



# Bullhole Berthing Structure

## Construction Methodology

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# 1. Introduction

## 1.1 Project Description

1.2 The proposed works are structural repairs and strengthening works to an existing berthing structure off the coast of the Isle of Mull.

1.3 A structural survey undertaken by AECOM has identified structural defects that if not repaired may result in further damage to the structure or the serviced vessel during operation.

1.4 AECOM has produced design drawings and specifications for a package of work to reinstate the structure to a suitable condition.

## 1.5 The Proposed Development Site

1.6 The Proposed Development site is located in Bullhole Channel between Eilean nam Ban and Ross of Mull, North of Fionnphort (Isle of Mull).

1.7 The Proposed Development Site is centred on NGR NM 30306 24838 and covers an area of less than 200m<sup>2</sup>.

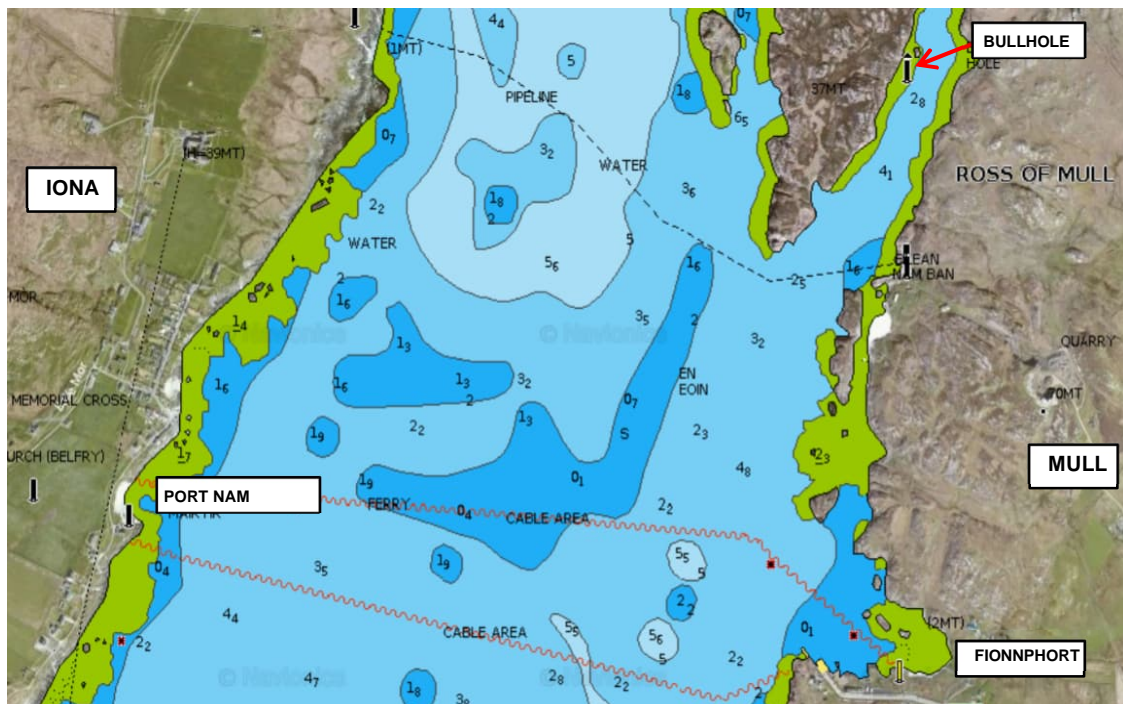


Figure 1-1: Bull Hole Location. Source: Navionics.

1.8 Bullhole Jetty is a steel structure anchored to the rock with berthing piles that are approximately 18m long and 5m apart connected to land by two walkways at either side, being the overall dimension of about 38m.

1.9 The primary use of the structure is sheltered berthing location for the vessels serving the Fionnphort-Iona CMAL ferry service. It is understood that the structure was constructed in 1991, though no record drawings are available of the original construction. An inspection of the structure was undertaken by Arch Henderson in 2011, including repair proposals. Copies of the drawings for these works have been provided by CMAL.

