Helensburgh Pier

Market Scoping Study

On behalf of **Argyll & Bute Council**

Project Ref: 332010810 | Date: May 2023

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For and on behalf of Stantec UK Limited				

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Executive Summary

Initially constructed in the 1800s, Helensburgh Pier is a masonry structure with a timber extension, projecting 245m from the shoreline. Whilst being a Grade C listed structure and locally regarded to be a significant heritage asset, lack of use and minimal maintenance has led to a deterioration in the condition of the pier, with one section badly fire damaged.

Through the Argyll & Bute Rural Growth Deal 'Tourism and Place' programme (or other funds), there is a general aspiration to improve the pier but the scope and scale of investment remains to be determined. There is however significant community interest in restoring the ability for a range of vessels to berth in Helensburgh, with the pier acting as the marine gateway to the town. What is not certain is the extent to which a market exists for using a berthing facility at Helensburgh, and in particular the extent to which ongoing maintenance and capital replacement liabilities could be funded through dues.

To this end, Argyll & Bute Council (A&BC) commissioned Stantec UK Ltd and partners Mott MacDonald to undertake a market scoping study exploring, at a high-level, the market for using Helensburgh and the design and costs of different options for upgrading the pier.

Desk-based research and 15 stakeholder interviews were carried out to determine the extent of the prospective market. Potential demand across the following sectors was investigated:

- Ferry
- Cruise
- Marine leisure
- Tours / excursions
- Operational vessels

Whilst there was evidence of demand for using a restored facility at Helensburgh, this demand would predominantly be leisure-based and seasonal, focused on tours and excursions and small cruise vessels. There would also be an absence of a regular and year-round demand from, for example, a ferry or cargo vessel. It is therefore **challenging to see how such a facility could be operated on a revenue neutral basis, particularly where long-term capital replacement has to be accounted for**.

It should be noted that the costs are presented in present day prices (i.e., Q2 2023) and do not include optimism bias[1], which would need to be accounted for in the Economic Case of any future business case.

[1] Optimism bias is a technique used in the Economic Case of the business case to compare value for money. It reflects the demonstrated systematic tendency of appraisers to underestimate project costs and timescales and overstate benefits. The options being appraised are subject to a percentage adjustment to their costs to reflect this based on recommended uplifts at different stages of the business case by project type. These uplift factors are set out in the H.M. Treasury *Green Book*. The key point in relation to this study is that Options 1 and 2 could potentially have a lower optimism bias as they do not involve any new construction works, albeit a view would need to be taken on this when developing a business case. The effect of this however would be to widen the value for money differential between options in favour of Options 1 and 2.

Capital cost estimate summary

Option	Estimated CAPEX	Estimated Capital Dredging Costs	Allowance for design and consents (15%)	Total
Option 1: Demolish timber pierhead and make good end of masonry pier	£750,000	-	£112,500	**£862,500**
Option 2: Remove damaged section of timber pier and make good remaining	£450,000	-	£67,500	**£517,500**
Option 3: Remove damaged section of timber pier and repair / upgrade timber pierhead for re-use	£950,000	£1,675,000	£393,750	**£3,018,750**
Option 4: Remove time pierhead and construct new pontoon facility	£2,050,000	£250,000	£345,000	**£2,645,000**

In addition to the capital costs, the Council estimate that a functional berth would accrue operational costs of circa **£100k** per annum to cover staff costs, insurances, inspections and overheads such as power, lighting and service charges. This figure does not include an allowance for capital replacement or uninsured accidental damage, for which it is recommend that **20%** of income is set aside in a bond / contingency fund.

The key point of note from the above table is that the provision of a restored berth **(Option 3)** or entirely new pontoon facility **(Option 4)** is significantly more expensive in capital and operational terms than options focused on tidying-up the current pier only, i.e., without restoring an operational berth **(Options 1 and 2)**.

Given the above, and **the scale of capital costs required to develop a new operational berth, it is unlikely that a commercially viable facility could be delivered at present (i.e., cost would exceed revenue)**. A robust business case in the context of the *Five-Case Model* could not therefore be made for such an investment. This is not to say that a commercially viable facility could not be developed in the future and thus any option progressed should include **future proofing** that allows for a new berth to be delivered at a later date.

Whilst the case cannot be made for a new operational berth at present, the benefit the pier brings to Helensburgh as a civic amenity and publicly accessible asset is widely recognised by the community and other key stakeholders. As such, the case for investing in the pier should be considered further, with a view to improving its appearance, matching it with the high-quality public realm in its immediate vicinity.

In order to provide a gateway into a more formal business case, the potential benefits of investing in the pier to improve its appearance and safety have been scoped using a logic mapping approach. Whilst the two prospective options vary slightly in form, both would provide improvements to the appearance of the pier and surrounding area and would deliver broadly equivalent benefits, potentially including:

- An expanded visitor economy
- Improved public health through improved access to green-blue space
- Increased revenue for local businesses with consequential benefits for the economy of Helensburgh

Further work, including primary research, would be required to fully understand the type and scale of the impacts which would emerge.

1 Introduction

1.1 Overview

1.1.1 As part of their £70 million Rural Growth Deal (RGD), Argyll & Bute Council (A&BC) is developing and delivering a programme of investment intended to turn economic potential into a successful future for the local authority area. Through the 'Tourism and Place' programme of the RGD, A&BC intend to allocate investment to projects designed to enhance the marine tourism offer across the region, with a specific focus on the core towns of Campbeltown, Helensburgh, Ardrishaig, Rothesay and Dunoon. Central to the aspirations for Helensburgh's waterfront is investment in its historic pier, which lies at the heart of the town.

1.1.2 Whilst there is a general desire to improve the pier, the scope and scale of that investment remains to be determined. There is however significant community interest in restoring the ability for a range of vessels to berth in Helensburgh, with the pier acting as the marine gateway to the town. What is not certain is the extent to which a market exists for using a berthing facility at Helensburgh, and in particular the extent to which ongoing maintenance and capital replacement liabilities could be funded through dues.

1.1.3 To this end, A&BC commissioned Stantec UK Ltd and partners Mott MacDonald to undertake a market scoping study exploring at a high-level the market for using Helensburgh and the design and costs of different options for upgrading the pier.

1.2 Helensburgh Pier and Waterfront

Helensburgh Pier

1.2.1 Like many of the piers in the Firth of Clyde, Helensburgh commenced life as a steamer pier, serving coastal traffic. Whilst the opening of Craigendoran Pier and the adjacent railway station in 1882 drew much of the traffic away from Helensburgh, it remained an operational pier and indeed picked-up some of the remnants of the Craigendoran traffic when that pier closed in 1972, including calls by PS *Waverley*. The pier was in regular operational use until 1st April 2012, the date on which the triangular Gourock – Kilcreggan – Helensburgh ferry service was withdrawn by the new operator Clydelink.

1.2.2 The pier itself is a masonry structure with a timber extension, projecting 245m from the shoreline. It is a Grade C listed structure and indeed is locally regarded to be a significant heritage asset worthy of preservation. However, lack of use and minimal maintenance has led to a deterioration of the condition of the pier, whilst the berth at the pierhead has been subject to siltation. This culminated in the Council issuing a 'Notice to Mariners' on 29th June 2022 advising that the pier is now closed to all vessels.[2]

1.2.3 Whilst the Council has recently undertaken significant maintenance work on the masonry pier and resurfaced much of the timber pier, the north-east side of the timber structure has suffered significant fire damage and is fenced off to the public, as shown in the image below:

[2] https://www.argyll-bute.gov.uk/sites/default/files/01_22_notice_to_mariners_helensburgh_june_22.pdf

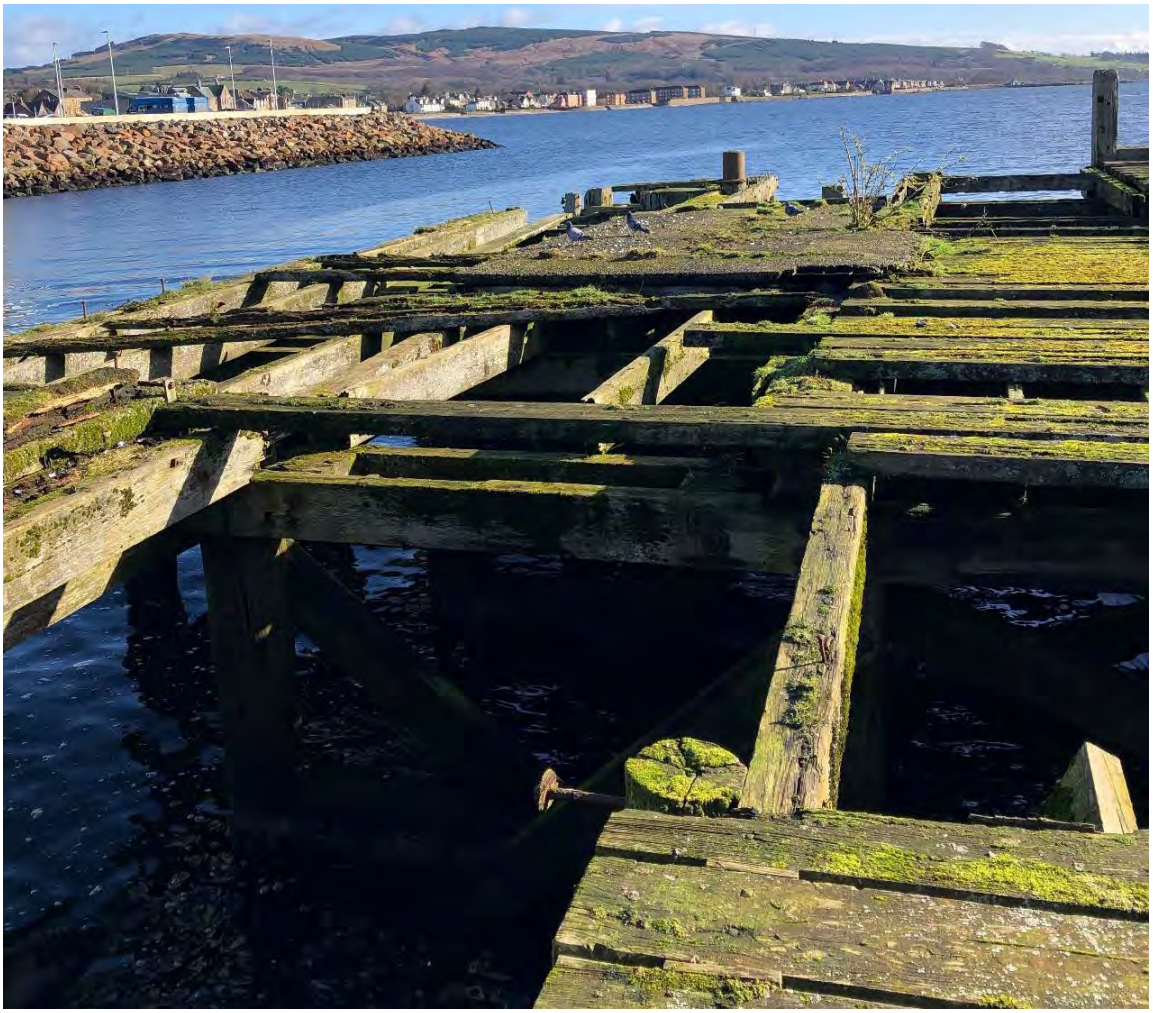

Figure 1.1: Damaged section of timber pier at Helensburgh

1.2.4 The condition of this part of the timber structure presents a risk and is also an eyesore. Whilst derelict or significantly deteriorated steamer piers are a prominent feature around the Firth of Clyde (e.g., Craigendoran, Arrochar etc.), the main difference with Helensburgh is that the pier lies at the heart of the town and in an area that has undergone extensive regeneration in recent years.

Helensburgh Waterfront

1.2.5 As previously noted, the pier is the focal point of the esplanade and indeed the town more generally. It has been a significant focus of regeneration activity in recent years, culminating in the opening of the new £25 million leisure centre and associated public realm improvements in September 2022.

1.2.6 The leisure centre development completed the long-running programme of regeneration of the esplanade, creating an attractive waterfront which compliments the wide range of independent and chain retail and leisure facilities in the town. Moreover, the pier and pierhead are already an established focal point and attraction for outdoor activity, including:

- Helensburgh is the start / end of the **John Muir Way**, the long-distance walking route across Central Scotland which terminates at Dunbar on the east coast. The start / end of the route is marked by a circular stone plinth with engraved footprints and a white stone bench on the waterfront near the pier.

- It is also the start / end of the **Argyll Sea Kayak Trail**, which runs to Oban. The pier has two slipways which serve both this trail and a range of other small craft including paddle boards, sculls, sailboards etc.
- A&BC is also currently designing **two new active travel routes from Helensburgh, one to Dumbarton and the other to Garelochhead**, improving connectivity between waterfront communities.[3]

1.2.7 It can therefore be seen that Helensburgh waterfront is a vibrant mixed-use area. Establishing a sustainable, viable future for the pier is the final step required to complete the programme of waterfront regeneration.

1.3 Scoping Report

1.3.1 The purpose of this scoping study is to identify whether there is a case for developing a more comprehensive business case for public sector investment in an operational berthing facility at Helensburgh, building on initial work by the Community Council. It is not a business case in its own right, rather it answers the question as to whether there is merit in further investing in an H.M. Treasury *Five Case Model* business case process.

1.3.2 The report consists of five further chapters, as follow:

- **Chapter 2** sets out the geographic and operational context within which a restored facility at Helensburgh would sit through profiling other harbours and berthing facilities in the Firth of Clyde. It is effectively a measure of the **supply-side**.
- **Chapter 3** identifies potential users of the pier, which have been identified through a set of structured in-depth interviews. This is effectively a measure of the **demand-side**.
- **Chapter 4** sets out high-level designs and cost estimates for four scenarios at Helensburgh: (i) demolishing the timber pierhead and making good the end of the masonry pier; (ii) removing the damaged section of the timber pier and making good of the remaining; (iii) removing the damaged section of the timber pier and repairing / upgrading the timber pierhead; and (iv) removal of the timber pierhead and construction of a new pontoon facility.
- **Chapter 5** sets out the conclusions of the analysis in relation to the provision of a new berthing facility at Helensburgh.
- **Chapter 6** defines the type of benefits that could potentially be realised through investment in the pier.

1.3.3 It should be noted at the outset that **A&BC has clearly established that any future operational berth must at least break-even** as its piers and harbours budget is already significantly over-committed and thus further cost liabilities cannot be accrued. Furthermore, the pier in its current form is a promenade pier rather than a working facility and there is no Harbour Master or operational staff assigned to it. Evidently therefore, the restoration of an operational berth would significantly increase the scale of these responsibilities and the cost to the Council. Given its significant commitments to other piers and harbours across the local authority area, it is possible that a different and non-Council ownership model would need to be considered.

[3] https://www.argyll-bute.gov.uk/active-travel

2 Operational and Geographic Context

2.1 Overview

2.1.1 In considering the case for restoring an operational berth at Helensburgh, it is important to understand the geographic and operational context into which it would be introduced. For a relatively short stretch of water in distance terms, the River and Firth of Clyde between central Glasgow and Dunoon have a significant number of berthing facilities, marinas, and harbours of different types. They also have a highly varied mix of traffic ranging from ferries and large cruise liners to coastal shipping, military and marine leisure craft.

2.2 Operational Context

2.2.1 This section briefly summarises the operational parameters within the study area and highlights relevant legislation in relation to competition (in the context of public sector investment).

Statutory Harbour Authority

2.2.2 Statutory Harbour Authorities (SHAs) are Statutory Bodies responsible for the management and running of a harbour, which is defined as any natural or artificial harbour, any port, haven, estuary, tidal or other river or inland waterway navigated by sea-going ships.[4] The River and Firth of Clyde are defined as a 'harbour' as per the figure below:

[4] https://www.gov.uk/guidance/harbour-orders#:~:text=Statutory%20Harbour%20Authorities%20(SHAs)%20are,Order%20under%20the%20HA%201964
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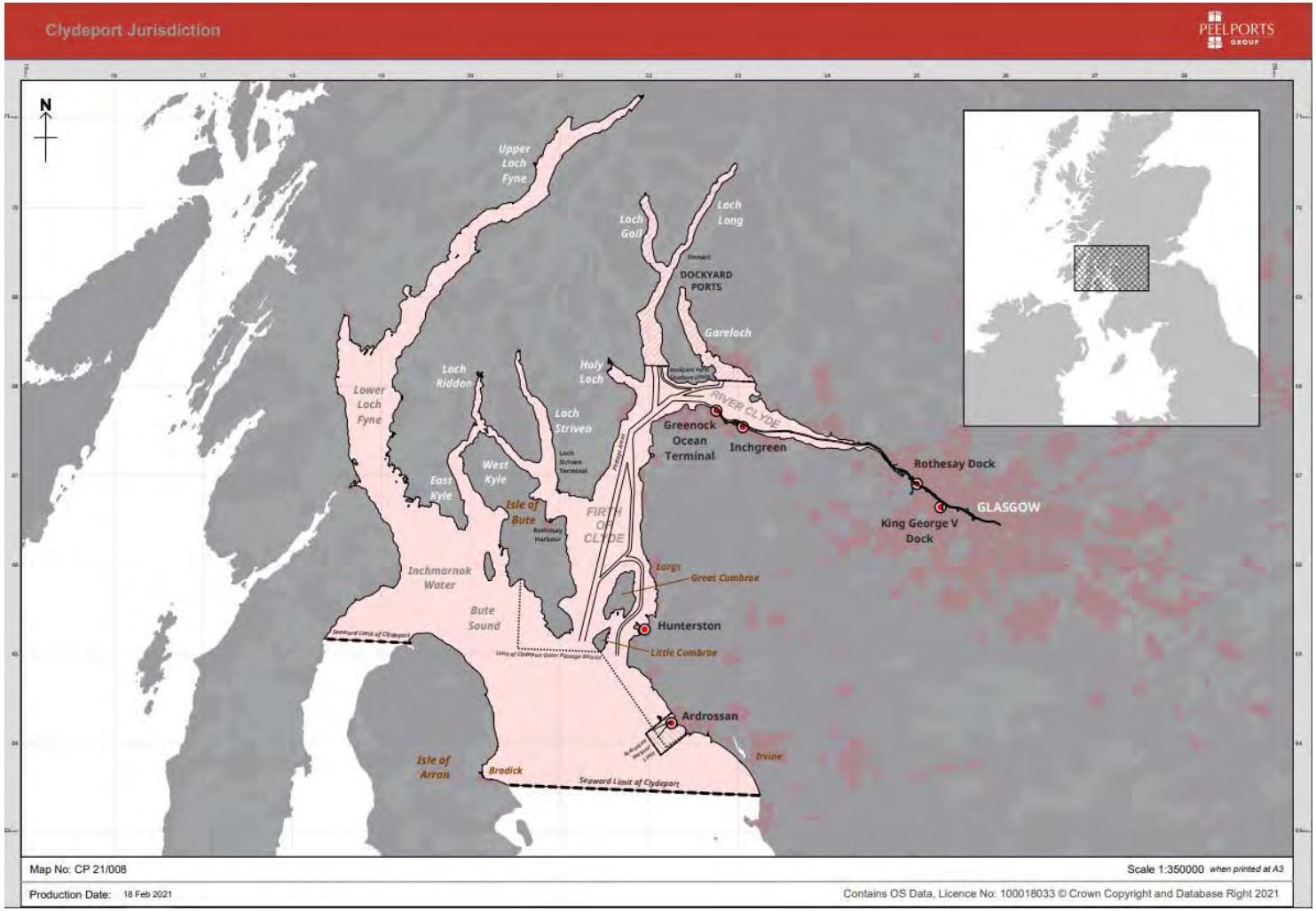


Figure 2.1: River and Firth of Clyde Statutory Harbour Authority area (Source: Peel Ports)[5]

[5] https://www.peelports.com/marine/our-ports/clydeport

2.2.3 As can be seen from the above figure, the River and Firth of Clyde as far south as Arran are under the jurisdiction of Peel Ports as the SHA.

2.2.4 However, the three hashed areas in the figure - Gareloch, Loch Goil and Loch Long, collectively defined as the Dockyard Ports – fall under the jurisdiction of the King's Harbour Master (KHM) Clyde. These harbour areas incorporate H.M. Naval Base Clyde (Faslane) and the Royal Naval Armaments Depot (RNAD) Coulport and thus fall under the control of the Royal Navy. This is relevant because **the waters around Helensburgh Pier are located within the Gareloch area and thus fall under the jurisdiction of the KHM**. This means that short notice operational restrictions can be imposed, including the closure of Rhu Narrows[6] for 3-4 hours (for access to HMNB Clyde) and the imposition of an exclusion zone around vessels exiting Rhu Narrows (which would have implications for cross-Clyde movements from Helensburgh).

2.2.5 This in itself is not a barrier to craft operating to or from Helensburgh and indeed a regular ferry service ran to Kilcreggan and Gourock until 2012. However, the potential for the imposition of short notice restrictions needs to be understood.

Key Point: Helensburgh Pier falls within the KHM SHA area. This introduces the potential for the imposition of short notice restrictions, including the closure of Rhu Narrows, although historic precedent demonstrates that these can be worked around.

Helensburgh Pier

2.2.6 As the owner of Helensburgh Pier, A&BC has a range of legal responsibilities to ensure that it is a safe and well-maintained facility.

2.2.7 In order to offset these costs, the Council (or another owner if the pier was sold or transferred) would need to raise revenue from users. For most piers and harbours, the key source of revenue is berthing dues (a rate per vessel or vessel gross tonne) and pier dues (a rate per passenger / item landed). Revenue can be raised from other ancillary activities such as the provision of fresh water, cranage, rope handling etc. but there is limited scope for Helensburgh in this regard as it has no such facilities at present.

2.2.8 A&BC publish an annual fees and charges card, which itemises the costs of using one of its facilities.[7] The key point of note is that charges are relatively low in absolute terms and thus **raising the required revenue to safely maintain and operate the pier will require either volume and / or regular use by larger vessels**.

Key Point: As Helensburgh Pier is owned by the Council, it has a legal responsibility to ensure that it is a safe and well-maintained facility. The restoration of an operational berth at Helensburgh would increase the cost burden of doing so and thus would require equivalent revenue to be raised from users.

Subsidy Control Act 2022

2.2.9 In developing the case for an operational berthing facility at Helensburgh, the Council would need to ensure that it complied with all competition legislation, including the Subsidy Control Act 2022, which superseded European State Aid law.

2.2.10 As a Council owned facility, the onus would be on A&BC to ensure that any investment does not distort the market or abstract demand from commercial facilities such as Rhu Marina or those operated by Peel Ports. The Council would need to take independent legal advice on

[6] https://www.royalnavy.mod.uk/khm/clyde/port-information

[7] https://www.argyll-bute.gov.uk/fees/22/piers

the specific state aid / competition issues related to Helensburgh as Stantec is not qualified to advise on this issue.

2.3 Geographic Context

2.3.1 This section provides an overview of the other harbours, berths, and marinas in the upper Firth of Clyde (i.e., from Bowling around the Tail o' the Bank to Gourock and Dunoon), as detailed in the map below.

Figure 2.2 Harbours, berths and marinas in the upper Firth of Clyde

2.3.2 It is acknowledged that facilities further to the south such as Inverkip, Fairlie etc. may be of relevance, but these are considered slightly peripheral to the main study area. The table below provides a high-level summary of each of these facilities in terms of the primary sectors accommodated:

Table 2.1: Harbours, berths and marinas in the upper Firth of Clyde by primary sectors accommodated

Facility	Large Cruise	Small Cruise	Ferry	General Cargo	Operational	Marina / leisure	Tour / Excursion	Comment
Clydebank						✓	✓	Small river pontoon for access to Clydebank.
Bowling						✓		Small leisure harbour at the entrance to Forth & Clyde Canal.
James Watt Dock					✓	✓		190 berth marina with layover berths for larger vessels such as ferries, tugs, pilot vessels and small cruise ships. The Dales Marine Garvel dry dock is also located here.
Greenock (Ocean Terminal)	✓	✓		✓				Cruise terminal with adjacent container port.
Rhu						✓	✓	235 berth marina with shore-based services and facilities.
Kilcreggan			✓				✓	A regular CalMac ferry service operates to Gourock from Kilcreggan. The pier also regularly accommodates the PS *Waverley*.
Holy Loch						✓	✓	250 berth marina with shore-based services and facilities. Can also be used for small ferry layover.
Hunters Quay			✓					Ferry terminals for Western Ferries' service between Hunter's Quay and McInroy's Point.
McInroy's Point			✓					
Dunoon		✓	✓				✓	Ferry terminal for CalMac services to Gourock. Also used by small cruise vessels and the PS *Waverley*. Owned by A&BC.
Gourock			✓					Ferry terminal for CalMac services to Dunoon and Kilcreggan, as well as a layover berth for larger CalMac vessels. Owned by Caledonian Maritime Assets Ltd.

2.3.3 The main points of note from the above table are as follows:

- The Firth of Clyde has an extensive marine leisure offer, most of which operates from commercially owned marinas. These include **Holy Loch**, **James Watt Dock**, **Rhu** and **Inverkip** and **Fairlie** to the south. Formal marina provision is supplemented by swing moorings throughout the Firth of Clyde. There is also a proposed new "King's Marina" development at Rosneath.
- **Gourock**, **Hunters Quay** and **McInroy's Point** are dedicated ferry terminals, whilst this is the primary function of both **Dunoon** and **Kilcreggan**.
- There is a buoyant tour and non-sailing based leisure market in the Firth of Clyde. The **PS *Waverley*** is the most widely recognised operator in this field, but there are a range of tour and adventure providers who offer **boat trips and excursions**. Evidently, the wider the range of facilities available to these providers, the more varied their itineraries can be.
- Whilst **Greenock** is the only port that can handle large cruise liners, the high value small cruise ship market is growing strongly, with the likes of Hebridean Island Cruises and Majestic Line being active in the Firth of Clyde.

2.3.4 Having set out the operational and geographic context for the proposed development at Helensburgh, the next chapter considers potential demand and use.

3 Market Analysis

3.1 Introduction

3.1.1 This chapter considers the potential demand for a new berthing facility at Helensburgh across five sectors:

- Ferry
- Cruise
- Marine leisure
- Tours / excursions
- Operational vessels

3.1.2 The analysis has been informed by a combination of desk-based research and **15** stakeholder interviews, including with wider public sector stakeholders which have a non-operational interest. The following organisations responded to our request for an interview or provided written input:

- Argyll & Bute Council
- Destination Helensburgh
- European Cruise Services
- Firth of Clyde Boat Tours
- Glasgow City Boats
- Greenheart Wood Traders
- Hebridean Island Cruises
- H.M. Naval Base Clyde
- King's Harbour Master
- Loch Lomond and the Trossachs National Park
- Northern Lighthouse Board
- Peel Ports Limited
- Transport Scotland
- Visit Scotland
- Waverley Excursions
- You&Sea

3.1.3 In order to respect commercial confidentiality, comments are not attributed to specific stakeholders unless there is a clear reason to do so.

3.2 Ferry

3.2.1 The most recent commercial use of the pier was to provide the Helensburgh terminus of the Gourock – Kilcreggan – Helensburgh ferry service, and thus consideration of its potential future role as a ferry terminal is an obvious starting point for the analysis. There are three potential options which emerged through the engagement:

- Restoration of a **cross-Clyde ferry service**
- Introduction of a **Helensburgh to HMNB Clyde (Faslane) ferry service**
- Helensburgh as a calling point on a wider **Clyde Waterbus** network

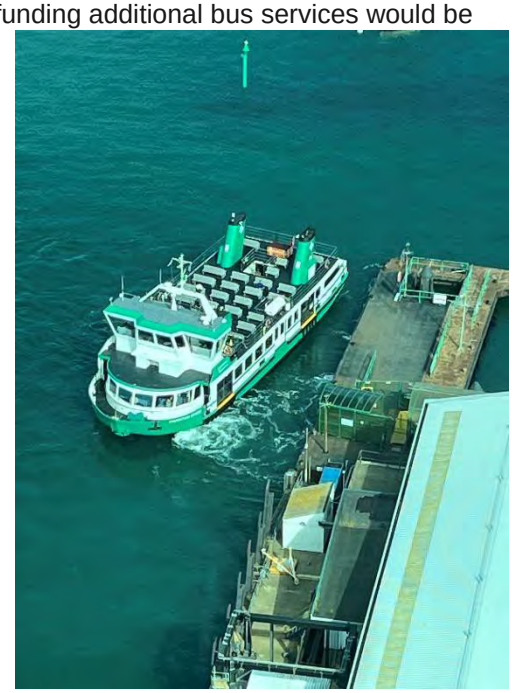
3.2.2 Securing a ferry route would significantly enhance the business case for a restored berth at Helensburgh as it would provide a regular daily income from both berthing and pier dues.

Cross-Clyde ferry service

3.2.3 The most apparent ferry related opportunity would be the restoration of a cross-Clyde ferry service. This could take the form of:

- Restoration of the former **triangular Gourock – Kilcreggan – Helensburgh service**, either all day or at certain points in the day; or
- A new **direct connection** to either **Gourock** or **Greenock**

3.2.4 There are no river crossing opportunities between Inverclyde and West Dunbartonshire / Argyll & Bute west of the Erskine Bridge. There is therefore a lengthy road-based diversion with few public transport opportunities for those travelling between these two sides of the river, e.g., from Greenock to Helensburgh. Whilst this is of course common in estuarial waters across the UK (e.g., between Kent and Essex, Somerset, and South Wales etc.), there is a significant daily employment flow between Inverclyde and HMNB Clyde. A ferry service to Helensburgh and onward bus connection to the base would facilitate this traffic and reduce road-based travel to Faslane, albeit securing and funding additional bus services would be commercially challenging for the Council. For context, commuting to / from HMNB Clyde generates around 3,500 car journeys every weekday, equating to around 14,000,000 car miles per annum[8]. Further to this, surveys carried out at the base indicated that around 80% of people working at the base travel by private car.



3.2.5 The most obvious comparator route in this respect is the Gosport Ferry in Hampshire (see inset image). This is a highly frequent passenger only service across Portsmouth Harbour, connecting the peninsula in which the town is located with Portsmouth Harbour Station Pier and, by extension, neighbouring HMNB Portsmouth.

3.2.6 It should be noted however that there are a number of challenges with establishing a new cross-Clyde ferry service:

- Firstly, and most importantly, the service would in all likelihood **require significant subsidy**, given that this was the case for the previous triangular service. Furthermore, since that service was withdrawn, the rate of increase in ferry costs in Scotland has generally significantly outstripped the growth in fares revenue.
- If such a route was established, it would most sensibly sit within the Clyde and Hebridean Ferry Services (CHFS), which is funded by Transport Scotland. However, **Transport Scotland discounted this option in the Strategic Transport Projects Review 2** (STPR2) at Preliminary Appraisal stage on the basis that it did not address the transport problems and opportunities.[9] Whilst it can be argued that STPR2 is not necessarily the correct 'home' for this option, it has to be recognised that re-establishment of the previous route is not an immediate priority for government. Indeed, Transport Scotland is currently

[8] Fastline Faslane, Stantec, 2022

[9] Strategic Transport Projects Review 2, Appendix G, Option A&B534 - appendix-g-groupings-related-to-recommendations-december-2022-stpr2.pdf (transport.gov.scot)

progressing a combined vessels and infrastructure programme for Dunoon and Kilcreggan which does not include Helensburgh.

- In the absence of a commitment from central government to the route, **it is not clear who would fund the vessel or operating subsidy**. It is not an obvious priority for A&BC and Strathclyde Partnership for Transport (SPT) has largely retrenched from its previous role as a ferry operator. Moreover, if A&BC did run such a service, it would effectively be partially paying for the maintenance of Helensburgh Pier through an internal transfer of funds.
- The service could also potentially **abstract demand from the Kilcreggan route**, which is currently used for travel to HMNB Clyde. This would also increase the subsidy on that route.

Key Point: Whilst there is a logic to a cross-Clyde ferry service, the likely level of subsidy and the absence of an obvious procuring body makes this a long-term proposition at best.

HMNB Clyde ferry service

3.2.7 Recognising the issues of journey time reliability on the A814 between Helensburgh and HMNB Clyde, as well as the ongoing challenge of funding bus services, one stakeholder suggested operating a ferry service from Helensburgh to HMNB Clyde. This would allow rail-based travel to Helensburgh Central to connect with the ferry or a Park & Ride in the town.

3.2.8 At the time of writing, there is an hourly bus service between Helensburgh and the base, with peak travel periods being at shift change and muster times. Outwith this, travel to the base is generally by private car.

3.2.9 Whilst the aspiration for a ferry service to HMNB Clyde is well-understood, our research and engagement has highlighted several practical challenges. These include:

- Evidently, the highest security assets at HMNB Clyde are on the wetside rather than the landside. A **scheduled ferry service could not therefore be permitted to operate within the perimeter of the base** and thus a new berthing facility would be required to provide access through the south gate. As well as the issue of identifying an appropriate site, a new berth would need to be built for the ferry, which would be an additional capital outlay.
- The entire route would be located in the KHM SHA area (see Chapter 2) and thus would be **subject to disruption to accommodate the movement of military vessels**. This would particularly be the case in the event of Rhu Narrows being closed to navigation.
- **Demand would be 'peaky', clustered around shift change and muster times**. This would require a vessel capable of handling peak demand, but which would run close to empty most of the rest of the time as there would be little reason to use the ferry except for travelling to the base.
- The issue of **which party would procure and fund the ferry service** would again arise. In this context, there would also be a question over the **funding of a new berth at HMNB Clyde** and on the **subsidy impact for bus services from Helensburgh** to the base, given that at least some demand would likely be abstracted.
- A ferry service would offer **few benefits over bus-based connections** in terms of cost, journey times or scalability.

Key Point: The security, operational and funding challenges of establishing and operating a ferry service between Helensburgh and HMNB Clyde, when combined with the limited benefits, means that this is not a realistic proposition.

Clyde Waterbus

3.2.10 There has been a long-held ambition to develop a comprehensive 'Clyde Waterbus' network connecting Glasgow with settlements across the Firth of Clyde. The concept is based on the urban ferry networks which operate in cities such as London, New York, and Sydney. SPT commissioned a feasibility study by MVA Consultancy in 2008/09 to consider this opportunity.

3.2.11 Whilst the MVA study did identify a core demand, a number of operational challenges, including a requirement for interchange at Bowling, made the concept commercially unviable. This is particularly the case when the waterbus services would effectively be competing with high frequency and faster rail services on both sides of the river.

3.2.12 Whilst a waterbus network remains a long-term aspiration for some stakeholders, it is not a realistic proposition in the short to medium-term, particularly given current funding and resource constraints.

Key Point: Any Clyde Waterbus service remains a very long-term proposition at best and cannot be considered to support the case for a new berthing facility at Helensburgh Pier.

3.3 Cruise

3.3.1 Despite the pandemic, the global cruise market continues to grow in almost every respect, i.e., the number of vessels in operation, total tonnage, the number, and variety of itineraries offered etc. The Firth of Clyde has benefitted significantly from this, becoming a feature of 'around Britain and Ireland' and 'Northern Europe' itineraries in particular, whilst there has been a significant growth in luxury small cruise vessels and adventure cruises (e.g., Hebridean Princess, Majestic Line, Azamara, Hurtigruten etc.) Greenock has by some distance been the main beneficiary of this, with 91 cruise calls booked in the 2023 season alone.[10]

3.3.2 In the scope for this study, two opportunities were identified for Helensburgh:

- To provide a **regular berth for very small luxury cruise ships**
- To act as a **tender berth for cross-Clyde movements** from Greenock

Cruise vessels

3.3.3 As well as the attractions of the town itself, Helensburgh would offer a gateway to Loch Lomond and the Trossachs and also attractions currently served by coach on cruise tours from Greenock (e.g., Inverary Castle).

