Railway Line Bridge, similar to the bridge which was granted planning permission in 2002. This will connect the NUIG campus directly with the Headford Road area and the eastern side of the city.”*

The GTS also identified a lack of legible corridors for cyclists through the city centre and a need for more dedicated cycle routes to the UG and University Hospital Galway areas. The proposed bridge would aim to address these issues.

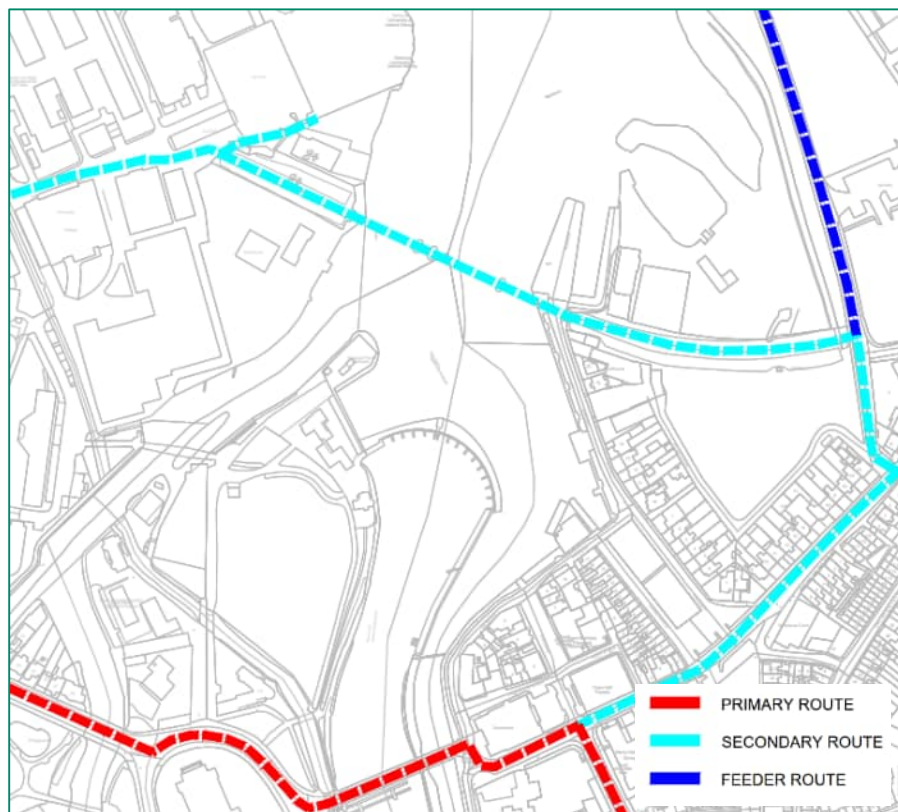


Figure 2-6 Extract from Galway Transport Strategy

#### 2.4.5 Policy Summary

The planning policy demonstrates that the principle of the proposed bridge is considered fully compliant with top to bottom policies on a National, Regional, and Local policy level. In summary, the key findings include;

- Compliance with the NPF's; NSO 1 - Compact Growth, NSO 4 – Sustainable Mobility and NSO 7 - Enhanced Amenities and Heritage.



- The NWR RSES has explicitly outlined the proposed bridge compliance by referring to improving key transportation components of new river crossings, specifically outlining; “a new link from the Headford Road area to NUIG campus via a bridge on the piers of the old rail line.”
- The CDP reiterates the objective of the RSES and references the need to provide safe access and enhance permeability through a number of new river crossings, in particular, it outlines; “The proposed pedestrian and cycle bridge on the piers of the old Clifden Railway line from Woodquay to University of Galway will link places of study, work, retail and recreation by sustainable modes of transport, bringing vibrancy and new areas of public realm”. In addition, the CDP has set out specific objectives in regard to walking, of importance the proposed bridge is explicitly referred to in the CDP, further referencing the need to; “Provide a new pedestrian and cycle bridge on the piers of the Old Clifden Railway Line from the Headford Road Regeneration area to University of Galway Campus.”
- Appendix F of the GTS has identified a variety of proposed infrastructure, including; “to construct a pedestrian bridge across the existing piers of the former Clifden Railway Line Bridge, [emphasis added] similar to the bridge which was granted planning permission in 2002. This will connect the UG campus directly with the Headford Road area and the eastern side of the city”.

## 2.5 Environmental Policy

The bridge location is included within the Special Area of Conservation (SAC) (site code 000297) of Lough Corrib. The lake is the second largest lake in Ireland with an area of approximately 18,240ha. The SAC covers an area of 20,556 ha extending over the entire area of Lough Corrib, its tributaries including the River Corrib as far as its confluence with Galway Bay at Wolf Tone Bridge in Galway City Centre. The Galway Bay area is separately covered by the Galway Bay Complex SAC (site code 000268).

The legal basis on which SACs are selected and designated is the EU Habitats Directive, transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended. The Directive lists certain habitats and species that must be protected within SACs. Irish habitats include raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries, and sea inlets. The 25 Irish species which must be afforded protection include Salmon, Otter, Freshwater Pearl Mussel, Bottlenose Dolphin and Killarney Fern.

In summary the Lough Corrib SAC is protected due to the large number of rivers carrying wild Atlantic Salmon and Freshwater Pearl Mussel. In addition, adjoining areas of conservation interest include raised bog, woodland, grassland, and limestone pavement which are incorporated within the site designation. The Lough Corrib SAC will be discussed in further detail as part of Chapter 9 Environmental Considerations.

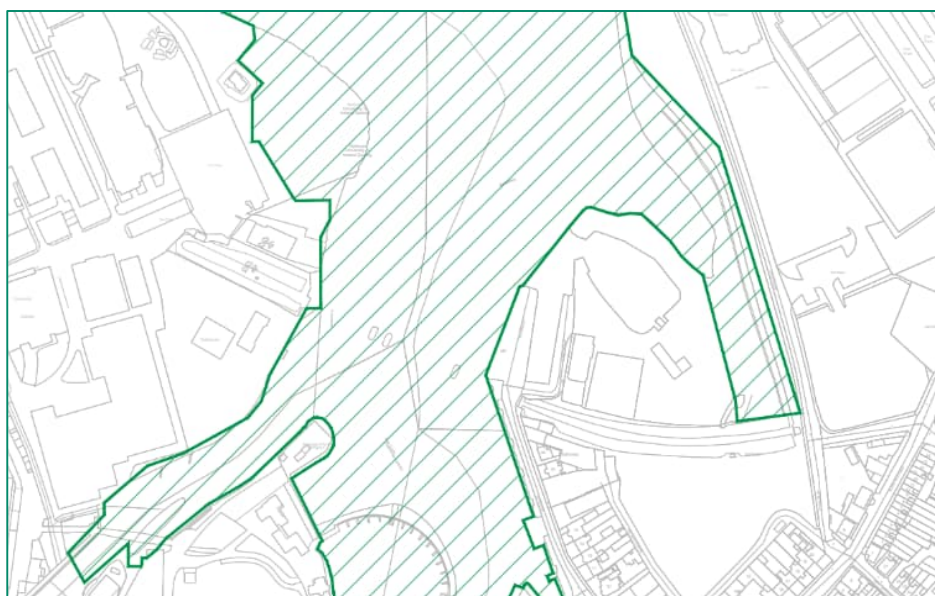


Figure 2-7 Special Area of Conservation Boundary

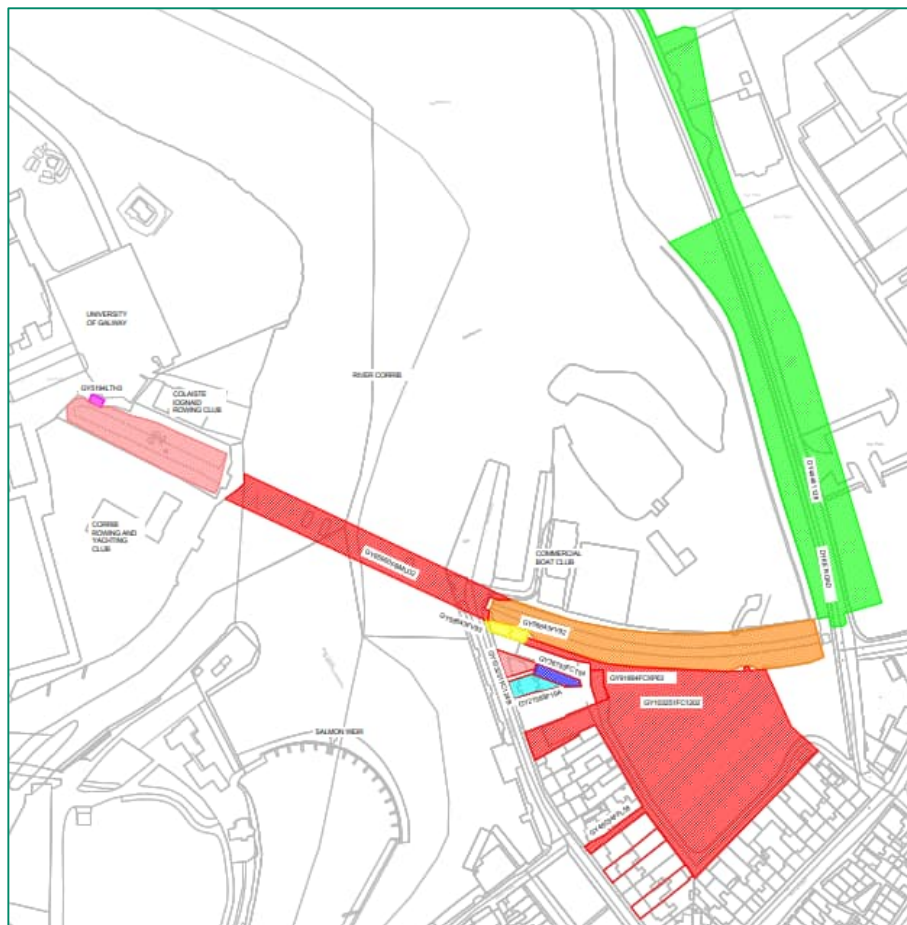
## 2.6 Landownership

The lands surrounding the proposed bridge are owned by numerous landowners. The Property Registration Authority is the state body responsible for recording landownership within Ireland. The authority provides an online

data base (landdirect.ie) which details the ownership of over 2.2 million registered properties. The table and figure below summarise the registered land folios and landowners which are available on the data base.

Folio Number	Figure Colour	Landowner
GY5194LTH3	Magenta	Electricity Supply Board
GY85950FBMU32	Red	Galway City Council
GY58643FV93	Yellow	Landowner No.1
GY58643FV92	Orange	Landowner No.2
GY38793FCT54	Blue	Galway Rowing Club
GY103251FC142B	Red	Galway City Council
GY21588F19A	Cyan	Landowner No.3
GY91864FCXP63	Red	Galway City Council
GY103251FC1202	Red	Galway City Council
GY48034FFL58	Red	Galway City Council
GY44451138	Green	The Mayor Aldermen and Burgesses of the Borough of Galway
Unconfirmed	Pink	University of Galway

**Table 2-2 Land Folios and Landowners**



**Figure 2-8 Registered Land Folio Boundaries**

The western approach embankment to the bridge (pink) is reportedly owned by UG, however no official documentation has been provided to date which confirms this land ownership. Further investigation will be required at the next stage of project development to confirm ownership.

## 2.7 Development Precedent

### 2.7.1 Clifden Railway Bridge

In 2000 Galway City Council proposed to construct a new pedestrian bridge across the River Corrib utilising the piers of the Clifden Railway Bridge. The City Development Plan 1999 had identified several potential extensions to existing walkways and the provision of new walkways as Specific Objectives for the development of Recreation and Amenity facilities within the city. Development of a walk from the Dyke Road to the lands of UG was one such Specific Objective. The proposals progressed to planning stages before being placed on hold. The main purpose of the bridge was to provide a direct connection between Galway City centre and UG lands, this connection would have facilitated future development of underutilised lands along Dyke Road and Headford Road respectively.

In 2002 Galway City Council received conditional planning permission under the Roads Act 1993 (ref 07.ER.2012) from ABP to construct the 150m long pedestrian bridge over the River Corrib utilising the existing piers and abutments of the Clifden Railway Bridge. A multi span cable stayed bridge structure was proposed with vertical pylons supported on each pier. A fanned cable arrangement was adopted with the cables for the eastern spans located along the central axis of the bridge deck and cables for the western spans located along the outside edge of the bridge deck. At the time of application, a number of submissions were made by local residents and community groups to object to the application. Despite these objections' permission was granted by the Bord with a number of conditions. As the permission was granted under the Roads Act no expiration date is imposed on the application and it is considered to still be valid. However, a review of the approved planning has identified the following issues:

- A cable stayed bridge arrangement is not justified for the span lengths (cable stayed generally utilised where spans are over 80m). Other structural forms would be more appropriate for the <50m span lengths.
- A concrete deck was specified which adds considerable dead weight to the structure. A steel deck would be more appropriate.
- The crossing of the cables at the central span is considered to be of poor aesthetic merit and results in a doubling up of structural elements.
- The cable arrangement for the eastern span located along the central axis of the bridge resulted in a 1m wide dead zone along the middle of the bridge cross section.
- The legislation governing the EIS prepared at the time of the application would now be considered outdated. With current EIS legislation being far more onerous.

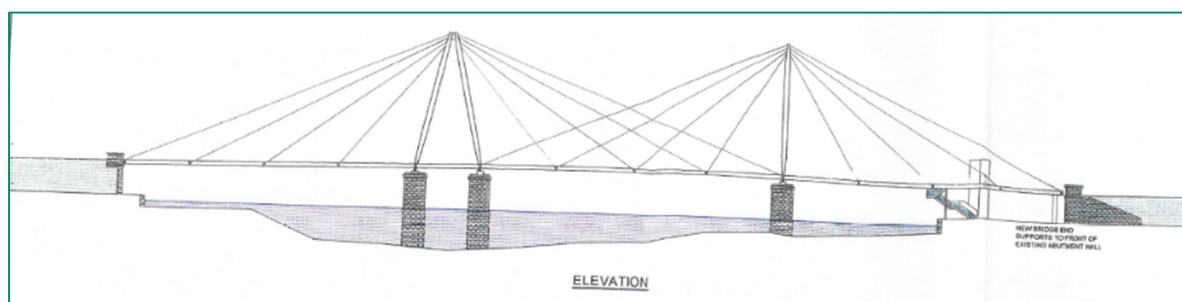


Figure 2-9 Elevation of proposed bridge

### 2.7.2 Salmon Weir Pedestrian and Cycle Bridge

GCC and the NTA are currently progressing the development of the Salmon Weir Pedestrian and Cycle Bridge in Galway City. This new 80m shared pedestrian and cycle bridge will be constructed parallel to the existing Salmon Weir Road Bridge and will aim to increase facilities for pedestrians and cyclists crossing the River Corrib in an east west direction and connecting the city centre to Galway Cathedral and on to University Road. The bridge is covered under the Galway Transport Strategy (GTS).

As part of the environmental assessment stages of the project an Environmental Impact Assessment (EIA) Screening and Appropriate Assessment (AA) Screening were carried out to determine the environmental effects of construction.

The EIA Screening report concluded that effects of development were considered to likely be of significance due to the close proximity to European sites and the potential for significant negative effects on biodiversity and water quality during construction as well as potential for significant effects on archaeological, architectural and cultural



sites in the vicinity. The screening recommended that a full Environmental Impact Assessment Report (EIAR) be carried out on the basis of the above.

The AA Screening concluded that construction of a bridge over the River Corrib could be the significant detrimental change in water quality in Lough Corrib or Galway Bay either alone or in combination with other projects. The screening recommended that a full Stage 2 AA be prepared on the basis of the above.

Based on the recommendations of both screening reports GCC applied to ABP to determine if a full EIAR and AA should be prepared. The Bord's decision was as follows:

*NOT TO DIRECT the road authority to prepare an environmental impact assessment report in respect of the above proposed road development based on the reasons and considerations set out below: Having regard to the following:*

- (a) the criteria set out in Schedule 7 of the Planning and Development Regulations 2001, as amended,*
- (b) the nature and limited scale of the development which is below the threshold for prescribed road development set out in article 8(b) of the Roads Regulations, 1994, as amended,*
- (c) the location of the development in a built-up area and the existing pattern of development in the vicinity,*
- (d) the limited potential for significant effects on the environment, and*
- (e) the submission of the planning authority.*

On 18<sup>th</sup> August 2021, GCC received planning approval (ref ABP-308783-20) from ABP to progress with the proposal to construct the bridge. The approval also includes approval for the Compulsory Purchase Order and land acquisition to construct the bridge. The project is currently at construction stage.

### 2.7.3 Connemara Greenway

The Connemara Greenway is a proposed project to provide a continuous 76km long greenway from Clifden to Galway City Centre. The first phase of this project focuses on construction of the greenway between Clifden and Oughterard, this section of the scheme has previously received planning permission from ABP in 2013. (Ref: 07. JA0033). The planning and design phases of the second section of the greenway between Oughterard and Galway City Centre has recently commenced with Galway County Council appointing AECOM to lead the design and secure planning permission for the route.

The current alignment of the route assumes a terminus point at O'Shaughnessy Bridge near UG. Alternative terminus points may be considered as part of the options stage for this project, with potential for Clifden Railway Bridge providing superior linkages to existing infrastructure when compared to O'Shaughnessy Bridge.

## 2.8 Do-Nothing and Do-Something Scenarios

Under the Common Appraisal Framework (CAF) and as part of development of all projects an investigation on the Do-Nothing and Do-Something Scenarios should be carried out to determine the viability and feasibility of the proposed works. Do-Minimum and Do-Maximum scenarios should also be considered; however, in the case of Clifden Railway Pedestrian and Cycle Bridge the Do-Something, Do-Minimum and Do-Maximum are considered to be the same as all would require construction of the proposed bridge. A decision on proceeding with the project to the next stages of development should be based on the relative merits of the scenarios presented below with one being considered the preferred.

The Do-Nothing assumes a base case and investigates the existing road infrastructure and its ability to meet future demands for traffic and safety without any upgrade works, other than routine maintenance. The TII Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013) defines the Do-Nothing scenario as follows:

*"The Do-Nothing assumes that there will be no other investment in the transport network (other than regular maintenance) during the appraisal period beyond that being considered as part of the scheme under appraisal."*

To this end the road arrangement of pedestrian and cycle facilities will remain as is currently. All users travelling between Dyke Road and UG will be required to follow the existing linkages between Dyke Road, Headford Road, crossing the existing Salmon Weir bridge, continuing along University Road to access UG.

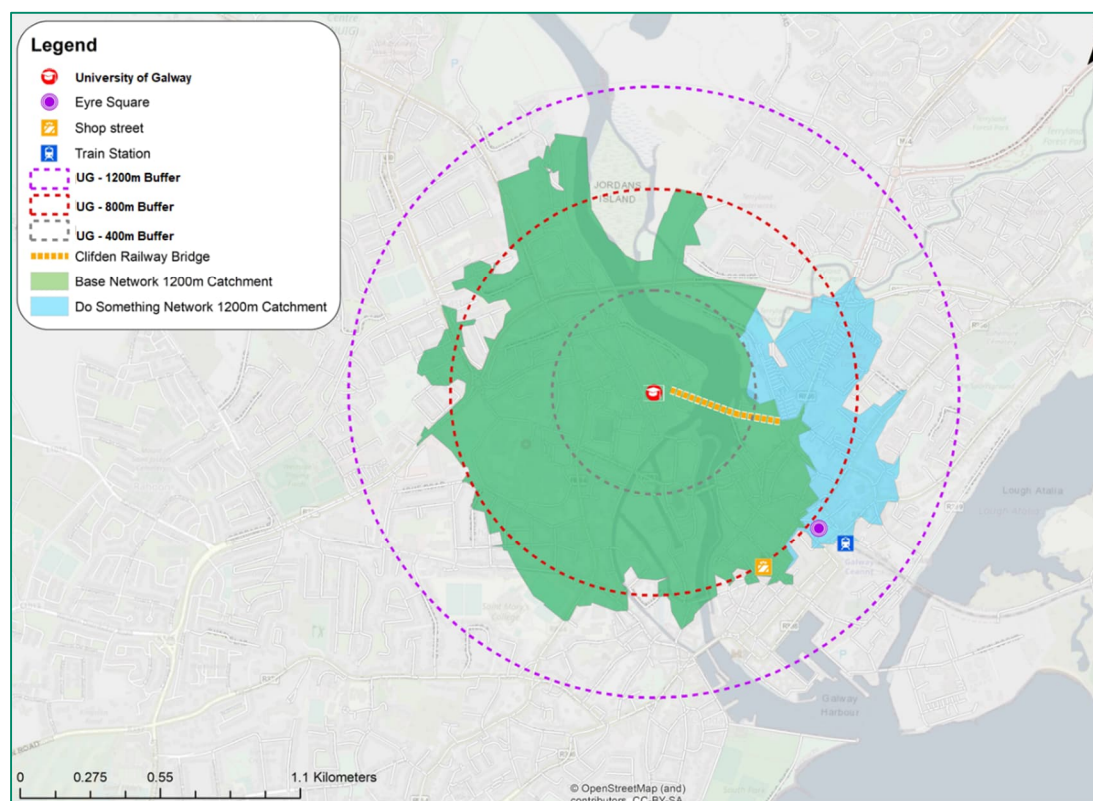
The Do-Something has also been investigated which assumes the Clifden Railway Pedestrian and Cycle Bridge is constructed to meet the predicted user demand. The scenario assumes the Do-Minimum requirements as defined in the TII Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013) as incorporated as follows:

*“The Do-Minimum Option should include those transportation facilities and services that are committed within the appraisal period. All elements of the Do-Minimum Option must be part of each proposed Do-Something Option except where an option replaces services or facilities within the corridor. To provide a basis of comparison the Do-Minimum Option must include the following features:*

- *The maintenance of existing facilities and services in the study corridor and region;*
- *The completion and maintenance of committed projects or policies in the study corridor that have successfully completed their environmental review; and*
- *The continuation of existing transportation policies.”*

In order to determine the optimum scenario, the detailed isochrone shown in the figure below has been prepared to determine the UG catchment areas based on the ‘Do-Nothing’ scenario (shown in green) and the additional catchment areas generated by the ‘Do-Something’ scenario (shown in blue).

The isochrone clearly shows that large areas of land between Dyke Road, Headford Road and Bohermore Road fall within the additional catchment area of the Do-Something scenario. This is considered significant due to the large potential for redevelopment of lands in this area which will benefit hugely from more direct linkages to UG and the western side of Galway City.



**Figure 2-10 Comparison of Do Nothing and Do Something Network Isochrone**

On the above basis the Do-Something scenario is established as viable and feasible while also being the most advantageous scenario and as such the bridge has been progressed through a detailed options stage development and evaluation in the following chapters. A detailed appraisal and multi criteria analysis have been carried out in line with the requirements of the CAF to determine the most appropriate bridge option to progress to the next phase of project development.

## 3. Description of Structure and Options Considered

### 3.1 Introduction

The bridge will be designed in line with the standards set out in the Design Manual for Urban Roads and Streets (DMURS), as published by the Department of Transport, Tourism and Sport (DTTAS), the National Cycle Manual (NCM) as published by the National Transport Authority and DN-STR-03005 - Design Criteria for Footbridges, as published by Transport Infrastructure Ireland (TII).

For the purposes of the report the existing bridge piers and abutments shall be denoted as per the figure below.

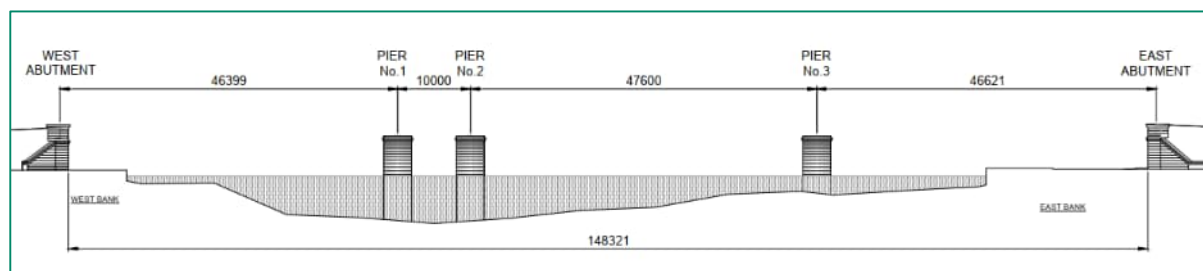


Figure 3-1 Existing Bridge Notation

#### 3.1.1 Vertical Alignment

The vertical alignment will vary depending on the option being progressed and the required vertical clearance envelope above the carriageways. A 5.7m headroom clearance beneath new footbridges is generally accepted as the minimum allowable dimension based on DN-GEO-03036, Cross Sections and Headroom. However, the headroom for this bridge will be fixed based on the height of the existing abutments above carriageway level at Waterside. The point cloud survey indicates that this dimension is 4.6m for the eastern abutment. This dimension shall be defined as the minimum vertical clearance for all options. The western abutment clearance could not be measured as part of the survey due to a lack of access to lands owned by the Corrib Rowing and Yachting Club.

The vertical clearance from water level shall be considered critical to avoid impeding on existing water-based activities on the River Corrib. The minimum vertical clearance shall be determined based on the pier heights above water level. The topographical survey recorded the water level on 27.10.2021 to the front of the Colaiste Iognaid Rowing Club at 5.61mOD. The survey also recorded the top of pier level for Pier No.1 as 11.51mOD. Therefore, the vertical clearance on 27.10.2021 based on the water level was 5.90m. This is considered the minimum vertical clearance to be provided. It should be noted that the actual vertical clearance will vary depending on the bridge options and will likely be in excess of 5.90m when bearing pads and plinths are allowed for to the top of the piers. To allow comparison between existing and proposed situations the topographical survey also recorded data at Quincentennial Bridge. The water level was recorded as 5.85mOD with a bridge soffit level of 10.71mOD. Thus, the vertical clearance for boats at Quincentennial Bridge was 4.86m. This existing bridge forms the current pinch point for vertical clearance on the River Corrib restricting the size and type of boats on the river.

Where possible, DMURS recommends a longitudinal alignment gradient of no greater than 5% and no less than 0.5%. These gradients have been determined based on accessibility requirements and to help improve the drainage capabilities and reduce the risk of standing water on the bridge deck and approaches. These gradients shall be considered the maximum and minimum allowed for all options.

#### 3.1.2 Horizontal Alignment

The bridge location and horizontal alignment is fixed by the location of the existing piers and abutments. This horizontal alignment is on a straight between the abutments. The horizontal alignment of the bridge approaches will follow the alignment of the existing embankments with the exception of the western approach where sections of the embankment have been removed and constructed upon. In this case, the horizontal alignment shall be designed based on a curvature which allows a suitable stopping sight distance for cyclists to all hazards.


The standard cross fall across the bridge and approaches shall vary between 1.25% and 2.5% either side of the centre line of the alignment. Where large curvatures are required in the approach embankments consideration shall be given to providing a maximum 2.5% superelevation on the cycle track to ensure water drains towards the shorter radius of the curve as required by the NCM.

### 3.1.3 Cross Sectional Width

The cross-sectional width of the bridge shall be constrained by the width of the abutments between existing masonry parapet upstands. The GCC Conservation Officer was engaged to confirm if removal of the parapet upstands would be permitted as part of the works. Unfortunately, removal of these parapet upstands is unlikely to be permitted due to the protected nature of the structure. The point cloud survey indicates that the width between parapet upstands at the eastern abutment is approximately 6.3m. To allow for tolerances a 0.025m clearance shall be provided between the bridge superstructure and each parapet. Therefore, the maximum available cross-sectional width for the bridge shall be 6.25m.

The available cross-sectional width shall allow for 0.3m wide structural members including parapets on either side of the cross section with the remainder of the cross section divided into segregated cycle and pedestrian facilities.

The NCM Width Calculator provides guidance on the width required for cycle facilities which varies based on the cycling regime. For all options, the proposed cycling regime will be 2.5m over the main central span to allow for a two abreast and overtaking regime. In addition, a further 0.65m shall be provided based on the requirement for an inside edge offset from the bridge parapets. No outside edge shall be required due to the lack of kerbs and vehicle lanes.



A Inside Edge	B Cycling Regime	C Outside Edge	D Additional Features
Kerb 0.25m	Single File 0.75m	30kph, 3.0m wide lane 0.50m	Uphill 0.25m
Channel Gully 0.25m	Single File + Overtaking, Partially using next lane 1.25m	50kph, 3.0m wide lane 0.75m	Sharp bends 0.25m
Wall, Fence or Crash Barrier 0.65m	Basic Two-Way 1.75m	Railled kerb, dropped kerb or physical barrier 0.50m	Cyclist stacking, Stopping and starting 0.50m
Poles or Bollards 0.50m	Single File + Overtaking, Partially using next lane 2.00m	Kerb to vegetation etc. (ie. cycleway) 0.25m	Around primary schools, interchanges, or for larger tourist bikes 0.25m
	2 Abreast + overtaking (tracks and cycleways) 2.50m		Taxi ranks, loading, line of parked cars (min 5.8m) 1.00m
			Turning pocket cyclists 0.50m

Figure 3-2 National Cycle Manual Width Calculator

DMURS provides guidance on the required footway widths for various levels of expected pedestrian activity from low to high. While there is currently no pedestrian usage over the River Corrib in this location it is expected that demand from users will grow as infrastructure is developed and improved in the area. In addition, the expected redevelopment of the lands surrounding the bridge location is expected to increase pedestrian demand further.

Based on the predicted growth to a moderate number of users a minimum clear width of 2.5m is considered the desired width for pedestrian activity.



**Figure 3-3 DMURS Pedestrian Activity Widths**

The bridge cross section will be 6.25m over the entire crossing made up as follows:

- 0.3m pedestrian/cyclist parapet
- 0.65m inside edge offset
- 2.5m two abreast + overtaking
- 2.5m pedestrian walkway
- 0.3m pedestrian/cyclist parapet

## 3.2 Bridge Options Considered

### 3.2.1 Option 1 Asymmetric Cable Stayed

The first option considered is a two-span cable stayed bridge with a main span of approximately 94.105m and back span of 56.53m with a single 35m high asymmetric pylon. The use of a cable structure and associated pylon creates a landmark structure which will be visible from large areas of the city. The design has been developed based on a modification of the permitted bridge design from 2002. The modifications were aimed at maximising span lengths, avoiding multiple pylons, reducing dead space, and avoiding clashing of cables. Based on a maximum span of 94.105m the use of a cable stayed bridge is considered justifiable and would be in accordance with current engineering and industry practice for such structures.



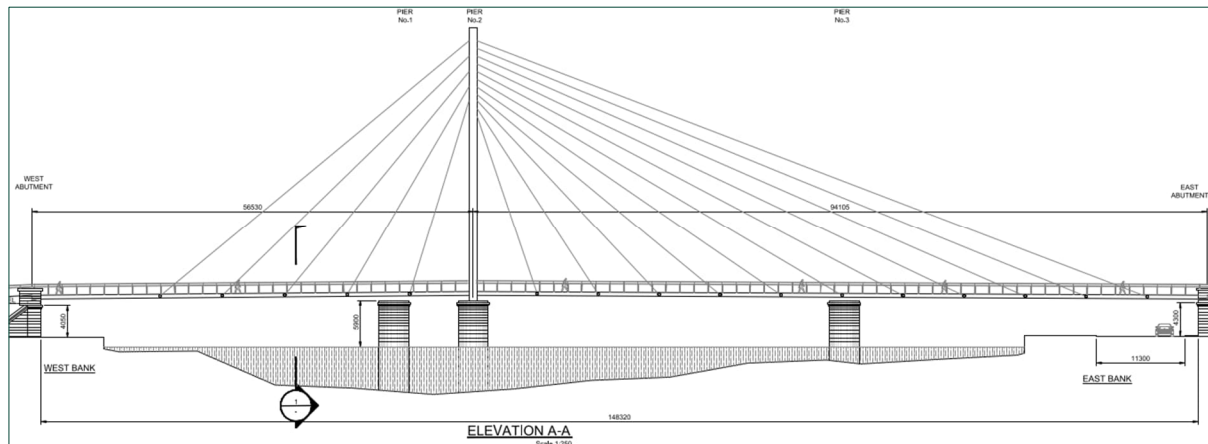


Figure 3-4 Option 1 Elevation

The main Pylon will be supported on Pier No.2 and will be approximately 35m in height. The pylon will be formed of two large diameter circular steel hollow sections in an A shaped frame arrangement inclining inwards over the centre line of the bridge deck. The pylon shall be used to absorb and transfer loading from the cables directly downwards into the existing pier. The proposed span arrangement creates an imbalanced loading arrangement which will need to be accounted for within the flexural strength of the pylon. Where the flexural capacity of the pylon cannot resist the imbalanced loading, an anchorage block located to the rear of the abutments with suitable tie back cables could be considered to resist the loads. The bridge deck shall be used to brace the pylon at its intersection avoiding the need for secondary steel bracing.

The superstructure will be continuous over its length and will be designed to overspan Pier No.1 and No.3 avoiding all loading on these piers. A minimum longitudinal gradient of 0.05% will be provided falling either side of the centre line of the pylon. This gradient will improve drainage and prevent standing water on the bridge deck. The superstructure will be formed of parallel longitudinal rectangular hollow section beams supported by two rows of cable stays. Transverse rectangular hollow sections will span between these longitudinal sections at regular intervals providing support to a solid steel deck plate. The deck plate along with the transverse sections will act together to provide suitable horizontal stiffness to the bridge. The longitudinal sections will act to support the bridge parapets on either side of the bridge cross section. The total bridge superstructure depth will be approximately 0.5m.

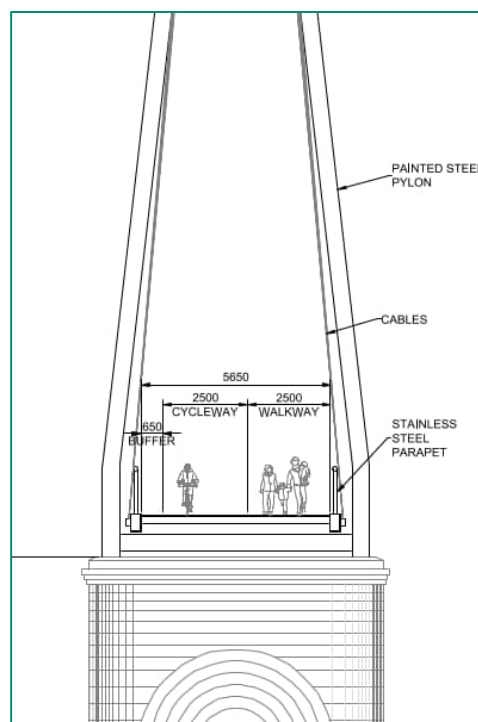


Figure 3-5 Option 1 Cross Section

The cables stays shall be formed in a modified fan arrangement in two planes along the outer extremity of the bridge deck. The fan arrangement will be achieved with the cables spaced closer together vertically at the pylon

with a larger horizontal spacing along the deck. The cables will be anchored to the deck by the use of an adjustable type fork and pin anchorage. The cables shall be formed by groups of relatively small diameter locked coil strands consisting of an inner core made by round wires and with one or more external layer of Z shaped wire. To improve durability the cables shall be sealed in steel or high-density polyethylene casing providing increased protection.

A founding slab and support plinth will be constructed directly on top of the existing pier to support the central pylon. The slab will be detailed to spread all loads across the top of the pier similar to a spread foundation. Bearing pads will also be constructed to the rear of the existing abutments to provide vertical support to the bridge at these locations. Expansion joints will also be required at the abutments to ensure a continuous running surface for users.



Figure 3-6 Option 1 Photomontage

### 3.2.2 Option 2 Rippled Arch

Option 2 proposes a three-span 3D arched truss structure, each approximately 47m in length supported on the existing piers. An additional 10.13m ladder beam structure will also be provided spanning between Pier No.1 and No.2 respectively. The option is highly visually dynamic and creates a flowing rippled design in response to the River Corrib below. The use of a truss structure creates a modern interpretation of the original Clifden Railway Bridge.

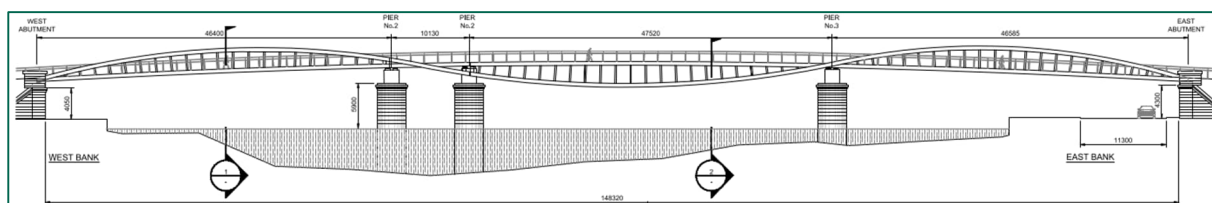
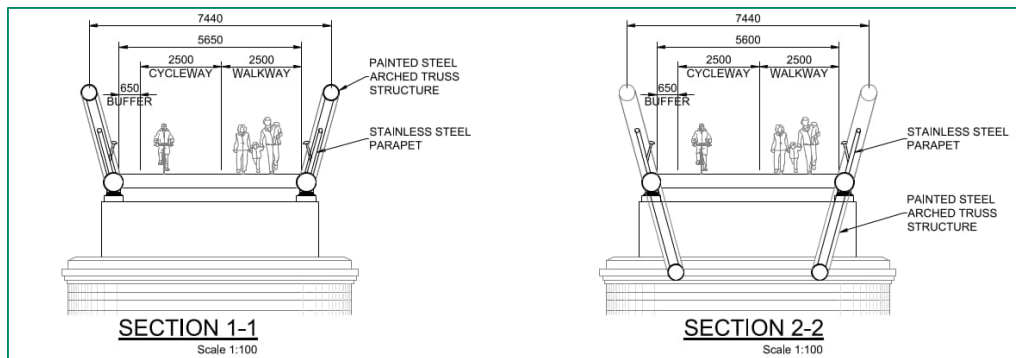


Figure 3-7 Option 2 Elevation

The truss structures will be designed as three simply supported independent arched trusses with parabolic top/bottom longitudinal chords which are continuous across the structure. The overall depth of the truss will vary from 0.5m (at supports) to approximately 3.5m (at centre of span). Inclined vertical members will be provided to transfer loading between the longitudinal members. The truss members shall be formed in circular hollow steel sections providing greater geometrical flexibility when compared to other section types. The trusses have been designed to alternate between fully through above deck and fully through below deck structures across the span which when viewed in elevation create a striking ripple effect. The above deck structure helps to achieve the minimum vertical clearance of 5.9m between the Western abutment and Pier No. 1. This ripple effect is also carried through in the cross section with the above deck trusses inclining outwards away from the centre line of the bridge deck while the below deck truss inclining inwards towards the centre line. A simply supported ladder beam shall be

provided spanning between Pier No.1 and No.2. This ladder beam structure shall support non-structural steel sections which will be detailed to allow the ripple effect to be continuous through the point of contraflexure between the truss spans.



**Figure 3-8 Option 2 Cross Section**

The bridge deck will be detailed with a maximum longitudinal gradient of 0.5% away from the centre point of the bridge. The gradient has been incorporated not only to aid drainage but also to add to the dynamic design and to increase the viewpoint from the central span. The bridge deck will be formed of a steel plate connected to the longitudinal truss members. The deck shall be supplemented by rectangular hollow sections running transversely between the central longitudinal chords. The deck plate and bracing shall act together to accommodate the horizontal loading on the structure. The bridge deck shall be finished with a combined waterproofing and surfacing layer minimising superimposed loading while also maximising the slip resistance for users. The central longitudinal truss member shall also support the bridge parapets on either side of the cross section.

All spans will be simply supported with bearings located on each pier. The bearings will provide appropriate allowances for movement of the structure during the design life. To ensure a continuous surface for users, joints will be provided at the top of deck level between each span. For this option all existing bridge piers and abutments will be used to support the bridge. Suitable bearing pads and plinths will be constructed to the top of each element to receive the truss spans. The required height of the bearing plinths will be relative to the longitudinal fall across the structure. Conservation and protection of the protected piers will need to be maximised during the design of the plinths to ensure they enhance rather than detract from the existing structure. At the abutments the bridge will be supported on bearing pads constructed to the rear of the abutment, these pads will require minimal build up from existing top of abutment level.





Figure 3-9 Option 2 Photomontage

### 3.2.3 Option 3 Curved Box Girder

The final option considers the use of a multispan curved box girder with a total length of approximately 151m and intermediate supports at each pier. The girder creates a low-key simple elegant structure which is extremely light weight with excellent strength parameters. The box girder will be designed as a modified box girder with a single closed section formed in plated structural steel elements. An elliptical section has been considered to help improve aesthetics with shadowing from the deck above making the structure appear thinner in elevation. The total dept of the girder will be approximately 1.5m deep, this depth will be constant across the entire length.

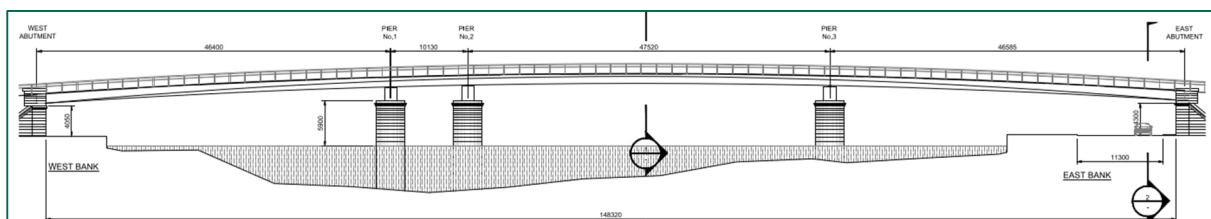
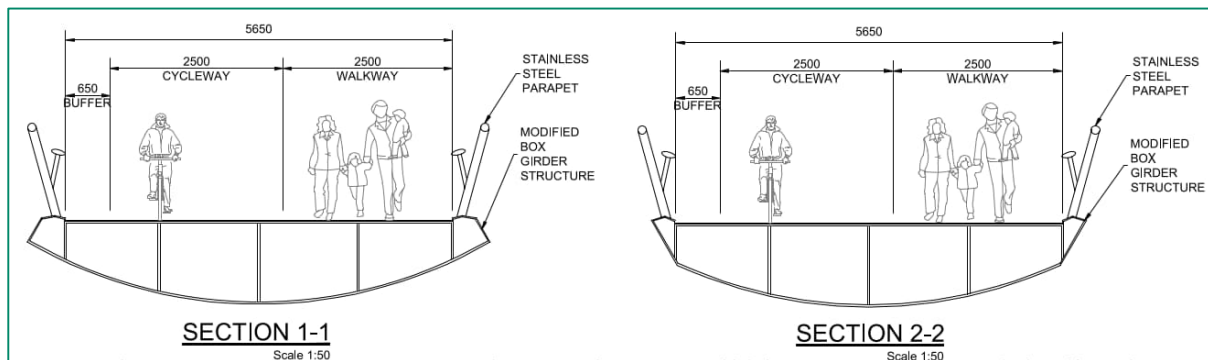


Figure 3-10 Option 3 Elevation

The box girder will be designed to act similar to parallel plate girders with a steel bottom flange, inclined steel webs and a deck plate forming the top flange. This allows the width of the cross section to be minimised to reduce material usage. Transverse stiffeners will be required along the length of the deck plate to increase the stiffness and reduce deflections. Internal diaphragms will also be required within the structure to help control deflections, these diaphragms will be formed of steel plates and will be located across the entire superstructure length. The edge beam shall be formed as part of the box girder with a varying cross section used to create interesting, curved features across the elevation to further improve aesthetics. This edge section will be used to support the required parapets across the bridge.



**Figure 3-11 Option 3 Cross Section**

Similar to Option 2 the bridge deck will be detailed with a maximum longitudinal gradient of 0.5% either side of the centre point of the bridge. The gradient will help to improve aesthetics and also improve viewpoints from the centre of the structure. The bridge deck shall be finished with a combined waterproofing and surfacing layer minimising superimposed loading while also maximising the slip resistance for users.

As the box girder will be designed to be continuous, bearings will be required at each pier to provide a suitable vertical restraint preventing vertical deflection of the box girder. In addition, the bearings will be required to resist substantial loads in the horizontal direction. Bearings will also be provided at the end supports to the rear of the existing abutments. Based on the continuous span arrangement maximum movements will be experienced at the rear of the abutments. Expansion joints will be required at these locations to provide a suitable continuous surface for users. The articulation of the bridge will be discussed in further detail in the subsequent sections of the report. Similar to Option 2, construction of bearing pads and plinths will be required to the top of each pier to receive the box girder and bearings, these build ups will need to address the conservation and protection of the existing piers.

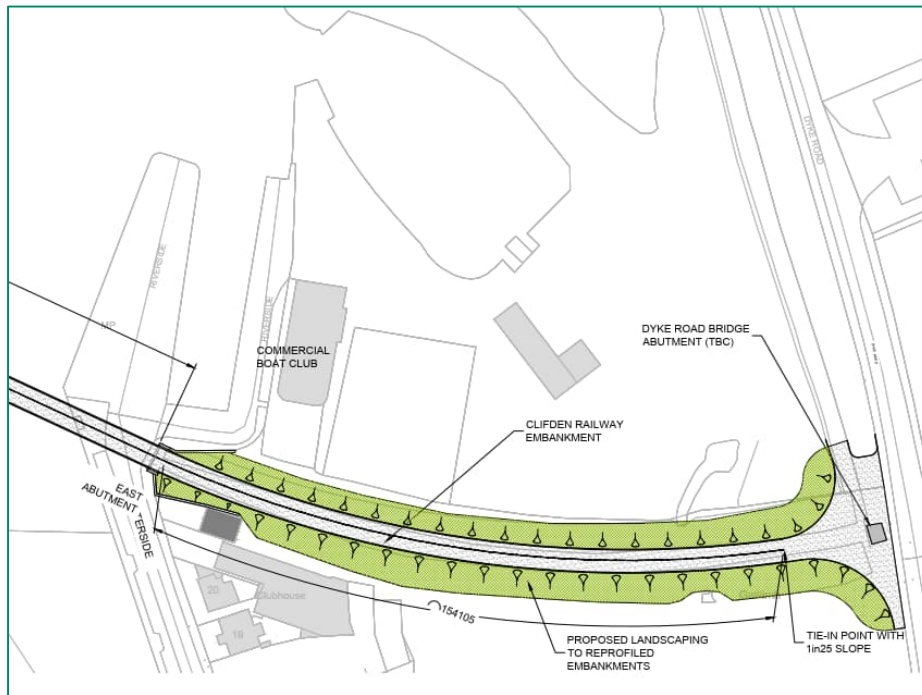


**Figure 3-12 Option 3 Photomontage**

### 3.3 Approach Tie Ins

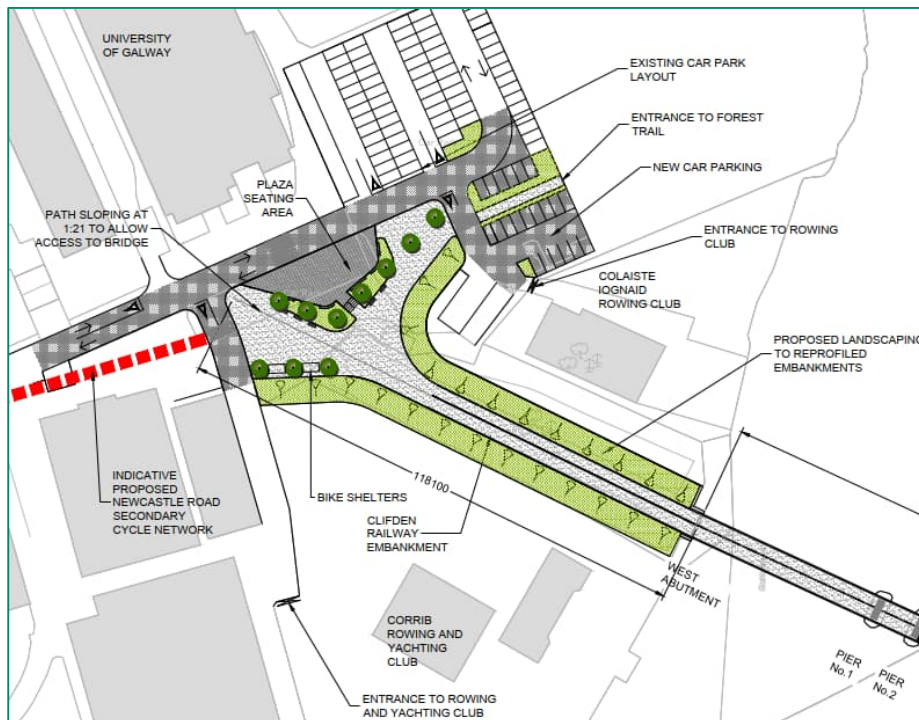
For all bridge options similar tie in points have been considered. For the eastern approach it is proposed to regrade the existing railway embankment to tie in with existing facilities along Dyke Road. The length of approach embankment will be fixed at approximately 157m. The gradient will vary between options and will be proportionate to the structural depth of the bridge. The maximum permitted gradient shall be 5%. At the base of the approach embankment a new shared pedestrian and cyclist plaza will be constructed to accommodate user desire lines to existing/proposed facilities. The use of a shared area will minimise the risk of conflict between users.





**Figure 3-13 Eastern Tie-in Plaza**

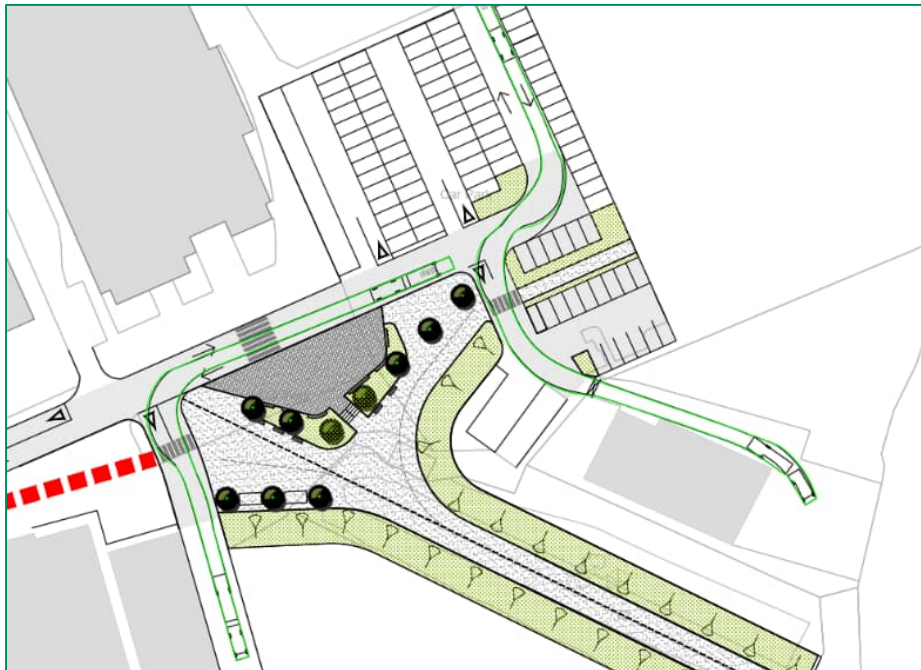
A similar approach has been adopted for the design of the western approach with regrading of the existing embankment proposed. However, additional land take from UG will be required to accommodate the approach as portions of the original embankment have been removed. The land take required will result in a loss of vehicular parking based on the existing parking arrangements within the UG lands. A redesign of parking areas and the road network has been prepared to minimise the effects on UG and loss of parking. In addition, the shared plaza area has been designed to accommodate predicted vehicular desire lines to the Corrib Rowing and Yachting Club and to the Commercials Rowing Club. The proposed tie ins for the options are shown in the figures below.



**Figure 3-14 Western Tie-in Plaza**

A Swept Path Analysis also known as Auto tracking has been carried out for the western tie in plaza to ensure access for larger vehicles is maintained to the Corrib Rowing and Yachting Club and the Colaiste Iognáid Rowing Club. The analysis assumed a total vehicle length for a car and boat of 14.7m which includes a 5.8m car plus 8.0m boat. The analysis shows that access is possible for this type of vehicle without over running of the kerbs and

pedestrian areas. Further optimisation of the design should be carried out at the next stage of the project to refine the carriageway arrangements to further improve access.



**Figure 3-15 Swept Path Analysis for Car and Boat**

## 4. Technical Evaluation

### 4.1 Introduction

Each option presents various technical merits and challenges which need to be overcome to ensure the bridge meets the minimum required design life. The technical design of the bridge will need to be executed in accordance with a number of different national and international technical standards such as the DMRB and Eurocodes.

### 4.2 Design Life

The design working life of all options will be a minimum of 120 years as defined in the TII publication, DN-STR-03012 - Design for Durability. Maintainable elements. However, the components listed below are subject to greater wear and will require replacement within the design life. Careful design and detailing combined with thorough routine inspections, quality control and supervision on site will help achieve the minimum expected design life listed in the table:

Component	Years
Bridge Bearings	50
Expansion Joints	50
Parapets	50
Drainage Systems	50
Deck Waterproofing	50
Steelwork Paint Systems	20
Stay Cable System	60
Stay Cable Dampers	30
Structural Health Monitoring	25

Table 4-1 Design life of structural elements

### 4.3 Structural Analysis and Design

The preferred bridge option will be designed in line with the requirements contained within the Eurocode Standards, as transposed in the Irish National Standards and Annexes. In addition, the designs shall consider the requirements of the Design Manual for Roads and Bridges (DMRB) as published by TII, DMURS and the NCM.

The cable stayed Option 1 is the most complex of the three options in terms of design. The option is formed by three main superstructure elements namely a longitudinal structural steel deck, the cabling system, and the vertical steel pylon. Each element will act together to transfer loading directly to the foundations. The pedestrian loads are supported directly on the bridge deck, these loads are transferred from the deck to the diagonal cables which in turn transfer the load through tension to the pylon. At the pylon the diagonal cable loading is resolved into horizontal and vertical components. The vertical loads are transferred directly through the pylon into the substructure (bearings, bearing support plinth and existing piers). The horizontal forces generally act in opposite directions on either side of the pylon with the sum of the forces equating to zero net horizontal force when the bridge is designed as a balanced cable stay (i.e. two spans of equal length). However, for Option 1 an asymmetric design is being progressed, in this case the horizontal forces from the main span are greater than the forces imparted from the smaller back span. The net horizontal force for this option will need to be resisted by bending and flexure of the main pylon members and in turn bending within the substructure. To minimise this bending moment a modified fan arrangement has been assumed for the cable arrangement. The fan arrangement is structurally superior to other cable arrangements and helps to minimise the moment imparted on the pylon. At preliminary and detailed design stages 3D finite element models will be prepared to analyse the predicted loading combinations for the bridge, helping to determine the optimum number of cables and the optimum cable arrangement. At this stage detailed analysis should also be carried out to determine the worst-case construction stage loading. Cable stayed bridges are particularly sensitive to deflection and this will need to be assessed as part of the modelling stages for all load combinations including construction stages to ensure deflection is within the allowable limits. IS EN 1993-1-11 also requires the design to consider a high degree of redundancy by allowing for failure of at least one cable, this failure could occur during routine maintenance or replacement of cables and anchors. Finally, the cable option requires significantly increased design requirements due to the complex tensioned cable design which will need to account for tension loss and creep of the cables over the design life.

The Option 2 Rippled Arch, while still technically challenging to deliver, is significantly less complex when compared to Option 1. The structure will be designed as three independent Vierendeel truss spans with an additional ladder beam span. The superstructure will be formed using steel circular hollow sections which provide a substantially higher strength to weight ratio when compared to other steel sections. The arches will be formed using a top and bottom longitudinal chord with vertical and transverse bracing providing stiffness. The top chord will act in compression and the bottom chord in tension under downward loading. The chords are braced by the vertical members transferring load between the longitudinal members. The Vierendeel truss design uses rigid joints between members transferring bending, axial and shear forces. For axial loading the force is carried equally by each part of the steel member, enabling the designer to maximise the efficiency of the truss members and create a lightweight structure in comparison to other options. The inclination of the truss chords inwards and outwards from the centre line of the bridge will add a degree of complexity with additional horizontal loading also applied to the chords. 3D grillage models can be used at preliminary and detailed design stage to analyse the structure for loading and determine the most appropriate steel section sizes. The design will also need to consider the temporary construction stages with particular consideration given to the proposed lifting arrangement for each span.

The steel box girder of Option 3 will be designed as a modified elliptical steel box girder using a number of individual plate sections welded together to form the profile. The girder will essentially act similar to a pair of plated girders braced at the top and bottom. The top bracing will be formed by a solid deck plate with a combined waterproofing and asphalt layer forming the finished surface of the bridge. To maintain the elliptical shape during construction and over the service life of the bridge, diaphragms will be added and welded to the internal sides of the box at regular intervals. The use of a box creates a clean and continuous structural element when viewed in elevation or when viewed from the soffit of the bridge. Plated sections will also be used to form the edge beams to support the bridge parapets. A finite element shell model will be used at preliminary and detailed design stages to assess the required plate thicknesses based on the determined load combinations. For the box girder construction stage load analysis will be critical for the design particularly if an incremental push launch construction methodology is utilised. This construction methodology requires advanced analysis to ensure that the superstructure is capable of withstanding the required construction stage effects.

For the preliminary design, consideration should be given to a developing a project specific pedestrian load model for use in the design. IS EN 1991-2 states that when bridge widths are in excess of 6m the standard load models used within the standards may not be appropriate and that complementary load models with associated combinations rules may have to be defined for the individual project. These load models should consider the various types of activities that may take place on a wider footbridge. In addition, where possible the use of the service vehicle load model should be avoided within the design through the incorporation of suitable bollards which prevent vehicles traversing the bridge. Accommodating service vehicle use is likely to substantially increase the material requirements and dead weight of the structure, increasing construction costs and the impacts on the existing piers and abutments.

## 4.4 Structural Assessment

As part of the early stages of project inception GCC appointed Arup to undertake an assessment of the piers and abutments to determine if they are capable of withstanding the additional loads of a new bridge. For the assessment Arup assumed two potential options, namely a cable stayed bridge (similar to 2002 planning application) and a through beam bridge. At the time of Arup appointment, no further project development had occurred, and bridge options presented within this report had not been developed. The following executive summary is taken from the Arup Condition Assessment Report

*“Visual inspection of the existing abutments and piers indicated that the structures are currently in good condition. Preliminary assessment of possible bridge foundation options suggest that support of a new pedestrian/cycle bridge could be accommodated using the existing piers. Depending on the bridge form and construction methodology, options exist to support the bridge from the existing piers or by independently supporting the bridge loads through piling or new bearing material within the curtilage of the existing piers. Similarly, it is anticipated that support of the proposed bridge can be supported for the existing bridge abutments or accommodated behind the existing bridge abutments provided the loads are taken to competent bearing material.”*

At the preliminary design stage, a further detailed structural assessment of the piers and abutments will need to be carried out which accurately reflects the loads implied due to the preferred bridge option. This assessment should consider the preferred connection detail to the top of the piers and abutments. To this end the assessment should consider loading directly to the top of the existing piers and abutments to determine if they have the suitable capacity thus reducing the construction costs, H&S risks, and heritage risks. It should be noted from a site visit carried out by AECOM that the piers and abutments appear to be in good condition and are founded on excellent

ground conditions with no scour evident. In addition, the piers and abutments were originally designed to resist railway loading which is substantially higher than pedestrian loading on the proposed bridge. In the event that the existing piers and abutments fail to meet the capacity requirements of the assessment, alternative support options should be considered and progressed. The assessment should be carried out in accordance with the requirements detailed within AM-STR-06002 The Assessment of Road Bridges and Structures.

## 4.5 Dynamics

Pedestrian bridges are generally lightweight with long spans which results in a lower natural frequency than the typical road bridge. Pedestrian bridges in the past have been susceptible to dynamic excitation, due to the frequency of pedestrian movements and wind loading. Pedestrian movements can take many forms i.e. walking, running, jumping, and dancing, each with a different effect on the dynamic response. Depending on the conditions, if the frequency of the loading approaches the natural frequency of the bridge it can result in excessive vibrations causing discomfort to the user. The level of discomfort experienced varies between people, to accommodate this a large range of frequencies above and below the natural frequency of the bridge should be avoided during detailed design. I.S. EN 1991-2 provides an indication of the typical frequency ranges for particular movements as follows:

- Pedestrians walking normally exerts a frequency in the vertical direction of between 1 and 3 Hz and in the horizontal direction between 0.5 and 1.5 Hz; and
- Groups of joggers typically exert a frequency of 3 Hz.

A dynamic analysis will be carried out to determine the natural frequency and response of the bridge to movement. This analysis will allow the designers adjust the bridge such as increasing the dead load to move the natural frequency of the bridge away from the expected range of frequencies from the live loading. The use of a damping system to alter the natural frequency would be an expensive addition and should be avoided if at all possible. Option 1 is likely to pose the largest risk for dynamic excitation due to its long span and lightweight deck when compared to the other options. Option 2 and Option 3 are likely to be heavier resulting in less risk.

## 4.6 Structure Classification

The classification of a structure ranges from Category 0 to 3 and depends on a number of factors related to the structural and geotechnical complexity of the design. The definition of each category is defined in the Eurocode standards and within TII publication DN-STR-03001. Each category is defined as follows:

- Category 0 – Simple Structures (simply supported 0-5m span structures)
- Category 1 – Simple Structures (simply supported 5-10m span structures)
- Category 2 – Intermediate Structures (all structures falling between Category 1 and Category 3)
- Category 3 – Complex Structures (typically individual spans in excess of 50m, high skew, cable stay design etc)

The level of check and form of certificates required for a structure are dependent on the categories above. Generally lower category structures result in lower consultancy costs and shorter programme durations for checking and approval. Higher categories especially Category 3 can add substantial design costs and programme delays due to requirements to procure independent third-party consultants separate to the design team to carry out a full independent check.