1.10 There are no infrastructure or roads on Eilean nam Ban and landside access is limited due to the rocky approach.





Figure 1-2: Bullhole Plan Location. Source: AECOM Map Portal, Esri

### 1.11 Existing Structure

The structure is shown in Figure 1-3 and Figure 1-4 below which are extracts from Arch Henderson drawing 115022/001 for repair works undertaken in 2011.

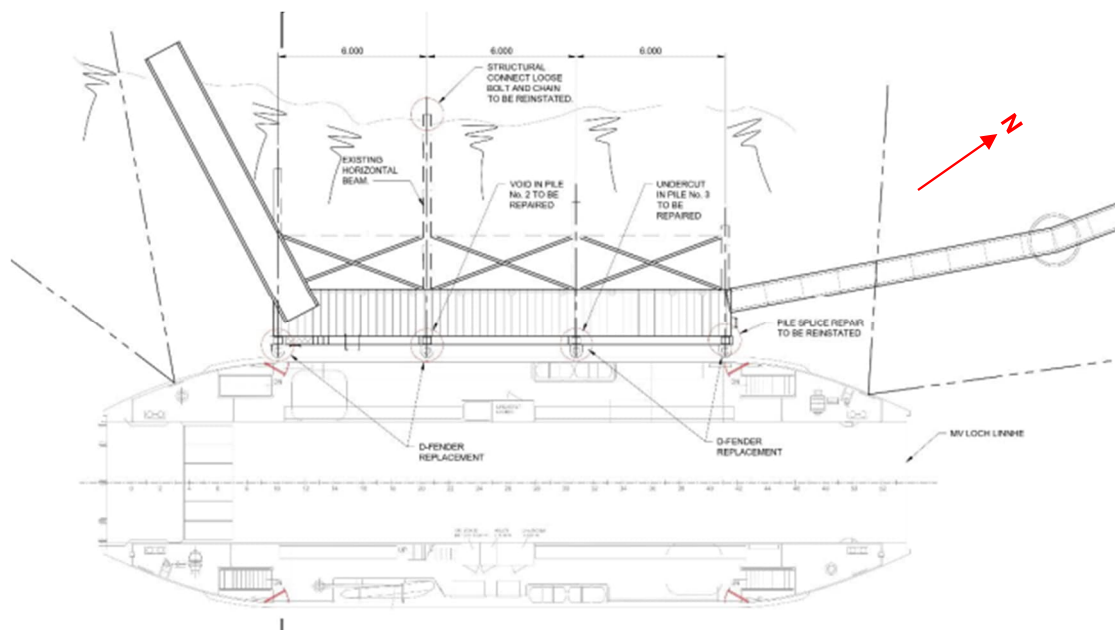
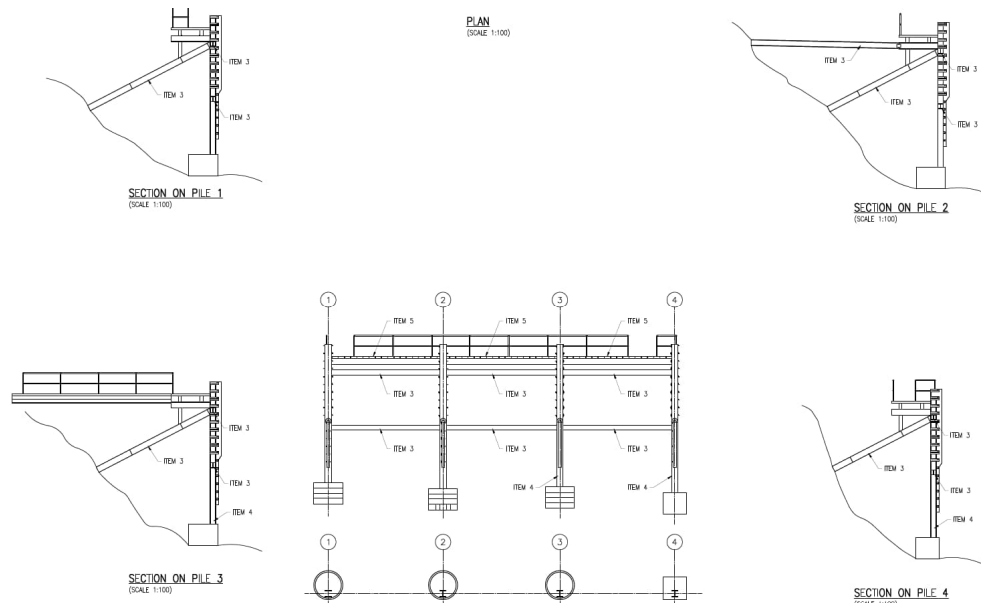