3.3.4 An appropriately sized new berth at Helensburgh could accommodate very small luxury cruise ships such as the MV *Hebridean Princess* and those operated by e.g., Majestic Line. It would however in all likelihood be too small for the 'small' vessels that call at Greenock, such as those operated by, for example, Seabourn or Hurtigruten. Tendering would be an option but would offer little obvious advantage over Greenock where vessels can come alongside.

[10] https://www.largsandmillportnews.com/news/23399977.cruise-liner-schedule-clyde-2023-set-busiest-ever/

3.3.5 Engagement with the domestic cruise industry suggested that Helensburgh would be an attractive port of call for the reasons outlined above. Indeed, one cruise operator noted that they would potentially call there at the bookends of the season (i.e., March and November).

3.3.6 There is therefore a potential cruise market at Helensburgh, albeit a small one. Should the concept of an operational berth at Helensburgh be progressed into a business case, more detailed engagement with niche cruise companies would be required to further establish the extent of the market. There would also be a trade-off to consider in that cruise vessels may require or desire a higher standard of facilities on the pier in terms of passenger access, provision of water and waste etc. which would come at a cost. The Council or whichever body is operating the pier, would also potentially need to consider compliance with the International Ship and Port Facility Security (ISPS) Code for vessels arriving from outwith the UK, although advice would need to be sought on this.

3.3.7 Note that the risk of market distortion in terms of drawing traffic from Greenock or other ports would need to be assessed as part of any future business case.

Key Point: Targeted engagement with the domestic cruise industry highlighted potential demand for occasional calls at Helensburgh, providing access to Loch Lomond and the Trossachs and Argyll & Bute more generally. This demand in itself would not sustain a restored berth at Helensburgh but would be a valuable source of revenue to complement other activities. The market potential of this sector should be considered further if the concept is progressed into a business case.

Cruise ship tendering

3.3.8 A suggestion highlighted in the engagement was the use of cruise vessel tenders to bring passengers to Helensburgh from Greenock, both as a destination in its own right and as a means of negating the coach journey via the Erskine Bridge for tours bound for Argyll & Bute.

3.3.9 Whilst this may appear intuitively sensible at face value, it is not in reality a practical proposition. Tendering is expensive and demanding on human resources and is also not generally popular with cruise passengers, particularly those of an older demographic or with mobility issues. It is also subject to disruption in inclement weather. Indeed, this is likely to be one of the reasons why a deepwater cruise berth was developed at Greenock in the first place.

3.3.10 Moreover, cruise companies have established relationships with coach operators to take passengers on pre-arranged tours, which are sold at a significant margin.

3.4 Marine Leisure

3.4.1 As outlined in Chapter 2, there is an extensive and vibrant marine leisure (sailing) market in the Firth of Clyde. At face value therefore, the development of a transit berth (i.e., a berth where a vessel can stop for a short period but with no shoreside facilities typically found at a marina) would appear to be a realistic proposition. Indeed, the success of equivalent developments at both Campbeltown and Oban was a significant driver for this study.

3.4.2 However, the Firth of Clyde is well served by commercial marinas (ten in total), with Rhu Marina and James Watt Dock being particularly close by. There is therefore a significant risk of market distortion, and the Council would need to take independent legal advice to satisfy itself that it would not be breaching competition legislation. This was manifestly not the case at Campbeltown and Oban, which both addressed a clear and unfulfilled need in the market.

Key point: Whilst there is an extensive marine leisure market in the Firth of Clyde, it could be challenging for Helensburgh to tap into this without the risk of market distortion. Should the project proceed to business case, the Council would need to satisfy itself that it could build and operate a transit berth without the risk of a legal challenge.

3.5 Tours and excursions

3.5.1 There are several marine tour companies operating in in close proximity to Helensburgh, many of which participated in the engagement programme. There was across the piece a positive view of the prospect of developing Helensburgh as a destination for their operations. Key reasons included: the location of Helensburgh as a gateway to Loch Lomond and the Trossachs and Argyll & Bute; its amenities including restaurants and bars; and its rail connection to / from Glasgow.

PS *Waverley*

3.5.2 Of perhaps greatest significance given its historic importance to Firth of Clyde communities is the PS *Waverley* and, potentially in the longer-term, the reintroduction to service of TS *Queen Mary*. Waverley Excursions noted that they would operate two trips per week to Helensburgh during the 8-12 week period that they operate in the Firth of Clyde during the summer. It should be noted however that the pier extension would need to be appropriately designed to accommodate her berthing requirements. Waverley Excursions noted that Helensburgh Pier has the greatest potential for increasing their revenue of any other pier in the UK that may be able to reopen and that, in terms of net income gain per season, Helensburgh Pier being available would be worth over £100k to the organisation.

3.5.3 It is though important to note that, from a revenue perspective, as a not-for-profit body, Waverley Excursions does not pay dues at Council ports, although their calls would obviously contribute significant footfall to the town. Accommodating PS *Waverley* would also give rise to additional costs, including increased maintenance funding to account for wear and tear on the pier and the requirement to pay staff (potentially at overtime rates as happens elsewhere) to attend the pier when she is visiting,

Other tours and excursions

3.5.4 You & Sea own Boat Trips Helensburgh, which operate out of Rhu Marina. They indicated that if an appropriate facility was developed, they would like to move their operation to start and end tours at Helensburgh Pier, while continuing to berth overnight at Rhu. It was suggested that they would like to operate tours on an average of 3-4 days per week. This would likely breakdown into weekend-only trips in the shoulder months, increasing to 6-7 days a week in the middle of the summer. There would be a maximum of four trips a day, with a passenger capacity of 50 across the day. Further to operating tours from Helensburgh, Boat Trips Helensburgh noted that they are also considering the potential for a small water sports operation (windsurfing, paddle boarding etc.) at Helensburgh during the summer.

3.5.5 Another local operator did not envisage that there would be demand for boat trips from their base near Glasgow to Helensburgh given the road links and relatively low-cost rail fares. However, they did suggest that they would be interested in operating a tour, which stops at Helensburgh. They currently operate one tour per week in winter, increasing to up to four tours per day in summer.

Key Point: Overall, the engagement established that there would be a seasonal demand for use of Helensburgh by tour and excursion vessels. As well as raising dues, these tourist-focused services would generate footfall for Helensburgh town centre.

3.6 Operational Vessels

3.6.1 Through the engagement and desk-based research, we explored whether Helensburgh would be an attractive facility for a range of operational vessels including tugs, pilot vessels, MoD Police, Northern Lighthouse Board etc. However, most of these potential users already have well-established and better suited bases or would require specific equipment if they were to consider using Helensburgh with any regularity.

3.7 Next Steps

3.7.1 Having profiled the potential market at a high-level, the next chapter sets out the infrastructure options and costs.

4 Infrastructure Options

4.1 Overview

4.1.1 The pier at Helensburgh consists of two structural forms:

- The root of the pier (and the majority of its length) is an infilled masonry wall
- The pierhead is formed by a timber extension

4.1.2 The infilled masonry section of the pier was recently repaired (July 2022) and is now in good condition. However, as explained in Chapter 1, the condition of the timber section varies due to a combination of fire damage and wear and tear.

4.1.3 As such, a visual inspection of the pier was undertaken on 22nd April 2023 to assess the condition of the timber pierhead. This chapter details the following:

- A review of the existing information to better understand the condition of the pier and its exposure to prevailing weather and wave conditions.
- Consideration of the potential consenting requirements that would be relevant for any future developments.
- A review of the key engineering components of the proposed pontoon facility provided to the study team.
- The development of four high-level options and the anticipated costs associated with each.

4.1.4 In addition to this chapter, the following appendices present supplementary information:

- Appendix A: Previous Condition Reports
- Appendix B: Condition Photographs (2022)

4.2 Helensburgh Pier

4.2.1 As noted in Chapter 1, Helensburgh Pier was constructed in the 1800s to facilitate the berthing of steamers. The original masonry section was extended with a timber pierhead in circa 1871 and has largely remained unchanged in form since then.

4.2.2 It is understood that a fire occurred on the north-eastern corner of the timber pierhead over 20 years ago[11]. This section of the pierhead has since been fenced off and no repairs or remedial works are understood to have taken place. Amendments have been made to the timber pierhead in recent years to install new access stairs along the southern berthing face but the pier is not currently used for the berthing of larger vessels due to the condition of the structure.

Description of the structure

4.2.3 Helensburgh Pier is a Category C listed structure owned by A&BC. The pier is approximately 245m long, with the final 25m being a timber pierhead. The landward 220m, as previously mentioned, is an infilled masonry approach structure. As part of the development of the leisure centre, the approach structure that was previously topped with a concrete deck has been refurbished and coated with a coarse anti-wear surface.

[11] National Piers Society – Helensburgh Pier (2023) [online] Available at: <https://piers.org.uk/piers/helensburghpier/>Accessed 19th April 2023

4.2.4 There is a small, approximately 4m wide, concrete slipway between the pier and the leisure centre. The structural details and overall dimensions of the slipway are unknown. It is understood that the slipway is used for launching kayaks and is part of the Argyll Sea Kayak Trail[12].

The figure provides a visual overview of the pier and the aforementioned structures.

Figure 4.1 Helensburgh Pier Overview

Record Information

4.2.5 Limited as-built record information for the structure is available. However, there are several inspection reports from 2018 and 2019 that have been used to inform this chapter:

- Arch Henderson (2018) Principal Inspections – Helensburgh Pier
- Argyll & Bute Council (2019) Report on the Structural Assessment of Helensburgh Pier – Report Number 00040-28/2019
- Tritonia Scientific Ltd (2019) Underwater Inspection of Helensburgh Pier
- Bmtrada (2019) condition survey and indicative in-situ strength grading of the structural timber components forming Helensburgh Pier
- Argyll & Bute Council (Helensburgh and Lomond Area Committee) (2019) Helensburgh Pier Survey and Recommendations (draws on information in 1, 2, 3 and 4)
- Aspect (2022) Multibeam Bathymertric Survey – Helensburgh Pier

[12] https://www.wildaboutargyll.co.uk/see-and-do/on-the-water/argyll-sea-kayak-trail/

- British Listed Buildings – Helensburgh Pier. 2023. A Category C Listed Building in Helensburgh – Argyll and Bute[13] (accessed 19th April 2023)

4.3 Scope of Inspection

4.3.1 The scope of this inspection included a top-side walkover of the timber pierhead. However, only publicly available areas were accessed.

Limitations

4.3.2 Due to the fire damaged section of the pierhead being in very poor condition, the area presented in Figure 4.2 was not accessed.

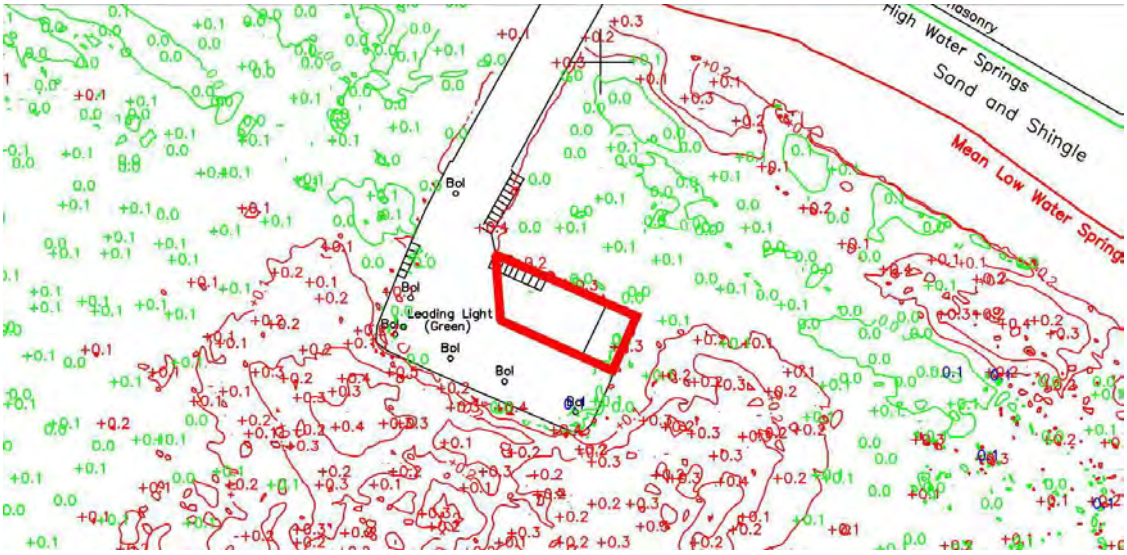


Figure 4.2 Access restrictions on pierhead

4.4 Condition Summary

Masonry pier

4.4.1 The masonry pier is approximately 220m in length and approximately 8.5m in width. From the walkover, it appears that the pier is constructed of semi-dressed masonry blocks and is assumed to be infilled. From aerial imagery prior to the 2022 repair works, the deck of the pier appears to have been concrete and this has now been covered in a coarse anti-wear surface as part of the development of the new leisure centre.

4.4.2 During the walkover, MML was unable to gain insights into the condition of the pier walls, although it is assumed that any major defects would have been repaired during the 2022 works.

Concrete slipway

4.4.3 The concrete slipway adjacent to the masonry pier is approximately 4m wide, although the length is unknown - the walkover was undertaken at a low tide and the toe of the slipway was not visible. The section of the slipway that was above the water level appeared in fair condition and no evidence of any recent repairs was apparent.

[13] https://britishlistedbuildings.co.uk/200407145-helensburgh-pierhelensburgh#.ZEZ_C_zMJPY

Pierhead

4.4.4 The pierhead generally comprises a single layer of deck boards running longitudinally over a grillage of horizontal joists which are in turn supported on vertical piles in a regular piled grid. The deck boards are then overlain with a recent addition of a non-slip composite grid decking surface. The composite grid decking is in good condition - however, it was not possible to ascertain the condition of the timber boards below without removal of the composite grid surface. An image of the decking surface can be seen in Appendix B.

4.4.5 There are five mooring bollards on the pierhead, one of which can be seen in Appendix B. The bollards are corroded and are fixed to the pierhead by anchor bolts.

4.4.6 From the 2019 Tritonia underwater survey report, there are approximately 150 support piles at the timber pierhead. The survey noted that the exterior piling appeared to be structurally sound and that the underside of the pierhead was largely intact other than instances of broken or missing rafters / deck joists. Other than the timbers that were visible from the edge of the boat steps and from the masonry approach section of the pier, the condition of the underside of the timber pierhead could not be assessed by MML during the walkover.

4.4.7 The 2019 BM TRADA condition survey measured various pile sizes, typically ranging from 260mm x 260mm to 320mm x 320mm (it is assumed that these were originally installed as 10” and 12” square piles respectively). The survey also noted that six piles on the southern berth face contained substantial cross grain fractures and that this has likely been the result of heavy impact during berthing. This report also noted that the majority of the inspected piles were in sound condition and were identified as greenheart timber.

4.4.8 As previously mentioned, a section of the timber pierhead was fire damaged over 20 years ago and is in very poor condition. This section of the pierhead is fenced off from the remainder of the pierhead. However, it may pose a health and safety risk to any persons entering the water from the slipway that is situated in the lee of the pierhead, or to any approaching small boats / rubber dinghies and swimmers.

4.4.9 The boat steps and associated railings generally appear in good condition. These were however closed off, presumably due to the lack of requirement for use of the pierhead berthing face.

4.4.10 On the western side of the timber pierhead, there are a set of steps missing (see Appendix B). It is unknown whether these were removed or have fallen into the sea through poor condition.

2022 Repair Works

4.4.11 The most recent repair works were completed in 2022, the full extent of these works to Helensburgh Pier is currently unknown, but it included as a minimum:

- Resurfacing works were undertaken to the masonry approach section of the pier
- Lighting on the masonry section of the pier was also replaced during these repair works

4.4.12 It is understood that no repairs were undertaken on the timber pierhead as part of these works.

4.5 Review of proposed pontoon solution

4.5.1 The primary driver of this study was the provision by Helensburgh Community Council of a proposal to redevelop Helensburgh Pier through the removal of the timber pierhead and the

installation of pontoons[14]. This section sets out the detail of that proposal ahead of a wider option generation and appraisal exercise.

4.5.2 The aim of the proposal is to upgrade the facility to accommodate the berthing of small vessels, ferries and leisure craft to increase footfall and tourism in Helensburgh.

4.5.3 The proposed pontoons would extend 140m in a south-south-west orientation (the same as the existing masonry pier) with a 40m pontoon section close to end of the masonry pier at 90 degrees to the main pontoon arm. The pontoons would be accessed by a 25m long gangway that would be connected to the end of the existing masonry pier. See **Appendix C** for the proposed specification and **Appendix D** for sketches of the proposal.

4.5.4 In December 2022 the pontoon elements of the proposal were priced at **£948,752** by SF Marina[15]. This includes all materials required for the pontoons. However, it does not include delivery and installation of the pontoons, any utilities connections to the pontoons from the existing pier, the demolition of the timber pierhead, the making good of the masonry pier end or capital dredging.

4.5.5 There would be a number of potential benefits and limitations associated with the proposal as described above. These are listed below.

Benefits

4.5.6 If the development were to be used to the extent that is anticipated by those putting forward the original pontoon proposal, it could bring the following benefits:

- As described in Chapter 3, depending on the suitability of navigational approach and available water depths, there would be a small market for vessel calls, including the PS *Waverley*, small and high-end domestic cruise vessels and tour and charter vessels.
- Increased revenue to local Helensburgh businesses and potentially Argyll & Bute Council.
- A restored berthing facility would also provide the necessary facilities for the restoration of a ferry route from Helensburgh.
- Removing the derelict section of timber pier would improve the overall appearance of the pier.

Limitations

4.5.7 The following limitations were identified:

- The wave climate is unknown and extending 140m outwards into the Firth of Clyde could cause issues at the exposed end of the pontoon leg (this is evidenced by the breakwaters around Rhu Marina). Whilst the proposed concrete pontoons have some wave attenuation characteristics, more detailed review of the wave climate would be required to confirm their suitability for year-round use.
- Given the more exposed nature of the pontoon leg, it may be difficult to adequately anchor the pontoons, potentially leading to this being a seasonal facility.
- From the 2022 Aspect bathymetric survey, the seabed is relatively flat and slopes from approximately -2.6m Chart Datum (CD) at the front of the timber pierhead to approximately -2.7mCD at the end of the proposed pontoon leg. Mean Low Water

[14] Helensburgh Pier – Proposed Floating Pontoon Extension for berthing Small Ships, Ferries, MOD Vessels & Leisure Craft - Specification (2022)

15https://sfmarina.com/?gclid=CjwKCAjw9J2iBhBPEiwAErwpeVwC7LG7x39LLbhUmTmUzYXRNfjadDn1KONR0SXk3XcReTI0Q-aGtBoCfigQAvD_BwE

Springs is at +0.3mCD. Allowing for 1m under keel clearance, this would limit the draught on vessels to approximately 2.0m, for all tides access.

- If the facility was to be used for visitors from cruise ships, there may be a requirement for a border control post to be installed for any international visitors.
- The proposed gangway is too short to provide Equality Act (2010) compliant gradients across all states of the tide.

4.5.8 Based on the above, and the anticipated level of demand, we recommend that this solution is modified to an option similar to that presented as **Option 4** later in this chapter, with potential dredging as described to ensure available water depths for in-scope vessels.

4.6 Option Generation and Appraisal

4.6.1 This section presents the potential options relation to the redevelopment of Helensburgh Pier. The costs of these options are presented within this chapter, along with a brief appraisal of each option.

4.6.2 Any option for future repair or upgrade to the pier would be subject to consultation with regulatory bodies to determine the impact of the proposal on the setting of the historic pier.

Option 1: Demolish timber pierhead and make good end of masonry pier

4.6.3 The first option would be to:

- Demolish and completely remove the timber pierhead
- Make good the end of the existing masonry pier

4.6.4 This would remove any maintenance burden that is currently associated with the timber pierhead and allow the masonry pier to become the focal point of the waterfront. Figure 4.3 presents an aerial image with the transparent red area showing the extent that would be removed under this option.

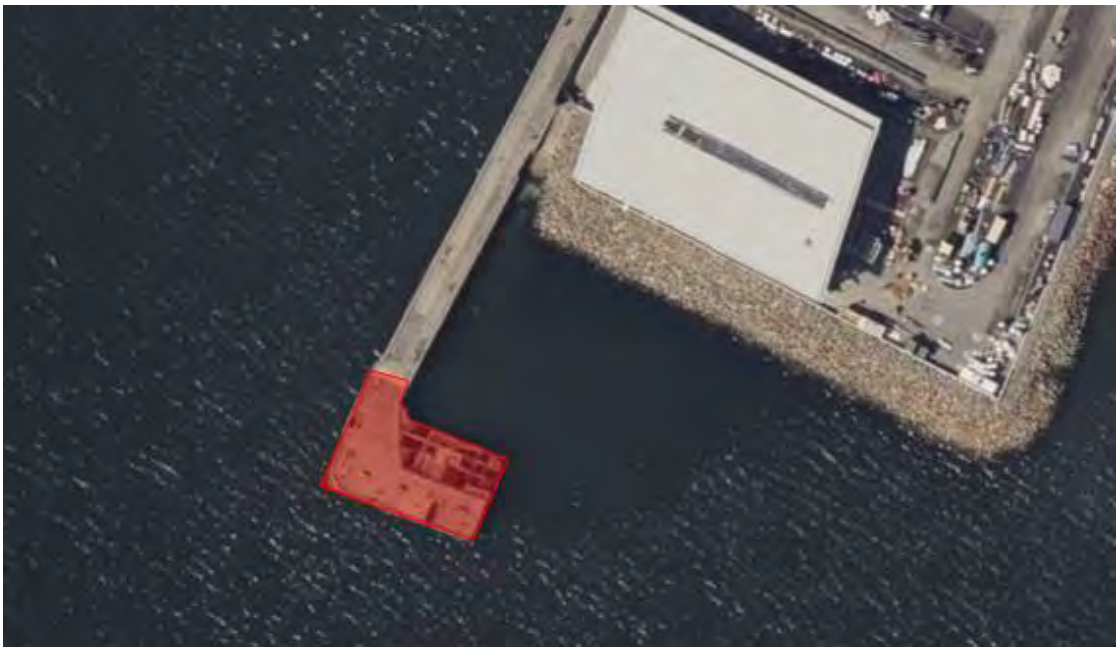


Figure 4.3 Entire timber pierhead to be demolished as part of Option 1

Appraisal of Option 1

4.6.5 The table below illustrates some of the advantages and disadvantages associated with Option 1.

Table 4.1 Option 1 – advantages and disadvantages

Advantages	Disadvantages
The maintenance burden of the timber pierhead would be removed.	Helensburgh would lose part of a historic listed structure that has been present for over 150 years.
The health and safety risks that are present due to the fire damaged section of the pierhead would be mitigated in their entirety.	The limited shelter that the timber pierhead provides to the concrete slipway would be lost.
It would make the launching and recovery of small leisure craft from the concrete slipway easier as a result of easier navigation	The potential for future use by vessels would be lost without further capital investment.

Option 2: Remove damaged section of timber pier and make good remaining

4.6.6 The second option consists of:

- Removing the fire damaged section of the timber pierhead
- Making good the remaining structure (not to upgrade the timber pierhead) to continue its use as a public realm space

4.6.7 This option would remove the potential health and safety hazard of the fire damaged section of the pierhead, and potentially improve the image of the remaining section of the pierhead for use by the public. Figure 4.4 presents the area of the timber pierhead that would be removed as part of this option.

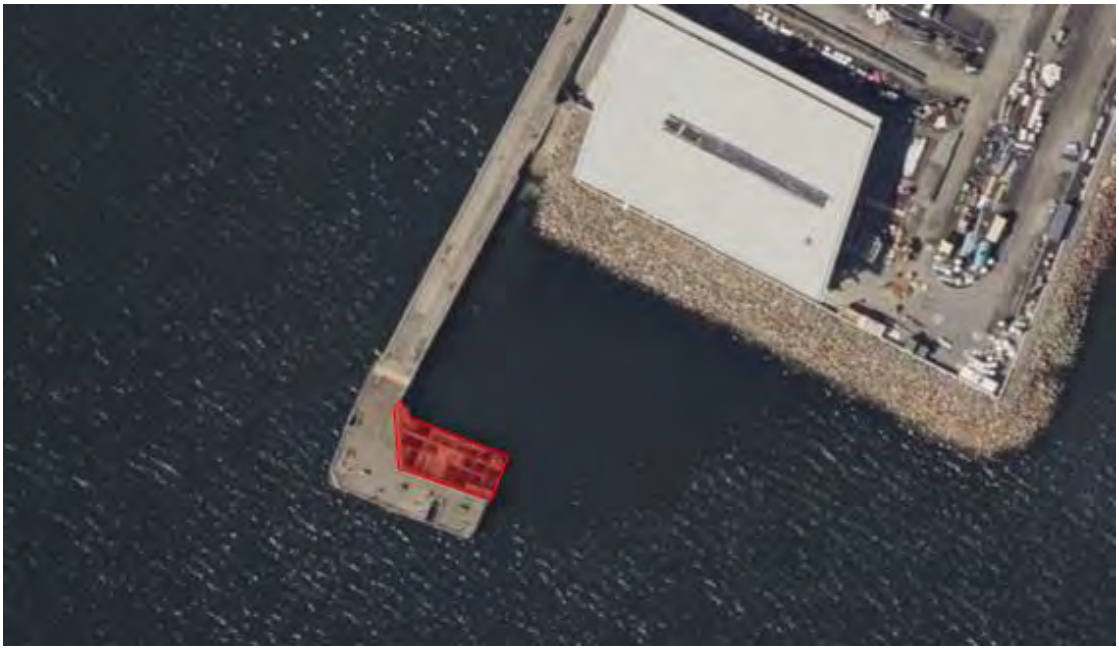


Figure 4.4 Area of Timber Pierhead to be Demolished as Part of Option 2

Appraisal of Option 2

4.6.8 The table below illustrates some of the advantages and disadvantages associated with Option 2.

Table 4.2 Option 2 – advantages and disadvantages

Advantages	Disadvantages
The health and safety risks that are present due to the fire damaged section of the pierhead would be mitigated in their entirety.	There may be a small reduction in shelter at the concrete slipway due to a portion of the pierhead being removed
The remainder of the pier would be safe for use as a public realm space and its appearance would be enhanced.	The structural capacity of the pierhead would be reduced by removing a section of it. This may impact its capacity for future vessel berthing.
It would make the launching and recovery of small leisure craft from the concrete slipway slightly easier than is currently the case (although not to the same extent as Option 1).	
The potential for future development of the timber pierhead remains possible.	

Option 3: Remove the damaged section of timber pier and repair / upgrade timber pierhead for re-use, including dredging

4.6.9 Similar to Option 2 above, a third option is to:

- Remove the fire damaged section of the timber pierhead
- Repair / upgrade the remainder of the timber pierhead for use as a berthing structure for vessels
- Dredge to remove any tidal restrictions for use of the berth

4.6.10 Whilst of a much smaller scale than the proposed pontoon option, subject to design, this option would likely permit the pierhead to be reinstated for use by a selection of vessels, **all subject to analysis to demonstrate that the reduced section of pier has the residual capacity to resist berthing loads**. Figure 4.5 below presents the area of timber pierhead that would be removed as part of this option.

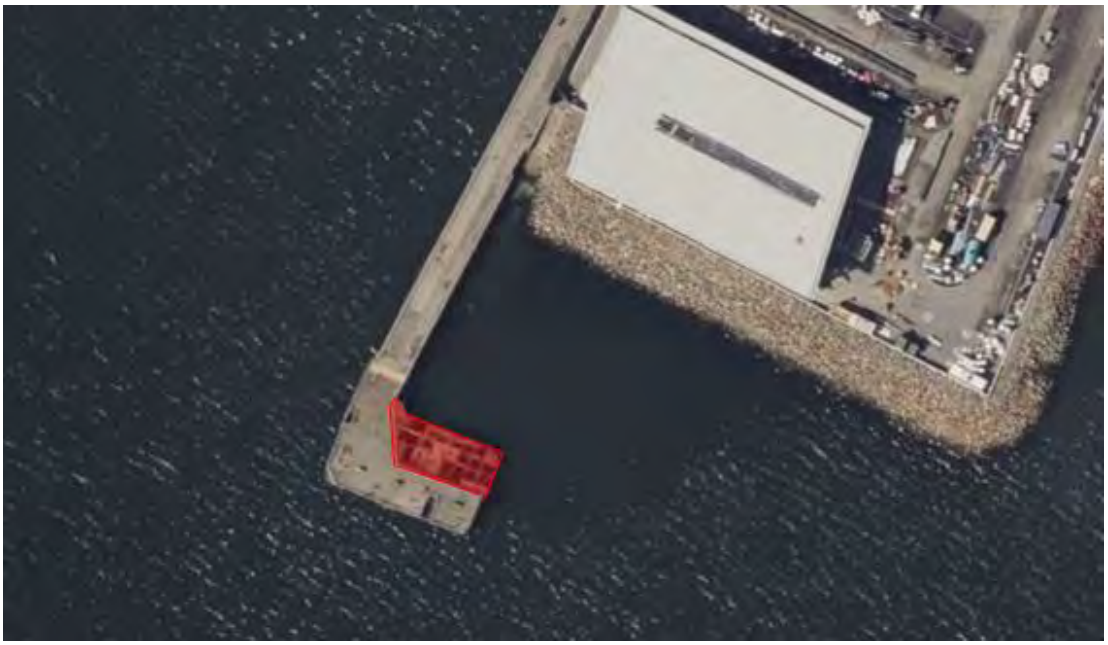


Figure 4.5 Section of timber pierhead to be demolished as part of Option 3

4.6.11 From a dredging perspective, working on an assumed 1.91m vessel draught, Mean Low Water Spring tide at +0.3mCD, together with allowances for under keel challenge and siltation of the dredged area, it is assumed a dredge depth of -3.0mCD would be required, subject to sedimentation studies to confirm the rate of siltation of the dredged area. The area is shown in Figure 4.6, with the darker blue area presenting a dredged pocket on the berth, and the lighter area showing the dredged approach required for non-restricted berthing of the PS *Waverley* (as an assumed design vessel).

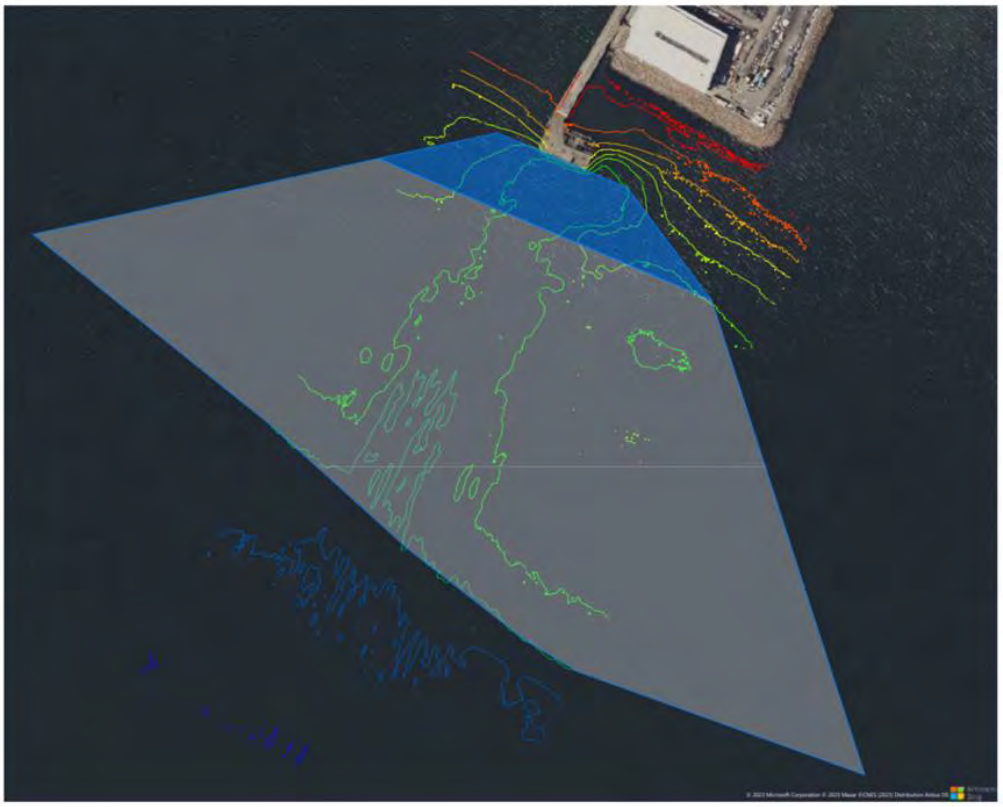


Figure 4.6 Potential dredge areas

4.6.12 Based on previous surveys, it is anticipated that repairs would be restricted to the timber deck, safety barriers, access steps, ladders, etc., together with repairs to the damaged piles mentioned in the BMTRADA report. It is assumed that the driving of new piles would not be required.

Appraisal of Option 3

4.6.13 The table below illustrates some of the advantages and disadvantages associated with Option 3.

Table 4.3 Option 3 – advantages and disadvantages

Advantages	Disadvantages
The health and safety risks that are present due to the fire damaged section of the pierhead would be mitigated in their entirety.	There may be a small reduction in shelter at the concrete slipway due to a portion of the pierhead being removed.
It would make the launching and recovery of small leisure craft from the concrete slipway slightly easier than is currently the case (although not to the same extent as Option 1)	Dependant on a structural inspection of the remaining pierhead and the repairs may be expensive.
The remainder of the pier would be safe for use as a public realm space and its appearance would be enhanced.	Large areas of dredging may be required. The volume and frequency of dredging will depend on the in-scope vessels and the outcomes of sediment transportation and wave modelling during detailed design.
Dependant on the extent of repair / upgrade, the potential for future development of the timber pierhead remains possible.	

Option 4: Remove timber pierhead and construct new pontoon facility

4.6.14 In order to have a comparative option to the proposed pontoon solution, this final option presents the potential construction of a small pontoon facility at Helensburgh Pier. This would require:

- The removal of the timber pierhead in its entirety
- Making good the end of the masonry pier
- Installing pontoons in the same orientation as the existing pier
- Installing an access gangway from the masonry pier end

4.6.15 The originally proposed pontoon facility had suggested a main pontoon leg 140m long. However, this option reduces that length to 100m and removes the secondary leg of the pontoon at 90 degrees to the main leg. This would reduce the number of 20m pontoons from nine to five, while still allowing for the berthing areas to be at approximately the -2.5mCD contour, as shown in Figure 4.7.

4.6.16 This is consistent with the proposed pontoon facility as the orientation of the pontoons is the same. However, since this option would consist of only 100m of pontoons, the water depth at the end of the pontoon leg would be marginally shallower (-2.6mCD instead of -2.8mCD).