Option 1 is the only Category 3 option proposed falling within this classification due to the cable stayed structural form and both the main span and back span lengths in excess of 50m.

Option 2 and Option 3 are currently both classified as Category 2 structures as all span lengths are less than 50m in length but greater than 10m. There is potential at preliminary that the classification could increase to Category 3 based on the final articulation arrangement as discussed in the following section.

## 4.7 Bearings and Joints

Due to the length of the bridge and structural forms proposed all options will require multiple bridge bearings and expansion joints. Bearings are generally one of the more expensive single elements within bridge construction. The bearings are required to allow for movement between the bridge superstructure and substructure during the design life. Typically, thermal expansion and contraction are the worst-case forces resulting in significant movement within the superstructure. Bridge bearings used in design will be in accordance with the clauses set out in DN-STR-03004 – “Bridge Bearings. Use of BS 5400: Part 9:1983”. Expansion joints will be designed in accordance with DN-



STR-03006. The articulation of the bridge (bearing layout) will need to consider the types, direction, and amount of movement to avoid the build-up of secondary forces. The articulation can be formed by one of the three bearing types:

- Fixed Bearing – allowing rotational movement only.
- Guided Bearing – allowing rotational movement and translational movement in one direction only.
- Free Bearing – allowing rotational movement and translational movement in all directions.

All options will utilise the different combinations of the above bearing types.

Option 1 will likely require a minimum of six bearings depending on the final design. Fixed bearings will be provided at the central pylon with all movement occurring at the abutments. Guided and free bearings will be provided at these locations accommodating the movement. No bearings will be provided at Pier No.1 and No.3 as the superstructure will be designed to span over these piers without physical connection.

In total Option 2 will require approximately sixteen bearings equating to four bearings per span with each span designed as an independent structure. Each span will be provided with one fixed bearing, one guided bearing and two free bearings.

Finally, Option 3 will require eight bearings in total. Four bearings will be provided to the abutments (two per abutment). Further guided and free bearings will be provided to the tops of both Pier No.1 and Pier No.3 respectively. At Pier No.2 a fixed support could be progressed to avoid additional bearings at this location. Further investigation at Preliminary Design stage may also allow a reduction in the number supports required for this option.

Where bearings are utilised expansion joints are also required. Where the superstructure meets the substructure, a gap will be provided to allow for the predicted movements. This gap can be relatively large depending on the bridge type and span and presents a trip hazard for users. In these locations' expansion joints provide a continuous running surface reducing hazards while also prevent debris build up within the gap. The expansion joints are formed of engineered plastic materials which compress and expand during movement of the bridge.



## 5. Economic Evaluation

### 5.1 Cost Estimate

An options stage construction cost estimate has been prepared based on indicative quantities calculated from the drawings for each option. Where required details and geometrical requirements have been taken from similar bridges on which AECOM has previously worked to provide certainty in the cost estimates. The construction rates used have been based on AECOM's internal cost database or based on Spon's Civil Engineering and Highway Works Price Book as required. It should be noted that costs are indicative only and may vary depending on the preliminary design, detailed design, and the Contractor's construction methodology.

Item	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Construction Costs	€8,873,550.00	€7,571,550.00	€7,088,550.00

**Table 5-1 Construction Cost Estimate**

The construction costs provided above do not include for additional add on costs such as Land and Property, Inflation and Contingency. These add on costs have been calculated in accordance with the draft NTA Cost Management Guidelines. These guidelines provide a detailed contingency calculator which provides an estimated contingency requirement based on the project phase. The calculator estimates that a 36.1% contingency is required for Phase 2 – Concept Development and Option Selection based on a standard project definition. While this contingency is considered high it should be noted that the contingency is likely to reduce substantially as the project progresses and any unknowns are clarified. For example, the contingency calculator provides an upper and lower bound contingency of 20% and 10% respectively for a project that has reached Phase 5 Detailed Design and Procurement.

The NTA Cost Management Guidelines also includes an Option Comparison Cost Estimate Template which has been used to develop an accurate total cost for each option. This template provides a breakdown of construction costs for major work items and includes for Traffic Management costs, Administration Costs (incl. Design costs), land and property costs, inflation, and contingency. For the purposes of accurately estimating the inflation costs a four-year programme has been assumed to cover preliminary design through to construction with a 2.5% average inflation rate per year assumed. This rate of inflation has been received from AECOM's internal Treasury teams and is based on the Central Banks monetary policy for the coming years. The table below provides the Total Option Comparison Cost Estimate for each option exclusive of VAT. The detailed cost estimate and the contingency calculator have been included in Appendix D.

Item	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
<b>Construction Costs</b>	<b>€8,873,550.00</b>	<b>€7,571,550.00</b>	<b>€7,088,550.00</b>
<b>Option Add-On Costs</b>			
<i>Preparation and Administration Costs</i>	€1,774,710.00	€1,135,732.50	€1,063,282.50
<i>Traffic Management Related Costs</i>	€0.00	€0.00	€0.00
<i>Land and Property Costs</i>	€197,900.00	€197,900.00	€197,900.00
<b>Sub Total Add-On Costs</b>	<b>€1,972,610.00</b>	<b>€1,333,622.50</b>	<b>€1,261,182.50</b>
<i>Total Inflation Allowance</i>	€2,129,652.00	€1,741,456.50	€1,630,366.50
<i>Total Contingency Allowance</i>	€4,612,826.23	€3,771,994.78	€3,531,373.84
<b>Total Option Comparison Cost Estimate (ex VAT)</b>	<b>€17,588,638.23</b>	<b>€14,418,633.78</b>	<b>€13,511,472.84</b>

**Table 5-2 Total Option Comparison Cost Estimate**

## 6. Aesthetic Evaluation

### 6.1 Introduction

The basic principles of bridge aesthetics should be incorporated and considered before the options are progressed. These principles are described as follows:

- Expression of Function – it is generally accepted that a bridge should clearly express its overriding function. This is considered the basis of good design and any adjustments or additions to the form should add to the expression of functionality and not detract from it.
- Form – the form should derive from the function of the bridge. The form will be justified based on the loading, the clearance requirements, construction issues and the environmental needs. In certain cases, the form will be derived based on the nature of a site.
- Character – a bridge should always be a natural addition and have a permanent association with its setting and surroundings.
- Detail – the quantity and quality of the most minor details are critical to the scale, proportion, and perceived attention to the aesthetics of the bridge.
- Scale – the scale of the bridge relates to its overall feeling when viewed against the overall landscape. The scale of the bridge may be large and oppressive or small and intimate all based on detail and form.
- Proportion – this is the sizing or proportion of the structural elements to each other. It is generally preferred to maintain a simple mathematical relationship or ratio throughout the major elements of the bridge; and
- Environmental Intrusion – it is always preferred to minimise the intrusion of a bridge or structure on its surrounding landscape.

### 6.2 Option 1 Asymmetric Cable Stayed

Option 1 is an asymmetric, cable stayed pedestrian bridge whose form and function has been dictated by the site constraints, notably the location of the existing piers, which has determined the location of the main pylon support. The proposal includes a 35-metre-high pylon located on Pier No.2 with 11 no. cables to the eastern side at 8m centres and 5 no. cables to the western side at 8m centres. The pylon legs incline towards the centre of the bridge. The bridge is aligned centrally over the existing piers and within the confines of the existing stone parapets on the east and west abutments. The bridge deck is 0.5m deep with a minimum of 0.2m clearance provided to all piers.

The size, scale and form of the proposed option creates a landmark structure which is easily recognised and seen from a distance in Galway City. The use of cable structures is uncommon in Ireland with only a handful in existence throughout the country adding to the landmark nature of the option. Strabane Footbridge shown in the figure below was designed by AECOM and constructed in 2015 with a similar structural form and size to the option proposed.



Figure 6-1 Strabane Footbridge

The relationship between pylon height (35m) and bridge span (148m) are visually in proportion. Similarly, the pylon thickness (1m) is visually in proportion to the thickness of the deck to be supported. The cable arrangement provides for rhythm with cables spaced at equal centres each side of the pylon. Connections between cable and deck add visual interest via the expressed connections. Stainless steel balustrades with inclined posts and horizontal handrails provide further visual rhythm. Integrated LED feature lighting within the handrail will cast lighting over the deck surface creating additional interest by night and avoiding the need for standard lamp posts. Lighting of the cabling system and or pylon could also be considered to create a highly impactful feature lighting system which highlights the structure from greater distances when compared to other options. The deck will be finished in a combined waterproofing and surfacing layer which can be specified in numerous colours to align with the finished surface colour of the approach ramps.

The pylon is located on Pier No.2 on the western side of the river, adjacent to the taller buildings that exist on the western bank of the River Corrib. This aims to reduce the visual impact of the pylon on the surrounding context. The slender appearance of the deck aids in providing clear structural clarity in that the structural form is predominantly above deck. Although there is structural clarity, the presence of the unused existing piers will undermine the functional clarity of the proposal and as such the proposal lacks efficiency.

The long straight lines in the form of the pylon and cables dominate the natural setting of the River Corrib and as such the cable stayed proposal has a greater visual impact on river views due to the presence of the high-level support structure.

### 6.3 Option 2 Rippled Arch

Option 2 is an arched truss in a ripple form with the two outer spans being formed with above deck truss structures and the central span formed with a below deck truss. The form references a ripple when sunlight plays across the River Corrib as a contextual response to the beautiful setting. More than a piece of infrastructure here is an opportunity to create a place to pause and appreciate uninterrupted views of the river, the surrounding landscape and towards the city. The extent of the arched chord above deck will splay outwards from the centre to create a welcoming feel on arrival. The arched chord below deck will incline inwards towards the centre maximising views of the river Corrib and Galway City. This creates a visually dynamic bridge on crossing as well as when viewed from the city. The use of arched trusses makes a historical connection to the past and the original Clifden Railway Bridge truss design.

The use of truss structures across Ireland is a fairly common solution for pedestrian and cycle bridges with spans less than 50m. However, the use of a ripple form with alternating above and below deck arches will give the bridge a unique character, creating a landmark structure for the city of Galway and within Ireland. The Lagan Gateway Bridge just completed by Belfast City Council has a comparable structural form to the proposed below deck central span. The figure below shows the bridge during the construction.



Figure 6-2 Lagan Gateway Bridge

As with Option 1 the bridge is aligned centrally over the existing piers and within the existing stone parapets on the east and west abutments. The structural depth of the deck is 0.5m, similarly and to provide consistency the arched longitudinal chord of the truss is also 0.5m. The bracing is set at 2m centres and is inclined from the centre point of each arch radii. Clear order is achieved between the chord thickness and bracing thickness which accentuates the dynamic flow of the undulating arched truss.

The deck is inclined at a maximum gradient of 1:20 towards the centre to create a gradual rise and fall across the bridge which assists with drainage of surface water. The deck will be finished in a combined waterproofing and surfacing layer which can be specified in numerous colours to align with the finished surface colour of the approach ramps.

The form of the bridge is expressive with potential to light the arches at night, providing a greater presence when viewed from afar without having a significant visual impact. Locating the central arch truss below deck between Pier No.2 and No.3 provides good visual balance to the bridge when viewed from afar. This also provides for a suitable dwelling point mid span allowing for uninterrupted views of the river and surrounding landscape. Stainless steel balustrades with inclined posts and horizontal handrails provide further visual rhythm. Integrated LED feature lighting within the handrail will cast lighting over the deck surface creating additional interest by night

The proposed design is of a suitable scale for the surrounding context with structural clarity in the use of the existing piers evident.

## 6.4 Option 3 Curved Box Girder

Option 3 is a modified steel box girder option which creates a low-key simple elegant structure. The design includes a gentle incline to the deck, a deliberate acknowledgment to mark the crossing of the River Corrib on the user's journey. The form has a deliberately low visual impact when viewed from afar with detail and interest expressed in the balustrading and cladding to the soffits. The structural form allows the greatest flexibility to play with shadowing making the bridge appear thinner in elevation. An elliptical bottom plate has been specified to improve shadowing on the bridge elevation, with a rippled edge beam to creating interest and improving aesthetics.

A number of box girder bridges have been constructed in recent years in Ireland although few are classified as landmark structures. The use of modified box girder will create a structural form which is unique to Galway City. The Lille Langebro bridge in Copenhagen is a comparable bridge recently constructed whereby a modified box girder was used to create an undulating appearance manipulating light and shadow.



Figure 6-3 Lille Langebro Bridge

As with the other options the bridge is aligned centrally over the existing piers and within the existing stone parapets on the east and west abutments. The total depth of the structure is 1.5m formed by the modified box girder which includes an elliptical bottom plate. Multiple arch planes will be visible when viewed in elevation created by the top of parapet, top, middle, and bottom edge of girder and soffit of bridge. These planes shall vary across the structure to create an undulating appearance. Five planes have been progressed to create a sympathetic link of stretching the five arch rings at the base of Pier No.1 and No.2.





**Figure 6-4 Pier No.1 Arch Rings**

The deck is inclined at a maximum gradient of 1:20 towards the centre to create a gradual rise and fall across the bridge which assists with drainage of surface water and creates a positive feeling of crossing the river. As the deck level has been increased due to the increased structural depth of the box girder, this option requires additional land on the western embankment (UG Lands) to provide a compliant 1:20 access ramp.

Stainless steel balustrades with vertical posts and horizontal handrails provide further visual rhythm. Integrated LED feature lighting within the handrail will cast lighting over the deck surface creating additional interest by night. The deck will be finished in a combined waterproofing and surfacing layer which can be specified in numerous colours to align with the finished surface colour of the approach ramps.

The proposed design is of a suitable scale for the surrounding context with structural clarity in the use of the existing piers evident. The design proposal has the least visual impact of all 3 options when viewed from a distance.

## 6.5 Conservation

Conservation and protection of the existing piers and abutments should be maximised throughout the design. The following guiding principles of conservation should be adhered too where possible:

- Minimum Intervention – low key intervention maintaining as much of the existing elements with as little changes as possible. Over restoration can be detrimental to the character of the structure and can lead to a loss of tangible features.
- Repair rather than replace – unnecessary replacement of historical elements can adversely affect the character of a structure and diminish its authenticity. All works should seek to retain old fabric that contributes to the interest of the structure.
- Honesty of repairs and alterations – all attempts to disguise or artificially age alterations and repairs should be avoided. New interventions should not necessarily look old but should not detract from the visual integrity of the original structure.
- Use of appropriate materials and methods – where possible locally sourced and matching materials should be used in all works.
- Restoration – ideally restoration should not result in a loss of historic fabric or features of a structure. Restoration should result in the returning of the structure to its known earlier state prior to intervention.
- Reversibility - the use of techniques and materials which allow a repair or alteration to be reversed at a later date without loss of historic features or fabric is always to be preferred.

In consideration of the requirements to conserve the existing piers and abutments options have also been progressed which allow greater visibility and access to the protected elements. Gratings within the bridge deck have also been considered which allow bridge users the opportunity to view the elements from above, again giving a greater understanding and appreciation of the piers.



## 6.6 Materials

The choice of materials for use on the bridge can have a major impact on the visual aesthetic of the bridge. Where possible materials such as masonry should be locally sourced and match the masonry of the existing piers. Other materials such as structural steel and surfacing finishes can be specified to either blend with or contrast the existing elements.

The proposed painted structural steel which can be finished with a number of different painted colours to create an eye-catching elevation. The choice of colour will have a negligible impact on costs but can offer significant improvements to the visual aesthetics. The colour card shown below illustrates the various steel paint colours that are available for a painted steel structure. The colours shown are in accordance with DN-STR-03007 – “Quality Assurance Scheme for Paints and Similar Protective Coatings” and BS4800 – “Schedule of Paint Colours for Building Purposes”.

For the purposes of developing photomontage/visualisations of the bridge options a dark grey paint colour has been progressed. This dark grey colour provides suitable contrast to the bright grey colour of the stainless steel while also allowing the bridge to blend with its surroundings particularly when viewed from Salmon Weir.



Figure 6-5 Painted Steel Colour Card in accordance with DN-STR-03007 & BS4800

## 7. Evaluation of Durability and Maintenance Requirements

### 7.1 Introduction

Maintenance of the bridge will be required throughout the 120-year design life. The type and cost of maintenance will have a large effect on the Total Lifecycle cost of the bridge. Further to this, the proposed bridge options contain various articulation arrangements which may pose large maintenance costs throughout the design life.

### 7.2 Maintenance and Inspection Regime

Inspections of the bridge will be required regularly throughout its service life. The inspections will be carried out in line with the TII EIRSPAN Bridge Management System. The EIRSPAN system was introduced in 2001 to provide an integrated management system for the bridges in Ireland. The system coordinates activities such as inspection, repairs, and maintenance work to ensure optimal management of the bridge stock. The EIRSPAN system recommends the following intervals for inspections:

- Routine Inspection to be undertaken every year; and
- Principal Inspection to be undertaken at least every 6 years.

The above recommendations are the maximum recommended intervals and are dependent on the condition of the bridge and levels of deterioration since the previous inspection. If high levels of deterioration are identified the inspection interval should be decreased.

Inspection and maintenance requirements for Option 1 will likely be far greater than either of the other two options. Cable stayed structures require significant maintenance to ensure they remain operable and reach their design life. This includes a check that all cables are correctly tensioned and taking loading. Where possible exposed cable saddles and anchors will be utilised to allow easier inspection and maintenance. Stainless steel elements may also be specified for critical elements to maximise resistance to corrosion and improve durability. The cables shall be sealed in steel or high-density polyethylene casing providing increased protection. Inspection and maintenance of the cable anchors, longitudinal edge beams, parapets, finishes and surfacing will likely occur from bridge deck level. Inspection of the transverse superstructure elements, superstructure soffit and bearings will occur from water level below from boats/barges with temporary mobile scaffolding or access platforms. Access ladders should be incorporated within the pylon to allow inspection of the pylon members and the cable saddles. During the detailed design consideration needs to be given to a degree of redundancy which allows for failure of at least one cable, this failure will occur during routine maintenance or replacement of cables and anchors.

Option 2 will have a simpler maintenance regime when compared to Option 1, however, the complex geometry and significant number of joints and connections will result in additional requirements compared to Option 3. Where possible welded connections will be maximised in the design over bolted connections. Welded connections are significantly more durable than bolted which can become loose and require inspection of the tension within the bolt during the design life. Ease of access for inspection and maintenance from bridge deck level to the truss members in the fully through above deck spans will be a major advantage for this structure. However, the fully through below deck central span will need to be inspected and maintained from water level below. All other elements will be inspected and maintained similar to Option 1 with the longitudinal superstructure elements, parapets, finishes, and surfacing occurring from bridge deck level. Meanwhile inspection of the transverse superstructure elements, superstructure soffit and bearings will occur from water level below.

The modified box girder design of Option 3 will likely be the easiest of the three options to inspect and maintain. The girder will have significantly less connections when compared to the other two options. Access for inspection and maintenance to the interior of the box via manholes/access holes within the bridge deck will need to be considered as part of the design. This access would be classified as a confined space entry which is a high-risk activity, and an appropriate procedure needs to be implemented to ensure adequate processes are in place to reduce the risks. Consideration should be given to methods of ventilating the interior of the box and access should allow for emergency rescue as required. Inspection and maintenance of the longitudinal edge beams, parapets, finishes, and surfacing will occur from bridge deck level. Inspection of the superstructure soffit and bearings will need to occur from water level below.

Inspection and maintenance of the existing piers and abutments also needs to be considered as part of the inspection and maintenance regime. The existing abutments will be accessed from the approach embankments and from existing ground level to the front of the abutments. The piers will need to be inspected from the river during inspection of the superstructure elements.

For all options consideration should be given to use of rope access inspections to limit the need for water access from the River Corrib. Rope access can provide a cheaper alternative and improve safety when compared to access from boats and barges where scaffolding and access platforms are required. Rope access is particularly useful as closures of the navigable channel of the River Corrib will not be required. Access and tethering points for ropes need to be considered as part of the design and included within the superstructure. These tethering points should be located at equal spacings along the length of the superstructure providing suitable connection points for the inspection team. Rope access inspection should only be carried out by experienced bridge inspectors with suitable qualifications and insurances.

### 7.3 Bearings and Expansion Joints

All options require the use of bridge bearings due to the bridge length and predicted movements of the structural members under loading, particularly thermal effects. The number and type of bearings will vary depending on the preferred option. All bearings will be designed to ensure a minimum design life of 50 years according to DN-STR-03012. In addition, bearings which maximise the use of stainless-steel components should be specified to maximise resistance to environmental factors and exposure classes.

Proper inspection and maintenance of the bridge should allow bearings to meet and exceed the 50-year design life. Maintenance works such as painting, and lubricating should be carried out as required to maximise the design life. As the replacement of bearings will likely be a large cost item, with bearings scheduled to be replaced at least twice over the 120-year design life the preferred option should be designed to allow for easy access to bearings and bearing shelves. Good detailing should also consider maximising the efficiency of replacement with suitable jacking points provided at each bearing location.

Expansion joints will be required for options where the superstructure meets the substructure, and a gap is provided to allow for the predicted movements. The expansion joints provide a continuous running surface across this gap. The type of expansion joint to be used will be determined at detailed design based on the likely movements within the bridge and the size of the gap. Expansion joints that are correctly designed allow the movement of the bridge at the expansion gaps while providing a continuous surface for users. Expansion joints are weak points in the structural continuity of the bridge. They must be correctly installed and maintained to prevent leakage and water ingress from the upper deck surfaces to lower or internal surfaces and bearings. Expansion joints in the structure, will be required to remain watertight for a minimum of 10 years after opening.

### 7.4 Materials

The choice of construction material for the bridge will have a major impact on the overall durability and inspection and maintenance requirements throughout the design life of the bridge. A number of different materials have been considered as part of the options development for the bridges. A composite concrete and steel structure was originally proposed for the 2002 planning application. Current industry best practice would dictate that concrete is no longer a suitable option for a long span footbridge due to the significant dead weight of the material. Instead, a steel structure provides the optimum solution for the bridge.

Painted steel is currently the preferred steel specification for the bridge superstructure with stainless steel proposed for the parapets. Weathering steel and stainless steel were also considered for the superstructure however, both have been ruled out. Weathering steel is not considered an appropriate construction material for this location due to the site proximity to the sea (less than 5km) which leads to a substantial increase in corrosion rates due to air borne chlorides. Stainless steel, while providing superior durability qualities when compared to other materials has also been ruled for the main superstructure elements out due to the substantial increase in construction costs. The material provides lower strength capacities when compared to structural steel, but this is mitigated by the sustainability lower maintenance requirements. The use of stainless steel will be confined to the parapet which are likely to experience increased maintenance requirements due to the aggressive marine environment. The choice of using stainless steel for the main superstructure elements should be revisited again at preliminary design stage following further development of the construction cost estimate to determine if GCC can justify the increase construction costs for stainless steel. Painted steel will be specified with a suitable protective paint system such that no maintenance shall be required up to 12 years and no major maintenance before 20 years as required in DN-STR-030012 Design for Durability. The steelwork will be designed and detailed to discourage the accumulation of water, dirt and debris and minimise the risk of rusting or deterioration. Intermittent fillet welds shall also be avoided to maximise durability.

## 8. Hydraulic Considerations

### 8.1 Introduction

Construction of a new bridge in any landscape has the potential to impact the surrounding area's likelihood to flood. As the bridge spans the River Corrib with a significant level difference it is unlikely that works will affect the predicted flood levels or the available flood plain storage of the River Corrib. However, the potential flooding impacts caused due to the construction should not be ignored and the potential for flooding should be investigated.

The River Corrib connects Lough Corrib to the Atlantic Ocean at Galway. The river is the shortest river in Ireland at only 6km long, however despite this it is the second fastest flowing river in Europe due to the large volume of displaced water from Lough Corrib. The flow of the River Corrib through Galway City is regulated by Salmon Weir located to the south of the bridge.

### 8.2 Salmon Weir

Salmon Weir is located directly to the south of the bridge and was constructed in 1851. The weir is directly responsible for controlling the water flow and water levels within Galway City and the River Corrib. Depending on the weather conditions and amount of rainfall more or less gates are opened in the weir controlling the rate of water entering Galway Bay. The more gates that are open the greater the drag in the water upstream of the weir. This drag current has a major impact on boats and vessels within the water.

Access to the weir is currently controlled by a large exclusion zone created by connecting large floating bollards directly to the piers of the bridge. As part of preliminary design consideration should be given to reducing the area within this exclusion zone to return a large section of the River Corrib to public use. Fixings to the riverbed could be considered which would provide a suitable tie down points for a revised floating bollard arrangement.



Figure 8-1 Existing Salmon Weir Exclusion Zone

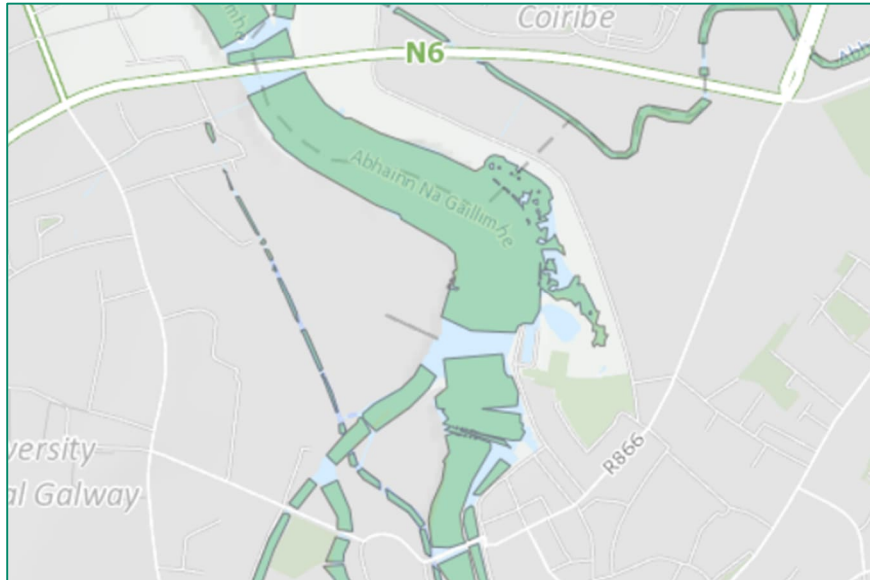
### 8.3 Flooding

A review of the OPW flood mapping ([www.floodmaps.ie](http://www.floodmaps.ie)) shows that there is historical data relating to flooding in the areas surrounding the River Corrib in Galway City. Several incidences of flooding have been recorded in close proximity to the bridge in Galway City. The details are the following

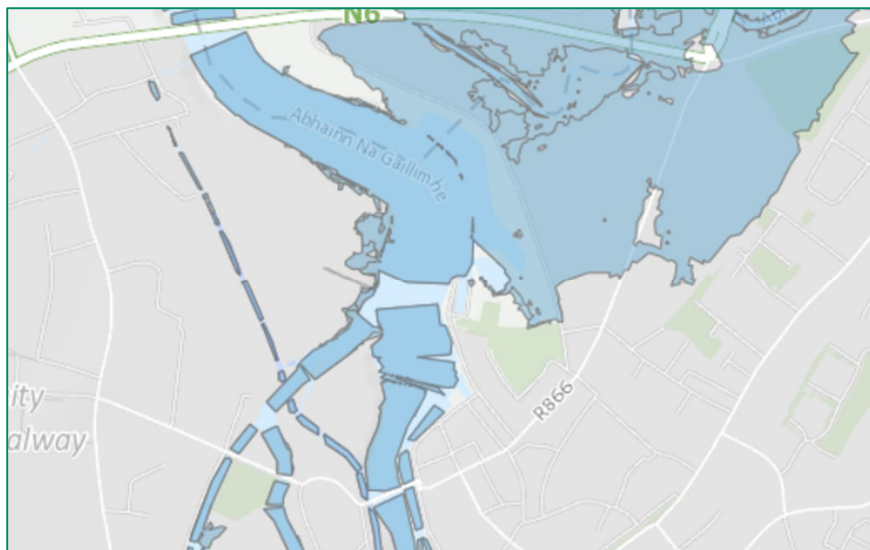
- On the 3<sup>rd</sup> of January 2014, flooding was reported in Galway City and Salthill.
- On the 28<sup>th</sup> of January 2013, flooding was reported in Galway City centre; Flood Street, Spanish Arch/ Quay Street and Lough Atalia Road. This flooding was due to heavy rainfall after almost 1cm of rain fell in two hours.
- On the 17<sup>th</sup> of January 1995, flooding was reported in Galway City as a result of heavy rainfall and coupled with very high tide. The city experienced this again on January 20<sup>th</sup> which was attributable mainly to melting

snow and heavy rainfall. The main areas affected were Quay Street, Flood Street, The Docks Area and Lower Salthill.

The design of the proposed bridge will consider the 1 in 200 year coastal and 1 in 100 year river flood extents in accordance with the CFRAMS. Further review of the flood mapping in the area may be required at conceptual design stage to identify any updates to the flood record. The figures below show the coastal and river flood extents as of July 2021.



**Figure 8-2 Coastal Flood Extents**



**Figure 8-3 River Flood Extents**

## 8.4 Section 50

For all bridges over water consent under Section 50 from the Commissioners of Public Works (OPW) will be required to construct, replace, or alter a bridge as there is a potential to change the hydraulic characteristics of a watercourse. The Section 50 application process will need to consider the proposed bridge and the effect on the surrounding hydraulics. The application must consider the 1% (AEP) or 1 in 100 year fluvial flood levels. In addition to a fluvial flood flow standard, if a bridge is located within a tidal zone with a coastal flood extent, it must cater for a tide level with a 0.5% (AEP) or 1 in 200 year flow without significantly changing the hydraulic characteristics of the watercourse. It is likely that the Section 50 application process will be straightforward due to the high vertical alignment of the bridge and thus is unlikely to affect flooding in the area.



## 8.5 Section 245

Consent of the Minister for Arts, Heritage, Gaeltacht, and the Islands will be required for the construction of the proposed bridge as it spans navigable water. Section 245 is an amendment of the Road Act, 1993 which covers this consent requirement.

Amendment of Roads Act, 1993.	<p><b>245.</b>—The Roads Act, 1993, is amended by the insertion of the following after section 15 of that Act:</p> <p>“Requirements as regards railways, canals, etc.</p> <p>15A.—A road authority shall not construct or reconstruct a bridge or viaduct over, or a tunnel under—</p> <p>(a) a railway, save with the consent of the Minister for Public Enterprise, or</p> <p>(b) any inland waterway within the meaning of the Minister for Arts, Heritage, Gaeltacht and the Islands (Powers and Functions) Act, 1998, or any navigable water, save with the consent of the Minister for Arts, Heritage, Gaeltacht and the Islands.”.</p>
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## 8.6 Galway City Flood Relief Scheme

The OPW, Galway City Council (GCC) and other Local Authorities, have commissioned and completed the Western Catchment Flood Risk Assessment and Management (CFRAM) Study. This study area included Galway City as an Area for Further Assessment (AFA) and concluded that a flood relief scheme would be viable and effective for the community. Subsequently, Galway City Council appointed Arup to deliver Corrib go Cósta - the Galway City Flood Relief Scheme. The scheme will fall under three of Galway's catchment areas including Galway Bay North, the Corrib, and Galway Bay South East.

The objective of the Galway City Flood Relief Scheme is to assess, design and deliver a viable, cost-effective, and environmentally sustainable flood relief scheme for Galway city. The Galway City Flood Relief Scheme, while primarily commissioned to address the flooding problem in Galway City, is also aimed to add a distinctive and recognisable structural form to Galway City. The scheme will include architectural solutions and a landscape design in addition to addressing flood risk management. The project is currently in Stage 1 – Options Assessment with construction currently programmed for 2026.

It is likely that the proposed bridge will have minimal impact on the food relief scheme due to the high vertical alignment of the bridge and thus is unlikely to affect flooding in the area.

## 9. Environmental Considerations

### 9.1 Introduction

The potential environmental effect of the scheme must be considered as part of the design. The impacts on human health, biodiversity, the landscape, and climate are just a few of the factors to be considered. The magnitude of the environmental impacts will be related to a number of factors such as the location, quantity, and choice of materials, span, and structural form etc. Considering the type and location of the bridge, Biodiversity and Cultural Heritage are considered the most critical elements and are covered in the greatest detail.

### 9.2 Biodiversity

The scheme, based on its preferred option and location, will require an 'Appropriate Assessment (AA) Screening' to determine if an Appropriate Assessment is required. Given its location and the proximity of several European sites, it is very likely that a full Appropriate Assessment, and preparation of a Natura Impact Statement, will be needed. The alignment of the bridge will be the same for all three options and only the design of each bridge option will vary.

#### 9.2.1 Baseline Environment

The bridge is located in the developing area of Galway city. The bridge crosses the River Corrib, which is designated as Lough Corrib SAC and is located between the Inner Galway Bay Special Protection Area (SPA) and Lough Corrib SPA. This bridge also crosses the following terrestrial habitats: mixed broadleaved woodland (WD1), and railway piers, abutments, and pavement (BL3). In the surrounding environment, the dominant habitat is hardstanding (BL3), but there are also smaller areas of reed and large sedge swamp habitats (FS1) located approximately 100 m north of the scheme along the River Corrib. This habitat includes an area of species-poor Annex 1<sup>1</sup> habitat type transition mires and quaking bogs (code 7140). Species-rich grassland (GS2), species poor grassland (GA2), riparian woodland (WN5) and mixed broadleaved woodland (WD1), scattered trees and parkland (WD5), hedgerows (WL1) and treelines (WL2) are also present within 150 m of the bridge.

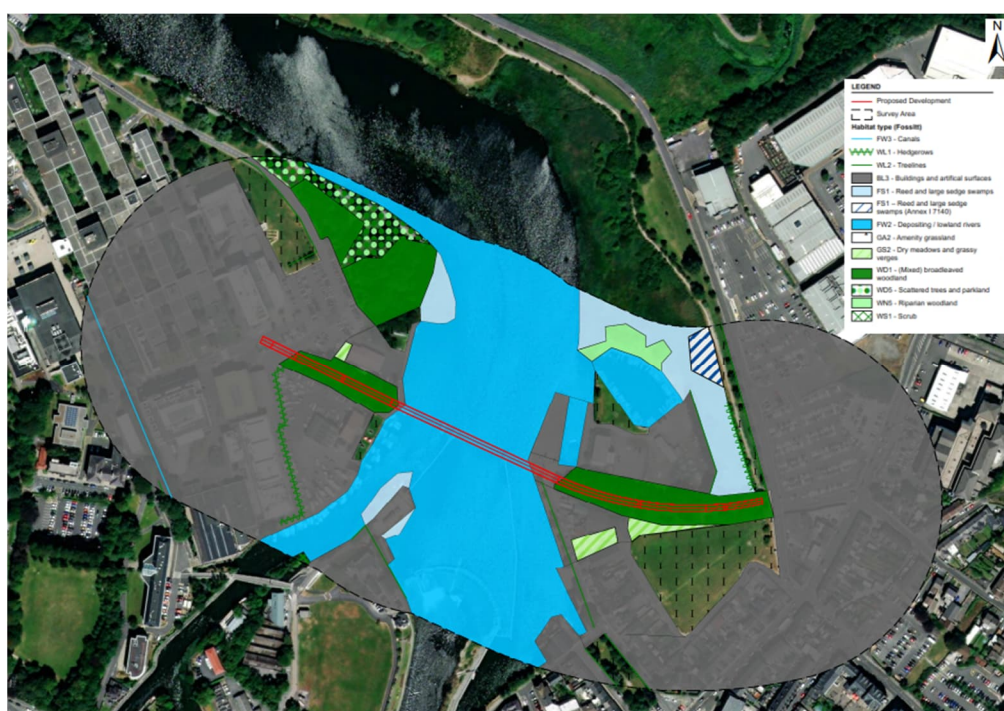


Figure 9-1 Habitats identified within the scheme and survey area (150 m from scheme)

A Preliminary Ecological Appraisal (PEA) was carried out for the bridge and the key major constraints identified were the nearby European sites, notable habitats (e.g. the River Corrib SAC and woodlands), bats, otter, breeding birds, non-breeding birds, fish and invasive species. Furthermore, moderate constraints were also identified for rare and protected plant species and minor constraints were identified in relation to badger, other terrestrial

<sup>1</sup> Annex I of the European Union Habitats Directive.

mammals, amphibians and invertebrates. For further details, see the PEA which is attached as an appendix to this report.

From an ecological perspective, all of the options being considered have a similar alignment and will result in the loss of the same habitats. The three options are therefore neutral in comparison to each other on the basis of habitat loss and impacts on all notable species, excluding birds which may be impacted by the design of the bridge. Option 1 will include the installation of a two-span cable stayed bridge which will reach a height of 35 m. This particular design option could result in an increased bird collision risk and is therefore considered to be more impacting in this regard than Option 2 and Option 3. Therefore, Option 1 is less preferred, solely on the basis of the increased bird collision risk.

All three options should consider the following key design features to minimise impacts to ecological features, further details of which can be found in PEA within Appendix E.

- lighting design to avoid illuminating the watercourse and interfering with bat foraging and commuting;
- avoiding in-river works during fish migration period;
- avoiding pollution during construction and operation; minimising barrier impact from presence of new structure on commuting bats and birds
- due to the presence of Japanese knotweed and other non-scheduled invasive non-native species identified in proximity to the scheme, it is recommended that an Invasive Species Management Plan (ISMP) is produced prior to any construction works; and,
- all three options will cross in the same area of the woodland, which has a number of mature trees present. The preferred option should ensure that the loss of any of these trees as well as hedgerow and other screening vegetation should be kept to a minimum.

To inform the assessment of ecological effects of the scheme it is recommended that the following further surveys are carried out:

- targeted breeding bird surveys are recommended. This should include general breeding bird surveys of the scheme and wider survey area (150 m from scheme), in addition to vantage point watches to determine use of the River Corrib within the scheme for foraging and/or commuting by Special Conservation Interest (SCI) species. The surveys should be carried out between March and August, inclusive.
- targeted non-breeding bird surveys (vantage point watches) covering the scheme and surrounding area to be carried out to establish the use of the River Corrib by foraging and/or commuting birds during the non-breeding season (September to February, inclusive).
- plant survey of the River Corrib be carried out during the optimal botanical survey period (April to September, inclusive);
- bat activity transects, as well as vantage point watches to monitor use of the River Corrib by bats for foraging and/or commuting;
- targeted otter surveys within the Site and along the River Corrib are recommended. This survey can be carried out year-round;
- pre-construction badger surveys to ensure no setts have been established within the scheme or zone of influence since the PEA was prepared; and,
- survey for fish species at appropriate times of year to account for the migratory period of difference species. This is likely to involve electric fishing within the scheme and surrounding watercourse.

## 9.3 Cultural Heritage

The proposed bridge is located in a heritage sensitive location with the old Clifden Railway Line abutments and piers recorded as a Protected Structure (RPS 8601) on the Galway City Development Plan 2023-2029 and on the National Inventory of Architectural Heritage as NIAH 30309001. Additionally, all river and water related structures such as bridges, piers, weirs, mill streams and canals are also Protected Structures (RPS 8501) on the Galway City Development Plan 2023-2029.

Details of these and other heritage assets within the vicinity comprising archaeological and architectural assets are included in an archaeological desk-based assessment which has been prepared for the project and is included as Appendix F.

### 9.3.1 Potential impacts to heritage associated with the options

The three bridge options all seek to utilise the original Clifden Railway Bridge abutments and piers (RPS 8601). As such, there are impacts to the Protected Structure which will be common to all three.

The west and east embankments comprise earthen banks which originally continued further inland to facilitate a measured change in gradient from bridge to ground level on the railway line. The embankments have since been truncated with the remaining sections comprising the highest parts adjacent to the river and piers. These banks are steep and will require regrading to facilitate pedestrian and cycle access.

The majority of railway related features were removed when the bridge was decommissioned in 1935, although there is the possibility that features may still be in place including those relating to the drawbridge mechanism on the western embankment. The regrading of the embankments would impact upon such features should they exist. The embankments are also considered part of the Protected Structure (RPS 8601).

#### 9.3.1.1 Option 1 Asymmetric Cable Stayed

This bridge option would see a cable stayed bridge erected upon the original abutments and piers. The bridge would be supported on a pylon located on the Pier No.2 and the west and east abutments. The bridge structure will overspan Pier No.1 and No.3.

The pylon will extend to a height of 35m with an arrangement of 22 no. cables to the east (11 each side of bridge deck) of the pylon and 10 cables to the west (5 each side). This use of a cable structure and associated pylon is intended to create a landmark structure which will be visible from large areas of the city especially in views along the river. It will impact the fabric and settings of Protected Structures including the old Clifden Railway Line abutments and piers (RPS 8601), river and water related structures (RPS 8501) and those Protected Structures visible in views towards the centre of Galway to the south.

The proposed bridge will positively enhance the Protected Structures including the abutments and piers (RPS 8601), river and water related structures (RPS 8501) and their setting as the substructures will be restored to their former use. The proposed bridge will enable access to the structures and enhance understanding and appreciation of these assets as important elements within the industrial heritage of Galway. The landmark bridge, however, would be highly visible in views to and from Protected Structures along the river towards the centre of Galway to the south.

This bridge option will entail physical impacts to the fabric of Pier No.2 and the abutments / embankments on the western and eastern banks. The fabric of Pier No.1 and Pier No.3 will not be physically impacted. These impacts will be directly associated with known elements of a Protected Structure (RPS 8601) and could also be associated with currently unknown elements such as former railway infrastructure on the embankments. Physical impacts to fabric are common to all three bridge options. Option 1 would have slightly less physical impact upon the existing fabric of the Protected Structure (RPS 8601) than the other two options. Additionally, the bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. The cable stayed bridge is designed to be a landmark feature within the urban landscape, with much greater physical presence than the other two bridge options, which will be visible from across Galway City. This will affect the settings of Protected Structures within the vicinity including Clifden Viaduct (RPS 8601) itself and views into Galway City Centre and associated Protected Structures downstream.

#### 9.3.1.2 Option 2 Rippled Arch

This bridge option would see a trussed arch bridge erected upon the old Clifden Railway Line abutments and piers. The bridge would be supported on plinths located on each of the three piers and the west and east abutments.

The arched trusses will extend to a maximum height of 3.16m above the bridge decking between the west bank and Pier No.1 and between Pier No.3 and the east bank. An arched truss will span below the centre of the bridge decking between Pier No.2 and No.3 for a maximum depth of 3.32m.

The placing of the arched truss bridge upon the old Clifden Railway Line abutments and piers (RPS 8601) will create an impact to the fabric and setting of this Protected Structure. The truss will also impact the settings of the water related structures (RPS 8501) and those Protected Structures visible in views towards the centre of Galway to the south. However, views over the centre of the bridge will be less impeded as the trussed arch travels under the bridge deck.

The bridge will positively enhance the Protected Structures, including the old Clifden Railway Line abutments and piers (RPS 8601), river and water related structures (RPS 8501) and their setting as the piers will be restored to their former use. The bridge will enable access to the structures and enhance understanding and appreciation of



these assets as important elements within the industrial heritage of Galway. This less intrusive bridge option will enhance views to and from Protected Structures along the river towards the centre of Galway to the south. It is also noteworthy that the original 19th century railway bridge was a truss design, and so this option is sympathetic to the original design of the bridge.

This bridge will entail physical impacts to the fabric of all piers and the abutments / embankments on the western and eastern banks. These impacts will be directly associated with the fabric of the Protected Structure (RPS 8601) and could also be associated with currently unknown elements such as former railway infrastructure on the embankments. Physical impacts to fabric are common to all three bridge options. This bridge is designed as an arched truss bridge which will be less visually intrusive than Option 1. It will affect the settings of Protected Structures within the vicinity including Clifden Viaduct (RPS 8601) itself and views into Galway City Centre and associated Protected Structures downstream. The bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. Additionally, of the three bridge design options, this proposed design is the most sympathetic to the original 19th century trussed girder railway bridge and provides a clearer link to the original design intent for the former Clifden Viaduct.

#### **9.3.1.3 Option 3 Curved Box Girder**

This bridge option would see a steel box girder bridge erected upon the abutments and piers. The bridge would be supported on plinths located on each of the three piers and the west and east abutments.

The total depth of this bridge would be 1.5m across the entire structure. The placing of the steel box girder bridge upon the old Clifden Railway Line abutments and piers (RPS 8601) will create an impact to the fabric and setting of this Protected Structure. The bridge will also impact the settings of the water related structures (RPS 8501) and those Protected Structures visible in views towards the centre of Galway to the south. However, views over the proposed bridge will be less impeded as the structure is only 1.5m high.

The proposed bridge will positively enhance the Protected Structures, including the abutments and piers (RPS 8601), river and water related structures (RPS 8501) and their setting as the piers will be restored to their former use. The proposed bridge will enable access to the structures and enhance understanding and appreciation of these assets as important elements within the industrial heritage of Galway. This less intrusive bridge option will enhance views to and from Protected Structures along the river towards the centre of Galway to the south and is the simplest in visual form.

This bridge option will entail physical impacts to the fabric of all piers and the abutments/embankments on the western and eastern banks. These impacts will be directly associated with the fabric of the Protected Structure (RPS 8601) and could also be associated with currently unknown elements such as former railway infrastructure on the embankments. Physical impacts to fabric are common to all three bridge options. The girder bridge would be the least visually intrusive and simplest in visual form of the three bridge options. However, it will still affect the settings of Protected Structures within the vicinity including Clifden Viaduct (RPS 8601) itself and views into Galway City Centre and associated Protected Structures downstream. The bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. However, its appearance would be that of a simple bridge which does not translate the original design intent for the railway viaduct in comparison to Option 2 and is therefore less sympathetic to the historical origins of the bridge.

### **9.3.2 Additional Heritage Considerations**

All options consider the use of a grated deck system over the piers. This grating will allow views to the piers below and increases visibility of the protected structure. These gratings will provide opportunity for the piers to be a focal point within the new structure.

One of the ABP conditions of the original approved planning application from 2002 was for a plaque to be installed at the bridge location to provide historical information on the bridge. As part of the design, it is considered appropriate to retain this condition and to provide a suitable location for a plaque.

## **9.4 Landscape and Visual**

The Galway City Development Plan 2023-2029 identifies 'blue spaces' such as the coastline, Lough Corrib, River Corrib waterways and canals as important natural resources that bring benefit for people and the environment, including creating an attractive landscape. These assets are considered to significantly contribute to the positive image of the city. Policy 5.3 of the Galway City Development Plan 2023-2029 requires the integrity of blue areas to be maintained by avoiding significant impacts and by meeting requirements of statutory bodies, and national and



European legislation and standards. Policy 5.3 also contains a number of items which should be considered during the design of the proposed bridge options and during the construction phase of the preferred bridge option should planning permission be granted.

Irrespective of the preferred bridge option, a Landscape and Visual Impact Assessment (LVIA) is likely to be required as the bridge will be visible from a number of areas and the presence of a bridge will alter the existing setting, would likely alter views in Galway City and the local area, and could restrict open views along the river. The preferred bridge option is likely to be the bridge option with the least impact on the surrounding landscape and local views. A survey may be required as part of the LVIA, which could be a standalone report or a chapter of an EIAR should one be deemed required.

As part of this report photomontages/visualisations have been prepared for all options. The photomontage locations have considered a number of Landscape and Visual constraints including views to and from protected structures. These include views towards the Galway Cathedral and from Salmon Wier Bridge. The view from Salmon Weir Bridge is considered to be critical as this is a protected view.

## 9.5 Water and Flood Risk

Galway City Development Plan 2023 - 2029 notes that Galway City is vulnerable to three key sources of flooding; fluvial, groundwater and coastal due to its landscape setting. Occurrences of localised flooding are attributed to a combination of high tides, high winds, and surges. The city has been identified as an area of further assessment as part of the OPW Preliminary Flood Risk Assessment (PFRA) and the Western CFRAMs Programme. Climate change and the potential for increased flooding should be considered during the design of the preferred bridge option. As the bridge is located within a flood extent a flood risk assessment will likely be required. Further information on flood risk is provided in Section 8 of this report.

The three proposed bridge options are located in an area of the River Corrib identified as a drinking water river and an area where groundwater bodies intersect with a designated SAC (Lough Corrib SAC). The bedrock aquifer to the east of the proposed bridge options is described as 'Regionally Important Aquifer – Karstified' while to the west it is described as 'Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones'. The groundwater vulnerability in the area is predominately highly vulnerable. No groundwater wells or springs, group scheme and public supply source protection areas or group water scheme abstraction points were identified at the location of the proposed bridge options.

## 9.6 Land and Soils

The quaternary sediments where the proposed bridge options would be situated are generally overlying by Urban made ground with pockets of Fen Peat to the north east. Bedrock geology to the east of the proposed bridge options is defined as Marine shelf facies; Limestone & calcareous shale, while that to the west is defined as Orthogneiss suite, mainly quartz diorite (Connemara). No geological heritage sites were identified in the area. Ground conditions have been considered further within Section 12 of this report.

## 9.7 Noise and Vibration

The proposed bridge options are located in Galway City. The existing noise environment would likely comprise of noise from local roads and typical of a recreational area. All three proposed bridge options are non-motorised and are not anticipated to increase noise levels within the area.

## 9.8 Air Quality and Climate

The proposed bridge options are located in air quality index region 3 and the air quality index was 3- Good<sup>2</sup> at the time of writing the report. The proposed bridge options occur in air zone C 'Other Cities and Large Towns'. The closest air monitoring site to the proposed bridge options is at Ragoon. All three proposed bridge options are non-motorised and are not anticipated to alter air quality or climate in the area.

## 9.9 Population and Human Health

The proposed bridge options are located in Galway City. The population of Galway City was recorded as 79,934 during the 2016 census. There are a number of recreational areas, places of education, sports grounds and places of worship in the area surrounding the proposed bridge options including the Corrib Rowing and Yachting Club, a

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<sup>2</sup> <https://gis.epa.ie/EPAMaps/>

boat club, St Joseph's College Rowing Club, the Galway Rowing Club, Galway Cathedral, the University of Galway amongst others. Further information on places of educational, local rowing and boat clubs are provided in Section 2.3 of this report.

## 9.10 Environmental Considerations Next Steps

### 9.10.1 Environmental Impact Assessment

It is noted that all of the options are over 100m in length and as such are likely to require a mandatory EIAR under Section 50(1) of the Roads Act 1993 (as amended). In addition, the bridge will also cross a SAC. The potential requirement for a mandatory EIAR and any potential likely significant impacts associated with the preferred bridge option will be assessed within an EIA Screening following design development of the preferred bridge option. The subsequent EIA determination will identify if an EIA and the production of an EIAR is deemed necessary.

Should it be determined during the screening phase that an EIA and the production of an EIAR is required the work related to the EIA would be carried out and completed as part of the planning application.

A number of environmental aspects would be considered as part of the EIA. In general, an EIAR would include the environmental topics listed below as well as chapters such as the Introduction, Need for the Proposed Road Development, Project Description, and Examination of Alternatives:

- Traffic Analysis.
- Population and Human health;
- Biodiversity;
- Land & Soils (incorporating Soils, Geology and Hydrogeology);
- Water (incorporating Water Quality and Hydrology);
- Air Quality;
- Climate;
- Noise and Vibration;
- Landscape;
- Cultural Heritage;
- Major Accidents and Disasters;
- Material Assets (Non-Agriculture);
- Material Assets (Agriculture)

### 9.10.2 Appropriate Assessment

Under article 6(3) of the EU Habitats Directive, any project which is not directly connected with or necessary to the management of a European site (SACs and SPAs), but which would be likely to have a significant effect on such a site, either individually or in combination with other plans or projects, must be subject to an 'Appropriate Assessment' of its implications for that site. In Ireland, the requirements of Article 6(3) are transposed into national law by the Planning and Development Acts 2000-2020. The process required by Articles 6(3) and 6(4) of the Habitats Directive is stepwise and must be followed in sequence.

The stages in the AA process are:

- stage 1 – Screening for AA;
- stage 2 – AA;
- stage 3 – Alternative Solutions; and,
- stage 4 – Imperative Reasons of Overriding Public Interest (IROPI).

The first step in the sequence of tests above is to establish whether an Appropriate Assessment is required. This is often referred to as 'AA Screening'. The purpose of AA Screening is to determine, in view of best available scientific knowledge, whether a project, either alone or in combination with other plans or projects, could have likely

significant effects on a European site, in view of that site's conservation objectives. Due to 2018 case law<sup>3</sup>, any conclusion regarding likely significant effects must not take account of any measures intended to avoid or reduce harm on European sites. In other words, the determination of likely significant effect should not, in the eyes of the Court of Justice of the European Union (CJEU), constitute an attempt at detailed technical analysis, which is reserved for the Appropriate Assessment (Stage 2).

There is one European site located within the boundary of the scheme – the Lough Corrib SAC. This European site is designated for a number of habitats and species including otter, Atlantic salmon, freshwater pearl mussel and white-clawed crayfish.

The Galway Bay SAC located approximately 770 m south of the scheme is also hydrologically linked to the scheme and is designated for a number of habitats and species including harbour seal, otter, and reefs.

There are also two SPAs located upstream and downstream of the scheme. The Inner Galway Bay SPA and Lough Corrib SPA are located approximately 770 km south and 2.8 km north, respectively, and they are designated for a number of breeding and wintering bird species, primarily waterbirds including common tern, dunlin, curlew, cormorant, and coot. The River Corrib likely acts as migratory flight path for many of these SCI species, several of which may also forage within the scheme.

Due to the presence of several European sites within and otherwise connected to the scheme, an Appropriate Assessment (AA) Screening will be required. Where this identifies that the scheme may have likely significant effects (LSE) on any European site, in the absence of mitigation, a full Appropriate Assessment and preparation of a Natura Impact Statement (NIS) will be required (Stage 2). **It is considered highly likely at this early stage in the design of the scheme that full AA and preparation of an NIS will be required.**

In addition to the European sites, there are also two internationally designated Ramsar sites and two nationally designated sites within 2 km of the scheme. The design of the scheme should seek to avoid or minimise impacts on these.

## 9.11 Planning Considerations

In considering the proper planning and sustainable development of an area, specific regard to the matters outlined in Section 34 of the Planning and Development Act 2000, as amended must be undertaken in the assessment of options proposed. For the purposes of this options report, a high-level assessment is guided by the requirements set out in section 34(2) (ia), where the provisions of the extant development plan are required to be considered.

### 9.11.1 Galway City Development Plan 2023-2029

The extant Galway City Development Plan (CDP) sets out the proposed policies and objectives for the development of Galway City over the period 2023-2029. A high-level review of the CDP policies and objectives are also included in Section 2 and identify that the planning principles of the proposed bridge would be viewed as supportive of the policies and objectives that are outlined. As per section 96 of the Planning and Development Act 2000, as amended, it is a requirement for a CDP to be consistent with national and regional policies, in particular consideration to the NPF and RSES. This section will provide additional input to inform the planning considerations for this options report.

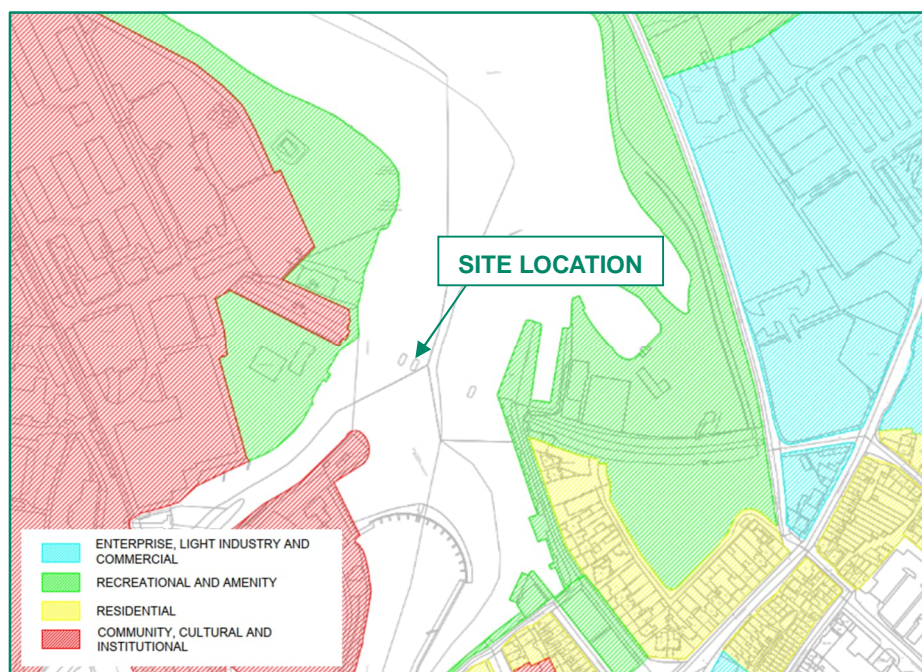
### 9.11.2 Development Management Standards

#### 9.11.2.1 Zoning

The CDP includes a number of different zoning types for the area surrounding the proposed bridge as highlighted in the figure below.

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<sup>3</sup> People Over Wind and Sweetman v Coillte Teoranta (C323/17).



**Figure 9-2 Extract from Zoning Map - Galway City Development Plan 2023-2029 [annotations added]**

As indicated the bridge will cross the River Corrib, which is a designated European site, but also identified under the record of protected structures as *Rivers and Waterways*, that includes a special interest of; *Technical / Historical / Social / Scientific / Archaeological / Architectural*, the site features of such include; *bridges, walling, embankments, piers and other associated infrastructure*.

Of relevance the bridge is predominantly located on lands zoned for Recreational and Amenity (RA) usage, this zoning includes an objective, namely;

*“To provide for and protect recreational uses, open space, amenity uses and natural heritage and biodiversity.”*

A range of specific development objectives for a number of RA zones are referred to within the CDP, of relevance, the proximity of the following to the bridge;

*“RA lands at University of Galway in the vicinity of the Quincentenary Bridge. The Council will consider the strategic requirements to link the northern and southern campus. This will be subject to examination of all potential options, transport, visual and environmental considerations and where it can be demonstrated that the preferred option will have sustainable benefits.”*

*“RA lands between the River Corrib and the Dyke Road and south of Quincentenary Bridge Road in Council ownership. The Council will consider the development of these lands to accommodate municipal and club water-based facilities. Development of these lands shall include criteria for a high standard of design and shall be subject to environmental assessments in relation to European sites.”*

Of further importance, the lands directly to the western side of the bridge will link to the UG, these lands have a designated zoning for Community, Cultural and Institution (CF), with an associated zoning objective that aims to;

*“...provide for and facilitate the sustainable development of community, cultural and institutional uses and development of infrastructure for the benefit of the citizens of the city.”*

As outlined in the policy section, objectives on a regional and local policy level have highlighted the need for a new link from the Headford Road area (eastern side of bridge) to the UG campus (western side of the bridge) via a bridge on the piers of the old rail line.

#### **9.11.2.2 Relevant Planning History**

A desktop search of Galway County Council's (GCC) online planning database, myPlan.ie and ABP online database was undertaken on the 1<sup>st</sup> March 2023, the findings include all final applications within the immediate vicinity of the bridge within the previous ten-year period, these applications are summarised in the table below.



Ref. No.	Address	Proposed Development	Decision	Expiry
22310	Headford Road, Townparks, Galway	Permission for development which consists of minor amendments to previously approved development ( PL 20/184, ABP-309673-21 ). The proposed amendments consist of the following : - Relocation of internal bin store to standalone external store to rear of the building. - Minor modifications to building footprint, elevations, landscaping, external surface treatments and site boundary treatments, - Minor modification and increased provision of bicycle parking, - Removal of previously granted mezzanine area between ground and second level, - Repositioning of firefighting emergency generator at ground level - Minor adjustments to Retail Units 1, 2, 3 and 4 with change of previous first floor of retail unit 1 to an office area with standalone entrance at street level. - Minor adjustments to student accommodation entrance. - Conversion of previously approved second floor gym to student accommodation communal areas - Minor amendments to second floor roof garden layout , - Minor amendments to second, third, fourth, fifth and sixth floor layouts to increase total number of bed spaces from 223 ( 68 units ) to 272 bed spaces (69 units ) - Minor amendments to plantroom at roof level ( increased area by 7.2sqm ) - Permission for proposed mechanical and electrical external plant concealed behind acoustic louvres at roof levels	Granted by GCC 23/11/2022	05/01/2028
20184 ABP-309673	Headford Road, Townparks, Galway	Demolition of an ESB enclosure and construction of a seven/eight storey development comprising 4 retail units, a gym and student accommodation (254 beds). (A Natura Impact Statement (NIS) will be submitted with the application)	Granted 11/02/2021 3 <sup>rd</sup> Party Appeal to ABP Granted 12/07/2021	11/07/2026
21280	Former Esso Garage site, Headford Road	Permission for retention which will consist of retention permission for up to a 2 year period from the date of August 29th 2020 for the use of site as a car park for public use (53 no parking spaces) to include advertising signage, pay and display unit and height restriction barriers	Refused 22/10/21	N/A
20265	Arts Science Concourse Building, Distillery Road, NUIG Campus, Galway	Permission for development which will consist of retention of development of a Protected Structure. The proposed development has consisted of the erection of solar panels on the roof of the protected Arts Science Concourse Building (RPS Unique ID 7003). The PV panels consist of two rows with a total area of 2,726m2 and a maximum height of 300mm	Granted 14/01/2021	13/01/2026
20129	Sluice Barrage House Fisheries Field Earls Island Galway	Permission for development: the development consists of the demolition of 2 no. existing structures (a canteen building and barrage pump house inc. office, locker room and WC) which are to be replaced with 1 new pump house including welfare facilities, stores and office inc. associated site works (A Natura Impact Statement (NIS) will be submitted with the application)	Granted 02/12/2020	01/12/2025
19107	Dyke Road Terryland Galway	Permission for development which comprises of a new raw water intake works located on the east bank of the River Corrib, 100m downstream of Quincentenary Bridge; associated pipework to transfer raw water from the new intake works to the existing intakes works, which in turn supplies Terryland Water Treatment Plant (WTP); and a new treated water rising main extending between Terryland WTP and existing rising main on the east bank of the River Corrib. A Natura Impact Statement has been submitted.	Granted 24/02/2020	23/02/2025
14210	National University of Ireland, Galway Main Campus University Road Galway	Permission for flood prevention works to Distillery Channel waterway which passes through the centre of the main NUI, Galway Campus. The flood prevention works involves the following: a) A penstock on water course linking Distillery Channel with River Corrib (known as Gerry's Cut). b) Replacement of existing concrete culvert pipes under pathway with large concrete box culvert. c) Removal of conc. pipe culverts halfway down along Gerry's Cut. All the above works are for urban drainage flow diversion directly to River Corrib. Distillery Channel is a protected structure falling under the heading 'Rivers/Waterways' unique identity no. 8501	Granted 18/11/2014	17/11/2019

**Table 9-1 Planning Application Search**

The table displays successive applications of a variety of land uses that have been granted on lands in the immediate vicinity of the proposed bridge. Of importance, the decision to grant application ref. no. 20184/ABP-309673/22310, which comprises student accommodation for 272 beds, would indicate a significant increase in population for the immediate area of the proposed bridge, it is considered that the approval of such application, re-



confirms the need for what has been outlined under regional and local policy level objectives that seek to implement a new link from Headford Road to the UG campus via a bridge on the piers of the old rail line.