Figure 1-3: Structure on Plan

- 1.12 The primary berthing structure comprises four steel piles at 6m spacing. Each pile is cast into a base foundation comprising an in-situ concrete filled precast manhole. Lateral support at the head of each pile is provided by a raking strut which is anchored to the rock face.
- 1.13 A walkway is formed of a secondary steel structure supported off the pile head and stut and is accessed from bridging structures at either end. These structures do not contribute to the primary load path of the structure to resist vessel loads.
- 1.14 All pile foundations are located below LAT. The steel work fixed back to the rock face



**Figure 1-4: Elevation and Sections through Structure**

#### 1.15 Existing Damage

**1.16** AECOM produced a Visual Inspection Report [BUHO-ACM-XX-XX-RP-MT-000001] in November 2020, in which several defects were recorded.

**1.17** *Steel Member Corrosion-* The steel members located within the marine environment have experience loss of thickness due to corrosion. Thickness measurements were taken during the 2020 dive survey as part of the Visual Inspection report and are discussed later in this report. It was noted that if the original system had a painted protection system, this is no longer present, and no cathodic protection system appears to have been installed.

**1.18** *Pile Splice Repair-* The lower sections of Piles 3 and 4 had experienced failure in 2011 and Arch Henderson specified a repair detail comprising PFC sections bolted to both sides of the web of the pile section. The 2020 dive survey identified that the repair detail on Pile 4 has subsequently failed due to bolt shear and is no longer connected to the pile. It was assumed that damage this was likely caused by a combination of corrosion and a large berthing force. With the vessel impacting Pile 4 first during an angular berthing, this would align with the damage after the repair.

**1.19** *Lateral Bracing-* The lateral bracing comprises angle sections welded to the top and underside of the angled struts. As the orientation of the struts has the flanges pointing vertically, there was minimal area for welding between these. Although only observed from the walkway above, the 2020 visual survey considered that some of these welds may have failed either due to damage or corrosion.

**1.20** *Waling Beams-* One of the waling beams spanning between the piles was observed to have experienced damage in the form of permanent bending deformation around its minor axis. It was considered that the large spacing of the piles would allow the bow of the vessel to impact these beams, and this was assumed to be the cause of this damage.

**1.21** *Pile Foundation Undercut-* The concrete manhole foundations have experienced undercut with the worst observed on Piles 2 and 3, creating a gap under each foundation. The 2011 Arch Henderson repair specification included reinstatement of this, however the undercut was still visible during the 2020 inspection.



## 2. Proposed Development

### 2.1 Phasing

2.2 All proposed works shall be undertaken in a single phase.

### 2.3 Enabling Works

2.4 No intrusive investigations or pre-construction works are required.

### 2.5 Access

2.6 As landside access is limited, it is considered that all works shall be undertaken from a workboat, barge, or pontoon, with a suitable crane. The vessel shall be berthed against the structure during the works.

2.7 The higher sections of the work area are located at approximately 6.4mCD. These may be accessed either via a MEWP located on the work vessel, or temporary access scaffolding. The existing structure has not been assessed to provide support to this, therefore all scaffolding would be constructed off the seabed/rock.