4.6.17 The deck of the timber pierhead is a +5.4mCD[16] with MLWS at +0.3mCD - in order to comply with the Equality Act (2010), the gradient of any gangway must the shallower than a 1-in-10 slope. Assuming that the freeboard of the pontoons would be 1.0m (the same as the proposed pontoon facility), this would result in a vertical difference of 4.1m (+5.4m to +1.3m). Therefore,

[16] Argyll and Bute Council (2019) Report on the Structural Assessment of Helensburgh Pier – Report Number 00040-28/2019

the access gangway would require to be at least 41m in length to accommodate a MLWS tide. Figure 4.7 below presents a sketch of the potential layout of this option, to scale.

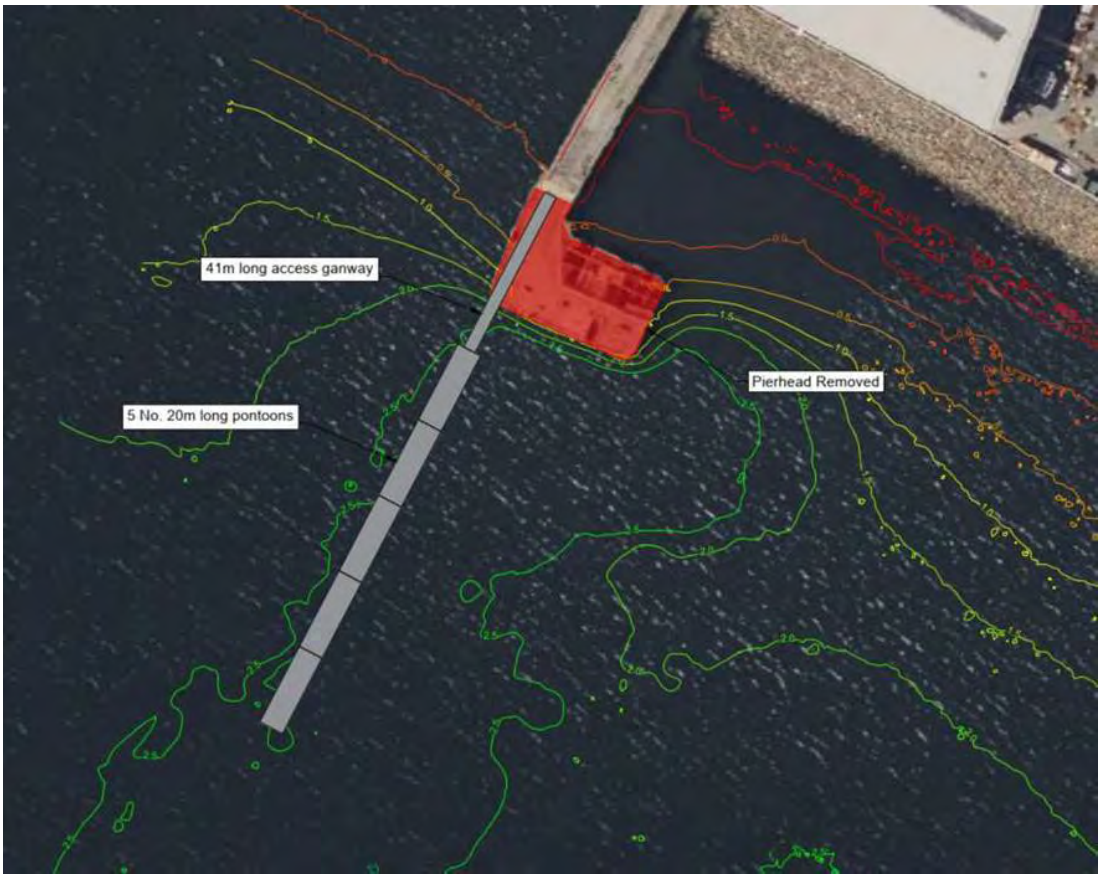


Figure 4.7: Option 4 sketch

4.6.18 A dredged channel would likely be required to allow vessels to navigate onto the pontoon berths at all states of the tide. The anticipated dredged area is shown in Figure 4.8 below and extends to 3.0m below Chart Datum.

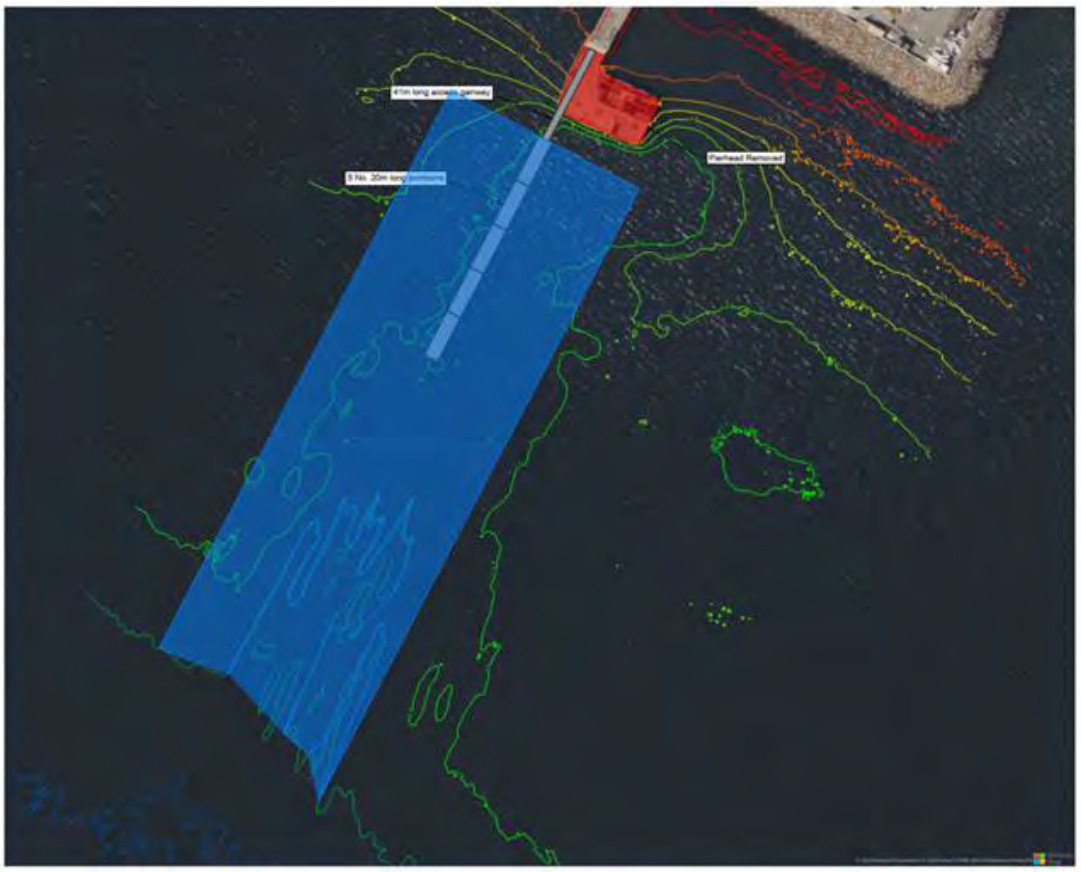


Figure 4.8 Option 4 dredged area

Appraisal of Option 4

4.6.19 The table below illustrates some of the advantages and disadvantages associated with Option 4.

Table 4.4 Option 4 – advantages and disadvantages

Advantages	Disadvantages
The health and safety risks that are present due to the fire damaged section of the pierhead would be mitigated in their entirety.	Helensburgh would lose part of a historic listed structure that has been present for over 150 years.
It would make the launching and recovery of small leisure craft from the concrete slipway easier than is currently the case as a result of improved navigation.	The minimal shelter that the timber pierhead provides to the concrete slipway would be reduced.
It would allow for the berthing of a wide range of vessels (subject to confirmation of wave climate, water depths, navigational approaches and the specification of the pontoons in terms of berthing capacity and freeboard).	A 41m long gangway is likely to require to be a through-trussed structure to provide adequate structural capacity in order to span such a large length, this would lead to greater expense, a greater load on the landing pontoon, and potentially impact on the visual character of the existing pier.

4.7 Cost Estimates

4.7.1 A preliminary and high-level cost estimate has been prepared in relation to the four options outlined above and is summarised in the table below. The estimates are based on experience

of similar projects, including feedback on previous cost estimates for a similar project at Dunoon.

4.7.2 It should be noted that the costs are presented in present day prices (i.e., Q2 2023) and do not include optimism bias[17], which would need to be accounted for in the Economic Case of any future business case.

Table 4.5: Capital cost estimate summary

Option	Estimated CAPEX	Estimated Capital Dredging Costs	Allowance for design and consents (15%)	Total
Option 1: Demolish timber pierhead and make good end of masonry pier	£750,000	-	£112,500	**£862,500**
Option 2: Remove damaged section of timber pier and make good remaining	£450,000	-	£67,500	**£517,500**
Option 3: Remove damaged section of timber pier and repair / upgrade timber pierhead for re-use	£950,000	£1,675,000	£393,750	**£3,018,750**
Option 4: Remove time pierhead and construct new pontoon facility	£2,050,000	£250,000	£345,000	**£2,645,000**

4.7.3 The key point of note from the above table is that the provision of a restored berth or entirely new pontoon facility is significantly more expensive in capital and operational terms than options focused on the current pier alone.

4.7.4 In addition to the capital costs, the Council estimate that a functional berth would accrue operational costs of circa **£100k** per annum to cover staff costs, insurances, inspections and overheads such as power, lighting and service charges. This figure does not include an allowance for capital replacement or uninsured accidental damage, for which it is recommend that **20%** of income is set aside in a bond / contingency fund.

[17] Optimism bias is a technique used in the Economic Case of the business case to compare value for money. It reflects the demonstrated systematic tendency of appraisers to underestimate project costs and timescales and overstate benefits. The options being appraised are subject to a percentage adjustment to their costs to reflect this based on recommended uplifts at different stages of the business case by project type. These uplift factors are set out in the H.M. Treasury *Green Book*. The key point in relation to this study is that Options 1 and 2 could potentially have a lower optimism bias as they do not involve any new construction works, albeit a view would need to be taken on this when developing a business case. The effect of this however would be to widen the value for money differential between options in favour of Options 1 and 2.

5 Conclusions and Next Steps

5.1 Conclusions

5.1.1 The market analysis set out in Chapter 3 clearly identified that there is a potential demand for using a restored berthing facility at Helensburgh. This demand would however be predominantly leisure-based and seasonal, focused on tours and excursions and small cruise vessels. From the perspective of Helensburgh overall, these are some of the highest value uses as they would introduce additional footfall and spending into the town.

5.1.2 However, whilst there is a potential core summer demand, there is an absence of a regular and year-round demand from, for example, a ferry or cargo vessels. It is therefore challenging to see how such a facility could be operated on a revenue neutral basis, particularly where long-term capital replacement has to be accounted for. Indeed, even at other Council owned piers such as Dunoon and Kilcreggan where there are regular ferry services, they are typically operated at a loss (or at least do not make provision for capital replacement).

5.1.3 Given the above, and **the scale of capital costs required to develop a new operational berth, it is unlikely that a commercially viable facility could be delivered at present (i.e., cost would exceed revenue)**. A robust business case in the context of the *Five-Case Model* could not therefore be made for such an investment. This is not to say that a commercially viable facility could not be developed in the future and thus any option progressed should include **future proofing** that allows for a new berth to be delivered at a later date.

5.1.4 Central to any future business case for a new berthing facility would be securing regular year-round traffic, which in reality would likely have to be a ferry service. Whilst there is no immediate prospect of a ferry operating from Helensburgh, the future opportunity would likely revolve around making the case for re-establishing the Gourock (or Greenock) connection, via Kilcreggan or otherwise. Given their other commitments, it is unlikely that Transport Scotland will actively pursue this route through the emerging *Islands Connectivity Plan*, and thus the onus would be on the Council (potentially in partnership with Inverclyde Council and SPT) to develop a business case for such a service.

5.1.5 In concluding, it is important to reiterate here that the starting point for this commission was one of revenue neutrality on the harbour account (pier revenues covering costs). If considered in terms of footfall and visitation, the benefits would be wider than dues alone, but these benefits would not be directly accrued by the Council or any other potential operator (i.e., they would not directly support the viability of a commercial pier facility).

5.1.6 From a specifically Rural Growth Deal perspective, it is a necessary pre-requisite that the investment is transformational (i.e., it should deliver changes rather than just maintenance / general tidy-up projects) and would have to be underpinned by a *Five-Case Model* business case that could be approved by government. It is therefore very unlikely that the project overall could be taken forward through this fund. The Council does however have access to a range of other capital funds that could be considered in relation to the delivery of Options 1 or 2.

5.2 Next Steps

5.2.1 Whilst the case cannot be made for a new operational berth at present, the benefit the pier brings to Helensburgh as a civic amenity and publicly accessible asset is widely recognised by the community and other key stakeholders. As such, the case for investing in the pier should be considered further, with a view to improving its appearance, matching it with the high-quality public realm in its immediate vicinity.

5.2.2 Chapter 6 scopes at a high-level the type and scale of benefits that could be realised through undertaking such remedial works on the pier structure and improving the public realm. This could form the basis of a more formal H.M. Treasury *Five Case Model* business case or a

simpler ‘Business Justification Case’ (BJC). The content of this report could inform much of the Strategic Case.

6 Benefits Scoping

6.1 Overview

6.1.1 While Options 1-2 vary slightly, it is anticipated that they would have similar potential benefits. In order to provide a gateway into a more formal business case, the potential benefits of investing in the pier are scoped in this chapter using a logic map based approach.

6.2 Theory of Change and Logic Map

6.2.1 In framing a business case and scoping the potential benefits, it is necessary to establish a 'theory of change'. This is a hypothesis of how, in this case, investment in the existing Helensburgh Pier would support positive outcomes and impacts for the town. The 'theory of change' forms the basis of scoping potential benefits and provides an indication of the data and analysis required to evidence those benefits.

6.2.2 Improvements to the pier will generate a multi-faceted set of 'cause and effect' chains and thus there is benefit in presenting these chains graphically through a logic map. Logic maps are diagrams that show the inter-relationships between different aspects of an intervention or programme of interventions. They graphically represent the underlying mechanisms through which an action leads to a certain result, by showing the logical steps along an anticipated route from inputs to outputs to outcomes to impacts.

6.2.3 Logic maps can also be used in *ex post* evaluation to provide an indication of the data required to evidence each step in the chain. By following a chain of causality from a logic map and collecting data that verifies that each link is working in practice, it is then possible to infer that the logic chain is working in practice.

6.2.4 The following definitions for each stage of the logic map process have been defined based on the H.M. Treasury *Magenta Book*:

- **Inputs:** The resources committed and activities undertaken to deliver the physical output.
- **Outputs:** The resulting change in the quality or level of service stemming from the input – e.g., restoration of the pier, public realm improvements etc.
- **Outcomes:** The immediate / short-term changes brought about by the investment – for example, increased marine tourism, increased footfall etc
- **Impacts:** The long-term results generated by each outcome – for example, an expanded visitor economy etc.

6.2.5 The logic map is shown in the figure below:

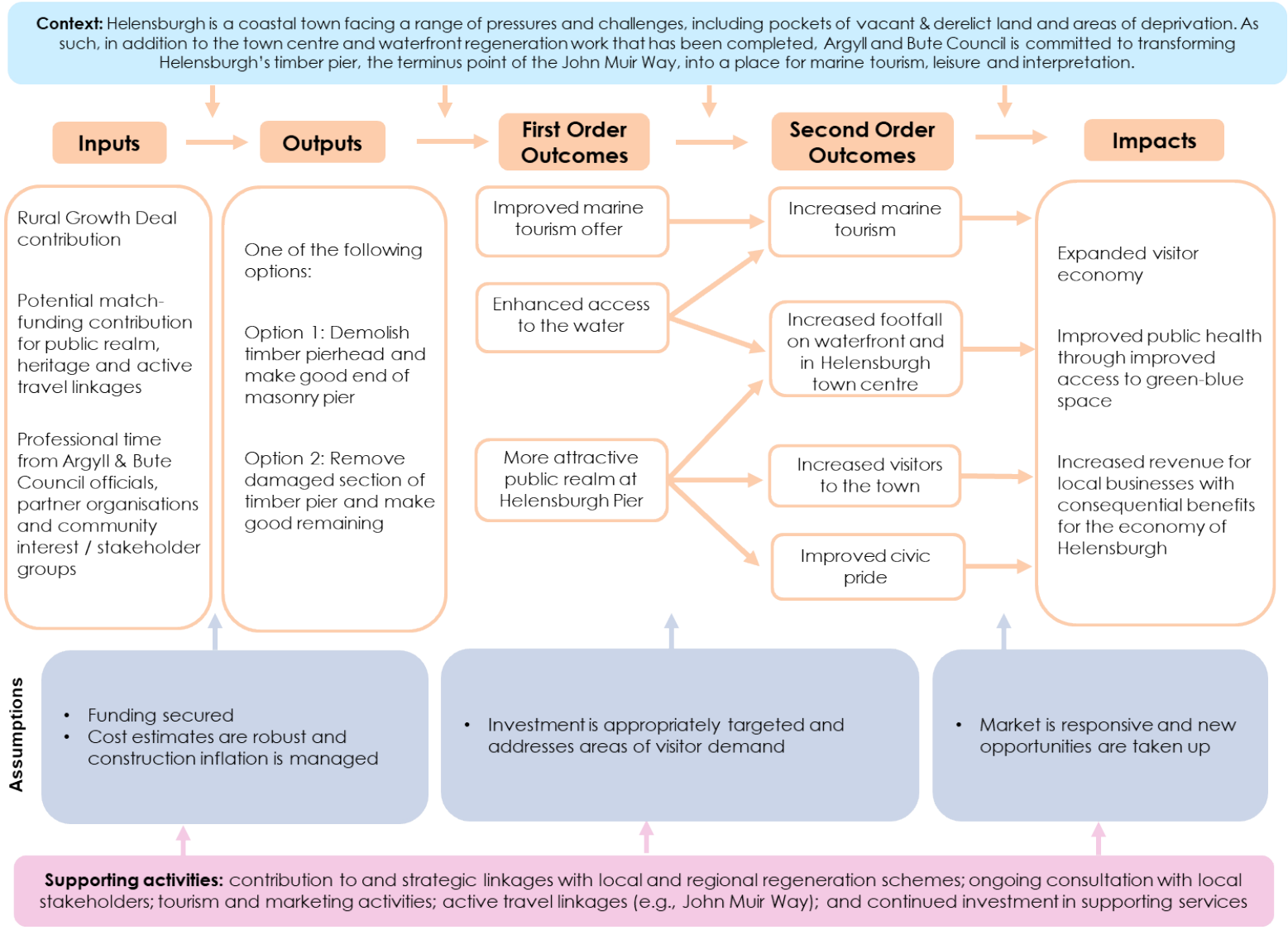


Figure 6.1 Benefits Logic Map

6.2.6 The refurbishment of Helensburgh Pier would complete the improvements to the public realm in the town and provide a high-quality facility for residents and visitors alike. It would also enhance access to the water for a range of leisure pursuits.

6.2.7 This would support a range of potential positive impacts including: an expanded visitor economy; increased revenue for local businesses; and improved public health.

6.2.8 The prospective benefits identified in this chapter should form the basis of the benefits realisation plan in the business case. Further work, including primary research, would be required to fully understand the type and scale of the impacts which would emerge.

Appendix A Previous Condition Reports

A. Previous Condition Reports

- Arch Henderson (2018) Principal Inspections – Helensburgh Pier
- Argyll and Bute Council (2019) Report on the Structural Assessment of Helensburgh Pier – Report Number 00040-28/2019
- Tritonia Scientific Ltd (2019) Underwater Inspection of Helensburgh Pier
- Bmtrada (2019) Condition survey and indicative in-situ strength grading of the structural timber components forming Helensburgh Pier
- Argyll and Bute Council (Helensburgh and Lomond Area Committee) (2019) Helensburgh Pier Survey and Recommendations (draws on information in 1, 2, 3 and 4)
- Aspect (2022) Multibeam Bathymertric Survey – Helensburgh Pier

Argyll & Bute Council

175016

Principal Inspections
Helensburgh Pier

March 2018

Arch Henderson LLP
142 St. Vincent Street,
Glasgow G2 5LA

Arch Henderson

Document Control

Notice

This document has been produced by Arch Henderson LLP for Argyll & Bute Council solely for the purpose of reporting on the inspection of Helensburgh Pier, Helensburgh.
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Last Saved Date	01.10.18
File Name	175016 Helensburgh Pier Inspection Report

Document History

Version	Issue Date	Changes
1	01.10.18	First Issue

Document Approvals

Role	Name	Signature	Date
Project Partner	Alan Kilbride		
Project Review Group			
Project Engineer	John McLaren		

Arch Henderson

Table of Contents

1 Introduction

This report details the findings of the visual structural inspection of Helensburgh Pier, Helensburgh on Thursday 22nd February 2018. The inspection comprised a diver's inspection below low water and an inspection above water.

The inspection also covered the rock armouring and gabion baskets forming the protection to the car park.

The inspection did not cover the toilet block at the head of the pier nor the car park.

The inspection only considered the structural parts of the pier.

2 Description of the Pier

The pier comprises two sections, a sandstone faced gravity pier with a timber open piled structure forming the pier head. The masonry pier was constructed during the nineteenth century and has been the subject of repairs and extensions during its lifetime. The timber open piled structure was constructed during the late nineteenth century and has also been the subject of repairs during its lifetime.

These are described below.

Masonry Pier

The masonry pier extends out from the shore in the direction just west of south. The quay is a masonry gravity structure with tarmac surfacing and measures approx. 221m long x 8.5m wide.

Timber Pier

The open piled timber structure extends in a direction just south of east and measures 20m wide x 37m long. An area of the pier measuring approx. 232m² has been isolated with a 2.4m high palisade fence to protect the public from a damaged section of the pier.

A landing platform with access stairs has been added on the southern berthing face.

A smaller access platform has been added to the western face of the timber pier.

Shore Protection to Car Park

The shore protection is generally provided by rock armouring extending from the masonry pier to the south east. The outer end of the return is also rock armouring. The inshore section is formed by rock filled gabion baskets.

3 General Condition of the Structures

The general condition of the structures are defined below.

Masonry Pier

The masonry pier is generally in a good condition considering the age of the structure, however it is covered in marine growth below low water level.

The sandstone facing is showing localised signs of loss of pointing and vegetation growth which are not affecting the performance of the structure presently, however if left unchecked could cause damage.

It is noted that a small section of handrailing on the north face of the pier is missing, however a temporary barrier has been installed at approx. chainage 1+40m.

Timber Pier

The timber pier is in a deteriorating condition, especially beneath the decking level. The timbers are showing various extents of erosion, loss of sectional area, pile C10 (refer to Figures 2 & 3) has a vertical split within the tidal zone, isolated timbers are either not connected or only connected at one end and there is evidence of timber repairs (including splicing) having been carried out.

The main reason for the loss of bracing members appears to be the loss of the connecting bolts. The bolted connections are in varying condition with many obscured by marine growth.

The residual timber, allowing for the loss of section generally appeared hard when checked using a divers' knife, indicating residual strength within the structure.

At deck level, a new GRP flooring has been recently installed on top of the existing decking boards thereby covering any defects to the timber decking boards.

A number of the bollards have not been properly secured to the timber structure i.e. some of the fixing screws have not been installed and there is localised damage to some of the connection plates. Refer to Figure 2 for details.

An area of the timber pier has been isolated with a 2.4m high palisade fence which has a padlocked gate for access. This area is showing is generally in a poorer condition than the rest of the pier.

Although loss of sectional area has been identified at various locations, Arch Henderson cannot quantify how much has been lost as the sizes of the original members is unknown.

Shore Protection to Car Park

The outer face of the rock armouring is in good condition.

There are locations at the inner end where the tying wire on the gabion baskets has corroded and in some cases broken allowing the stones out of the gabion basket.

4 Diving Inspection

Masonry Pier

The condition of the masonry pier below low water level is in a good condition with marine growth noted.

Timber Pier

The condition of the timber structure below low water level is in a deteriorating state with signs of erosion and loss of section to several piles.

Shore Protection to Car Park

No diving inspection was carried out on the rock armour.

5 Discussion

Masonry Pier

The sandstone gravity wall is generally in good condition however the wall is showing signs of localised loss of pointing and vegetation growth and the revetment is covered in marine growth below the water line. It is therefore recommended that this structure is monitored at regular intervals to monitor any deterioration.

The lifebuoy and housing at approx. chainage 1+06m should be replaced to ensure compliance with current Safety in docks ACOP.

Timber Pier

The timber pier is in a deteriorating condition.

The timber piles within the tidal zone are showing signs of erosion and loss of sectional area and a large area of the timber pier has been isolated to prevent the public accessing the damaged part of the pier.

A number of the pile bollards do not have the correct number of fixings with some of the bollard connection plates damaged.

As there is no record documents or drawings to confirm the original construction of the timber pier there may be eccentric loading put into the piles due to missing timbers and coupled with the erosion of the timber structure within the tidal zone, it is recommended that a detailed structural analysis is carried out to confirm the structural integrity of the pier. This should include an intrusive investigation to confirm the limiting residual sections of the structural members, a check of the connections and testing to confirm the condition of the residual timber.

It is further recommended that a restriction should be put in place to prevent any vessels from berthing at the pier until the above analysis is carried out.

It was noted during the survey the timber pier does not comply with the current Safety in Docks ACOP with regards to the provision of rescue and life-saving from water (ladder handgrips at cope level on the south face are damaged and lifebuoy missing from lifebuoy housing).

Shore Protection to Car Park

The damage to the gabions will continue to worsen with stones being washed out. This will expose the fine particles in the carpark infill to be locally washed out and may eventually lead to some local settlement of the surfacing.

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List of Appendices

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Appendix A – Figures

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE FOLLOWING ARCH HENDERSON REPORT '175016 PRINCIPAL INSPECTIONS, HELENSBURGH PIER MARCH 2018'.

SITE PLAN
SCALE 1 : 500

KEY PLAN
SCALE 1 : 2000

DRAFT

REV	DATE	REVISION DESCRIPTION	ORN	VER

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PROJECT
ARGYLL & BUTE COUNCIL
PRINCIPAL INSPECTIONS

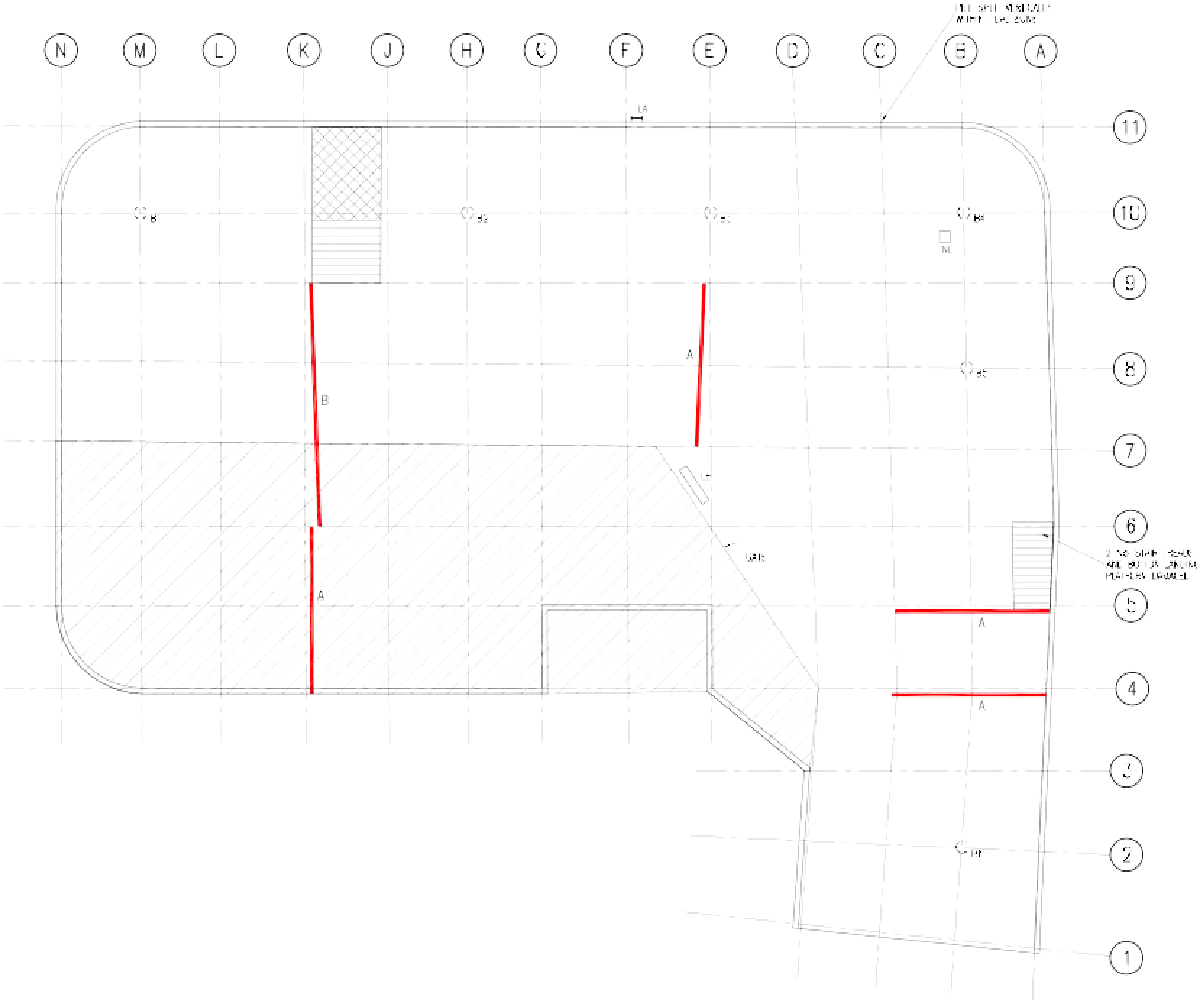
TITLE
HELENSBURGH PIER
GENERAL LAYOUT

DRAWN	DATE	VERIFIED	APPROVED
K.S.	170918	W.J	

SCALE. (A1)	DRAWING STATUS.
AS SHOWN	REPORT

DO NOT SCALE

DRAWING No HELENSBURGH FIGURE 1 REV /



NOTES

LEGEND

BOLLARD REF	COMMENTS
B1	4 FIXING SCREWS IN PLACE. BOLLARD SITS ON TOP OF GRP FLOORING
B2	3 FIXING SCREWS IN PLACE. BOLLARD SITS ON TOP OF GRP FLOORING
B3	3 FIXING SCREWS IN PLACE. BOLLARD SITS ON TOP OF TIMBER DECKING BOARDS
B4	NO FIXING SCREWS IN PLACE. MISSING SECTION OF BASEPLATE. BOLLARD SITS ON TOP OF GRP FLOORING
B5	2 FIXING SCREWS IN PLACE. MISSING SECTION OF BASEPLATE. BOLLARD SITS ON TOP OF GRP FLOORING
B6	NO FIXING SCREWS IN PLACE. MISSING SECTION OF BASEPLATE. BOLLARD SITS ON TOP OF GRP FLOORING

DRAFT


BOLLARD 1


BOLLARD 2


BOLLARD 3


BOLLARD 4


BOLLARD 5


BOLLARD 6

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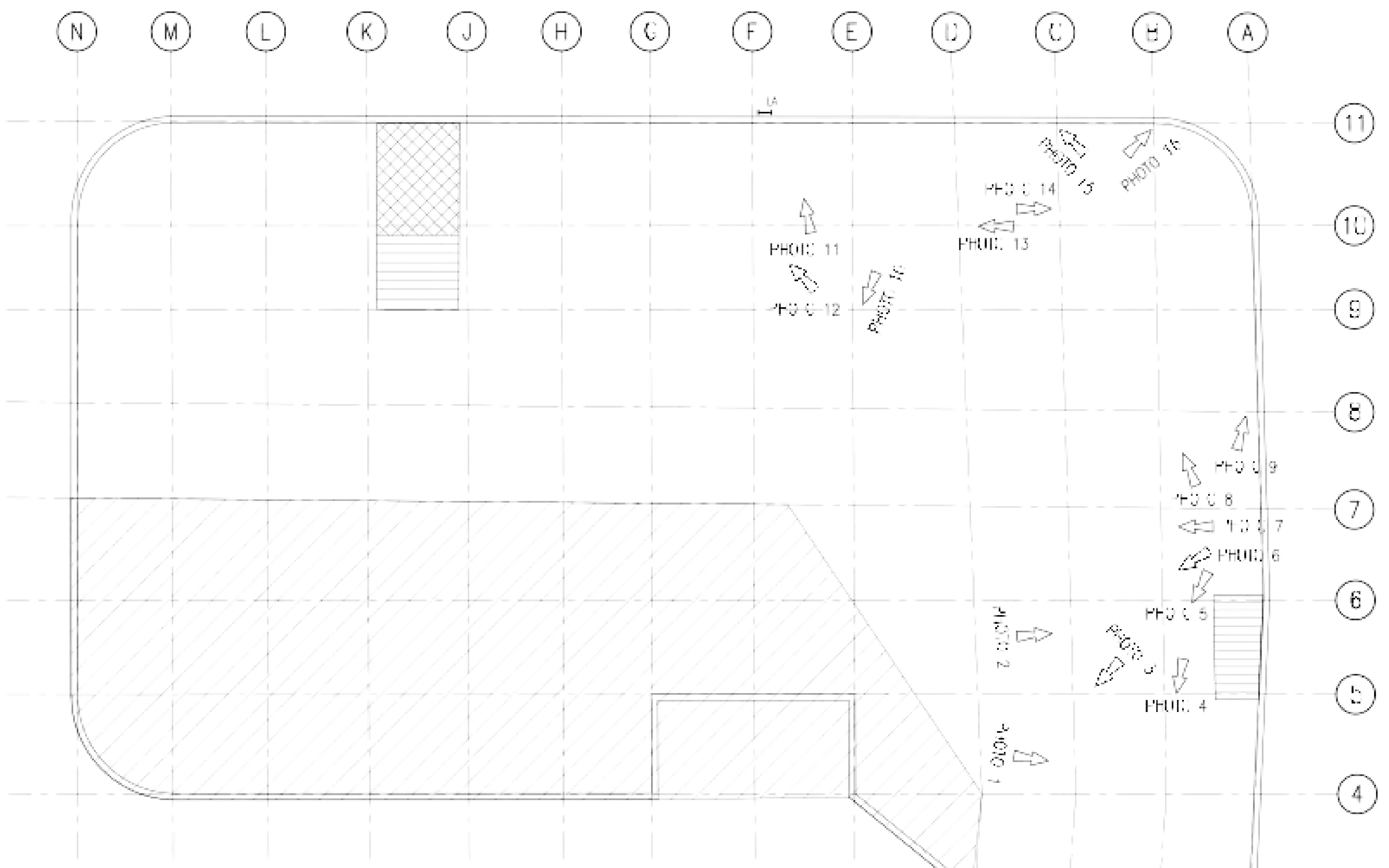
ARGYLL & BUTE COUNCIL
PRINCIPAL INSPECTIONS

TIMBER PIER
DECK PLAN

HELENSBURGH FIGURE 2



LEGEND

DENOTES ISOLATED AREAS OF PIER / LIFE BUOY STATION

PHOTO 10 — DENOTES APPROX. LOCATION AND DIRECTION OF PHOTOGRAPH 10

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE FOLLOWING ARCH HENDERSON REPORT "ARGYLL PRINCIPAL INSPECTIONS, HELENSBURGH PIER MARCH 2018".