Notwithstanding the above, and in consideration to Table 9-1, which focused on applications within the previous ten-year period, it is reminded that GCC applied for planning permission under the Roads Act 1993, as amended, (application ref. 07.ER.2012) to ABP in 2002. The application sought permission to construct a 150m long pedestrian bridge over the River Corrib. The design of application ref. 07.ER.2012, comprised a multi span cable bridge structure with vertical pylons supported on each pier, and a fanned cable arrangement spanning from the central axis of the bridge deck.

Application ref. 07.ER.2012 was later granted by ABP under the Roads Act 1993, as amended, however, it is reminded that no expiration date was sanctioned with the permission that was granted.

It is also considered that the approval of application ref. 07.ER.2012 would clearly demonstrate precedent, and further support, in principle, the appropriateness of the proposed bridge on the associated zoned lands.

### 9.11.2.3 Built heritage

The CDP recognises the value of the built heritage to the vitality of the city, its contribution to Galway's identity and image and is committed to the protection and enhancement of this heritage. In reference to section 51(1) the Planning and Development Act 2000 as amended, requires the CDP to establish a Record of Protected Structures (RPS) and designation of Architectural Conservation Areas (ACA), explicitly stating;

*"For the purpose of protecting structures, or parts of structures, which form part of the architectural heritage and which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, every development plan shall include a record of protected structures and shall include in that record every structure which is, in the opinion of the planning authority, of such interest within its functional area."*

The location of the bridge is not located within a designated ACA; however, the CDP does identify a number of buildings and structures within its immediate vicinity, in particular; *Bridges, Weirs, Walls, Embankment, Piers & Other Associated Infrastructure and Stone Pillars & Stone Embankments*. In addition, the RPS includes a list of such in the CDP. It is reminded that the RPS can be altered without invoking the statutory process. Furthermore, the CDP also states that it is policy to encourage the protection, enhancement, and active use of protected structures, specifically:

- Protect structures listed in the Record of protected Structures, in accordance with legislation and DEHLG Architectural Heritage Protection Guidelines 2011
- Ensure new development enhances the character or setting of a protected structure.
- Avoid protected structures becoming endangered by neglect or otherwise by taking timely appropriate.
- Have regard to the National Inventory of Architectural Heritage in the assessment of development.
- Consider the inclusion of buildings and structures of special interest or of distinctive heritage value in the Record of Protected Structures (RPS) and consider any recommendations for inclusion in the RPS made by Ministerial Recommendation
- Consult with the DHLGH and have regard to recommendations of the DHLGH on planning applications relating to protected structures
- Implement proactive measures to encourage the conservation of protected structures.
- Promote sustainable building design, best conservation practice and the appropriate maintenance, adaption and reuse of historic buildings.

The CDP highlights that any alteration to protected structures, required to enhance the general character, or setting should be carried out to best conservation practice.

### 9.11.2.4 Natural Heritage

The CDP re-iterates the precautionary principle in regard to Environmental Impact Assessment (EIA); *"where there is a presumption against any action whose environmental impact is uncertain and there is a strong bias towards avoiding potential environmental risks."*

As per section 172 of the Planning and Development Act 2000, as amended, in regard to EIA, it outlines;

- (1) *An environmental impact assessment shall be carried out by the planning authority or the Board, as the case may be, in respect of an application for consent for proposed development where either —*

*(a) the proposed development would be of a class specified in —*

*(i) Part 1 of Schedule 5 of the Planning and Development Regulations 2001, and either —*

*(I) such development [ would equal or exceed, as the case may be,] any relevant quantity, area or other limit specified in that Part, or*

*(II) no quantity, area or other limit is specified in that Part in respect of the development concerned,*

*or*

*(ii) Part 2 [ (other than subparagraph (a) of paragraph 2)] of Schedule 5 of the Planning and Development Regulations 2001 and either —*

*(I) such development [ would equal or exceed, as the case may be,] any relevant quantity, area or other limit specified in that Part, or*

*(II) no quantity, area or other limit is specified in that Part in respect of the development concerned,*

*or*

*(b) (i) the proposed development would be of a class specified in Part 2 of Schedule 5 of the Planning and Development Regulations 2001 but [ does not equal or exceed, as the case may be, ] the relevant quantity, area or other limit specified in that Part...”*

The CDP reiterates the above and in line with the Planning and Development Regulations 2001-2020, specifies in the event of a negative impact on the environment, a *sub-threshold/discretionary* EIA can be requested by the competent authority.

In regard to Appropriate Assessment (AA), as per section 177U (1) of the Planning and Development Act 2000, as amended;

*“A screening for appropriate [ assessment of a draft Land use plan or application for consent for proposed development ] shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site.”*

Under Article 6 of the Habitats Directive there is a requirement to establish whether, in relation to plans and project requiring an AA, the proposed project must prepare a Natura Impact Statement (NIS). In line with the above, the CDP explicitly states that proposed project will only be authorised after the competent authority has ascertained, based on scientific evidence where necessary, that;

- *The plan or project will not give rise to an adverse direct, indirect, or secondary effects on the integrity of any European site (either individually or in combination with other plans or projects); or*
- *The plan or project will have an adverse effects on the integrity of any European Site (that does not host a priority natural habitat type and/or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000; or*
- *The plan or project will have an adverse effect on the integrity of any European Site (that hosts a natural habitat type and/or a priority species) but there are no alternative solutions and the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, restricted to reasons of human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest. In this case, it will be a requirement to follow procedures set out in legislation and agree and undertake all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000.*

### 9.11.3 Land Acquisition

Land Acquisition will be required for all options. Where possible land acquisition should be progressed under negotiation to get public buy in to the project, where this is not possible a Compulsory Purchase Order should be

sought. The circumstances in which CPO is permitted is governed by Section 212(1) of the Planning and Development Act 2000 which states:

*A planning authority may develop or secure or facilitate the development of land and, in particular and without prejudice to the generality of the foregoing, may do one or more of the following:*

- a. Secure, facilitate and control the improvement of the frontage of any public road by widening, opening, enlarging, or otherwise improving.*
- b. Develop any land in the vicinity of any road or public transport facility which it is proposed to improve or construct.*
- c. Provide areas with roads, infrastructure facilitation public transport and such services and works as may be needed for development.*
- d. Provides, secure or facilitate the provision of areas of convenient shape and size for development.*
- e. Secure, facilitate or carry out the development and renewal of areas in need of physical, social, or economic regeneration and provide open spaces and other public amenities.*
- f. Secure the preservation of any view or prospect, any protected structure or other structure, any architectural conservation area or natural physical feature, any trees, or woodlands or any of archaeological, geological, historical, scientific, or ecological interest.*

ABP are the state body responsible for overseeing the CPO process and set out requirements to be fulfilled by the local authority. In general, the local authority is required to publish a notice of intention to compulsorily acquire land and forward the notice to each owner, occupier, and lessee of the which the order relates. If valid objections are received from any individual who is affected by the order, then an Oral Hearing must be held for both the individual and local authority to give evidence. The Bord inspector will then report to the Bord for consideration and approval or rejection of the CPO.

## 10. Health and Safety Considerations

### 10.1 Introduction

It is vital that adequate safety is considered within the design of any construction project. Health and safety will be achieved through communication, competent advice and questioning, effective training and education, management systems and monitoring programmes. Health and safety should be regarded as a core value and the elimination or mitigation of health and safety risks will be considered throughout the design process from feasibility right through to construction and handover. Health and safety risks during use right up to the end of service life should also be considered.

Construction is a dangerous industry with an abundance of risks to the health and well-being of workers, members of the public or the intended user. The hazards include, but are not limited to, harmful substances such as dust and chemicals, injuries from tools, falling from height, manual handling injuries and moving construction vehicles.

### 10.2 Safety, Health and Welfare at Work Regulations

The Safety, Health and Welfare at Work (Construction) Regulations 2013 are a statutory instrument in Ireland and are applied across the construction industry. The regulations are enforced by the Health and Safety Authority which was established in 1989 under the Safety Health and Welfare at Work Act, 1999. The Authorities role is to ensure the health and safety at work of all workers in any position. The regulations cover specific requirements for the following work items.

- General safety provisions
- Evacuation shafts, earthworks, underground works, and tunnels
- Cofferdams and caissons
- Compressed air
- Explosives
- General health hazards
- Construction work on or adjacent to water
- Transport, earthmoving and materials-handling, machinery, and locomotives
- Demolition
- Roads; and
- Construction site welfare facilities.

The regulations also contain duties specific to a number of roles such as Client, Contractor, Project Supervisor Construction Stage (PSCS) and Project Supervisor Design Process (PSDP).

The roles of the Client and the Designer typically are the least exposed to health and safety risks, yet these two parties have the greatest influence in reducing the health and safety risks through proper design and decision making. By comparisons Contractors, Operatives and the end user have the lowest ability to improve health and safety and yet are generally most exposed to the risks.

To this end during the design, a Designer's Risk Assessment (DRA) has been included in Appendix G in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013. The DRA will include the risks identified within the design and the resulting mitigation measures or alterations incorporated within the design. Where no mitigation is possible the DRA will be used to communicate the residual risks to the Contractor and site personal.

Where possible, the hierarchy of risk control will be implemented with the Designer and Contractor aiming to control all risks through elimination. Where this is not possible, reduction, isolation or mitigation controls will be incorporated to ensure safety during construction.

### 10.3 Construction Risks

Ensuring the health and safety of the workers, public and end user should always be the priority of everyone involved in a construction project. A risk register listing all potential health and safety issues along with mitigating actions should be developed as early as possible during the design. The risks should be assessed on their severity and probability to all workers and end users. Wherever possible, any risk that can be fully eliminated should be removed from the project by the hierarchy of control. Where elimination is not possible, mitigation measures should be introduced to reduce the probability and severity of the risk as much as possible. In some cases, where it is

impossible to eliminate or mitigate the risk in design the risk should be properly communicated to the respective parties involved in the construction of the project and control measures should be properly implemented.

Schedule 1 of the construction regulations provides the non-exhaustive list of particular risks which should be considered during the development of the risk register:

- Work which puts persons at risk of; Falling from height, burial under earth and engulfment in swampland.
- Work which puts persons at risk from chemical or biological substances.
- Work with ionising radiation.
- Work near high voltage power lines.
- Work on wells, underground earthworks, and tunnels.
- Work involving the use of explosives; and
- Work involving the assembly or dismantling of heavy prefabricated components.

The above risks are generic and applicable to a large number of construction projects. The following list of particular risks has been identified for the proposed bridge:

- All options will require construction activities from within the River Corrib. Working over water by its nature is a high-risk activity with substantial controls required. The works will include construction of bearing pads/plinths, installation of bearings (all options) and lifting/installation of individual bridge spans (Option 1 and 2). While working in the river consideration will need to be given to the rising and falling water levels and to the drag currents which vary greatly depending on the number of gates open within the Salmon Weir on a given day. During construction the Contractor will need to consider the presence of other river users at all times, these would include the rowing/yachting clubs and the OPW. Where possible the effects due to construction on other river users should be minimised.
- Construction of bearing pads/plinths and installation of bearings will require works to the top of the existing piers. This will require works from height with a potential fall of approximately 5.5m into the river below. Suitable fall restraint systems should be utilised with a preference for passive systems (guardrails, barriers, etc.) instead of active systems (harnesses).
- Options 1 and 2 will require the use of large lifting equipment and cranes positioned on the riverbanks in addition to large floating pontoons within the river channel. The lifting will need to be accurately sized and operated within its allowable limits particularly for weights and wind loads. Positioning of cranes will need to consider the surrounding ground conditions, particularly if positioned to the rear of quay walls along Eglinton Pier. These quay walls may need to be assessed to ensure they are capable of resisting the horizontal forces imparted on the walls without failure. Spreader plates should be used to minimise the transfer of these loads directly into the quay walls.
- During the 120-year design life inspection of the bridge soffit, existing piers and bearings and pads/plinths will be required to ensure the bridge remains serviceable. Replacement and maintenance of structural elements must also be considered. These works will need to be carried out from the river from a boat or floating pontoon. Suitable access points and tie down points should be considered for this equipment. Consideration should also be given during the design to the incorporation of access points from the bridge deck to bearing pad level and top of piers, this could be an appropriate mitigation to reduce risk of working on water. Consideration should also be given to rope access to allow inspections and maintenance of the bridge soffit. Rope access, with the correct processes implemented, can be a far safer method of access when compared to boats and pontoons which need to consider the flow of water.
- Option 3 proposes the use of a box girder solution. Girders depending on their size generally require inspection from inside the cavity to ensure deterioration is not occurring within the superstructure. Confined space entry is always required for this type of inspection which is considered a very high-risk activity. Suitable access points and ventilation points should be incorporated within the design to ensure the build-up of poisonous gases can be vented in advance of entry.
- Working on and near older structures presents a risk of damaging the structure which may lead to collapse. During construction a suitable structural monitoring system should be implemented to monitor loading effects on the existing piers and abutments. The monitoring system will need to define working limits beyond which construction works should be stopped.
- During construction access will need to be maintained at all times to the residential properties and various rowing and yachting clubs in the area. Construction works which require closure of public roads will need to consider appropriate programming to minimise effects in the areas. Where possible night-time and weekend



closures should be considered and should be discussed and agreed directly with the various clubs and landowners in advance of works.

- The proximity to UG lands should be considered as part of the construction methodology and site set up. The Contractor will need to be aware that students and staff are likely to be present within UG lands at all times throughout the year. Suitable site hoarding and storage of materials should be considered which minimise the risk of anti-social behaviour.
- When working over the water suitable netting should be considered to avoid the risk of tools and equipment falling from the bridge deck into the river below. This netting will need to consider suitable vertical clearances from the river below and should avoid impacting the use of the river by the rowing and yachting clubs at all times.

## 11. Construction and Buildability

### 11.1 Introduction

Considering the construction and buildability of all structures as early as possible in the design process is key to ensuring the structure can be successfully delivered through the construction stage. It is also important to consider the local residents of the area and surrounding environment when planning construction to ensure minimal disturbance while construction is taking place.

### 11.2 Land Take

An area of permanent land take will be required in order to construct the proposed bridge. In addition, the permanent land take will need to consider the future maintenance of both the bridge and its approaches. For this stage of project development, it is assumed that permanent land take will be required which will include both approach embankments and the east and west plaza areas. In order to facilitate maintenance a 3m wide offset has been assumed from the base of the approach embankments. This offset may be reduced at the next stages of project development and will be dependent on discussions and agreement with the various clubs and landowners. Where possible it is recommended that the acquisition of land is carried out by agreement and negotiation with the respective landowners.

In addition to the permanent land take, temporary lands will also be required to facilitate construction. Within the temporary land boundary consideration should be given to potential locations to facilitate site compounds. Due to a requirement for works on either side of the River Corrib it is likely that two compounds will be required. For options stage it is assumed that one larger compound will be provided to the eastern riverbank with a smaller compound provided to the western riverbank within UG lands. The compounds will include site facilities, parking, machinery storage, material storage and a steel assembly point. For all options significant space will be required to allow assembly of each of the bridge spans. For ease of construction the site compound locations need to provide direct access and be in close proximity to the final bridge location. Temporary lands are also required to provide suitable crane lifting areas for Options 1 and 2. Eglinton Pier has been identified as the most suitable location for lifting. Further optimisation of the lifting area requirements should be carried out at preliminary and detailed design when superstructure weights and crane capacities are confirmed.

The figure below highlights potential site compound locations on both riverbanks. Two options are presented for the larger eastern compound. One option is located in a heavily vegetated area to the north of the eastern embankment to the rear of the Commercial Boat Club. The other location is on the green amenity area to the south of the eastern embankment. Further investigation should be carried out to determine the suitability of each option. Consideration should also be given to the public opinion on temporary land take of an existing amenity area.

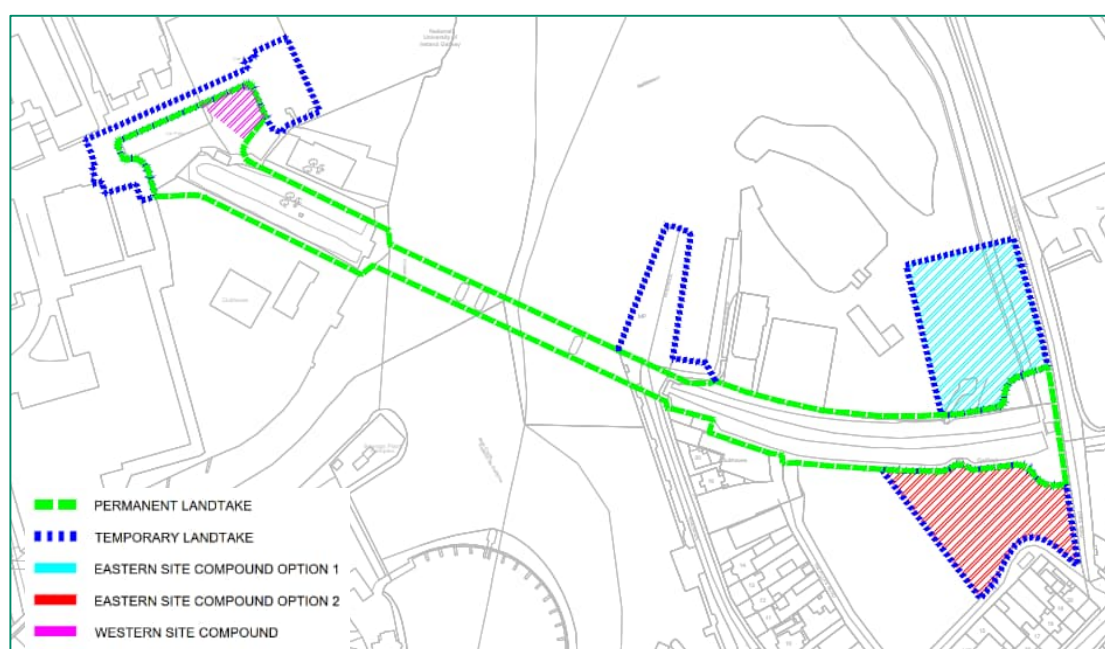


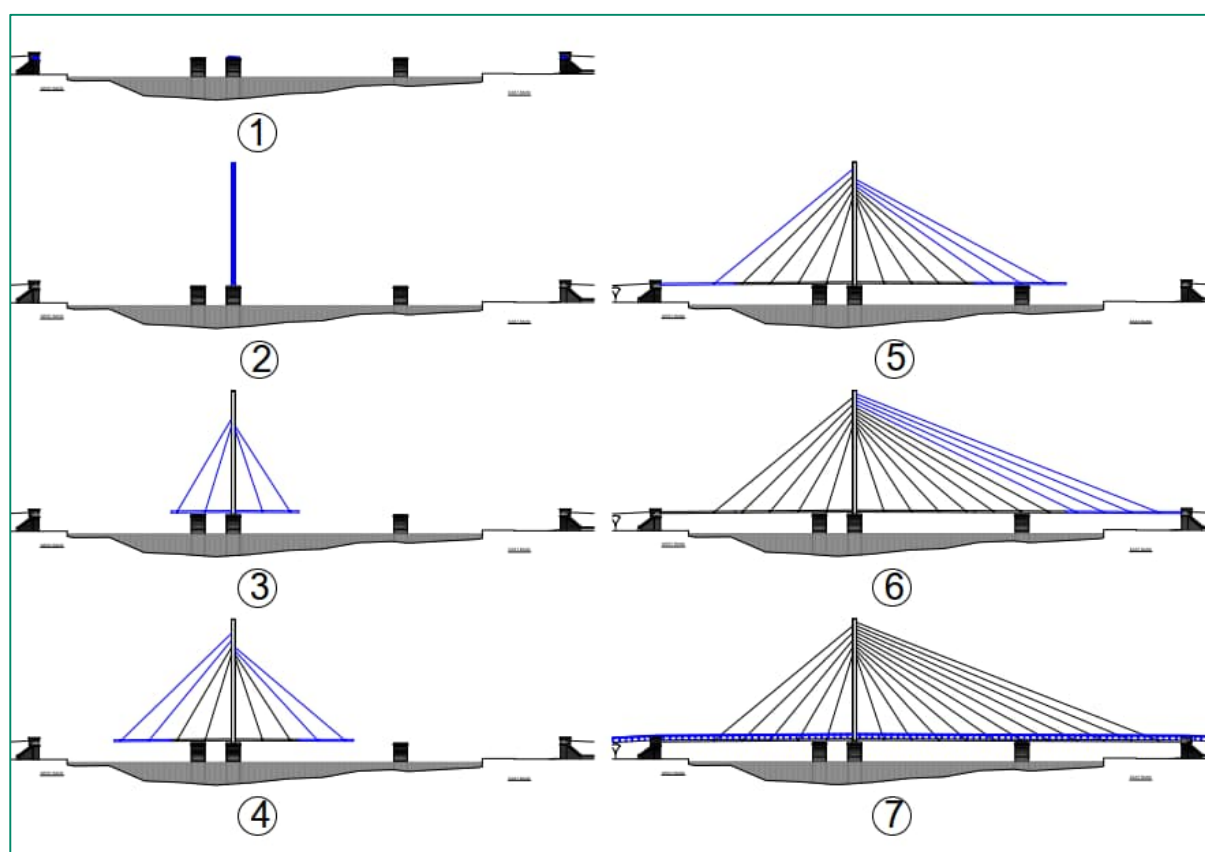
Figure 11-1 Temporary and Permanent Land take

## 11.3 Construction Methodology

Each of the options requires differing construction methodology with each having varying impacts on the environment, river users and members of the public. The construction methodologies discussed below are feasible construction options however it should be noted that alternative methodologies may be proposed by the Contractor at construction stage.

Option 1 is likely to be constructed using the balanced cantilever method of construction. Firstly, bearing pads and support foundations will be constructed to the top of Pier No.2 and to the rear of abutments. In parallel the pylon and bridge deck shall be preassembled in the construction compounds. Once the bearing pads are completed the preassembled steel pylon will be craned into position to the top of the pier. Once in place incremental sections of the deck will be craned into position on either side of the pylon, where possible these incremental sections should be balanced to avoid excessive bending within the pylon. The cable stays will be attached to the deck as each section is lifted into place. Detailing of the bridge deck will need to consider a suitable method of jointing each of the bridge deck section be it by welding or bolting. Welding while preferred from a maintenance viewpoint would be seen as difficult to achieve over the river, as a result bolting may be the preferred alternative. Once all sections of the deck have been lifted into place and all cables attached the bridge finishes such as lighting and parapets will be installed.

The construction of Option 1 is likely to require significantly more water access when compared to other options. Particularly for lifting of the pylon to Pier No.2. It is likely that the navigable channels of the river will need to be closed to users for extended periods of time while the cantilever sections are being fixed into place. In addition, to the above Option 1 requires specialist contractor experience in cable stayed construction.

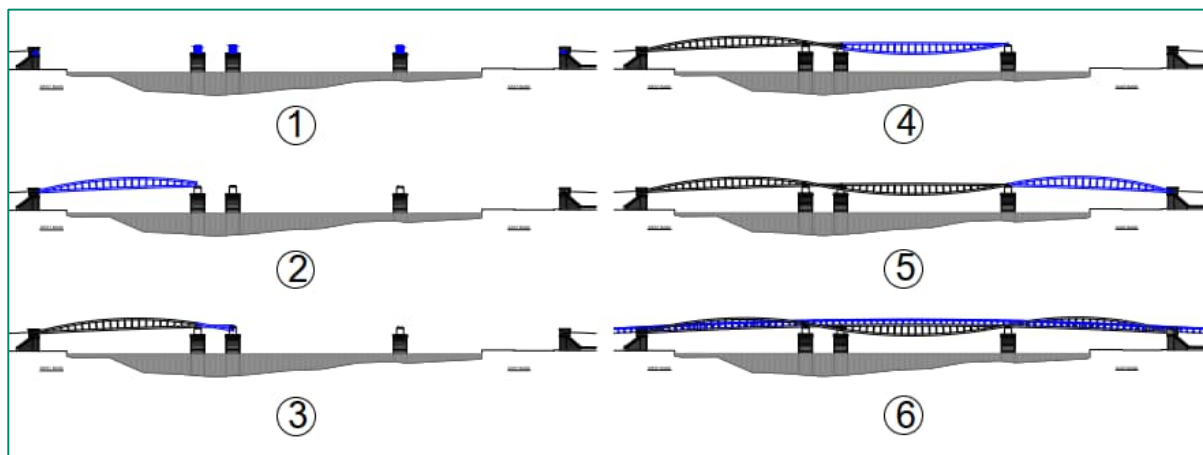


**Figure 11-2 Option 1 Indicative Construction Sequence**

Option 2 will be constructed using individual spans to form the bridge. Where possible the independent spans should be fabricated and assembled off site in a controlled environment within a steel fabrication yard. The fully assembled spans would then be transported via the road network. Where transporting of the fully assembled spans is not possible then the spans shall be transported in smaller sections and assembled within the construction compound for lifting into place, the assembly will include all parapets and finishes which provides a time benefit compared to Option 1. Once assembly is completed each of the spans will be transported from the construction compound to the top of the approach embankments ready to be lifted into position. As the spans are being assembled the bearing pads and plinths to the top of each pier and to the rear of the abutments will be constructed.

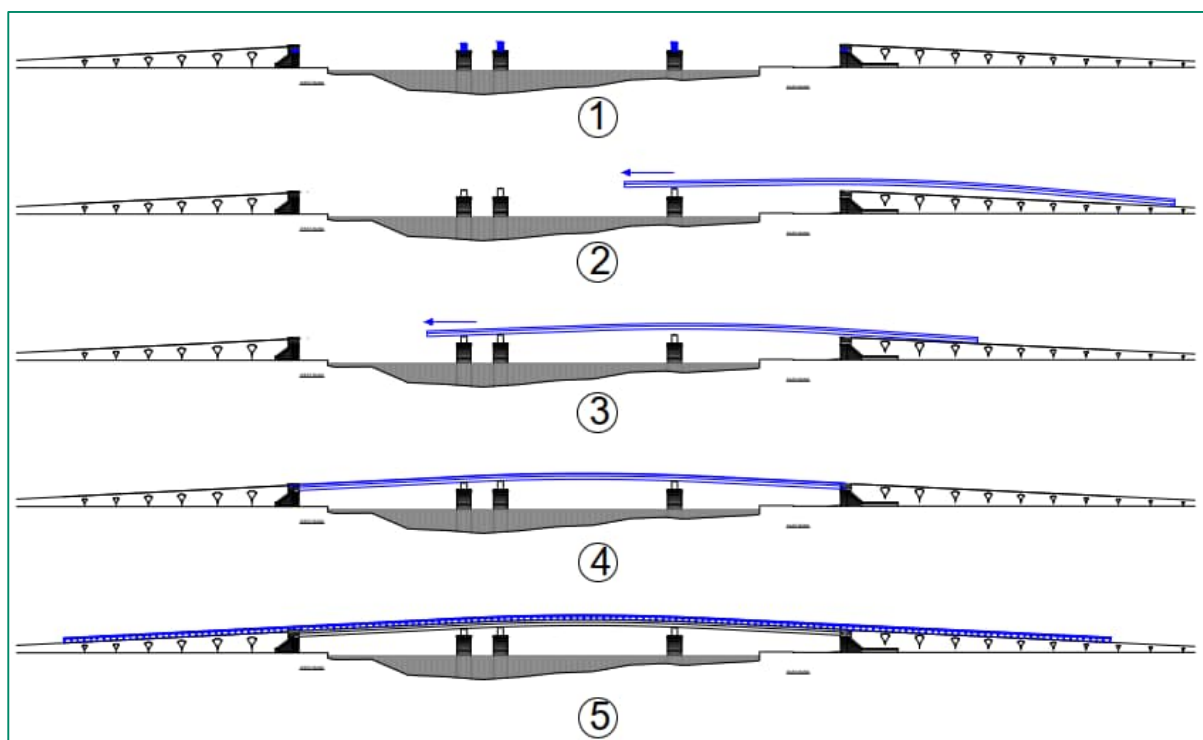
Each span will then be individually lifted and connected to the permanent bearings. Any finishes such as lighting will then be installed.

Option 2 requires some river access to allow construction of the bearing plinths to the top of each pier and it likely that the closure of the navigable channel would be required during superstructure crane lifts, however this would be limited to four lifts and would be short term.



**Figure 11-3 Option 2 Indicative Construction Sequence**

Finally, Option 3 will be constructed using the push launch method of construction. The entire superstructure will be assembled along top of the eastern approach embankment before being pushed using a combination of jacks and rollers from the eastern abutment outwards over each of the piers before landing on the western abutment. A temporary launching nose would be installed to the front of the bridge to guide superstructure over the existing piers while also preventing damage to the bridge. The bearing pads and plinths will need to be constructed in advance of the launching. Temporary bearings will be installed to the top of the bearings pads to support the bridge superstructure as it is being launched. The finishes can be installed as part of assembly if required or can be installed following the launch. Once the launch is complete the temporary bearings will be replaced with the permanent bearings. Option 3 requires the least water access of the three options presented with access only be required for construction of the bearing pads and plinths to each pier. The navigable channel will also be able to remain open during the push launch limiting the effects on the rowing and yachting clubs.



**Figure 11-4 Option 3 Indicative Construction Sequence**

## 11.4 Construction Traffic

Consideration will need to be given to the safe traffic movement in the area for pedestrians, cyclists, and vehicles, in particular where transport and erection of the bridge will require significant space and coordination of traffic flow within the area. During construction access will need to be maintained at all times to the residential properties and various rowing and yachting clubs. Construction works which require closure of public roads will need to consider appropriate programming to minimise effects in the area. Where possible night-time and weekend closures should be considered and should be discussed and agreed directly with the various clubs and landowners in advance of works.

Permission to transport large heavy prefabricated superstructures to the site or site compound will need to be granted by An Garda Síochána by applying for permit for movement of an abnormal load. An Garda Síochána will set out the allowable route, time and speed limits for the loaded vehicle and may need to provide an escort to the transporting vehicle to ensure maximum safety to other road users. It is suspected the bridge will be classed as an abnormal load as set down by Road Traffic (Construction and Use of Vehicles) Regulations 2013, S.I. 5 of 2003. The classification of abnormal loads is specified by the Road Traffic (Permits for Specialised Vehicles) Regulations 2009. Abnormal loads are any load that exceeds either 4.65m in height, 4.3m in width or 27.4m in length.

## 11.5 Temporary Works

For all options temporary works will be required at numerous stages of the construction process to enable safe construction. The design and execution of these temporary works will be the responsibility of the Contractor and their Temporary Works Designer. Hoarding, fencing, and compounds are typical temporary works which are required on all construction projects to prevent access from the public potentially leading to injury and mitigate the risk of vandalism and theft of construction equipment.

For construction over water temporary works such as temporary floating bridges and access pontoons could be considered to provide a suitable working area. These temporary floating installations could be installed from either riverbank to provide access to each of the existing piers for the construction of bearing pads and plinths while also allowing installation of the bearings. These temporary works would need to consider the various river users and avoid complete closure of the navigable channel at all times during construction.



## 12. Ground Conditions

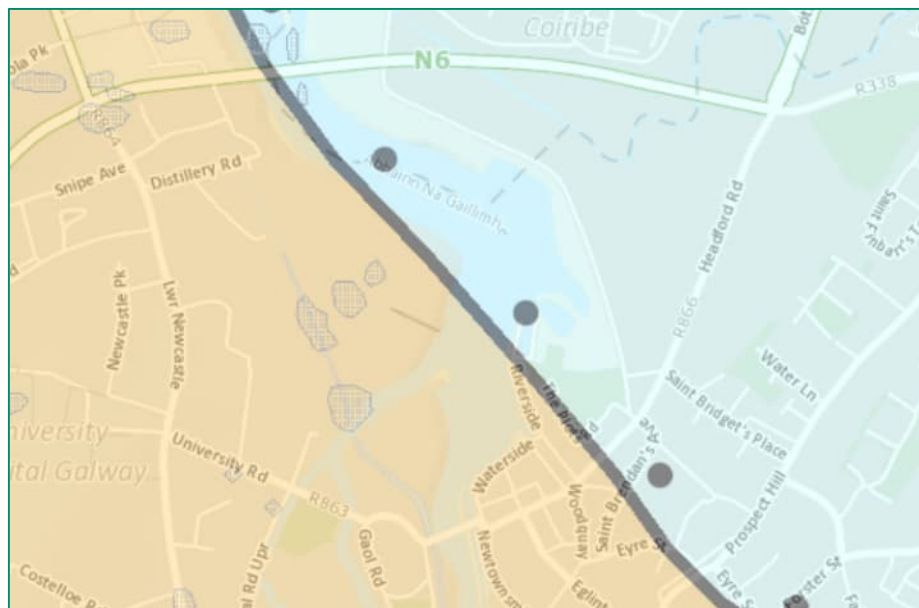
### 12.1 Introduction

A number of sources of information have been reviewed to provide appropriate data covering the ground conditions at the Clifden Railway Bridge. Outline databases have been utilised where appropriate. A detailed site investigation including a ground investigation and diving survey was carried out in 2000 as part of the original planning application for the bridge. In addition, a further site investigation was carried out in 2021 as part of an assessment of the existing piers prepared by Arup Consulting Engineers. In addition, a diving survey was also procured under AECOMs scope of services and carried out in September 2021.

### 12.2 Geology

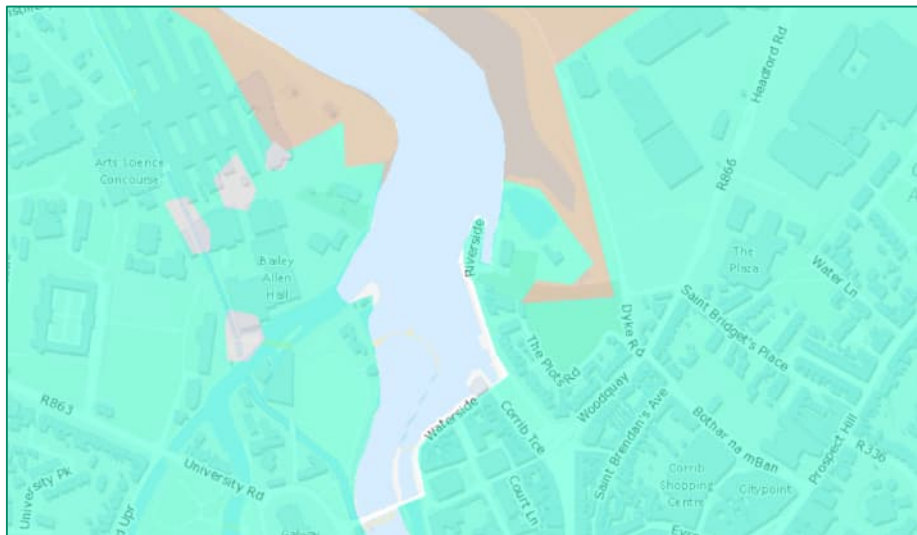
The Geological Survey of Ireland (GSI) is Ireland's public earth science knowledge centre and is responsible for the collection, interpretation and distribution of data relating to bedrock, groundwater, seabed, and public health risks.

A review of the site's underlying geology was completed using available data derived from the GSI Bedrock Geology map (scale 1:100,000) and indicates that the site is underlain by two main formations. The area to the north is denoted as Burren Formation which is typically a pale grey clean skeletal limestone. The area to the south is denoted as undifferentiated Metagabbro and Orthogneiss Suite which can be described as Diorite Gneiss (Qd), Quartz Diorite Gneiss & Granitic Gneiss (Qg) and Metagabbro and Related Lithologies (Mg). An unconformity is denoted as separating these formations.



**Figure 12-1 GSI Bedrock Geology Mapping highlighting Burren Formation (cyan) & Metagabbro and Orthogneiss (orange)**

The GSI Quaternary Sediments mapping indicates that the bedrock in the area is generally overlying by Urban made ground in the area to the south of the bridge crossing and by Fen Peat in the area to the north.



**Figure 12-2 GSI Quaternary Sediments Mapping highlighting Urban Made Ground (cyan) & Fen Peat (brown)**

## 12.3 2000 Site Investigation

As part of the development of the original planning application, Irish Drilling Ltd. were engaged to carry out a site investigation which included a ground investigation to assess the nature, integrity and ground conditions beneath the existing piers and abutments of the Clifden Railway Bridge. All fieldwork was carried out between March and June 2000 and included a total of fifteen rotary core boreholes. As part of the site investigation a diving survey was also carried out to identify the form and condition of the existing piers below water level.

### 12.3.1 Ground Investigation

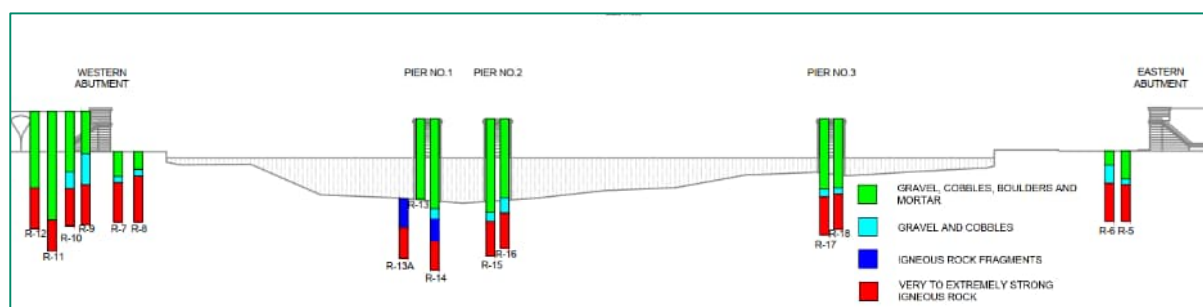
In total fifteen rotary core boreholes were carried out in various locations as part of the site investigation. Six rotary core boreholes were carried out to the western abutment, four were located to the rear of the abutment (R-9 to R-12) from the existing embankment with two boreholes located to the front of the abutment (R-7 & R-8). At the eastern abutment two boreholes were carried out both to the front of the abutment (R-5 & R-6). Four further boreholes were proposed but could not be carried out as no access was provided to the rear of the abutment (R-1 to R-4). Six rotary core boreholes (R-13 to R-18), two to each pier were also carried from the top of the piers. Finally, one additional borehole (R-13a) was carried out within the river to the south of Pier No.1 as obstructions were recorded to one of the boreholes to the same pier.

In general, all boreholes recorded similar ground conditions with varying depths. The results show large depths of fill material overlying gravel and cobbles overlying very to extremely strong igneous rock with fresh to slight weathering.

Location	Type	Depth below ground surface (m)	Thickness		Boreholes
			Range	Average	
Western Abutment (Front)	Fill	0	2.5 – 3.5	3.0	R-7, R-8
	Gravel and Cobbles	2.5 – 3.5	0.9	0.9	R-7, R-8
	Very to extremely strong Igneous Rock (possibly Dacite)	3.5 – 4.4	4.5 – 4.7	4.6	R-7, R-8
Western Abutment (Rear)	Fill/Overburden (brown silty clay with gravel and cobbles)	0	6 – 10.3	8.0	R-9, R-10, R-11, R-12
	Gravel and cobbles	6.0 – 10.3	0.6 – 6.5	4.0	R-9, R-10, R-11, R-12
	Jute/Slack	7.8 – 8.4	0.8 – 0.15	0.5	R-9, R-10
	Very to extremely strong Igneous Rock (possibly Dacite)	10.4 – 15.45	4.4 – 5.8	5.3	R-9, R-10, R-11, R-12
Eastern Abutment (Rear)	Fill	0	2.0 – 4.0	3.0	R-5, R-6
	Gravel and Cobbles	2.0 – 4.8	0.8 – 2.6	1.7	R-5, R-6
	Very to extremely strong Igneous Rock (possibly Dacite)	4.6 – 4.8	4.7 – 5.2	5.0	R-5, R-6
Piers	Gravel, Cobbles, Boulders and Mortar	0	9.8 – 13.3	11.4	R-13, R-14, R-15, R-16, R-17, R-18
	Overburden/Gravel and Cobbles	9.8 – 13.3	0.9 – 2.2	1.4	R-14, R-15, R-16, R-17, R-18
	Igneous Rock Fragments	4.1 – 14.3	3.0 – 4.1	3.5	R-13a, R-14
	Very to extremely strong Igneous Rock (possibly Dacite)	10.7 – 14.6	4.9 – 7.2	5.5	R-13a, R-14, R-15, R-16, R-17, R-18

**Table 12.1 Soil stratigraphy**

The following long section has been prepared to show the varying depths of each soil type relative to the borehole locations across the bridge.



**Figure 12-3 Geotechnical Long Section**

The ground investigation results generally indicate very favourable ground conditions with extremely strong bedrock close to riverbed level. Laboratory testing carried out as part of the site investigation identified rock strengths of 89MPa to 346MPa using the Unconfined Uniaxial Compression Test (Imperial College). Accepted

values for very strong rocks have compressive strengths in excess of 160MPa which is typically found in quartzites and fine-grained igneous rocks such as those recorded at the bridge crossing.

### 12.3.2 Diving Survey

The purpose of the diving survey to record the below water structural form and condition of the existing piers. The works were carried out by P. Beatty Marine on behalf of Irish Drilling Ltd. On the day of the survey visibility within the water was poor with limited opportunity to record details below a 2m water depth.

The divers recorded the elliptical circumference at the base of the piers as 13.02m. The first 3.6m of the columns are formed 12mm thick steel plates in four sections, rivetted together, each 0.9m high. A steel lip and timber collar at the top of this section supports a 1.8m high section of redbrick construction for Pier No.1 and No.3. Pier No.2 was recorded with a slightly different construction a timber fendering system recorded on the southern side of the pier in place of redbrick (redbrick recorded to northern side of Pier No.2). For all pier a further steel lip and timber collar is located to the top of this section (approximately 0.4m below water level) and supports the rough-cut stone which protrudes upwards out of the water. The figure below is extracted from the Diving Report to show the build-up of the piers.

The Diving Survey Report generally concludes that the bricks, steel plating and rivets are all in good condition with similar minor vegetation growth area 2m below water level. Some of the timber collars and fendering systems were noted to be in poor condition however these are noted to be non-structural elements. No reference to scouring beneath any of the piers was noted within the report.

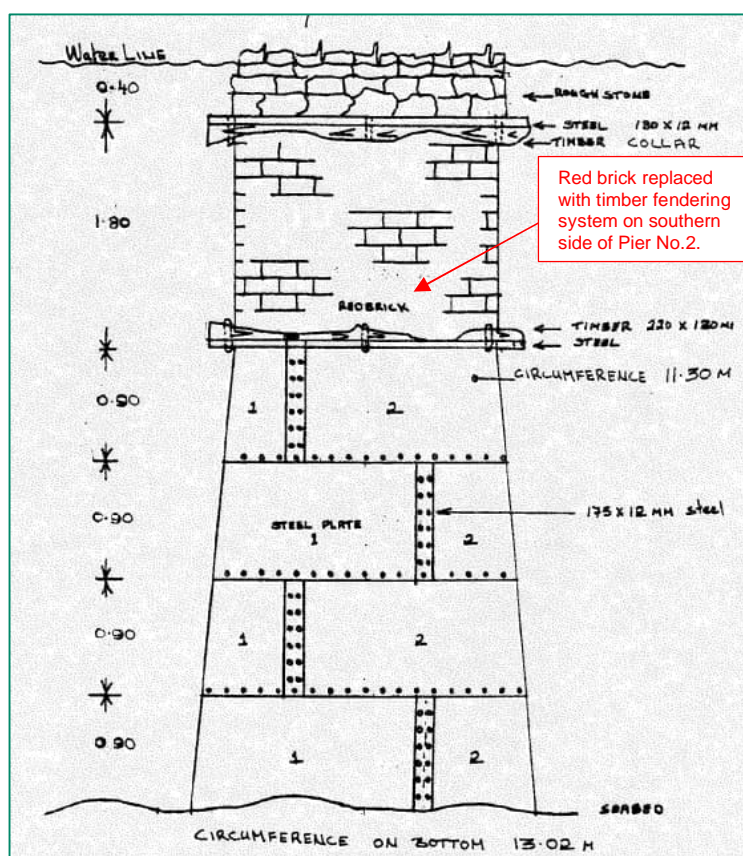


Figure 12-4 Extract from P Beatty Marine Diving Survey Report for Pier No.2

### 12.4 2021 Diving Survey

An underwater inspection of the bridge piers and riverbed was carried out by ADCO Ltd. The inspection was carried out on 31<sup>st</sup> August 2021. The aim of the inspection was to confirm the findings of previous P Beatty Marine Diving Survey (2002?) and to confirm any changes in the bridge piers condition in the intervening period. The scope also included general findings on the condition and topography of the riverbed, to consider if any displaced masonry from the bridge piers is present on the riverbed and to determine if any elements of the original railway bridge are present.

A detailed Underwater Inspection Report prepared by ADCO Ltd has been included in Appendix H. The following general observations are noted in the report:

- The riverbed is largely clear of modern debris and retains much of its natural character. However, zebra mussels have colonised this section of waterway and obscure large sections of the riverbed.
- The inspection of Pier Numbers 1-3 indicates that they remain in a good state of preservation with no obvious collapse from the above or below water areas of these structures.
- The riverbed falls to the south and west, with the deepest part of the river surrounding Pier Numbers 1-2; an average water-column depth of c. 7m present between these pier structures.
- No obstructions were noted for the water-column/ riverbed areas surrounding the three pier structures.
- The inspection did not positively identify any masonry collapse requiring recovery to surface, the presence of zebra mussels making identification of individual masonry pieces amongst the rock-armour problematic.
- A number of wrought-iron lifting tools were observed lying on the riverbed at a point c. 6m east of Pier Number 2; these items are thought to be contemporary with the construction of the railway viaduct in the late 1800s.
- A possible section of wrought-iron rail track was encountered at a point c. 6m to the west of Pier Number 1.



**Figure 12-5 Typical underwater view of bridge pier and riverbed including zebra mussel growth**



## 13. Consultation with Relevant Authorities

### 13.1 Key Stakeholders

A number of stakeholders have been contacted as part of an ongoing consultation process for the proposed bridge. Further consultation will be required with all bodies as part of the development of a conceptual design and any further works. Consultation will be ongoing throughout the design to achieve a successful planning outcome for the bridge.

Stakeholder	Contact Name	Title	Contact Details
Galway City Council	David Greally	Project Manager/Executive Engineer	Redacted
	Jimmy Callan	Senior Engineer	Redacted
	Fran McEvoy	Senior Executive Engineer	Redacted
	Uinsinn Finn	Director of Services	Redacted
	Emmet Humphreys	Senior Executive Architect	Redacted
	Caroline Phelan	Senior Planner	Redacted
	Dr Jim Higgins	Heritage Officer	Redacted
The National Transport Authority (NTA)	John Rooney	Project Manager	Redacted
	Oliver Dalton	Senior Project Manager	Redacted
Office of Public Works (OPW)	Liam Farrell	Engineer – Salmon Weir	Redacted
	Michael Corcoran	Foreman – Salmon Weir	Redacted
Coláiste Iognáid Rowing Club	David O'Sullivan	Principal	Redacted
Corrib Rowing and Yachting Club	John Mooney	Engineer (acting on behalf of Corrib Rowing and Yachting Club)	Redacted
University of Galway (UG)	Martin Barrett	Head of Engineering and Infrastructure	Redacted
	Brian Saunders	Assistant Director Buildings and Estates	Redacted
Lough Corrib Navigation Trust	Helen McDonagh	Secretary	Redacted

Table 13-1 Key Stakeholders

### 13.2 Utility Providers

Several existing services have been recorded in the area surround the proposed bridge. For all options it would be proposed to provide a number of spare ducts across the bridge for future use by utility providers. The number and size of the spare ducts should be agreed at Detailed Design.

The following table summarises the existing Utility Providers and their utilities in the surrounding area:

Utility	Contact Details	Services	Location
EIR	<a href="https://cei.openeir.ie">https://cei.openeir.ie</a>	EIR Duct	Corrib Terrace/Riverside
ESB	dig@esb.ie 1800 928 960	LV OH ESB Line	Riverside
		MV/LV UG ESB Duct	UG/Corrib Rowing Club
Gas Network Ireland	<a href="https://www.gasnetworks.ie/home/safety/dial-before-you-dig/">https://www.gasnetworks.ie/home/safety/dial-before-you-dig/</a> 1850 427 747	Low pressure distribution pipe	Courthouse Square/Waterside
Virgin Media	civils@virginmedia.ie	Virgin Media Duct	Corrib Terrace
Irish Water	datarequests@water.ie 1850 278 278	Clear Water Drain	Waterside/Riverside/Corrib Terrace
		Foul Water Drain	Riverside/Corrib Terrace

**Table 13-2 Utility Providers**

## 14. Conclusions and Recommendations

### 14.1 Conclusion

The three options presented above have undergone a multi-criteria analysis (MCA) to determine the preferred option. The summary of results of the MCA for each option, is presented in the table below. The description of each colour rating along with a detailed breakdown of the MCA process has been detailed Appendix A.

Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Technical			
Economic			
Aesthetics			
Durability & Maintenance			
Environmental			
Health & Safety			
Construction & Buildability			
Ground Conditions			

**Table 14.1 Summary of MCA Ratings**

In summary, the following key assessment and considerations are noted:

- Technical – Option 1 is by far the most technically challenging of the three options proposed. Option 2 by comparison is the most favourable of the under the technical evaluation. The independent span arrangement and truss structural form are common solutions for span lengths less than 50m.
- Economic – Option 3 is the most economical option presented. Option 2 is considered the median option due to the increased material fabrication requirements for the truss arrangement. Option 1 is the least favourable due to the substantially higher construction costs of the cabling system.
- Aesthetics – All options can be used to create a landmark striking bridge across the River Corrib. The sinusoidal rippled arch effect of Option 2 is seen as the most favourable option which echoes the ripples in the River Corrib and use of a truss structural form is sympathetic to the form of the original Clifden Railway Bridge
- Durability & Maintenance – Option 3 will be the easiest of the three options to inspect and maintain due to the similar structural form when compared to the other options. Option 1 by comparison will be significant more difficult to inspect and maintain throughout its design life requiring specialist inspection teams.
- Environmental – Option 1 is the least preferable option on ecological and cultural heritage considerations. Option 2 is considered the most favourable as it provides a link to the original design of the Clifden Railway Bridge and creates a lower visual effect on surrounding Protected Structures.
- Health & Safety – Option 3 requires the least amount of amount of time working over the water to facilitate construction and is the most favourable option in this regard. Option 1 is the least favourable as it requires significant portions of time working over water and requires large lifting equipment and craneage as part of construction.
- Construction & Buildability – Option 3 is the most preferable option due to the lowest requirement for working over water reducing construction risks. That being said the push launch method of construction is highly specialised. Option 2 avoids the use of specialist construction methods. Option 1 is likely the most difficult of the three options to construction with significant amount of working over water required and a specialist balanced cantilever construction method.

- Ground Conditions – The asymmetric design of Option 1 is least favourable for ground conditions with a large percentage of axial loading being imparted directing into Pier No.1 and the founding stratum. In addition, large bending and shear forces will be imparted. Option 2 and 3 are considered to be neutral due to the bearing arrangement imparting all loading directly into the existing piers via axial loading with limited bending and shear.

## 14.2 Recommendations

It is visible from the results of the MCA that Option 2 Rippled Arch is the most favourable option presented within this Structures Options Report. This option contains additional benefits when compared to the alternatives. It is this option which is proposed for selection as the emerging preferred bridge option to be carried forward to the next stages of project development namely Phase 3 Preliminary Design and Phase 4 Statutory Processes of NTA Project Approval Guidelines. As part of these phases the bridge design for the proposed option should be developed further with a full preliminary design prepared to confirm member sizes and determine structural requirements. At this stage an EIA Determination and AA Screening should be completed with the likely outcome that a full EIAR and NIS will be required for the project. Works should also be undertaken to gain statutory approvals including Section 50 and Section 245. Statutory and Non-Statutory Public Consultation would be recommended along with further stakeholder engagement to secure public support for the project. The successful outcome of the next phases of the project will be the achievement of full statutory consent from ABP for the proposed bridge.

## Appendix A Multi Criteria Analysis

The options have been evaluated and rated under the following list of criteria:

- Technical;
- Economic;
- Aesthetic;
- Durability & Maintenance;
- Environmental;
- Health & Safety;
- Construction & Buildability; and
- Ground Conditions.

Each option has been ranked using the rating table below against each of the options under each criterion, a justification for each ranking has also been provided. The option appearing the most advantageous when compared with the other options will be deemed the preferred solution.

Colour	Description
	Significant advantages over the other options
	Some advantages over other options
	Neutral compared to other options
	Some disadvantages compared to other options
	Significant disadvantages compared to other options



Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Technical	<p>Option 1 is considered significantly more complex and technically challenging when compared to the other two options. The design of the asymmetric cable structure brings added complications due to the increased bending and shear loading imparted on the vertical pylon. The use of a fan cable arrangement minimises this bending moment however it does not eradicate it. Deflection control of the cable stayed superstructure will be critical to ensure deflection remains within the allowable limits for this structural form. The design will also need to include a significant amount of redundancy to meet the Eurocode requirements for the bridge design to assume at least one cable failure. Option 1 is likely to pose the largest risk for dynamic excitation due to its long span and lightweight deck when compared to the other options</p> <p>The assessment of the existing piers will need to consider a significant portion of loading being directed to Pier No.1 only. The design will also need to consider the temporary construction loading for the balanced cantilever construction. With the deck will need to be designed for the worst-case construction condition.</p> <p>As the span lengths are in excess of 50m this option will be a Category 3 structure increasing design costs and project programme.</p>	<p>As each span is considered an independent structure within Option 2 the design is technical easier to achieve when compared to the other two options. Each span will be designed as an arched truss which is a common structural design solution for spans up to 50m. The truss will carry all loading through tension and compression of the steel elements.</p> <p>The similar span range of all truss spans may facilitate some efficiency in the design with one design covering multiple spans.</p> <p>The design will also need to consider the temporary construction stages with particular consideration given to the proposed lifting arrangement for each span.</p> <p>As the spans are less than 50m this option will be a Category 2 structure.</p>	<p>Option 3 is considered the median option technically. The box girder will be designed similar to a modified box girder with plated steel elements welded together to form an enclosed shape which transmits loading similar to a beam structure with the girders essentially acting similar to a pair of parallel girders braced at the top and bottom.</p> <p>The proposed construction methodology for a push launch construction technique presents a challenge within the design with numerous different construction loadings needing to be analysed and designed for to ensure the superstructure is capable of withstanding the required construction stage effects.</p> <p>As the spans are less than 50m this option will be a Category 2 Structure.</p>
Economic	Option 1 is the most expensive option of the three presented with an estimated cost of €17,588,638.23.	Option 2 is median option of the three with an estimated cost of €14,418,633.78.	Option 3 is the cheapest option of the three options with an estimated construction cost of €13,511,472.84.

Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Aesthetic	The structural form of a cable stayed structure is generally considered to be landmark structure adding to the surrounding environment. Locating the pylon on Pier No.2 on the western side of the river results in it being adjacent to the larger built form that exists on the west bank of the River Corrib. This aims to reduce the visual impact of the pylon on the surrounding context. However, the visual effects of the pylon will still be visible from surrounding areas due to the low-rise nature of Galway City. The slender appearance of the deck aids in providing clear structural clarity in that the structural form is predominantly above deck. Although there is structural clarity, the presence of the existing piers undermines the functional clarity of the proposal and as such the proposal lacks efficiency	The sinusoidal rippled arch effect creates a landmark pleasing structure which echoes ripples in the River Corrib below when a stone is dropped from height. The use of each span is clear an expressive of the structural mechanics of the bridge. The form of the bridge is expressive with potential to light the arches at night, providing a greater presence when viewed from afar without having a significant visual impact. The proposed design is of a suitable scale for the surrounding context with structural clarity in the use of the existing piers evident.	The use of the box girder creates a simple clean minimal structure with the lowest visual impact on the surrounding area. The use of an elliptical bottom plate coupled with a rippled undulating edge beam create interest and improve aesthetics. The proposed design is of a suitable scale for the surrounding context with structural clarity in the use of the existing piers evident. The design proposal has the least visual impact of all 3 options when viewed from a distance.
Durability and Maintenance	<p>Option 1 will be the most difficult of the three options to inspect and maintain. A significant amount of maintenance is required for all cable stayed structures to ensure they remain operable and reach their design life. Inspection of the pylon and cables requires working from a significant height. All anchors and saddles should be exposed where possible to improve access for maintenance. A level of redundancy needs to be incorporated within the design to allow for failure of one cable during replacement and maintenance. Specialist inspection teams will also be required for the cable stayed inspection.</p> <p>This option has the lowest number of bearings of the three options presented. Bearings have a significant inspection and maintenance requirement to ensure they remain serviceable during their 50-year design life.</p>	<p>This option is significantly easier to inspect and maintain when compared to option 1, however the significant number of connections and welds required to construct the truss increase the inspection and maintenance requirements. Welded connections are the preferred connection type due to reduced requirements when compared to mechanical bolted connections. The fully through above deck trusses will be easily accessed for works from deck level of the bridge. Works from access boats will be required to inspect below deck elements including the bridge soffit.</p> <p>This option requires significantly more bearings and expansion joints when compared to the other two options which increase the inspection and maintenance requirements.</p>	<p>Option 3 will be the easiest of the three options to inspect and maintain due to the simpler structural form when compared to the other options. This option will have far less connection and weld details when compared to Option 2. This option may require confined space entry to allow inspection and maintenance, this is a high-risk activity, and a suitable access procedure needs to be implemented for these works.</p> <p>Bearings and expansion joints will be required at each support location for this option; however, the straight horizontal alignment of the girder means that a single row of bearings can be detailed at the piers reducing requirements for inspection and maintenance over water.</p>

Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Environmental	<p>Option 1 is the least preferred option from an ecological perspective, the use of a pylon height of 35m coupled with the cabling system is likely to result in increased bird collision risk when compared to the other options.</p> <p>Option 1 would have slightly less physical impact upon the existing fabric of the Protected Structure than the other two options. Additionally, the bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. The cable stayed bridge is designed to be a landmark feature within the urban landscape, with much greater physical presence than the other two bridge options, which will be visible from across Galway City. This will affect the settings of Protected Structures within the vicinity including Clifden Viaduct itself and views into Galway City Centre and associated Protected Structures downstream.</p>	<p>Option 2 and Option 3 are ranked similarly from an ecological perspective with similar impacts noted.</p> <p>This bridge is designed as a trussed arch bridge which will be less visually intrusive than Option 1. It will affect the settings of Protected Structures within the vicinity including Clifden Viaduct itself and views into Galway City Centre and associated Protected Structures downstream. The bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. Additionally, of the three bridge design options, this proposed design is the most sympathetic to the original 19<sup>th</sup> century trussed girder railway bridge and provides a clearer link to the original design intent for the former Clifden Viaduct.</p>	<p>Option 2 and Option 3 are ranked similarly from an ecological perspective with similar impacts noted.</p> <p>The steel girder bridge option would be the least visually intrusive and simplest in visual form of the three bridge options. However, it will still affect the settings of Protected Structures within the vicinity including Clifden Viaduct itself and views into Galway City Centre and associated Protected Structures downstream. The bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine and industrial heritage. However, it's appearance would be that of a simple bridge which does not translate the original design intent for the railway viaduct in comparison to Option 2 and is therefore less sympathetic to the historical origins of the bridge.</p>

Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Health and Safety	<p>All options will require some construction activities from within the River Corrib. Working over water by its nature is a high-risk activity with substantial controls required. Option 1 requires the largest amount of time working over the water making it higher risk than the other options.</p> <p>Option 1 and Option 2 require the use of large lifting equipment and cranes positioned on the riverbanks as well as large floating pontoons located in the river during construction. wind loads. Positioning of cranes will need to consider the surround ground conditions, particularly if place to the rear of quay walls along Eglinton Pier.</p> <p>Construction of the balanced cantilever structure will require significantly more interface and potential conflict with river users within the River Corrib closed to users for a far longer period compared to other options. Significantly more construction is predicted from the western riverbank with significantly more interface with members of the public within UG Lands.</p>	<p>Option 2 requires the median amount of time working over the water to facilitate construction of bearing pads and plinths and landing of the bridge superstructure.</p> <p>Option 1 and Option 2 require the use of large lifting equipment and cranes positioned on the riverbanks as well as large floating pontoons located in the river during construction. wind loads. Positioning of cranes will need to consider the surround ground conditions, particularly if place to the rear of quay walls along Eglinton Pier.</p> <p>Interface with the river users during construction will be limited to during bridge lifts and construction of bearing plinths and pads. During these times there is a likely risk of conflict with users.</p>	<p>Option 1 requires the least amount of amount of time working over the water to facilitate construction of bearing pads and plinths. The push launch method of construction reduces working over water requirements when compared to other options.</p> <p>Confined space entry is required for this inspection and maintenance of the interior of the girder which is considered a very high-risk activity.</p>
Construction and Buildability	<p>Option 1 is likely to be constructed using the balanced cantilever method of construction which is a highly specialised method of construction. Option 1 requires specialist contractor experience in cable stayed construction.</p> <p>The construction of Option 1 is likely to require significantly more water access when compared to other options. Particularly for lifting of the pylon to Pier No.2. It is likely that the navigable channels of the river will need to be closed to users for extended periods of time while the cantilever sections are being fixed into place.</p>	<p>The construction methodology for Option 2 is well known by experienced contractors and is similar to a large number of bridges constructed throughout Ireland.</p> <p>Option 2 requires some river access to allow construction of the bearing plinths to the top of each pier and it likely that the closure of the navigable channel would be required during superstructure crane lifts, however this would be limited to four lifts and would be short term.</p>	<p>The push launch construction methodology proposed for Option 3 is specialised and requires the use of large jacks and rolling equipment which may not be readily available in Ireland.</p> <p>Option 3 requires the least water access of the three options presented with access only be required for construction of the bearing pads and plinths to each pier. The navigable channel will also be able to remain open during the push launch limiting the effects on the rowing and yachting clubs.</p>

Assessment Criteria	Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Box Girder
Ground Conditions	The asymmetric cable design is will impart the majority of its loading directly into Pier No.1 via axial loading. This loading will be substantially higher than the loads imparted on each sub structure and on the founding stratum when compared to the other options. That being said the founding stratum is considered extremely strong and resistant to axial loads. The preliminary design will need to determine if the axial loads from the single pylon are in excess of the axial resistance of the founding stratum. In addition, the asymmetric design results in bending moments being imparted on Pier No. 1 which will also need to be resisted by the founding stratum.	Each span of Option 2 will be designed as an independent structure supported at the piers and abutments. The use of bridge bearings results in a majority of the load being transferred into the substructure and founding stratum via axial compression loading. The existing ground conditions are considered to be extremely resistant to these axial loads. Limited bending and shear forces will be transmitted at the locations of fixed and guided bearings. These forces will also need to be resisted by the founding stratum; however, the loads are considered to be far lower than those imparted by Option 1.	The continuous girder arrangement of Option 3 provides benefits over the other options with only free bearings provided to the piers which induce axial loads only. The result is that no bending or shear forces are experienced at the in the founding stratum at the piers. Despite these benefits Option 3 is likely to be heavier than Option 2 with more axial loading imparted on each pier.  The abutments will be required to resist all bending and shear within the design, however larger bearing plinths can be detailed at the abutments to disperse the loads a greater distance reducing the bearing pressure required from the founding stratum.