### 2.8 Utilities

2.9 No new or existing utilities will be affected by these works.

### 2.10 Demolition

2.11 No existing structures are to be demolished as part of these works.

### 2.12 Dredging

2.13 No dredging is to be undertaken as part of these works.

### 2.14 Dredging

2.15 No dredging is to be undertaken as part of these works.

### 2.16 Construction Staffing

2.17 The number of construction staff present on the Proposed Development Site will vary according to the construction phase and activities being undertaken.

### 2.18 Health & Safety

2.19 Health and safety during construction will fall under the Construction (Design and Management) (CDM) Regulations 2015. A Construction Phase Health and Safety Plan will be prepared following award of consent.

2.19.1 Suitable signage will be erected at the entrance to the Proposed Development Site in order to highlight that construction activities are being undertaken and provide directions and health and safety information. During the construction phase public access on the Proposed Development Site would be restricted for health and safety purposes.

### 2.20 Natural Resource and Waste Management

2.21 Waste materials will be generated throughout the construction and operation of the Proposed Development. All waste materials will be managed following the principles of the waste hierarchy as set by the European Waste Framework Directive (Directive 2008/98/EC).

2.22 Waste material will be managed and disposed from the Proposed Development Site in accordance with the relevant legislation (Environmental Protection Act 1990 (as amended), Landfill (Scotland) Regulations 2003 and the Waste Management Licensing (Scotland) Regulations 2011).

## 3. Construction Methodologies

### 3.1 Foundation Undercut Repair

**3.2** The sections of scoured concrete are to be reinstated with new concrete. Cement bag-work has proposed as permanent formwork for this new concrete, to provide additional scour protection to the foundations.

**3.3** The level of the four foundations varies, with the level of the highest top at LAT. Therefore, all works will be undertaken below the waterline.

**3.4** The following activities shall be undertaken:

- Clean all marine growth from face of exposed concrete on all foundations including within undercut voids.
- Face of concrete to be scabbled with wire brush to ensure adhesion of new material.
- Lay cement bags in staggered coursing around front perimeter of foundations to create minimum 500mm high formwork around foundation.
- Pour concrete into formwork, ensuring undercut void is fully filled. An anti-washout admixture must be used.

### 3.5 Pile 4 Splice Repair

**3.6** The damaged pile splice is to be repaired via the introduction of a reinforced concrete surround, using a sacrificial steel formwork box.

**3.7** The level of the proposed repair occurs between MLWN and just below LAT. It is assumed that some or all the works will be programmed to occur during a low springs tide, for ease of access to the top of the foundation.

**3.8** The following activities shall be undertaken:

- Clean all marine growth from top of concrete foundation.
- Face of concrete to be scabbled with wire brush to ensure adhesion of new material.
- Drill holes through web of pile to install reinforcement links.
- Drill and fix anchor bars into top of foundation using an epoxy-based grout.
- Install reinforcement links, tied to pile and anchor bars.
- Install steel formwork box in two halves, with mechanical fixings between.
- Pour concrete into formwork. An anti-washout admixture must be used.

### 3.9 Waling Beam Struts

**3.10** New steel struts are to be installed between waling beams to provided additional strength.

**3.11** The level of all the proposed repairs occurs above MLWN. It is assumed that some or all the works will be programmed to occur during a low tide such that no work is required below the waterline.

**3.12** The following activities shall be undertaken:

- Remove surface corrosion from existing steelwork in connection areas.
- Weld new brackets connection plates to existing waling beams
- Install new steel struts, including drilling bolted fixings to existing waling beams.

## 4. Site Photos



Figure 4-1 : Overview of Jetty from South



Figure 4-2 : General Condition of Berthing Structure (waling beams to be strengthened)





Figure 4-3 : Southern Access Walkway



Figure 4-4 : Typical Steelwork Corrosion





Figure 4-5 : View from Shore