PHOTO 1

PHOTO 2

PHOTO 3

PHOTO 4

PHOTO 5

PHOTO 6

PHOTO 7

PHOTO 8

PHOTO 9

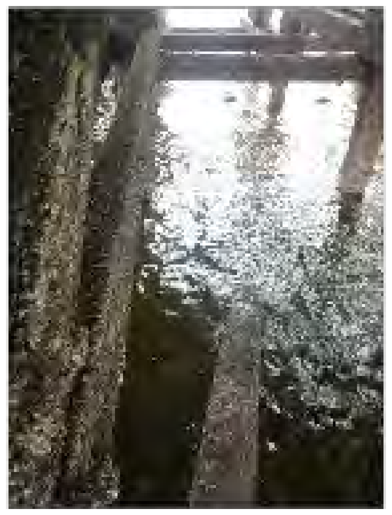


PHOTO 10

PHOTO 11

PHOTO 12

PHOTO 13

PHOTO 14

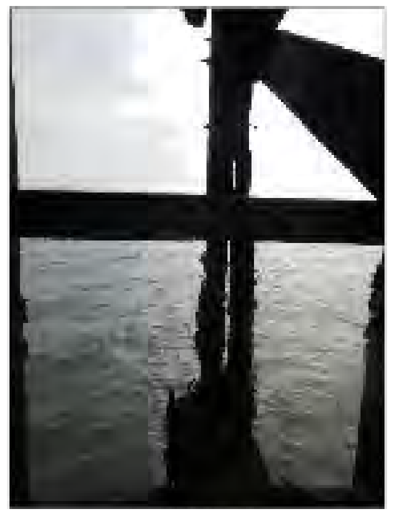


PHOTO 15

PHOTO 16

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REV	DATE	REVISION NOTE	DRN	VER

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CLIENT

ARGYLL & BUTE COUNCIL
PRINCIPAL INSPECTIONS

TITLE

TIMBER PIER
LOCATION OF PHOTOGRAPHS

DRAWN	DATE	VERIFIED	NT SCALE

SCALE	DRAWING STATUS
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DO NOT SCALE

DRAWING NO.	REV.
HELENSBURGH FIGURE 3	/

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Appendix B – DMRB Proformas

Structure Inspection Report

Structure Name	Masonry Pier	**Inspected By**	John McLaren
Date of Inspection	22-Feb-18	**Overall Assessment**	**GOOD**
Type of Inspection	**PRINCIPAL**	**Location**	Helensburgh Pier

Description

Sandstone faced gravity wall projecting out from shoreline

Photograph

Showing north west face of masonry pier

Showing southern face od masonry pier

Defect Assessment	Est. cost (£)	Extent	Severity	Work	Priority	PD	Comments
Wall (below water line)		D	2	N			100% covered in marine growth below water line. Localised signs of loss of pointing.
Wall (above water line)		B	2	N			Localised signs of loss of pointing and vegetation growth
Handrails	3,000	B	3	R	H		Missing section of handrail to be replaced
Lifebuoy	400	B	3	R	H		Life buoy to be replaced

Signed | Name J. McLaren | Date 01-Oct-18

Structure Inspection Report

Structure Name	Timber Pier	**Inspected By**	John McLaren
Date of Inspection	22-Feb-18	**Overall Assessment**	**POOR**
Type of Inspection	**PRINCIPAL**	**Location**	Helensburgh Pier

Description

Open piled timber structure, comprising vertical piles with horizontal and diagonal bracing adjacent to the masonry pier. A section of the pier has been isolated to prevent public access.

Photograph

Showing north east face of timber pier

Showing construction below deck

Defect Assessment	Est. cost (£)	Extent	Severity	Work	Priority	PD	Comments
Timber Structure (below water line)	See below	D	3	R	M		Signs of erosion & loss of sectional area
Timber Structure (above water line)	260,000	D	3	R	M		Signs of erosion, loss of sectional area and missing timbers
Boat steps (south face)		A	1	N			Localised signs of corossion to handrailing
Boat steps (west face)	3,500	B	4	R	H		Bottom landing and 2 No. treads to be replaced
Ladders	1,000	D	4	R	H		Handrails above cope level damaged
Life-saving equipment	500	B	3	R	H		Lifebuoy and housing to be replaced

Signed | Name J. McLaren | Date 01-Oct-18

Structure Inspection Report

Structure Name	Shore Protection	**Inspected By**	John McLaren
Date of Inspection	22-Feb-18	**Overall Assessment**	**GOOD**
Type of Inspection	**PRINCIPAL**	**Location**	Helensburgh Pier

Description

Rock armouring leading from east from masonry pier leading to gabion baskets on return leg.

Photograph

Rock armouring

Gabion baskets

Defect Assessment	Est. cost (£)	Extent	Severity	Work	Priority	PD	Comments
Rock armour		A	1				
Gabion baskets	20,000	B	2	R	L		Corrosion of tie wire to gabions causing fill to be washed out

Signed | Name J. McLaren | Date 01-Oct-18

Arch Henderson

Appendix C – Photographs

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

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Photo 35

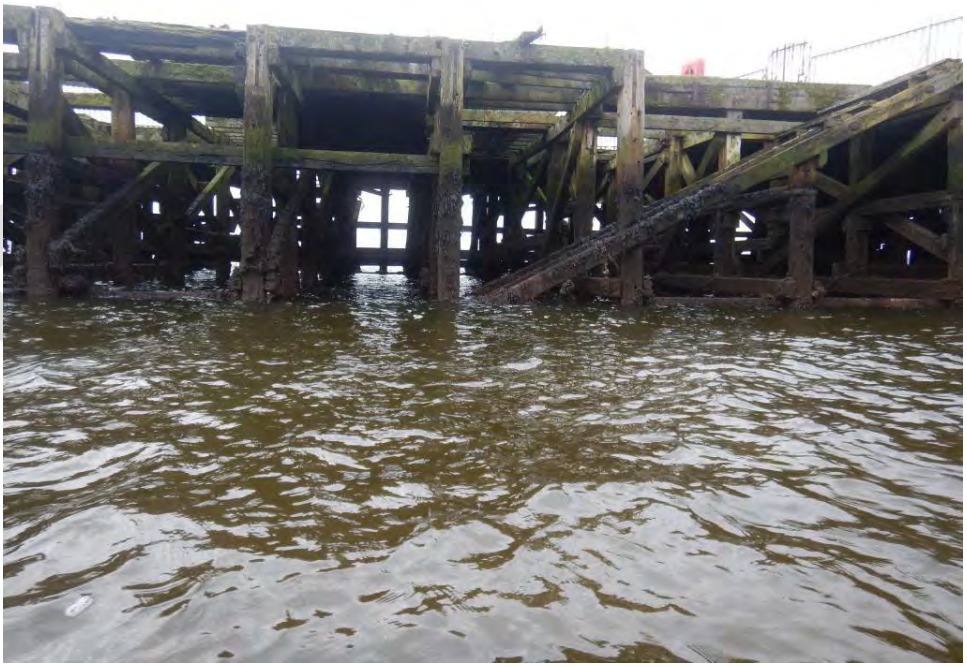

Photo 36

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Photo 83

Photo 84

Arch Henderson 1919

Appendix D – Dive DVDs

Development & Infrastructure
Infrastructure Design

Report on the Structural Assessment of Helensburgh Pier

Report no: **00040-28/2019**

Issued Versions

Draft	Name	Title	Signature	Date
Prepared by	John McGeeney	Graduate Engineer		24/04/2019
Checked by	Elsa Simoes	Senior Engineer		25/04/2019
Approved by	Stewart Clark	Marine Operations Manager		/04/2019

	Name	Title	Signature	Date

Contents

1.0 Executive Summary

Helensburgh Pier is a timber pile structure that is currently closed to public access and vessels. Arch Henderson undertook a principal inspection on behalf of Argyll and Bute Council (A&BC) in 2018, and results indicated that the pier needed further studies. A&BC concluded that a structural analysis required be undertaking and along with Tritonia Scientific and BM Trada proceeded with a detailed visual inspection, timber testing, dive inspection, and condition survey during December 2018.

From the available data, three options are produced which include:

- Minor repairs to the existing timber pier (excluding fire damaged section) – To allow pedestrian access only.
- Major repairs to the existing Timber Pier (including the fire damaged section, fendering system and bollards) – To facilitate Waverley berthing.
- Monolithic piles with fendering system and access gangway (excluding major repairs to the timber structure) – To facilitate Waverley berthing.

2.0 Introduction

2.1 Aims

A principal inspection was carried out by Argyll and Bute Council, Tritonia Scientific Ltd, and BM Trada for the structures making up Helensburgh Pier. The findings were to then be compiled into a report highlighting the condition of the pier. The remit was to carry out a principal inspection in accordance with the DMRB for the following structures:

TIMBER PIER HEAD

This Principal Inspection Report includes:

- A photographic record of the inspection (Appendix A)
- Relevant drawings for the inspection (Appendix B)
- Dive Survey Report (Appendix C)
- Condition Survey (Appendix D)

The aim of this report is to convey in detail the results of the principal inspection and therefore show the condition of the facility. A detailed diagnosis relating to the timber elements is included in this report, as well as recommendations for future inspections and repairs.

2.2 Limitations

No material testing of connections was undertaken during the inspection process, nor any services or lighting.

2.3 Disclaimer

The underwater inspection data within refers to report:

TSL19013-9 Underwater Inspection of Helensburgh Pier (Tritonia Scientific Ltd, January 2019)

The condition survey within refers to report:

TC 18250 Condition survey and indicative in-situ strength grading of the structural components forming Helensburgh Pier, Helensburgh. (BM Trada January 2019)

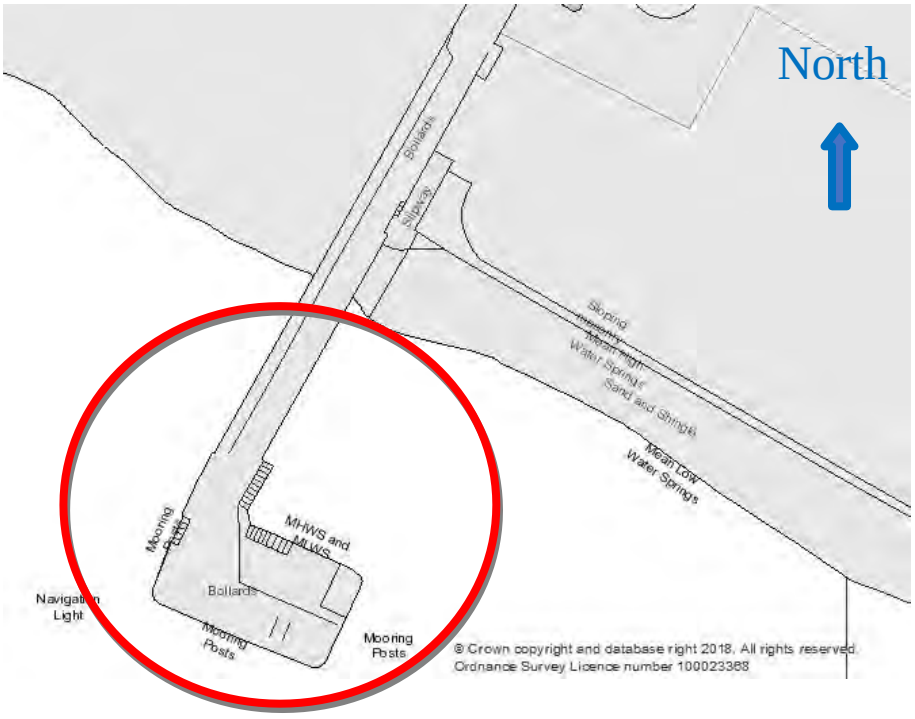
This report is intended for internal discussion only within Argyll and Bute Council

3.0 Background

3.1 Location

Helensburgh Pier is situated on the Helensburgh and Lomond district within Argyll and Bute along the banks of the Firth of Clyde. Pier access is gained from the adjacent A814 Road.

Location Plan – 1:500,000 Map (N.T.S)



Pier Location Plan – 1:1,000 Map (N.T.S)

3.2 History and Function

Helensburgh Pier dates from circa 1800's and was constructed to facilitate berthing of steam ships. The original stone wall and infill structure was extended with a timber pier head circa 1871 and has largely remained unchanged. Modern amendments to the structure have been undertaken to install new access stairs along the southern berthing face. Due to a combination of fire and continuously impact damage the Paddle Steamer Waverley no longer berths at the pier.

The pier's current principal function is leisure.

3.3 Construction

The surveyed structure consists of a pier head which is of timber construction. The adjoining masonry approach structure is not part of this report.

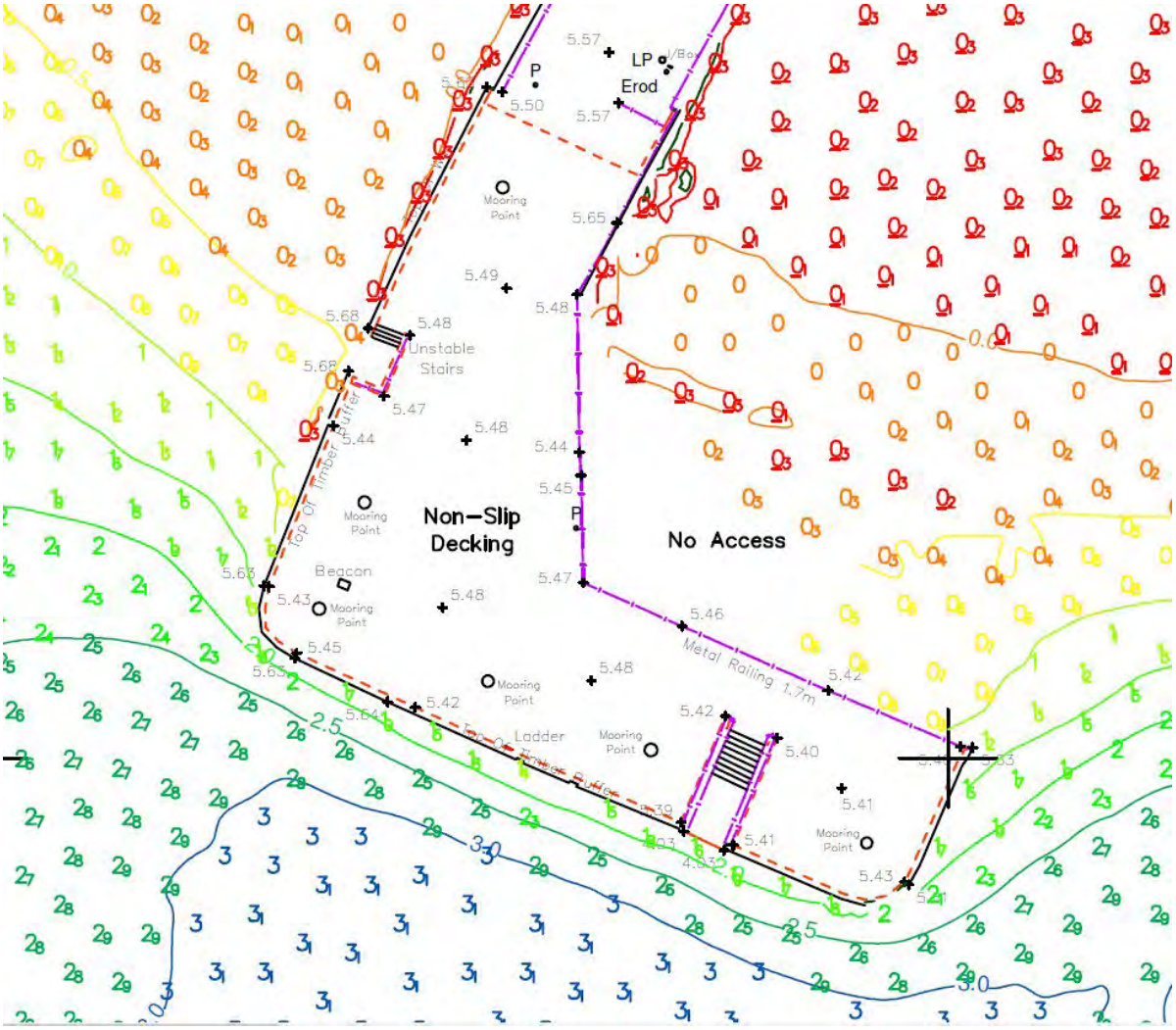
The pier head consist of timber piles with timber cross bracing, and horizontal bracings at mid and low level. Double beams span longitudinally across the tops of the piles, with deck joists above. Supported by the joists are timber deck planks, overlaid with anti-slip FRP board.

Connections between timber elements are of steel bolts through nodes, and steel straps from longitudinal beams to piles.

4.0 Existing Information

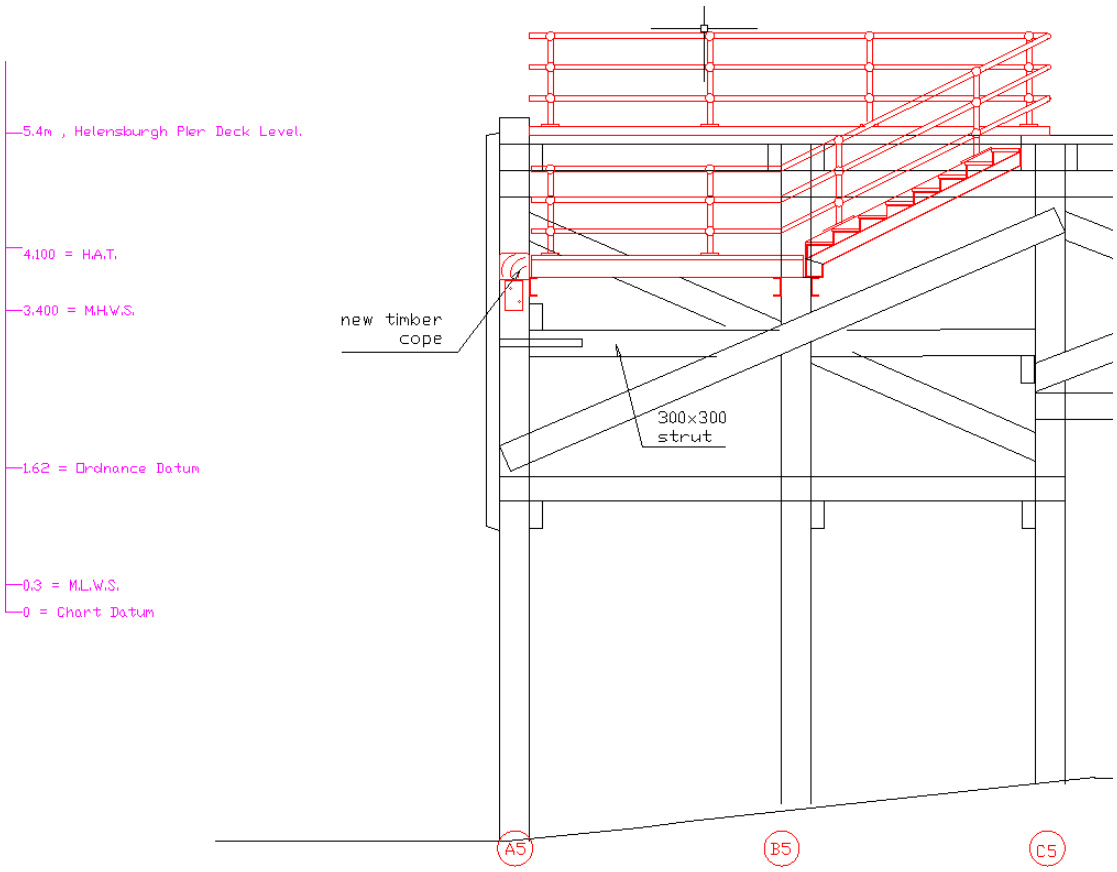
4.1 Survey

A topographic, bathymetric, and 3D laser scan survey of the pier and surrounding area was undertaken by Aspect Land + Hydrographic Surveys during July 2017. An excerpt is presented below.



4.2 Drawings

Argyll and Bute Council produced drawings for a previous repair to the timber pier during 2004, which also illustrates tide levels in relation to the structure. An excerpt is included below.



5.0 Visual Inspection, Records and Discussion

5.1 Investigation Undertaken

This inspection includes the pier structure.

A visual inspection was carried out on 11th to the 13th December 2018 and included notes, measurements and photographs to form the basis of this report. Argyll and Bute Council's Infrastructure Design Department inspected the structure above the water level, whilst Tritonia Scientific Ltd undertook a dive survey of the structure below. BM Trada undertook invasive testing of the timber piles and several other timber members.

5.2 Above sea level

Several of the underdeck timber noggings are decayed and splitting is evident between bolt holes on many diagonal bracing members. A timber pile on the west extent of the southern berthing face has a major loss of section below high water. Along this southern face, a top chord member is not connected to the adjacent pile and a mid-level horizontal beam between piles is split along the grain. Adjacent to the southern staircase, significant structural damage is evident by splitting across the grain of several timber piles and fenders. The south east corner of the structure also has significant structural damage to piles with previous bolted plate repairs and missing fenders.

Many steel bolted connections are corroded due to the environmental conditions of the site. On deck level, many of the cast bollards are missing bolts to secure them to the structure.

The fire damaged north east area of the pier head has missing members and the timber staircase in this section is mostly destroyed. The west stairs have two broken risers which require replacement.

5.3 Under Water

The underwater survey found no evidence of significant structural damage to the majority of the timber piles, however noted that the South East corner had suffered significant impact damage. Although many of the joist beams were intact, some were misaligned or damaged. The fired damaged area was also noted, but not surveyed in detail.

6.0 Material Testing

Exova BM Trada undertook a condition survey of the timber piles and other main structural elements that form the pier. The condition of the timbers was assessed using a combination of visual examination, hand held probes, hammer soundings, and fine probe drilling. The condition survey is included in Appendix D of this report.

BM Trada concluded the following:

i. *Given the age of the structure, the pier head is in a reasonable overall condition.*

ii. *The inspection of submerged timbers was carried out at their intertidal zone. However, it was not possible to inspect every member at low tide due to changes between low and high tide.*

iii. *Six timber piles on the south elevation and south east corner contained significant cross grain fractures as a result of heavy, regular impact damage, likely caused by docking vessels. All timbers reported to contain these fractures are in need of repair/replacement in accordance with a specification designed by a suitably qualified structural engineer.*

iv. *The majority of the inspected piles (mainly around the perimeter) were found to be in a sound condition, but with some surface erosion and impact damage. The residual section sizes were recorded in this instance, and these can be used by the structural engineer for design calculations.*

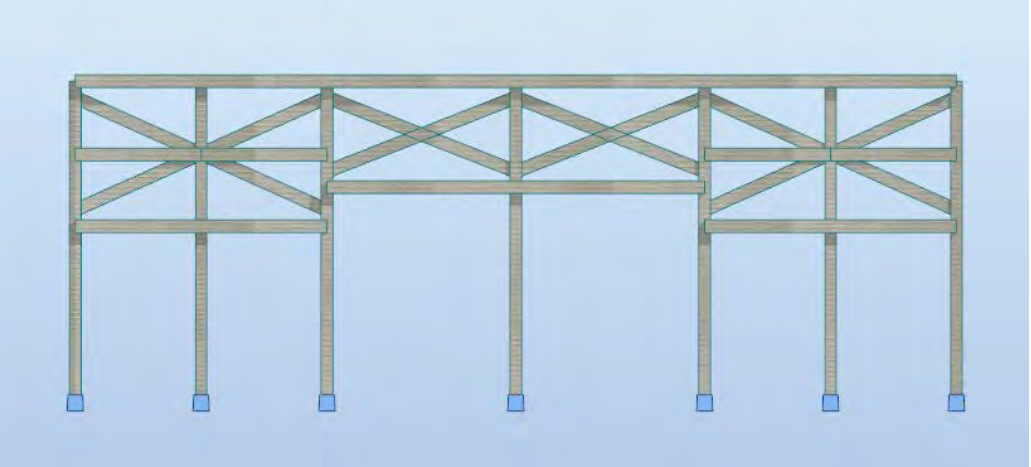
v. *All samples taken from the timber piles and some horizontal and diagonal braces were identified as greenheart. Where members are reported to be sound and HS strength grade they can be assigned an indicative Strength Class of D70. One sample, from an unknown location, likely to be an upper horizontal, was identified as opepe. HS grade opepe can be assigned an indicative Strength Class of D50.*

vi. *We would expect the tropical hardwood members to achieve a further (minimum) 15 year service life.*

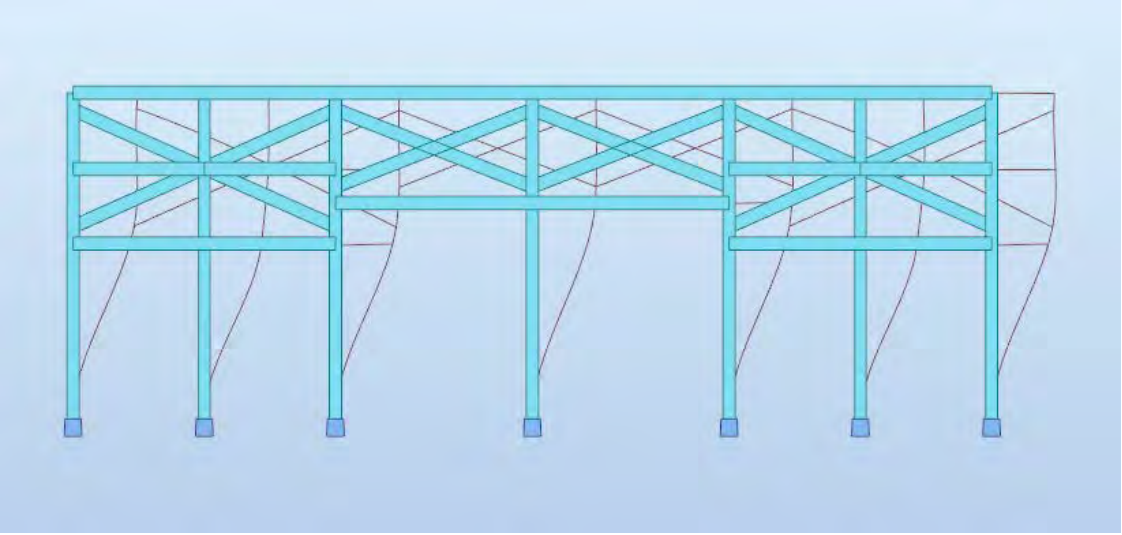
vii. *Fungal decay was present in the majority of softwood deck joists, double deck joists and noggings. These members have come to the end of their service life, and no further service life can be recommended.*

7.0 Structural Modelling

2D analysis of three cross sections of the timber pier head structure was undertaken using Autodesk Robot Structural Analysis Professional 2019.



With the present condition of the timber elements, the structure failed with regards to BS 6349 calculated berthing and impact loads for a vessel representing the PS Waverley. The failure of the members was observed in exceeding the allowable displacements and stresses.



Further detailed structural analysis is in the process of being undertaken to determine to which extent the pier should be strengthened.

8.0 Remedial and Strengthening Options

Several options for the timber pier exist to allow varying use:

8.1 Minor repairs to the existing timber pier (excluding fire damaged section) – To allow pedestrian access only

This option would allow pedestrian access only to the timber pier, however the fire damaged portion of the structure would remain off limits, nor would the Waverley be permitted to berth. This option would repair some of the damaged or missing deck joists, however the majority would still be near the end of their service life. Work would be expected to be completed within the current financial year.

8.2 Major repairs to the existing Timber Pier (including fire damaged section, fendering system and bollards) – To facilitate Waverley berthing

This option would allow pedestrian access plus berthing of the Waverley. The works involved would be a full replacement of damaged timber piles and longitudinal beams and joists, as well as the fire damaged area. Some additional steel tie rods may be required to be installed to ensure structural stability. Work would be estimated to commence late in the 2019/2020 financial year.

8.3 Monolithic piles with fendering system and access gangway (excluding repairs to the timber structure) – To facilitate Waverley berthing

This option would allow pedestrian access plus berthing of the Waverley. The works involved would be installation of steel tubular piles along the southern berthing face of the timber structure. The piles would have continuous fendering along their berthing face, and be designed to take all structural loads, removing the need of major works to the existing timber structure. The fire damaged area would remain off limits. Work would be estimated to commence late in the 2019/2020 financial year.

9.0 Estimated Costs

For each of the options, an estimated cost is produced below:

9.1 Minor repairs to the existing timber pier (excluding fire damaged section) – To allow pedestrian access only

Item No.	Description	Unit	Quantity	Rate	Price £
1	Replacement of damaged softwood deck joists (65 linear metres)	m	65	£366	£ 23,790.00
2	Replacement of damaged cross bracing	No	2	£3,000	£ 6,000.00
		The total of the Prices			£ 23,790.00

BoQ Total		£ 23,790.00
Demob		£15,000
Unpriced items	20%	£ 4,758.00
	Sub total	**£ 43,548.00**
Preliminaries	10%	£ 4,354.80
Contingency sum for additional works but only to be executed and paid for on the express written instruction of the Engineer	20%	£ 8,709.60
	Sub total	£ 56,612.40
Design & Supervision	10%	£ 4,354.80
	Sub total	£ 60,967.20
Optimisum Bias (2020)	2%	£ 1,219.34
	Project Total	**£ 62,186.54**

9.2 Major repairs to the existing Timber Pier (including fire damaged section, fendering system and bollards) – To facilitate Waverley berthing

Item No.	Description	Unit	Quantity	Rate	Price £
1	Repair of hardwood pile (Greenheart) **outer face** (approx. 3000mm height of pile, horizontal joint with bolted splice joint)	No	12	£6,000	£ 72,000.00
2	**PROVISIONAL ITEM** Repair of hardwood pile (Greenheart) **inner structure** (approx. 3000mm height of pile, horizontal joint with bolted splice joint)	No	3	£7,500	£ 22,500.00
3	Replacement timber fenders	No	11	£150	£ 1,650.00
4	Replacement of softwood deck joists (650 linear metres)	m	650	£366	£ 237,900.00
5	Replacement of softwood noggins (125 linear metres)	m	125	£366	£ 45,750.00
6	Replacement of steel connections for loose bracing members	No	10	£195	£ 1,950.00
7	Replacement of timber deck planks in fire damaged area (100mm thick, 250mm wide)	m²	250	£150	£ 37,500.00
8	Installation of tension rods	t	2.35	£2,885	£ 6,779.75
		The total of the Prices			£ 426,029.75

BoQ Total		£426,029.75
Demob		£80,000
Unpriced items	20%	£ 85,205.95
	Sub total	**£591,235.70**
Preliminaries	10%	£ 59,123.57
Contingency sum for additional works but only to be executed and paid for on the express written instruction of the Engineer	20%	£118,247.14
	Sub total	£768,606.41
Design & Supervision	10%	£ 59,123.57
	Sub total	£827,729.98
Optimisum Bias (2020)	2%	£ 16,554.60
	Project Total	**£844,284.58**

9.3 Monolithic piles with fendering system and access gangway (excluding repairs to the timber structure) – To facilitate Waverley berthing

Item No.	Description	Unit	Quantity	Rate	Price £
1	Tubular Piles	No	5	£20,000	£ 100,000.00
2	Dredging	Sum	1	£30,000	£ 30,000.00
3	Bollard & Fendering	Sum	1	£80,000	£ 80,000.00
4	Access Bridge	Sum	1	£20,000	£ 20,000.00
5	Access platform & Gate	Sum	1	£40,000	£ 40,000.00
6	Replacement of damaged softwood deck joists (65 linear metres)	m	65	£366	£ 23,790.00
		The total of the Prices			£ 270,000.00

BoQ Total		£270,000.00
Demob		£80,000
Unpriced items	20%	£ 54,000.00
	Sub total	**£404,000.00**
Preliminaries	10%	£ 40,400.00
Contingency sum for additional works but only to be executed and paid for on the express written instruction of the Engineer	20%	£ 80,800.00
	Sub total	£525,200.00
Design & Supervision	10%	£ 40,400.00
	Sub total	£565,600.00
Optimisum Bias (2020)	2%	£ 11,312.00
	Project Total	**£576,912.00**

10.0 Conclusion

A slow accumulation of decay, mechanical and fire damage has resulted in serious degradation of the timber structure.

It is recommended that the pier is not re-opened to the public until works are carried out. Vessel berthing should only be permitted once strengthening works have been completed.

It is recommended that any options to allow berthing of the Waverley be fully discussed with the vessel's operators.

At present from the condition survey undertaken by BM Trada, the residual life of the structure is estimated at 15 years assuming there is no vessels berthing at the pier .

11.0 References

BM Trada. *Condition survey and indicative in-situ strength grading of the structural timber components forming Helensburgh Pier, Helensburgh*. (2019)

British Standards Institute. *BS 6349-2:2010 Maritime Works – Part 2: Code of practice for the design of quay walls, jetties and dolphins.*

British Standards Institute. *BS 6349-4:2014 Maritime Works – Part 4: Code of practice for design of fendering and mooring systems.*

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Institution of Structural Engineers. *Appraisal of Existing Structures (Third Edition).* (2010)

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Appendix A – Photographs

Pile section loss at west end of southern berthing face

Splitting across the grain of timber fender from impact damaged, adjacent to stairs.

South east corner pile and fender impact damage and previous repairs

Fire damaged area missing deck planks

Appendix B – Drawings

Appendix C – Dive Survey Report

Appendix D – Condition Survey Report

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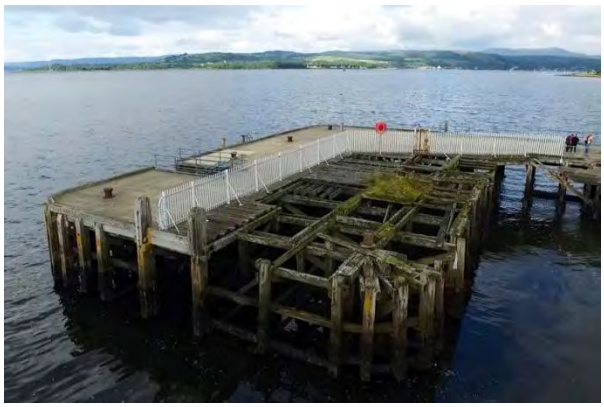
(Argyll & Bute Council Ref No: AB321757)

Underwater Inspection of Helensburgh Pier



Prepared for the Argyll and Bute Council by Martin D.J. Sayer of Tritonia Scientific Ltd.

January 2019

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REPORT No: TSL19013-9

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Underwater Inspection of Helensburgh Pier

1. Methodology

1.1 Surveys were conducted between the 11th and 13th of December 2018. Photographs of some of the pier structure at a very low tide were taken on 4th March 2018 by Mr David Cantello, a local resident, and sent to Tritonia.

1.2 The Pile layout is taken from the January 1985 survey, Reference number DRC No. H/1/N/197. The numbering used is our own.

1.3 Diving surveys were conducted of the outer wooden piles (numbers 1 to 45; see Figure 1) using digital single lens reflex photography (Nikon D800 with 2 x Inon Z240 strobes). Where possible, biofouling was scraped off the surfaces to be photographed first. **NB, underwater photographs were taken using a 15mm fisheye lens to maximise the information per image; however, this lens creates distortion and may accentuate the actual condition of vertical/horizontal surfaces.**

1.4 Stereophotogrammetry was undertaken in three different ways:

(a) For the underside of the pier structure images were taken by swimmers orientated on their backs with the cameras positioned upwards and using video (GoPro HERO 6 with 2 x WeeFine Solar Flare 2800 lights).