## Appendix B Drawings

File name: I:\NA\AECOM\NET\COM\FILES\EN\HEAD\UBL\IN\HED\BL2\LEGACY\IED\B2\FP001\DATA\DCS\PROJECTS\CI6065050\_NTA\_GCC\_CLIFDEN\_RAILWAY\1000\_CAD\_GIS\910\_CAD\00-SHEETS\CRWB-ACM-ZZ-ZZ-DR-AX-0001.DWG  
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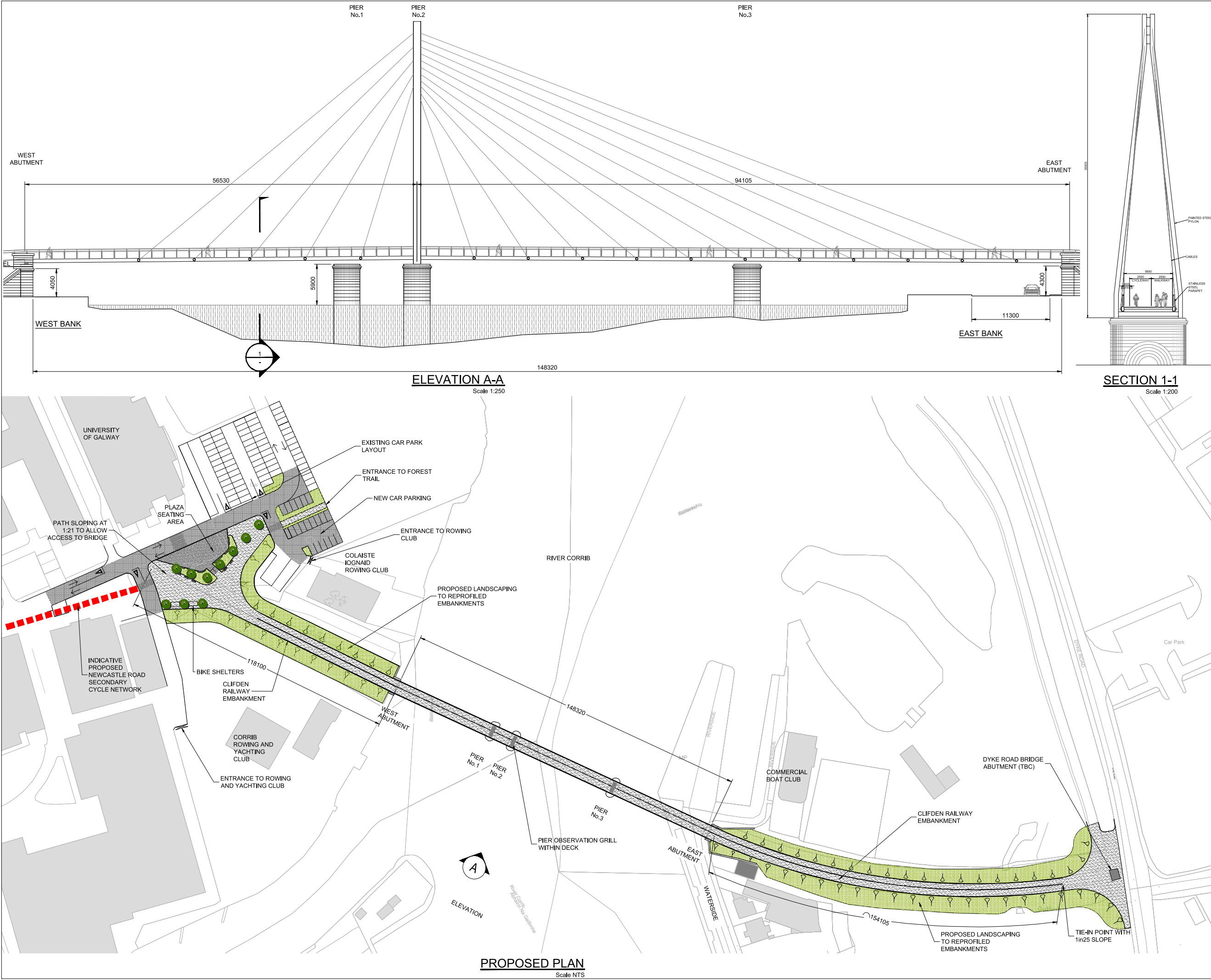
ISO A1 594mm x 841mm

Approved: GR

Checked: NR

Designer: AC

Project Management Initials:



**PROJECT**

CLIFDEN RAILWAY  
PEDESTRIAN AND  
CYCLE BRIDGE

**CLIENT**

Comhairle Cathrach na Gaillimhe  
Galway City Council



**CONSULTANT**

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**NOTES**

ISSUE/REVISION		
D	MAR 2023	FINAL ISSUE
C	FEB 2023	FINAL ISSUE
B	JAN 2022	FINAL ISSUE
A	AUG 2021	ISSUED FOR COMMENTS
I/R	DATE	DESCRIPTION

**PROJECT NUMBER**

60656050

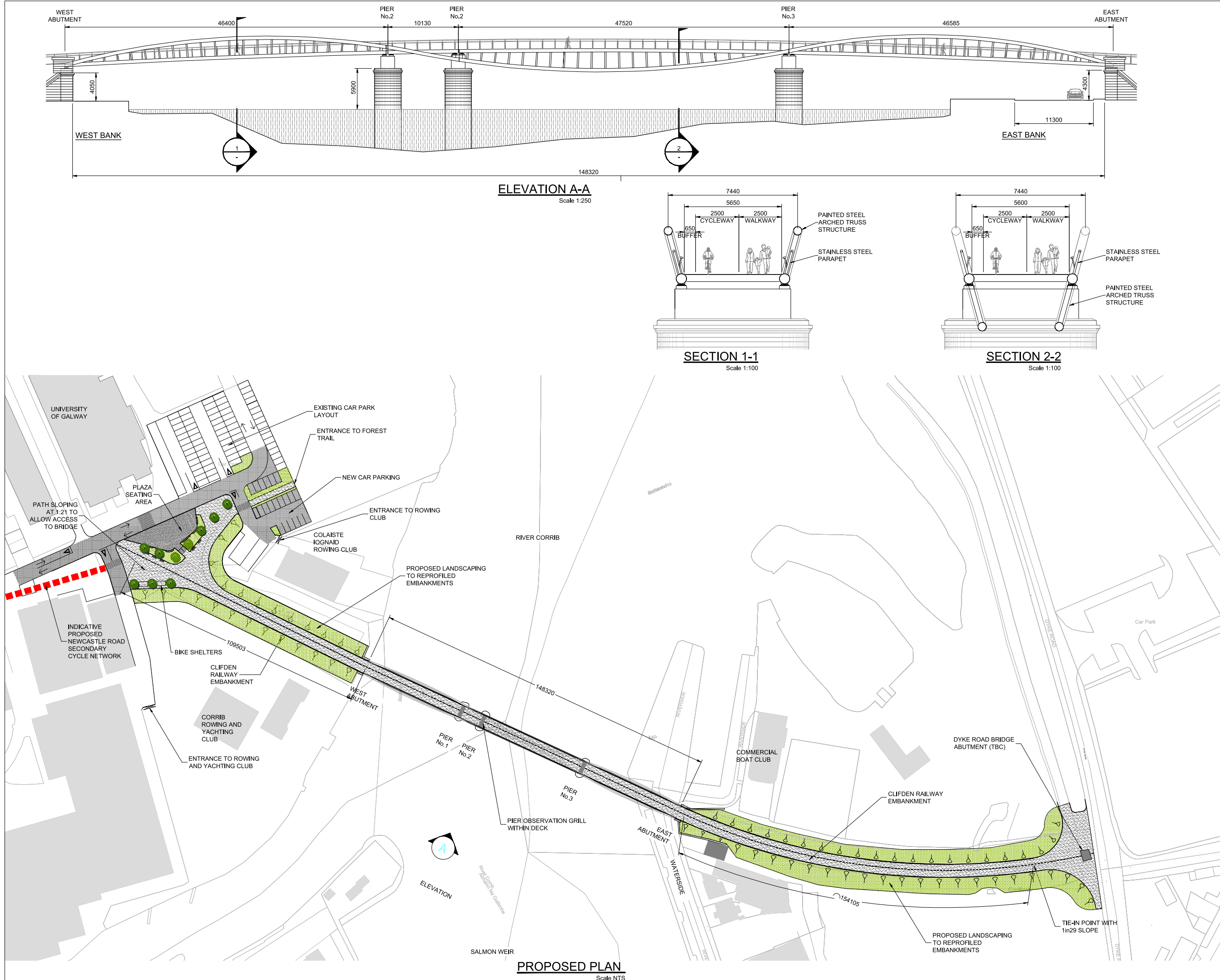
**SHEET TITLE**

OPTION 1 - ASYMMETRIC CABLE  
STAYED  
PROPOSED PLAN & ELEVATION

**SHEET NUMBER**

CRWB-ACM-ZZ-ZZ-DR-AX-0001

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PROJECT

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PROJECT NUMBER

60656050

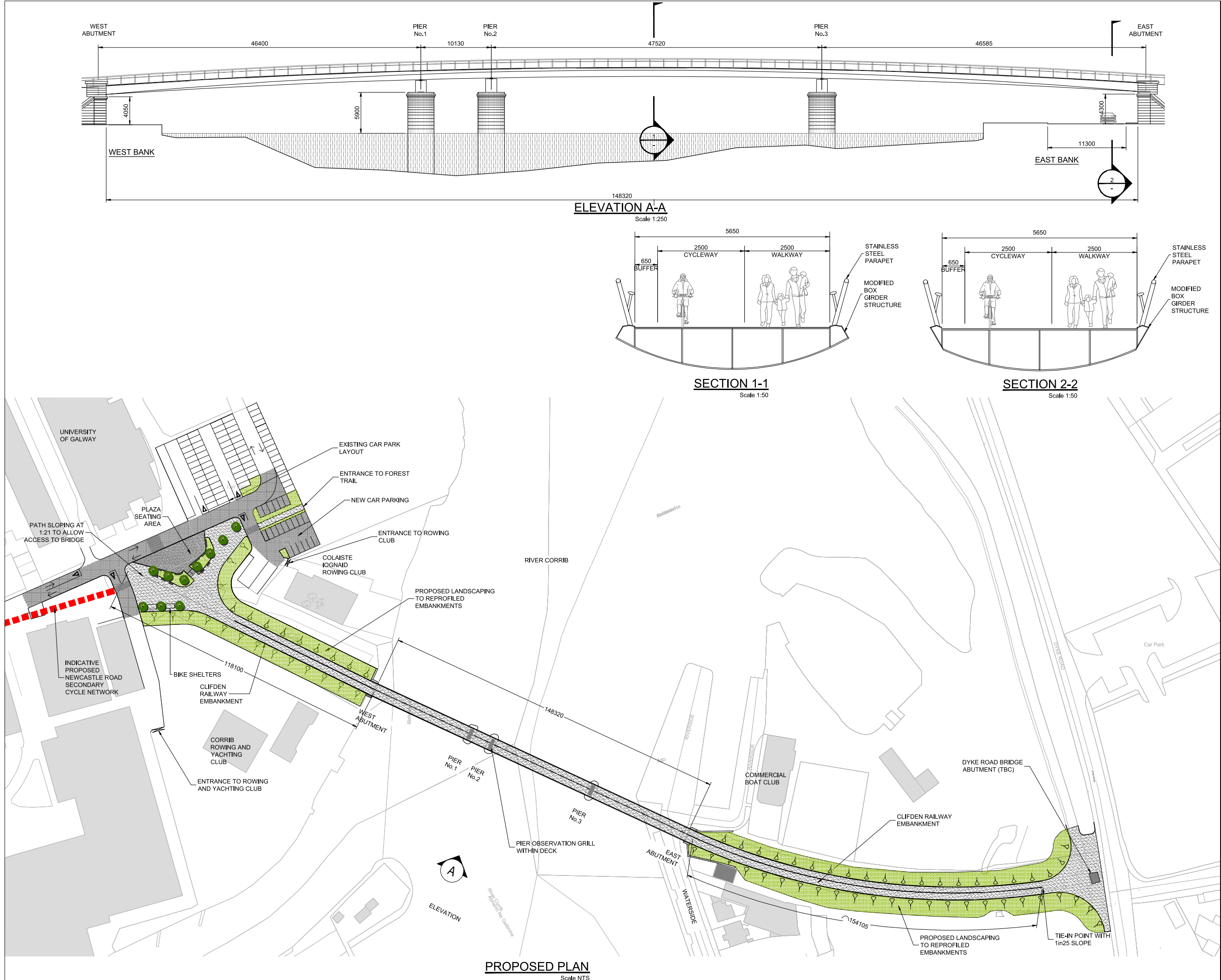
SHEET TITLE

OPTION 2 - RIPPLED ARCH  
PROPOSED PLAN, ELEVATION  
& SECTION

SHEET NUMBER

CRWB-ACM-ZZ-ZZ-DR-AX-0002





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PROJECT

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PEDESTRIAN AND  
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C	FEB 2023	FINAL ISSUE
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A	AUG 2021	ISSUED FOR COMMENTS

PROJECT NUMBER

60656050

SHEET TITLE

OPTION 3 - CURVED BOX GIRDER  
PROPOSED PLAN, ELEVATION  
& SECTION

SHEET NUMBER

CRWB-ACM-ZZ-ZZ-DR-AX-0003

## Appendix C Photomontages & Photographs



CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 1 - VIEW FROM SALMON WEIR BRIDGE







CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 1 - VIEW FROM SALMON WEIR/OPW





CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 1 - VIEW TOWARDS CATHEDRAL





CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 2 - VIEW FROM SALMON WEIR BRIDGE







CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 2 - VIEW FROM SALMON WEIR/OPW





CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 2 - VIEW TOWARDS CATHEDRAL





CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 3 - VIEW FROM SALMON WEIR BRIDGE







CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 3 - VIEW FROM SALMON WEIR/OPW

**AECOM**

 Comhairle Cathrach na Gaillimhe  
Galway City Council

 **NTA**  
Údarás Náisiúnta Iompair  
National Transport Authority



CLIFDEN RAILWAY PEDESTRIAN AND CYCLE BRIDGE  
OPTION 3 - VIEW TOWARDS CATHEDRAL







**Photo No.1 - General view of piers from eastern riverbank**



**Photo No.2 - General view of Pier No.1 and No.2**



**Photo No.3 – Western face of Pier No.1**



**Photo No.4 – Damage noted to Pier No.1**



Photo No.4 – Arch rings to Pier No. 1



Photo No.5 – Western face of Pier No.2



Photo No.6 – Eastern face of Pier No.3



Photo No.7 – General view of western abutment





Photo No.8 – General view of eastern abutment

## Appendix D Cost Estimates

Option Comparison Cost Estimate Template



NOTE: For Band 2 & 3 Projects the activity cost heads presented are the minimum expected for a linear road project and are to be proposed, discussed and agreed in writing with NTA prior to production of the cost estimate.

Project Title:		Clifden Railway Bridge Pedestrian and Cycle Bridge			
Project / Contract Code:		Clifden Railway Bridge Pedestrian and Cycle Bridge	Prepared By (Individual / Organisation):		Arthur Costello (AECOM)
Approving Authority:		Galway City Council	Date Estimate Prepared:		01/02/2023
Sponsoring Agency:		National Transport Authority	Base Date of Estimate:		Q1 2023
Route Option Number / Reference:		Option 1 Asymmetric Cable Stayed	Option 2 Rippled Arch	Option 3 Curved Arch Girder	
Project Information					
Mainline Cross-Section Type (Single/Dual):	Cable Stayed Bridge	Arched Truss	Box Girder		
Anticipated Programme Duration (Months):	24	24	24		
Location:	Galway City Centre	Galway City Centre	Galway City Centre		
Total Mainline Length (m):	450	450	450		
Other Relevant Project Information:					
Project Costs					
Option Construction Costs					
	€	€	€	€	€
Site Clearance	€ 31,500.00	€ 31,500.00	€ 31,500.00	€ -	€ -
Fencing	€ 21,000.00	€ 21,000.00	€ 21,000.00	€ -	€ -
Road Restraint Systems	€ 478,800.00	€ 478,800.00	€ 478,800.00	€ -	€ -
Drainage & Service Ducts	€ 52,500.00	€ 52,500.00	€ 52,500.00	€ -	€ -
Earthworks	€ 761,250.00	€ 761,250.00	€ 656,250.00	€ -	€ -
Pavements	€ 315,000.00	€ 315,000.00	€ 315,000.00	€ -	€ -
Kerbing & Footways	€ 105,000.00	€ 105,000.00	€ 105,000.00	€ -	€ -
Traffic Signs & Road Marking	€ 52,500.00	€ 52,500.00	€ 52,500.00	€ -	€ -
Road Lighting	€ 105,000.00	€ 157,500.00	€ 105,000.00	€ -	€ -
Structural Concrete (including Structures Generally)	€ 4,410,000.00	# € 3,780,000.00	€ 3,622,500.00	€ -	€ -
Accommodation Works	€ 31,500.00	€ 31,500.00	€ 31,500.00	€ -	€ -
Works for Statutory Undertakers	€ 31,500.00	€ 31,500.00	€ 31,500.00	€ -	€ -
Landscaping & Ecology	€ 420,000.00	€ 420,000.00	€ 420,000.00	€ -	€ -
Other Project Costs	€ 42,000.00	€ 73,500.00	€ 10,500.00	€ -	€ -
Preliminaries including Site Compounds (excluding traffic management)	€ 2,016,000.00	€ 1,260,000.00	€ 1,155,000.00	€ -	€ -
Sub-Total A - Construction Costs	€ 8,873,550.00	€ 7,571,550.00	€ 7,088,550.00	€ -	€ -
Option Add-On Costs					
	€	€	€	€	€
Preparation and Administration Costs	€ 1,774,710.00	€ 1,135,732.50	€ 1,063,282.50	€ -	€ -
Traffic Management Related Costs	€ -	€ -	€ -	€ -	€ -
Land and Property Costs	€ 197,900.00	€ 197,900.00	€ 197,900.00	€ -	€ -
Sub-Total B - Add-On Costs	€ 1,972,610.00	€ 1,333,632.50	€ 1,261,182.50	€ -	€ -
Total Inflation Allowance	€ 2,129,652.00	€ 1,741,456.50	€ 1,630,366.50	€ -	€ -
Total Contingency Allowance (Appendix C)	€ 4,612,826.23	€ 3,771,994.78	€ 3,531,373.84	€ -	€ -
Sub-Total - Adjustments	€ 6,742,478.23	€ 5,513,451.28	€ 5,161,740.34	€ -	€ -
Total Option Comparison Cost Estimate (excluding VAT)	€ 17,588,638.23	€ 14,418,633.78	€ 13,511,472.84	€ -	€ -
Total Rate Per Km (excluding VAT)	€ 39,085,862.74	€ 32,041,408.40	€ 30,025,495.20		
Rev	Title	Prepared By		Checked By	Issue Date
1	Clifden Railway Pedestrian and Cycle Bridge Options Cost Estimate	Arthur Costello		Niamh Rodgers	17/12/2021
2	Clifden Railway Pedestrian and Cycle Bridge Options Cost Estimate	Arthur Costello		Niamh Rodgers	01/02/2023
Note: Costs are considered to include allowances for overheads and profit. Costs are reflective of costs at the base date stated above. VAT is not applicable to all land and property therefore it is not appropriate to apply a uniform percentage. The value associated with VAT on land and property is to be determined on an individual basis and included as a lump sum.					



## Contingency Calculator

Project Title:	Clifden Railway Pedestrian and Cycle Bridge
Project / Contract Code:	Clifden Railway Pedestrian and Cycle Bridge

NTA Project Phase:	Phase 2 - Concept Development and Option Selection	Work Classification:	'Standard' project
--------------------	--	----------------------	--------------------

Contingency Factors:	'Non-standard' project		'Standard' project				Quantitative Risk Assessment (QRA)			
NTA Project Phase	Upper bound Contingency (%)	Lower bound Contingency (%)	Upper bound Contingency (%)	Lower bound Contingency (%)	QRA Required		Band 1	Band 2	Band 3	
Phase 1 - Scope and Purpose	66	50	44	30	No		N/A	N/A	N/A	
Phase 2 - Concept Development and Option Selection	66	50	44	30	No		N/A	N/A	N/A	
Phase 3 - Preliminary Design	50	30	35	20	Yes		Appendix G	Appendix O	Appendix O	
Phase 4 - Statutory Processes	50	30	30	20	Yes		Appendix G	Appendix O	Appendix O	
Phase 5 - Detailed Design and Procurement	30	10	20	10	Yes		Appendix G	Appendix O	Appendix O	

Contributory Factors	Mitigation Action	% Weighting	% Completed	% Mitigation
Land / Planning	Proposed works confined to land within NTA ownership / control	5.0%	75.0%	3.8%
	Additional land values confirmed / land acquired	2.5%	0.0%	0.0%
	Liaison with Planning Authority / Planning commenced or awarded	2.5%	100.0%	2.5%
Design development / complexity	Design developed beyond stated NTA Project Phase	5.0%	50.0%	2.5%
	Design comprises standard construction elements	2.5%	50.0%	1.3%
	NTA / Contractor has a proven track record of delivering similar solutions	2.5%	50.0%	1.3%
Risk management	Key Project risks identified and mitigation measures defined	2.5%	50.0%	1.3%
	Key Project risks allocated appropriate cost and time allowances / QRA produced	20.0%	50.0%	10.0%
Estimates / costs independently verified	Cost build-up independently checked and verified	5.0%	50.0%	2.5%
	Alignment of costs with NTA benchmarks	7.5%	50.0%	3.8%
Scope of Proposal	Scope of works is well defined and robust	5.0%	100.0%	5.0%
Project intelligence / surveys and investigations	Surveys and investigations undertaken to inform the design	5.0%	80.0%	4.0%
Stakeholders	Affected stakeholders identified, consulted and key requirements documented	15.0%	50.0%	7.5%
Environmental impact	Proposed solution has minimal environmental impact	2.5%	50.0%	1.3%
	Base price and delivery programme includes appropriate allowance for environmental / ecological mitigation	5.0%	50.0%	2.5%
Health & Safety	Methodology mitigates serious incident occurrence	5.0%	50.0%	2.5%
Procurement	Procurement strategy concluded / tried and tested solution recommended	2.5%	100.0%	2.5%
	Procurement successfully completed	5.0%	50.0%	2.5%
		100.0%		56.5%

### Mitigated Contingency Calculation

Upper Bound =	44.0%
Lower Bound =	30.0%
Difference =	14.0%
Mitigation % =	56.5%
Mitigation Value =	7.9%
Applicable Contingency Percentage	36.1%

### Example of Applying Percentage Completion of Mitigating Action

#### Contingency Calculator Categories

Contributory Factor: Estimates / costs independently verified

Mitigation Action: Cost build-up independently checked and verified

#### Example of Using the Calculator:

% Completed: 100%

Why: A peer review was undertaken on all projects costs (not just construction related costs). Comments from the peer review were incorporated where deemed appropriate.

Cost build-up independently checked and verified	5.0%	100.0%	5.0%
--	------	--------	------

## **Appendix E Preliminary Ecology Appraisal Report**

# Clifden Railway Pedestrian and Cycle Bridge

Preliminary Ecological Appraisal Report

Galway City Council

Project number: 60656050

March 2023



## Quality information

**Prepared by**

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**Approved by**

Niamh Rodgers  
Regional Director

## Revision history

Revision	Revision date	Details	Authorized	Name	Position
01	12/08/2001	First Issue	NR	Niamh Rodgers	Regional Director
02	29/10/2021	Final Issue	NR	Niamh Rodgers	Regional Director
03	01/02/2023	Final Issue	NR	Niamh Rodgers	Regional Director
04	01/03/2023	Final Issue	NR	Niamh Rodgers	Regional Director
05	01/03/2023	Final Issue	NR	Niamh Rodgers	Regional Director

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# 1. Introduction

## 1.1 Background

AECOM was commissioned by Galway City Council (GCC) to conduct a Preliminary Ecological Appraisal (PEA) for a proposed pedestrian and cycling bridge crossing at the River Corrib in Galway City (hereafter referred to simply as the 'Proposed Development'). The Proposed Development will be constructed on the existing railway piers and abutments at the River Corrib. An options report will be drafted for the Proposed Development.

The location of the Proposed Development is hereafter referred to as the 'Site' and the approximate central grid reference of the Site is M 29647 25853 (ITM 529603, 725878). The preliminary Site location and draft Proposed Development plan for the three bridge options will be shown on drawings. The approximate Site boundary is shown on Figure 1.

## 1.2 Aims and objectives

AECOM conducted an ecological walkover survey of the Site and areas within 150 m of the Site (hereafter the 'survey area'), where accessible. The Site is located on the River Corrib, existing railway piers and abutments, woodland on each side of the River Corrib, and road pavement.

This Preliminary Ecological Appraisal Report (PEAR) sets out the survey methods, results, potential ecological constraints associated with the Proposed Development and recommendations for further survey work and/or mitigation, where these are deemed necessary. The approach applied when carrying out the desk study generally accords with the *Guidelines for Preliminary Ecological Appraisal* published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2017). This PEAR addresses relevant wildlife legislation and planning policy as summarised in Section 2.

The purpose of this PEA was to:

- identify all habitats within the survey area as far as access permitted;
- search for and assess the potential for protected species to occur, such as badger *Meles meles*;
- carry out a bat roost suitability assessment of trees and buildings;
- search for invasive non-native plant species, including Japanese knotweed *Reynoutria japonica*;
- provide figure(s) showing the location of identified ecological features of relevance and of any further surveys recommended; and,
- provide advice on any potential ecological constraints, further detailed ecological surveys, initial mitigation recommendations, and recommendations for enhancement measures that may be feasible as part of the Proposed Development.

## 2. Relevant legislation and planning policy

### 2.1 Wildlife legislation

The following wildlife legislation is potentially relevant to the Proposed Development and was considered as part of this PEA:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive');
- Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive');
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (as amended) (the 'Water Framework Directive');
- Regulation 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (the 'Invasive Alien Species Regulations');
- Convention on Wetlands of International Importance ('Ramsar Convention');
- The Planning and Development Acts 2000 to 2020;
- The Wildlife Acts 1976 to 2018 and the Wildlife (Amendment) Act 2000 (collectively referred to as the 'Wildlife Acts');
- the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (as amended);
- Flora (Protection) Order 2015 S.I. 356/2015 (the 'Flora Protection Order'); and,
- EC Environmental Objectives (Surface Waters) Regulations 2009 (SI 272 of 2009).

Note that compliance with legislation may require the attainment of relevant protected species derogation licences prior to implementing works.

### 2.2 National planning policy

#### 2.2.1 Project Ireland 2040 National Planning Framework (NPF)

The *Project Ireland 2040 National Planning Framework* (NPF) sets out the Government's planning policies for Ireland and how these should be applied. NPF sets out that to achieve sustainable development, the planning system must incorporate an environmental objective, which should include:

- integrated planning for green infrastructure and ecosystem services;
- enhancing the conservation status and improve the management of protected areas and protected species;
- using natural resources prudently;
- minimising waste and pollution; and,
- mitigating and adapting to climate change, including moving to a low carbon economy.

There is a presumption in favour of sustainable development in NPF.

#### 2.2.2 National Biodiversity Action Plan 2017 – 2021

The *National Biodiversity Plan 2017 – 2021* for Ireland outlines seven main objectives to meet commitments under the Convention on Biological Diversity (CBD) and EU Biodiversity Strategy. These objectives include:

- mainstream biodiversity into decision-making across all sectors;
- strengthen the knowledge base for conservation, management, and sustainable use of biodiversity;
- increase awareness and appreciation of biodiversity and ecosystem services;
- conserve and restore biodiversity and ecosystem services in the wider countryside;
- conserve and restore biodiversity and ecosystem services in the marine environment;

- expand and improve management of protected areas and species; and,
- strengthen international governance for biodiversity and ecosystem services.

## 2.3 Local planning policy

The planning policies in this section have been considered when assessing potential ecological constraints and opportunities identified by this PEA and when assessing requirements for further survey, design options and ecological mitigation, as described in Section 5.

### 2.3.1 Galway City Development Plan 2023-2029

As per Section 27(1) of the Planning and Development Act 2000 (as amended), every planning authority in Ireland is required by law to provide a County/City Development Plan (CDP) that sets out the overall strategy for the proper planning and sustainable development for the area.

The primary aim of a CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout the county. With the general emphasis to enhance the quality of life, environment, community, and economy that supports the sustainable development of each county. The relevant national and regional objectives have been developed further and are translated into local objectives through the CDP.

The *Galway City Development Plan 2023-2029* sets out an overall strategy for the proper planning and sustainable development within the functional area of GCC. This CDP includes an overall strategic vision for which set out a number of high-level aims, including, enhancing and protecting the green network and biodiversity, which explicitly states:

*“Protect and enhance the distinctive and diverse natural environment in the city and strengthen the green and blue network and linkages, recognising the biodiversity value of the amenity, the range of recreational benefits this provides, the potential for facilitating active and healthy lifestyles, the effect it can have on the quality of general health and wellbeing and the value it has for providing good place making and an attractive city setting.”*

This green network supports the linkage between different multi-functional spaces within the city including protected Spaces of ecological and biodiversity importance. In order to achieve these aims the CPD sets out Galway City Council's policies for the sustainable development of Galway City to 2029. The following policy is relevant to biodiversity and the Proposed Development:

#### Policy 5.1: Green Network and Biodiversity

- support sustainable use and management of areas of ecological importance, parks and recreation amenity areas and facilities through an integrated green network policy approach in line with the *Galway Recreation and Amenity Needs Study*, and where it can be demonstrated that there will be no adverse impacts on the integrity of European Sites;
- achieve a sustainable balance between meeting future recreational needs (both passive and active) and the preservation of the city's biodiversity and ecological and cultural heritage;
- support the implementation of the National Biodiversity Action Plan (NBAP) 2017- 2021 (and any subsequent NBAP) and the All-Ireland Pollinator Plan (2021-2025) and support the actions of the City Council's Heritage Plan 2016-2021 and Biodiversity Action Plan 2014-2024 and updates relating to the promotion of ecological awareness, biodiversity and best practices.
- co-operate with the NPWS, landowners and stakeholders in the preparation and implementation of management plans for designated sites; and,
- ensure that all passive and active recreational proposals are considered in the context of potential impact on the environment, sites of ecological and biodiversity importance and general amenity.

### 2.3.2 Galway City Biodiversity Action Plan 2014 – 2024

The objectives of the *Galway City Biodiversity Action Plan 2014 – 2024* is to raise awareness and appreciation of biodiversity, maintain and enhance biodiversity within the city, and increase the knowledge and understanding of biodiversity.



It describes the River Corrib as having high biodiversity value as it provides a link between coastal habitats and the rich mosaic of habitats in the wider area. The River Corrib and associated wetlands include lowland river, reed swamps and wet woodland. It is also particularly important for Atlantic salmon *Salmo salar*, brook lamprey *Lampetra planeri*, and sea lamprey *Petromyzon marinus*.

The following actions are relevant to biodiversity and the Proposed Development:

- Action 18: ensure adequate protection of important bird habitats in and around the city waterways, urban woodlands and hedgerows to ensure no net loss of bird habitats. Ensure a bird survey is carried out before old structures are developed or restored in order to consider possible mitigation measures; and,
- Action 20: develop appropriate strategies for preventing the introduction and spread of invasive alien species.

### 3. Methods

#### 3.1 Desk study

A desk study was carried out to identify nature conservation designations, and records of protected and notable habitats and species potentially relevant to the Proposed Development. A stratified approach was taken during the desk study, based on the likely Zone of Influence (Zoi) of the Proposed Development on different ecological features. Accordingly, the desk study identified:

- international nature conservation designations (i.e. Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites) within 15 km of the Site and/or those located more distantly but which may be hydrologically connected to the Proposed Development;
- national nature conservation designations (i.e. Natural Heritage Areas (NHAs) and Proposed NHAs (pNHAs)) within 2 km; and,
- records of protected and notable habitats and species within 2 km.

The desk study was carried out using the sources detailed in Table 1. For the purposes of this PEA, protected and notable habitats and species included:

- habitats and species listed on Annexes I and II respectively of the Habitats Directive, which listing indicates importance in a European context and affords protection if designated as Qualifying Interests (QI) of SAC;
- species listed on Annex IV of the Habitats Directive, which are known as European Protected Species and are subject to strict protection anywhere they occur;
- bird species listed on Annex I of the Birds Directive, which listing indicates importance in a European context and affords protection where designated as Special Conservation Interest (SCI) of SPA;
- species listed on the Wildlife Acts;
- fish species and habitats protected under the Fisheries Consolidation Act 1959 (No. 14 of 1959), as amended, the Inland Fisheries Act 2010 (No. 10 of 2010) as amended, and the Local Government (Water Pollution Acts) 1977-1990, as amended;
- plant species listed on the Flora Protection Order;
- species and habitats listed on the National Biodiversity Action Plan 2017 – 2021;
- species that are Nationally Rare, Nationally Scarce or listed in Red Data Lists, which are published by the National Parks and Wildlife Service (NPWS) in collaboration with relevant Northern Irish agencies (e.g. Gilbert *et al.*, 2021; King *et al.*, 2011; Lockhart *et al.*, 2012; Marnell *et al.*, 2019; Nelson *et al.*, 2011; Nelson *et al.*, 2019; Regan *et al.*, 2010; Wyse-Jackson *et al.*, 2016); and,
- invasive non-native species of plants and animals listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (as amended) (hereafter 'scheduled invasive species'), those of EU concern under the EU Invasive Alien Species Regulation, and those listed by the National Biodiversity Data Centre as invasive in Ireland.

Other species or habitats, that may be rare, scarce, or otherwise notable, are included where deemed appropriate through available information and/or professional judgement.

**Table 1. Desk study data sources**

Data source	Date accessed	Data obtained
Environmental Protection Agency (EPA) maps website ( <a href="https://gis.epa.ie/EPAMaps/">https://gis.epa.ie/EPAMaps/</a> )	29/06/2021	<ul style="list-style-type: none"> <li>• International statutory designations within 15 km.</li> <li>• Other statutory designations within 2 km.</li> <li>• Information on watercourses, water quality, soils, and geology.</li> </ul>
NPWS Protected Sites in Ireland website ( <a href="https://www.npws.ie/protected-sites">https://www.npws.ie/protected-sites</a> )	29/06/2021	<ul style="list-style-type: none"> <li>• Details on relevant statutory and non-statutory designations.</li> </ul>

Data source	Date accessed	Data obtained
NPWS map viewer ( <a href="http://webgis.npws.ie/npwsviewer/">http://webgis.npws.ie/npwsviewer/</a> )	29/06/2021	<ul style="list-style-type: none"> <li>Biological records within 2 km.</li> </ul>
National Biodiversity Data Centre (NBDC) ( <a href="https://maps.biodiversityireland.ie/">https://maps.biodiversityireland.ie/</a> )	12/07/2021	<ul style="list-style-type: none"> <li>Biological records within 2 km.</li> <li>High and medium impact invasive species in Ireland.</li> </ul>
<i>The Status of EU Protected Habitats and Species in Ireland</i> (Article 17 Report) ( <a href="https://www.npws.ie/publications/article-17-reports/article-17-reports-2019">https://www.npws.ie/publications/article-17-reports/article-17-reports-2019</a> )	29/06/2021	<ul style="list-style-type: none"> <li>Information on the status of EU protected habitats and species in Ireland.</li> </ul>
Irish Red Lists	29/06/2021	<ul style="list-style-type: none"> <li>Conservation status of plants, amphibians, reptiles, freshwater fish, invertebrates, birds, and terrestrial mammals (including bats).</li> </ul>
Ordnance Survey Ireland maps and aerial photography ( <a href="https://www.osi.ie/">https://www.osi.ie/</a> )	29/06/2021	<ul style="list-style-type: none"> <li>Habitats and connectivity relevant to interpretation of planning policy and potential protected / notable species constraints.</li> </ul>
National Inventory of Architectural Heritage ( <a href="https://www.buildingsofireland.ie/">https://www.buildingsofireland.ie/</a> )	29/06/2021	<ul style="list-style-type: none"> <li>Information on historical structures in the local area.</li> </ul>
Underwater Inspection Report (ADCO, 2021)	29/10/2021	<ul style="list-style-type: none"> <li>Information on invasive species (zebra mussel <i>Dreissena polymorpha</i>) identified during underwater inspection for the Proposed Development.</li> </ul>

### 3.2 Field study

An ecological walkover survey was carried out on 14 May and 21 May 2021 where access was permitted and safe. This walkover survey involved an inspection of habitats and a general assessment of the potential for those habitats to support protected species (e.g. birds, bats, and otter) or other features such as invasive non-native species. Survey for otter was also carried out along water features in the survey area. The bat roost suitability of all trees and buildings within the survey area was assessed following guidance from Collins (2016). Any evidence of protected, notable, or invasive species were also recorded.

### 3.3 Limitations

Desk study information is dependent on records having been submitted for the area of interest. As such, a lack of records for particular habitats or species does not necessarily mean they are absent from the area of interest. Similarly, the presence of records for particular habitats and species does not automatically mean they still occur within the area of interest or are relevant in the context of the Proposed Development.

Where habitat boundaries coincide with discernible boundaries on recent aerial photography (where available) the resolution is as determined by the accuracy and clarity of the aerial photography. Otherwise, habitat mapping is as estimated in the field. Where areas of habitat are given, they are approximate and should be verified by measurement on the Proposed Development site where required for design or construction.

The existing railway piers located within the River Corrib and private properties in the survey area were inaccessible during the survey. However, these areas were viewed from the nearest road using binoculars.

Furthermore, at this stage no detailed survey of the River Corrib was carried out.

There were no other significant limitations to the desk study or field survey conducted as part of this PEA.



## 4. Results

### 4.1 Nature conservation designations

There are eleven international nature conservation designation within 15 km of the Site. There are two nationally designated sites within 2 km of the Site. These are set out in Table 2 below and shown on Figure 1. Designated sites in Table 2 are listed in ascending order of distance from the Site, with those closest described first.

**Table 2. Statutory designated nature conservation sites**

Site name [site code]	Reason(s) for designation	Distance and direction from the Site (as the crow flies)
Lough Corrib Ramsar site and SAC [000297]	<p>Ramsar designation: The second largest lake in Ireland supports one of the largest areas of wetland vegetation consisting of reed, sedge and rush communities in the country. Other habitats include sessile oak <i>Quercus petraea</i> woodland, calcareous fen, callows grassland, marsh and raised bog with a soak system. The site provides important feeding grounds for waterbirds and supports internationally important numbers of several breeding and wintering waterbirds and nationally important numbers of numerous other waterbird species. The site supports the otter and numerous rare and threatened plant and fish species.</p> <p>SAC designation</p> <ul style="list-style-type: none"> <li>• Active raised bogs [7110]</li> <li>• Alkaline fens [7230]</li> <li>• Bog woodland [91D0]</li> <li>• Brook lamprey [1096]</li> <li>• Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]</li> <li>• Degraded raised bogs still capable of natural regeneration [7120]</li> <li>• Depressions on peat substrates of the <i>Rhynchosporion</i> [7150]</li> <li>• Freshwater pearl mussel <i>Margaritifera margaritifera</i> [1029]</li> <li>• Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. [3140]</li> <li>• Lesser horseshoe bat <i>Rhinolophus hipposideros</i> [1303]</li> <li>• Limestone pavements [8240]</li> <li>• Molinia meadows on calcareous, peaty or clayey-silt-laden soils <i>Molinion caeruleae</i> [6410]</li> <li>• Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0]</li> <li>• Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoeto-Nanojuncetetea</i> [3130]</li> <li>• Oligotrophic waters containing very few minerals of sandy plains <i>Littorelletalia uniflorae</i> [3110]</li> <li>• Otter <i>Lutra lutra</i> [1355]</li> <li>• Petrifying springs with tufa formation (<i>Cratoneurion</i>) [7220]</li> <li>• Salmon [1106]</li> <li>• Sea lamprey [1095]</li> <li>• Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites) [6210]</li> <li>• Slender green feather-moss <i>Hamatocaulis vernicosus</i> [6216]</li> <li>• Slender naiad <i>Najas flexilis</i> [1833]</li> <li>• Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]</li> <li>• White-clawed crayfish <i>Austropotamobius pallipes</i> [1092]</li> </ul>	Within the Site
Lough Corrib pNHA [000297]	<ul style="list-style-type: none"> <li>• Same reasons for designation as described in Lough Corrib SAC row above (Lough Corrib pNHA partially overlaps the Lough Corrib SAC boundary)</li> </ul>	430 m, north-west
Galway Bay Complex SAC and pNHA [000268]	<ul style="list-style-type: none"> <li>• Alkaline fens [7230]</li> <li>• Atlantic salt meadows <i>Glauco-Puccinellietalia maritimae</i> [1330]</li> <li>• Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]</li> <li>• Coastal lagoons [1150]</li> <li>• Harbour seal <i>Phoca vitulina</i> [1365]</li> <li>• <i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]</li> </ul>	770 m, south

Site name [site code]	Reason(s) for designation	Distance and direction from the Site (as the crow flies)
	<ul style="list-style-type: none"> <li>Large shallow inlets and bays [1160]</li> <li>Limestone pavements [8240]</li> <li>Mediterranean salt meadows <i>Juncetalia maritimi</i> [1410]</li> <li>Mudflats and sandflats not covered by seawater at low tide [1140]</li> <li>Otter [1355]</li> <li>Perennial vegetation of stony banks [1220]</li> <li>Reefs [1170]</li> <li>Salicornia and other annuals colonising mud and sand [1310]</li> <li>Semi-natural dry grasslands and scrubland facies on calcareous substrates <i>Festuco-Brometalia</i> (*important orchid sites) [6210]</li> <li>Turloughs [3180]</li> <li>Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]</li> </ul>	
Inner Galway Bay Ramsar site and SPA [004031]	<p>Ramsar designation: The shallow sheltered part of a large sea bay with numerous intertidal inlets and small low islands composed of glacial deposits. The area provides important habitat for marine life along Ireland's west coast. The site supports the richest seaweed flora on the Irish coast (500+ species) and 65% of the Irish marine algal flora occur in the area. The site supports internationally and nationally important numbers of numerous species of waterbirds. There is a large cormorant colony on Deer Island.</p> <p>SPA designation:</p> <ul style="list-style-type: none"> <li>Bar-tailed godwit <i>Limosa lapponica</i> [A157]</li> <li>Black-headed gull <i>Chroicocephalus ridibundus</i> [A179]</li> <li>Black-throated diver <i>Gavia arctica</i> [A002]</li> <li>Common gull <i>Larus canus</i> [A182]</li> <li>Common tern <i>Sterna hirundo</i> [A193]</li> <li>Cormorant <i>Phalacrocorax carbo</i> [A017]</li> <li>Curlew <i>Numenius arquata</i> [A160]</li> <li>Dunlin <i>Calidris alpina</i> [A149]</li> <li>Golden plover <i>Pluvialis apricaria</i> [A140]</li> <li>Great northern diver <i>Gavia immer</i> [A003]</li> <li>Grey heron <i>Ardea cinerea</i> [A028]</li> <li>Lapwing <i>Vanellus vanellus</i> [A142]</li> <li>Light-bellied brent goose <i>Branta bernicla hrota</i> [A046]</li> <li>Red-breasted merganser <i>Mergus serrator</i> [A069]</li> <li>Redshank <i>Tringa totanus</i> [A162]</li> <li>Ringed plover <i>Charadrius hiaticula</i> [A137]</li> <li>Sandwich tern <i>Sterna sandvicensis</i> [A191]</li> <li>Teal <i>Anas crecca</i> [A052]</li> <li>Turnstone <i>Arenaria interpres</i> [A169]</li> <li>Wetland and waterbirds [A999]</li> <li>Wigeon <i>Anas penelope</i> [A050]</li> </ul>	770 m, south
Lough Corrib SPA [004042]	<ul style="list-style-type: none"> <li>Arctic tern <i>Sterna paradisaea</i> [A194]</li> <li>Black-headed gull [A179]</li> <li>Common gull [A182]</li> <li>Common scoter <i>Melanitta nigra</i> [A065]</li> <li>Common tern [A193]</li> <li>Coot <i>Fulica atra</i> [A125]</li> <li>Gadwall <i>Anas strepera</i> [A051]</li> <li>Golden plover [A140]</li> <li>Greenland white-fronted goose <i>Anser albifrons flavirostris</i> [A395]</li> <li>Hen harrier <i>Circus cyaneus</i> [A082]</li> <li>Pochard <i>Aythya ferina</i> [A059]</li> <li>Shoveler <i>Anas clypeata</i> [A056]</li> <li>Tufted duck <i>Aythya fuligula</i> [A061]</li> <li>Wetland and waterbirds [A999]</li> </ul>	2.8 km, north
Cregganna Marsh SPA [004142]	<ul style="list-style-type: none"> <li>Greenland white-fronted goose [A395]</li> </ul>	8.3 km, south-east

Site name [site code]	Reason(s) for designation	Distance and direction from the Site (as the crow flies)
Connemara Bog Complex SAC [002034]	<ul style="list-style-type: none"> <li>Alkaline fens [7230]</li> <li>Blanket bogs (*if active bog) [7130]</li> <li>Coastal lagoons [1150]</li> <li>Depressions on peat substrates of the <i>Rhynchosporion</i> [7150]</li> <li>European dry heaths [4030]</li> <li>Marsh fritillary <i>Euphydryas aurinia</i> [1065]</li> <li>Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinia caerulea</i>) [6410]</li> <li>Natural dystrophic lakes and ponds [3160]</li> <li>Northern Atlantic wet heaths with <i>Erica tetralix</i> [4010]</li> <li>Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [91A0]</li> <li>Oligotrophic to mesotrophic standing waters with vegetation of the <i>Littorelletea uniflorae</i> and/or <i>Isoetes-Nanojuncetea</i> [3130]</li> <li>Oligotrophic waters containing very few minerals of sandy plains <i>Littorelletea uniflorae</i> [3110]</li> <li>Otter [1355]</li> <li>Reefs [1170]</li> <li>Salmon [1106]</li> <li>Slender naiad [1833]</li> <li>Transition mires and quaking bogs [7140]</li> <li>Water courses of plain to montane levels with the <i>Ranunculus fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]</li> </ul>	12.4 km, west
Ross Lake and Woods SAC [001312]	<ul style="list-style-type: none"> <li>Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. [3140]</li> <li>Lesser horseshoe bat [1303]</li> </ul>	13.5 km, north-west
Lough Fingall Complex SAC [000606]	<ul style="list-style-type: none"> <li>Turloughs [3180]</li> <li>Alpine and boreal heaths [4060]</li> <li><i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]</li> <li>Semi-natural dry grasslands and scrubland facies on calcareous substrates <i>Festuco-Brometalia</i> (*important orchid sites) [6210]</li> <li>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]</li> <li>Limestone pavements [8240]</li> <li>Lesser horseshoe bat [1303]</li> </ul>	14.2 km, south-east
East Burren Complex SAC [001928]	<ul style="list-style-type: none"> <li>Alkaline fens [7230]</li> <li>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) [91E0]</li> <li>Alpine and boreal heaths [4060]</li> <li>Calaminarian grasslands of the <i>Violetalia calaminariae</i> [6130]</li> <li>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]</li> <li>Caves not open to the public [8310]</li> <li>Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. [3140]</li> <li><i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]</li> <li>Lesser horseshoe bat [1303]</li> <li>Limestone pavements [8240]</li> <li>Lowland hay meadows (<i>Alopecurus pratensis</i>, <i>Sanguisorba officinalis</i>) [6510]</li> <li>Marsh fritillary [1065]</li> <li>Otter [1355]</li> <li>Petrifying springs with tufa formation <i>Cratoneurion</i> [7220]</li> <li>Semi-natural dry grasslands and scrubland facies on calcareous substrates <i>Festuco-Brometalia</i> (*important orchid sites) [6210]</li> <li>Turloughs [3180]</li> <li>Water courses of plain to montane levels with the <i>Ranunculus fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]</li> </ul>	14.4 km, south

## 4.2 Habitats

The habitats present within the survey area are shown on Figure 2 and are described in the sub-headings below.



The habitats within the Site boundary include the River Corrib (FW2), mixed broadleaved woodland (WD1), and railway piers, abutments, and pavement (BL3 Buildings and artificial surfaces). Habitats present in the survey area are described below in the order that they are listed in *A Guide to Habitats in Ireland* (Fossitt, 2000).

### **FW2 Depositing/lowland rivers**

The Proposed Development crosses the River Corrib, which is a lowland river that flows south from Lough Corrib through Galway City into Galway Bay. The section of the River within the Site is approximately 120 m wide. Within the Site, the riverbanks are artificial and constructed of concrete and/or masonry, and there is little or no aquatic vegetation on the surface of the water. There are reed swamps at the edges of the River Corrib in the survey area outside of the Site, which are described further in the sub-section FS1 Reed and large sedge swamps below.

### **FW3 Canals**

There is a man-made canal outside of the Site to the south-west that connects to the River Corrib. It has moderately steep vegetated banks and relatively slow flow. The invasive non-native species butterfly-bush *Buddleja davidii* is present along the canal.

### **FS1 Reed and large sedge swamps**

There are reed and large sedge swamp habitats within the survey area that are all located outside of the Site at the River Corrib. Two small areas of this habitat type are considered to be Annex I habitats and are located north of the Site on the eastern side of the Corrib River. These habitats were also identified by BEC Consultants from previous surveys conducted in 2013, 2014, 2015 and 2017 (Barron *et al.*, 2017).

One area is a poor example of the Annex I habitat type transition mires and quaking bogs (code 7140) that is located approximately 100 m north of the Site. This habitat is waterlogged with abundant common sedge *Carex nigra*, bogbean *Menyanthes trifoliata*, marsh cinquefoil *Potentilla palustris*, and frequent common reed *Phragmites australis*. It also comprises occasional mosses, cuckooflower *Cardamine pratensis*, marsh-marigold *Caltha palustris*, water horsetail *Equisetum fluviatile*, yellow iris *Iris pseudacorus*, and rarely brown sedge *Carex disticha*, common valerian *Valeriana officinalis*, meadowsweet *Filipendula ulmaria*, and Yorkshire-fog *Holcus lanatus* closer to the edges of this habitat.

The majority of the reed and large sedge swamp habitat within the survey area are species-poor and dominated by common reed and occasionally comprise horsetail *Equisetum* spp. and bogbean. These species-poor habitats include one large area approximately 100 m upstream of the Site, one small area approximately 40 m downstream of the Site, and another small area approximately 75 m upstream of the Site.

### **GA2 Amenity grassland (improved)**

There are several amenity grasslands within the survey area, located outside of the Site. They are frequently mown short and are typically associated with private properties. One amenity grassland is a sports pitch located approximately 10 m south of the Site, which has short sward height and also contains daisy *Bellis perennis* and creeping buttercup *Ranunculus repens*. Another amenity grassland is located approximately 100 m south of the Site and is part of a small park.

### **GS2 Dry meadows and grassy verges**

There is a narrow grassy verge located directly south of the Site on the eastern side of the River Corrib between a woodland and an amenity grassland sports pitch. It is infrequently mown with tall swards and patches of moist soil.

It is relatively species rich, containing the following species: hairy sedge *Carex hirta*, Yorkshire-fog, sweet vernal grass *Anthoxanthum odoratum*, silverweed *Potentilla anserina*, meadowsweet, yellow iris, great willowherb *Epilobium hirsutum*, black medic *Medicago lupulina*, cuckoo flower, speedwell *Veronica* sp., creeping buttercup, meadow buttercup *Ranunculus acris*, red clover *Trifolium pratense*, bush vetch *Vicia sepium*, daisy, ribwort plantain *Plantago lanceolata*, hogweed *Heracleum sphondylium*, hedge bindweed *Calystegia sepium*, broad-leaved dock *Rumex obtusifolius*, curled dock *Rumex crispus*, bramble *Rubus fruticosus* agg., cleavers *Galium aparine*, horsetail, rushes *Juncus* spp., and blackthorn *Prunus spinosa*.

## WN5 Riparian woodland

There is a small section of riparian woodland approximately 120 m north of the Site. Although access to this woodland was limited, it was viewed from the nearest road. This woodland appears to be dominated by willow *Salix* spp.

## WD1 (Mixed) broadleaved woodland

There are two areas of mixed broadleaved woodland within the Site boundary, which are on both sides of the River Corrib.

The mixed broadleaved woodland on the eastern side of the River Corrib within the Site is located on a relatively steep berm. It appears to be frequently visited by humans as indicated by the trails and abundance of litter throughout. The trees are between 10 to 15 m tall. This woodland is dominated by sycamore *Acer pseudoplatanus* trees and bramble scrub and also comprises hawthorn *Crataegus monogyna*, Atlantic ivy *Hedera hibernica*, common nettle *Urtica dioica*, Yorkshire-fog, creeping buttercup, ribwort plantain, and hart's-tongue *Asplenium scolopendrium*.

The mixed broadleaved woodland on the western side of the River Corrib within the Site is located adjacent to the rowing club. It is on a shorter and more gently sloped berm than the woodland described above and does not appear to be frequently visited by humans. The trees are between 10 to 15 m tall and the dominant tree species is sycamore. Ash *Fraxinus excelsior* is also frequent. It has a dense understory dominated by bramble, hawthorn and Atlantic ivy. Other plant species in this woodland include willow species *Salix* spp., blackthorn, cleavers, creeping buttercup, horsetail, common nettle, hart's-tongue, tutsan *Hypericum androsaemum*, and bluebell *Hyacinthoides non-scripta*. The invasive non-native species Japanese knotweed and butterfly-bush were also recorded in this woodland.

There are also two areas of mixed broadleaved woodland outside of the Site located approximately 45 and 75 m north-west. These woodlands are adjacent to the River Corrib and the canopy is approximately 10 m high. There are several public paths throughout these woodlands connecting to the wider parkland area. The woodlands are dominated by silver birch *Betula pendula* and sycamore with frequent ash, beech *Fagus sylvatica*, hawthorn, and occasional willow species. There is limited understory vegetation comprising occasional Atlantic ivy, hogweed, dandelion *Taraxacum officinale* agg., herb-robert *Geranium robertianum*, cleavers, daisy, cock's-foot *Dactylis glomerata*, and ribwort plantain. Invasive non-native species are also present and include Japanese knotweed and winter heliotrope *Petasites fragrans*.

## WD5 Scattered trees and parkland

There is an area of scattered trees and parkland located approximately 90 m north of the Site. It is a public park along the River Corrib with several paths that are well used. Common spotted-orchid *Dactylorhiza fuchsia* and horsetail were present in the grassland beside the river. The tree species were typically immature ash with some hawthorn, silver birch, and lime *Tilia* sp. The understory comprised willow scrub, sweet vernal-grass *Anthoxanthum odoratum*, fescue species *Festuca* sp., yarrow *Achillea millefolium*, butterbur *Petasites hybridus*, ribwort plantain, dandelion, creeping buttercup, rushes, bird's-foot-trefoil *Lotus corniculatus*, Atlantic ivy, daisy, silverweed, and common sedge *Carex nigra*. The invasive non-native species Japanese knotweed and winter heliotrope were also frequent throughout this parkland area.

## WL1 Hedgerows

There are hedgerows located directly north of the Site along the path beside the large area of reed swamp habitat. They are approximately 4 m tall with patchy dense scrub and occasional ash trees. The hedgerows are dominated by willow species, mainly grey willow *Salix cinerea*, and butterfly-bush.

There is also a section of hedgerow south of the Site surrounding the rowing club that is composed of the planted non-native species New Zealand broadleaf *Griselinia littoralis*.

## WL2 Treelines

There are several treelines located outside of the Site boundary but within the wider survey area

There is a planted treeline directly south of the Site along the River Corrib that is approximately 10 to 15 m tall with mown amenity grassland below. The tree species include lime., sycamore, and rowan *Sorbus aucuparia*.

The other treelines within the survey area typically comprise sycamore, ash, hawthorn, bramble, lime, rowan, Atlantic ivy and occasionally willow, alder *Alnus glutinosa*, and conifer trees.

### BL3 Buildings and artificial surfaces

Buildings and artificial surfaces in the survey area include paved areas and private residential and commercial properties, including several rowing clubs and the University of Galway (UG). They are of negligible ecological value and comprise built-up areas with occasional small areas of amenity grassland, scattered trees, scrub, ornamental parkland and gardens, and bare ground.

## 4.3 Notable species

Notable species returned by the desk study are summarised in the relevant sections below and a full list of notable species within 2 km of the Site is presented in Appendix A.

The purpose of the ecological walkover was to identify evidence of notable species in the survey area and to identify areas where further survey may be required. Evidence of notable species identified during the ecological walkover survey is summarised in the relevant sections below and shown on Figure 3.

### 4.3.1 Flora

Four notable plants were returned from the search of the NBDC database within 2 km of the Site. These were green field-speedwell *Veronica agrestis*, slender tufted-sedge *Carex acuta*, mountain liverwort *Marchantia polymorpha* and strawberry-tree *Arbutus unedo*.

Furthermore, the Lough Corrib SAC located within the Site has two plant species as QI: slender green feather-moss and slender naiad.

No rare or protected plant species were identified during the walkover survey. However, rare or protected species may be present within the River Corrib.

### 4.3.2 Bats

Four species of bats were returned from the search of the NBDC databases within 2 km of the Site. These were Leisler's bat *Nyctalus leisleri*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus* and Daubenton's bat *Myotis daubentonii*. None of the records stated whether they were of bat roosts, or merely observations of flying bats. Furthermore, as stated in the UG biodiversity trail leaflet<sup>1</sup> all nine species of bats in Ireland have been recorded flying above the UG campus, which is adjacent to Site. This includes lesser horseshoe bat, which is a Qualifying Interest of the Lough Corrib SAC. Lesser horseshoe bat was also recorded on NBDC approximately 1.5 km north of the Site. Therefore, all Irish bat species are presumed to occur at times within the Site.

There is suitable habitat for commuting and foraging bats within the Site and wider survey area, particularly along the River Corrib and in areas of woodland which are well-connected to the wider landscape.

No evidence of roosting bats and no trees or structures with bat roost suitability were identified within the survey area.

### 4.3.3 Otter

Nineteen records of otter within 2 km of the Site were returned by the NBDC database. As stated in the *Galway City Biodiversity Action Plan 2014 – 2021*, otters are known to be present in the River Corrib and this species is also a Qualifying Interest of Lough Corrib SAC.

While no evidence of otter (e.g. spraints, holts) was recorded within the survey area during the walkover survey, otters are known to be present within the River Corrib and the river provides suitable habitat for commuting and foraging by this species within the Site and wider survey area. There is limited suitability for resting otter within the Site due to the sub-optimal habitat present including the riverbanks which are artificial and constructed of concrete and subject to frequent human disturbance. There is however, potential for otter resting sites in the

<sup>1</sup> Available online at: <https://www.nuigalway.ie/media/nuigalwayie/content/files/aboutus/Biodiversity-Trail.pdf>. Last accessed July 2021.



wider survey area within suitable habitats including the riparian woodland situated approximately 120 m north of the Site.

#### 4.3.4 Badger

Two records of badger within 2 km of the Site were returned by the NBDC database. No evidence of badger activity was recorded during the walkover survey. The Site provides limited habitat for badger as the woodland is surrounded by hardstanding and is frequently disturbed by humans.

#### 4.3.5 Other terrestrial mammals

The NBDC database search returned records of pygmy shrew *Sorex minutus*, hedgehog *Erinaceus europaeus*, red squirrel *Sciurus vulgaris* and Irish hare *Lepus timidus* within 2 km of the Site. These species are protected under the Wildlife Acts.

No evidence of pygmy shrew was recorded during the walkover survey. However, sightings are rare and this species has been recorded in the NBDC approximately 300 m north of the Site and is therefore presumed to occur throughout the survey area in existing suitable habitat (i.e. dense vegetation or under rocks or logs), wherever adequate insect food supplies exist (Hayden and Harrington, 2001).

No observations or evidence of hedgehog were recorded during the walkover survey. However, hedgehog are nocturnal and field signs are less frequently observed than for other mammals. Hedgehog has been recorded previously in the NBDC approximately 500 m away during a roadkill survey in 2011. Suitable habitat for refuge and foraging is present within the Site including grassland, scrub and woodlands. It is therefore likely that hedgehog occurs within the Site and wider survey area.

No observations or evidence of red squirrel were recorded during the walkover survey. However, a recent study (Roberts and Lawton, 2019) of the dispersal of red squirrels in Galway City has identified a number of red squirrels located in nearby woodlands and parks including wooded areas such as Merlin Woods and Menlo village, which are located approximately 3.6 km east and 2.7 km north of the Site respectively. One-off sightings have also been reported in Dangan, located to the 1.6 km north-west of the Site, and Terryland Forest Park located approximately 1.2 km north-east of the Site. Sightings suggest that Terryland and Dangan woods are functioning as ecological corridors for dispersing individuals. There is a small area of suitable mixed broadleaved woodland for red squirrel within the Site and survey area, however, these small areas are largely fragmented by the existing River Corrib and hardstanding. On a precautionary basis, this species is therefore presumed to use the Site and survey area infrequently to feed and/or commute.

No observations or evidence of Irish hare was recorded during the walkover survey. As stated in the *Galway City Biodiversity Action Plan 2014 – 2021*, Irish hare are known to be present in Galway City and the presence of this species in an urban setting is considered to be significant and reflects the quality and interconnectedness of the natural corridor areas. Given the presence of small areas of suitable habitat such as grassland and woodland within the survey area, this species is presumed to be present within the Site and/or survey area.

#### 4.3.6 Marine mammals

The NBDC database search returned records of bottlenose dolphin *Tursiops truncatus*, common porpoise *Phocoena phocoena*, common seal *Phoca vitulina*, grey seal *Halichoerus grypus* and striped dolphin *Stenella coeruleoalba* within 2 km of the Site.

These species live in primarily oceanic environments and while they may be present in the Galway Harbour estuary, located approximately 1 km downstream of the Site, they are unlikely to occur within the Site given the freshwater habitats present at this location and because of the presence of physical barriers such as existing bridges and a weir. These species are therefore considered likely absent from the Site and wider survey area.

#### 4.3.7 Amphibians

Records of common frog *Rana temporaria* and smooth newt *Lissotriton vulgaris* within 2 km of the Site were returned by the NBDC database.

The most recent record of smooth newt was from 2019 within the UG campus. The smooth newt record is within grid M295260 and is located approximately 120 m north of the Site. This grid reference has an accuracy of 100 m so the exact habitat in which the smooth newt was recorded is unknown. However, there are no suitable aquatic

waterbodies (e.g. slow-moving wet ditches or ponds) within the Site. Therefore, smooth newt are presumed to be absent from the Site.

A total of 57 records of common frog were returned from the NBDC within grid square M2824, in which the Site is located. This grid square is 1 km<sup>2</sup> so the exact habitat in which common frog was recorded is unknown, however it is noted to have been recorded in UG campus in which the Site is located. This species is therefore presumed to be present throughout the Site and survey area.

#### 4.3.8 Reptiles

No records of common lizard *Zootoca vivipara* within 2 km of the Site were returned from the NBDC database search. Common lizard was not observed during field surveys and there is no optimal habitat for this species. Therefore, common lizard is presumed to be likely absent from the Site and survey area.

#### 4.3.9 Birds

A total of 41 protected and rare bird species were returned by the NBDC database search within 2 km of the Site. However, the majority of these are identified at the 2 km grid reference M22X resolution. Therefore, it cannot be confirmed if these birds were recorded within or near the Site itself. Furthermore, it cannot be confirmed in many cases whether they were breeding or non-breeding, since the records mostly do not state whether nests or territorial behaviour were observed. The full list of these species is presented in Appendix A.

Waterbird species including common tern, herring gull *Larus argentatus*, lesser black-backed gull *Larus fuscus*, black-headed gull, mute swan *Cygnus olor*, mallard *Anas platyrhynchos*, cormorant, and moorhen *Gallinula chloropus* were identified flying over the Site and/or roosting feeding within the survey area along the River Corrib during the ecological walkover survey. Barn swallow *Hirundo rustica* was also noted flying and feeding over the Site along the River Corrib. As described in Section 4.1.1, common tern, black-headed gull and cormorant are SCI bird species of the Inner Galway Bay SPA and/or Lough Corrib SPA. These species are considered to have both wintering and breeding populations of national importance.

Furthermore, AECOM was informed in June 2021 that an unidentified gull species was observed nesting on one of the existing piers.

#### 4.3.10 Invertebrates

The NBDC database search returned eight species of notable invertebrates within 2 km of the Site.

These were swan mussel *Anodonta cygnea*, ear pond snail *Radix auricularia*, dingy skipper *Erynnis tages* (near threatened), Irish damselfly *Coenagrion lunulatum*, red-shanked bumblebee *Bombus ruderarius*, moss carder-bee *Bombus muscorum*, large bed bailed bumble bee *Bombus lapidaries* and brown may dun *Kageronia fuscogrisea*.

There is suitable habitat for these species within the survey area (e.g. wetland and grassland habitats), but this habitat is sub-optimal due to its limited floral diversity and surrounding hardstanding. While these species may be present within the Site and survey area, they are unlikely to rely on the habitats within the Site as there is plentiful optimal habitat in the surrounding area.

Furthermore, the Lough Corrib SAC in which the Site is located, is designated for freshwater pearl mussel and white-clawed crayfish. The Site is not located within freshwater pearl mussel catchments or white claw crayfish catchments of known extant populations and the Site provides no optimal habitat for either of these species. Both freshwater pearl mussel and white-clawed crayfish are therefore likely absent from the Site and survey area and presumed to be absent within the Site and survey area.

#### 4.3.11 Fish

Four records of European eel *Anguilla anguilla* within 2 km of the Site were returned by the NBDC database.

The River Corrib is been designated for Atlantic salmon (hereafter simply 'salmon'), brook lamprey and sea lamprey. Salmon are likely present within the Site during upstream and downstream migration periods.

A study by NPWS (O'Connor, 2007) on lampreys within the River Corrib river found only one species of lamprey, brook lamprey, to be present upstream of the Galway weir in River Corrib. Although there are records of sea lamprey in some of the tributaries of Lough Corrib, these records pre-date the construction of this weir and it is now believed the weir acts as a barrier to sea lamprey and may also have resulted in the extinction of some

migratory fish species in the River Corrib. It is therefore presumed that brook lamprey is the only lamprey species present within the Site and survey area.

### 4.3.12 Invasive non-native species

#### Flora

Three records of scheduled invasive plant species (i.e. those listed on the Third Schedule of the Habitats Regulations) were returned from the NBDC database within 2 km of the Site. These were giant-rhubarb *Gunnera tinctoria*, Japanese knotweed hybrid *Reynoutria japonica x sachalinensis* = *F. x bohemica* and Spanish bluebell *Hyacinthoides hispanica*.

Canadian waterweed *Elodea canadensis* was the only high impact invasive species returned from the NBDC database. A further five medium impact invasive species were also returned from the NBDC data which were wall cotoneaster *Cotoneaster horizontalis*, narrow-leaved ragwort *Senecio inaequidens*, butterfly-bush three-cornered garlic *Allium triquetrum* and Douglas fir *Pseudotsuga menziesii*.

The ecological walkover survey identified a total of four invasive flora species within the Site and survey area. Three invasive flora species were recorded within the Site. Japanese knotweed (a scheduled invasive species), butterfly-bush (a non-scheduled medium impact invasive species) and sycamore (a non-scheduled medium impact invasive species) were identified in the mixed broadleaved woodland on the western side of the River Corrib, adjacent to the rowing club. The approximate location of the invasive flora species are shown on Figure 3.

Three invasive species were identified within the survey area, Japanese knotweed, winter heliotrope and sycamore were identified in mixed broad-leaved woodland and parkland area located north of the Site and west of the River Corrib within the UG campus. Butterfly-bush was also identified north of the Site on the eastern side of the River Corrib.

#### Fauna

NBDC returned records of seven species of non-scheduled invasive non-native fauna within 2 km of the Site, which included three high impact species: brown rat *Rattus norvegicus*, New Zealand flatworm *Arthurdendyus triangulates*, and American mink *Mustela vison*. Four medium impact species were also identified from records: European rabbit *Oryctolagus cuniculus*, Budapest slug *Tandonia budapestensis*, bank vole *Myodes glareolus*, and common garden snail *Cornu aspersum*.

Zebra mussel (a scheduled high impact invasive species) was identified by ADCO in August 2021 within the Site during an underwater inspection of the in-water components (i.e. bridge piers) associated with the Proposed Development. Zebra mussel was recorded covering much of the submerged area of each pier (up to 80%) and extending into the surrounding riverbed (approximately 45% coverage).

No invasive fauna species were identified during the ecological walkover survey.



## 5. Ecological constraints and recommendations

### 5.1 Approach to the identification of ecological constraints

The Proposed Development should seek to follow the mitigation hierarchy where there is potential for impacts on identified ecological features:

1. avoid features where possible;
2. minimise impact by design, method of working or other measures (mitigation) (e.g. by enhancing existing features); and,
3. compensate for significant residual impacts (e.g. by providing suitable habitats elsewhere on the client-owned parts of the wider site).

This hierarchy requires the highest level to be applied where possible. Only where this cannot reasonably be adopted should lower levels be considered. The rationale for the proposed mitigation and/or compensation should be provided, including sufficient detail to show that these measures are feasible and would be provided.

The likelihood of the relevant ecological features constraining the Proposed Development has been assessed with reference to the scale described in Table 3. The higher the importance of the ecological feature for the conservation of biodiversity at national and local scales, the more likely it is to be a material consideration during determination of the planning application for the Proposed Development.

**Table 3. Scale of constraint / opportunity to the Proposed Development**

<b>Scale of constraint / opportunity</b>	<b>Definition</b>
Major	<p><u>Constraint</u></p> <p>Without further action and/or mitigation on this issue, the project is unlikely to obtain consent (planning application or otherwise, where this is required), and will cause or risk legal offence(s) or non-compliance with policy. In this instance, the Proposed Development was consented in perpetuity in 2002. However, there appeared to have been no consideration of the Proposed Development being located within the Lough Corrib SAC in the original application documentation. Therefore, an AA Screening (and NIS if required) was strongly recommended to ensure compliance. Further action could include survey and/or assessment of ecological features known or deemed likely to occur in the zone of influence. The issue is a material consideration to the consenting process (where required) and the action and/or mitigation required to address it is likely to be significant and/or not straightforward.</p> <p><u>Opportunity</u></p> <p>An opportunity exists to deliver significant ecological enhancement on or close to the Site for the ecological feature(s) in question, which singly or together are of high conservation value. The feature(s) are known to be present within the likely zone of influence or could reliably be predicted to move into it following enhancement. The overall nature conservation benefit of the enhancement(s) is likely to be high.</p>
Moderate	<p><u>Constraint</u></p> <p>Further action and/or mitigation on this issue is likely to be required for the project to obtain consent (planning application or otherwise, where this is required) or may be stipulated by a condition of consent, and without such action there may be legal offence(s) or non-compliance with policy. Further action could include survey and/or assessment, including of ecological features whose status is not yet sufficiently well known within the zone of influence. The action and/or mitigation required to address the issue is however likely to be moderate, and at this stage it is considered unlikely that it would pose a significant consenting risk to the project.</p> <p><u>Opportunity</u></p> <p>An opportunity exists to deliver ecological enhancement on or close to site for the ecological feature(s) in question, which are of moderate conservation value. The feature(s) are known to be present within the likely zone of influence or could reliably be predicted to move into it following enhancement. The overall nature conservation benefit of the enhancement(s) is likely to be moderate.</p>
Minor	<p><u>Constraint</u></p> <p>The project is expected to obtain consent (planning application or otherwise, where this is required) without any further survey or assessment of this issue. However, a basic action is still required pre-construction or during construction, which may be stipulated by a condition of consent, in order to avoid possible legal offence(s) or non-compliance with policy. This is likely to involve ecological features that are not subject to special protection and are common and widespread. The action and/or mitigation required to address the issue is expected to be minimal and is unlikely to hinder the project (for example, clearance of vegetation during specified seasons).</p> <p><u>Opportunity</u></p> <p>An opportunity exists to deliver ecological enhancement likely to benefit relatively common and/or widespread species (e.g. provision of bird nest boxes) or to create or enhance a small area of habitat which is not of very high biodiversity value.</p>
None	<p>There is no constraint on the project because the ecological feature is absent from the Site and zone of influence, or if present then it is not subject to protection and/or it can clearly be determined that there is no possibility of a significant adverse effect.</p>

## 5.2 Constraints and recommendations: nature conservation designations

There is one statutory designated site within the Site boundary and within which the Proposed Development will lie – the Lough Corrib SAC. This European site is designated for a number of habitats and species including otter, salmon, freshwater pearl mussel and white-clawed crayfish.

The Galway Bay SAC located approximately 770 m south of the Proposed Development is also hydrologically linked to the Proposed Development and is designated for a number of habitats and species including harbour seal, otter and reefs.

There are also two European sites located upstream and downstream of the Proposed Development. The Inner Galway Bay SPA and Lough Corrib SPA are located approximately 770 km south and 2.8 km north respectively, and they are designated for a number of breeding and wintering bird populations, primarily waterbirds including

common tern, dunlin, curlew, cormorant, and coot. The River Corrib likely acts as migratory flight path for many of these SCI species, several of which may also forage within the Site.

Due to the presence of several European sites within and otherwise connected to the Site and the Proposed Development, an Appropriate Assessment (AA) Screening will be required. Where this identifies that the Proposed Development may have likely significant effects (LSE) on any European site, in the absence of mitigation, a full Appropriate Assessment and preparation of a Natura Impact Statement (NIS) will be required. It is considered highly likely at this early stage in the design of the Proposed Development that full AA and preparation of an NIS will be required.

In addition to the European sites, there are also two internationally designated Ramsar sites and two nationally designated sites within 2 km of the Proposed Development. The design of the Proposed Development should seek to avoid or minimise impacts on these.

Therefore, due to the likely requirement for full Appropriate Assessment, statutory designated sites for nature conservation pose a **Major constraint** to the Proposed Development.

### 5.3 Constraints and recommendations: habitats

As the Site is located on the Lough Corrib SAC and comprises notable habitats such as the River Corrib and woodlands. Notable habitats are considered to pose a **Major** constraint to the Proposed Development. Consideration of the potential impacts on these habitats, especially the Annex I habitats identified during the site walkover survey, will need to be given by the Appropriate Assessment described above.

Other non-QI habitats are of much lower ecological value. The design of the Proposed Development should seek to minimise the loss or disturbance of semi-natural habitats, where possible. However, these and the other artificial habitats present a **Low constraint**.

### 5.4 Constraints and recommendations: species

#### 5.4.1 Flora

No rare or protected plant species were identified during the walkover survey. However, a detailed plant survey was not carried out for the River Corrib and notable plants may be present. It is therefore recommended that further plant survey of the River Corrib be carried out during the optimal botanical survey period (April to September, inclusive).

Due to the requirement for further survey, rare or protected plant species pose a **Moderate constraint** to the Proposed Development.

#### 5.4.2 Bats

The habitats within the Site and wider survey area, including the River Corrib, woodland, hedgerows, and treelines have high suitability to support commuting and foraging bats. Desk study data confirms the likely presence of all nine Irish species on or near to the Site.

The Proposed Development is to be constructed on existing railway piers located in the River Corrib and will extend to the woodland on each side of the River Corrib. Therefore, bat foraging and commuting habitat will be lost and/or potentially fragmented by the Proposed Development.

Artificial lighting installed on the new bridge or otherwise associated with the Proposed Development could impact bat on bat foraging and commuting as several species are known to avoid areas illuminated by artificial lighting. The design of the Proposed Development must therefore seek to avoid the use of artificial lighting, or will require to adopt lighting which does not cause pollution of the River Corrib and surrounding habitats. This will need to be informed by a lighting specialist, working collaboratively with an ecologist. The potential for bat habitat fragmentation and/or degradation will be a key consideration of the Appropriate Assessment, as lesser horseshoe bat is a QI species of Lough Corrib SAC, Lough Fingall Complex SAC and East Burren Complex SAC. Likewise, the use of artificial lighting on the Site during the construction phase should also be avoided or minimised as far as possible and any artificial lighting required should be directed to minimise light spill onto notable habitats such as the River Corrib and woodland.

To clearly establish the significance of the impacts from the Proposed Development on bats, further surveys are required during the optimal survey period of May to September, inclusive. These will likely involve bat activity



transects, as well as vantage point watches to monitor use of the River Corrib by bats for foraging and/or commuting.

Given the scale and location of the Proposed Development within the River Corrib, bats are considered a **Major constraint**.

### 5.4.3 Otter

Otter are a QI of the River Corrib SAC. This species is known to be present in the river and it is highly likely that individuals use the Site for foraging and/or commuting. The Proposed Development is to be constructed on existing railway piers located in the River Corrib and will likely involve minimum in-stream works, such as use of temporary floating pontoons or boats that will not impact the riverbed. Any works (particularly in-stream works) associated with the Proposed Development have the potential to directly impact otter (e.g. injury or disturbance to commuting and/or feeding otter) or indirectly impact otter (e.g. water pollution). Given the location of the Proposed Development within the River Corrib, otter are therefore considered a **Major constraint**.

Although no evidence of otter was recorded within the Site, on a precautionary basis the following mitigation measures should be implemented:

- any excavations will be left with a means of escape (such as a ramp or slope) for any otters or other animals that may enter overnight. Excavations will be checked at the start of each working day to ensure no animals are trapped within them. Alternatively, small excavations may be covered completely overnight; and,
- any open pipes will be capped overnight to prevent entry of animals.

Targeted otter surveys within the Site and along the River Corrib are recommended. This survey can be carried out year-round.

Consideration of the potential impacts on otter will be required as part of the Appropriate Assessment described above.

### 5.4.4 Badger

No badger setts or evidence of badger activity were identified during the walkover survey. Furthermore, there is limited habitat suitability for badgers and this species is therefore considered to present a **Minor constraint**.

Furthermore, the same general measures to prevent entrapment of animals overnight described above for otter will be implemented for badger, i.e. provision of means of escape from excavations or covering overnight and capping of open pipes overnight.

On a precautionary basis, pre-construction badger surveys are recommended to ensure no setts have been established within the Site or zone of influence since this PEAR was prepared.

### 5.4.5 Other terrestrial mammals

Pygmy shrew, hedgehog, red squirrel, Irish hare are potentially present within the Site. General measures to prevent entrapment of animals overnight set out above for otter will be implemented for these mammals, i.e. provision of means of escape from excavations or covering overnight, and capping of open pipes overnight.

These mammal species are considered to pose a **Minor constraint** given the ease of implementing the above measures.

### 5.4.6 Amphibians

There is no suitable aquatic habitat for smooth newt. However, common frog may be present within the Site and survey area. The River Corrib itself provides limited suitability for common frog due to the size / flow of the watercourse and presence of fish (which predate on frogs).

On a precautionary basis, to ensure the protection of common frog, the following mitigation measures are recommended:

- preventing pollution (including siltation) of watercourses and reed beds;
- storing any chemicals in an appropriate container in a suitable storage area;

- reducing soil exposure during the works; and,
- maintaining the hydrology of the watercourses.

Amphibians are considered to pose a **Minor constraint** to the Proposed Development.

## 5.4.7 Reptiles

Common lizard is presumed to be absent from the Site as it was not observed during field surveys and there is no optimal habitat for this species. Therefore, common lizard is considered to pose **no constraint** to the Proposed Development.

## 5.4.8 Birds

### 5.4.8.1 Breeding birds

There is potential for common breeding birds in the woodland habitats located within the Site on either side of the River Corrib. Red Listed breeding bird species may occur in the Site during the breeding season, such as grey wagtail *Motacilla cinerea*. However, these species are nevertheless fairly common, there will be no significant loss of their habitat and mitigation to avoid offences regarding active nests is the same as for other likely breeding birds, as set out below. AECOM was informed in June 2021 that an unidentified gull species was observed nesting on one of the existing piers within the Site. It is possible that this may have been an SCI species of the Inner Galway Bay SPA and/or Lough Corrib SPA.

All bird species are protected under the Irish Wildlife Acts from intentional killing or injury, and disturbance during the breeding season (March 1st to August 31st, inclusive). The protection extends to the eggs, young, and nests of birds.

Therefore, works on the existing piers and/or removal of woody vegetation (including scrub) to facilitate the Proposed Development should not be undertaken during the bird breeding season, where possible. If works on the existing piers or vegetation removal cannot be avoided during the breeding season, and as a last resort suitable for smaller areas of vegetation only, a suitably experienced ecologist will check for active bird nests prior to the works taking place. Where active nest(s) are found, the ecologist would establish exclusion zone(s) of appropriate size from which machinery, personnel and materials will be excluded until the nesting attempt(s) have finished. Note that the latter method of checking for active nests may result in project delays, therefore the preferred method is to carry out required works on existing piers and vegetation clearance outside the bird breeding season.

Furthermore, as detailed in Section 5.2.1, the Proposed Development is located on the River Corrib between two SPAs – the Inner Galway Bay SPA and Lough Corrib SPA – these are designated for breeding populations of waterbird species including common tern, Artic tern, sandwich tern, black-headed gull and common gull. The operational phase of the Proposed Development may affect SCI species as they commute and/or forage along the River Corrib.

In accordance with Action 18 of the *Galway City Biodiversity Action Plan 2014-2024* as described in Section 2.3.4, further targeted breeding bird surveys are recommended. This will include general breeding bird surveys of the Site and wider survey area, in addition to vantage point watches to determine use of the River Corrib within the Site for foraging and/or commuting by SCI species. The surveys should be carried out between March and August, inclusive.

Consideration of the potential impacts of the Proposed Development on SCI species of the Inner Galway Bay SPA and Lough Corrib SPA will be required as part of the Appropriate Assessment described above.

Given the potential presence of a nesting SCI gulls species on the existing pier and the potential for the Proposed Development to disturb SCI breeding species commuting/feeding along the River Corrib, breeding birds are considered to be a **Major constraint** to the Proposed Development.

### 5.4.8.2 Non-breeding birds

As detailed in Section 5.2.1, the Proposed Development is located in the River Corrib between two SPAs – the Inner Galway Bay SPA and Lough Corrib SPA. The majority of the SCI species of these European sites –are regularly-occurring migratory waterbirds, including pochard, Greenland white-fronted goose, gadwall, shoveler, tufted duck, coot, golden plover.

The Proposed Development could result in direct impacts, such as injury, or indirect impacts such as disturbance and/or displacement of birds from using the River Corrib in the immediate vicinity of the Proposed Development.

The River Corrib is likely to be an important commuting route for wintering SCI birds between the Inner Galway Bay SPA and Lough Corrib SPA. Therefore, fragmentation of this commuting route could occur from the Proposed Development.

As described for the breeding season, it is therefore recommended that vantage point watches covering the Site and surrounding area are carried out to establish the use of the River Corrib by foraging and/or commuting birds during the non-breeding season (September to February, inclusive).

Consideration of the potential impacts of the Proposed Development on SCI species of the Inner Galway Bay SPA and Lough Corrib SPA will be required as part of the Appropriate Assessment described above.

In the absence of mitigation, and due to the likely use the Site by non-breeding SCI bird species non-breeding birds are therefore considered to present a **Major constraint** to the Proposed Development.

#### 5.4.9 Invertebrates

The Lough Corrib SAC is designated for freshwater pearl mussel and white-clawed crayfish, however as described in Section 4.3.10, these are likely absent from the Site and survey area. There are also potentially swan mussel, ear pond snail, dingy skipper (near threatened), Irish damselfly, red-shanked bumblebee, moss carder-bee, large red-tailed bumble bee and brown may dun *Kageronia fuscogrisea* invertebrates present within the Site.

However, the habitats directly affected by the Proposed Development provide very limited opportunity for notable invertebrates, due to its limited floral diversity and surrounding hardstanding. Therefore, based on the habitats present within the Proposed Development footprint and the provision of pollution prevention mitigation to avoid impacts on all habitats, effects on any of notable invertebrates are unlikely.

Therefore, invertebrates are considered to pose a **Minor constraint** to the Proposed Development.

#### 5.4.10 Fish

The Lough Corrib SAC is designated for salmon, brook lamprey and sea lamprey. There are also potentially European eel present within the Site. The Proposed Development could interrupt this important commuting route for fish via direct fragmentation and/or polluting events.

Survey for fish species is therefore recommended at appropriate times of year to account for the migratory period of difference species. This is likely to involve electric-fishing within the Site and surrounding watercourse.

One of the key impacts of the Proposed Development on fish species would be disturbance due to in-stream works. It is therefore highly likely that any in-stream works or works which could generate significant underwater noise, will be required to avoid the key migratory period for fish species.

Full consideration of the potential effects of the Proposed Development on QI fish species will be required as part of the Appropriate Assessment.

Therefore, fish pose a **Major constraint** to the Proposed Development.

#### 5.4.11 Invasive non-native species

##### Flora

Japanese knotweed is the only scheduled flora species present within Site. There is a risk that the Proposed Development could cause the spread of invasive non-native species (including Japanese knotweed) in the wild, which is an offence under the Third Schedule of the EC (Birds and Natural Habitats) Regulations 2011 and 2015 (S.I. No. 477/2011), and there are provisions that govern control of such species. It is an offence to release or allow to disperse or escape, to breed, propagate, import, transport, sell or advertise species listed on the Third Schedule (including Japanese knotweed). This therefore presents a **Major constraint** as this species could easily spread. To demonstrate due diligence and avoid the accidental spread of non-native species, it is recommended that an Invasive Species Management Plan (ISMP) is produced prior to any construction works.

Other non-scheduled invasive species identified within the Site and survey include butterfly-bush, sycamore and winter heliotrope. As a non-scheduled invasive species, there is no legal requirement to manage or control these species. However, as good practice, these species should be avoided, where possible. It is recommended that



the ISMP includes these non-scheduled invasive species and pre-construction surveys be carried out to determine the spread of invasive within the Site and zone of influence.

Invasive non-native plants are therefore a **Moderate constraint** to the Proposed Development, in that further survey and the production of a ISMP are recommended.

### **Fauna**

Zebra mussel is the only scheduled fauna species present within the Site. There is a risk that the Proposed Development could cause the spread of this invasive non-native species in the wild, which is an offence under the Third Schedule of the EC (Birds and Natural Habitats) Regulations 2011 and 2015 (S.I. No. 477/2011), and there are provisions that govern control of such species. It is an offence to release or allow to disperse or escape, to breed, propagate, import, transport, sell or advertise species listed on the Third Schedule (including zebra mussel). This therefore presents a **Major constraint** as this species could easily spread. To demonstrate due diligence and avoid the accidental spread of non-native species, it is recommended that an Invasive Species Management Plan (ISMP) is produced prior to any construction works.

## 6. Summary

In summary, the Proposed Development lies directly within one European site and is clearly connected to several others. A suite of further surveys is therefore required to establish use of the Site by the QI / SCI species of these European sites. These surveys include:

- further plant survey of the River Corrib to be carried out during the optimal botanical survey period (April to September, inclusive);
- bat activity transects, as well as vantage point watches to monitor use of the River Corrib by bats for foraging and/or commuting during the optimal survey period (May to September, inclusive);
- targeted otter surveys within the Site and along the River Corrib which can be carried out year-round;
- pre-construction badger surveys within the Site;
- if works on the existing piers or vegetation removal cannot be avoided during the breeding season, and as a last resort, a suitably experienced ecologist will check for active bird nests prior to the works taking place;
- general breeding bird surveys of the Site and wider survey area, in addition to vantage point watches to determine use of the River Corrib within the Site for foraging and/or commuting by SCI species during the breeding season. The surveys should be carried out between March and August, inclusive;
- vantage point watches covering the Site and surrounding area are carried out to establish the use of the River Corrib by foraging and/or commuting birds during the non-breeding season (September to February, inclusive); and,
- survey for fish species to be carried out at appropriate times of year to account for the migratory period of difference species. This is likely to involve electric-fishing within the Site and surrounding watercourse.

A full Appropriate Assessment will almost certainly be required, and consideration will need to be given to how the design of the Proposed Development can avoid, including through the use of mitigation, significant adverse effects on these European sites. At a high level, design and/or mitigation measures which are very likely to be required include: avoiding the use of artificial lighting; designing the bridge so as to allow the continued free movement of bats, birds, fish and otter along the watercourse; and, timing works to avoid key periods such as fish migratory season. A range of other standard measures, such as pollution prevention techniques, will also be essential.

For other ecological features not associated with European sites, it is recommended that a full Ecological Impact Assessment (EclA) is completed (either as a standalone exercise or as part of a wider Environmental Impact Assessment for the Proposed Development). This will ensure compliance with *Galway County Heritage and Biodiversity Plan 2017 – 2022* objectives including NH 4.3 and NH 4.10 as described in Section 2.3.3 and that notable habitats and species not directly associated with European sites are protected.

It is also recommended that an Invasive Species Management Plan is prepared, setting out how invasive non-native species (e.g., Japanese knotweed and zebra mussel) will be managed during the construction phase of the Proposed Development.

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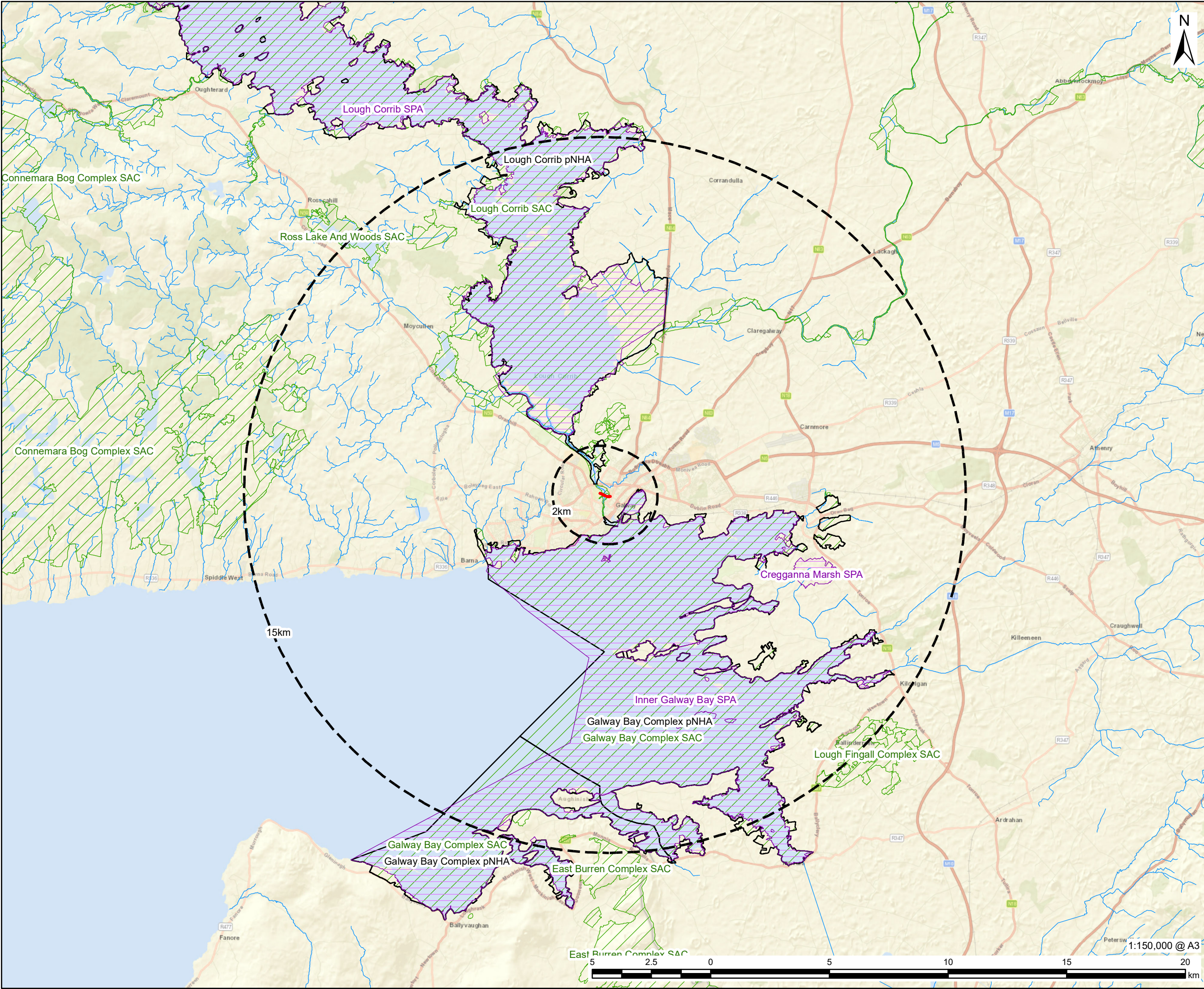
## **8. Figures**

Figure 1 – Location of the Proposed Development and designated sites

Figure 2 – Habitats

Figure 3 – Notable species identified during ecological walkover surveys





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# AECOM

## PROJECT

Clifden Railway  
Pedestrian and Cycle  
Bridge Galway

## CLIENT

Galway City Council

## CONSULTANT

AECOM Limited  
4th Floor, Adelphi Plaza  
George's Street Upper  
Dun Laoghaire, Co Dublin, A96 T927  
www.aecom.com

## LEGEND

- Proposed Development
- Watercourses
- Study Area Buffer
- Special Protection Area
- Special Area of Conservation
- Proposed Natural Heritage Area

## NOTES

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

## ISSUE PURPOSE

FINAL

## PROJECT NUMBER

6065050

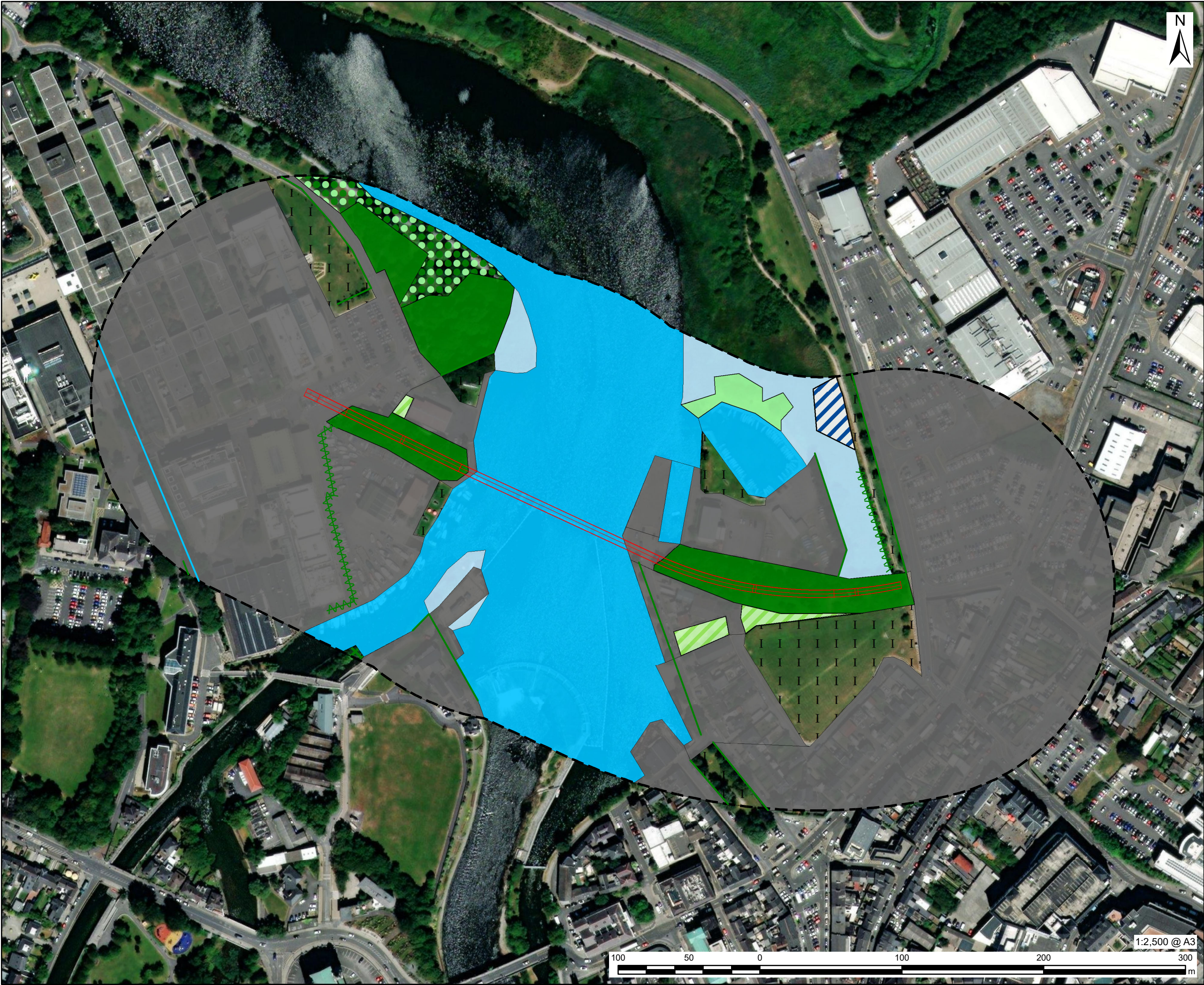
## FIGURE TITLE

Designated sites

## FIGURE NUMBER

Figure 1





AECOM

PROJECT

Clifden Railway  
Pedestrian and Cycle  
Bridge Galway

CLIENT

Galway City Council

CONSULTANT

AECOM Limited  
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LEGEND

Proposed Development

Survey Area

Habitat type (Fossitt)

FW3 - Canals

WL1 - Hedgerows

WL2 - Treelines

BL3 - Buildings and artificial surfaces

FS1 - Reed and large sedge swamps

FS1 - Reed and large sedge swamps (Annex I 7140)

FW2 - Depositing / lowland rivers

GA2 - Amenity grassland

GS2 - Dry meadows and grassy verges

WD1 - (Mixed) broadleaved woodland

WD5 - Scattered trees and parkland

WN5 - Riparian woodland

WS1 - Scrub

NOTES

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PROJECT NUMBER

6065050

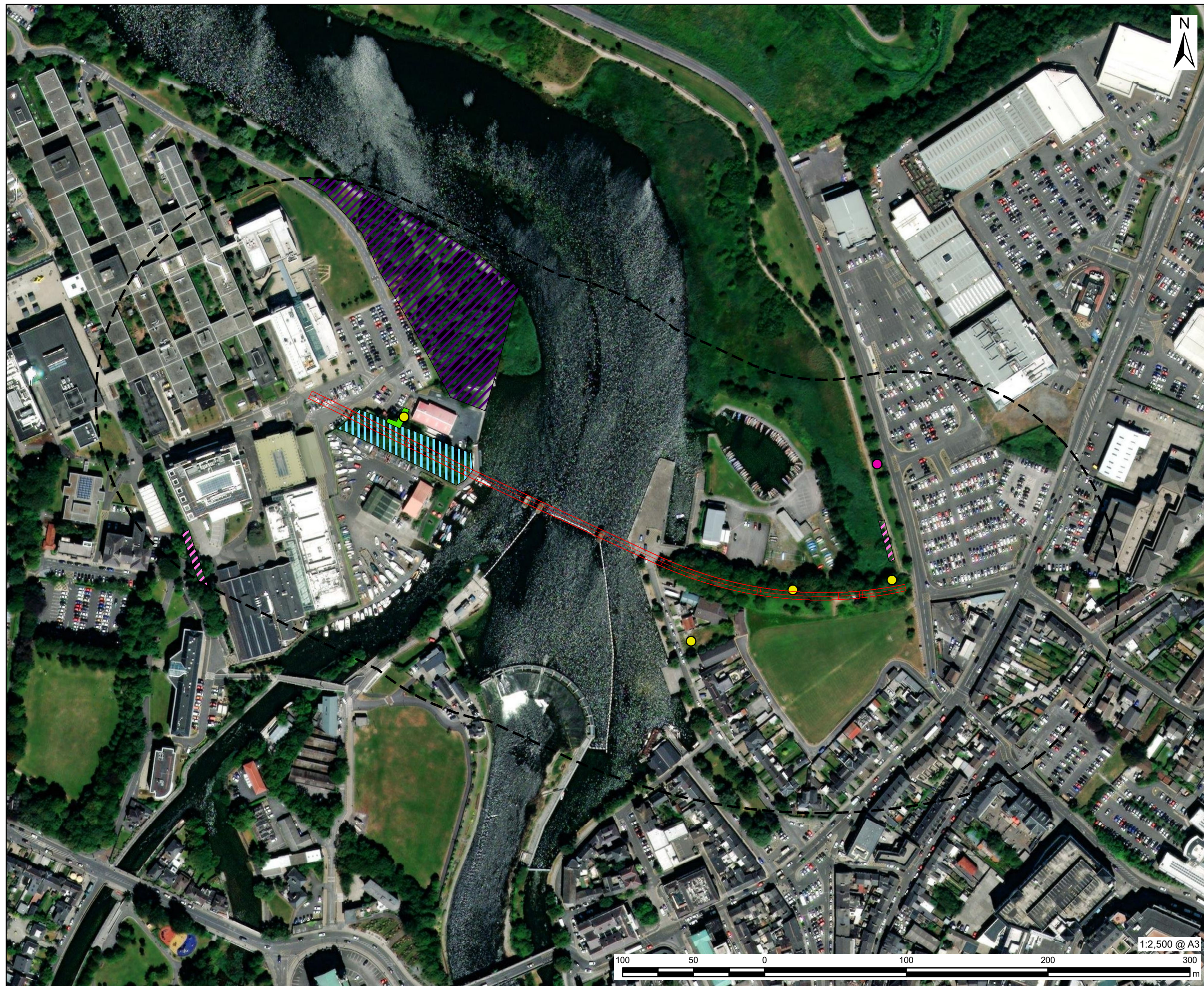
FIGURE TITLE

Habitats

FIGURE NUMBER

Figure 2





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## Appendix A NBDC desk study results

**Table A1. Notable species records returned by NBDC within 2 km of the Site**

Taxon	Species	Scientific name	Conservation designation(s)
Amphibian	Common frog	<i>Rana temporaria</i>	WA
	Smooth newt	<i>Lissotriton vulgaris</i>	WA
Bird	Barn swallow	<i>Hirundo rustica</i>	WA, BoCCI Amber List
	Bar tailed godwit	<i>Limosa lapponica</i>	WA, BoCCI Red List
	Black guillemot	<i>Cephus grylle</i>	WA, BoCCI Amber List
	Black-headed gull	<i>Larus ridibundus</i>	WA, BoCCI Amber List
	Brent goose	<i>Branta bernicla</i>	WA, BoCCI Red List
	Common coot	<i>Fulica atra</i>	WA, BoCCI Amber List
	Common linnet	<i>Carduelis cannabina</i>	WA, BoCCI Amber List
	Common redshank	<i>Tringa totanus</i>	WA, BoCCI Red List
	Common starling	<i>Sturnus vulgaris</i>	WA, BoCCI Amber List
	Curlew	<i>Numenius arquata</i>	WA, BoCCI Red List
	Dunlin	<i>Calidris alpina</i>	WA, BoCCI Red List
	Eurasian oystercatcher	<i>Haematopus ostralegus</i>	WA, BoCCI Red List
	Eurasian teal	<i>Anas crecca</i>	WA, BoCCI Amber List
	Eurasian wigeon	<i>Anas penelope</i>	WA, BoCCI Red List
	European golden plover	<i>Pluvialis apricaria</i>	WA, BoCCI Red List
	European shag	<i>Phalacrocorax aristotelis</i>	WA, BoCCI Amber List
	Great cormorant	<i>Phalacrocorax carbo</i>	WA, BoCCI Amber List
	Great northern diver	<i>Gavia immer</i>	WA, BoCCI Amber List
	Herring gull	<i>Larus argentatus</i>	WA, BoCCI Amber List
	House martin	<i>Delichon urbicum</i>	WA, BoCCI Amber List
	House sparrow	<i>Passer domesticus</i>	WA, BoCCI Amber List
	Lesser black-backed gull	<i>Larus fuscus</i>	WA, BoCCI Amber List
	Little egret	<i>Egretta garzetta</i>	BirdsDir A1; WA;
	Little gull	<i>Larus minutus</i>	WA, BoCCI Amber List
	Mallard	<i>Anas platyrhynchos</i>	WA, BoCCI Amber List
	Mediterranean gull	<i>Larus melanocephalus</i>	WA, BoCCI Amber List
	Mute swan	<i>Cygnus olor</i>	WA, BoCCI Amber List
	Northern lapwing	<i>Vanellus vanellus</i>	WA, BoCCI Red List
	Northern wheatear	<i>Oenanthe oenanthe</i>	WA, BoCCI Amber List
	Peregrine falcon	<i>Falco peregrinus</i>	BirdsDir A1; WA; BoCCI Amber List
	Razorbill	<i>Alca torda</i>	WA, BoCCI Red List
	Red-breasted merganser	<i>Mergus serrator</i>	WA, BoCCI Amber List
	Red-throated diver	<i>Gavia stellata</i>	WA, BoCCI Amber List
	Ringed plover	<i>Charadrius hiaticula</i>	WA, BoCCI Amber List
	Sand martin	<i>Riparia riparia</i>	WA, BoCCI Amber List
	Sandwich tern	<i>Sterna sandvicensis</i>	WA, BoCCI Amber List
	Sky lark	<i>Alauda arvensis</i>	WA, BoCCI Amber List
	Tufted duck	<i>Aythya fuligula</i>	WA, BoCCI Red List

Taxon	Species	Scientific name	Conservation designation(s)
	Twite	<i>Carduelis flavirostris</i>	WA, BoCCI Red List
	Willow warbler	<i>Phylloscopus trochilus</i>	WA, BoCCI Amber List
Fish	European eel	<i>Anguilla anguilla</i>	CR
Invertebrate - bee	Large red tailed bumble bee	<i>Bombus lapidarius</i>	NT
	Moss carder-bee	<i>Bombus muscorum</i>	NT
	Red-shanked bumble bee	<i>Bombus rudericus</i>	VU
Invertebrate - butterfly	Dingy skipper	<i>Erynnis tages</i>	NT
Invertebrate - dragonfly	Irish Damselfly	<i>Coenagrion lunulatum</i>	VU
Invertebrate - mayfly	Brown may dun	<i>Kageronia fuscogrisea</i>	NT
Invertebrate - mollusc	swan mussel	<i>Anodonta cygnea</i>	VU
	ear pond snail	<i>Radix Auricularia</i>	VU
	Budapest slug	<i>Tandonia budapestensis</i>	Med Inv
	Common garden snail	<i>Cornu aspersum</i>	Med Inv
Invertebrate - flatworm	New Zealand flatworm	<i>Arthurdendyus triangulatus</i>	High Inv
Mammal - bat	Common pipistrelle	<i>Pipistrellus pipistrellus</i>	HabDir; WA
	Daubenton's bat	<i>Myotis daubentonii</i>	HabDir; WA
	Lesser noctule	<i>Nyctalus leisleri</i>	HabDir; WA
	Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	HabDir; WA
Mammal – terrestrial other	American mink	<i>Mustela vison</i>	Sch Inv
	Bank vole	<i>Myodes glareolus</i>	Med Inv
	Brown rat	<i>Rattus norvegicus</i>	High Inv
	Eurasian badger	<i>Meles meles</i>	WA
	Eurasian pygmy shrew	<i>Sorex minutus</i>	WA
	Eurasian red squirrel	<i>Sciurus vulgaris</i>	WA
	European otter	<i>Lutra lutra</i>	HabDir; WA
	European rabbit	<i>Oryctolagus cuniculus</i>	Med Inv
	Irish hare	<i>Lepus hibernicus</i>	WA
	West European hedgehog	<i>Erinaceus europaeus</i>	WA
Mammal - marine	Bottle-nosed dolphin	<i>Tursiops truncatus</i>	WA
	Common porpoise	<i>Phocoena phocoena</i>	WA
	Common seal	<i>Phoca vitulina</i>	WA
	Grey seal	<i>Halichoerus grypus</i>	WA
	Striped dolphin	<i>Stenella coeruleoalba</i>	WA
Plant	Butterfly-bush	<i>Buddleia davidii</i>	Med Inv
	Canadian waterweed	<i>Elodea canadensis</i>	High Inv
	Japanese knotweed hybrid	<i>Fallopia japonica x sachalinensis = F. x bohemica</i>	Sch Inv; High Inv
	Giant-rhubarb	<i>Gunnera tinctoria</i>	Sch Inv; High Inv
	Green field-speedwell	<i>Veronica agrestis</i>	NT
	Mountain liverwort	<i>Marchantia polymorpha</i>	FPO, EN



Taxon	Species	Scientific name	Conservation designation(s)
	Narrow-leaved ragwort	<i>Senecio inaequidens</i>	Med Inv
	Slender tufted-sedge	<i>Carex acuta</i>	NT
	Spanish bluebell	<i>Hyacinthoides hispanic</i>	Sch Inv; High Inv
	Strawberry-tree	<i>Arbutus unedo</i>	NT
	Three-cornered garlic	<i>Allium triquetrum</i>	High Inv
	Wall cotoneaster	<i>Cotoneaster horizontalis</i>	Med Inv

HabDir – Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora ('Habitats Directive');

BirdsDir A1– Annex 1 of the Directive 2009/147/EC on the conservation of wild birds ('Birds Directive').

WA – The Wildlife Acts 1976 to 2018 and the Wildlife (Amendment) Act 2000 ('Wildlife Acts').

FPO – Flora Protection Order.

IFA – Irish Fisheries Acts

BoCCI Red List – Birds of Conservation Concern in Ireland on the Red List.

BoCCI Amber List – Birds of Conservation Concern in Ireland on the Amber List.

Irish Red List status (CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near Threatened, DD - Data deficient).

Sch Inv - Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) (as amended).

High Inv – high-impact invasive species in Ireland; Med Inv – medium-impact invasive species in Ireland

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## **Appendix F Archaeological Assessment Report**



# Clifden Railway Pedestrian and Cycle Bridge Galway

Archaeological Desk-based Assessment

Galway City Council

March 2023

## Quality information

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# 1. Introduction

- 1.1 This Archaeological Desk-based assessment has been prepared by AECOM on behalf of Galway City Council ('the Client') to inform the development of a proposed pedestrian and cycle river crossing over the River Corrib (hereafter referred to as the 'Proposed Development') in Galway City (Figure 1).

## 2. The Proposed Development

- 2.1 The Proposed Development seeks to provide an architecturally sensitive river crossing in the form of a pedestrian and cycle bridge over the River Corrib. This bridge will provide a link between the University of Galway (UG) and the Dangan area, to the west of the River Corrib, with the City Centre area, including Dyke Road and Headford Road areas, to the east.
- 2.2 It is proposed that this pedestrian and cycling bridge will be placed on the old Clifden Railway Line abutments and piers located at Woodquay in Galway City (Figure 2). The proposed pedestrian and cycle bridge was originally developed as a Millennium Project, with planning permission granted by An Bord Pleanála (Ref. PL 07.ER2012) in 2002 for a cable stayed bridge on the existing piers. This bridge has not been constructed, but support for the project remains high.
- 2.3 The bridge is considered a key feature in Galway Transport Strategy City Cycle Network (GCC, 2016) and will link into the Dublin-Galway, Galway-Barna and Galway-Clifden Greenways which will merge in Galway City. It is an objective in the Galway City Development Plan 2023-2029 (GCC, 2022) to provide a bridge on the piers of the old Clifden Railway Bridge.
- 2.4 This assessment is intended to provide baseline information on the cultural heritage significance and archaeological potential of the site and surrounding area, in order to inform the development of options for taking forward the bridge project and ultimately achieving the objectives of the Galway City Development Plan 2023-2029.
- 2.5 The old Clifden Railway Line abutments and piers are recorded as a Protected Structure (RPS 8601) on the Galway City Development Plan 2023-2029 and on the National Inventory of Architectural Heritage as NIAH 30309001.

## 3. Scope

- 3.1 This Archaeological Desk-based assessment is concerned with the cultural heritage resource. This comprises archaeological assets, architectural heritage and designed landscapes such as gardens and demesnes. This baseline also considers the setting of these heritage assets, which can be described as the surroundings in which the heritage assets are experienced and appreciated.
- 3.2 The main objectives of the Archaeological Desk-based assessment are:
- to identify cultural heritage assets within the red line boundary of the Proposed Development site and associated study area which extends 300m from the boundaries of the Proposed Development site;
  - to assess the baseline information and offer an analysis of the potential for currently unrecorded archaeological assets within the Proposed Development site;
  - to assess the importance of the cultural heritage assets;
  - to assess the potential impact of the proposed development on cultural heritage assets within the Proposed Development site; and
  - to assess the potential impact of the Proposed Development on the settings of designated cultural heritage assets within the settings assessment study area which extends 300m from the site boundaries.



## 4. Methodology

### 4.1 Legislation and Guidance

4.1.1 This Archaeological Desk-based assessment has been undertaken in accordance with all relevant legislation, policies and guidelines. The documents utilised in the preparation of this study include:

- National Monuments Acts (1930 – 2004);
- The Heritage Act 1995 (as amended);
- National Heritage Plan (2002);
- Planning and Development Acts 2000 – 2020;
- Galway City Development Plan 2023 – 2029 (GCC, 2022);
- EPA's draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017);
- Department of the Environment, Heritage and Local Government's (DEHLG) 'Government Policy on Architecture 2009 – 2015' (DEHLG, 2009); and
- Department of Arts, Heritage and the Gaeltacht's (DAHG) 'Architectural Heritage Guidelines, Guidelines for Planning Authorities' (DAHG, 2011).

### 4.2 Local and National Policy Framework

#### Galway City Development Plan 2023 - 2029

- 4.2.1 Local Heritage policy for Galway City is contained within Chapter 8 of the Galway City Development Plan 2023 – 2029 published in 2022 by Galway City Council. The primary aim of the heritage policies contained within the plan are to create a high quality, sustainable built environment and to enhance the distinctive character of the city, through the protection of the built and archaeological heritage and through high quality architecture and urban design.
- 4.2.2 The development plan notes that Galway has exceptionally strong links with the past which are evident in the built form, architecture and archaeology of the city. In particular, the *'city centre has a distinct physical character, with narrow streets, contrasting buildings, canals, millraces. The natural landscape and relationship with the River Corrib and Galway Bay also contributes to creating a unique urban setting'* (GCC, 2022). From this, part of the strategy within the development plan is to protect and enhance the built and archaeological heritage of the city.
- 4.2.3 The Development Plan recognises that Galway has a significant number of buildings and structures which are deemed worthy of protection and have been included on the Record of Protected Structures. For Protected Structures, there are a number of objectives in place to safeguard this resource. The policy directly relevant to this study is Policy 8.2 Built Heritage- Record of Protected Structures which outlines the following:
- Protect structures listed in the Record of protected Structures, in accordance with legislation and DEHLG Architectural Heritage Protection Guidelines 2011
  - Ensure new development enhances the character or setting of a protected structure.
  - Avoid protected structures becoming endangered by neglect or otherwise by taking timely appropriate.
  - Have regard to the National Inventory of Architectural Heritage in the assessment of development.
  - Consider the inclusion of buildings and structures of special interest or of distinctive heritage value in the Record of Protected Structures (RPS) and consider any recommendations for inclusion in the RPS made by Ministerial Recommendation
  - Consult with the DHLGH and have regard to recommendations of the DHLGH on planning applications relating to protected structures
  - Implement proactive measures to encourage the conservation of protected structures.

- Promote sustainable building design, best conservation practice and the appropriate maintenance, adaption and reuse of historic buildings.

4.2.4 The development plan also recognises that Galway has a rich archaeological heritage which extends from the Mesolithic, medieval and post-medieval periods which includes considerable industrial heritage. This industrial heritage highlights the historic relationships between the city and its various waterways including the River Corrib, canals and millraces. Policy 8.4 relates to archaeology with the following directly relevant to this study:

- Protect and promote the archaeological heritage of the city.
- Ensure that proposed development within the designated city centre Zone of Archaeological Notification is not detrimental to the character of an archaeological site or its setting.
- Have regard to the archaeological recommendations of the DHLGH on any planning applications.
- Endorse the sustainable use of archaeological heritage as an educational and cultural resource and promote public awareness of the archaeological heritage of the city.
- Require the surveying, recording or excavation of archaeological heritage to include standing historic buildings and underwater archaeological heritage during the development process, where appropriate.
- Seek the preservation in situ or, at a minimum, preservation by record of archaeological sites/monuments included in the Record of Monuments and Places and of previously unknown sites, features or objects of archaeological interest that are revealed through development activity.
- Ensure that any development proposal with potential to impact on archaeological heritage, including the setting and amenity of sites and monuments, includes for an archaeological assessment. This includes within terrestrial, riverine, lacustrine, marine inter-tidal and sub-tidal environments.
- Protect the archaeological heritage of the city.
- Have regard to the archaeological recommendations of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs on any planning applications.
- Endorse the sustainable use of archaeological heritage as an educational and cultural resource and promote public awareness of the archaeological heritage of the city.
- Require the surveying, recording or excavation of archaeological heritage during the development process where appropriate.
- Ensure that any development proposal with potential to impact on archaeological heritage includes for an archaeological assessment. This includes within terrestrial, riverine, inter-tidal and sub-tidal environments.

Policy 8.5 also seeks to Promote the protection of the varied industrial heritage of the city and encourage greater appreciation and public awareness of this heritage.

4.2.5 Other aspects of the Development Plan are also applicable to this study and tie directly to the aim of the Proposed Development. Chapter 4 Sustainable Mobility and Transportation notes that an aim to improve pedestrian access around the city will be to:

- Provide a new pedestrian and cycle bridge on the piers of the Old Clifden Railway Line from the Headford Road Regeneration area to University of Galway Campus.

## 4.3 Sources

4.3.1 The preparation of the baseline was informed by material gathered and collated from various online and written sources, including:

- National Monuments Service (NMS) and Archaeological Survey of Ireland (ASI);
- National Inventory of Architectural Heritage (NIAH);
- Galway City Development Plan 2023-2029, Record of Protected Structures; and
- Written source material on the River Corrib Viaduct and the history of Galway city.

4.3.2 The Proposed Development was subject to a previous Environmental Impact Statement (EIS) prepared in 2001 (Ryan Hanley Consulting Engineers, 2001). This EIS included a Cultural Heritage

survey of the site and a desk study carried out by Markus Casey, Consultant Archaeologist which has been used to inform the present assessment. Field assessment for the current project included an underwater inspection report (ADCO 2021) the results of which have been used to inform the baseline.

## 4.4 Determination of the Baseline Environment and Study Area

- 4.4.1 A study area of 300m from the site boundary has been used to identify all known and potential cultural heritage (archaeological, architectural heritage and designed landscapes) assets. This study area is illustrated on Figure 3. Heritage data from all sources has been identified within this 300m buffer. The size of this study area enabled a detailed examination of the heritage assets surrounding the site, in order to provide sufficient archaeological and historical contextual information and allow an assessment of the archaeological potential of the site to be made.

## 4.5 Assessing the Importance of Heritage Assets

- 4.5.1 A heritage asset is defined as a monument, building, group of buildings and sites, which are the combined works of nature and man constituting the historic or built environment (UNESCO 1972). A heritage asset's value is not solely expressed through any designated status but can also be exhibited through a series of values or special interests. These include architectural, historical, artistic, archaeological, cultural, scientific, social or technical interests. In order to assess the potential effects of a development upon a heritage asset, it must first be assigned a level of importance. This can be done in accordance with a four-point scale (Table.1). This table has been derived from the following guidance, with reference to relevant legislation and policy, and using professional judgement:

- Department of Arts, Heritage and the Gaeltacht, 2013, NIAH Handbook;
- Environmental Protection Agency, 2017, Draft Guidelines on Information to be Contained in Environmental Impact Assessment Reports;
- Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs and Transport Infrastructure Ireland, June 2017;
- National Roads Authority (2005a), Guidelines for the Assessment of Archaeological Heritage Impacts (particularly Appendix 2, Significance Criteria); and
- National Roads Authority (2005b), Guidelines for the Assessment of Architectural Heritage Impacts (particularly Table 8).