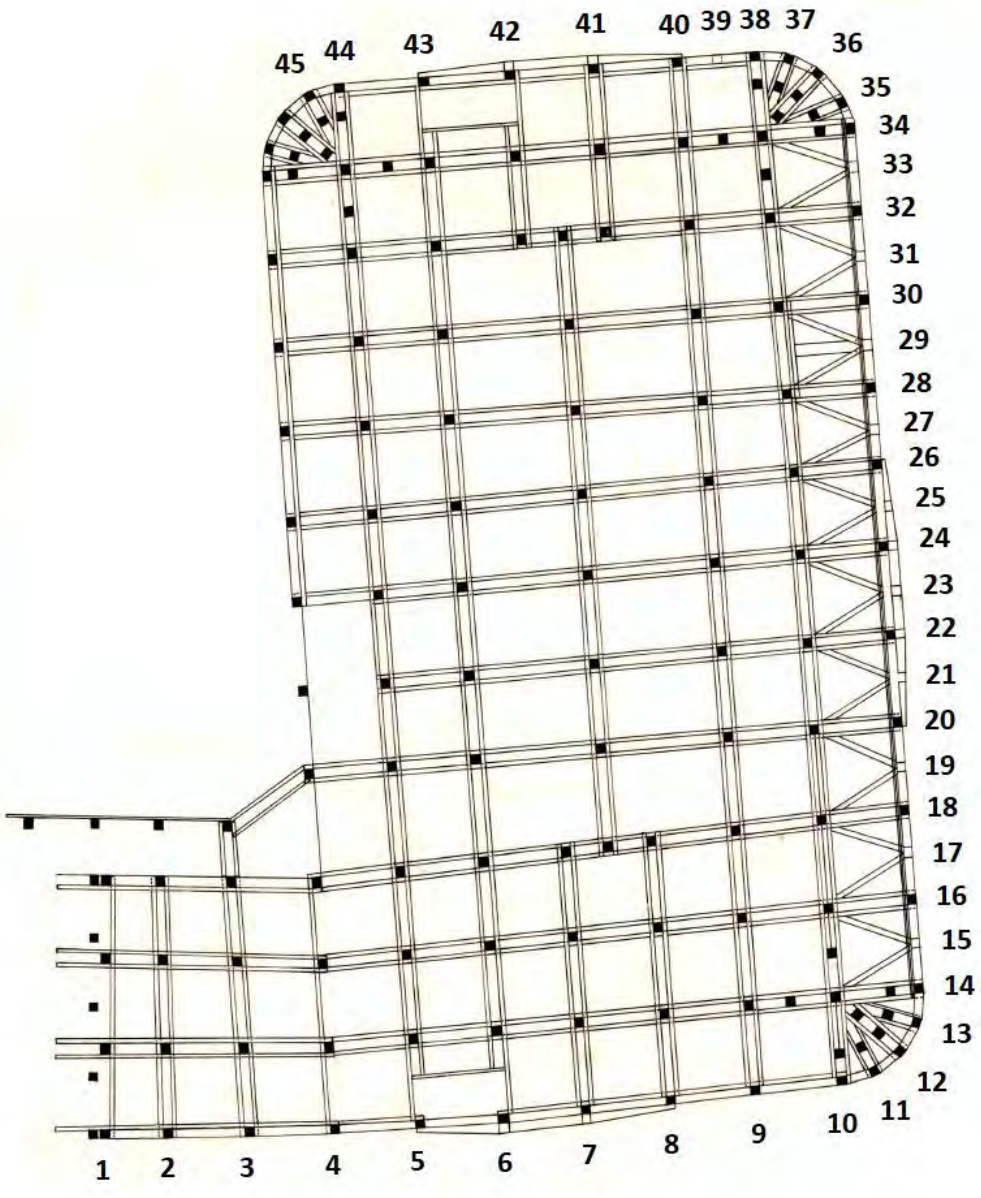
(b) For the outside pier structure images were taken from a RHiB using video (GoPro HERO 6 with 2 x WeeFine Solar Flare 2800 lights) and digital single lens reflex photography (Nikon D800 with rectilinear 12-24mm lens).

(c) For the topside pier structure images were taken using digital single lens reflex photography (Nikon D800 with rectilinear 12-24mm lens).

1.5 Models were generated using a commercial licence edition of *Agisoft Metashape*. Orthorectification on the all the models was achieved using depth-resolved spirit-levels.

1.6 Non-destructive testing was not conducted as there were no metal structures associated with the pier.

FIGURE 1: Helensburgh Pier – Wooden Outer Piles



2. Results

2.1 The nomenclature for the results of the underwater survey of the outer wooden piles is shown in Figure 1.

2.2 Photographs

Wooden piles; outer: 45 wooden piles on the three outer sides of the pier structure were photographed; the final side of the structure was too shallow for diving but some of these structures were revealed at extreme low tide in the photographs of Mr Cantello. The underwater photographs numbered 01-45 would appear to match the numbers given in Figure 1 and are included in the media data under the folder name: A&BC surveys 2018\Helensburgh 2018\UW photos. However, some of the double and single piles don't match the figure exactly and so the plan may not be totally accurate. The diver descended on pile 01 and surfaced at piles 14, 34 and 45; those pile numbers matched their respective positions on the plan.

The intertidal photographs of Mr Cantello are included in the media data under the folder name: A&BC surveys 2018\Helensburgh 2018\intertidal

The majority of the piles were biofouled, but selected removal of the fouling did not reveal any significant structural defects. However, there were a number of either piles or beams observed lying on the seabed or in a state of partial collapse (see below). It is unclear whether these had any structural purpose or had been discarded during repairs / replacements. These can be seen in Figure 2 (located between piles 04 and 05; named 04-b.jpg in the media data file), next to pile 05 (Figure 3), next to pile 6 (Figure 4), next to pile 15 (Figure 5; this is the same structure visible in the background of 16.jpg), between piles 37 and 38 (Figure 6; named 37-b.jpg in the media data file), and next to pile 41 (Figure 7).

A hanging pile was observed on pile 27 (Figure 8); it was unclear whether this was a structural element or loose fendering.

FIGURE 2: Helensburgh Pier – Between piles 04 and 05 (04-b.jpg)

FIGURE 3: Helensburgh Pier – Pile 05 (scale = 58.5 x 6.0 cm)

FIGURE 4: Helensburgh Pier – Pile 06 (scale = 58.5 x 6.0 cm)

FIGURE 5: Helensburgh Pier – Pile 15 (scale = 58.5 x 6.0 cm)

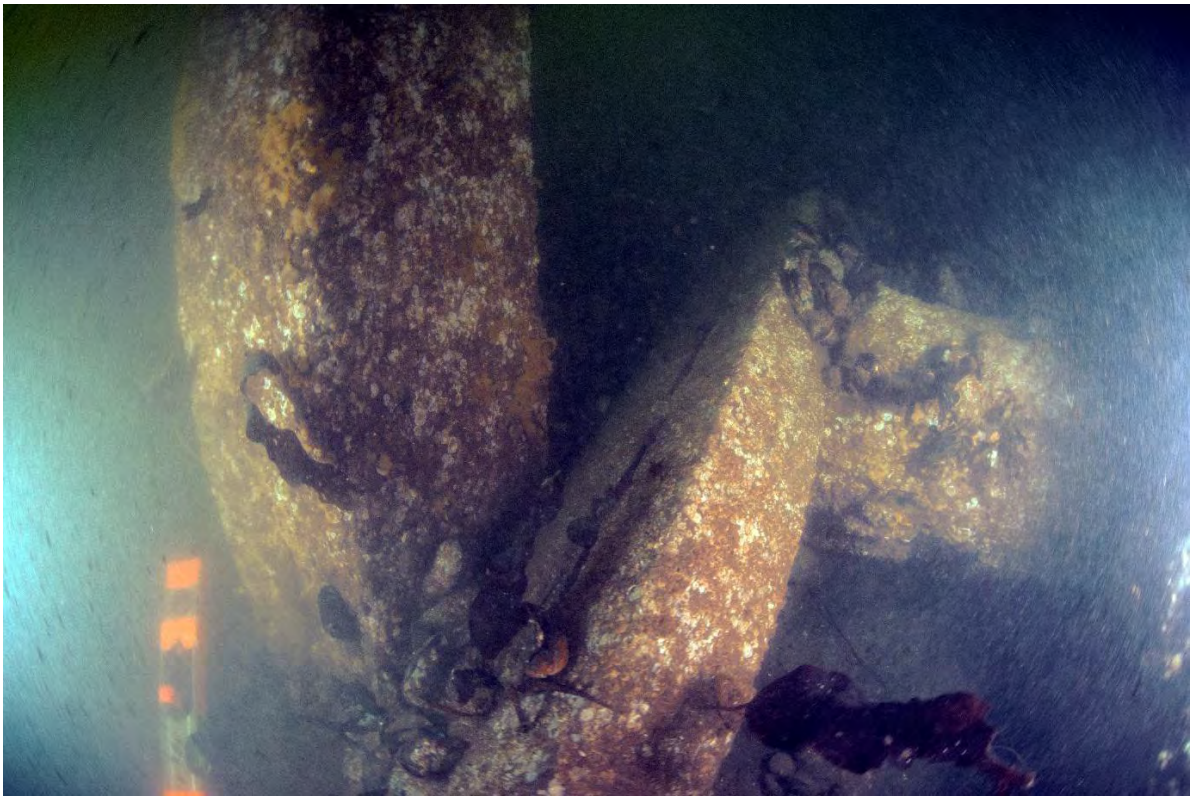


FIGURE 6: Helensburgh Pier – Between piles 37 and 38 (37-b.jpg)

FIGURE 7: Helensburgh Pier – Pile 41 (scale = 58.5 x 6.0 cm)

FIGURE 8: Helensburgh Pier – Pile 27 (scale = 58.5 x 6.0 cm)

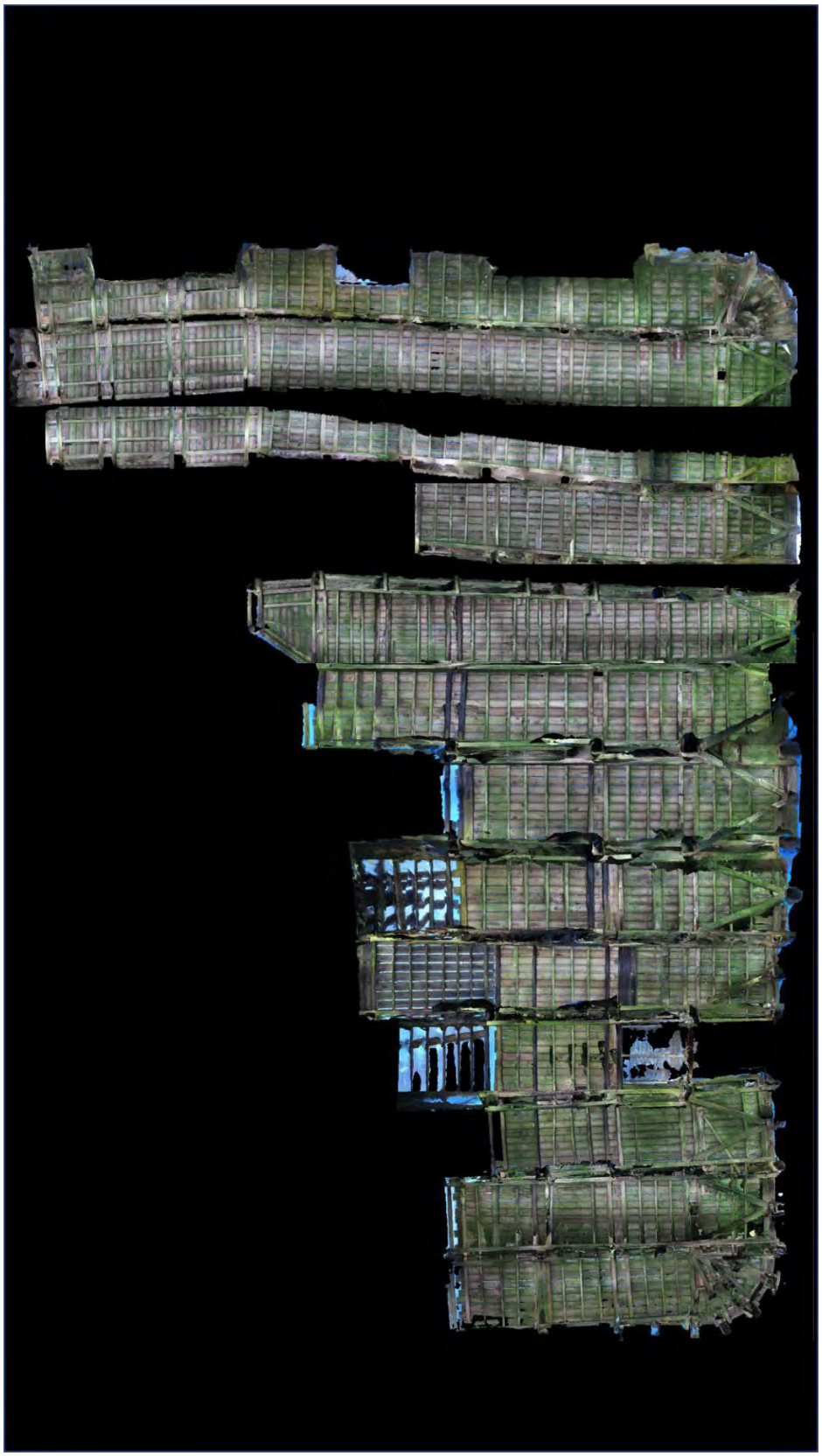
Only a few of the intertidal photographs can be matched up with the underwater survey. Pile 01 is the right-hand pile in photograph DSC_3759.jpg. Intertidal photographs DSC_3763.jpg and DSC_3764.jpg match up with Piles 04 and 05, and the photograph 04-b (see Figures 2 and 3). The intertidal photographs appear to show that the structure is partially collapsed in this area.

Intertidal photograph DSC_3769.jpg shows where some of the pier piles have been cut-off in the past.

2.3 Stereophotogrammetry

Underside: The stereophotogrammetry did not align for the whole of the underside of the pier. This was because of the difficulty in obtaining imagery between the wooden sections. However, the individual sections did align in most cases; Figure 9 is a composite image of the underside.

FIGURE 9: Helensburgh Pier – Composite image of the underside of the pier constructed from individual stereophotogrammetry models of the individual sections



For reference, we have used the term “beam” to denote the larger central supporting wooden structures and “rafter” for the wood lying over the beams but supporting the upper decking.

There are a number of areas of note on the underside of the pier:

a. Missing rafters – Where the normal pattern of rafters was interrupted, and where there was colouring on the boarding that suggested rafters had been in place before, it was assumed that rafters were damaged or missing. Areas where it is thought that rafters are missing are marked on Figure 10. Examples shown are where rafters are missing and broken (Figure 10, boxes A and B; Figures 11 and 12, respectively).

b. Fire damage – There were a number of beams and rafters that were blackened; this was assumed to have been as a result of the fire. Areas where blackened structures were seen are marked on Figure 13. Examples of potential fire damage are shown in Figure 13, boxes C and D, and Figures 14 and 15.

c. Mis-aligned rafters – There were some sections where the rafters appeared to be out of alignment. It was accepted that these could have been deliberate, but the sections highlighted here have colouring on the floor boards above that suggest that the rafters may have moved. Areas where mis-alignment was seen are marked on Figure 16. Examples are shown in Figure 16, boxes E and F, and Figures 17 and 18.

d. Angled rafters - In some places, the line of rafters, rather than being perpendicular to the floor boards, were at an angle, close to 45° to the perpendicular. Areas with angled rafters are marked on Figure 19. An example is shown in Figure 19, box G, and Figures 20 and 21.

FIGURE 10: Helensburgh Pier – **Composite image of the underside of the pier showing areas with missing rafters (in white)**

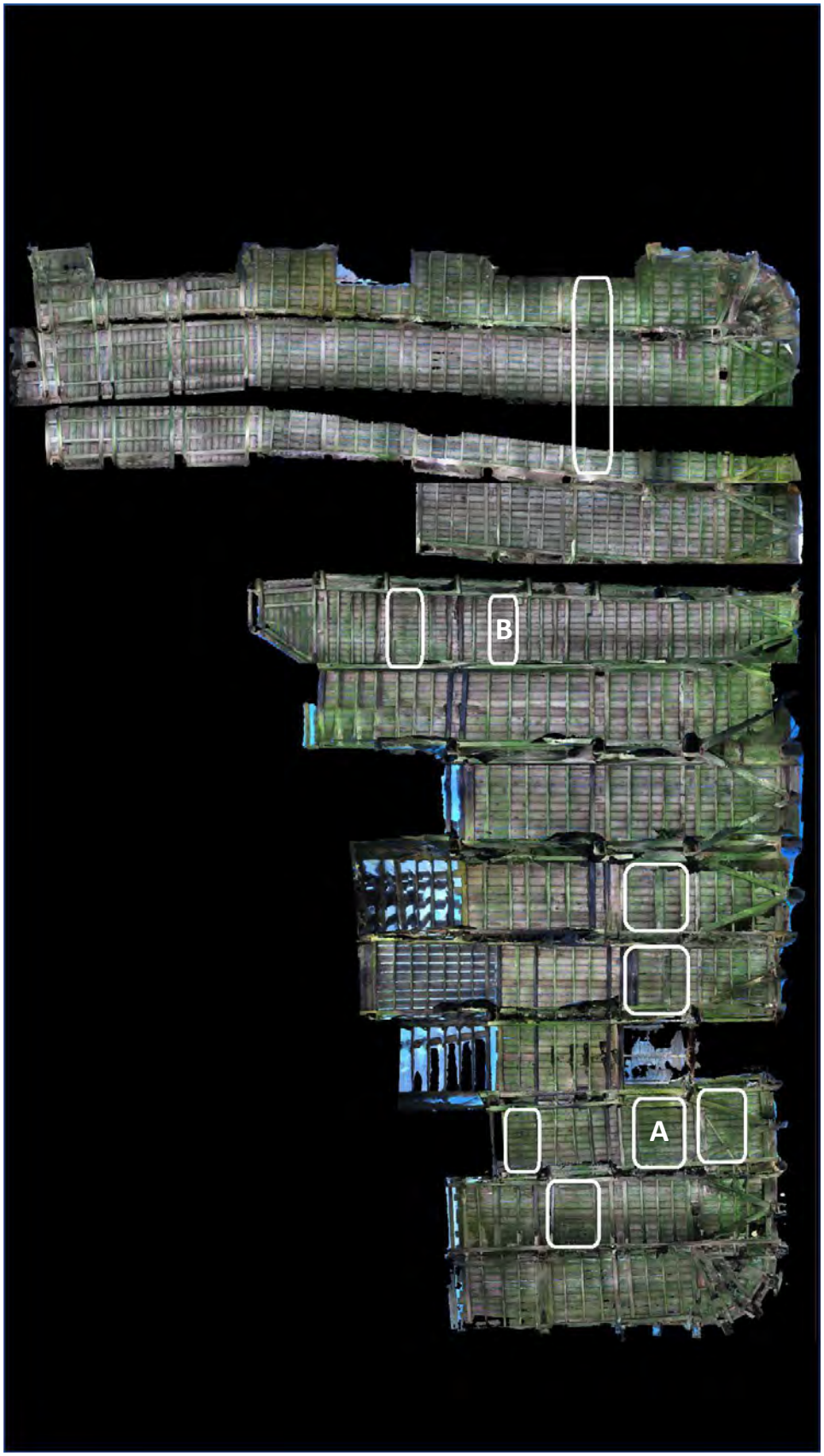


FIGURE 11: Helensburgh Pier – Missing and broken rafters ("A" in Figure 10)

FIGURE 12: Helensburgh Pier – Missing rafter ("B" in Figure 10)

FIGURE 13: Helensburgh Pier – **Composite image of the underside of the pier showing areas with presumed fire damage (in white)**

FIGURE 14: Helensburgh Pier – Burnt beams, rafters and floor boards ("C" in Figure 13)

FIGURE 15: Helensburgh Pier – Burnt rafters ("D" in Figure 13)

FIGURE 16: Helensburgh Pier – **Composite image of the underside of the pier showing areas where rafters are out of alignment (in white)**

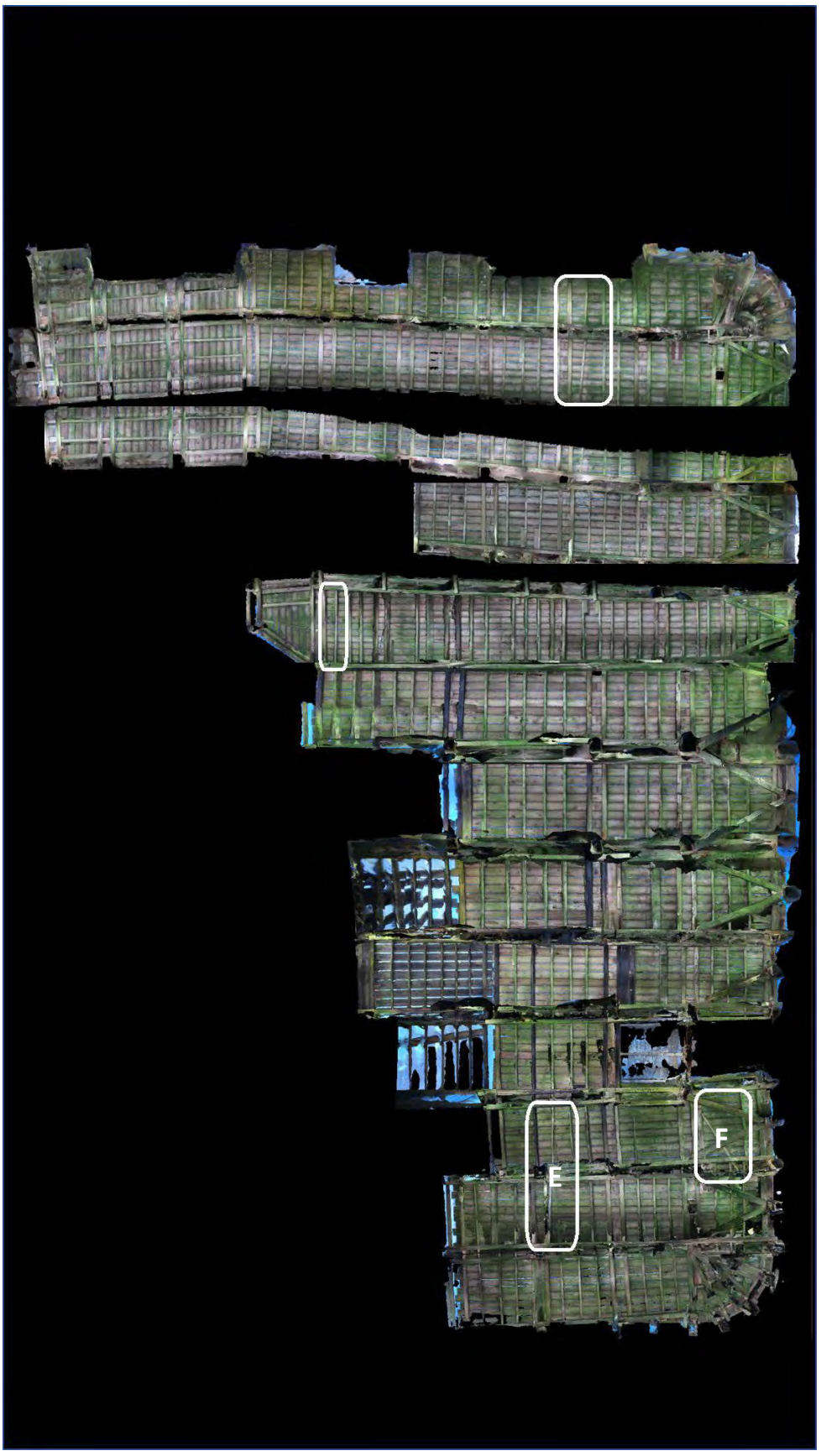


FIGURE 17: Helensburgh Pier – Misaligned rafters ("E" in Figure 16)

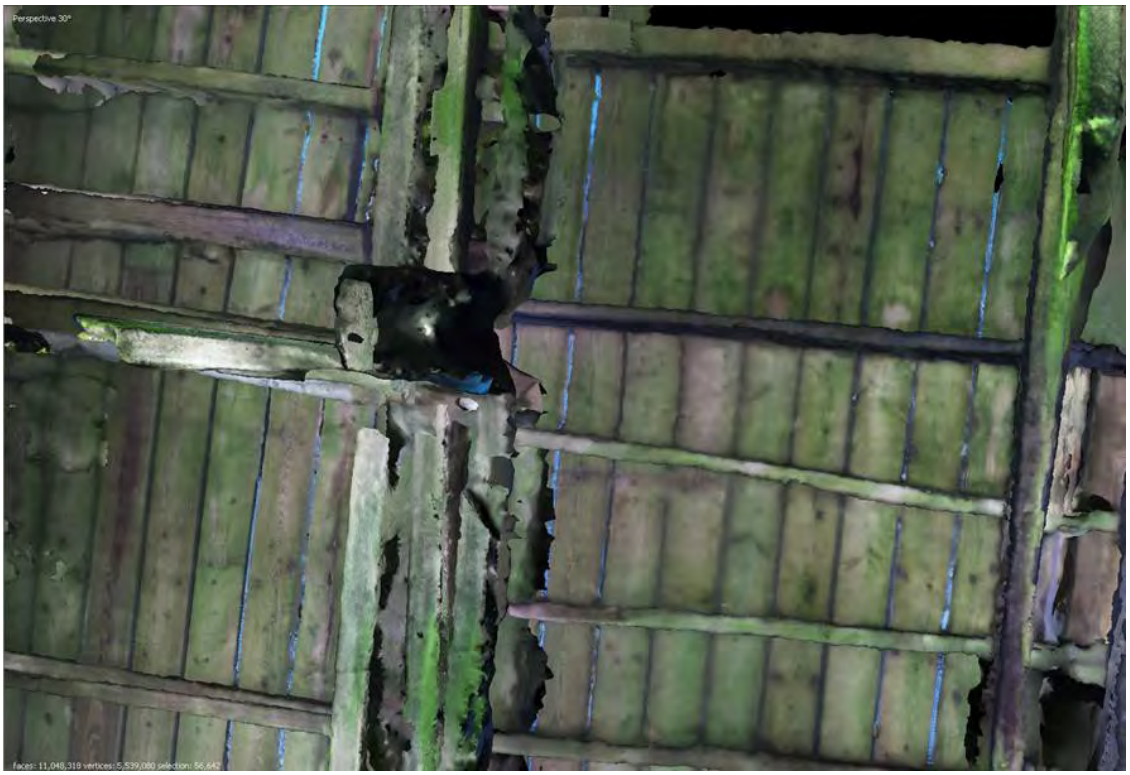


FIGURE 18: Helensburgh Pier – Misaligned rafters ("F" in Figure 16)

FIGURE 19: Helensburgh Pier – **Composite image of the underside of the pier showing areas with angled rafters (in white)**

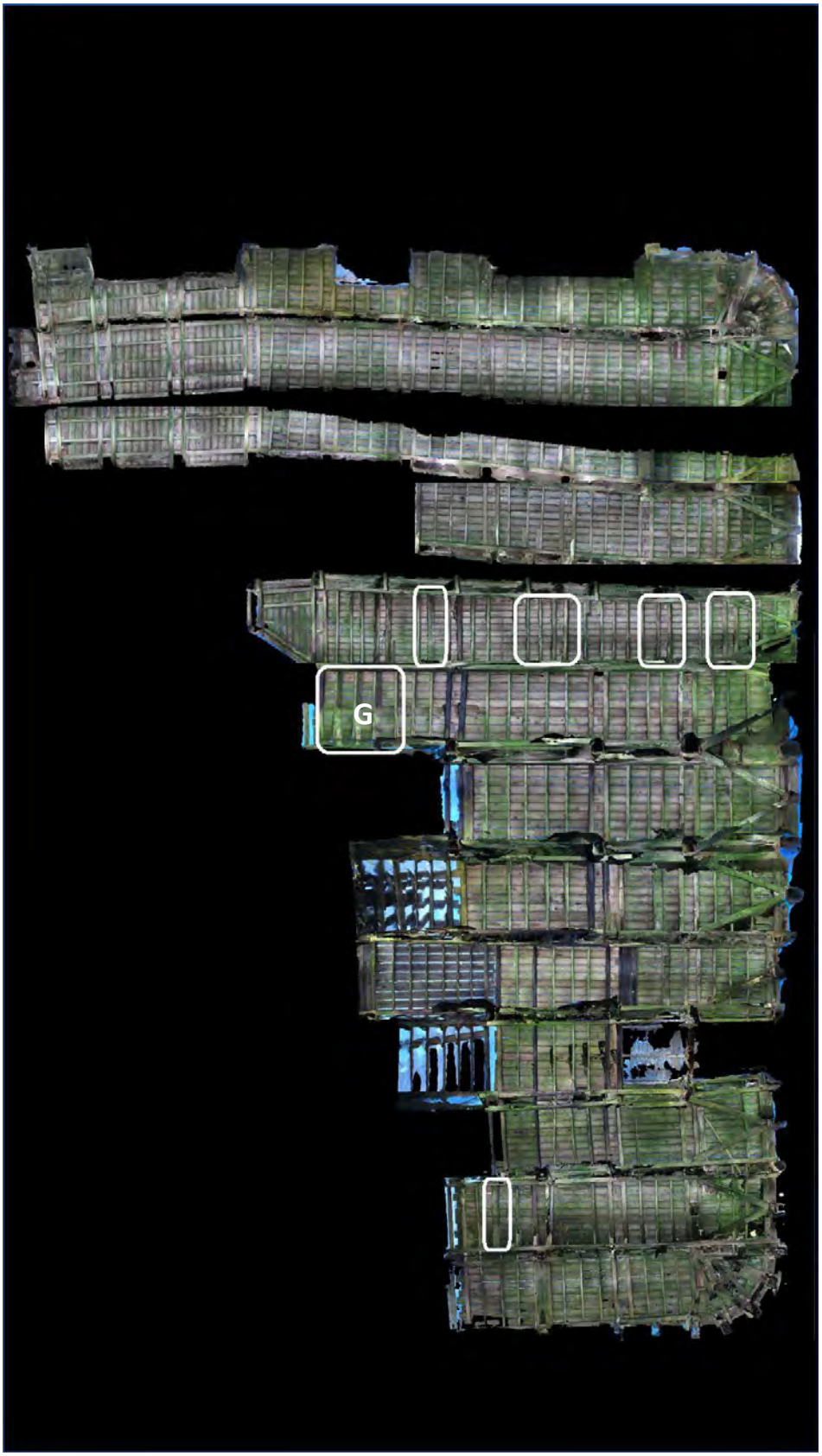
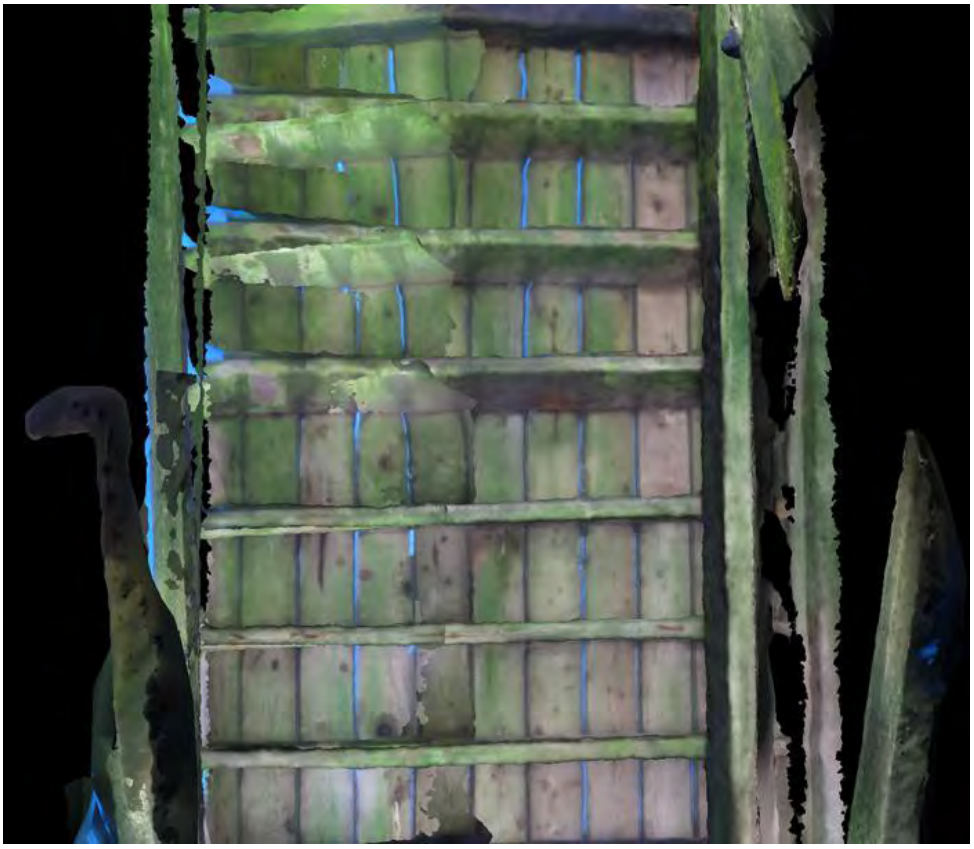


FIGURE 20: Helensburgh Pier – Angled rafters ("G" in Figure 19)

FIGURE 21: Helensburgh Pier – Angled rafters ("G" in Figure 19)



Topside: There was full alignment in the stereophotogrammetrical models of the deck and piles and it was possible to attach them together to generate a single topside model (Figure 22); an animation of the final model is included in the media data under the folder name: A&BC surveys 2018\Helensburgh 2018\stereophotogrammetry. The ortho-rectified model is available in XYZ point cloud format and can be interrogated for accurate measurements. An example of damage to the exterior piling is shown in Figure 23; damage to one of the deck bollards in shown in Figure 24.