**Table.1: Factors Determining the Importance of Heritage Assets**

IMPORTANCE	CRITERIA
National/High	<p>National Monuments.</p> <p>Recorded Monuments deemed to be of high importance using legislation, EPA guidance, NRA Significance Criteria and professional judgement.</p> <p>Protected Structures deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Structures recorded by the NIAH Building Survey with a National Rating or deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Designed landscapes recorded by the NIAH Garden survey with main features substantially present and deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Architectural Conservation Areas containing structures and/or designed landscapes of predominantly national importance.</p> <p>Undesignated archaeological remains which are rare or complex in nature, and deemed to be of high importance using legislation, EPA guidance, NRA Significance Criteria and professional judgement.</p>
Regional /Medium	<p>Recorded Monuments deemed to be of medium importance using legislation, EPA guidance, NRA Significance Criteria and professional judgement.</p> <p>Protected Structures deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Structures recorded by the NIAH Building Survey with a Regional Rating or deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p>



IMPORTANCE	CRITERIA
	<p>Designed landscapes recorded by the NIAH garden survey with main features substantially present and deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Architectural Conservation Areas containing structures and/or designed landscapes of predominantly regional importance.</p> <p>Undesignated architectural heritage assets which are deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Undesignated archaeological remains which are neither particularly common nor uncommon, and/or of moderate complexity, and deemed to be of medium importance using legislation, EPA guidance, NRA Significance Criteria and professional judgement.</p>
Local/Low	<p>Structures recorded by the NIAH Building Survey with a Local or Record Only Rating or deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Designed landscapes recorded by the NIAH garden survey with only peripheral features surviving, and deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Townland Boundary Features.</p> <p>Undesignated architectural heritage assets which are deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement.</p> <p>Undesignated archaeological features which are particularly common or in poor condition, and deemed to be of low importance using legislation, EPA guidance, NRA Significance Criteria and professional judgement.</p> <p>Parks/Gardens/Demesnes recorded by the NIAH Garden Survey which have poor historic legibility.</p>

## 4.6 Setting Assessment Methodology

- 4.6.1 This assessment has been guided by Historic England's Historic Environment Good Practice Advice in Planning: Note 3 (Second Edition) – The Setting of Heritage Assets (HE 2017). The Setting of Heritage Assets provides guidance on setting and development management, including assessing the implications of development proposals, a counterpart to which has not yet been produced in the Republic of Ireland.
- 4.6.2 A staged approach is recommended for settings assessments, the first step of which is to identify the cultural heritage assets affected and their settings. The second step is to assess whether, how and to what degree these settings make a positive contribution to the importance of the heritage asset(s), i.e., "what matters and why". This includes a description of the key attributes of the cultural heritage asset itself, and then considers the physical surroundings of the asset, including its relationship with other heritage assets; the way the cultural heritage asset is appreciated; and the asset's associations and patterns of use. The third step (where appropriate) is to assess the effect of the proposed development on the significance of assets through the consideration of the key attributes of the proposed development in terms of its location and siting; form and appearance; additional effects; and permanence.
- 4.6.3 The assessment methodology has also been guided by the Department of the Environment, Heritage and Local Government's Architectural Heritage Protection, Guidelines for Planning Authorities which was published in 2004 and revised in 2011. This contains the relevant guidance which is detailed below. It is important to note that paragraph 13.8.1 of the guidance states that proposed development outside the curtilage or grounds of a protected structure or ACA should be given similar consideration as for proposed development within the attendant grounds. This methodology has been combined with the Historic England methodology, in order to conduct a similar and more robust assessment of the impacts of the proposed development on recorded archaeological monuments, in addition to architectural heritage. This guidance wording is detailed below:

### *Development Within the Attendant Grounds*

*13.7.1 It is essential to understand the character of a site before development proposals can be considered. Where attendant grounds of particular significance are proposed for development, a conservation plan could be prepared in advance of any planning application which would identify the significance of the site and locate areas within the designed landscape, if any,*

*which could accept change and development and those areas which could not without damaging the architectural heritage of the place.*

*13.7.2 When dealing with applications for works within the attendant grounds of a protected structure, a visit to the site should be considered an essential part of the assessment. The planning authority should consider:*

- a) Would the development affect the character of the protected structure?*
- b) Would the proposed works affect the relationship of the protected structure to its surroundings and attendant grounds?*
- c) Would the protected structure remain the focus of its setting? For example, a new building erected between a structure and a feature within the attendant grounds will alter the character of both;*
- d) Do the proposed works require an alteration of the profile of the landscape, for example, the creation of a golf course? How would this affect the character of the protected structure and its attendant grounds?*
- e) Do the proposals respect important woodland and parkland? Do they conserve significant built features and landscape features?*
- f) Are there important views of or from the structure that could be damaged by the proposed development? Would important vistas be obstructed by new development?*
- g) Would distant views of important architectural or natural landmarks be blocked or changed? Would a significant skyline be altered?*
- h) Even where the proposed development is at a distance from the protected structure, could it still have an impact? This could include tall or bulky buildings interrupting views of or from the protected structure and other features of the designed landscape;*
- i) Where the new works would not be directly visible from the protected structure, would they be visible from the approaches to the structure or from other important sites or features within the attendant grounds? If so, would this be acceptable?*
- j) What effect would the scale, height, massing, alignment or materials of a proposed construction have on the protected structure and its attendant grounds?*

*Other Development Affecting the Setting of a Protected Structure or an Architectural Conservation Area (ACA)*

*13.8.1 When dealing with applications for works outside the curtilage and attendant grounds of a protected structure or outside an ACA which have the potential to impact upon their character, similar consideration should be given as for proposed development within the attendant grounds. A visit to the site should be considered an essential part of the assessment.*

*13.8.2 New development both adjacent to, and at a distance from, a protected structure can affect its character and special interest and impact on it in a variety of ways. The proposed development may directly abut the protected structure, as with buildings in a terrace. Alternatively, it may take the form of a new structure within the attendant grounds of the protected structure. A new development could also have an impact even when it is detached from the protected structure outside the curtilage and attendant grounds but is visible in an important view of or from the protected structure.*

*13.8.3 The extent of the potential impact of proposals will depend on the location of the new works, the character and quality of the protected structure, its designed landscape and its setting, and the character and quality of the ACA. Large buildings, sometimes at a considerable distance, can alter views to or from the protected structure or ACA and thus affect their*

*character. Proposals should not have an adverse effect on the special interest of the protected structure or the character of an ACA.*

4.6.4 In addition to the documents listed above, the setting assessment methodology has also utilised the guidance contained within the following document:

- Cork County Council, 2006, Guidance Notes for the Appraisal of Historic Gardens, Demesnes, Estates and their Settings. This document was prepared by Cork County Council in response to increasing adaptation and redevelopment of planned landscapes within the county and also has relevance to development beyond Cork

4.6.5 The guidance notes advise the following stepped approach:

- Identification and description of development, history, features and boundaries of the designed landscape using scoping, archival research and fieldwork;
- Evaluation & assessment of significance including Historical Landscape description, archaeological and horticultural aspects;
- Assessing development proposals through an assessment of the heritage impact; and
- Recommendations for mitigation & management including future research.

## 4.7 Limitations and Assumptions

4.7.1 The assessment is based upon currently available information at the time of writing.

4.7.2 While examination of the bridge piers was possible by boat, the embankments were inaccessible at the time of the site visit.

# 5. Baseline Environment

## 5.1 Geology and Topography

5.1.1 The underlying bedrock geology of the site comprises Burren Formation and Metagabbro & Orthogneiss (Geological Survey of Ireland).

## 5.2 Archaeological and Historical Background

5.2.1 Galway City is located on the mouth of the River Corrib as it drains into Galway Bay. The River Corrib flows out of Lough Corrib in a single channel until its progress is slowed by two large ridges of metamorphic rock (Prunty and Walsh, 2016). This forced the river to widen and, in the process, form several smaller rivers and islands. The settlement of Galway was located at the endpoint of the northernmost ridge because the River Corrib is fordable at this point. This crossing point was later formalised with the construction of the West or Great Bridge during the early 15th century (Prunty and Walsh, 2016).

5.2.2 The settlement of Galway was first mentioned in the annals of 1124 when the Gaelic lords erected a stronghold at the mouth of the river. However, the town of Galway only developed after the seizure of the area by the Anglo-Norman de Burgh family in the 1232 (Ayto and Crofton, 2005). The de Burghs built their castle in a strategic location within reach of the ford and the strand where ships could beach. Galway became the centre of English settlement, with the Irish confined to the village of Claddagh.

5.2.3 This takeover was not without opposition with the castle and new settlement being destroyed in 1233 and then again in 1247 and 1266 (Prunty and Walsh, 2016). The castle and town were rebuilt, prospering as the town took advantage of the economic advantages of the riverine and maritime location. Town walls were constructed from 1272 onwards financed by revenue from trade with the town known as a fishery for eels and salmon. Galway prospered during the late medieval period becoming a key player in the mercantile life of Europe's Atlantic seaboard trading with Spain, Portugal, France, England and the North Sea and Baltic ports (Prunty and Walsh, 2016).



- 5.2.4 The decline of the control of the central government in Dublin during the late medieval period led to Galway gaining self-governance from King Richard III in 1484 when they were granted power to elect annually their own mayor, bailiffs and corporation. During this period, the settlement expanded with suburbs created outside the city walls (Figure 4). It should be noted that the location of the Proposed Development was not within the medieval settlement of Galway (GA094-100), instead, being located to the north close to the location where the Terryland River joins the River Corrib on its east bank. The area around the mouth of the Terryland River was wet marshy land known locally as the Suckeen Bogs.
- 5.2.5 This is reflected in the recorded archaeological sites within the vicinity of the Proposed Development with the earliest being a Franciscan Friary (GA094-102) which was located on the now-reclaimed St. Stephen's Island 279m to the south of the Proposed Development. This friary was found by William de Burgh in 1296 and was located outside the north gate of the city. The Friary was largely demolished by the 17<sup>th</sup> century apart from the church which was reused as a courthouse before being completely rebuilt in 1781.
- 5.2.6 Galway continued to prosper into the Post-Medieval period and was described at the start of the 17<sup>th</sup> century as small but '*all is faire and statelie buildings*' (Ayto and Crofton, 2005). There is one asset within the study area dating to this period. This is the dovecote and bawn wall (RPS 7004) which is located 255m to the north-west of the Proposed Development within the grounds of UG. The asset comprises a circular structure 3.25m in diameter and 4m high with fragments of a stout wall which are thought to represent the remains of the bawn wall and an angle tower associated with the castle (GA094-040) formerly located to the north and outside the study area. This castle was described as small and located within a bawn wall along with a thatched cabin. The castle (GA094-040) was destroyed during the late 18<sup>th</sup> century and a brewery was built upon the site. The angle tower was reused as a dovecote with the asset classified as such on the National Inventory of Architectural Heritage.
- 5.2.7 The wars of the 17<sup>th</sup> century brought a change of fortune for the town as it backed the wrong side during the Civil War and was burnt after surrendering to the Parliamentarians under General Charles Coote in 1652. The town also backed the losing side during the Williamite Wars and lost its property rights and religious freedom in 1691 after surrendering to King William III (Ayto and Crofton, 2005).
- 5.2.8 Galway stagnated during the 18<sup>th</sup> century and it was only during the latter part of that century that confidence returned with new industries opening as well as the city becoming a port for sailings to America. The population increased as labourers moved into the town from the countryside seeking employment. Linen and wool were processed in the town with a bleach mill located at Earls Island on the west bank of the River Corrib. Its associated bleach green was located to the north-east and incorporated the western extent of the Proposed Development site. Major public works during the 19<sup>th</sup> century included the Town Gaol in 1810, the County Gaol in 1811 and the fever hospital in 1820 all on Nun's Island to the south of the Proposed Development as Galway began to expand towards the north.
- 5.2.9 The area of the Proposed Development was still outside the city in 1839 (Figure 5). The western extent is shown as consisting of the bleach green previously mentioned while the ground beyond this to the west is marked as a planned landscape which would become Ballymunterally College (NIAH 5241). The eastern extent of the Proposed Development is shown as open ground labelled as liable to flood. An embankment (which will later become Dyke Road) is shown along the western edge of the open ground and this marked the start of the reclamation and development of the bogs (Prunty and Walsh, 2016). The north extent of Nun's Island beyond the fever hospital and County Gaol is shown as marginal ground with the only feature a lime kiln (GA094-116) which is located 193m to the south of the Proposed Development. The lime kiln later had a three-room house built over it. This house was demolished in 1990. A canal/mill race (NIAH 30308001) was built around 1830 leading south-east from a distillery at Newcastle House to the River Corrib.
- 5.2.10 The widespread famine which resulted from the failure of the potato crop in 1845-9 resulted in a huge influx of the poor into the town seeking work, food and shelter. The local authorities found it difficult to cope as infrastructure, services and the economy were placed under enormous pressure. The local businesses and industries suffered and continued to decline after the famine. This decline was heightened when the Dublin to Athlone railway was extended to Galway in 1851 enabling access to cheaper goods and commodities than could be produced locally.

- 5.2.11 The extension of the railway did open opportunity with Galway becoming a tourist destination during the later 19<sup>th</sup> century. Industrial development was also prevalent along the River Corrib towards the location of the Proposed Development. Water had been the original reason for the foundation of the settlement of Galway and it was put to good use again for industry with further mill races and canals constructed in addition to the canal/mill race (NIAH 30308001). The Eglinton canal (RMP 30313013) was constructed during the mid-19<sup>th</sup> century while improvements to riverine infrastructure included the quay (GA094-100059) located 136m to the south of the location of the Proposed Development.
- 5.2.12 The Galway to Clifden Railway (Midland Great Western Railway), constructed in 1895, attempted to improve access in the west of Ireland. The viaduct within the Proposed Development site was the direct result of this; carrying the railway over the River Corrib. The railway line was short-lived, falling victim to private haulage firms and the decline in tourism during the early 20<sup>th</sup> century. The railway line closed in 1935 with the bridge deck was sold for scrap, leaving the embankments and bridge piers in place.
- 5.2.13 The area around the Proposed Development continued to be developed during the latter part of the 19<sup>th</sup> century and early-20<sup>th</sup> century. The eastern extent of the Proposed Development spanned marginal ground between the Dyke Road embankment and the Eglinton Pier (NIAH 30309003). Eglinton Pier was constructed by the Midland Great Western Railway at the behest of the Lough Corrib Navigation Trust. It was for watercraft that normally used Woodquay as a base to operate from a point upstream of the Proposed Development (Casey, 2001). The pier included a berth with associated features including a crane and a small building. Other riverine activity included a regulating weir (GA094-100057) with an associated salmon pass which was built across the river 110m to the south of the Proposed Development. The office of the Western Fisheries Board (RMP 3607) was built on the shore directly adjacent to the salmon pass.
- 5.2.14 The bleach mill and its green had gone by the early 20<sup>th</sup> century, though other industrial activity was in the area such as a bag factory and marble works at Earls Island. Not all the development was industrial, however. The largest building in the vicinity was Queen's college (RPS 10303) which was set within its own grounds of Ballymuntermally College (NIAH 5241). Built during the mid-19<sup>th</sup> century, this college is located 336m to the south-west of the Proposed Development and was the foundation for the current University of Galway (UG) campus.
- 5.2.15 The 20<sup>th</sup> century has seen the area developed with University College Galway expanded on the western bank of the River Corrib greatly denuding the lands of Ballymuntermally College (NIAH 5241). The university campus is now a major complex surrounding the western extent of the Proposed Development which has been subsequently truncated with over half the original length of the embankment removed to accommodate the campus (Figure 6). Similarly, the embankment on the east bank originally continued to the east with a small gap to allow access along Dyke Road, with the railway crossing over the road. The embankment to the east of Dyke Road has been completely removed.
- 5.2.16 The UG campus contains several prominent buildings including the arts block (RPS 7003), the library (RPS 7001), the Civil Engineering block (RPS 10309), the Faculty of Education (RPS 10310), the Martin Ryan Institute (RPS 10307) and the former IMI building (RMP 10308). The former IMI building (RMP 10308) was originally a warehouse and part of the Perisses Distillers and Irish Munitions Industries. Residential development had also expanded from Galway on both sides of the river while the marginal ground between Dykes Road and the Eglinton Pier has been reclaimed and developed.

## 5.3 National Monuments

- 5.3.1 There are no sites or monuments under Preservation Order and no National Monuments in state care or ownership and guardianship of the Minister for Housing, Local Government and Heritage, within the Proposed Development site boundaries, or within the 300m study area.

## 5.4 Record of Monuments and Places

- 5.4.1 The Record of Monuments and Places notes 10 non-designated archaeological sites within the 300m study area around the Proposed Development (Figure 3). Details of these can be found in Appendix A. Most of these archaeological sites have been mentioned in 5.3 except for two.

- 5.4.2 These are a redundant record (GA094-089) and a quarry (GA094-085) which are both located within the grounds of UG to the west of the Proposed Development. Both were identified as possible earthworks from cartographic research, but subsequent site visits revealed that the earthworks are non-archaeological.

## 5.5 Record of Protected Structures

- 5.5.1 A review of the Galway City Development Plan 2023-2029 notes 35 Protected Structures within the study area with the viaduct remains within the Proposed Development site recorded as (RPS 8601) while all river and water related structures such as bridges, piers, weirs, mill streams and canals are also considered Protected Structures (RPS 8501). This means that the Proposed Development site and the entire area around it is statutorily protected including the Eglantine Pier (NIAH 30309003), the quay (GA094-100059) and the regulating weir (GA094-100057). A number of the buildings within the UG campus are also recorded as Protected Structures as are some residential buildings located to the south and the city centre. The viaduct within the Proposed Development site will be described in greater detail later in this assessment while details of the other Protected Structures can be found in Appendix A.

- 5.5.2 The Protected Structures within the 300m study area are listed in Table 2.

**Table.2: Protected Structures within 300m study area**

RPS Ref.	NIAH/RMP Ref.	Address	Structure	Distance from the Proposed Development
7004	30308002	Dovecot and Bawn Wall, UG, Newcastle Lower	C16th Turret and Tower House Wall. Site of tower house.	255m to the north-west
3601	30313014	Human Right's Building UG, University Road	Former fever hospital, 3 Bay 2 Storey Educational Building	300m to the south-west
3607	30313037	Fisheries Field, Earl's Island	2 Storey weir lodge, former fisheries office	158m to the south
3609	30308007 GA094-116	Fisheries Field, Earl's Island	1830s limekiln with the foundations of ancillary buildings	190m to the south-west
8501	30308001	UG Campus	Canal/mill race, built c.1830, running (south) from beneath swimming pool car park (recent development) through pair of recent concrete square pipes into stone-lined basin, now heavily overgrown.	150m to the south-west
8501	30309003	Eglantine Pier, Townparks	Rectangular plan dock of limestone block construction. Limestone mooring posts to east and west, with modern paving. Cast-iron gate/loading winch located to east side.	Immediately adjacent to the north
8501	GA094-100057	Weir -regulating	Weir with salmon pass located in the River Corrib extending south from Earl's Island.	152m to the south
8501	GA094-100059	Quay	Quay located at Waterside.	145m to the south
8501	30313038	Mill Race, Gaol Road, Townparks	Limestone and rubble stone-lined mill race cutting, built c.1870, associated with now demolished marble works and lime kiln	242m to the south-west



8501	30319001	Claddagh Quay, Townparks	Banks of Lower Corrib River, canalised c.1750, following relatively straight course from Salmon Weir, southwards into Galway Bay	240m to the south-west
9501-9506	N/A	Nos. 1-6 St. Brendan's Road, Headford Road	Row of 2 bay, 3-storey houses	150m to the south-east
10501-10503	N/A	Nos. 7-9 Waterside	Row of 2 bay, 3-storey commercial properties built a terrace in 1880.	195m to the south-east
10504	30314005	Corrib House, 3 Waterside	2 Bay 2 Storey corner Residential Building built 1840.	218m to the south
10505	30314006	Corrib Villa, No. 4 Waterside	6 Bay 3 Storey Building built 1890	220m to the south
2605	30314009	No. 3 Courthouse Square	Part of 6 Bay 4 Storey Building. Site of Franciscan friary complex	231m to the south
2604	30314008	No. 2 Courthouse Square	Part of 6 Bay 4 Storey Residential Building. Site of Franciscan friary complex	231m to the south
2603	30314007	No. 1 Courthouse Square	Part of 6 Bay 4 Storey Residential Building. Site of Franciscan friary complex	231m to the south
2606	30314002	Courthouse Square	Free-Standing Circular-plan Cast-Iron George V Post Box c.1916	235m to the south
2601	30314011	Courthouse Square	Early C19th City and County Courthouse. Site of Franciscan friary and former county courthouse	201m to the south
2602	30314012	Courthouse Square	C19th Courthouse, now Theatre. Former town courthouse and site of Franciscan friary	248m to the south
9603	N/A	Convent of Mercy Grounds and Graveyard, St. Francis Street	Convent Grounds with Graves. Medieval fragments, doorway, site of medieval waterway	298m to the south
10507	N/A	Salmon Weir Bridge, Waterside	Free standing elm-wood sculpture of a leaping salmon	274m to the south.
7001		Library, UG	Multi Bay, 3 Storey over partial basement, Library Building. Several extensions in same style, includes restaurant	186m to the north-west
7003	N/A	Arts Block, UG	Multi Bay Single/4 Storey over partial basement, Educational Building	65m to the north-west
10307	N/A	Martin Ryan Institute, UG	Multi Bay 3 Storey Residential Building	190m to the south-west
10308	N/A	Former IMI Building, UG	Multi Bay 1/2 Storey University Building. Former industrial warehouse.	57m to the south-west.
10310	30308003	Dept. of Education Block, UG	7 Bay 3 Storey University Building	184m to the west-southwest

10309      30308004      Civil Engineering Block, UG      9 Bay 3 Storey University Building      176m to the west-southwest

## 5.6 National Inventory of Architectural Heritage- Buildings

- 5.6.1 The National Inventory of Architectural Heritage (NIAH) notes 27 assets within the study area (Figure 3). The majority of these assets are also Protected Structures and have been discussed under this designation. One asset is not recorded as a Protected Structure. This is County Hall (NIAH 30314077) which is located on Prospect Hill 256m to the south-east of the Proposed Development. The current structure was built in 1999 of snecked squared rubble limestone and incorporating features of the former three bay, three storey with attic infirmary building of 1780, which later became the headquarters for Galway County Council.

## 5.7 National Inventory of Architectural Heritage- Gardens

- 5.7.1 The NIAH notes one Historic Garden within the study area (Figure 3). This is Ballymuntermally College (NIAH 5241) which was located on the west bank of the River Corrib and is now occupied by the UG campus. The western embankment of the Proposed Development would have originally extended into Ballymuntermally College (NIAH 5241) although this area has undergone significant development and is no longer recognisable as a Historic Garden.
- 5.7.2 The western extent of Ballymuntermally College (NIAH 5241) has been less disturbed by modern development and its footprint and boundary are still discernible.

## 5.8 Discussion and Photographic Survey of the Proposed Development

- 5.8.1 The Proposed Development comprises the former Corrib Viaduct which carried the Galway to Clifden (Midland Great Western Railway) over the River Corrib. The history and construction of the viaduct have been well documented in several sources including an extract from the journal *Engineering* from November 1895 which details the construction methodology has been reproduced in the book 'Reflections on Lough Corrib' (Semple, 1973).
- 5.8.2 The 149m long viaduct consisted of three pillars in the river with two flanking abutments on each bank resulting in three 43.8m spans and a 6.4m lifting span (Casey, 2001). The lifting span was aligned with the Eglinton canal close to the western bank. Along with the condition for the construction of the Eglinton Pier, the Lough Corrib Navigation Trust also required that the Midland Great Western Railway include a drawbridge on the bridge so that larger vessels could navigate to and from the sea via the canal (Semple, 1973).
- 5.8.3 The No. 3 pier closest to the east bank of the River Corrib was constructed within a timber cofferdam and sits on masonry footings on hard boulder clay. It is constructed with cut stone to the bottom of the structure (Arup, 2021). The foundations of Nos. 1 and 2 piers, carrying the lifting span, are each of two wrought-iron cylinders riveted on a staging over the position they were to occupy when lowered (Semple, 1973). These foundations are twice as deep as for pier No.3. It was found that the riverbed comprised boulders which hindered the cylinders sitting upright. This problem was solved by divers blasting and excavating the boulders outside the cylinders and bringing them to a uniform bearing. The area round the cylinders was excavated then filled with concrete in bags.
- 5.8.4 The hollow space between the sides of each cylinder was filled with brickwork and cement while the central chamber was filled with bags of concrete (Casey, 2001). The problems encountered in sinking the cylinders of No.2 pier gave valuable lessons and these mistakes were not made with No. 1 pier which was constructed very quickly. This pillar housed the 188-ton balance weights for the lifting span that dropped into rebates built into the masonry of the pillar wall.
- 5.8.5 The exteriors of the three pillars was faced in Galway limestone of a dark grey colour while the bed-stones that superstructure rested upon were constructed with Cornish white granite (Semple, 1973). The superstructure was laid down on a timber platform with rails on it to carry a goliath crane that travelled backwards and forwards the length of the bridge, while a low level timber bridge allowed material to be transported into position (Appendix B Plate 1). A dive survey in 2000 noted that No.2

pier has a timber collar around its south column which is believed to be a fender structure to protect against accidental boat impact (Arup, 2021). A subsequent dive survey in August 2021 found this timber collar to be still intact while rock armouring was also present at the base of the No.2 pier and also at the base of No.1 pier (ADCO, 2021).

- 5.8.6 Two large revetted earthen embankments were constructed at the approaches on both sides of the river and the abutments for these were constructed with Portland cement faced by mortared coursed distressed blocks of Galway limestone (Casey, 2001). A small cabin was originally located on the southern slope of the western embankment to allow for redundant control of the drawbridge which was remotely operated by electricity from Galway railway station c.700m to the south-east.
- 5.8.7 The superstructure of the bridge comprised steel trusses and was 4.7m wide at the girders and reached a maximum width of 6.5m at the pillars. Appendix B Plates 2 and 3 show the operational bridge during the early 20<sup>th</sup> century. Of note, is the small redundant control cabin which can be seen on the embankment on the western bank of the river (Appendix B Plate 2).
- 5.8.8 The Proposed Development site was visited on the 27th May 2021 in order to assess its current condition and to create a photographic record. Conditions on the day were very wet and overcast. Description will start on the east bank with each individual component described separately.

#### **Embankment and Abutment Dyke Road**

- 5.8.9 The embankment on the east bank extends from the Dyke Road at the east to the Eglinton Pier (Plate 4). This represents one section of the railway line as the embankment historically stopped at Dyke road then restarted to the east of the road. There are, now, no visible signs of the railway to the east of the road with the area occupied by commercial development. The ground adjacent to the south of the extant embankment is level and under grass. Historic cartographic evidence shows that this area is reclaimed and was formerly marshland. The embankment is steep and grass covered with mature vegetation growing on the slopes and summit. It is inaccessible and no structural details are obvious along the majority of the embankment. The exception to this is a drain located at ground level approximately mid-way along the south slope of the embankment (Appendix B Plate 5). The drain is heavily overgrown obscuring detail, but it appears to be semi-circular and formed from dressed stone.
- 5.8.10 The abutment consists of a squared off rectangular butt with a very slight base batter and topped by a string course on a double offset surmounted on both sides by a low stone wall (Appendix B Plates 6 and 7). The low wall is also constructed with mortared coursed distressed blocks of Galway limestone and its purpose was to protect the roller bearings on which the railway line rested (Casey, 2001). The abutment is flanked on both sides by an angled sloping revetment to a low wall located at the base of the embankment (Appendix B Plate 8).
- 5.8.11 The area to the immediate west and north of the abutment is occupied by the Eglinton Pier (RPS 8501) which is still in use and appears well-maintained (Appendix B Plate 9).

#### **No. 3 Pier**

- 5.8.12 No. 3 pier is the most easterly of the three piers (Appendix B Plate 10). It is oblong in plan and surmounted by a corbelled string course 3 ft. high (Semple, 1973). The string course is mostly overgrown with vegetation but appears intact (Appendix B Plate 11). The main body of the pier is featureless apart from the remains of a metal frame attached to the south-east corner (Appendix B Plate 12). This comprises a rusted rectangular frame fixed to the pier by a leg at each end. The frame appears to have been designed to hold a sign.

#### **No. 2 Pier**

- 5.8.13 No. 2 pier is oblong in plan and surmounted by a string course as with the No. 3 pier (Appendix B Plate 13). This pier is paired with No. 1 pier as part of the mechanism for the lifting span. It was constructed on two wrought-iron cylinders and this is reflected in the lower part of the pier which is formed by two columns rising from the cylinders which then join into the main body of the pier. This is decorated on No. 2 pier by pseudo-Romanesque round-headed arches with imposts beneath the water level with each arch consisting of four receding orders with plain voussoirs (Casey, 2001).

#### **No. 1 Pier**



- 5.8.14 This is the most westerly pier and very similar in design to No. 2 pier being oblong in plan and surmounted by a string course (Appendix B Plate 14). This pier housed the 188-ton balance weights for the lifting span that dropped into rebates built into the masonry (Appendix B Plates 15). These rebates are also located on the eastern facing side though are less obvious (Appendix B Plates 16). A rope has been attached to the rebate located on the north-west corner and this is used for informal recreation to access the top of the pier for diving during good weather.
- 5.8.15 The lower part of the pier is decorated with pseudo-Romanesque round-headed arches as with No. 2 pier (Appendix B Plates 17). The string course on top of the pier is missing some stonework and may have been damaged when the bridge was decommissioned in 1935 when the lifting mechanism was removed (Appendix B Plates 18).

#### **Embankment and Abutment UG**

- 5.8.16 The western embankment and abutment is located on the west bank of the River Corrib in an area that is now part of UG or more specifically, it is within the Corrib Rowing and Yachting Club's compound. This area was not accessible during the site visit although the abutment was visible from the River Corrib (Appendix B Plate 19). The embankment is heavily overgrown with the abutment partially obscured. However, documentary sources note that it is a similar construction to the eastern abutment.
- 5.8.17 Documentary sources noted a small cabin on the southern slope of the embankment for redundant control of the drawbridge. The remains of the cabin were still visible until the early 21<sup>st</sup> century (Casey, 2001). The location is now heavily overgrown and it is uncertain if any trace of this structure remains. Casey (2001) also noted that one of the short lengths of walling that flanked the rollers on which the bridge superstructure was missing. It is uncertain if the subsequent vegetation growth has caused further damage to the structure.
- 5.8.18 The earthen embankment is completely overgrown with the structure barely visible through the vegetation (Appendix B Plate 20). The embankment has been truncated during the 20<sup>th</sup> century to facilitate the expansion of the UG campus with the result that only approximately half the original length of the structure remains.

## **6. Potential Impacts**

### **6.1 Direct Impacts during the Construction Phase**

- 6.1.1 The Proposed Development will see a pedestrian and cycle bridge set on the abutments and piers of the former Corrib Viaduct (RPS 8601) while Greenway infrastructure will be created on the earth embankments. The design of the bridge is for a three-span 3D arched truss structure (AECOM 2021). The former Corrib Viaduct (RPS 8601) is an industrial heritage feature constructed during the late 19<sup>th</sup> century then mostly dismantled in 1935.
- 6.1.2 The bridge design will see a trussed arched bridge erected on the original piers and abutments with the bridge supported on plinths located on the existing structures. The plinths will be directly attached causing impact to the existing structures though the existing fabric of the piers and abutments will remain intact.
- 6.1.3 The erection of the trussed arched bridge on the piers and abutments will be a largely positive impact as these will be restored to their former use, thereby, adding access to the structures and enhancing understanding and appreciation of these assets and also the industrial heritage of Galway. Similarly, the regrading of the embankments will allow access to these structures which are currently inaccessible enhancing understanding and appreciation of them.
- 6.1.4 The baseline study has shown that the area is located outside the historic core of Galway. The area of the Proposed Development is located within the River Corrib and its adjacent banks. The banks comprise low lying, flat terrain with the area on the east bank originally forming the Suckeen Bogs. This marginal ground has since been drained and the eastern embankment is set on reclaimed ground. Similarly, the western embankment is located on an area which was historically used as a bleach green. Such areas needed to be open and flat so that linen sheets could be spread out to

bleach in the sun. The embankments were constructed to carry the railway over the river and are constructed with imported fill material.

- 6.1.5 Construction works to create the Greenway infrastructure within the embankments will not impact upon archaeological remains. However, the embankments are statutorily protected industrial heritage features. Regrading will be required in order to facilitate access to the embankments. This will alter the appearance of the embankments and could also remove extant railway related features such as any remaining workings of the drawbridge including any remains of the cabin on the western embankment
- 6.1.6 Galway City owes its existence to the River Corrib and the river has been a valuable resource for thousands of years. It is highly likely that evidence of exploitation of the river is located on the riverbed in the form of archaeological artefacts. The construction of the Corrib Viaduct (RPS 8601) and the Eglinton Pier (RPS 8501) would have directly impacted upon such remains should they have existed. In particular, the foundation for No. 3 pier was constructed using a cofferdam while the areas around the foundations of Nos. 1 and 2 were blasted and excavated by divers.
- 6.1.7 It is likely that any archaeological artefacts originally located within the line of the viaduct will have been disturbed or destroyed by the construction works of the original bridge. There is the possibility that other archaeological artefacts, such as log boats, could have been washed downstream into the area during the intervening period. Construction works could impact upon such remains, should they exist.
- 6.1.8 However, no evidence for such remains was noted during the recent dive survey in August 2021. Items associated with the construction of the viaduct comprising wrought-iron lifting tools used for moving the masonry blocks were observed 6m east of Pier No. 2 while a section of rail track was noted 6m to the west of Pier No. 1 (ADCO 2021).

## 6.2 Impacts to Setting during Construction Phase

- 6.2.1 The Proposed Bridge is located in a heritage sensitive location with the old Clifden Railway Line abutments and piers recorded as a Protected Structure (RPS 8601) on the Galway City Development Plan 2023-2029 and on the National Inventory of Architectural Heritage as NIAH 30309001. Additionally, all river and water related structures such as bridges, piers, weirs, mill streams and canals are also considered Protected Structures (RPS 8501) on the Galway City Development Plan 2023-2029 while many of the buildings within the UG campus are also Protected Structures. The piers of the viaduct are interesting features within the river which are largely hidden from view on the banks by modern buildings and mature vegetation. This mature vegetation includes that on the embankments.
- 6.2.2 The Proposed Development will make the former Corrib Viaduct a highly visible feature along the river including the reinstatement of the embankments which will require the removal of the covering vegetation. This will expose the large earth banks and also remove some of the vegetation that currently screens the viaduct from the shore thereby altering the setting of the Protected Structures.
- 6.2.3 The Proposed Development will be visible downstream towards Galway especially from nearby Protected Structures such as the regulating weir (RPS 8501) (Appendix B Plate 21) and also those on Fisheries Island, the former fisheries office (RPS 3607) (Appendix B Plate 22) and the limekiln (RPS 3609) (Appendix B Plate 23).
- 6.2.4 The western side of the Proposed Development will be located within the UG campus and will be visible from the majority of the Protected Structures located here including the Former IMI Building (RPS 10308) (Appendix B Plate 24) and the Arts Block (RPS 7003) (Appendix B Plate 25) which will have direct lines of sight to the Proposed Development.
- 6.2.5 The Proposed Development will see a trussed bridge structure restored to the Corrib Viaduct. The original trussed bridge was contemporary with many of the Protected Structures listed, although the setting would have been quite different. The area would have been very much outside the main area of the city and quite industrial in nature. The area, now, is part of Galway City and mainly formed by the UG campus as well as modern commercial and residential development.
- 6.2.6 The new trussed bridge will impede views between the Protected Structures on either side of the river though these were not designed to be intervisible nor will it affect the ability to understand these assets. As mentioned, the area is now within the boundaries of Galway City with the resultant noise

from traffic. Noise from the Construction should not greatly add to this. Therefore, the Proposed Development should not greatly impact the settings of these assets during the construction phase.

- 6.2.7 The dome of Galway Cathedral (RPS 3602) is also visible from the location of the Proposed Development (Appendix B Plate 21) while the Courthouse (RPS 2601) and Town Hall (RPS 2602) cannot be seen for intervening buildings. However, views over the centre of the proposed bridge will be less impeded as the trussed arch travels under the bridge decking. Views back towards the Proposed Development are also screened by intervening buildings although cranes may be visible during the construction phase (Appendix B Plate 26).
- 6.2.8 The new trussed bridge will not impede views to Protected Structures within Galway City nor affect the ability to understand these assets. Similarly, these assets are located within Galway City adjacent to busy roads and noise from traffic. They will not be affected by noise from the construction of the Proposed Development. Therefore, the Proposed Development should not affect the settings of these assets during the construction phase.

## 6.3 Impacts during the Operation Phase

- 6.3.1 All direct impacts to known and unknown heritage assets will occur during the Construction phase and there is no requirement for mitigation measures during the Operation Phase. Significant effects for the operation of the Scheme derive from changes both positive and negative to the setting of heritage assets. These largely mirror the effects assessed for the permanent presence of the Proposed Development as detailed above in the assessment of the construction phase.
- 6.3.2 A benefit of the Proposed Development will be improved access across the river with bridge users able to enjoy views downstream into the City. This will include views of the Protected Structures within the river and along its banks. This will lead to a greater understanding and appreciation of these heritage assets and the setting of Galway City and its close links with the water environment and surrounding topography.

# 7. Mitigation Measures

- 7.1 The purpose of this assessment is to determine the heritage constraints associated with the Proposed Development. The final bridge design comprises a trussed arch bridge supported on plinths located on the existing structures of the old Clifden Viaduct while the earthen embankments will be regraded to provide access. These details determine the full extent of impacts to these heritage constraints and it is recommended that the following proposed mitigation measures are appropriate.
- 7.2 The previous Environmental Impact Statement (EIS) prepared in 2001 recommended that a detailed survey of the site as it stands should be carried out by an archaeologist prior to any alterations being made. In particular, the area of the west abutment should be examined for evidence of the remains of the original drawbridge mechanism.
- 7.3 The EIS also recommended that the design of the bridge should be carefully chosen in order to be less visually obstructive within the area of the River Corrib to the north of the regulating weir (RPS 6501).
- 7.4 The current assessment concurs with these recommendations and notes that the proposed trussed arch bridge will be less visually intrusive than other designs such as a cable stayed bridge. The trussed arch bridge will affect the settings of Protected Structures within the vicinity including Clifden Viaduct (RPS 8601) itself and views into Galway City Centre and associated Protected Structures from upstream. However, the bridge would provide access across the river, improving understanding and appreciation of the former Clifden Viaduct and the surrounding riverine / industrial heritage assets. Additionally, this proposed design is similar to that of the original girder bridge and would provide greater understanding and appreciation of the former Clifden Viaduct.
- 7.5 The proposed design also minimises disturbance to the existing bridge piers and abutments by using pylons located on these structures to support the bridge. It is noted that the chosen design of the bridge



should be discussed and agreed with the relevant heritage authorities, including the Heritage Officer within Galway City Council.

- 7.6 It is recommended that a detailed survey is conducted of the embankments after vegetation removal in order to identify and record any industrial heritage features still present, in particular any remains of the original drawbridge mechanism. The design of the bridge may need to adapt to avoid these features, so it is recommended that this work is carried out prior to finalisation of the bridge design.
- 7.7 It is recommended that construction works associated with the embankments and within the river should be subject to constant archaeological monitoring in order to identify any additional features or artefacts that may be uncovered to be assessed.
- 7.8 It is recommended that the mitigation be undertaken by a suitably qualified industrial and maritime archaeologist working under licence to the National Monuments Section, Department of the Culture, Heritage and The Gaeltacht. The appointed archaeologist will undertake full-time monitoring of the excavations and where appropriate, carry out archaeological investigation.
- 7.9 During this watching brief, the archaeologist will be delegated authority by the Contractor's engineer to:
- Halt construction work by the Contractor in a specified area where it is necessary to examine any potential archaeological material encountered.
  - Undertake any archaeological procedure necessary for the recording and removal of archaeological objects or features before work by the Contractor can resume within a specified area.
  - Instruct the Contractor as to the measures required to be taken to protect archaeological/industrial heritage remains to be left in situ, should circumstance arise.
- 7.10 The Contractor will agree with the Consultant and the Archaeologist:
- A programme to ensure that excavation of material that is of archaeological/industrial heritage interest, is carried out under the supervision of the Archaeologist.
  - A method statement describing how the embankments will be excavated and what excavation machinery will be used in the stripping and removal of the fill material.
  - Arrangements to allow the Archaeologist sufficient time to examine, record and remove, if necessary, the revealed and discovered archaeological/industrial heritage remains.
  - Arrangements to protect archaeological remains to be left in situ.
- 7.11 In the event that significant or complex archaeological/industrial heritage features are uncovered during monitoring, consultation may include a visit to the site by the National Monuments Service and the Consultant to inspect the remains and agree an appropriate mitigation strategy.
- 7.12 The appointed archaeologist shall comply with the requirements of the National Monuments Section of the Department of Arts, Heritage and the Gaeltacht as to the appropriate mitigation in the event of the discovery of archaeological material during monitoring.
- 7.13 Any recommendations contained in this report are subject to the ratification of the National Monuments Section, Department of the Culture, Heritage and The Gaeltacht.

## 8. References

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# Appendix A Gazetteers of Recorded Heritage Assets

## Recorded Monuments within 300m of the scheme

RMP Ref	RPS ref	Type	Period	Description	Condition
GA094-038		Church	Late Medieval	On W bank of River Corrib 1 km NNW of the town of Galway (GA094-100----). Erected in 1509-10 by one of the Lynches of Galway. Described by OS Letters as a rectangular 'chapel' (E-W; L c. 9m, W c. 4.5m) which had a twin-light window, presumably in E gable, and an arched recess in one of the side-walls. Demolished between 1913-44 but the window and some other fragments are preserved in UCG (see (GA094-130----). A holy well (GA094-110----) lay c. 50m to S.	Destroyed
GA094-039	7004	Dovecote and bawn wall	Post Medieval	The classification Dovecote is from the Concordance list and no details on the dovecote are on file but it is noted that 'Fragments of a stout wall and an ivy-clad circular angle-tower or dovecote (D3.25m, H c.4m) in the grounds of UG may be the last vestiges of the bawn (Walsh 1990b). The asset may be one of the angle towers on the bawn associated with the castle (GA094-040) reused as a dovecote.	Some remains
GA094-085		Quarry	Post-Medieval	A hachured feature marked on the 1944-5 revision of the OS 6-inch map proved on inspection in 1982 to be a water-logged pit: possibly a disused quarry. As it is of post-AD 1700 date it does not come within the remit of the Archaeological Survey of Ireland.	Some remains
GA094-089		Redundant record	Not applicable	This record was formerly classified as Unclassified Earthwork site in the SMR (1987) and as Earthwork Unclassified in the RMP (1997). A review of the evidence indicates that it is not sufficient to warrant its acceptance as an archaeological monument.	Not applicable
GA094-100057	8501	Weir - regulating	Modern	No details given	Substantial remains
GA094-100059	8501	Quay	Modern	No details given	Substantial remains
GA094-102		Religious house - Franciscan friars	Medieval	On the now-reclaimed St Stephen's Island on E side of the River Corrib just outside N gate of Galway town (GA094-100----). This Franciscan friary, founded by Wm. de Burgo in 1296, stood to N of the present Franciscan church in Francis St. The scale and layout of buildings is unclear but representations appear on a number of 16-17th-C maps. In 1657 'all the buildings...demolished' except the church which was reused as a court house. Reoccupied and repaired in 1689 and 1723-4, and completely rebuilt in 1781. Amongst its possessions was a watermill (GA094-102003-). (Hardiman 1820, 264-73; Jennings 1947; Gwynn and Hadcock 1970, 250-1)	Destroyed
GA094-116	3609	Kiln	Post Medieval	Located in Fisheries Field. The kiln flue faces north towards the mouth of the Eglington Canal which was probably used to transport materials to and from the kiln. Measuring 6m square with an arched flue at centre on the north side. Adjoining it on the east is another square platform 6.4m. the top of which is reached by a ramp on its south side. No trace of a kiln noted here- this platform appears to have been built as an access and loading area for the kiln. A 3-roomed house was built on top of the kiln with kitchen extension on top of the loading area. These were demolished in 1990.	Substantial remains
GA094-119		Structure	Post-Medieval	A curve in the wall at the junction of Court Lane and St Anthony's Place was identified as the remains of a possible dovecote. There is no dovecote shown in this location on the mid-17th century Pictorial Map of Galway (TCD MS 1209.73) and the evidence is not sufficient to warrant accepting it as the remains of such. The construction of the curve at this corner appears to continue in a straight line along Court Lane rather than, as one would expect if it were a dovecote, to continue the line of the arc of such a structure. It is possible that the stonework might indicate the remnants of a building or structure of some antiquity, but this cannot be certain: it is clearly earlier than the remainder	Some remains



RMP Ref	RPS ref	Type	Period	Description	Condition
				of the wall above. On the W face of the corner stone, immediately above the curve, the faint carving of a cross is visible, which is reminiscent of those enigmatic early-19th century carvings associated with J. or I. Healy found at various locations in the city. A fragment from a 15th-17th century window (GA094-120----) has been incorporated in the wall to the N.	
GA094-120		Architectural fragment	Post-Medieval	Incorporated in a wall on the east side of Court Lane near the junction with St Anthony's Place is a fragment of a probable window sill (H 0.14m; Wth 0.10m). The stone bears some punch dressing typical of 16th/17th century date and the residual base projection for a mullion.	Some remains

## Architectural Heritage within 300m of the Scheme

RPS Ref	NIAH Ref/RMP Ref	Name	Description
RMP 8501	30308001	Mill Race UG Galway	Canal/mill race, built c.1830, running (south) from beneath swimming pool car park (recent development) through pair of recent concrete square pipes into stone-lined basin, now heavily overgrown. Large concentration of waste and debris to basin and environs. Unclear if base is puddled or stone-lined. Canal enters recent tunnel (20m to south) with rubble stone block bridge (north end) which has been extended (south) having granite block voussoirs to arch and rubble stone parapet. Canal continues below street (30 m south), tunnel terminating with recent rubble bridge façade with camber arch having limestone voussoirs and keystone, bridge extended and faced (underside most likely concrete). Banks of cutting continue to be lined with rubble and block stone lining having occasional lengths of concrete coping, repairs and occasional drains feeding cutting (mostly recent). Fabric of basin walls improves markedly (30m south) especially on west bank where rubble stone is replaced by cut blockwork of similar quality to lock basins. Channel then widens just north of next bridge having limestone voussoirs and rubble stone parapets. Water level also drops at this point by half a metre as water flows over concrete or stone weir (moss obscures view) with traces of now absent sluice gate indicated by presence of various niches in basin walls. North of sluice mechanism is single-span rubble stone block road bridge, formerly humped back but now flattened having tooled limestone voussoirs and recent rubble stone and concrete parapets to tarmac surface, widened with concrete lintel to south face. Basin heavy with sediment and rubbish at this point and walls change becoming battered as canal narrows slightly changing back to roughly coursed rubble stone structure with concrete coping. Canal continues (south) cutting getting steadily shallower beneath rubble stone foot bridge with parapet and tooled limestone voussoirs becoming more overgrown, batter of wall becoming shallower. Canal enters paired concrete culvert (c.5m) with rubble stone surround and coping to tarmac foot and road bridge. Modern bridge (south) with reinforced concrete supporting piers alongside canal with resulting reinforcement and rebuilding of banks. Two recent bridges present as basin returns to original rubble block fabric. Canal exits beneath modern UG building area (heavily overgrown) before entering another concrete pipe culvert with recent parapet and surround façade of rubble stone block work. Culvert runs for approx 12m before re-entering cutting via pipe at another rubble façade. Banks far less well defined here, for stretches comprised of carved bedrock with occasional stretches of rubble stone block work becoming more frequent towards south until basin is once again fully lined with rubble blocks and deep cutting once more. Final stretch of canal is of rubble stone work again before running under final stone block construction bridge with limestone voussoirs. Canal splits with inlet from Lough Corrib to east feeding in via timber and iron sluice gate (formerly narrow block-lined lock basin. Main flow, however, continues south where water flow from canal and Lough flow underneath blockwork bridge which resembles large millrace, having battered north elevation with remains of attached steel footbridge which is now unsafe.

RPS Ref	NIAH Ref/RMP Ref	Name	Description
7004	30308002	Dove cote	Freestanding round-plan dovecote, built c.1800, now in use as storage. Roofless, having exposed rubble limestone walls, single square-headed opening, to entrance, having limestone block surround and replacement battened timber door. Adjoining rubble stone walls to east and north of similar construction.
10310	30308003	Faculty of Education Building UG	Detached seven-bay three-storey faculty building, built c.1890, having central projecting entrance bay to front elevation (south) and two-bay single-storey flat-roof addition to rear. Flat roof having roughcast rendered parapet with render cornice concealing rainwater goods, cast-iron downpipe to rear addition and cast-iron service pipe to rear elevation (east). Painted roughcast rendered walls with moulded render plinth, having rendered sill courses to all floors. Lined and ruled rendered walls to addition having render cornice at eaves level. Camber-headed window openings having raised render reveals, one-over-one pane timber sliding sash windows with twelve-pane overlights, including offset central stairwell bay to rear. Square-headed opening to main entrance having raised render surround, double-leaf timber panelled door with geometric overlight, camber-headed opening to additional entrance having replacement battened timber door. Located within the grounds of UG campus.
10309	30308004	Faculty Building UG	Detached nine-bay three-storey H-plan faculty building, built c.1890, having three-bay projecting bays to east and west ends of front elevation, six-bay side elevations, and mid-twentieth-century addition to east end of rear. Hipped slate roof to main block, having rendered chimneystacks, battened timber-clad overhanging eaves with carved timber brackets, and cast-iron rainwater goods with decorative brackets. Painted roughcast rendered walls with moulded render plinth, having render sill courses to ground, first and second floors. Camber-headed window openings having one-over-one pane timber sliding sash windows with twelve-pane overlights, including offset stairwell to west end of rear elevation. Camber-headed openings to entrances having recessed render surrounds, with exception of rear entrance, double-leaf carved timber panelled doors with twelve-pane overlights over carved timber entablature comprising dentillated cornice, decorative frieze and architrave, tooled limestone steps to middle bays of projections to front elevation. Located within the grounds of UG campus.
10303	30308005	University UG	Freestanding two-storey ashlar limestone-built Gothic Revival University quadrangle, built 1845, facing east. Comprises central three-bay entrance block advanced to front and rear elevations with octagonal three-stage clock tower and having octagonal turrets to corners of plan, flanked by six-bay wings terminated to front elevation by single-bay ends flanked by octagonal turrets. Returns to north and south comprising blocks having twelve-bay external and ten-bay internal elevations, internal elevations having slightly advanced central entrance bays, external elevations having recessed end bay to east end and projecting pedimented bay towards west end. Slightly lower rear, west, side of quadrangle is two-storey over basement, presenting two storeys to interior of quadrangle and has Aula Maxima to centre of internal elevation and which projects to front and rear elevations and is flanked by blocks with five-bay first floors and mainly blank ground floors with nine-bay single-storey projecting cloister arcades to front. Canted windowed bay to centre of rear elevation of Aula Maxima. Externally west block is terminated by projecting, gabled single-bay ends canted windowed bay to centres. Pitched artificial slate roofs (where visible) having ashlar limestone triple and quadruple flue chimneystacks with ceramic pots. Ashlar limestone parapets throughout, crenellated to exterior, including to turrets, and all elevations having chamfered block copings and moulded string courses to base of parapet and between storeys. Copper alloy tented domed roofs to east-facing turrets, and copper-alloy spired domed roof with decorated limestone to eaves including crocketed finials. Ashlar limestone walls throughout, with stepped buttresses to exterior walls, and with decorative panels to bell tower. Square-headed mullioned-and-transomed window openings to all elevations, internal and external, having tooled limestone sills, block-and-start

RPS Ref	NIAH Ref/RMP Ref	Name	Description
			surrounds, label-mouldings, and painted metal lattice windows. Trefoil-headed tracery in windows to external elevations of front and side blocks and to ground floor of north, east and west internal elevations. Pointed-arch window openings to Aula Maxima, to main external entrance and to first floor entrances of side blocks, all having tooled limestone sills, block-and-start surrounds, hood-mouldings and intersecting tracery, trefoil-headed to Aula Maxima and main entrance. Pointed four-light window to middle stage of bell tower, having quatrefoil mouchettes and multifoil rose above, with flanking similar two-light windows with trefoil mouchettes. Simpler pointed four-light window to first floor of entrance block internally with oculus above and flanked by similar two-light windows. Pointed-arch double-light windows to interior of arcades, having tooled limestone surrounds, sills and tracery. Pointed-arch five-light window to east elevation of Aula Maxima, with complex trefoil tracery over including mouchettes and smaller trefoil-headed lancets over. Pointed arched openings to top stage of bell tower and turret elevations, having tooled stone sills and surrounds, with timber louvres and having ogee-arch hood-mouldings with finials decorated in style of crocketed finials. Four-centred Tudor arch opening to main entrance, having tooled limestone surrounds and voussoirs with rendered soffit to interior. Pointed segmental-headed openings to entrances at ends of internal elevations of north and south blocks and flanking entrance bays of front block, having tooled limestone surrounds and voussoirs with single and double-leaf panelled timber doors with limestone stepped approaches and label-mouldings, with two-light quatrefoil overlights to internal elevation of north block. Located within UG campus.
8601	30309001	Corrib Viaduct	Remains of former railway bridge and embankment, built c.1895, rails and bridge superstructure now removed. Comprises earthen embankments running approximately east-west on both banks of River Corrib and terminating in rock-faced ashlar limestone construction abutments with oversailing block coping courses and coped parapet. Three rock-faced ashlar limestone piers in river having rounded ends and with coping in same style as abutments and west-most piers having Romanesque-style arrangement of arches with rock-faced voussoirs and springer blocks.  The Corrib Viaduct displays fine stonework displayed in its piers and abutments, demonstrative of the pride that was involved in such civic projects whilst their design is also reflective of the medieval character of Galway City and also the Romanesque Revival style.
8501	30309003	Eglinton Pier, Riverside	Rectangular plan dock, built c.1845, of limestone block construction. Pecked limestone block coping stones to sides, and roughly coursed rubble stone slipway. Limestone mooring posts to east and west, with modern paving. Cast-iron gate/loading winch located to east side.
8501	30313013	Eglinton Canal, Canal Road Lower/Upper	Eglinton Canal, built c.1850, following curving path south from inflow from River Corrib Upper and passing beneath five bridges which have made watercourse non-navigable. Canal begins to north of Salmon Weir on west bank of Corrib River (upper) where small harbour is located. Canal then proceeds to move south-west with limestone block-lined banks having limestone block coping stones and narrow tarmac footpath to west bank before splitting into two separate waterways with main canal continuing to south-west and shorter but equally substantial branch proceeding south beneath road bridge and recent pedestrian bridge where branch would have serviced small group of mills which are built surrounding small harbour at end of branch. Main canal continues south-west before curving back around to continue south-east after passing beneath two recent concrete construction road bridges with concrete and steel rail parapets. Canal at these points narrowed by addition of limestone block-lined piers which reduce spans of each bridge by two metres eliminating need for more complex structures. Between these two bridges is second branch which follows south-easterly route before re-entering canal south of lock basin via stone-lined channel. Lock basin comprised of limestone block lining with limestone coping blocks, timber lock gates and box, sluice racks having recent



RPS Ref	NIAH Ref/RMP Ref	Name	Description
			cast-iron safety railings to banks. One set of gates removed with flow of canal now regulated by remaining gate and sluice racks to north of lock basin. Canal then continues to south-east before splitting again with south-east branch passing under William O'Brien Bridge and into Claddagh Quay and second branch travelling roughly north-east before re-entering River Corrib (lower) after passing over stone-lined weir.
3601	30313014	Galway University Irish Centre for Human Rights, University Road	Three-bay two storey L-plan faculty building, built c.1880, having canted front elevation, and varied rear elevation with lean-to additions and some recent flat-roofed additions. Hipped and pitched slate roofs having rendered chimneystacks, cast-iron and replacement uPVC rainwater goods. Roughcast rendered walls having rendered plinth and eaves course. Square-headed window openings having tooled limestone sills and six-over-six pane timber sliding sash windows. Round-headed door opening to chamfered central bay with tooled limestone doorcase comprising tooled limestone pilasters, imposts and archivolt, and replacement timber door and fanlight. Square-headed door opening to rear having painted raised render surround and timber battened door. Rubble-stone enclosing wall and gate piers having cut limestone coping and cast-iron railings and gates.
8501	30313015	Salmon Weir Bridge, Gaol Road, Waterside/Newtownsmith	Seven-span limestone block road bridge, built 1818, comprising seven segmental arches having tooled limestone voussoirs, rendered soffits, springing from limestone block and rubble piers with bow-ended cutwaters having tooled limestone gadroon capping, base of piers now encased in concrete. Moulded tooled limestone string course below parapet, latter of tooled limestone block construction with painted cast-iron balustrade with limestone coping over. Cast-iron lamp standards to parapet. Bridge spans River Corrib and partly filled-in canal. Two east-most arches separated by block and earth walkway. Recent wrought-iron walkways and equipment associated with eel fisheries to south side of bridge, with metal pipe attached to south face of bridge.
3602	30313016	Galway Cathedral, Gaol Road	Free-standing gable-fronted cruciform-plan Roman Catholic Cathedral, built 1965, facing north, comprising six-bay double-height nave with pair of three-stage bell towers recessed from façade corners, and with three-bay recessed entrance, five-bay side aisles, two-bay double-height transepts and chancel. Copper-roofed dome to crossing on octagonal limestone drum and corbelled pendentive with limestone spired turrets to corners with cross finials. Extensive two-storey narthex to south elevation with concealed crypt level, central break-front bay and stairs tower (east), porch to west transept with pitched roof, barrel-roofed porch to east transept and further secondary five-bay porch entrances to side aisles. Pitched copper alloy-clad roofs to nave, chancel, transepts and side aisles with similar to domed roof of crossing. Bell towers are square plan topped by two-level openwork tooled limestone lantern with limestone spires to lower square-plan level and cross finial to upper octagonal level. Limestone cross finials and coping to gables with limestone parapet concealing gutters to nave, chancel and transepts. Copper-alloy downpipes with embossed crucifix motif to hoppers. Helmed copper-alloy roof to clerestory stairs tower (east). Rock-faced limestone walls having carved panel decorations and statuary to gable-front and copper-alloy cross to south. All window openings have lead-lined stained-glass set into moulded tooled limestone surrounds. Tri-point-arch window openings to side aisles, round-headed window openings to clerestory, ogee-arch window openings to porches, square-headed single, double and triple window openings to narthex with lead-lined lattice windows with integrated stained glass. Tripartite tri-point headed window openings to transept porch (west). Triple round-headed window openings to drum of crossing dome. Multifoil rose windows to gable elevations of nave and transepts having tracery. Three square-headed door openings to main entrance having limestone panelled reveals with integrated piscina, tooled limestone composite Corinthian columns with crocheted capitals between doors supporting entablature comprising architrave, frieze and dentillated cornice with finials over columns. Round-headed tympanum to each doorway with stone panels carved in relief with tooled limestone

RPS Ref	NIAH Ref/RMP Ref	Name	Description
			voussoirs. Double-leaf copper alloy-clad doors to each opening with decorative metal fixings. Square-headed openings to side-aisle porches, having tooled limestone surrounds, stepped approach and timber panelled double-leaf doors. Round-headed door opening to narthex (east) with overlight, tooled limestone surround and composite Tuscan/Ionic columns to flanks supporting entablature comprising architrave, frieze and dentillated cornice with capping finials. Camber-headed door opening to gable elevation of west transept having chamfered limestone surround, double-leaf timber panel doors with glazed side panels and lead-lined lattice-work overlights having tooled limestone mullions and transom. Round-headed door opening to west elevation of narthex having tooled limestone surround with battened timber door. Exposed limestone block work walls to interior and arcaded side aisles with finely carved arches. Limestone arches to crossing with mosaic decoration to squinches and pointed-arch niches to lower stage of dome. White marble raised altar. Decoratively carved timber pews. Side chapels to south-east and south-west. Timber barrel-vaulted roof with square panel decoration.
3607	30313037	Western Fisheries Board, Fisheries Field, Townparks	Detached irregular-plan single-storey with dormer level house, dated 1899, presenting four-bay elevation to south and two-bay elevations to north and east. Front, south, side has slightly projecting gable towards centre with chimneystack, and gabled single-storey porch. North elevation has stairs return, return at right angles to main block, and single-bay lean-to in angle between returns. Canted-bay window to east elevation. Artificial slate roof, pitched to main block and to porch, and hipped to stairs return. Render shouldered copings to gables with rendered chimneystacks, cast-iron and replacement uPVC rainwater goods, and fleur-de-lys finial to porch and to gables. Lined and ruled rendered walls with plinth and having two tooled limestone plaques to front elevation, that to east bay reading 'Galway Fishery 1669' and that to central gable reading 'H 1899'. Decorative moulded render oculus openings to upper part of east end bays of long walls and to lower part of west gable. Square-headed window openings having tooled limestone sills and replacement one-over-one pane timber sliding sash windows, bipartite and with label-mouldings to front elevation, stairs return and ground floor of rear return. Hipped slate roof to bay-window and camber-headed window to porch gable. Camber-headed door opening to front elevation having replacement double-leaf battened timber doors and square-headed opening to rear having replacement timber glazed door.
8501	30313038	Mill Race, Gaol Road, Townparks	Limestone and rubble stone-lined mill race cutting, built c.1870, associated with now demolished marble works and lime kiln. Water source supplied from north by Eglinton Canal. Mill race follows curving path southwards before flowing into Corrib River. Race passes under four small pedestrian bridges and single-span section of Salmon Weir road bridge. Rusticated limestone to three of original bridges and Salmon Weir Bridge with rusticated voussoirs, soffit, parapets and coping stones. Concrete construction to recent additional bridge.
10311	30314002	Post box Courthouse Square, Townparks	Freestanding cast-iron pillar post box, erected c.1915, on cylindrical base, with raised 'GR' royal cipher, having moulded neck and plinth with dentillation to shallow domed cap. Sited in front of courthouse in paved pedestrian area.
10506	30314005	Corrib House, 3 Waterside, Townparks	Detached three-bay two-storey house, built c.1810, having two windows to first floor, lower three-bay two-storey return to rear and two-storey lean-to to south elevation. Hipped artificial slate roofs having rendered chimneystacks, cast-iron and replacement uPVC rainwater goods and rendered eaves course. Artificial slate to lean-to. Lined-and-ruled rendered walls with render plinth and channelled render quoins. Square-headed window openings with painted render and stone sills, raised render block-and-start surrounds to front and north elevations of main block, with keystones to ground floor windows, two-over-two pane sliding sash windows, tripartite to ground floor of north elevation comprising one-over-one pane timber sliding sash with two-over-two pane flankers. Raised render surrounds to windows of return with two-over-two pane and six-over-one pane timber sliding sash windows, tripartite

RPS Ref	NIAH Ref/RMP Ref	Name	Description
			<p>window to ground floor with one-over-one pane timber sliding sash having two-over-one pane flankers, and single timber casement window. Two-over-two pane timber sliding sash, and replacement uPVC windows to south side elevation. Segmental-headed door opening to front having raised render block-and-start surround, timber doorcase with panelled pilasters and fluted brackets, timber panelled door with glazed timber side panels, panelled stall risers, spoked timber fanlight and limestone stepped approach. Square-headed door opening to south elevation having raised render surround and battened timber door.</p>
10505	30314006	The Coves, 4 Waterside, Townparks	<p>Detached two-bay three-storey house, built c.1910, having flat-roofed full-height canted bays to front elevation, and lower two-bay three-storey addition and recent conservatory to rear. Hipped artificial slate roof with rendered chimneystacks and cast-iron rainwater goods. Lined-and-ruled rendered walls to front and north elevations, rendered to rear and roughcast rendered to south elevation. Painted tooled stone eaves course to canted bays and timber cladding to eaves of main body of house. Square-headed window openings throughout with timber sliding sash windows. Canted bays have two-over-two pane windows with one-over-one pane flankers and moulded render sills and rear elevation has stone sills and two-over-two pane windows, some double to addition. Square-headed door opening to front having timber panelled door, vertically-divided overlight and limestone threshold and step. Lined and ruled rendered walls to north and south having rendered copings with square-headed pedestrian entrance having timber sheet door and limestone threshold.</p>
2605	30314007	3 Courthouse Square, Townparks	<p>Terraced two-bay four-storey house, built c.1800, east bay shared with neighbouring house to east. Pitched slate roof having rendered chimneystack and cast-iron rainwater goods. Roughcast rendered walls with rendered eaves course. Square-headed window openings having painted tooled limestone sills, raised render reveals and timber sliding sash windows, two-over-two pane to top floor, six-over-six pane to middle floors and one-over-one pane to ground floor. Segmental-headed door opening having raised render reveal, timber panelled door and spoked fanlight.</p>
2604	30314008	2 Courthouse Square, Townparks	<p>Terraced two-bay four-storey house, built, c.1800, having recent gabled extension to rear. Pitched slate roofs having rendered chimneystack and cast-iron rainwater goods. Roughcast rendered walls with rendered eaves course. Square-headed window openings having painted limestone sills, raised render reveals and timber sliding sash windows, two-over-two pane to top floor, six-over-six to middle floors and one-over-one pane to ground floor. Segmental-headed door opening having raised render reveal, replacement timber door and spoked timber fanlight.</p>
2603	30314009	Postgraduate Applications Centre, 1 Court House Square, Townparks	<p>Terraced two-bay four-storey house, built c.1800, now in use as office and having recent flat-roofed extensions to rear. Pitched slate roof having rendered chimneystack and cast-iron rainwater goods. Roughcast rendered walls with rendered eaves course. Square-headed window openings having painted limestone sills, raised render reveals and timber sliding sash windows, six-over-three pane to top floor, two-over-two to middle floors and replacement uPVC to ground. Segmental-headed door opening having raised render reveal, replacement timber door and spoked timber fanlight.</p>
10506	30314010	Lough Corrib House, 5 Waterside, Court House Square	<p>Attached corner-sited four-bay three-storey over basement double-pile house, built c.1810. M-profile hipped slate roof having rendered chimneystacks and cast-iron rainwater goods. Lined-and-ruled rendered walls having rendered and red-brick eaves course. Square-headed window openings having tooled limestone sills. Two-over-two pane timber sliding sash windows, tripartite to south elevation, with mainly replacement uPVC windows to top floor. Round-headed door opening within tooled limestone doorcase comprising panelled pilasters with plinths and having foliate consoles supporting moulded open-pediment, and having decoratively-carved timber panelled door. Entrance approached by flight of limestone steps with</p>



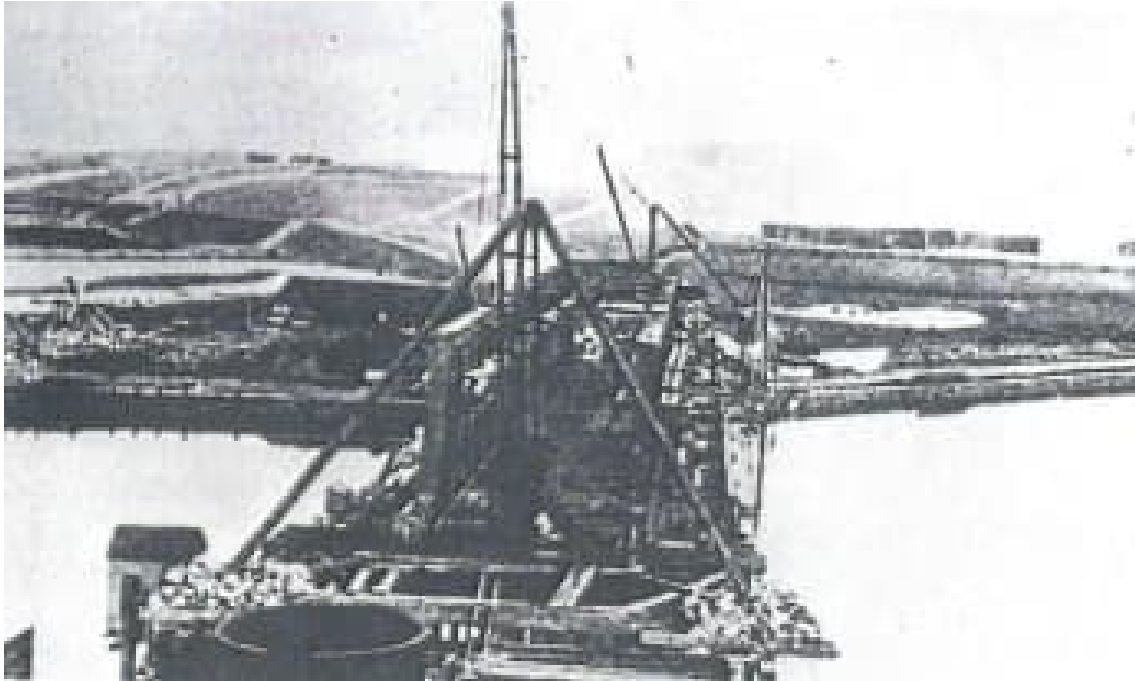
RPS Ref	NIAH Ref/RMP Ref	Name	Description
			cast-iron railings. Cut limestone plinth wall to area, with cast-iron railings. Rendered wall to north having moulded coping and square-headed vehicular and pedestrian entrances.
2601	30314011	Galway Courthouse, Court House Square, Townparks	Freestanding court house, built 1815, having five-bay single-storey front façade with slightly advanced end bays, and projecting Doric-style portico, with five-bay two-storey over half-basement side elevations, and slightly recessed lower three-bay two-storey over half-basement returns forming two-storey advanced pedimented end-bays of rear, flanking four-bay two-storey over basement pedimented recessed section. Main rear pediment has clock to tympanum with moulded render surround. Hipped slate roof with central roof-light, carved limestone parapet, rendered chimneystacks, cast-iron rainwater goods, and with moulded limestone cornice to front and side elevations of main block. Ashlar limestone front façade with cut-stone plinth continuing to side elevations of main block, end bays of front façade have round-headed recesses with niches and trophies of justice in relief above plat band, and all window openings and niches have rectangular panels to aprons. Plat band becomes moulded cornice to portico. Portico has dentillated architrave, panel to frieze and rolled cornice to entablature over lower frieze with lions' head decorations above columns. Painted lined-and-ruled rendered walls to side and rear elevations, having limestone quoins to main block, plat band to mid-level of upper windows, continuing as cornice to lower block, with further cut-stone eaves course to sides of main block. Front two bays of side elevations of main block are articulated by square-headed recesses, with channelled render to ground floor, and ground floor of other bays have round-headed recesses. Limestone plaques between floors of advanced rear bays. Round-headed windows flanking main entrance, with recessed surrounds and blank tympanums. One oculus to back bays of main block, round-headed window openings to upper floor of advanced rear bays, and square-headed window openings elsewhere, all with tooled limestone sills, front façade and first floor of rear block having cut-stone sill course. Fixed timber-framed twelve-pane windows to front façade. Timber sliding sash windows elsewhere, upper floors of rear block and ground floor of rear bays of main block having six-over-six pane windows, three-over-six pane to basement of rear block and to upper floors of advanced rear bays, openings of latter having fanlights. Basement to main block has three-over-three pane windows. Paired window openings to front bays of side elevations of main block, having rolled render surrounds and four-over-four pane windows, tripartite to ground floor with overlights and moulded render cornices. Multiple-pane double fixed windows to top floor of rear bays of main block. Square-headed door opening to main entrance, with carved stone doorcase comprising roll-moulded surround, surmounted by capitals with roundel motifs, moulded cornice, and having double-leaf timber panelled doors with dentillated cornice lintel and paned overlight. Round-headed door openings to end bays of rear elevation, having tooled limestone surrounds and voussoirs, moulded lintel, timber panelled door, fanlight, and fronted by limestone step and decorative wrought-iron railings. Interior features include ornate staircase with turned bannisters and gallery. Doorway having timber doorcase with panelled pilasters and dentillated segmental-headed pediment and timber-glazed side-lights and panelled double-leaf door, approached by moulded limestone steps with wrought-iron handrails, all flanked by paired rendered pilasters. Polished granite steps with cast-iron hand-rails to basement stairways.
2602	30314012	Town Hall Theatre, Courthouse Square, Court Avenue	Freestanding former court house, built 1825, formerly used as town hall, now in use as theatre. Single-storey entrance block with slightly advanced end bays and ashlar limestone facade with slightly projecting Doric portico to recessed three-bay middle unit. Five-bay three-storey rear block slightly recessed from side elevations of front block and having four-bay side and five-bay rear elevations, latter with projecting porticoed entrance. Hipped slate roof to rear block behind tooled limestone parapet concealing rainwater goods. Flat roof to front block with tooled limestone parapet wall concealing rainwater goods, and having rectangular panels to parapet of end bays

RPS Ref	NIAH Ref/RMP Ref	Name	Description
			and portico. Moulded cornice to front façade. Channelled walling to end bays of front façade with plinth and impost course. Tooled entablature to portico with string courses to frieze. Painted rendered walls to side and rear elevations, with double-height round-headed recesses to side elevations, with tooled limestone plinth, tooled sill courses to upper floors, moulded cornice to eaves, and channelled quoins. Segmental-headed window openings to end bays of front and to side elevations of front block, with chamfered tooled limestone sills, having limestone stall-risers and channelled voussoirs to front façade, all with fixed timber-framed tripartite windows with small-pane overlights and having decorative timber panels. Square-headed window openings elsewhere, rear block having limestone sills and channelled stone surrounds to top floor and raised render surrounds to other floors, with replacement timber windows. Three-bay main entrance comprises square-headed door openings with double-leaf timber glazed doors to each side of fixed timber-framed window, all with overlights, and limestone stepped approach. Doric portico to rear entrance comprises four columns supporting entablature with frieze and cornice, with square-headed doorway to rear having timber glazed double-leaf door with overlight and side-panels, with limestone stepped approach. Square-headed door openings to side and rear elevations within round-headed recesses having carved moulded limestone surrounds with recent keystones and replacement double-leaf battened timber double-leaf door, with limestone steps.
7803	30314013	Keane Mahony Smith, 37 Prospect Hill, Townparks	Terraced two-bay four-storey over basement house, built c.1810, now in use as offices with clinic to basement. Rendered parapet concealing roof and rainwater goods. Broached ashlar limestone to ground floor of front elevation, having lined-and-ruled render to other floors, and roughcast render to basement. Tooled limestone sill course to first floor and recent fascia board to ground floor. Square-headed window openings with limestone sills, replacement uPVC windows. Six-over-one pane timber sliding sash window to ground floor with tooled block-and-start surround. Round-headed door opening to front elevation with tooled block-and-start surround and render doorcase comprising fluted pilasters with plinths and capitals and entablature with panels and flower motifs to frieze, timber panelled door and spoked fanlight, approached by limestone landing over area, with cast-iron railings around area. Square-headed door opening to basement having replacement timber glazed door, and accessed by limestone steps on tooled limestone plinth with cast-iron railings.
8501	30314076	Canal, Newtownsmith, Townparks	Canal, built c.1860, having block and rubble limestone and yellow-brick lining with limestone coping blocks to banks and puddled bed. Runs north from River Corrib southwards before terminating in small harbour. Latter has four blocked disused mill-races, in group of three to east and single to west, lower parts of arches being blocked up. All arches elliptical with dressed limestone voussoirs. Pedestrian walkway to west bank with two major road bridges crossing canal as well as two recent pedestrian bridges. Canal includes small aqueduct where canal is carried over mill-race channel feeding into River Corrib, having ashlar limestone block construction with voussoirs and coping stones and also carrying pedestrian footpath. At about mid-way point is lock with rounded approaches and metal and timber sluice still operational. Canal continues to south beneath bridge and into small harbour where it feeds back into Lower Corrib via stone block weir to south-west corner of harbour.
	30314077	County Hall, Prospect Hill, Townparks	Sneaked squared rubble limestone, constructed c.1999, incorporating features of former three-bay three-storey with attic façade of former infirmary building of c.1780 later used as Galway County Council headquarters. Features window openings comprising cut limestone coping, square-headed window openings with recent timber sliding sash frames, six-over-six pane to ground floor and three-over-six pane to upper storeys, having cut-stone Gibbsian surrounds with triple keystones and cut-stone sills. Oculus openings to attic-storey with timber louvers and cut-stone Gibbsian surrounds. Round-headed door opening having cut-stone Gibbsian surround and

RPS Ref	NIAH Ref/RMP Ref	Name	Description
			recent timber glazed double-leaf door, overlights and timber tympanum. Recent commemorative plaque to wall.
8501	30319001	Lower Corrib River, Claddagh Quay, Long Walk, Townparks	Banks of Lower Corrib River, canalised c.1750, following relatively straight course from Salmon Weir, southwards into Galway Bay. Three bridges cross this section of river, Salmon Weir Bridge, William O'Brien Bridge and Wolfe Tone Bridge. Banks consist of mixture of stone rubble and limestone blockwork lining with several tributaries to western bank from mill races and Eglinton Canal at southern end of river. Also mill races to eastern bank north of William O'Brien Bridge. Mill races feeding into river enter it either via stone block construction weirs with remains of cast-iron fixings from now absent sluice mechanisms or through stone-lined channels, quality of which varies between finely constructed ashlar lining and rougher rubble and mortar work. Many mills associated with these races still stand and mainly concentrated on western bank where they are built right on river edge with walls acting as part of raised embankments which line length of river to protect against flooding. Other large feature of Lower Corrib is salmon trap comprising concrete piers with metal salmons traps between them.



## Appendix B Photographs



**Plate 1** Viaduct under construction. Note marginal ground on eastern riverbank (After Semple, 1973).



**Plate 2** Looking north at the completed bridge. Note cabin on the western embankment (After Semple, 1973).



Plate 3 Looking east with the drawbridge section of the bridge in the foreground (After Semple, 1973).



**Plate 4** The eastern embankment.





**Plate 5** The eastern abutment.



**Plate 6** Low walls which flanked the railway roller bearings on the abutment.





**Plate 7** The angled sloping wing wall on the abutment.



**Plate 8** The Eglinton pier (RPS 8501).



**Plate 9** No. 3 Pier- east facing elevation.



**Plate 10** No. 3 pier- string course.





**Plate 11** No. 3 pier- metal frame attached to south-east side.



**Plate 12** No. 2 pier- east facing elevation.





**Plate 13** No. 1 pier- west facing elevation. Note rebates for the drawbridge.



**Plate 14** No. 1 pier- detail of rebate.



**Plate 15** No. 1 pier – rebates on east facing elevation.



**Plate 16** No. 2 pier- detail of pseudo-Romanesque arch.





**Plate 17** No. 1 pier- damage to string course on east facing elevation.



**Plate 18** Western embankment and abutment.





**Plate 19** Overgrown, truncated end of the western embankment.



**Plate 20** The regulating weir (RPS 8501) with Galway Cathedral (RPS 3602) in the background.



**Plate 21** The former Fisheries office (RPS 3607).



**Plate 22** The limekiln (RPS 3609).





**Plate 23** The former IMI Building (RPS 10308).



**Plate 24** The arts block (RPS 7003) within the UG campus.





**Plate 25** The Courthouse (RPS 2601) and Town Hall (RPS 2602).



## Appendix G Designers Risk Assessment



# Clifden Railway Pedestrian and Cycle Bridge

## Designers Risk Assessment

<b>Project Number:</b>	60656050	<b>Revision</b>							
<b>Client:</b>	Galway City Council	<b>Rev</b>	01	02	03	04	05	06	07
<b>Designer:</b>	AECOM	<b>Date</b>	16/09/21	17/12/21	01/02/23	01/03/23			
<b>Contractor:</b>	Not applicable	<b>Client</b>	✓	✓	✓	✓			
<b>Prepared by:</b>	Rionach Murphy	<b>Designer</b>	✓	✓	✓	✓			
<b>Checked by:</b>	Arthur Costello	<b>Main Contractor</b>	-	-					
<b>Approved by:</b>	Niamh Rodgers	<b>Sub-Contractors</b>	-	-					
		<b>Other</b>	-	-					

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
1	Access and egress to the site and compound	Access and egress to site and compound from busy urban area.	High	Design has ensured that sufficient lands are made available within the temporary landtake area. All lands are to be accessed from Dyke Road.	N/A	Low	Contractor to be made aware of temporary landtake area and to ensure that construction works are carried out within this area. Contractor to ensure that access and egress to the site is from Dyke Road.
2	Site security	Unauthorised access by members of the public to the works areas	High	Sufficient space has been provided within the indicative Temporary CPO area to allow suitable hoarding/fencing to be erected to prevent unauthorised access to the works areas	N/A	Low	Contractor to ensure that fencing is erected and maintained throughout the construction works.
3	Plant movements	Insufficient ground bearing pressure for site works.	Medium	Preliminary Ground investigations have been carried out to determine if there are potential risks of low ground bearing pressures.	N/A	Low	Further Ground Investigations to be carried out as part of Detailed Design to determine any further areas of low ground bearing pressures. Appropriate hoarding to be provided at construction stage to separate works from areas of adverse ground conditions.

# Clifden Railway Pedestrian and Cycle Bridge

## Designers Risk Assessment

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
4	Multiple Construction Projects	Likelihood for a number of concurrent construction projects to take place in proximity to the bridge location (i.e. Dyke Road Redevelopment).	Medium	Sufficient space has been provided within the indicative Temporary CPO area providing a suitable construction zone for exclusive use for the proposed bridge.	N/A	Low	Contractor to discuss sequencing and construction programme with the client and other Contractors working nearby. On-site personnel to be aware of ongoing site activities and follow any appropriate safety requirements. Barriers and hoarding to be put in place as appropriate to protect on-site personnel and segregate different site activities.
5	Underground services	Potential for unknown and/or undocumented services in the vicinity of the proposed structure.	Medium	Desk top study of available utility information carried out and all known services in the vicinity of the proposed structure have been shown on preliminary design drawings.	In correctly utility locations provided in information received from utility providers. Changes to utilities in the period before construction.	Low	Further desk top study to be carried out at Detailed Design stage to identify any additional services which have been constructed in the interim. At construction stage full CAT scan site survey to be carried out prior to commencement. Any services identified should be located by hand excavation, marked and protected or re-routed before commencement of works.
6	Excavations adjacent to an existing Structures and live carriageway	Excavations required to construct the bridge run the risk of undermining the live carriageways along Dyke Road and within UG. Also risk of impact on existing structures such as abutments and piers	High	The bridge location and geometry has been determined to avoid excessive excavation works near the existing abutments and piers. Excavations to construct plaza areas are considered to be low depth reducing the risk of undermining carriageways.	N/A	Low	The contractor is to be aware of the risk of undermining existing carriageways. As part of the detailed design the construction methodology should consider if temporary works such as sheet piling are required to avoid undermining. The contractor is to ensure that vibration levels from excavation are limited and that safe working limits are developed prior to works.
7	Structural Instability	Instability of structural elements during construction	High	Minimal interventions are required to existing elements such as piers and abutments reducing the risk of instability.	N/A	Medium	Where required the Contractor shall ensure that temporary works are provided on site to ensure structural stability during construction. All temporary works required are to be designed by a temporary works designer.

# Clifden Railway Pedestrian and Cycle Bridge

## Designers Risk Assessment

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
8	Bridge Superstructure Construction	Risks to operatives during cutting & welding of steel members	High	The bridge construction methodology has been considered which minimises on site fabrication. Some on site assembly will be required. Where possible the bridge superstructure will be fabricated off site in a controlled environment and assembled on site limiting the amount of on-site works required	Works to assemble the superstructure within the site compound	Low	Contractor is to ensure that assembly of the bridge superstructure is carried out by suitably qualified steel workers
9	Bridge Superstructure Construction	Transportation and delivery of bridge superstructure	High	The bridge design has ensured that the superstructure can be fabricated off site and assembled within the site compound. Where required the bridge will be delivered to site in sections to avoid major logistical issues with delivery of the a fully assembled superstructure	N/A	Low	Contractor and detailed designer to liaise with the steel work fabricator to ensure that transportation and delivery of the bridge can be successfully achieved.
10	Working at Height	Risk of fall of plant, materials and people.	High	The bridge design has been developed to ensure the bridge spans can be lifted/pushed into position fully assembled avoiding the need for works from height. Simple connection details such as bolting have been considered as part of the design to avoid the need for welding from height.	N/A	Medium	Detailed Designer and Contractor to consider construction methodology to ensure minimal lifts are required. Where these elements are lifted in sections the Contractor shall ensure appropriate guard rails and netting provided to the structure to prevent falling objects. Contractor to ensure suitable fall restraint systems/harnesses to be used when working at height.
11	Working over/near Water	Risk of drowning	High	The bridge design has been developed to ensure the bridge spans can be lifted/pushed into position fully assembled avoiding the need for major works over water. Simple connection details such as bolting have been considered as part of the design to minimise the time spent over water. The geometry of bearing pads and plinths considers a working area of the top of piers to allow construction.	N/A	Medium	Contractor to consider the use of mobile temporary platforms or bridges to provide access the piers. Consideration should also be given to the use of a safety boat during all works over water. Personal floatation devices to be used at all times when working over or near water. The Contractor should consider putting in place a suitable emergency procedure for water based accidents particular for those which may occur in the Salmon Weir Exclusion Zone



# Clifden Railway Pedestrian and Cycle Bridge Designers Risk Assessment

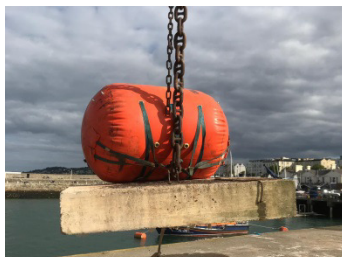
Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
12	Night-time Working	Reduced visibility and fatigue caused by night-time working poses the risk of slips, trips, falls and unsafe working practices being incorporated.	High	The design has assumed that bridge spans will be lifted during night-time works requiring closure of traffic lanes in the surrounding area. The design has been developed to ensure the lifting can be carried out over a short number of nights limiting the requirements for night-time working.		Low	The Detailed Designer and Contractor will need to consider the construction methodology and sequencing to limit night-time working. Where night works are required the Contractor must ensure that all staff are briefed on the dangers of night-time work and that site personnel are not overworked and remain vigilant.
13	Anti-Social Behaviour (as built)	Risk of people jumping into the River Corrib from the bridge.	High	Anti climb parapet will be designed and sufficient signage regarding water conditions in the vicinity will be installed,		Medium	The Detailed Designer and Contractor are to ensure that the design is constructed to minimise risks to the end user.
14	Works near other river users	Conflicts between river users such as rowing and yacht clubs and construction works.	High	Design has assumed minimal working over water requirements, bridge lifts are to be carried out over weekend and night time works limiting the risk of conflict.		Low	Contractor to be aware of the various river users on the River Corrib. Construction methodology to consider the presense of river users at all times. Contractor to undertake discussions with all clubs in the surrounding area and notify them of proposed works and the construction programme.

## Appendix H Underwater Inspection Report



**Underwater Inspection Report:**

**Railway Viaduct, Piers 1-3**  
**Proposed Clifden Railway Pedestrian**  
**and Cycle Bridge**  
**River Corrib, Wood Quay**  
**Galway City**







## Underwater Inspection Report:

### Railway Viaduct, Piers 1-3 Proposed Clifden Railway Pedestrian and Cycle Bridge River Corrib, Wood Quay Galway City

# AECOM

28 October 2021

Project Director  
Project Manager

Beverly Studios, Church Terrace, Bray, Co. Wicklow

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Document No.	Revision	Prepared by	Checked by	Status	Copy
21/019	A	R. Bangerter	N. Brady	Final	Soft

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## EXECUTIVE SUMMARY

*Location:* River Corrib, Wood Quay, Galway  
*Structure:* Pier Numbers 1-3, former Railway Viaduct  
*ITM Coordinate:* 529594E, 725880N (centrepont)

ADCO Ltd. was appointed by AECOM, on behalf of Galway City Council, to carry out an underwater inspection of the in-water components (bridge piers) associated with a railway viaduct that crossed the River Corrib at Wood Quay, Galway City. The viaduct (NIAH number 30309001) was built in the late 1800s and was later decommissioned with the removal of its track/ superstructure in the late 1930s.

The inspection work is required as part of the proposed Clifden Pedestrian and Cycle Bridge project; a development that seeks to reinstate a river crossing at this location and utilise the existing bridge piers/abutments from the former viaduct. An underwater survey was required to assess the current condition of these structures and the riverbed that surrounds them.

ADCO carried out the inspection work, in accordance with HSE/ HSA Diving at Work regulations, on the 31st August 2021.

The following report presents the findings from ADCO's inspection work, detailing the submerged elements of the viaduct's three (3) in-water pier structures (as presented in Section 5.0 of this report). However, the wider riverbed area was also assessed and the following general observations can be made:

1. The riverbed is largely clear of modern debris and retains much of its natural character. However, zebra mussels have colonised this section of waterway and obscure large sections of the riverbed.
2. The inspection of Pier Numbers 1-3 indicates that they remain in a good state of preservation with no obvious collapse from the above or below water areas of these structures.
3. The riverbed falls to the south and west, with the deepest part of the river surrounding Pier Numbers 1-2; an average water-column depth of c. 7m present between these pier structures.
4. No obstructions were noted for the water-column/ riverbed areas surrounding the three pier structures.
5. The inspection did not positively identify any masonry collapse requiring recovery to surface, the presence of zebra mussels making identification of individual masonry pieces amongst the rock-armour problematic.
6. A number of wrought-iron lifting tools were observed lying on the riverbed at a point c. 6m east of Pier Number 2; these items are thought to be contemporary with the construction of the railway viaduct in the late 1800s.
7. A possible section of wrought-iron rail track was encountered at a point c. 6m to the west of Pier Number 1.



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- Figure 3: Schematic Drawing showing Western Elevation of Pier Number 3.
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## **LIST OF ABBREVIATIONS**

E	Easting
N	Northing
DSV	Dive Support Vessel
ITM	Irish Transverse Mercator
HSE	Health and Safety Executive (UK)
HSA	Health and Safety Authority (Ireland)
NGR	National Grid Reference
NIAH	National Inventory of Architectural Heritage
SSDE	Surface Supplied Diving Equipment



## 1.0 BACKGROUND

ADCO Ltd. was appointed by AECOM, on behalf of Galway City Council, to carry out an underwater inspection of the riverbed and in-water elements of a former nineteenth-century railway viaduct located at Wood Quay, River Corrib, Galway City (Figure 1).

The railway viaduct was one of more than thirty bridges constructed for the Midland Great Western Railway Company on the 48-mile long Galway to Clifden line. The line was opened on 1st July 1895 and was closed in April 1935.<sup>1</sup>

The viaduct across the Corrib was of three 150-foot long spans with a bascule lifting navigation span of 21-feet on its western side (Plate 1). Following closure of the line, the metalwork superstructure was dismantled, leaving only the bridge piers standing.

Today, the bridge piers constitute an iconic feature above the salmon weir in Galway city, located within a stretch of the river populated by boat clubs and lying directly east of the NUI Galway campus. The piers and the former abutments are registered in the National Inventory of Architectural Heritage, which describes the site as comprising, 'earthen embankments running approximately east-west on both banks of River Corrib and terminating in rock-faced ashlar limestone construction abutments with oversailing block coping courses and coped parapet. Three rock-faced ashlar limestone piers in river having rounded ends and with coping in same style as abutments and west-most piers having Romanesque-style arrangement of arches with rock-faced *voussoirs* and springer blocks', and assesses the site's importance as being of regional importance, 'displaying fine stonework in its piers and abutments, demonstrating the pride that was involved in such civic projects whilst the design is also reflective of the medieval character of Galway City and also the Romanesque Revival style'.<sup>2</sup>

The location of the bridge components are presented in the Figures 1 and 2, which also show the extent of ADCO's Underwater Inspection Area (Plates 2-3). The coordinates (ITM) for same are provided below in Table 1.

In-water Structure	Easting	Northing	Dist. to nearest quayside
East Abutment	529678	725841	3m to the East
Pier 1	529585	725884	37m to the West
Pier 2	529594	725880	47m to the West
Pier 3	529637	725860	18m to the East
West Abutment	529544	725903	8.5m to the West

<sup>1</sup> <https://www.archiseek.com/2013/clifden-railway-viaduct-galway/>;  
<https://www.railscot.co.uk/img/74/40/>

<sup>2</sup> National Inventory of Architectural Heritage, reference 30309001.

**Table 1:** Location of *in situ* components from the former Railway Viaduct, River Corrib, Wood Quay Galway.

The current report presents the findings from the inspection work, which was carried out on the 31st August 2021.

It is understood that the Piers 1-3 were last subject to inspection in May 2000.<sup>3</sup>

## 2.0 SCOPE OF WORK

The aim of the underwater inspection was as follows:

1. Assess the current condition of the in-water elements of the three (3) piers.
2. Provide a general account of the topography of the riverbed surrounding Pier 1-3.
3. Consider whether any masonry has been displaced from these structures.
4. Ascertain if further elements of the former railway bridge are present on the surface of the riverbed.

## 3.0 METHODOLOGY

A comprehensive underwater survey of the pier structures was carried out and included an assessment of the surrounding riverbed, extending across a 92m (east-west) by 16m (north-south) area (Figure 1).

While most of the channel was accessible, the very western side did not have access due to moored boats.

The inspection commenced on the east side of the River Corrib and progressed westward; recording Pier Number 3 first, followed by Pier Number 2 and finally Pier Number 1. Section 5.0 of the report discusses each of the pier structures, presented in the order that they were recorded. Structural details were recorded using direct measurement, allowing a series of schematic drawings of the in-water sections of each pier to be produced (see Figures 3-6).

The dive work was completed by a six (6) person dive-team. Underwater visibility of between 6m-8m was present and a maximum depth of 7m was recorded.

Dive logs were maintained during the diving operations and a copy of the relevant logs has been included in the report.

### 3.1 HSE/ HSA Compliance

Dive operations were carried out to HSA/HSE standards, using surface supplied equipment, from a licensed Dive Support Vessel (*Black Betty*, P2 licence 1929). All diving and water-

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<sup>3</sup> 'Inspection of Railway Pillars on Corrib, Wood Quay', P. Beatty Marine, report prepared for Irish Drilling, May 2000.

based operations were undertaken in accordance with HSE/ HSA Diving at Work regulations.<sup>4</sup> A Site Specific Risk Assessment was issued to AECOM prior to commencement of site work.<sup>5</sup> This included a copy of ADCO's Planned Maintenance System (PMS) for all SSDE and associated apparatus operated by the company.

ADCO in-water personnel are certified to a minimum HSE Part III level, have undertaken sea-survival training and hold BOSIET/FOET certification. All personnel are Safe Pass-certified and First Aid-trained. A number of the on-site personal are also IMCA certified Dive Medics.

### 3.2 Constraints

The very western side of the river channel was inaccessible due to the presence of moored boats.

Riverweed is present across the upper parts (first 1.5m-2m) of the submerged pier structures (Plate 4). Where necessary, this growth was removed to facilitate recording. Moreover, zebra mussels (*Dreissena polymorpha*) have colonised large sections of the riverbed, c.45% coverage, and obscure much of the deeper elements of these structures; growth being focussed across the lower 2m-3m of each pier/pillar (Plate 5).<sup>6</sup> This coverage ranges between 60% and 80% across the full circumference of the structure. As such, it was necessary to expose small sections of the pier/pillar wall in order to record specific details that may be obscured beneath. These details were later cross-referenced with the inspection report from 2000, an inspection that was carried out prior to the introduction of zebra mussels at this location.

### 3.3 Terminology

When referring to the degree of compaction observed for seabed deposits under inspection, the terms loose, medium, and hard are relative and do not relate to the measured properties of these deposits. When referring to sediment grain size, the Wentworth scale has been adopted, as detailed in Table 2.

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<sup>4</sup> ADCO carries out all site work in compliance with Health and Safety requirements for Diving at Work and specifically the *Industry (Diving Operations) Regulations 1981, SI 422* and the more recent *HSA, Health and Welfare at Work (Diving) Regulations 2018, SI 254 of 2018 and S.I. No. 180 of 2019*. Note: the company also complies with *Safety, Health and Welfare at Work Act 1989 and 2005; Safety, Health and Welfare at Work (Construction) Regulations 1985 (SI 138 of 1995) and 2001 (SI 481 of 2001)*.

<sup>5</sup>Niall Brady, Site Specific Health and Safety Plan: Underwater Inspection, Clifden Pedestrian and Cycle Bridge. ADCO safety document issued 25 August 2021.

<sup>6</sup> ADCO's protocols for biosecurity were observed, as per Section 22.0 of the risk assessment, and measures were put in place to ensure no introduction or spread of invasive species could take place as part of the inspection work.



Size (mm)	Grade
>256	Boulder
>64	Cobble
>4	Pebble
>2	Granule (gravel)
>1	Very coarse sand
>1/2	Coarse sand
>1/4	Medium sand
>1/8	Fine sand
>1/16	Very fine sand
>1/32	Coarse silt
>1/64	Medium silt
>1/128	Fine silt
>1/256	Very fine silt
<1/256	Clay

**Table 2:** Sediment grain size categories as applied to the seabed deposits discussed.

## 4.0 UNDERWATER INSPECTION

The underwater inspection was systematic and comprehensive. The information provided below references the items/details provided in Figures 3-7 of this report.

### 4.1 Riverbed Topography

The riverbed is composed of a compact deposit of coarse sand and gravel (hand-penetration depth of <20mm) with frequent sub-rounded cobbles (< 200mm in size) and small angular to sub-angular boulders (<300mm in size) (Plates 6-7). Larger boulders were also observed to the northeast (c. 10m distance) of Pier Number 2; measuring up to 1.5m length and upstanding from the riverbed to a maximum height of 500mm.

The riverbed, extending between Piers 2-3, slopes gently to the south (downstream) and to a greater extent to the west, with a fall of c. 3m over a distance of 44m. The riverbed continues to slope to the west of Pier Number 2 for a distance of c. 20m. At which point the riverbed starts to rise, shallowing out to a depth of 1.5m at a point c. 12m west of Pier Number 1.

Erosion of the riverbed was observed on the north (upstream) side of Pier 3, where a localised scour hole measuring 2m north-south x 1.8m east-west is present. Scouring at this location has exposed 600mm section of the pier's foundations (Plate 8). However, no undercutting of the structure is evident, the foundations extending well below the scour limit. The upper parts of the pier's foundations also remain partially exposed on the east side of the structure, presumably where water velocity is greater.

A deposit of small (<300mm) to medium sized (<500mm) angular boulders surround the base of each of the pillars (full circumference) that comprise the submerged sections of Piers 1 and 2. This deposit, which acts as rock-armour protection, forms a c. 40-degree slope that extends a maximum distance of c.1.5m from the base of each pillar (Figures 4 and 6, Plate 9). A number of potential masonry pieces (bridge collapse) were observed near the base of the rock-armour.

As previously noted, zebra mussels obscure much of the submerged surface area of each pier (up to 80% coverage) and have also colonised the surrounding riverbed (c.45% coverage), anchoring themselves to the larger cobbles and boulders present (Plate 10). At Pier 3, this growth is concentrated on the west side of the structure (c. 90% coverage), while the east side of the structure remained largely exposed (c. 10% coverage). In contrast, the zebra mussels are present for the full circumference of both sets of pillars that comprise Piers 1-2 (c. 80% coverage).

The following depths were noted for the upstream (north) and downstream (south) sides of Pier Numbers 1-3 (Table 3):

Pier Number	Location	Depth at base	Depth at distance of 2m from base
3	North Side	2.8m	2.1m
3	South Side	2.6m	2.5m
2	North Side	5.9m	6.6m
2	South Side	5.8m	6.63m
1	North Side	6.25m	6.93m
1	South Side	6.45m	7m

**Table 3:** Water-column depths at locations on the upstream/ downstream sides of Piers 1-3.

## 4.2 Pier Number 3 [Figure 3]

Pier Number 3 is in a good state of preservation; its masonry remaining fully intact and tightly-joined across it's above/below water extent. The pier is sub-rectangular (semi-elliptical) in form, measuring c. 9m length and 3.5m width, with a circumference of 21.9m. It has been constructed using good-quality, edged-dressed (30mm frame), rock-faced limestone ashlar (Plate 11). The masonry is relatively uniform in size and shape, averaging 1.1m in length and 450mm-500mm depth. Tight masonry seams are evident throughout (3mm-4mm), bonded using a fine-grained hydraulic lime mortar (Plate 12-13). Some calcification was observed towards the waterline. Cone-shaped (pincer-lift) holes are located at the top/centre of each masonry block, measuring 30mm in diameter (Plate 14). Tiered, oversail, coping forms the uppermost part of the structure (Plate 15).

The masonry extends 2.40m below the water line before reaching a masonry footing, measuring 500mm in depth, which protrudes 150mm from the pier-wall (Plate 16). This

footing rests upon the upper surface of the pier's foundation, which comprises a solid mass of rubble-stone and mortar. The foundation is exposed, on the north and east side on the structure, to a maximum depth 500mm (Plate 17). No undercutting or damage/erosion to the foundation is evident, the structure extending well below the existing bed-level of the river.

### 4.3 Pier Number 2 [Figures 4-5]

Two (2) in-water pillars, positioned upstream (north) and downstream (south) of each other, rise 6m+ from the riverbed to support a single sub-rectangular pier structure located above the waterline (Figure 4). These pillars conjoin via a Romanesque style archway, comprising five (5) arch-rings, four (4) of which are tiered (Plate 18). Four (4) of the arch-rings are composed of neat-cut, rock-faced, ashlar with a final ring comprising brickwork. The arch-rings measure 350mm in width and have tiered recesses that measure as follows: top two tiers recessed by 200mm, the third tier recessed by 300mm, and the fourth (bottom) tier recessed by 400mm. The brickwork is composed of two (2) courses of red-brick, laid end-on, measuring 100mm length x 60mm width. The *intrados* (arch-ceiling) is also formed by this brickwork.

Rock-faced (limestone) ashlar has been used to construct the main-body of the pier and extends 500mm below the waterline to form the topmost part of both pillars (Plate 19). The masonry is fairly uniform in size and shape (measuring 800mm to 1.1m length and 450mm to 500mm depth) and is also edged-dressed. As observed for Pier Number 3, cone-shaped (pincer-lift) holes are located at the top/centre of each masonry block. In addition, the top of the pier is tiered using oversail coping.

Four (4) bands of cast-iron plate metal form the lower surface of each pillar, rising from the existing bed-level to a point 2.35m below the waterline; encompassing a 3.5m high section of the structure. This construction feature is covered in its entirety by zebra mussels, making detailed inspection problematic (see Plate 4). However, careful removal of mussel growth in several places identified that the metal-plate remained in a relatively good state of preservation. A line of equidistantly placed rivets (30mm Ø head) form the horizontal fastening points, positioned along the top of section of each plate, where the plate sections conjoin (Plate 20). In addition, a double line of rivets has been used to create the vertical fastenings between the plate sections.

Rock-armour surrounds the base of both pillars, the foundations of which are located well below the existing bed-level of the river.

**North Pillar:** a band of brickwork, measuring 1.4m width, is located above the plate-metal sections; extending the full circumference of the upstream pillar. The bricks have been laid



end-on and have a 20mm wide mortar-line between them (Plate 21). Riverweed obscures much of the brickwork (c. 70%), with zebra mussels covering a further c. 20%.

Collar features delineate the top and bottom parts of the brickwork. The upper collar is made of timber and measures 120mm width x c. 170mm in depth. The lower collar is composed of a fine-grained, poured-mortar that measures 120mm width and 200mm in depth. The poured-mortar collar overlies a narrow timber (50mm thickness) (Plate 22). Both of these collar features are covered (90%) by zebra mussels which obscure their fixing-points.

**South Pillar:** in contrast, the downstream pillar retains a series of timber fenders (softwood) that encircle the brickwork (Figure 5; Details A-C/ Drawing Items 1-3). These timbers, although water-eroded, remain largely *in situ* across the east side of the structure. Those located elsewhere, particularly across the west side of the pillar, have suffered greater erosion and are frequently missing. A ring of timber fenders would also have adorned the north pillar, but these items have not survived at that location.

Hand-forged iron nails have been used to secure the fender-planks to the structure, as detailed in Figure 5 (Drawing Item 1, Plate 23). Three (3) collar features provide fixing points for the timber fenders (Drawing Items 2-3). The upper and middle fixing points comprise timber collars that measure 120mm width and 170mm in depth. The lower collar, as observed for the north pillar, comprises a timber plank (50mm thickness), above which a fine-grained mortar has been poured to form a 200mm deep collar (Plate 24). The timbers collars have been affixed to the structure using 25mm Ø iron-pin fastenings.

Pier Number 2 remains in a good state of preservation and little or no erosion to the main-body of the structure was observed.

#### **4.4 Pier Number 1 [Figure 6]**

Pier Number 1 lies adjacent, 6m to the west, of Pier Number 2. It has been built to an almost identical design as Pier 2, using the same materials. Both pillars rise from the riverbed to conjoin into a single pier structure above the waterline (Figure 6). In addition, the structure retains a Romanesque style arch and oversail coping (Plate 25). As per the north pillar from Pier 2, both pillars (north and south) are missing their timber fenders, leaving only the brickwork and associated collar features beneath.

Where the two pier structures differ is across the uppermost parts of Pier Number 1; the top of the structure originally accommodating a lifting mechanism (presumably cantilevered) that could raise the section of track running between the two piers, allowing shipping to pass through safely. As a result, recesses (slots in the masonry) have been built into the pier

façades, two (2) on the east and two (2) west side of the structure (Drawing Items 3-4). In addition, the remains of a series of iron-fixing points are also present, protruding vertically from the topmost masonry course (Plates 26-27, Drawing Item 1). Red brick has also been incorporated into the structure, used to build up the inner side of the pier wall on its east side (Plates 28).

The recesses on the west side of the structure are located either side of the arch and measure 2.95m height, 3m depth, and 350mm width (Plates 29-31). The recesses on the east side of the structure are smaller, measuring 1.05m height, 2.1m depth, and 150mm width.

Remedial works to consolidate the masonry on the southwest side of the pier structure are evident; two (2) iron-straps having been used to retain the coping masonry at that location (Plate 32). The iron-straps measure 1m length, 70mm width, and 10mm thickness, fastened to the masonry at each end using threaded bolts/hexagonal nuts. It is likely that the coping was damaged during the removal to the railway track/bridge superstructure and the associated lifting mechanism, the repair also being contemporary with that endeavour. Despite this repair work, Pier Number 1 remains in a good state of preservation, and as noted for Pier Numbers 2-3, little or no erosion to the main-body and/or in-water elements of the structure was observed.

**North/ South Pillars:** neither of these pillars retain the timber fenders that are present on the southern pillar at Pier Number 2. The plate-metal sections remain obscured by zebra mussels (100% coverage) and the band of brickwork/ associated collars are covered by riverweed (c. 80% coverage) and zebra mussels (c. 10% coverage). Removal of aquatic growth from selected areas on each pillar confirmed that the construction method and material used are identical to that observed for the two pillars from Pier Number 2.

Rock-armour surrounds the base of both pillars, the foundations of which are located well below the existing bed-level of the river.

#### **4.5 Observations [Figure 7]**

The primary focus of the underwater work was to assess and record of the in-water elements of Pier Numbers 1-3, allowing a more detailed picture of these structures to be built-up as a whole (as detailed in Figures 3-6). However, the inspection also encompassed the wider riverbed, extending across a 76m east-west by 16m north-south area. As a result, the following general observations can also be made:

1. The riverbed is largely clear of modern debris and retains much of its natural character. However, zebra mussels have colonised this section of waterway and now obscure large sections of the riverbed.

2. The inspection of Pier Numbers 1-3 indicates that they remain in a good state of preservation with no obvious collapse from the above or below water areas of these structures.
3. The riverbed falls to the south and west, with the deepest part of the river surrounding Pier Numbers 1-2; an average water-column depth of c. 7m present between these pier structures.
4. No obstructions were noted for the water-column/ riverbed areas surrounding the three pier structures.
5. The inspection did not positively identify any masonry collapse requiring recovery to surface, the presence of zebra mussels making identification of individual masonry pieces amongst the rock-armour problematic.
6. A number of wrought-iron lifting tools were observed lying on the riverbed at a point c. 6m east of Pier Number 2; these items are thought to be contemporary with the construction of the railway viaduct in the late 1800s (Plate 33).
7. A possible section of wrought-iron rail track was encountered at a point c. 6m to the west of Pier Number 1. This feature protrudes eastward from the riverbed at a 45% angle, to a maximum height of 1m; the water column depth above this item being c. 5m.

## **5.0 RECOMMENDATIONS**

Given that the site is a registered in the National Inventory of Architectural Heritage, proposed works to the bridge piers should be subject to building conservation assessment and mitigation.

## **6.0 ACKNOWLEDGEMENTS**

Thanks are extended to Niamh Rodgers, Associate Director (Bridges and Structures) and Arthur Costello, Principal Bridge Engineer at AECOM. Thanks are also extended to Liam O'Farrell (Engineer) and Michael Corcoran (Foreman) from the Office of Public Works who manage the adjacent salmon weir. The inspection work was undertaken by Rex Bangerter (Project Director, HSE Diver), Niall Brady (Project Manager, HSE Diver), Brian McAllister (Dive Supervisor), Kyle McCoy (HSE Diver), Liam O'Shea (Coxswain/ HSE Diver) and Shem Caulfield (Dive Tender). The report was written by Rex Bangerter with historical background (Section 1.0) prepared by Dr Niall Brady. The report figures were produced by Bangerter.

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# ADCO DIVE LOG



## 1.0 GENERAL DETAILS

<b>Date:</b>	31.08.21
<b>Diving Contractor:</b>	ADCO Ltd., Beverley Studios, Church Terrace, Bray, Co. Wicklow
<b>Client:</b>	AECOM
<b>Project:</b>	Underwater Inspection, Clifden Railway Pedestrian and Cycle Bridge project.
<b>Location:</b>	River Corrib, Wood Quay, Galway City.
<b>Site:</b>	Piers 1-3, former Railway Viaduct.
<b>Platform/Vessel:</b>	DSV <i>Black Betty</i> (P2 1929).
<b>Breathing Equipment:</b>	Surface Supplied Diving [KBM 37]
<b>Gas Mix:</b>	Air
<b>Decompression Schedule:</b>	N/A
<b>Tools:</b>	Tape Measure/ Callipers/ Folding Rule/ Knives x 2/ Camera

## 2.0 DIVE TEAM

Position	Name	Bail Out Reading	Other
<b>Diver Supervisor:</b>	Brian MacAllister	-----	
<b>Diver 1:</b>	Rex Bangerter	200 Bar	Full checks completed
<b>Diver 2:</b>	Kyle McCoy	200 Bar	Full checks completed
<b>Standby Diver:</b>	Niall Brady	210 Bar	Full checks completed
<b>Tender 1:</b>	Liam O'Shea	-----	
<b>Tender 2:</b>	Shem Caulfield	-----	
<b>Data Recorder:</b>	Shem Caulfield	-----	
<b>Deckhand:</b>	n/a	-----	

## 3.0 RECORD OF DIVES

Diver:	Diver 1	Diver 1				
<b>Dive No.:</b>	1	2				
<b>LS:</b>	11:30	15:40				
<b>AB:</b>	11:30	15:42				
<b>LB:</b>	14:30	16:30				
<b>AS</b>	14:33	16:32				
<b>Bottom Time:</b>	183mins	52mins				
<b>Max Depth:</b>	7m	7m				

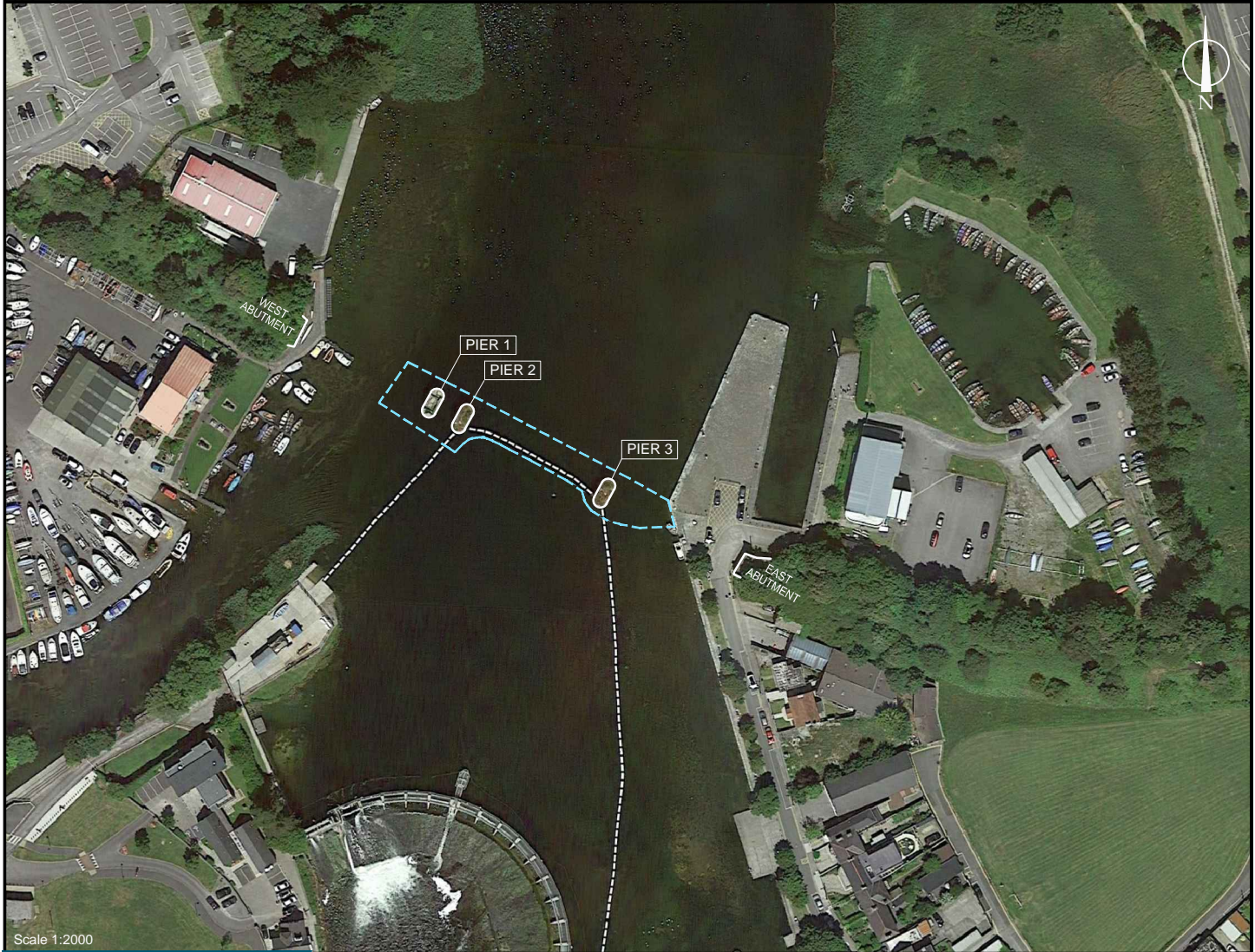
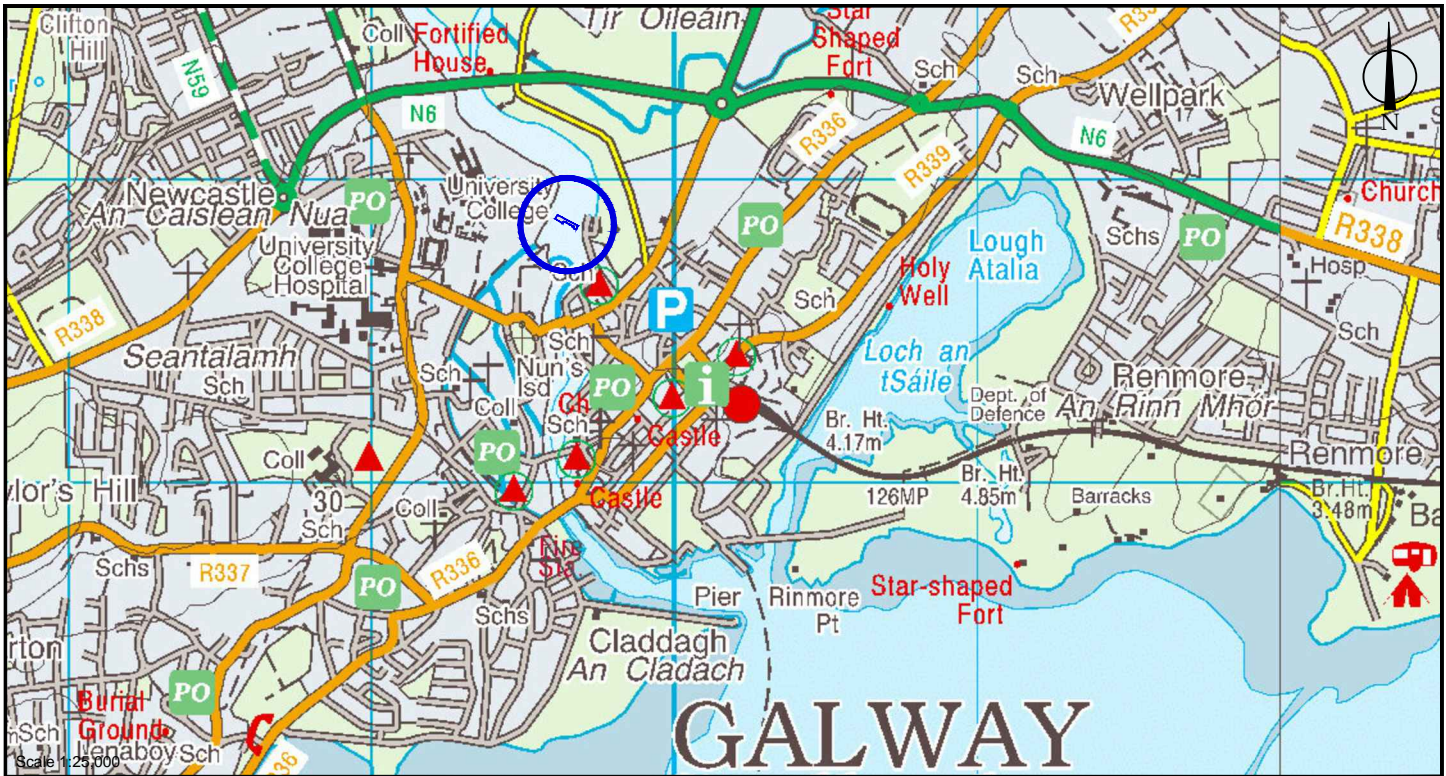
## 4.0 DESCRIPTION


**Dive 1:** U/w inspection of Pier 3 and surrounding riverbed, diver continues survey of riverbed west to Pier 2. Condition survey of Piers 2 and 3 carried out (north and south pillars).

**Dive 2:** Extend inspection to riverbed upstream, downstream and wets of Piers 1-2. Gather circumference measurements at base of Piers 1 and 2.

<b>Compiled by: B.M</b>	<b>Daily Total (mins)</b>	235
<b>Checked by: R.B</b>	<b>Running Total (mins)</b>	235
	<b>Page No.</b>	1



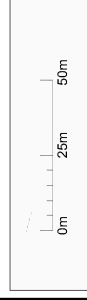



		<p><b>Notes</b></p> <p>----- Extent of ADCO U/w Inspection Area</p> <p>Source: Top- Extract from OS Discovery Series [1:50,000] Map. Bottom- Google Satellite Imagery [image captured 06.24.18]</p>			A4	<p><b>Title</b></p> <p>Figure 1- Location of ADCO Inspection Area surrounding Piers 1-3, Railway Viaduct, River Corrib, Wood Quay, Galway.</p>		
<p><b>Client</b> AECOM for Galway City Council</p>								
<p><b>Project</b> Clifden Railway Pedestrian and Cycle Bridge</p>		<p><b>Job/Exc No.</b> ADCO21/019</p>	<p><b>Compiled by</b> R.Bangerter</p>	<p><b>CAD reference</b> RiverCorrib_2021</p>	<p><b>Date</b> 19.09.21</p>	<p><b>Scale</b> 1:25,000/ 1:2000</p>	<p><b>Drawing No.</b> Figure 1</p>	

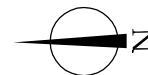


**MAP SERIES:**  
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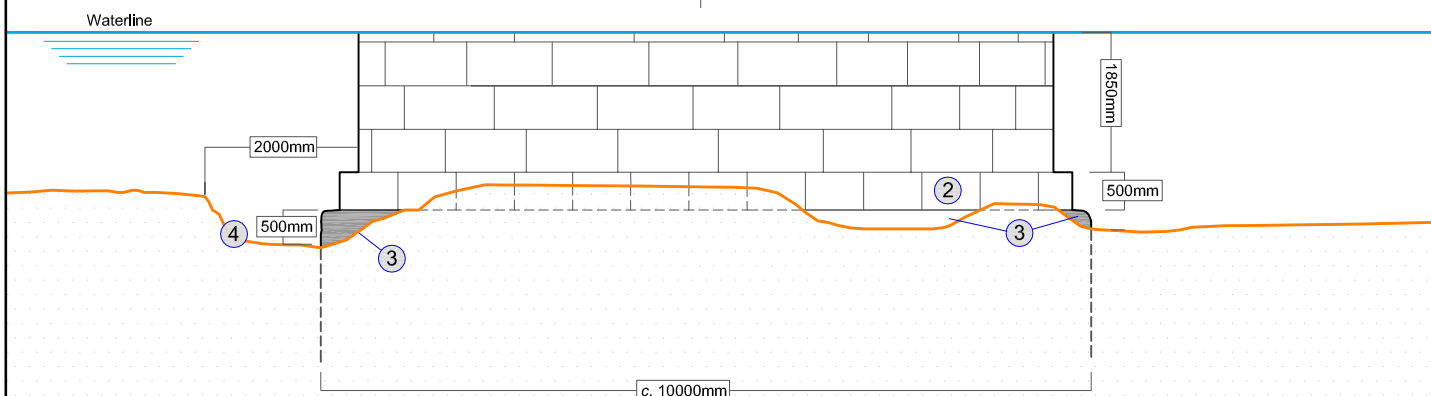
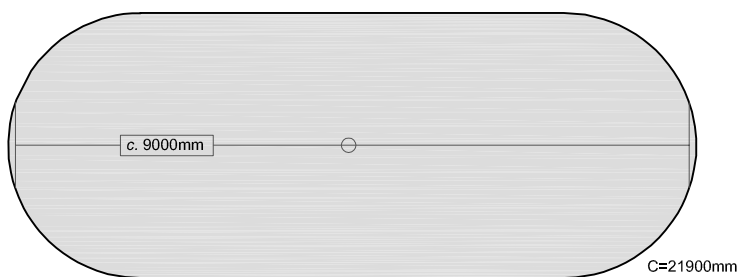
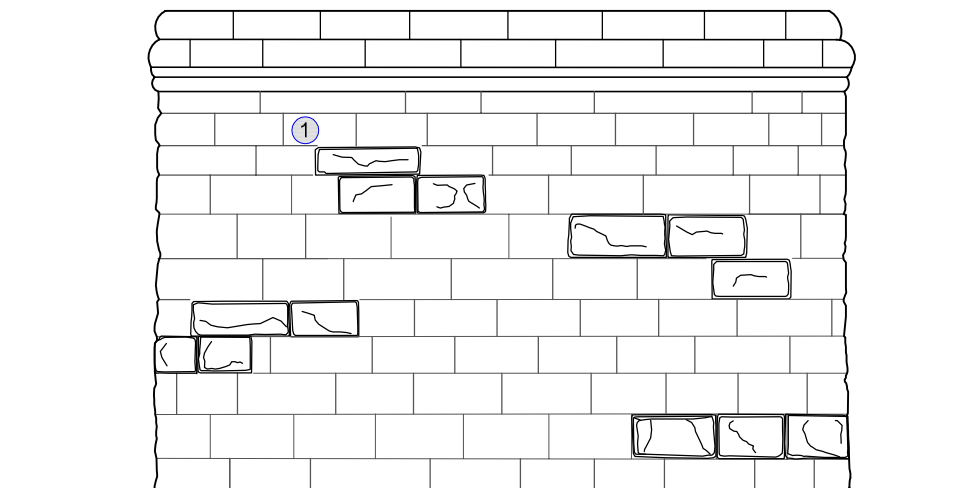
**MAP SHEETS:**  
GY094-02



	<b>Notes</b> ----- Extent of ADCO Inspection Area Source: OSI Historic Map Archive	A4	Job/Exc No. ADCO21/019	Compiled by R.Bangerter	CAD reference RiverCorrib_2021	Client AECOM for Galway City Council	Title Figure2 –Extract from OS 25-inch map (1888-1913) showing the Railway Viaduct with extent of ADCO Inspection Area superimposed.
			Date 22.09.21	Scale 1:2500	Drawing No. Figure 2	Project Clifden Railway Pedestrian and Cycle Bridge	



WEST ELEVATION



- ① Rock-faced [edge-dressed] Masonry.      ② Masonry course stepped out from pier wall by 250mm.      ③ Top of foundations visible in several places, comprising mass of rubble-stone and mortar.      ④ Scouring of riverbed on upstream side of pier; measuring 2000mm N-S and 1800mm E-W.