FIGURE 22: Helensburgh Pier – Screen grab of the topside stereophotogrammetry model

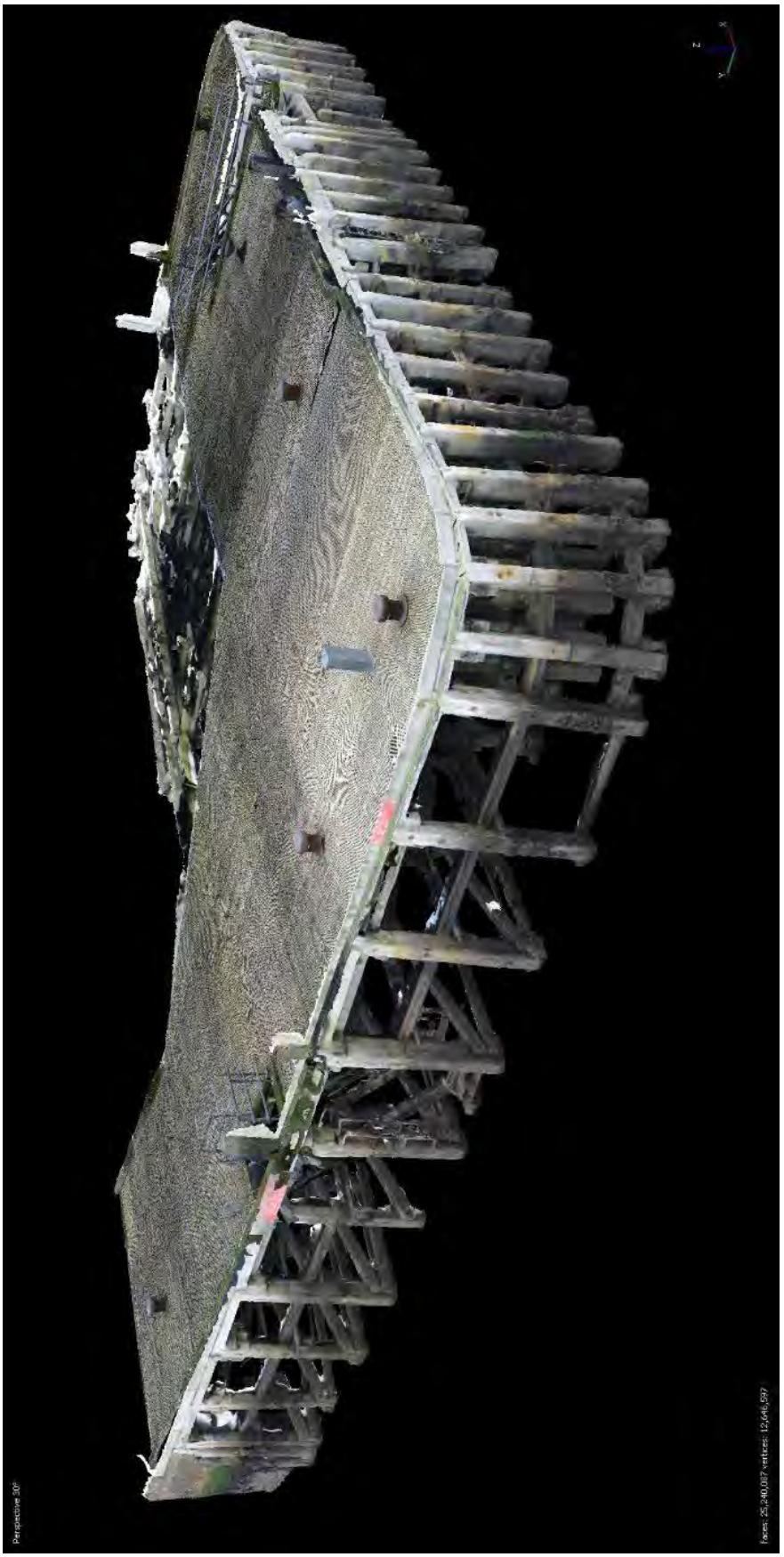


FIGURE 23: Helensburgh Pier – Screen grab of exterior piling damage

FIGURE 24: Helensburgh Pier – Screen grab of deck bollard damage

3. Observations and comments

3.1 The extreme fire damaged part of the pier was not surveyed in detail.

3.2 The underwater survey of the exterior piling showed that most of the piles appeared to be structurally sound. There were some beams on the seabed and it was not clear as to whether some or all of these were as a result of damage or deterioration, or that they had been discarded during repair works.

3.3 A number of stereophotogrammetry models were constructed from the survey images. The ortho-rectified models are available in XYZ point cloud format and can be interrogated for accurate measurements.

3.4 The underside of the pier structure was largely intact. However, there were instances of: missing or broken rafters; fire-damaged beams and/or rafters; mis-aligned rafters; and angled rafters. All of these defects can be measured from the associated XYZ point clouds.

3.5 The topside of the pier structure was largely intact. There were instances of damage to the exterior piling or fendering, and to the bollards on the deck. All of these defects can be measured from the associated XYZ point clouds.

bmtrada

Proud to be JXIIi of @ element

Condition survey and indicative in-situ strength grading of the structural timber components forming Helensburgh Pier, Helensburgh

Commercial in Confidence

A Report To:

Argyll and Bute Council
Kilmory
Lochgilphead
Argyll
PA31 8RT

Date: 18/01/2019

Issue Number: 1

Document Reference: TC 18250

Contents

1 Introduction

On 15th November 2018 BM TRADA received a request from Ms Elsa Simoes, Senior Engineer (Structures) for Argyll and Bute Council (the Client), for us to carry out a condition survey and strength assessment of the structural timber components forming Helensburgh Pier, Helensburgh.

BM TRADA issued Contract Agreement TC 18250 to the Client, which outlined the Scope of Work, our fee and BM TRADA's terms and conditions.

Subsequently, following discussions regarding the terms and conditions, on 6th December 2018, BM TRADA agreed and accepted the Client's short form contract, which contained the original Scope of Work and fee, and Argyll and Bute Council's terms and conditions. It was agreed with the Client that this would be taken as formal notification to proceed with the site investigation works.

2 Scope of Work

The following Scope of Work was agreed:

BM TRADA will visit Helensburgh Pier, Helensburgh, Scotland to carry out a condition survey and strength assessment of the structural timbers forming the pier structure.

The survey will concentrate on the main structure members i.e. support columns and structural framework, but not the timber deck boards, and be limited to what can be inspected in three working days (with two consultants).

The aim of the condition survey will be to determine the extent of any fungal decay, insect attack, marine borers and any other deterioration and whether it remains active.

The condition survey will be carried out using the following techniques:

- Visual examination assisted by the use of hand held-probes.
- Hammer soundings.
- Decay detection drilling to test the integrity of the timber utilising a hand-held, battery-operated drill fitted with 2mm diameter 300mm long probes, and probing with a sharp bradawl, to determine any loss of cross section of the timber components.

We will undertake indicative in-situ visual strength grading of the structural members. Indicative visual strength grading will be undertaken in accordance with the principles of the relevant British standard. We will require at least three faces of the timbers to be visible and free from paint and/or debris in order to carry out the visual strength grading process.

We will take small timber samples from representative members in order to confirm the species of timber used and to assign an indicative Strength Class to the timber components, in accordance with *BS EN 1912: 2012 'Structural timber - Strength classes - Assignment of visual grades and species'.*

We will produce a report summarising our findings. The report will contain marked up and referenced drawings and photographs of any areas considered important in relation to our survey findings.

3 Limitations

1 The findings of this report are based solely upon the information and evidence provided and made available to BM TRADA by the Client and/or the Client's representative(s) at the time that this report was written. Should subsequent information be made known to us we reserve the right to amend our findings.

2 Any information or evidence provided to BM TRADA for the preparation of this report by the Client or the Client's representative(s), or by any third party, has been taken by us at face value, unless we state specifically that we have validated it and include in this report evidence of such validation.

3 This report cannot be used for any purpose other than that for which it is expressly authorised within the contract under which it has been agreed and produced.

4 All advice offered by BM TRADA is offered on the basis that it represents the principles of good practice and that it has not necessarily been validated by BM TRADA.

5 Statements which appear in this report, which address current or likely future risks, and which project or estimate outcomes, are based on reasonable assumptions from empirical evidence. Such statements by their nature involve uncertainties, which themselves carry the risk that actual outcomes may differ materially from any predicted outcomes. BM TRADA does not guarantee or warrant any projections or estimates of risks or outcomes contained within this report.

6 Any contracted rights to confidentiality will be considered null and void should the report be modified in any way by any party without express permission of BM TRADA.

4 Background

Based on information provided by the Client, BM TRADA understands the following:

- The Helensburgh pier head structure is believed to have been constructed in the late 1800's,
- The pier head has historically been used to dock passenger ferries (paddle steamer Waverley) transporting members of the public to and from Helensburgh, and Greenock on the opposite side of the River Clyde.
- Currently, the pier head is not used to dock any vessels due to concerns regarding the structural capabilities of the timber components following a fire, structural impact damage, and also the potential of biological degradation of certain timber members.
- As part of a regeneration plan for Helensburgh pier head, which will incorporate a range of retail and residential space, and a new public swimming pool, the pier head is to

undergo refurbishment in order to restore the structure as accurately as possible to its original state. Survey works are required to understand the current condition of the structure so that a plan for any repair works can be made.

5 Procedures

The survey was carried out between Tuesday 11th and Thursday 13th December 2018 by Mr Ben Sharples, Technical Consultant, and Mr Phil O'Leary, Timber Technology Investigations - Head of Section, both for BM TRADA.

The survey was carried out via access from a boat, arranged by the Client.

5.1 Referencing

The extent of the timber survey works are highlighted in yellow on the drawings in Appendix A of this report.

Access to the majority of the internal structural components was limited due to cross bracing and differences in the tidal zones during the inspection. In addition, due to weather conditions, it was not considered a safe environment to manoeuvre a small boat in the narrow bays as there was a risk of injury, and damage to the boats.

The original grid reference system has been used to label components in the findings under Section 6 of this report. BM TRADA has added a reference to each pile forming the curved north-east, south-east and south-west corners of the pier head.

5.2 Condition Survey

The assessment of the pile components was carried out in the intertidal zone and above, where the timber is considered to be most at risk from erosion, biological degradation and impact damage.

Additional components, including the mid-horizontal components, cross-bracing and double-deck joists were mostly surveyed on a visual basis, subsequent to our findings from the survey of the piles.

The condition of the timbers was assessed using a combination of the following techniques:

- Visual examination, with the aid of hand held probes.
- Hammer soundings.
- Testing the integrity of the timbers using a deep fine probe drill capable of penetrating up to 300mm.

The condition survey has been carried out on all timbers that were considered safe to access at the time of our inspection.

5.3 Indicative in-situ Visual Strength Grading

The structural components were visually strength graded using the requirements, as guidance, detailed in *BS 4978:2007+A2:2017 Visual strength grading of softwood* -

Specification and *BS EN 16737:2016 Structural timber- Visual strength grading of tropical hardwood.* Grading was carried out on all timbers inspected.
The standards require that all six surfaces of the timber must be visible for examination. However, BM TRADA is of the opinion that it is possible to provide an indication of timber grade on the basis of three exposed faces which have not been colonised with marine fouling.

Representative small samples of timber were removed from several components for species identification to be carried out under microscopic investigation in BM TRADA's laboratories.

The structural timbers were then assigned to the appropriate strength class for the grade/species combination described in BS EN 1912: 2012 *'Structural timber - Strength classes - Assignment of visual grades and species'.*

BM TRADA assigned indicative strength grades to the timbers on the basis of their original, or _residual section size. All measurements are approximate. The Project Engineer will need to modify original section sizes to take account of mechanical notching, such as joints and areas of cut-outs.

5.4 Species Identification

The specimens were examined visually under a x1O hand lens to determine the gross features of the timber. Thin sections were cut from the specimens and prepared for examination under the microscope. The microscopic characteristics of the timber sections were then recorded. All these features were compared with published information and with those of reference timber samples held by BM TRADA.

6 Site Findings

All structural components had been affected by some form of degradation, whether biological, erosion or impact damage.

The results of the survey are presented in the tables below.

The residual sound section size of the components that had been affected by biological or erosive degradation have been recorded, and which can be used by a structural engineer to produce the structural capacity of the individual members. These residual sizes are displayed in the tables below.

Any impact damage significantly affecting the structural capabilities of the timber members has been recorded per timber member.

Advice has been given as to whether BM TRADA recommends replacement of individual timbers as a result of significant impact damage and/or fungal decay.

The column headed 'Grade' identifies the strength grade assigned to each member by BM TRADA as follows:

- HS - Tropical hardwood strength grade.
- REJ - Rejected for strength reducing factors.

6.1 Timber Pile Results

Table 1 Condition and strength grading results of the piles.

Pile Reference	Indicative Grade	Condition
1-9	HS	Pile supporting the landing of the steps. Sound. Residual section: 280mm x 280mm.
1-8	HS	Short pile supporting steps. Sound residual section: 200mm x 230mm.
1-7	HS	Sound. Residual section: 300mm x 300mm.
1-6	HS	Sound. Residual section: 280mm x 300mm.
1-5	HS	Sound. Residual section: 350mm x 350mm.
1-4	HS	Sound. Residual section: 250mm x 270mm.
1-3	2 x HS	Inner pile top section down to first steel strap. Residual section 180mm x 180mm. Below strap 230mm x 250mm. Outer pile sound. Residual section: 280mm x 300mm.
1-2	Inner- HS Outer - REJ	Inner pile sound. Residual section: 250mm x 250mm. Top 1000mm rounded off due to sapwood erosion. See Photograph 1 in Appendix B. Replace outer pile.
I-1-c	Inner- HS Outer - REJ	Inner pile sound. Residual section: 250mm x 250mm. Replace outer pile.
I-1-b	Inner- HS Outer - REJ	Inner pile sound. Residual section: 250mm x 250mm. Replace outer pile.
I-1-a	Inner- HS Outer - REJ	Inner pile sound. Residual section: 250mm x 250mm. Replace outer pile.
H-1	Inner- HS Outer - REJ	Inner pile sound. Residual section: 250mm x 250mm. Replace outer pile.
G-1	HS	Sound. Residual section: 280mm x 300mm.
F-1	**2 x** HS	Inner pile sound. Residual section: 320mm x 320mm. :)uter pile sound. Residual section: 320mm x 320mm.
E-1	**2 x HS**	Inner pile sound. Residual section: 320mm x 320mm. Outer pile sound. Residual section: 320mm x 320mm.
D-1	2x HS	Inner pile sound. Top 3500mm residual section: 320mm 0. 300mm x 300mm below. Outer pile sound. Residual section: 320mm x 320mm.
C-1	HS	!Sound. Residual section: 280mm x 280mm.
B-1-b	HS	!Sound. Residual section: 165mm x 300mm. Bottom section aooroximately 1000mm) of pile visible at low tide missing.
B-1-a	HS	Sound. Residual section: 200mm x 200mm. Pile slightly rounded due lo sapwood erosion.
A-1-c	REJ	!Significant cross-grain fracture to pile. Replacement/repair works equired.
A-1-b	HS	Sound. Residual section: 180mm x 180mm.
A-1-a	REJ	Siqnificant decay and damaqe alonq whole lenqth. Replace.
A-2-a	Inner- REJ Outer - HS	Inner pile: Significant cross-grain fractures to top 3000mm section. Replace. Outer pile sound, but connection to inner post is loose. 150mm x 300mm,
A-2-b	HS	Inner pile sound. Residual section: 280mm x 300mm.
A-3-a	REJ	nner pile: Significant impact damage and erosion. Replace.

A-3-b	REJ	Inner pile: Significant cross grain fracture. Replace/repair. Steel straps broken. See Photograph 2. No structural capacity to the section above he mid-horizontal.
A-4-a	REJ	Inner pile: Significant cross-grain fracture. See Photograph 3. Replace/repair. No structural capacity to the section above the mid 1orizontal.
A-4-b	HS	Sound. Residual section: 280mm x 280mm.
A-5-a	REJ	-ractures above the mid horizontal from impact damage. Residual section: 180mm x 200mm. Repair/replace.
A-5-b	2x HS	Inner pile sound. Residual section: 280mm x 300mm. Some impact klamage to one arris. Outer pile sound. Residual section: 150mm x 300mm.
A-6-a	3x HS	Inner pile sound. Residual section: 280mm x 300mm. Middle pile sound. Residual section: 50mm x 300mm. Outer pile sound. Residual section: 150mm x 300mm.
A-6-b	Inner - REJ Outer - HS	Inner pile: cross-grain fractures from impact damage. Residual $ection: 260mm x 280mm. Repair/replace. Outer pile sound, but loose. Residual section 150mm x 300mm.
A-7-a	Inner- REJ Outer - HS	Inner pile has a cross-grain fracture. Residual section: 270mm x 280mm. Repair/replace. Outer pile sound. Residual section: 260mm x 280mm.
A-7-b	HS	Sound. Top residual section: 280mm x 300mm reducing downwards to 280mm x 200mm.
A-8-a	2x HS	Inner pile sound. Residual section: 250mm x 280mm. Outer pile sound. Residual section: 280mm x 300mm.
A-8-b	2x HS	Inner pile sound. Residual section: 280mm x 300mm. :)uter pile sound. Residual section: 150mm x 300mm.
A-9-a	HS	Sound. Residual section: 260mm x 260mm.
A-9-b	2x HS	Inner pile sound. Residual section: 300mm x 300mm. Outer pile sound. Residual section: 150mm x 300mm.
A-10-a	HS	Sound. Residual section: 300mm x 300mm.
A-10-b	HS	Significant erosion to top 1500mm. Residual section: 200mm x 00mm. Residual section below: 300mm x 300mm.
A-11-a	REJ	Siqnificant impact damaqe. See Photoqraph 4. Repair/replace.
A-11-b	HS	Sound. Residual section: 300mm x 300mm.
A-12	HS	Sound. Residual section: 300mm x 300mm.
A-13-a	2x HS	Inner pile sound. Residual section: 270mm x 280mm. Outer pile sound. Residual section: 150mm x 290mm.
A-13-b	2x HS	Inner pile sound. Residual section: 270mm x 280mm. Outer pile sound. Residual section: 150mm x 290mm.
A-13-c	2x HS	Inner pile sound. Residual section: 270mm x 280mm. Outer pile sound. Residual section: 150mm x 290mm.
B-13	2x HS	Inner pile sound. Residual section: 260mm x 300mm. Outer pile sound. Residual section: 150mm x 280mm.
C-13	**2x HS**	Inner pile sound. Residual section: 220mm x 220mm. Outer pile sound. Residual section: 150mm x 280mm.
D-13	2x HS	Inner pile sound. Residual section: 280mm x 300mm. Outer pile sound. Residual section: 140mm x 280mm. Steel strap broken. See Photograph 5.
E-13	HS	No pile on the west elevation.
F-13	2x HS	Inner pile sound. Residual section: 290mm x 300mm. Puter pile sound. Residual section: 280mm x 280mm.

G-13	2 x HS	Inner pile sound. Residual section: 280mm x 300mm. :Juter pile sound. Residual section: 280mm x 280mm.
H-13	**HS**	Sound. Residual section: 280mm x 290mm.
1-13	**2 x HS**	Inner pile sound. Residual section: 300mm x 300mm. Outer pile sound. Residual section: 150mm x 300mm.
J-13	**HS**	Sound. Residual section: 260mm x 300mm.
K-13	HS	Sound. Residual section: 300mm x 340mm.
L-13	HS	Sound. Residual section: 280mm x 340mm.
M-13	HS	Sound. Residual section: 280mm x 280mm
H-2	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
H-3	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
H-4	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
H-5	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
H-6	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
H-7	HS	Sound. Residual section: 260mm x 260mm. Visual inspection only.
1-9	HS	Sound. Residual section: 280mm x 280mm.
J-9	HS	Sound. Residual section: 280mm x 280mm.
F-10	HS	Sound. Residual section: 280mm x 280mm.
G-10	HS	Sound. Residual section: 280mm x 280mm.
H-10	HS	Sound. Residual section: 280mm x 280mm.
K-10	HS	Sound. Residual section: 250mm x 260mm.
L-10	HS	Sound. Residual section: 250mm x 250mm.
F-11	HS	Sound. Residual section: 280mm x 280mm.
G-11	HS	Sound. Residual section: 280mm x 280mm.
H-11	HS	Sound. Residual section: 280mm x 280mm.
F-12	HS	Sound. Residual section: 280mm x 280mm.
G-12	HS	Sound. Residual section: 280mm x 280mm.
H-12	HS	Sound. Residual section: 280mm x 280mm.

6.2 Other Timber Component Results

Table 2 Condition and strength grading of other accessible components.

Component Reference	**Indicative Grade or not accessible** (-)	**Condition** **See comment at the bottom of this table**
Mid horizontal 1-2 to I-4	REJ	Reasons unrecorded.
Mid horizontal H-1 to 1-1	REJ	Significant cross grain fracture. Repair/replace.
Mid horizontal E1 to F1 E2 to F2 F1 to G1	3 x REJ	Significant erosion and fungal decay. See Photograph 6. Replace all three members.
Mid horizontal E1 to E2	HS	Sound. Disconnected from original position. Photograph 7.
East ends of all double deck joists F-	-	Significant decay, or completely absent.

1 to 1-1 (spanning east to west)		
Mid horizontals C-6 to E-6 each side of pile	-	Not connected at their south ends. See Photograph 8.
Perimeter noggings A-6 to A-8	-	Significantly decayed along their length. See Photograph 9. Replace.
South ends of double deck joists A-7 to C-7	-	ccessible sections significantly decayed.
Perimeter noggins at SW corner	-	Significantly decayed or absent.
Double deck joist ends at SW corner	-	All exposed south west ends of deck joists on the south west corner siQnificantly decayed. See PhotoQraph 10.
Deck joist C-13 to D-13	-	Significant fungal decay to 500mm of the north end.
Deck joist 1-10 to 1-13	-	Significant fungal decay along length.
Perimeter noggings D-13 to F13 and C-13 to D-13	-	ISignificant fungal decay in both members.
Mid horizontal and diagonal bracing C-10 to C-13 D-10 to D-13 F-10 to F-13 G-10 to G-13	All HS	II sound. Some wasting at the intertidal zone reducing ections to approximately 300mm x 300mm.
Deck joists fire affected area	-	Significant fire damage and fungal decay.

Table 2 above indicates those timbers that were accessible, and which we assigned an indicative grade of HS or rejected (REJ).

Wet rot fungal decay was observed in many of the remaining softwood deck joists and noggings inspected by us. Although 80% of the remaining sound sections could be assigned an SS grade and 20% a GS grade, the overall poor condition of these remaining softwood deck joists and noggings means that we are unable to recommend any further service life for them.

6.3 Species Identification

Samples were removed from various components (detailed in the table below) for formal species identification in BM TRADA's laboratories. The results are as follows:

Tabie 3 S,pecles 1.den f1flca rIOn o f samp es removed d u nng our site inspection.

Component	Species	Common Name
Deck joist C-13 to D-13	*Pinus taeda*	Pitch pine
Upper horizontal - unknown	*Pinus taeda*	Pitch pine
B-2-b pile	*Pinus taeda*	Pitch pine
Deck joist-unknown	*Pinus taeda*	Pitch pine
Noggin B13 to C-13	*Pseudotsuga menziesii*	Douglas fir

Deck joist - unknown	*Pseudotsuga menziesii*	Douglas fir
Diagonal brace D-12 to D-13	*Chlorocardium rodiei*	Greenheart
Diagonal brace A-12 to C-12	*Chlorocardium rodiei*	Greenheart
Pile A-7-a	*Chlorocardium rodiei*	Greenheart
Pile C-13	*Chlorocardium rodiei*	Greenheart
Mid horizontal E-1 to G-1	*Chlorocardium rodiei*	Greenheart
Pile A-12	*Ch/orocardium rodiei*	Greenheart
Outer pile G-1	*Ch/orocardium rodiei*	Greenheart
Upper horizontal K-1 to L-1	*Chlorocardium rodiei*	Greenheart
Cross brace - internal structure	*Chlorocardium rodiei*	Greenheart
Unknown (likely an upper horizontal)	*Nauc/ea diderrichii*	Opepe

6.4 Assigning an Indicative Strength Class

With reference to BS EN 1912: 2012:

HS grade greenheart may be assigned to Strength Class D70.

HS grade opepe may be assigned to Strength Class D50.

SS pitch pine may be assigned to Strength Class C24*.
GS pitch pine may be assigned to Strength Class C18*.

SS Douglas fir (imported) may be assigned to Strength Class C24*.
GS Douglas fir (imported) may be assigned to Strength Class C16*.

* The application of these indicative Strength Classes would be dependent upon softwood timbers not included in Table 2 above, but present in the pier, being confirmed as SS or GS by a suitably qualified specialist.

7 Discussion

7.1 Mechanical Damage

Seven of the components inspected, six of which were piles on the south elevation, contained substantial cross grain fractures. Given the size and position of the fractures and that they are on the elevation where vessels have been historically docking, it is likely that they are a result of heavy impact damage as vessels have hit the side of the pier when docking repeatedly for many years. The structural capacity of these members has been severely compromised and does require repair or full replacement in accordance with a design specification provided by a suitably qualified structural engineer.

7.2 Fungal Decay

Service life is determined by the extent of degradation by fungal decay and/or marine borer attack (see **7.3** below). This depends of the severity of the conditions of exposure, which can be variable in sea water conditions, e.g. water temperature, salinity of the water and the depth of the water at low and high tide.

It is unlikely that fungal decay will develop in timbers located at the intertidal zone due to a lack of oxygen, which fungi require to thrive, and because salts present in seawater/brackish water inhibit fungal growth. In addition, certain timber species have better resistance to decay than others, greenheart being highly resistant to biological degradation. For these reasons, the greenheart components i.e. piles, horizontals and bracing are less at risk from the development from fungal decay because of their location on the structure.

The inspection, carried out over three days, focused on the timber piles at their intertidal zone. It was not possible to inspect the full zone of every member surveyed due to the changes between low and high tide. It would need to be permanently low tide in order to do this, which is not possible. Therefore, some timbers that have been recorded as sound, could have some deterioration at the lower end of their intertidal zone.

7.3 Sea life

The choice of timber species for marine environments involving submersion in sea water must take into account the possibility of attack by marine borers. In the British Isles and other temperate waters, there are only two types of marine borers of economic significance. These are *Limnoria* (gribble) and *Teredo* (shipworm).

Shipworm can cause substantial damage, even to dense tropical hardwoods. However, the presence of shipworm has only been reported in the southern areas of Britain, and not as far north as Cumbria and Scotland. No shipworm damage was detected during our inspection.

Although gribble is reported to be present throughout British waters, there was no physical evidence during our inspection to suggest that any of the timbers had been affected.

No hardwoods have total resistance to marine borers. However, some of the more dense tropical hardwoods, particularly greenheart, have the best resistance.

Greenheart has a long history of successful use for marine construction around the UK for coastal defences and as harbour jetties and piers, and pontoon pilings. It is the heartwood of greenheart that is resistant to attack by marine borers. The outer sapwood has little resistance to attack. In order to produce economically viable piles in the desired cross sectional sizes, greenheart piles will often include some sapwood. Several piles were noted during our inspection to have more of a rounded cross section, likely a result of erosion of the less durable sapwood constituent of the piece of timber.

Nearly all timbers inspected had some surface erosion in their intertidal zone. An inevitable result of exposure to the surrounding waters and other sea life, such as barnacles and muscles, and minor impact, have had an effect. The natural variation of timber and even some marine fungi and sand particles suspended in the water will have also had an impact on the variable nature of the erosion in service. By scratching away the surface marine

fouling, a sound timber core was found, and the residual sizes have been recorded in Section 6 of this report. Structural calculations can therefore be made using these residual section sizes.

7.4 Service Life

We would expect the residual sized tropical hardwood components to achieve a minimum 15 year service life based on published documents, including *8S 8417:2011+A1:2014 Preservation of wood - Code of practice,* each of which contain information on greenheart and opepe, and other very durable timber species, submerged in marine water environments.

Given the overall poor condition of the softwood deck joists and noggings we are unable to recommend any further service life for these components.

8 Conclusions

BM TRAOA conclude the following:

i. Given the age of the structure, the pier head is in a reasonable overall condition.

ii. The inspection of submerged timbers was carried out at their intertidal zone. However, it was not possible to inspect every member at low tide due to changes between low and high tide.

iii. Six timber piles on the south elevation and south east corner contained significant cross grain fractures as a result of heavy, regular impact damage, likely caused by docking vessels. All timbers reported to contain these fractures are in need of repair/replacement in accordance with a specification designed by a suitably qualified structural engineer.

iv. The majority of the inspected piles (mainly around the perimeter) were found to be in a sound condition, but with some surface erosion and impact damage. The residual section sizes were recorded in this instance, and these can be used by the structural engineer for design calculations.

v. All samples taken from the timber piles and some horizontal and diagonal braces were identified as greenheart. Where members are reported to be sound and HS strength grade they can be assigned an indicative Strength Class of 070. One sample, from an unknown location, likely to be an upper horizontal, was identified as opepe. HS grade opepe can be assigned an indicative Strength Class of 050.

vi. We would expect the tropical hardwood members to achieve a further (minimum) 15 year service life.

vii. Fungal decay was present in the majority of softwood deck joists, double deck joists and noggings. These members have come to the end of their service life, and no further service life can be recommended.

9 Authorisation

	Issued by:	Under the authority of:
Signature:		
Name:	Ben Sharples	Richard White
Title:	Technical Consultant	Expert Consultancy Lead

Appendix A

Drawings (2 Pages)

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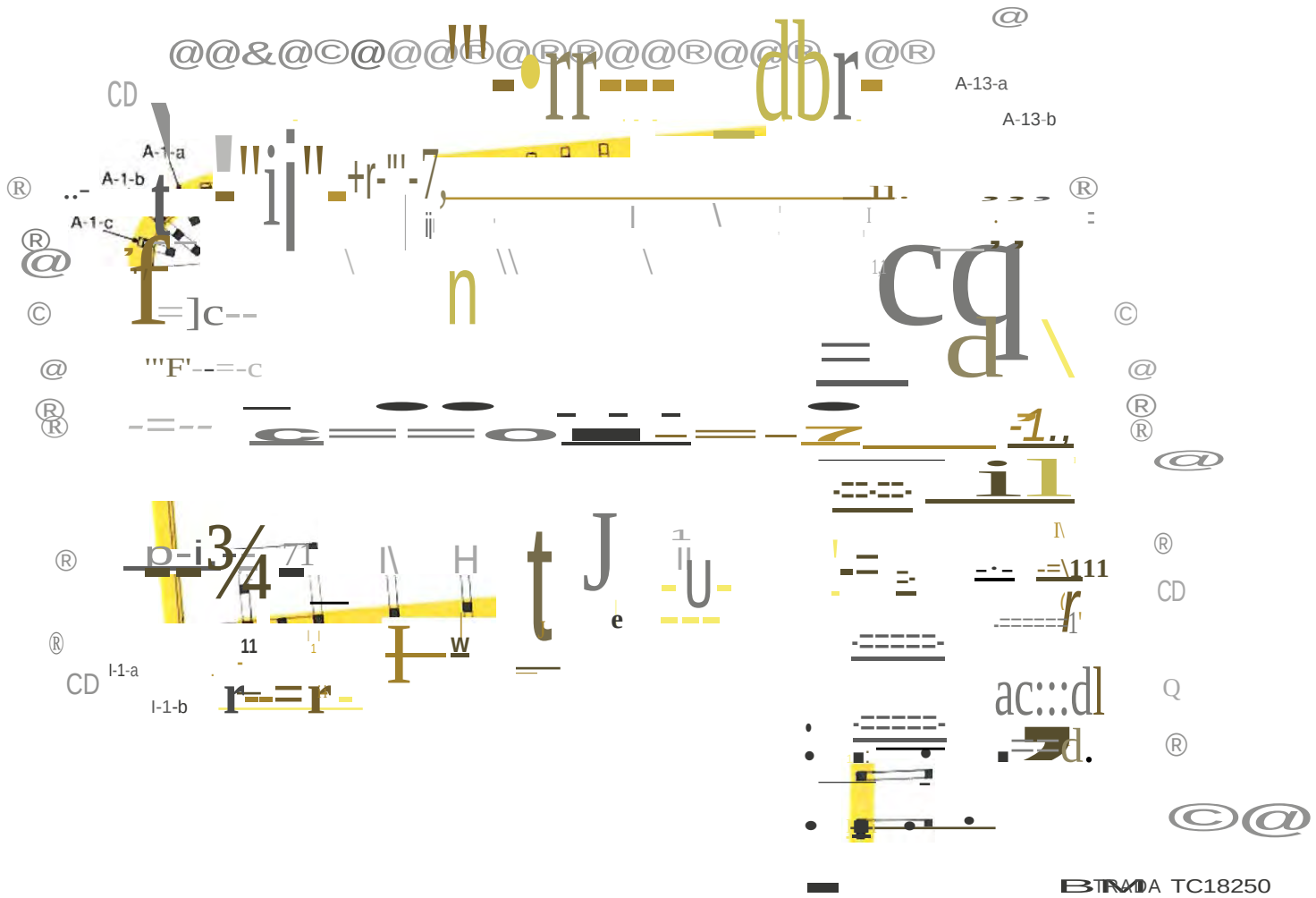

BTRADA TC18250
Helensburgh Pier
Extent of timber pile and mid horizontal survey works

Document No.:	TC 18250		
Author:	Ben Sharples	Issue Date:	18/01/2019
Client:	Argyll and Bute Council	Issue No.:	

bmtrada

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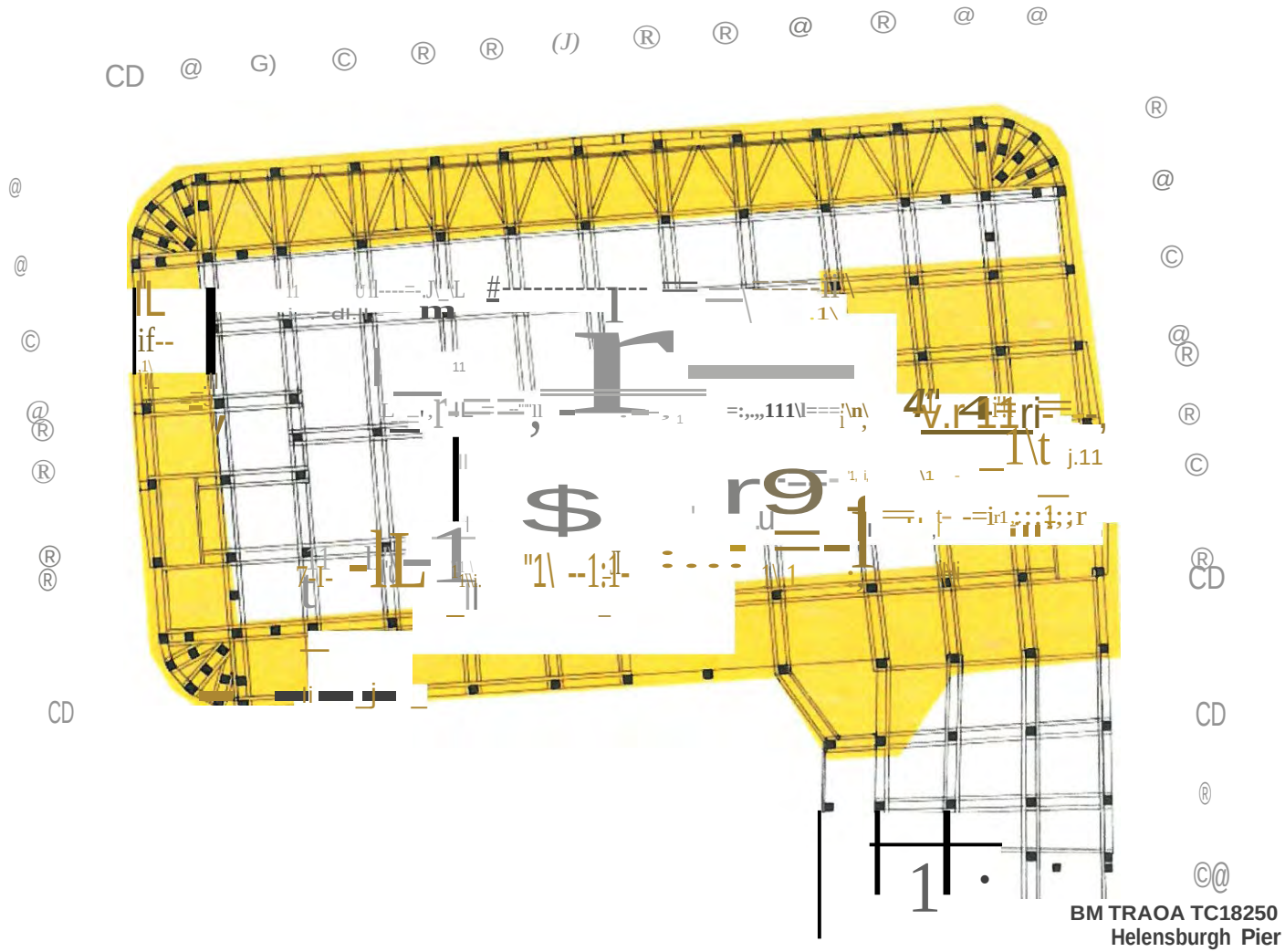


BM TRAOA TC18250
Helensburgh Pier
Extent of double deck joists survey works

Document No.:	TC 18250
Author:	Ben Sharples
Client:	Argyll and Bute Council
Issue Date:	18/01/2019
Issue No.:	

Appendix B

Photographs (X Pages)

Photograph 1 Rounded post (1-2) as a result of sapwood erosion/decay.

Photograph 2 Significant cross grain fracture to inner pile A-3-b.

Photograph 3 Significant cross grain fracture to inner pile A-4-a.

Photograph 4 Significant loss of cross section due to impact damage and erosion to pile A-11-a.

Photograph 5 broken steel strap around pile D-13.

Photograph 6 Example of significant decay and erosion to mid horizontals E-1 to F-1, E-2 to F-2 and F-1 to G-1.

Photograph 7 Mid horizontal E-1 to E-2 dropped from original position.

Photograph 8 Horizontal beam C-6 to E-6 disconnected.

Photograph 9 Significant decay to softwood nogging on the south elevation between piles A-6 and A-8.

Photograph 10 Significant decay to the south west ends of double deck joists at the south west corner.

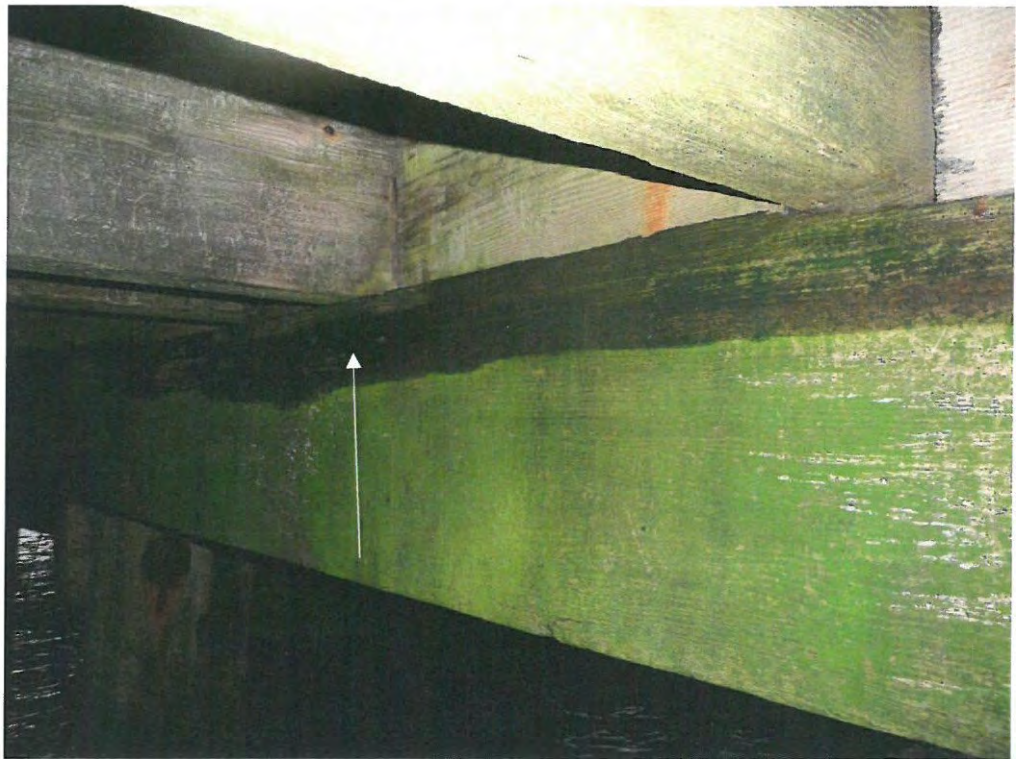
Photograph 11 Significant decay to nogging on west elevation and horizontal member below.

Photograph 12 Fungal decay seen at end grain of a softwood nogging on the south elevation.

Photograph 13 Example of a softwood double deck joist significantly decayed.

Photograph 14 Example of a softwood deck joist significantly decayed.

Photograph 15 Example of a softwood deck joist significantly decayed.



Photograph 16 Example of a softwood double deck joist significantly decayed.

ARGYLL AND BUTE COUNCIL | **HELENSBURGH AND LOMOND AREA COMMITTEE**

DEVELOPMENT AND INFRASTRUCTURE SERVICES | **20 JUNE 2019**

HELENSBURGH PIER

1.0 EXECUTIVE SUMMARY

1.1 This report provides Members with an update on the condition of Helensburgh Pier, along with options for future consideration.

1.2 A principal inspection was organised for Helensburgh Pier and carried out by the consultant Arch Henderson; their report was produced in October 2018. The report recommended that a restriction be put in place to prevent vessels berthing - a Notice to Mariners was duly issued based on the report recommendations.

1.3 A structural analysis was organised utilising in-house resources and options to reinstate the pier were considered:-

- Minor repairs to the existing timber pier. This option would ensure safe access for pedestrians only; it would not facilitate berthing of the Waverley and the fire-damaged section of the pier would remain off-limits. Related costs are likely to be in the region of £60K.

- Major repairs to the timber pier to reinstate all damaged sections: This option would facilitate Waverley berthing and permit full pedestrian access. Essentially, all damaged timbers would be replaced on a like-for-like basis, including timbers in the fire-damaged area. Costs for this option are likely to be in the region of £850K.

- Construct new berthing structure (monolithic piles with fendering system) adjacent to the pier and connected by an access gangway: This option would allow the Waverley to berth. Costs are likely to be in the region of £580K for this option.

- A further option could also be considered which would allow the re-opening of the berth face to smaller vessels i.e. with lesser berthing loads than the Waverley. A cost estimate for related works is yet to be produced.

- Following a meeting with Waverley Excursions, yet another option is now being considered which would involve berthing the Waverley to the west side of the pier. This option would involve dredging to allow the Waverley to approach the west side of the pier, but would involve less work on the pier itself. Again, a cost estimate for related works is yet to be produced.

1.4 Funding has not been identified for any of the current options under consideration; as such, high cost options identified above in sections 1.3.2 and 1.3.3 will not be pursued.

1.5 Listing of the pier – Helensburgh Pier has recently been listed as a Category C structure. It is likely that at least some of the proposals being considered for Helensburgh Pier would require listed building consent.

1.6 Council officers and representatives from Helensburgh Seafront Development Project (HSDP) have now met on a number of occasions to exchange information and discuss HSDP's plans. Gerard Lindsay and David Cantello from HSCP have now stated that their objective is to develop the pier to cater for small craft by installing pontoons to the east side and confirmed their understanding that refurbishment of the main pier structure is a matter for the council. Discussions have centred on assessing the viability of introducing these pontoons. A plan, indicating the likely location for new pontoons, is attached in Appendix D to this report. As both planned works could well be inter-dependent i.e. a) the Council's potential plans to re-instate a safe pedestrian area and/or re-open the berth face and b) the HSDP's plans to introduce pontoons, it is proposed that liaison between both groups continues for the mutual benefit of all interested parties.

1.7 The Area Committee is asked to:-

a) Note the update provided regarding the condition of the pier.

b) Endorse working between the Council and HSDP in relation to their aspiration for pontoons, with officers providing technical advice and support.

c) Recommend to the Council's Harbour Board that Officers continue to liaise with 'Waverley Excursions Ltd.' to arrive at the most cost effective, and low-cost, solution which would allow the Waverley to berth at Helensburgh Pier in the future, and

d) Agree that Officers provide a further update report at a future meeting of the Helensburgh and Lomond Area Committee.

ARGYLL AND BUTE COUNCIL	**HELENSBURGH AND LOMOND AREA COMMITTEE**
DEVELOPMENT AND INFRASTRUCTURE SERVICES	**20 JUNE 2019**

HELENSBURGH PIER

2.0 INTRODUCTION

2.1 A 'Notice to Mariners' (NTM) was issued in October 2018 to advise mariners that the berthing face at Helensburgh Pier was now closed – albeit on a temporary basis. The NTM is still in force. A number of briefing notes have been issued to Members to provide updates on surveys / design analysis etc. This report provides Members with details of the analysis which was carried out, to ascertain the actual condition of the pier, along with potential remedial options for future consideration.

3.0 RECOMMENDATIONS

3.1 The Area Committee is asked to:-

a) Note the update provided regarding the condition of the pier.

b) Endorse working between the Council and HSDP in relation to their aspiration for pontoons, with officers providing technical advice and support.

c) Recommend to the Council's Harbour Board that Officers continue to liaise with 'Waverley Excursions Ltd.' to arrive at the most cost effective, and low-cost, solution which would allow the Waverley to berth at Helensburgh Pier in the future, and

d) Agree that Officers provide a further update report at a future meeting of the Helensburgh and Lomond Area Committee.

4.0 BACKGROUND

4.1 Helensburgh Pier dates from circa 1800's and was constructed to facilitate berthing of steam ships. The original stone wall and infill structure was extended with a timber pier head in 1871. Prior to its closure to vessels in October 2018 it was little used, although the Waverley berthed on occasion over the summer months. Due to mechanical issues, the Waverley is not operating this season. In a normal season, the Waverley berths on approximately 20 separate days each year – from spring to early autumn. The income generated at the pier over the last few years has been minimal - as the Waverley is operated as a charity, no fees or dues have been applied by the Council.

4.2 A substantial section of the timber pier was damaged by fire in the nineteen nineties, following which, a decision was taken to fence the damaged section off from public access. At this time, no further works

were planned to reinstate fire damage timbers as the sub-structure of the pier was considered to be structurally sound.

4.3 As part of the site investigation works for the development of Helensburgh waterfront, a survey was carried out on Helensburgh Pier. Aecom Ltd was engaged by the Council to carry out this task and a Pier Visual Inspection Report was duly produced in early 2016. AECOM's report highlighted various areas of concern and made reference to some areas which posed a high risk to pedestrian safety – mainly tripping hazards on the decking; these areas were all duly attended to and made safe at the time. The report also recommended that a fully detailed inspection be carried out on the timber pier 'due to the need for more information to determine the overall structural condition'.

4.4 A consultancy brief for a detailed 'principal' inspection and structural report on a number of the Council's main piers and harbours, including Helensburgh Pier, was issued in early 2017, in line with AECOM's recommendations, and awarded to the consultant Arch Henderson in May 2017. Principal inspections provide information on the underlying condition of the facility and any potential limitations on berthing loads. The report for Helensburgh Pier, received by the Council in October 2018, recommended that:-

- *'…there may be eccentric loading put into piles due to missing timbers and coupled with the erosion of the timber structure within the tidal zone, it is recommended that a detailed structural analysis is carried out to confirm the structural; integrity of the pier.'*

- *'It is further recommended that a restriction should be put in place to prevent any vessels from berthing at the pier until the above analysis is carried out.'*

A Notice to Mariners was duly issued based on the report recommendations.

5.0 DETAIL

5.1 Following receipt of the Arch Henderson report, a structural analysis was organised utilising in-house resources; Argyll and Bute Council's Infrastructure Design Department inspected the structure above the water level, whilst Tritonia Scientific Ltd undertook a dive survey of the structure below. BM Trada undertook invasive testing of the timber piles and several other timber members. The surveys carried out identified that much of the bracing timbers, high-level horizontal members and connection plates require replacing. The underwater survey found no evidence of significant structural damage to the majority of the timber piles, however noted that the South East corner had suffered significant impact damage. Results from computer analysis indicated that the structure undergoes significant movement when berthing loads are applied. The design analysis and related surveys have cost, to date, in the region of £30K.

5.2 A topographic, bathymetric, and 3D laser scan survey of the pier and surrounding area was undertaken by Aspect Land + Hydrographic Surveys during July 2017. An excerpt is presented in Appendix A. The diagram in Appendix B shows movement in the structure when berthing

loads are applied and the photograph in Appendix C shows missing timbers in the fire-damaged area.

5.3 No funding has, as yet, been identified for carrying out reinstatement works at the pier. The following options are currently under consideration:-

- Minor repairs to the existing timber pier. This option would ensure safe access for pedestrians only; it would not facilitate berthing of the Waverley and the fire-damaged section of the pier would remain off-limits. Related costs are likely to be in the region of £60K.

- Major repairs to the timber pier to reinstate all damaged sections: This option would facilitate Waverley berthing and permit full pedestrian access. Essentially, all damaged timbers would be replaced on a like-for-like basis, including timbers in the fire-damaged area. Costs for this option are likely to be in the region of £850K.

- Construct new berthing structure (monolithic piles with fendering system) adjacent to the pier and connected by an access gangway: This option would allow the Waverley to berth. Costs are likely to be in the region of £580K for this option – but see 5.6 below – listing of the pier.

- A further option could also be considered which would allow the re-opening of the berth face to smaller vessels i.e. with lesser berthing loads than the Waverley. A cost estimate for related works is yet to be produced.

- Following a meeting with Waverley Excursions, yet another option is now being considered which would involve berthing the Waverley to the west side of the pier. This option would involve dredging to allow the Waverley to approach the west side of the pier, but would involve less work on the pier itself. Again, a cost estimate for related works is yet to be produced.

5.4 As mentioned previously, funding has not been identified for any of the current options under consideration; as such, high cost options identified above (2nd and 3rd bullet points) will not be pursued.

5.5 At this time, it is understood that work to replace Waverley's boilers is likely to cost in the order of £2 million. Although Waverley Excursions are confident that all necessary works will be carried out, it is unlikely that the Waverley will return to Helensburgh Pier until the 2020 sailing season.

5.6 Listing of the pier – Helensburgh Pier has recently been listed as a Category C structure. The guidance document issued by Historic Environment Scotland on the principles of listed buildings consent, states the following:-

'*Listed buildings are protected under the Planning (Listed Buildings and Conservation Areas) Scotland Act 1997. This establishes that any work which affects the character of a listed building will require listed building consent. It is a criminal offence to carry out such work without listed building consent'.*

The guidance document also states:-

'In assessing an application for listed building consent, the planning authority is required to have special regard to the desirability of preserving the building , or its setting, or any features of special architectural or historic interest which it possesses.'

It is therefore likely that, at least some of the proposals being considered for Helensburgh Pier, may require listed building consent – although, further advice in the guidance note states that '*like-for-like repairs would not normally require listed building consent'*. If a proposal is identified which is likely to affect the appearance of the pier, further guidance will be sought on this issue.

5.7 In the meantime, a local group made up of volunteers with professional backgrounds, the 'Helensburgh Seafront Development Project' (HSDP), has been researching options to introduce pontoons at Helensburgh Pier. The HSDP was set up as a SCIO Charity in December 2015 (SC046191).

Their Scottish Charity Registration states:

The organisation's purposes are:

1. To develop new recreational and community facilities at Helensburgh seafront for the benefit of the community and the general public and to foster wider community regeneration of the town.

2. To enable provision and organisation of recreation activities to improve quality of life and wellbeing for residents of Helensburgh & Lomond and its environs.

3. To enable the advancement of public participation in sports and recreation by creation of facilities and to targeting those affected by poverty, ill health and disability by working in partnership with other groups and agencies such as Enable to allow participation in canoeing and other water sports in the water basin area (West Bay Lagoon).

A Crowdfunder campaign in 2017 raised £850 for a feasibility study to progress the regeneration project. The HSDP's intention at that time was to save and regenerate Helensburgh Pier, and install a Wavebreaker / Walkway which would help with flood prevention and also provide a calm safe environment for water sports in Helensburgh's West Bay Lagoon. They also intended to install pontoons to attract visitors and small craft to the town and accommodate the Waverley Paddle Steamer.

HSDP's website currently outlines phase 1 of their project as a "technical feasibility study & business plan - the study will be used to assess the technical issues, operational constraints and the initial business case for the pier refurbishment".

5.8 Council officers and representatives from HSDP have now met on a number of occasions to exchange information and discuss HSDP's plans. Gerard Lindsay and David Cantello from HSCP have now stated that their objective is to develop the pier to cater for small craft by installing pontoons to the east side and confirmed their understanding that refurbishment of the main pier structure is a matter for the council. Discussions have centred on assessing the viability of introducing these pontoons. A plan, indicating the likely location for new pontoons, is attached in Appendix D to this report. As both planned works could well be inter-dependent i.e. a)

the Council's potential plans to re-instate a safe pedestrian area and/or re-open the berth face and b) the HSDP's plans to introduce pontoons, it is proposed that liaison between both groups continues for the mutual benefit of all interested parties.

5.9 Council officers have confirmed to HSCP representatives a willingness to share any helpful information obtained by them while assessing or progressing works agreed by the Harbour Board. It has been made clear that any additional studies/information required specifically to progress the HSCP's proposals will be the responsibility of HSCP.

6.0 CONCLUSION

6.1 A slow accumulation of decay, mechanical and fire damage has resulted in serious degradation of the Helensburgh Pier timber structure. Vessel berthing can only be permitted once strengthening works have been completed. Officers will continue to consider options, whilst liaising with both the Waverley Trust and HSDP.

7.0 IMPLICATIONS

7.1 Policy - None

7.2 Financial – Currently, no funding source has been identified.

7.3 Legal – The Council has a responsibility to ensure that the pier remains safe for users.

7.4 HR - None

7.5 Equalities / Fairer Scotland Duty – None

7.6 Risk – The berth at Helensburgh Pier will remain closed until such times as strengthening works have taken place.

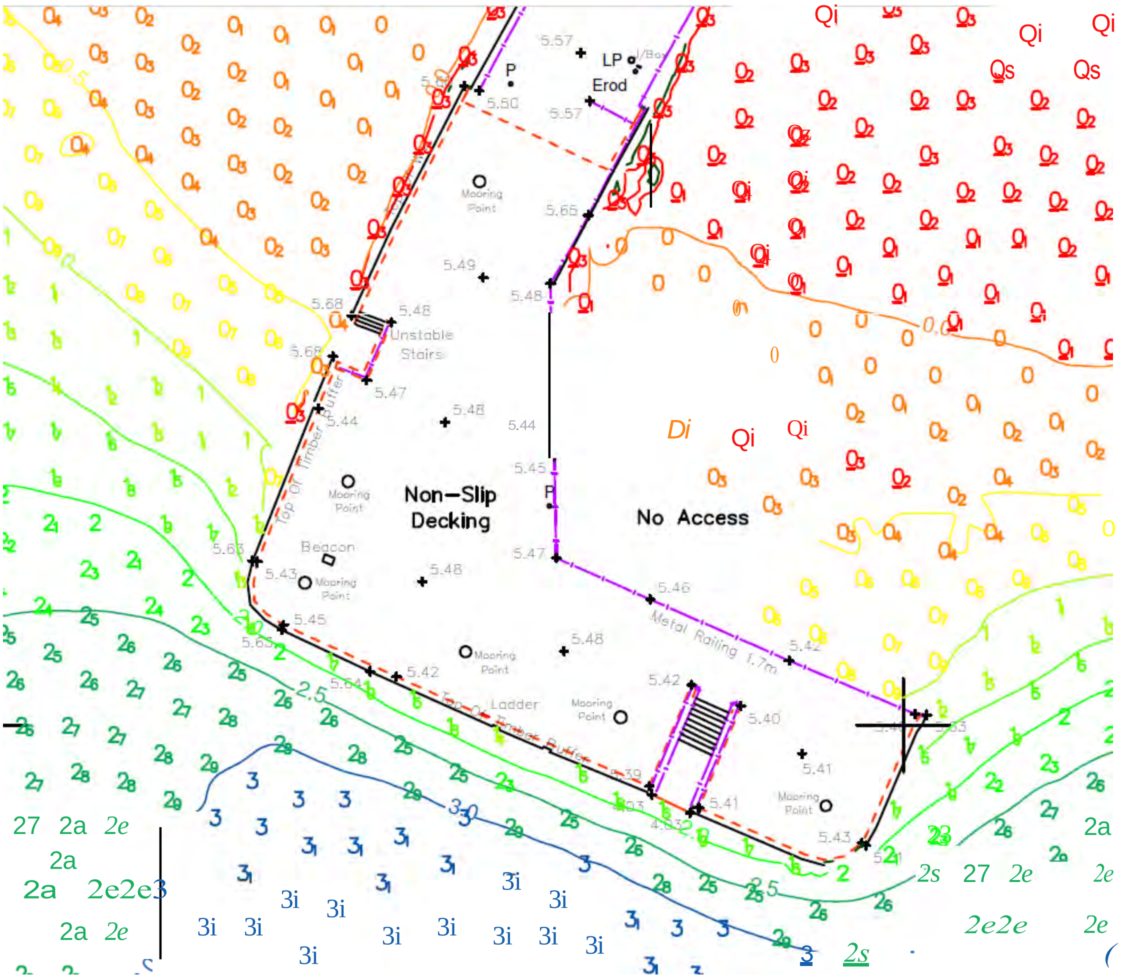
7.7 Customer Service – None.

Executive Director of Development and Infrastructure: Pippa Milne
Head of Roads & Amenity Services: Jim Smith
Policy Lead: Councillor Roddy McCuish
22 May 2019

For further information contact: Stewart Clark, Marine Operations Manager
Tel: 01546 604893

APPENDIX A

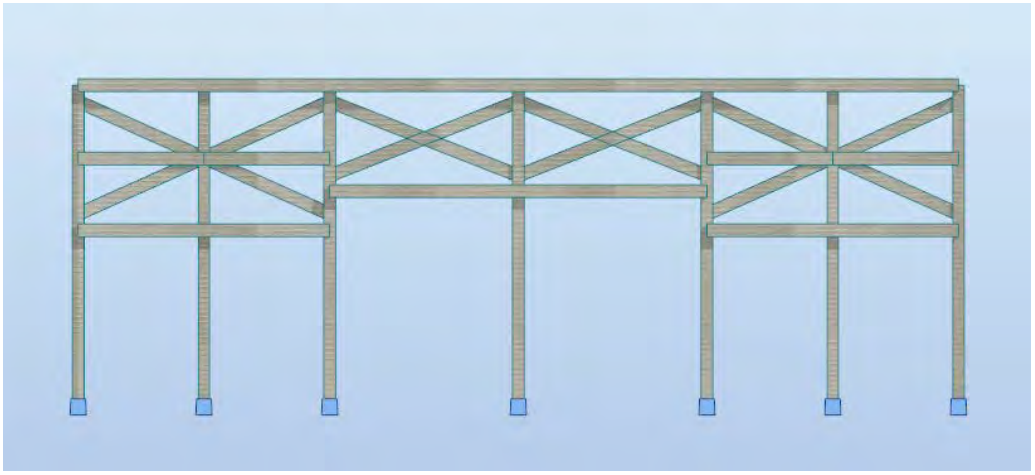
Bathymetric Survey



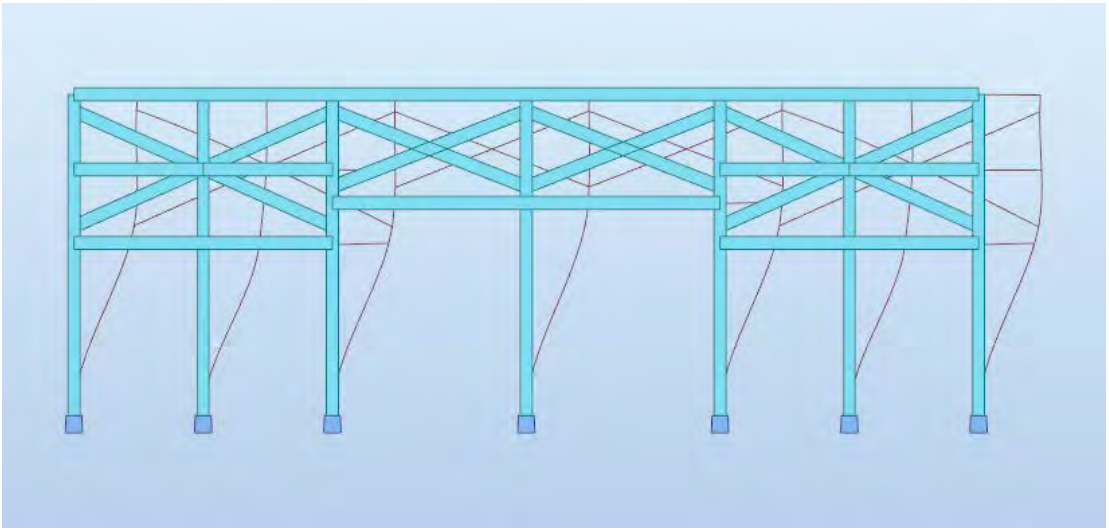
Non–Slip Decking
No Access
Unstable Stairs
Mooring Point
Beacon
Ladder
Metal Railing 1.7m
Top of Timber Buffer
LP
Erod
P

APPENDIX B

Structural / Sway Analysis



2D analysis of three cross sections of the timber pier head structure was undertaken.



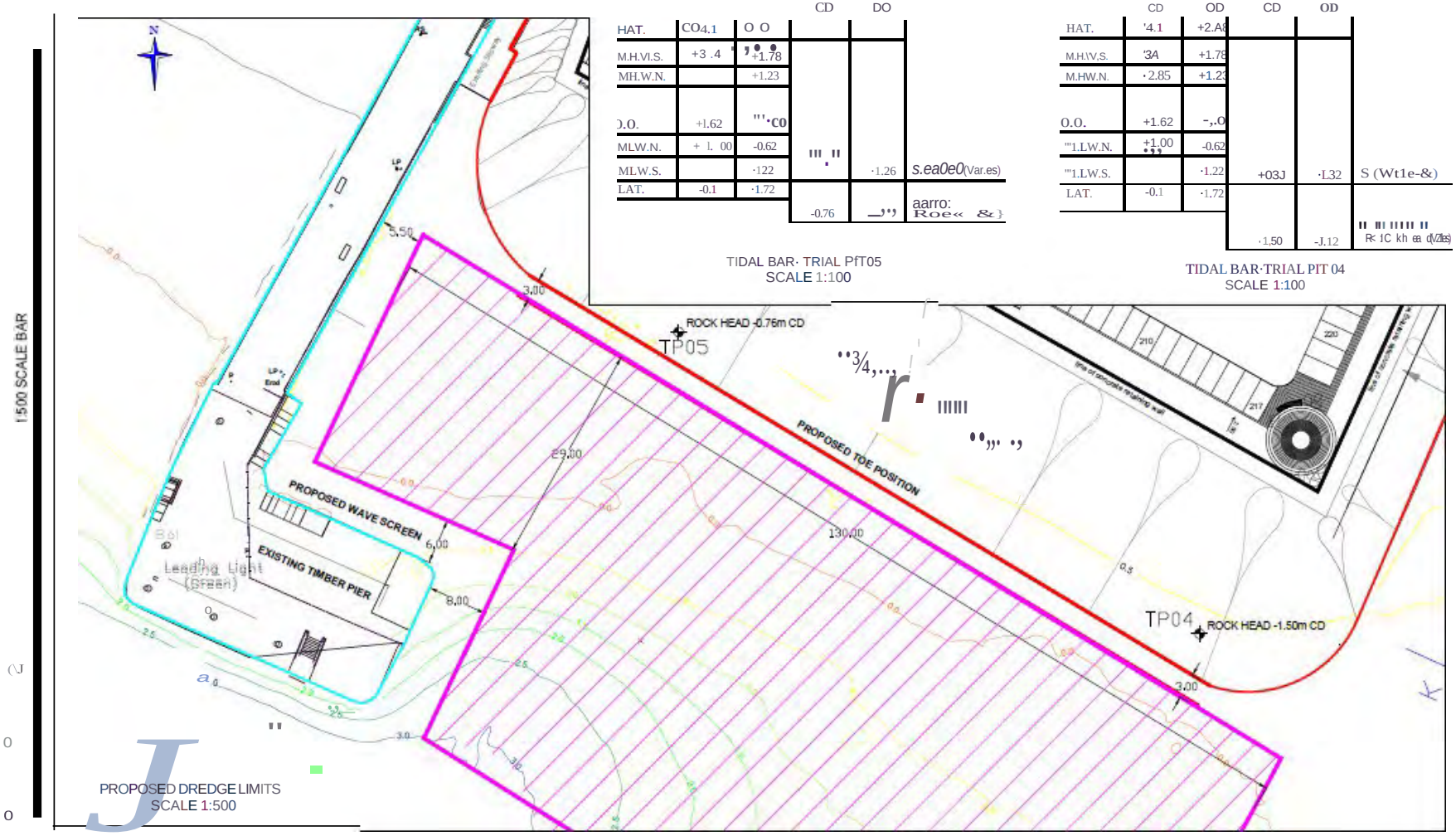
With the present condition of the timber elements, the structure failed with regards to BS 6349 calculated berthing and impact loads for a vessel representing the PS Waverley. The failure of the members was observed in exceeding the allowable displacements and stresses.

APPENDIX C

Fire damaged area missing deck planks

APPENDIX D

ARGYLL & BUTE COUNCIL --- DEVELOPMENT AND INFRASTRUCTURE SERVICES



PROPOSED DREDGE LIMITS
SCALE 1:500

			CD	DO	
HAT.	CO4.1	O O			
M.H.VI.S.	+3 .4	+1.78			
MH.W.N.		+1.23			
).O.	+l.62	"'·C0			
MLW.N.	+ l. 00	-0.62			
MLW.S.		·122		·1.26	s.ea0e0(Var.es)
LAT.	-0.1	·1.72	-0.76		aarro: Roe« & }

TIDAL BAR· TRIAL PfT05
SCALE 1:100

1:100 SCALE BAR

	CD	OD	CD	OD	
HAT.	'4.1	+2.A8			
M.H.\V.S.	'3A	+1.76			
M.HW.N.	· 2.85	+1.23			
O.O.	+1.62	-,.O			
"'1.LW.N.	+1.00	-0.62			
"'1.LW.S.		·1.22	+03J	·L32	S (Wt1e-&)
LAT.	-0.1	·1.72			
			·1.50	-J.12	R< 1C kh ea d(Vles

TIDAL BAR·TRIAL PIT 04
SCALE 1:100

Legend:

Proposed Rock Armour Revetment Toe

Existing Timber Pier

Dredging Boundary

Notes:

1) All dimensions are in metres unless stated otherwise
2) Levels shown are in metres to Chart Datum
3) Do not scale from this drawing
4) Dredging prohibited within:
   3.0 metres from toe of proposed revetment
   5.5 metres from approach pier
   6.0 metres from north east face of pier head
   8.0 metres from east face of pier head.

TITLE

Helensburgh Pier
Proposed Dredge Limits

DESIGNOFFICE.
MANSE BRAE. LOCHGILPHEAO. ARGYLL.PA31BRO

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Argyll & Bute COUNCIL

Aspect
Land+Hydrographic Surveys
CHARTERED SURVEYORS

TEL: 01294 313 399 • WEB: WWW.ASPECTSURVEYS.COM

MULTIBEAM BATHYMETRIC SURVEY

HELENSBURGH PIER, ARGYLL & BUTE

SEPTEMBER 2022

PROJECT REF: A8235_HELENSBURGH PIER_2022

REV: 00

Client:

Argyll & Bute Council
Development & Infrastructure
Manse Brae
Lochgilphead
PA31 8RD

ices Approved Development Partner

Achilles UVDB SILVER PLUS

QAS INTERNATIONAL ISO 14001:2015 REGISTERED COMPANY

QAS INTERNATIONAL ISO 45001:2018 REGISTERED COMPANY

ISO 9001:2015

1. SCOPE OF WORKS

Argyll & Bute Council has an obligation with respect to the Port Marine Safety Code to routinely survey its marine areas of responsibility to maintain safe passage and navigation.

On their instructions, Aspect Land & Hydrographic Surveys Ltd are to complete a series of multibeam bathymetric surveys of 25 ABC port, harbour and ferry terminal locations.

A survey schedule is in place to ensure that all 25 operational ports and harbours are surveyed over a 3-year cycle. The designated ports to be surveyed within 2022 (Year 1) are:

- Achnacroish
- Campbeltown
- Cuan Sound (Luing)
- Cuan Sound (Seil)
- Helensburgh
- Kilcreggan
- Lismore Point
- Port Appin
- West Loch Tarbert

Details within this report relate to the multibeam bathymetric survey completed at Helensburgh on 16th September 2022, to establish current seabed levels.

The results of the bathymetric survey are detailed in the rendered drawing A8235_Helensburgh Pier_MBES_CD_20220916.dwg. This drawing is also rendered as PDF files for ease of viewing on non-AutoCAD systems.

2. DELIVERABLES REGISTER

A list of the rendered deliverables is provided in the table below:

File Name	Contents
A8235_Helensburgh Pier_MBES_CD_20220916.dwg A8235_Helensburgh Pier_MBES_CD_20220916.pdf	AutoCAD drawing containing multibeam bathymetric data to CD. Also rendered as a PDF for ease of viewing on non-CAD systems
A8235_Helensburgh Pier_ISO_20220916-20190702.dwg A8235_Helensburgh Pier_ISO_20220916-20190702.pdf	AutoCAD drawing containing isopachyte data to level difference. Also rendered as a PDF for ease of viewing on non-CAD systems
A8235_Helensburgh Pier_MBES_0-5m_CD_20220916_Neg.xyz	ASCII XYZ file containing multibeam bathymetric data at 0-5m post-spacing to CD
A8235_Helensburgh Pier_MBES_Image_20220916.tif/tfw	Georeferenced imagery of multibeam bathymetric survey
A8235_Helensburgh Pier_MBES_Image_20220916.kmz	Georeferenced imagery of multibeam bathymetric data for viewing in Google Earth
A8235_Helensburgh Pier_MBES_CD_20220916.qscene	Fledermaus Scene file containing multibeam bathymetric data
A8235_Helensburgh Pier_Report of Survey_Rv0.pdf	pdf Report of Survey

3. GEODESY & DATUM

The horizontal datum used throughout the data gathering phase of the survey was OSGB36 (OSTN15). Data has been rendered in OSGB36 Datum, British National Grid.

The vertical datum for all data issued is Chart Datum. OSTN15 defines OSGB36 National Grid in conjunction with the National GPS Network.

In this respect OSTN15 can be considered error free (not including any GPS positional errors). The agreement between OSTN15 and the old triangulation network stations (down to 3rd order) is 0.1m rms.

Chart Datum is 1.62m below Ordnance Datum at Greenock.

4. MULTIBEAM BATHYMETRIC SURVEY

The following equipment was utilised throughout the duration of the survey:

Survey Vessel	Coastal Sensor II (MCA Cat III)
Positioning System	Trimble Applanix POS MV
GPS Correction Source	Trimble VRS NOW Network RTK
Echosounder	R2Sonic 2022 Multibeam System 400kHz
Motion Compensator	Trimble Applanix POS MV

ALHS' R2Sonic 2022 multibeam sonar system was used for the bathymetric survey. This was controlled using Sonic Control software during data gathering.