Client  
AECOM for Galway City Council

**Notes**

Source: ADCO U/w Inspection 31.08.21

- 1.1 Do not scale  
1.2 All dimensions in millimeters  
1.3 Data gathered using direct measurement  
1.4 © ADCO Ltd.

A4

**Title**  
Figure 3- Schematic Drawing showing Western Elevation of Pier Number 3.

**Project**  
Clifden Railway Pedestrian and Cycle Bridge

**Job/Exc No.**  
ADCO21/019

**Compiled by**  
R.Bangerter

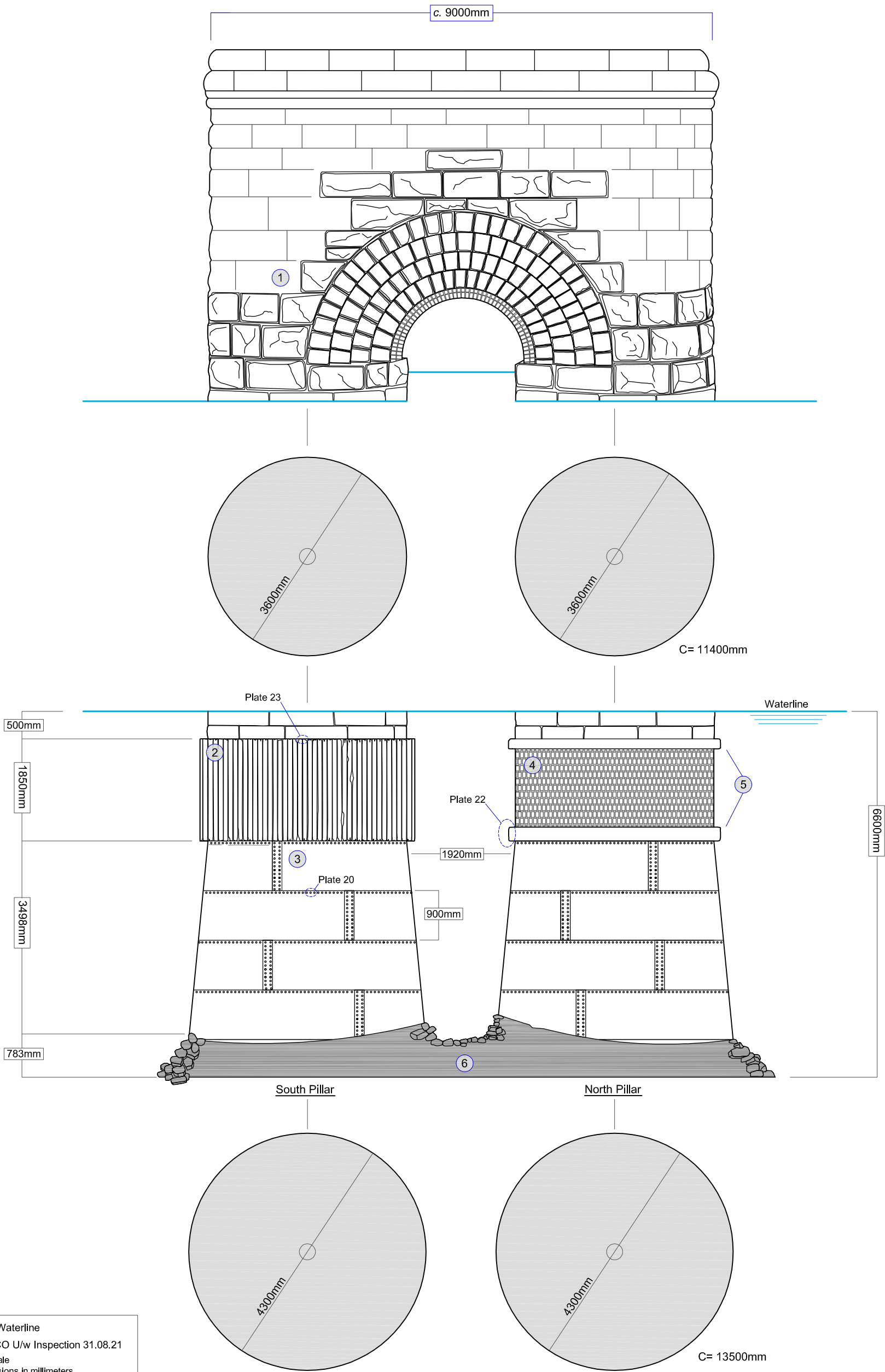
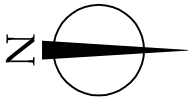
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RiverCorrib\_2021

**Date**  
17.09.21

**Scale**  
1:100

**Drawing No.**  
Figure 3





Waterline

Source: ADCO U/w Inspection 31.08.21

1.1 Do not scale

1.2 All dimensions in millimeters

1.3 Data gathered using direct measurement

1.4 © ADCO Ltd.



Client  
AECOM for Galway City Council

Project  
Clifden Railway Pedestrian and Cycle Bridge

Notes

- 1 Rock-faced [edge-dressed] Masonry.
- 2 Water-eroded Timber Fenders [182mm L, 90mm W, and 30mm T].
- 3 Four bands of Cast Iron Plate Metal riveted to structure [30mmØ rivet-head].
- 4 Brickwork, laid end-on [100mm x 60mm]
- 5 Timber/Poured-mortar Collars.
- 6 Rock-armour surrounding base of Pillars.

A3

Title

Figure 4- Schematic Drawing showing Eastern Elevation of Pier Number 2.

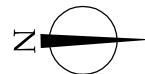
[see Figure 5 for Fender/Collar detail].

CAD reference  
RiverCorrib\_2021

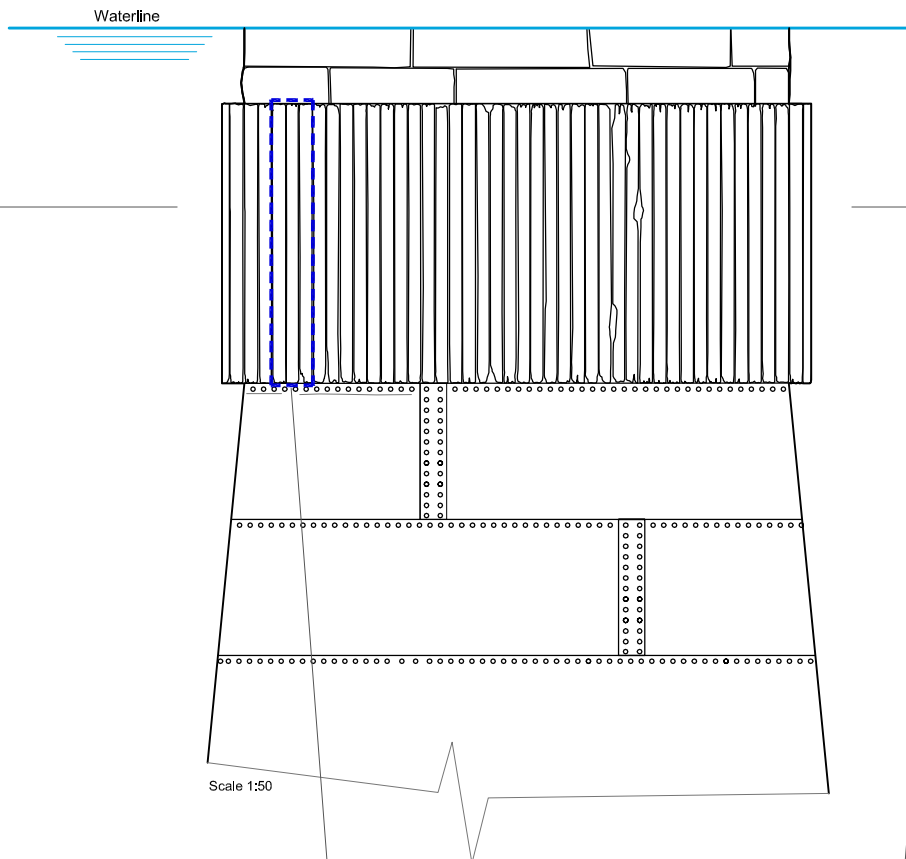
Date  
15.09.21

Scale  
1:75

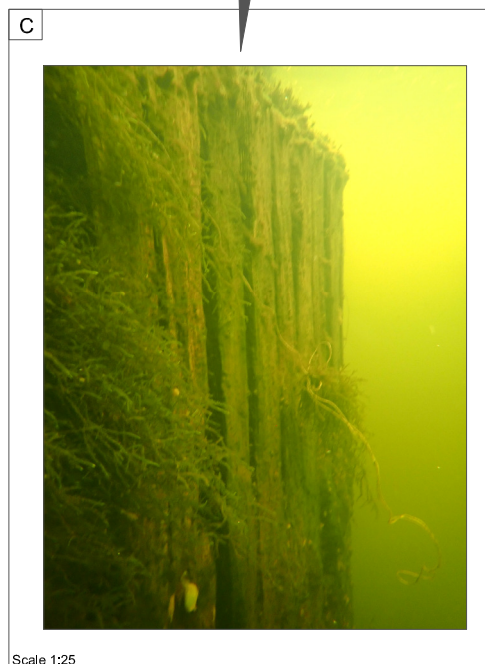
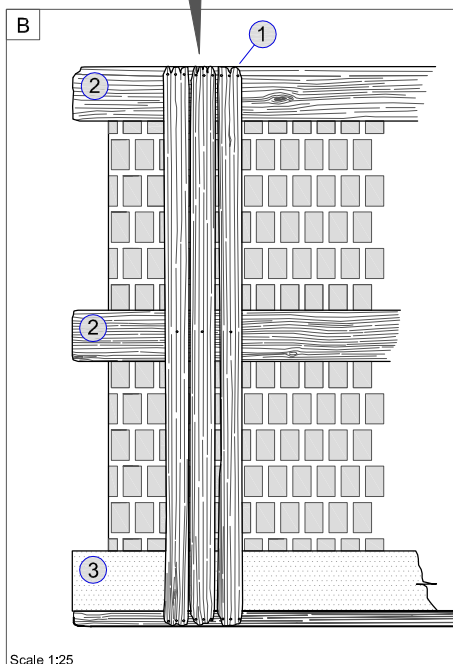
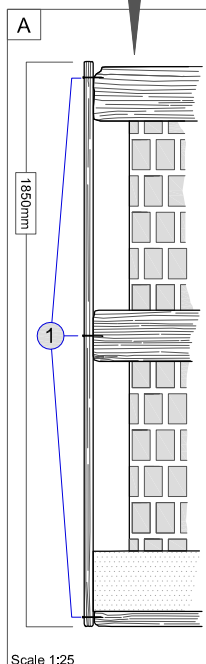
Drawing No.  
Figure 4



FENDER AND  
COLLAR DETAIL



Scale 1:50



- ① — Hand-forged iron nails used to fasten the fender planks [softwood] to timber collars; square nail heads measuring 10mm x 10mm.
- ② — Two timber collars extending the circumference of the pillar; both measure 120mm width and c. 170mm depth.
- ③ — Timber plank that extends the circumference of the pillar, above which a fine-grained hydraulic lime mortar has been poured to form a collar measuring 120mm width x 200mm depth.



Client  
AECOM for Galway City Council

Notes

Source: ADCO U/w Inspection 31.08.21

- 1.1 Do not scale  
1.2 All dimensions in millimeters  
1.3 Data gathered using direct measurement  
1.4 © ADCO Ltd.

A4

Title  
Figure 5- Fender and Collar Detail, South Pillar,  
Pier Number 2.

[see Figure 4 for Schematic Drawing of overall structure]

Project  
Clifden Railway Pedestrian and Cycle Bridge

Job/Exc No.  
ADCO21/019

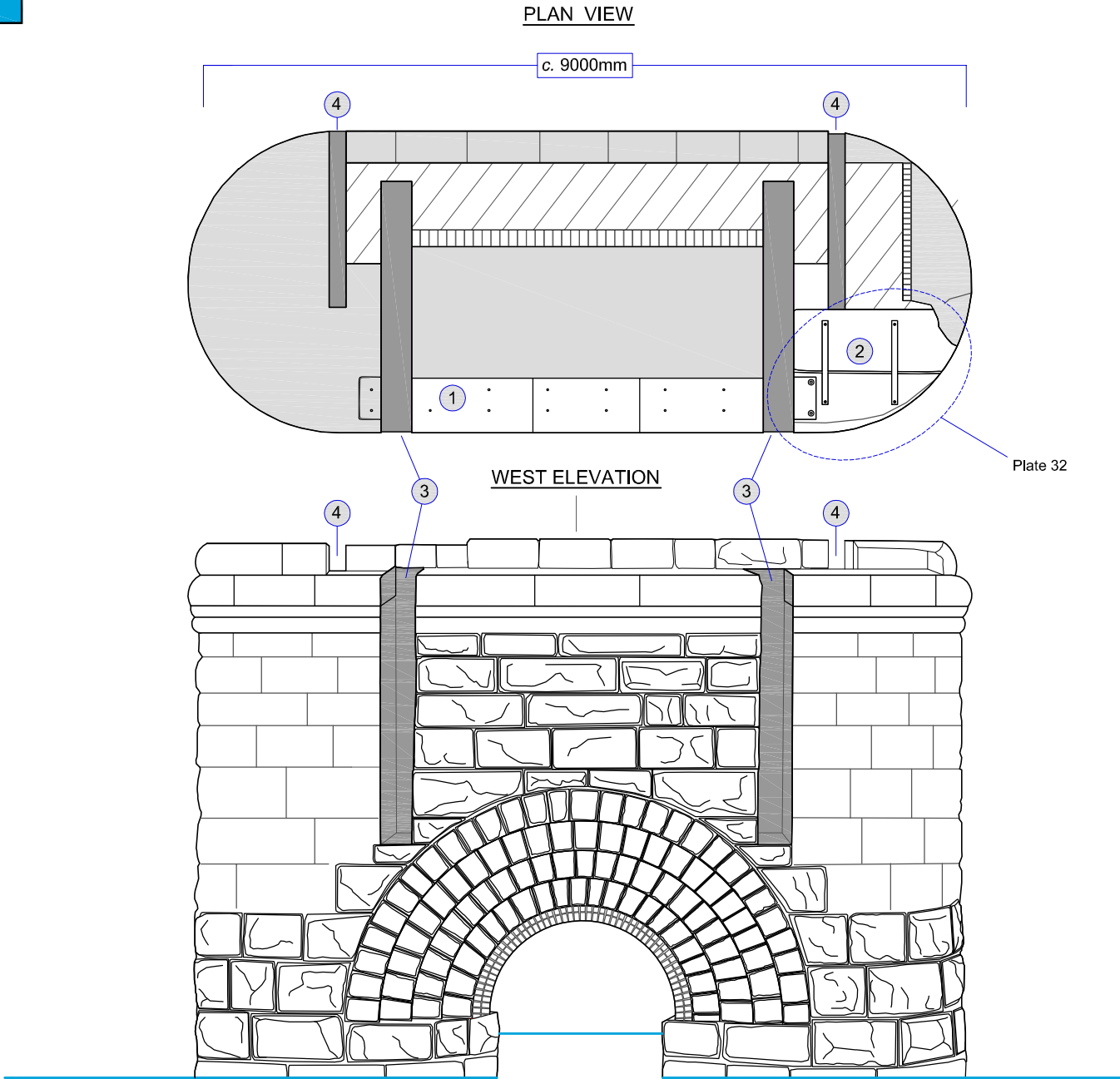
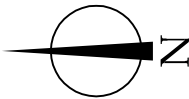
Compiled by  
R.Bangerter

CAD reference  
RiverCorrib\_2021

Date  
16.09.21

Scale  
1:25/ 1:50

Drawing No.  
Figure 5



Waterline

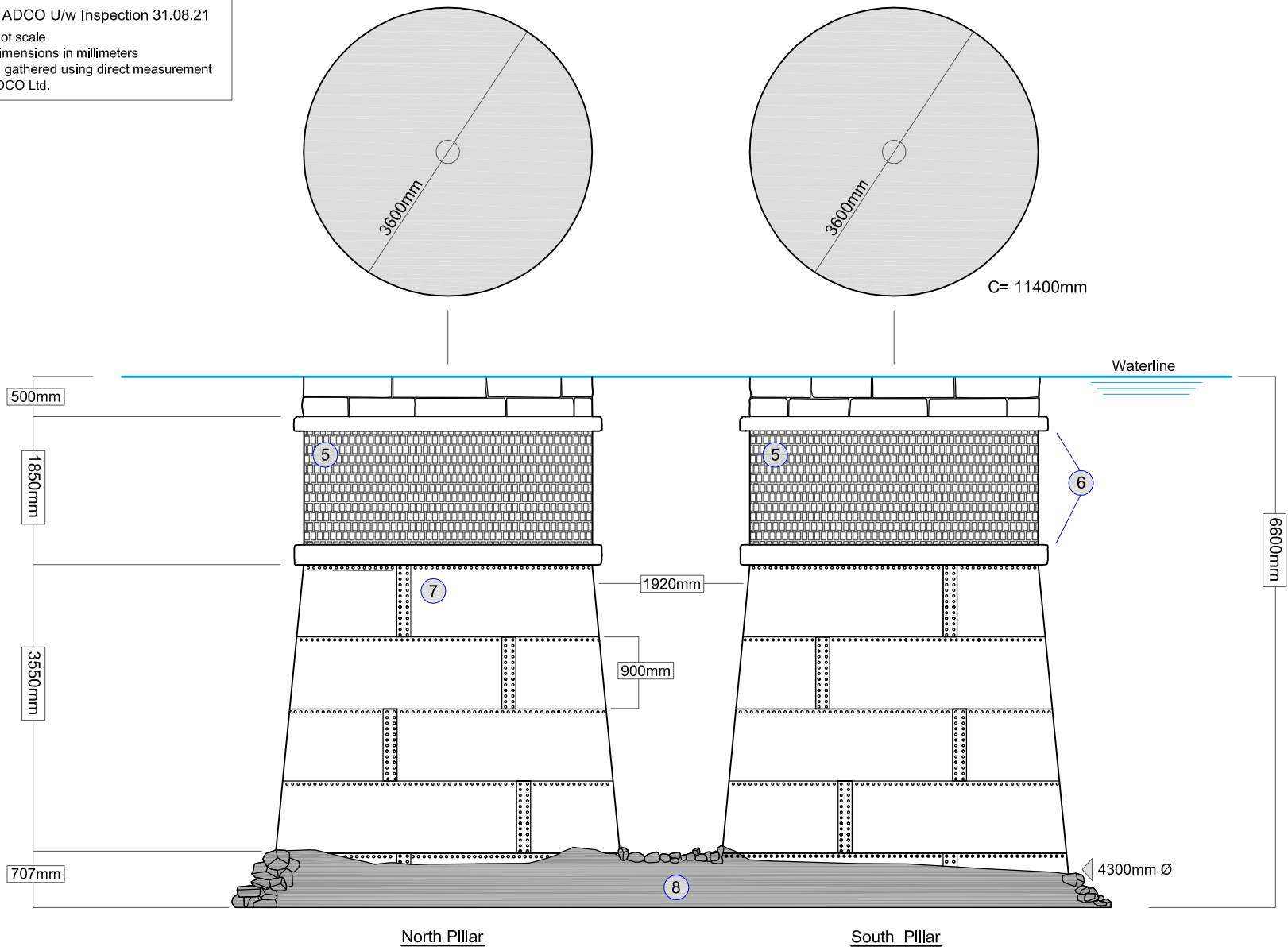
Source: ADCO U/w Inspection 31.08.21

1.1 Do not scale

1.2 All dimensions in millimeters

1.3 Data gathered using direct measurement

1.4 © ADCO Ltd.



**ADCO**

**Client**  
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**Project**  
Clifden Railway Pedestrian and Cycle Bridge

- 1 Series of iron fixing-points [25mmØ].
- 2 Repair to southeast corner of structure using pair of 1000mm long iron-straps.
- 3 Recess in masonry measuring 2950mm height x 3000mm depth x 350mm width.
- 4 Recess in masonry measuring 1005mm height x 2100mm depth x 150mm width.
- 5 Brickwork, laid end-on [100mm x 60mm]
- 6 Timber/Poured-mortar Collars.
- 7 Cast Iron Plate Metal riveted to structure [30mmØ rivet-head].
- 8 Rock-armour surrounding base of Pillars.

A3

**Title**  
Figure 6- Schematic Drawing of Pier Number 1, showing Western Elevation and top of structure in Plan View.

**Job/Exc No.**  
ADCO21/019

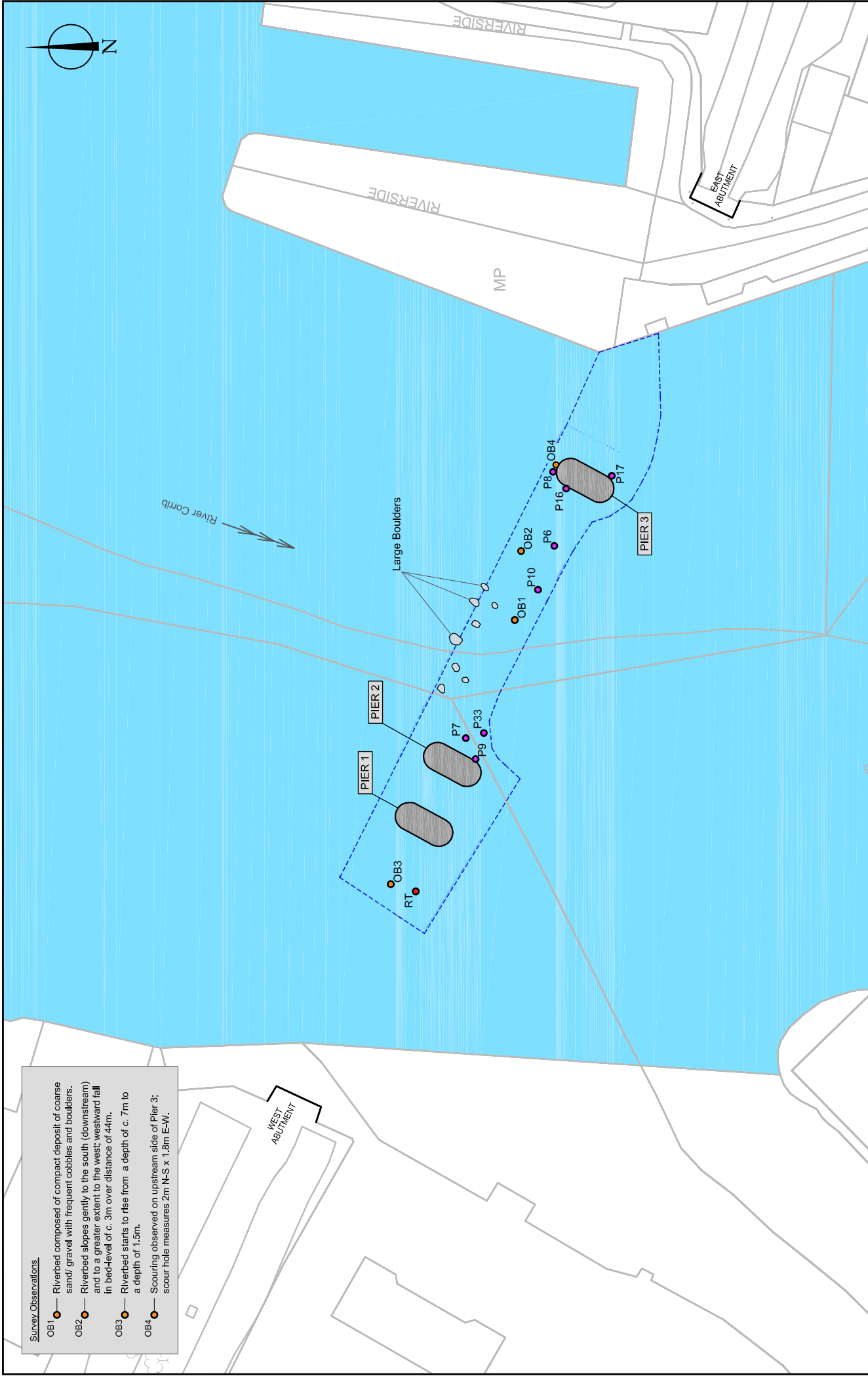
**Compiled by**  
R.Bangerter

**CAD reference**  
RiverCorrib\_2021

**Date**  
21.09.21

**Scale**  
1:75

**Drawing No.**  
Figure 6



**Survey Observations**

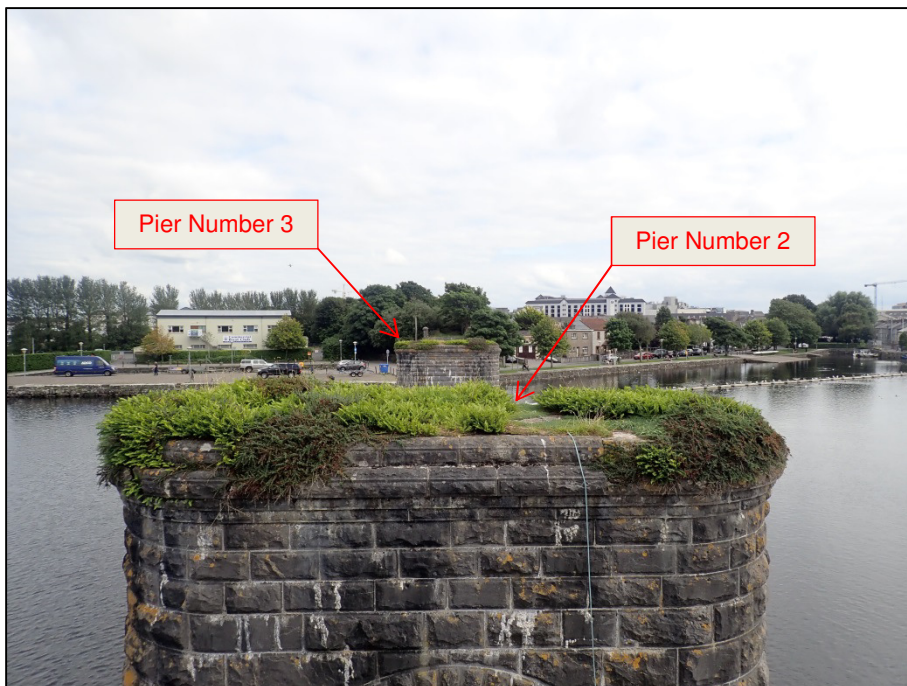
- OB1 — Riverbed composed of compact deposit of coarse sand/ gravel with frequent cobbles and boulders.
- OB2 — Riverbed slopes gently to the south (downstream) and to a greater extent to the west; westward fall in bed-level of c. 3m over distance of 44m.
- OB3 — Riverbed starts to rise from a depth of c. 7m to a depth of 15m.
- OB4 — Scouring observed on upstream side of Pier 3; scour hole measures 2m N-S x 1.8m E-W.

<b>Notes</b> P# — Selected Plate Locations RT — Location of possible Iron Rail-track --- Extent of ADCO Inspection Area	A4	Job/Exc No. ADCO21019	Compiled by R.Bangerter	CAD reference RiverCorrib_2021	Client AECOM for Galway City Council	Title Figure 7 - OS Background Mapping with survey extent and plate locations superimposed.	
		Date 25.09.21	Scale 1:1000	Drawing No. Figure 7	Project Clifden Railway Pedestrian and Cycle Bridge		





**Plate 1:** Historic Photography of the Railway Viaduct, taken from the west bank (source: John Robert Walsh, 1859-1963, NUI Galway, Photographic Archives, [www.library.nuigalway.ie](http://www.library.nuigalway.ie)).



**Plate 2:** East-facing view of Pier Numbers 2 and 3; shot taken from the top of Pier Number 1.

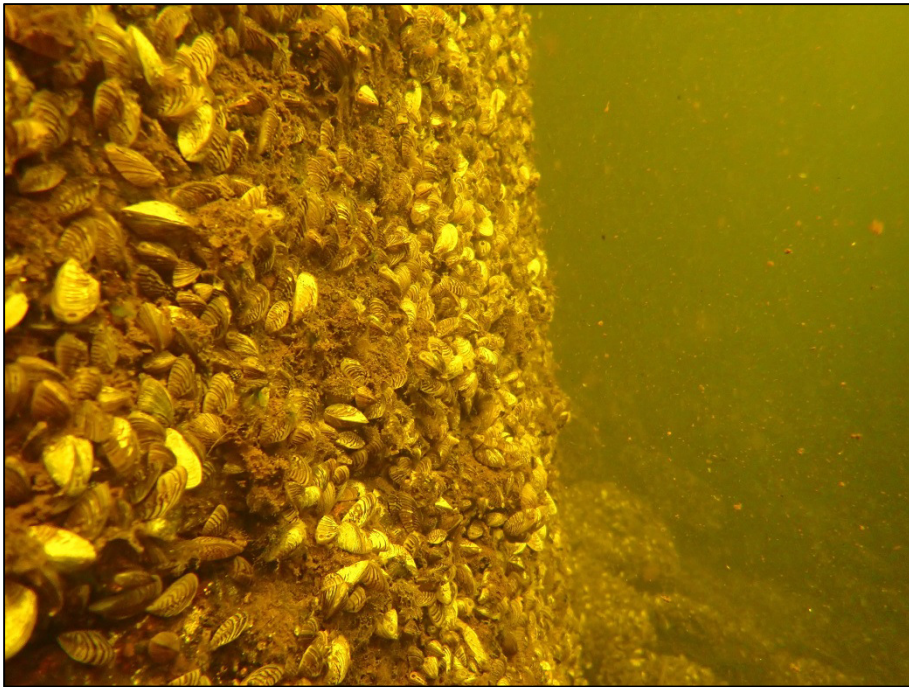


**Plate 3:** West-facing view of river channel and bridge abutment on west side of the waterway; shot taken from the top of Pier Number 1.



**Plate 4:** Example shot of riverweed present across the upper parts (first 1.5m-2m) of each of the submerged pier structures.



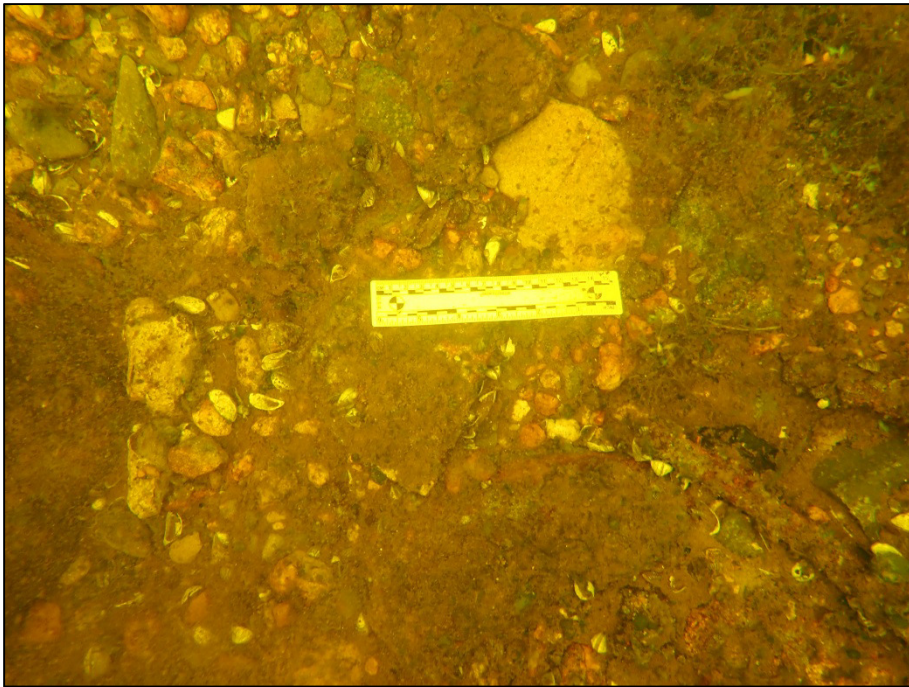


**Plate 5:** Example shot of the zebra mussels that cover the plate-metal sections of the north/south Pillars at Pier Numbers 1-2; shot taken at base of South Pillar, Pier Number 2.

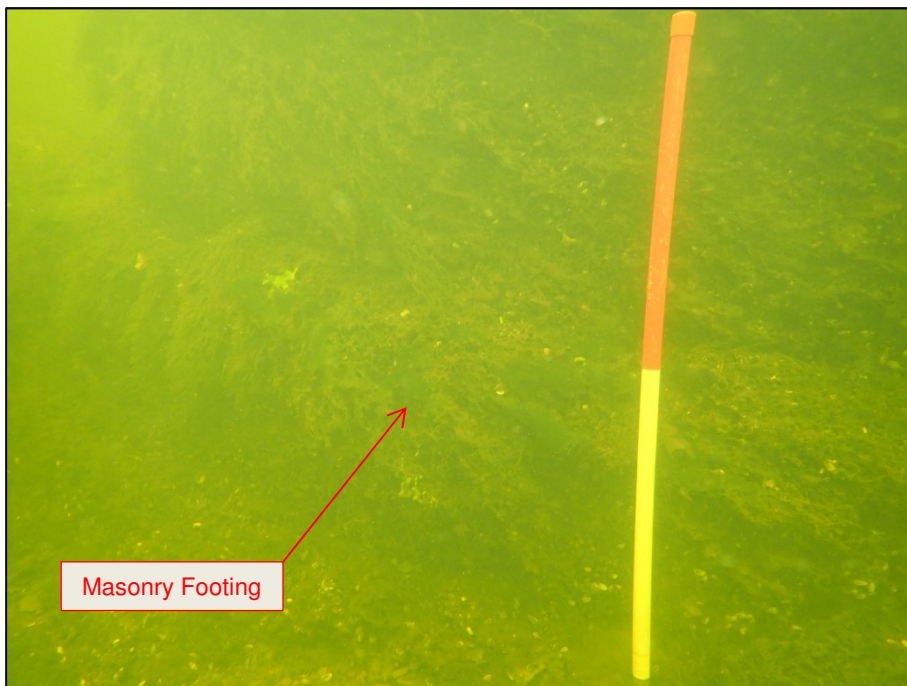


**Plate 6:** Example shot showing riverbed composition where the natural bed is visible/ free from zebra mussel growth (150mm scale); see Figure 7 for plate location.

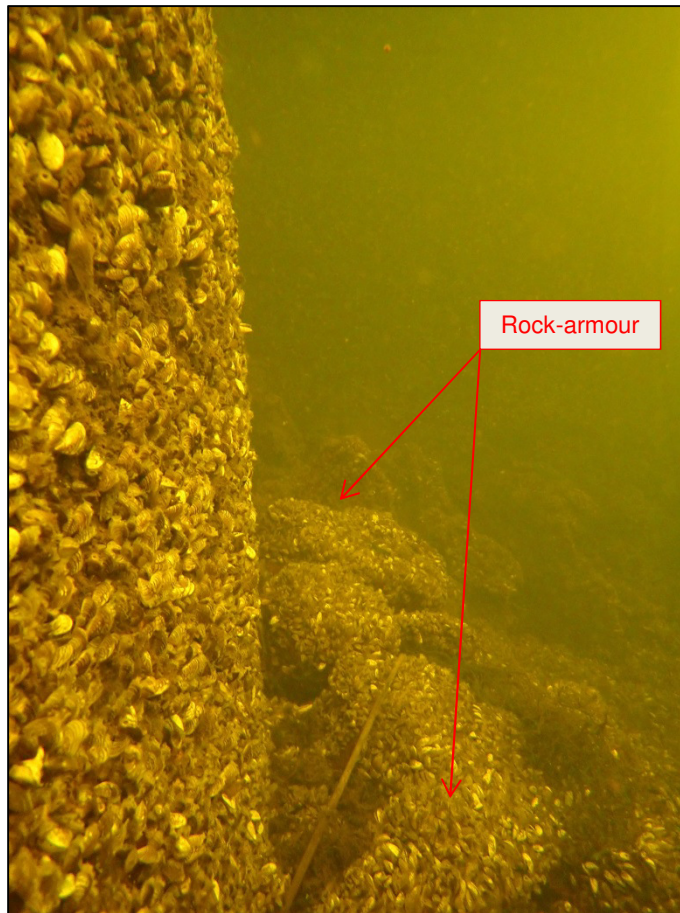




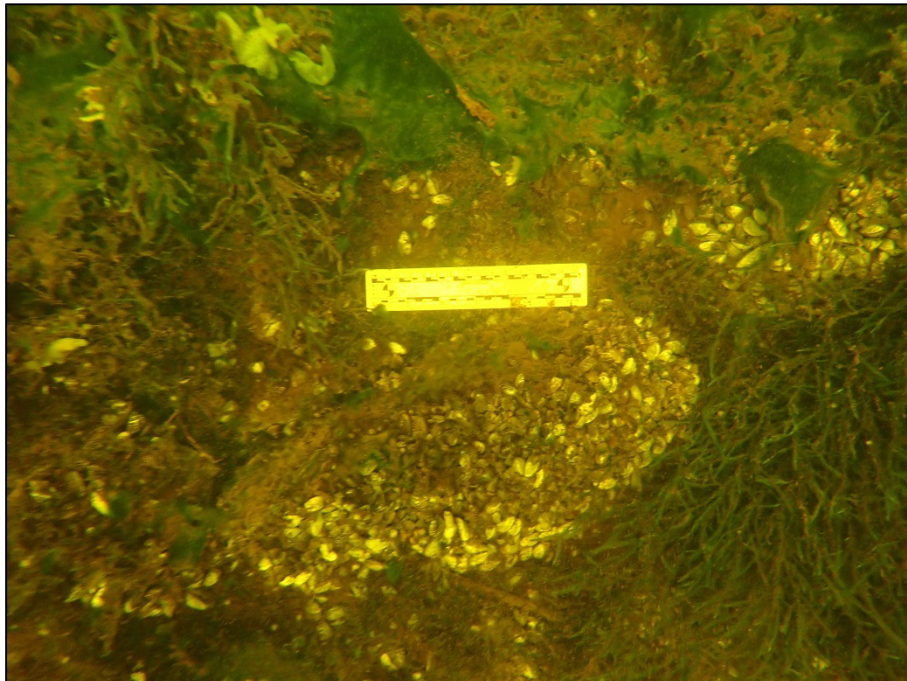
**Plate 7:** Example shot of riverbed composition surrounding Pier numbers 1-2; shot taken at a point 4m to the east of Pier Number 2 (150mm scale); see Figure 7 for plate location.



**Plate 8:** Underwater shot of north side of Pier Number 3, where scouring of the riverbed is active (1m scale); see Figure 7 for plate location.



**Plate 9:** Example shot of riverbed composition at base of Pier Number 2 (south pillar); shot taken on east side of pillar [Note, rock-armour at base of pillar].



**Plate 10:** Example shot of Zebra mussel growth on riverbed, covering the larger cobbles and boulders present (150mm scale); see Figure 7 for plate location.





**Plate 11:** Example shot of rock-faced limestone ashlar used in the construction of the pier walls (1m scale); shot taken on western façade of Pier Number 3.



**Plate 12:** Example shot showing neat/tight seams present between the masonry courses (15mm scale).





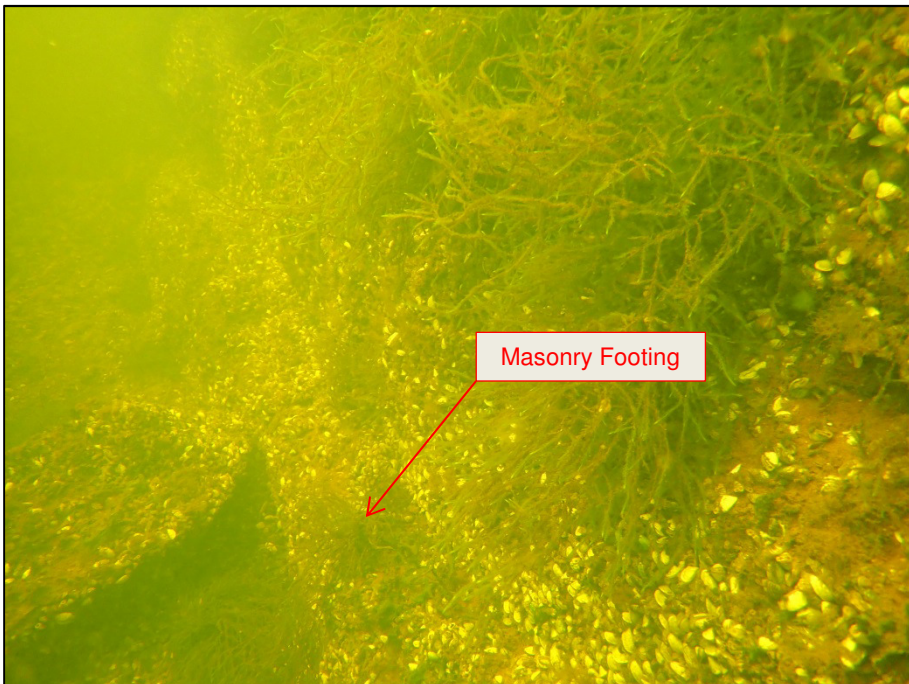
**Plate 13:** Detail shot showing mortar used to bond the masonry together (45mm scale).



**Plate 14:** Detail shot of the cone-shaped 'pincer holes' located top/centre of each masonry block (100mm scale).

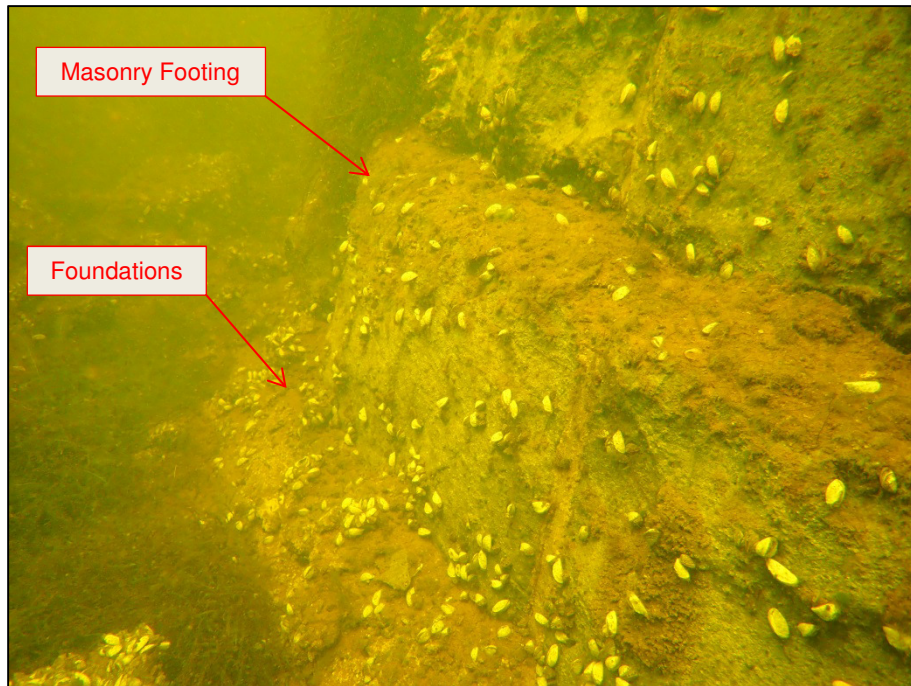


**Plate 15:** Example shot of oversail coping present at the top of Pier Number 3, shot taken on west side of structure.



**Plate 16:** Underwater shot along west side of Pier Number 3 showing line of exposed masonry footing; see Figure 7 for plate location.





**Plate 17:** Underwater shot of footing and top of foundation on east side of Pier Number 3; see Figure 7 for plate location.

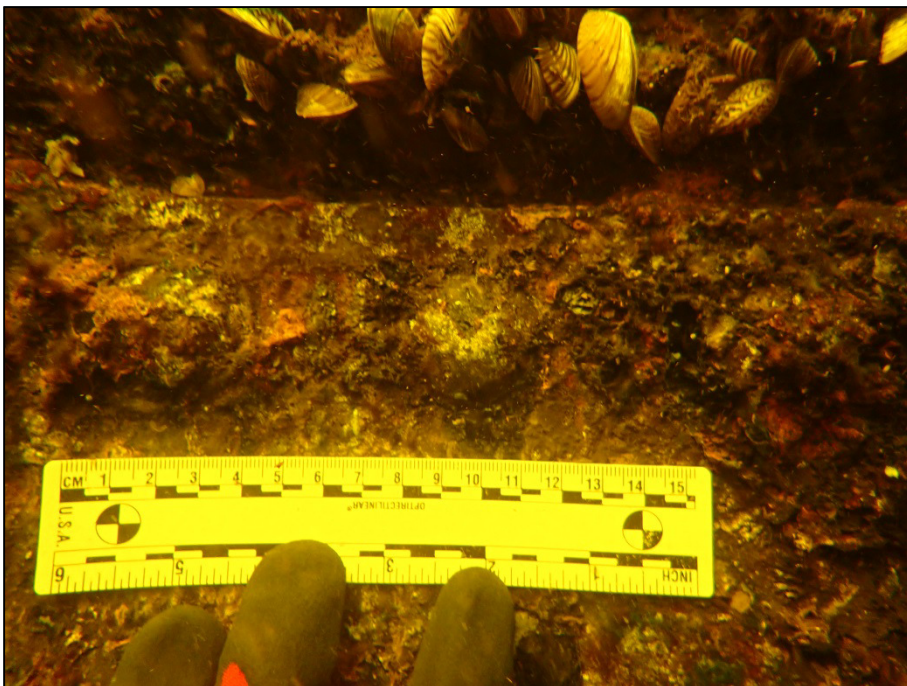


**Plate 18:** Detail shot of the masonry used in the tiered arch-rings that form the Romanesque style archways located on Pier Numbers 1 and 2 (150mm scale).

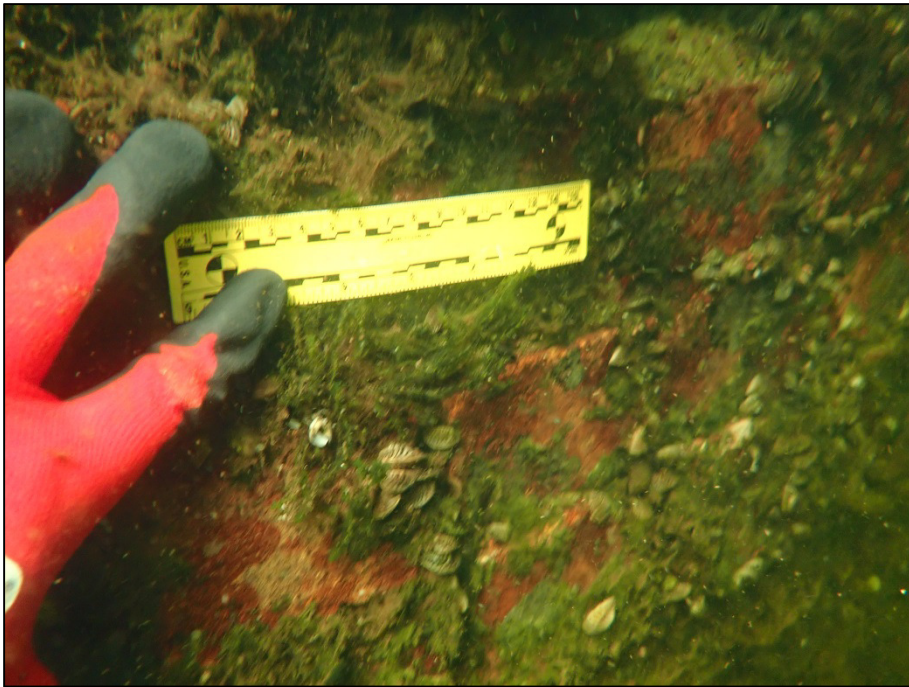




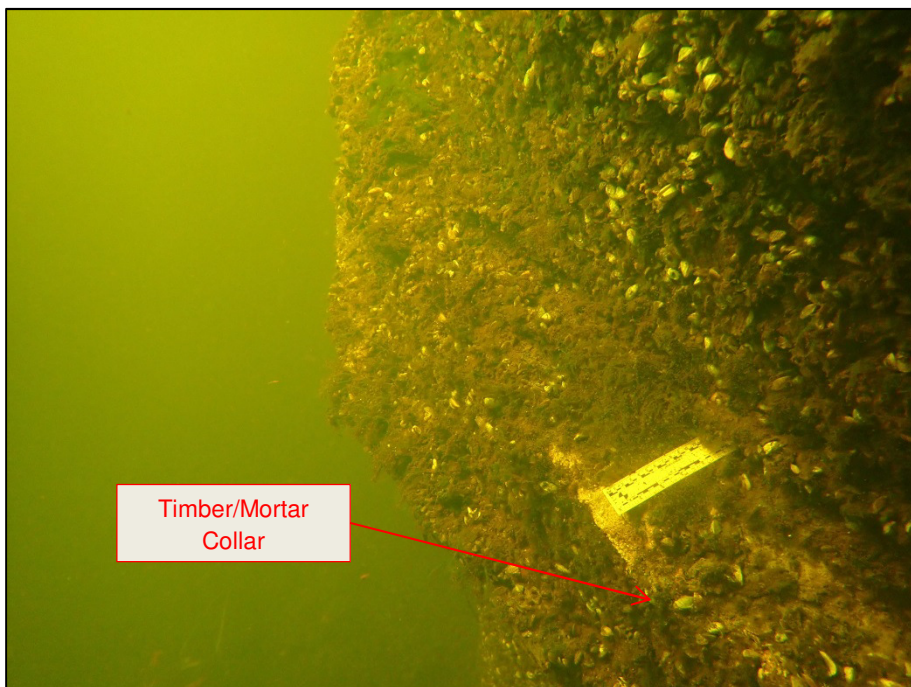
**Plate 19:** West-facing view of pier façade on north side of archway, Pier Number 2.



**Plate 20:** Detail shot of rivets used to secure the plate-metal to the surface of the pillar (150mm scale); see Figure 4 for plate location.



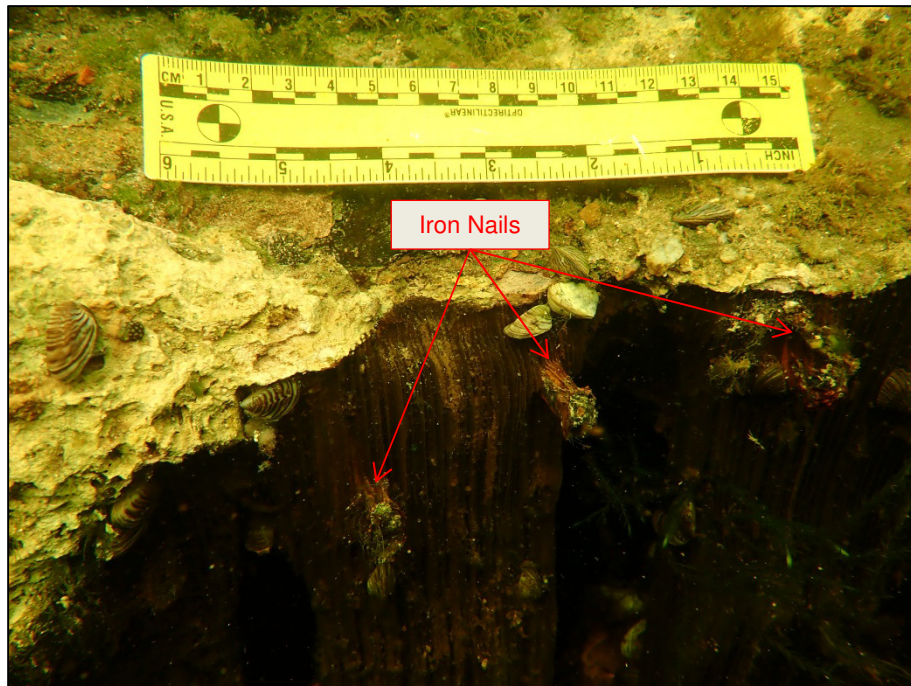
**Plate 21:** Detail shot showing exposed section of brickwork on the south side of the North Pillar, Pier Number 2 (150mm scale).



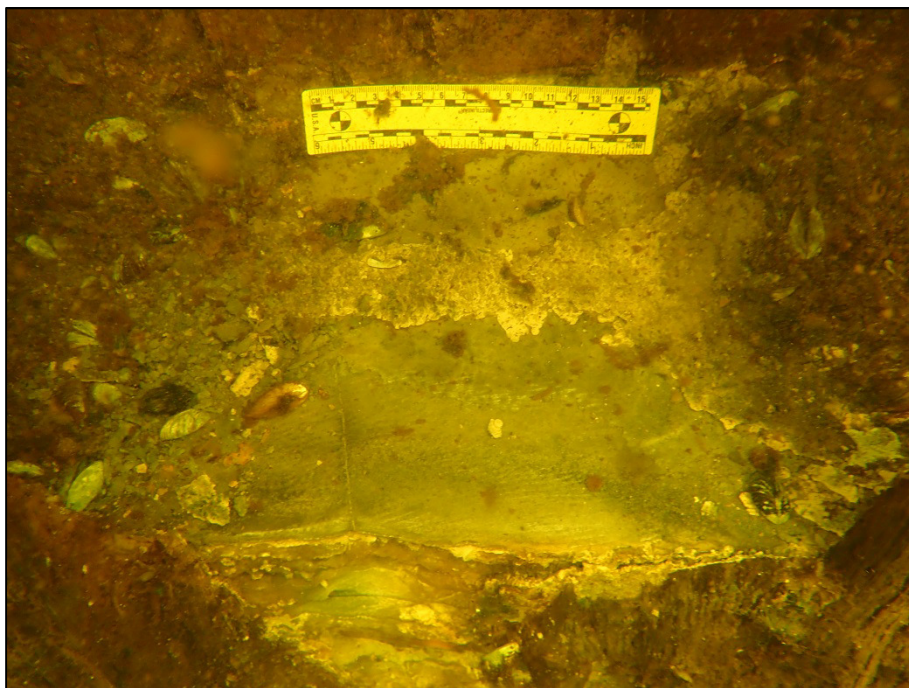
Timber/Mortar  
Collar

**Plate 22:** West-facing view of bottom collar, North Pillar/ Pier Number 2 (150mm scale); see Figure 4 for plate location.





**Plate 23:** Detail shot of hand-forged iron-nails used to fasten timber fenders to timber collar, South Pillar/ Pier Number 2 (150mm scale); see Figure 4 for plate location.



**Plate 24:** Detail shot showing top of the bottom collar located on southwest side of South Pillar, Pier Number 2 (150mm scale).





**Plate 25:** East-facing view of Romanesque style archway, Pier Number 1.



**Plate 26:** South-facing view of coping on west side of Pier Number 1 showing remnants of fixing-points protruding from the masonry (1m scale).





**Plate 27:** Detail shot of iron-plate secured to coping on south side of pier structure, top of Pier Number 1 (150mm scale).



**Plate 28:** NNE-facing view of top of Pier Number 1 showing use of brickwork on inside of pier wall (1m scale).





**Plate 29:** East-facing view across the upper façade of Pier Number 1; shot taken on its west side.



**Plate 30:** Example shot showing construction of side walls within recess/ slot (north slot) on west side of Pier Number 1.

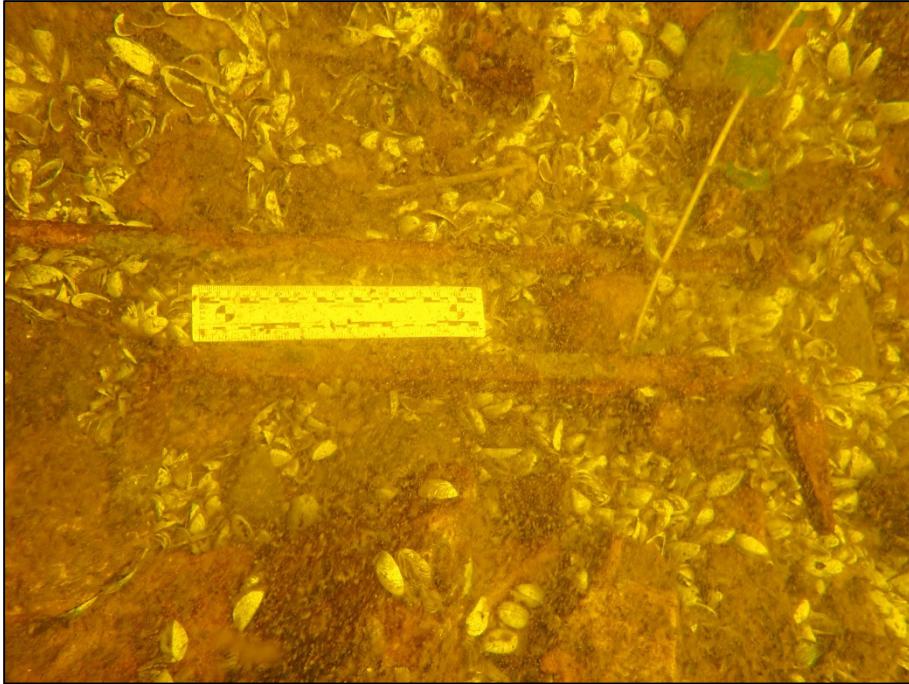




**Plate 31:** Aerial view of recess/slot (south slot) on west side of Pier number 1.



**Plate 32:** South-facing view of historic repair work to consolidate coping on the southwest side of the structure (1m scale).

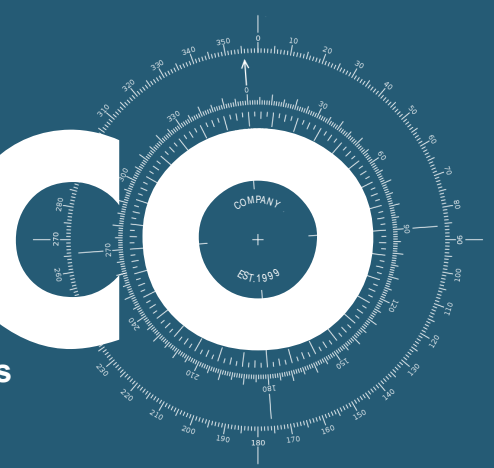


**Plate 33:** Underwater shot of wrought-iron lifting tools lying on riverbed (150mm scale); see Figure 7 for plate location.



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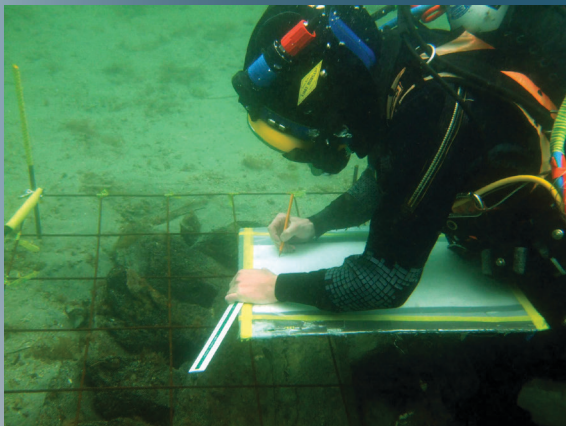


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