Detailed data with full seabed coverage was gathered throughout the survey area as a result of the R2Sonic 2022 head's narrow beam width and high ping rate and the selection of 400kHz as an operating frequency.

The system was operated at the maximum ping rate achievable throughout the survey, such that the ping rate was controlled by the depth of water.

Sound Velocity (SV) dips were carried out prior to commencing survey operations and thereafter whenever the surface sound velocity varied by more than 2 ms^{-1}. The SV dips were carried out using a Valeport Swift dipping probe with Datalog Express software, and the data was incorporated into the Hysweep Survey software for real-time corrections.

Positioning was achieved using an Applanix Pos MV Inertial system, providing horizontal and vertical positioning. Motion compensation for the system was provided by an Applanix Pos MV motion sensor mounted directly at the sonar head.

An R2Sonic Sonar Interface Module (SIM) was used to control the sonar throughout the course of data gathering. The multibeam data was transmitted to the survey laptop running Hypack Hysweep over an Ethernet connection. Hypack Hysweep Survey was used for data gathering. Hypack MBMax software was used for post-processing. The stages of multibeam processing are detailed in Annex B.

Data was gathered to give at least 200% insonification over the survey area. This allowed full quality assurance checks to be carried out. Calibration values for the survey vessel were calculated from a patch test conducted on the day of data collection. Details of the conduct of the patch test can be seen in Annex C.

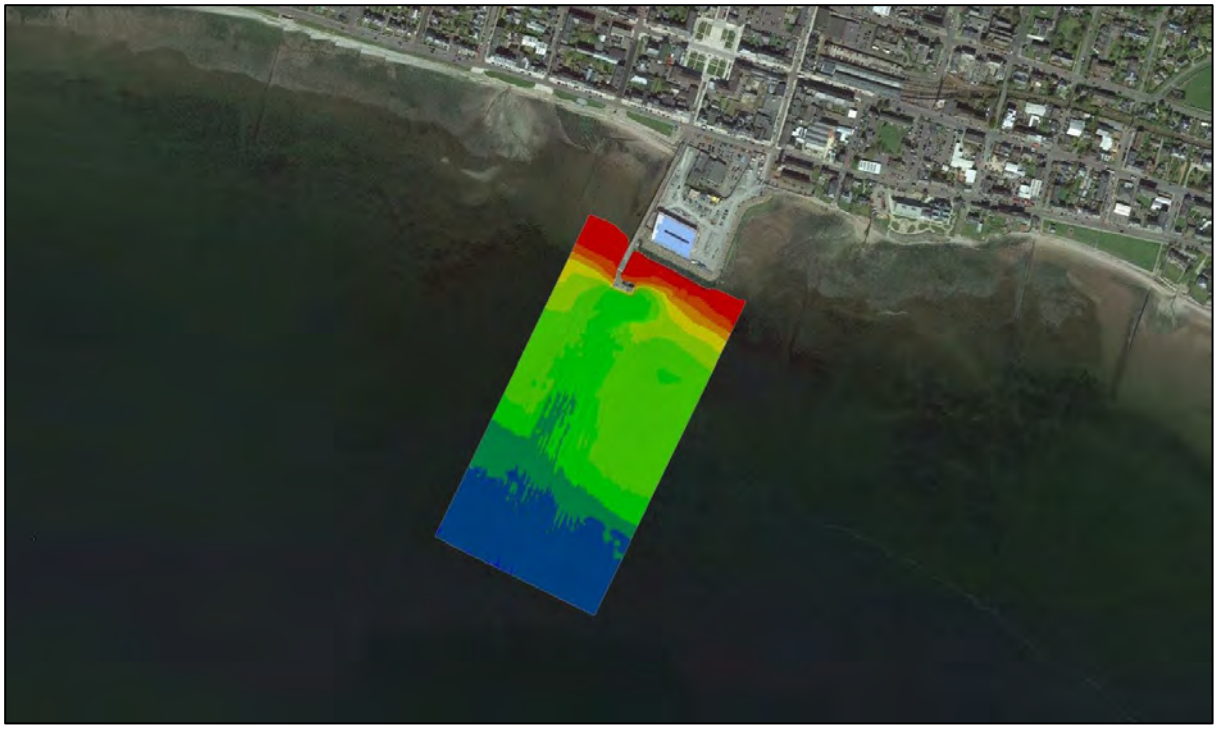


FIGURE 1 - HELENSBURGH PIER (GOOGLE EARTH IMAGE)

The depths encountered when surveying the area around Helensburgh Pier ranged from 1.3m above to 4m below CD. An overview of the data collected can be seen above.

There hasn't been much change across the site since the previous survey in 2019. The noticeable changes appear around the front of the pier. Any changes can be seen on the isopachyte drawing.

5. SURVEY VESSEL

ALHS' survey vessel Coastal Sensor II was used to carry out the multibeam bathymetric survey.

FIGURE 2 - SURVEY VESSEL COASTAL SENSOR II

6. SURVEY STANDARDS

The hydrographic survey is considered complete to International Hydrographic Organisation Special Order standard, with a Full Sea Floor Search being achieved as per IHO publication S44, Table 1. A representation of the section of interest within that document is shown in Table1:

Order	Examples of Typical Areas	Horizontal Accuracy (95% Confidence Level)	Depth Accuracy for Reduced Depths (95% Confidence Level)	100% Bottom Search	System Detection Capability	Maximum Line Spacing
Special	Harbours, berthing area and associated critical channels with minimum under keel clearances	2m	a = 0.25m b = 0.0075	Compulsory	Cubic features > 1m	Not applicable as 100% search compulsory

The error limits for depth accuracy are calculated by introducing the values listed in Table 1 for a and b into the formula $\pm\sqrt{[a^2+(b*d)^2]}$, where:

a constant depth error, i.e. the sum of all constant errors.

b*d depth dependent error, i.e. the sum of all depth dependent errors.

b factor of depth dependent error.

d depth.

The multibeam system was shown on numerous instances to be capable of detecting objects far smaller than the 1m cubic features specified for a Special Order survey.

7. SURVEY PERSONNEL

The following personnel were involved in the completion of the survey:

NAME	POSITION
C. Stephenson	Quality Assurance & Data Release
R. Angus	Hydrographic Surveyor
A. Morrison	Survey Coxswain

8. DOCUMENT ISSUE RECORD

DATE	REVISON	COMPILED	CHECKED	NOTES
27/09/2022	00	AJ	CKS	First Issue

Annex A
Horizontal & Vertical Positioning System Precision

A8235

Dynamic Positioning Precision

	HORIZONTAL ACCURACY	VERTICAL ACCURACY
REAL TIME KINEMATIC GPS	±10mm + 1ppm RMS	±20mm + 1ppm RMS

Annex B
Data Processing Procedures

A8235

Sonar Control 2000 software was used to control the MBES system during the data gathering phase.

Data was logged in HYPACK HYSWEEP software.

After data gathering the data was post processed in HYPACK MBMax where the following stages of processing were undertaken:

- Navigation data was processed.
- Motion Sensor data was examined and edited as required.
- Tidal data was examined and edited as required
- Automatic filtering of the data was carried out.
- Individual lines of MBES sounding data were manually edited.
- The data was gridded at appropriate post spacing for the scale of plot requested by the client. This was exported to AutoCAD for presentation.
- The data was contoured at 0.5m intervals in Hypack and exported to AutoCAD.

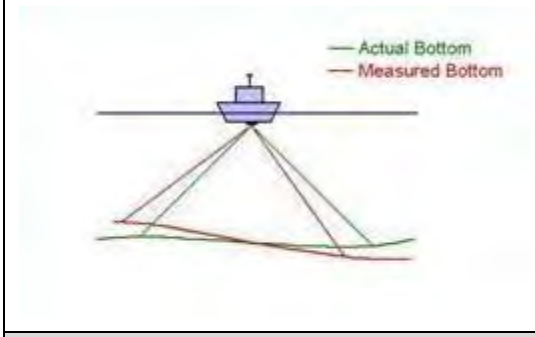
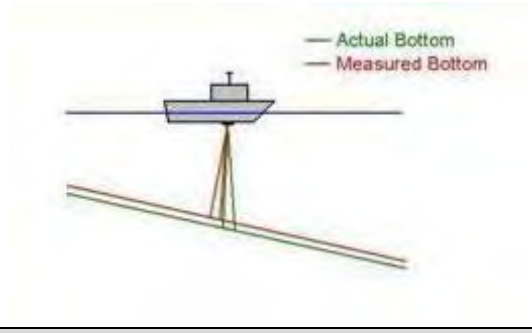
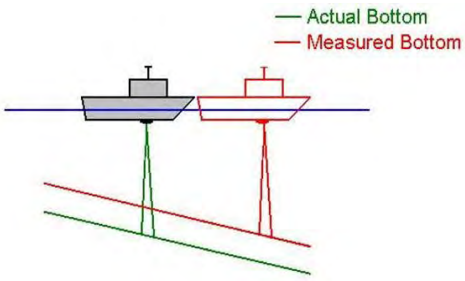
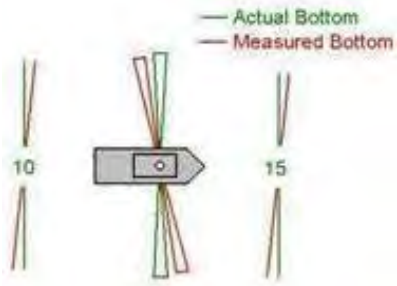
Annex C
Multibeam Echosounder Calibration

A8235

Patch tests are tests which are performed after initial equipment installation, and periodically thereafter as well as if sensors are modified, to quantify any residual biases from the initial system alignment.

During this calibration series, four separate tests must be performed to determine residual alignment biases for:

- Roll Offset
- Position Time Delay (Latency)
- Pitch Offset
- Yaw (Heading) Offset

ROLL	PITCH
	
▪ *Sonar and Motion Reference Unit (MRU) alignment relative to vertical.* ▪ *Can cause large depth and position errors at outer beams.*	▪ *Sonar and MRU alignment relative to vertical.* ▪ *Can cause depth and position errors across the swath.*
LATENCY	YAW (HEADING)
	
▪ *The delay between position and fix transmission.* ▪ *Will cause positional errors.* ▪ *Error is independent of multibeam system.*	▪ *Sonar and MRU alignment relative to vertical* ▪ *Can cause depth and position errors across the swath.*

Annex D
Standard Disclaimer

A8235

1. All client-supplied data is taken on trust as being accurate and correct, and ALHS cannot be held responsible for the quality and accuracy of that data set.

2. Geophysical interpretation of bathymetry and sonar is based on an informed opinion of the supplied data, and is subject to inherent errors out with the control of the interpretational hydrographer or geophysicist, which include but are not limited to GPS positioning errors, navigation busts, data quality, assumed speed velocity sediment profiles in the absence of Geotechnical data, sub bottom profile pulse width, and induced scaling errors therein associated with seismic signature. Seabed geomorphology and sub-seabed geology should be further investigated by visual or intrusive methods.

3. The limits of this survey are defined by the data set; out with the survey limits are not covered at any level by ALHS.

4. The data is accurate at the time of data acquisition, ALHS cannot be held responsible for environmental changes, and the client by accepting this report accepts that the environment of the seabed is subject to continuous change, that items of debris, hard contacts etc. may move, appear, be relocated or removed, thickness of surficial sediment change out with the knowledge of ALHS and they will not be held responsible for such actions at any level.

Appendix B Photographs

Figure App B 1: Pier from Shoreline

Figure App B 2: View of Pierhead from Masonry Approach Section

Figure App B 3: Recently Installed Composite Decking on Pierhead

Figure App B 4: Concrete Slipway between Pier and Leisure Centre

Figure App B 5: Missing Steps on Western Side of Pierhead

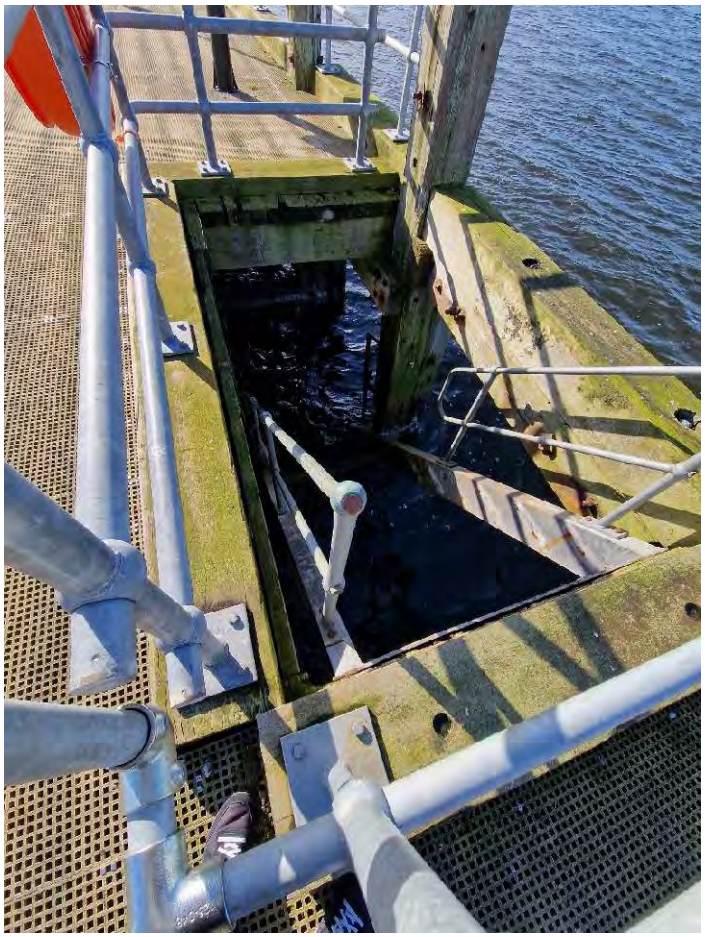


Figure App B 6: Pierhead Deck Facing Seawards

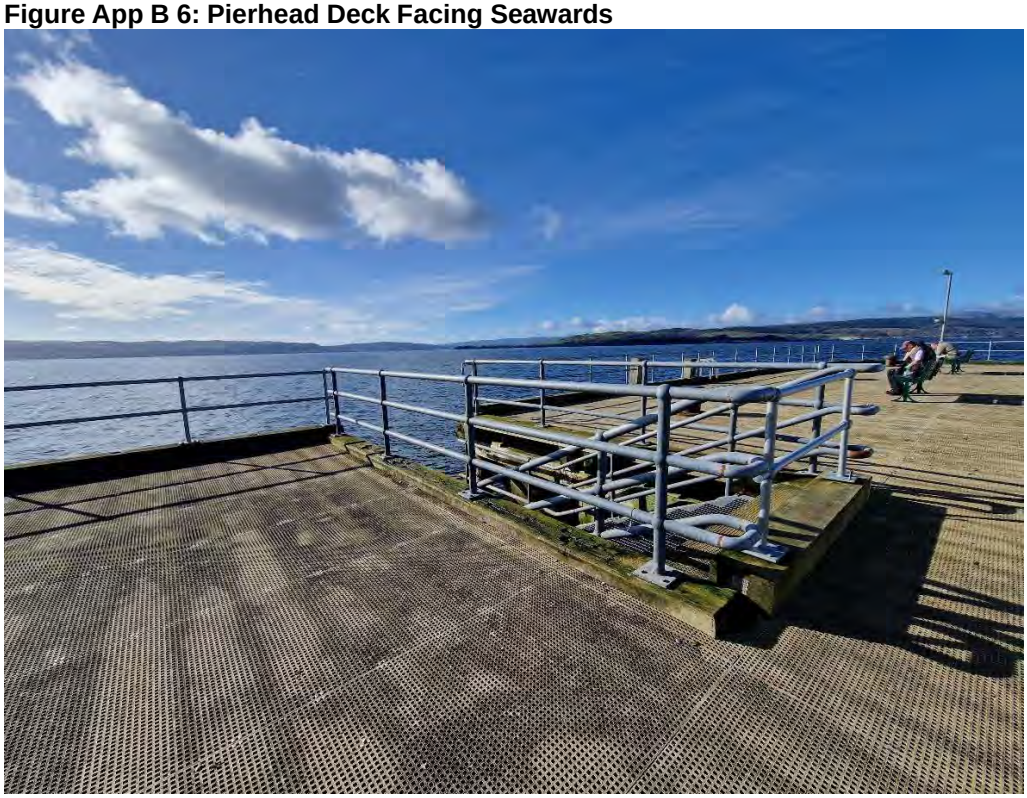


Figure App B 7: Boat-steps on Berthing Face of Pierhead

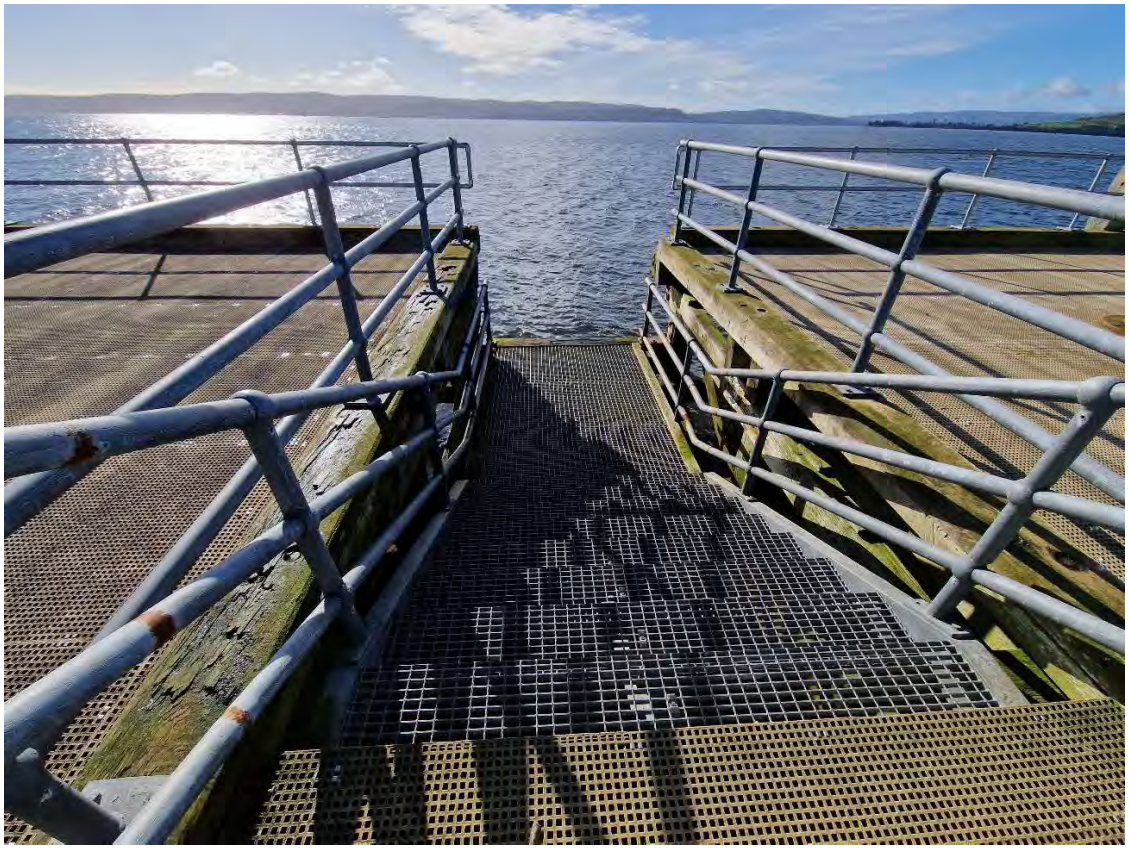


Figure App B 8: Fire Damaged Section of Pierhead (1)

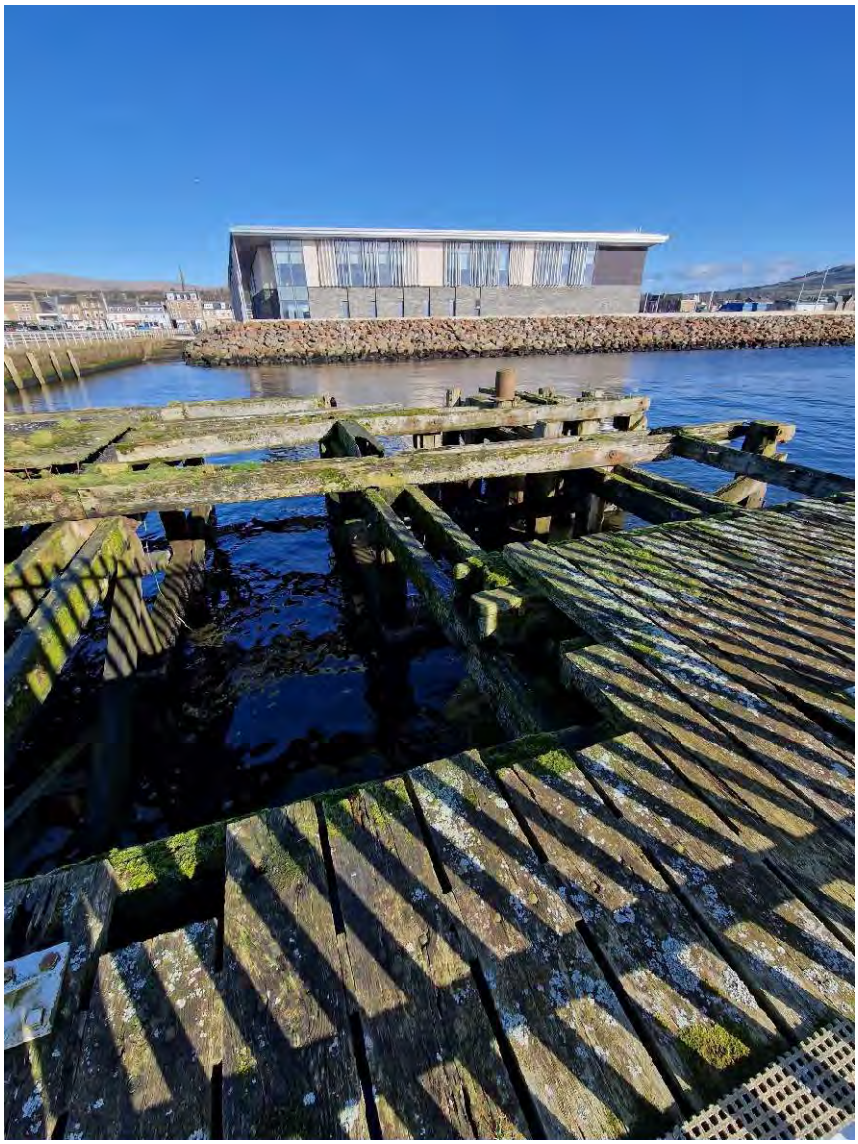


Figure App B 11: South-East Corner of Pierhead

Appendix C Proposed Pontoon Facility Specification

HELENSBURGH PIER

Proposed Floating Pontoon Extension for berthing Small Ships, Ferries, MOD Vessels & Leisure Craft

SPECIFICATION

Revised 08/12/22

History

1.1

In 1812, Henry Bell invented and built “Comet”, the first sea going paddle steamer in Europe. A rough stone pier was built in 1816 to berth “Comet”, which was bringing customers to Bell’s Baths Hotel in the town. He ran the first commercial paddle steamer route from Glasgow to Helensburgh. The now existing stone part of the pier dated from 1859 and the timber extension was added at the southern outer end in 1871.

In 1866, North British Railway Company started to establish regular steamer services from the pier until they constructed twin piers at Craigendoran with railway track spur to the pierhead 1.6km to the east of Helensburgh pier. Their steamer services moved from Helensburgh to Craigendoran in 1882. Craigendoran piers have since been dismantled.

Today, the timber outer end of Helensburgh pier is part derelict and in poor structural condition due to lack of maintenance. The pier has been closed to marine traffic since 2018.

Also, silting-up of the seabed occurs around the pierhead and the shore in the adjacent area. This required regular dredging to provide sufficient water depth to allow vessels to approach and safely berth at the pier at all states of the tide.

2.0 Stone Pierhead

2.1

Pier is constructed with cut and fitted blocks of stone and is 8.5 metres wide at the outer end. The height of the top surface is at +5.6 metres chart datum (CD).

3.0 Tidal Information

3.1	Chart Datum - metres
Highest Astronomical Tide (HAT)	+3.9
Mean High Water Springs (MHWS)	+3.4
Mean High Water Neaps (MHWN)	+2.8
Ordnance Datum (OD)	+1.62
Mean Low Water Neaps (MLWN)	+1.0
Mean Low Water Springs (MLWS)	+0.3
Chart Datum	0.0
Lowest Astronomical Tide (LAT)	-0.3

4.0 Wave Climate

4.1

Wave height is based on the direction and speed of the prevailing wind, as well as the fetch length for a given direction. i.e., the clear distance over water in one direction before encountering land.

4.2

Wind Data

Published wind data for Glasgow Airport confirmed the maximum estimated wind speeds and provided data on the prevailing wind direction. The dominant wind direction is from the southwest.

Estimated wind speeds based on basic wind speed of 24.5m/s

Return	Wind Speed metres per second				
Period	SE	S	SW	W	NW
Years					
2	14.65	16.17	18.45	18.83	16.55
5	16.12	17.79	20.31	20.73	18.21
10	17.03	18.79	21,45	21.89	19.24
25	10.10	19.99	22.81	23.28	20.46
50	18.87	20.83	23.77	24.26	21.32
100	19.59	21.63	24.68	25.19	22.14
200	20.29	22.40	25.56	26.08	22.92

4.3

Fetch Lengths

Bearing	Fetch Length	Land Description
Degrees	Km	
0 – 90	0.0	
106	1.6	Craigendoran Pier (dismantled)
136	4.0	Inner end of Ardmore Head
150	4.0	Ardmore Head
	8.8	Port Glasgow shore

157.5	SSE	7.7	Port Glasgow shore
180	S	6.2	Cartsdyke shore
202.5	SSW	5.1	Greenock shore
207		5.2	Greenock shore
225	SW	6.8	Gourock Bay
232		8.8	McInroy's Point
234		10.8	over Roseneath point to Cloch Point
		16.9	Dunoon shore
247.5	WSW	2.3	Roseneath, Culwatty Bay
270	W	2.3	Roseneath Peninsular
277		2.3	Castle Point
		3.4	Roseneath Jetty
295		3.4	Rhu Point
		5.2	Roseneath shore through Rhu Narrows
295 – 360		0.0	

Maximum wind speed is from the west (26.08 m/s) and from the southwest (25.56 m/s). The maximum straight fetch length is on narrow sector bearing 234 degrees.

4.4

Wave Data

Future wave heights predicted with wind from SW and fetch length of 16Km.

Return Period	Wave height
Years	metres
2	1.55
5	1.73
10	1.93
25	1.97
50	2.06
100	2.14
200	2.23

These predicted wave heights, which are increased by 15% to allow for rise in sea levels due to climate change.

Future wave period predicted with wind from SW and fetch length of 16Km.

Return Period	Wave Period
Years	Seconds
2	3.9
5	4.1
10	4.3
25	4.3
50	4.4
100	4.4
200	4.5

5.0 Proposed Floating Pontoon Extension

5.1

General Description

Existing timber outer end of the pier, which is in poor structural condition, will be removed and replaced by a 140 metre long floating pontoon extension accessed from the outer end of the stone pier by a 25 metre long X 2 metre wide bridge gangway. This arrangement is proposed to provide berthing for small ships in water depth of 3.5 metres chart datum with minimum of dredging. Small ships would approach the pontoon extension from deep water at a shallow angle to berth alongside either side of the pontoon extension. Small ships would depart by going astern back into deep water.

Additional to the main pontoon extension, it is proposed that alongside berthing would be provided for small passenger ferry, MOD vessels, other commercial craft and leisure craft. This will be 40 metre long pontoon berth connected to the inner end of the main pontoon extension at 90 degrees.

Fifth pontoon out on the main pontoon extension to have a raised deck level of 1.5 metres above water level. This is to provide optimum boarding arrangements for expected small ships.

Main 140 metre long pontoon extension to be 6 metres wide and have a freeboard of 1 metre. The 40 metre long pontoon, at 90 degrees, to be 4 metres wide and have a freeboard of 0.6 metres.

Whole arrangement of floating pontoons and access bridge must survive 1 in 200 year storm conditions.

Small ships up to following dimensions are to be accommodated.

Overall length	80 metres
Beam	20 metres
Draught	3.0 metres
Gross tonnage	2500gt

See drawings: DRG 1.1, 2 & 3

5.2

Mooring of vessels

Mooring Bollards are to be provided on both sides of the main extension spaced at approximately 10 metres. Consideration should be given to bollard pull that might be applied while berthing and un-berthing small ships and bad weather. It is not anticipated that these ships would berth during storm conditions.

Heavy duty marina style cleats to be provided on the small ferry, MOD vessel and leisure craft pontoon.

5.3

Services

Pontoons to have built-in ducts for water, electric power and low-level lighting.

5.4

Raised Deck level

It is envisaged that a raised deck level on a single pontoon would be strongly mounted on a ‘standard’ pontoon. This would be accessed by four ramps (ease of use for wheelchairs, barrows, etc.) See drawings.

5.5

Fendering

Main pontoons, except for raised deck pontoon, to have continuous heavy duty treated timber fendering suitable for small ships.

Raised deck pontoon to have greenheart or similar vertical fenders spaced at 1.0 – 1.2 metre centres on each side with dimensions 300mm x 140/150mm x 900mm high. These are to be strongly fastened to pontoon and deck supporting structure, which may be fabricated hot dip galvanised steel or marine grade aluminium construction. All fasteners to be hot dip galvanised steel or grade 316 stainless steel. The substantial fenders are to withstand impact of paddle steamer “Waverley” berthing. The steamer would approach the pontoon at a shallow angle and just before steamer’s sponson belting makes contact with the fenders the paddles are put astern to stop the steamer just before impact. Top of belting on paddle steamer is at 1.0 metres above sea level. The height of fenders should extend above top of deck such that vessels with belting

top up to 1.5 metres above sea level can be accommodated. Raised deck level structure must be strong enough to absorb hard impacts, which might arise during berthing of P. S. Waverley. Timber fenders should be fastened in place with bolts to allow easy replacement. The deck of raised deck may be of Iroko timber or marine grade non-slip checker plate.

5.6

Guard Rails

Main pontoon sections to have stanchions with detachable chains at one end between stanchions to provide a gate.

5.7

Chain & Concrete Anchor Moorings

Pontoons to be moored on chains, crossing below pontoons, and connected to concrete anchors.

5.8

P. S. Waverley

Length overall	73.15 metres
Beam over sponsons	17.45 metres
Draught	1.91 metres
Gross tonnage	693
Displacement	691.55 tonnes

Sponsons incorporate a spring beam to absorb impact with solid piers.

6.0 Scope of supply

A Main Pontoon Extension

1. Six pontoon units 6 metres wide x 20 metres long with freeboard of 1.0 metres with continuous fendering
2. One pontoon unit 6 metres wide x 20 metres long with freeboard of 1.0 metres with complete raised deck structure as per this specification with vertical fenders.
3. One bridge gangway 25m long x 2m wide with hinged bracket for attachment to stone pierhead.
4. Delivery
5. Offload, install and commission.

B Ferry, MOD vessels and leisure craft pontoons

1. Two pontoon units 4 metres wide x 20 metres long with freeboard of 0.6 metres with continuous longitudinal fendering.
2. Delivery
3. Offload, install and commission

C Moorings

1. Concrete block anchors.
2. Chains.
3. Offload, install and commission

D Services

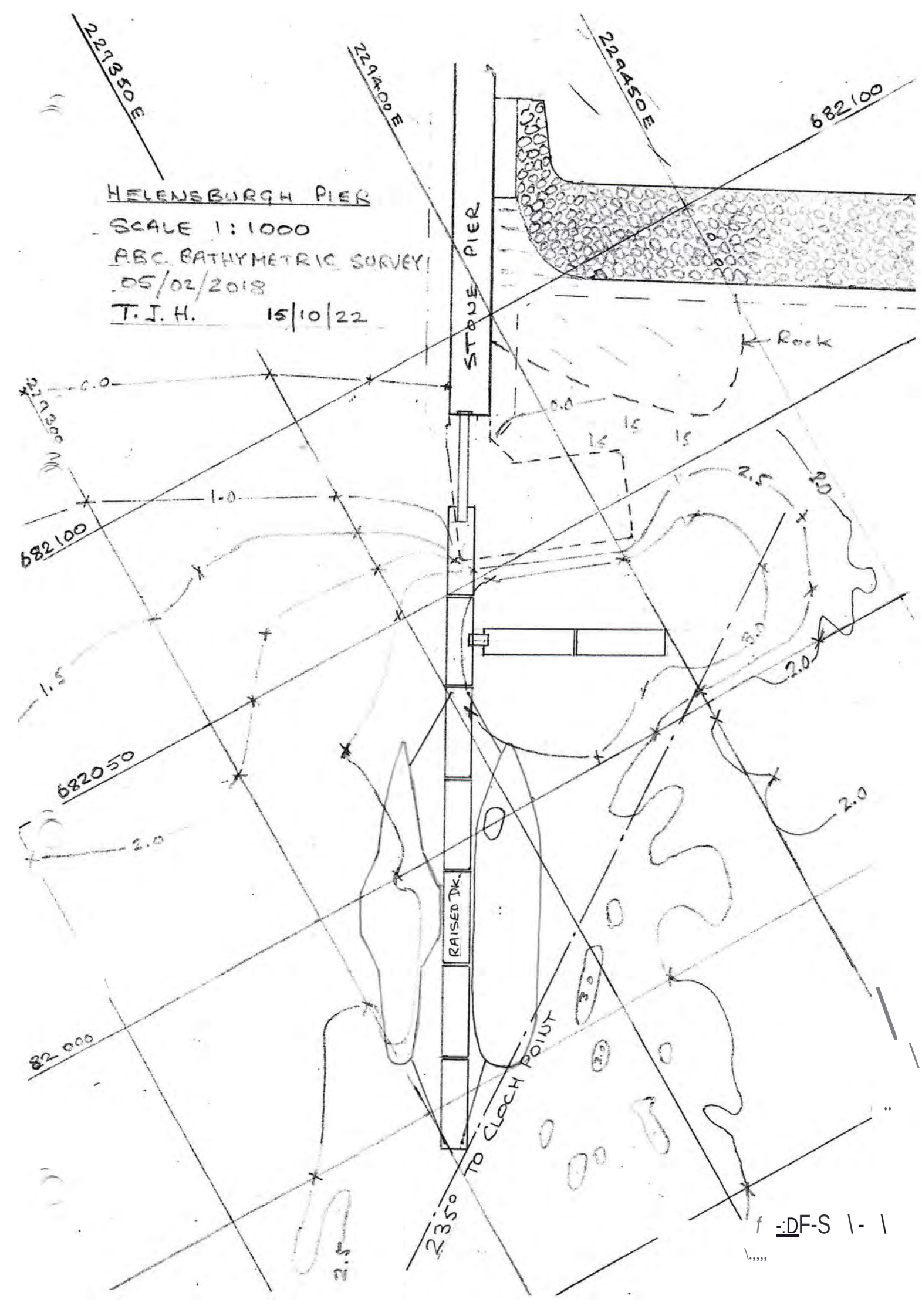
1. Built in ducts for water and electricity in pontoons
2. 440x300 utility box centre and 250x250 utility box sides

Revision A 06/08/22

Revision B 24/08/22

Revision C 08/12/22

Appendix D Proposed Pontoon Facility Sketches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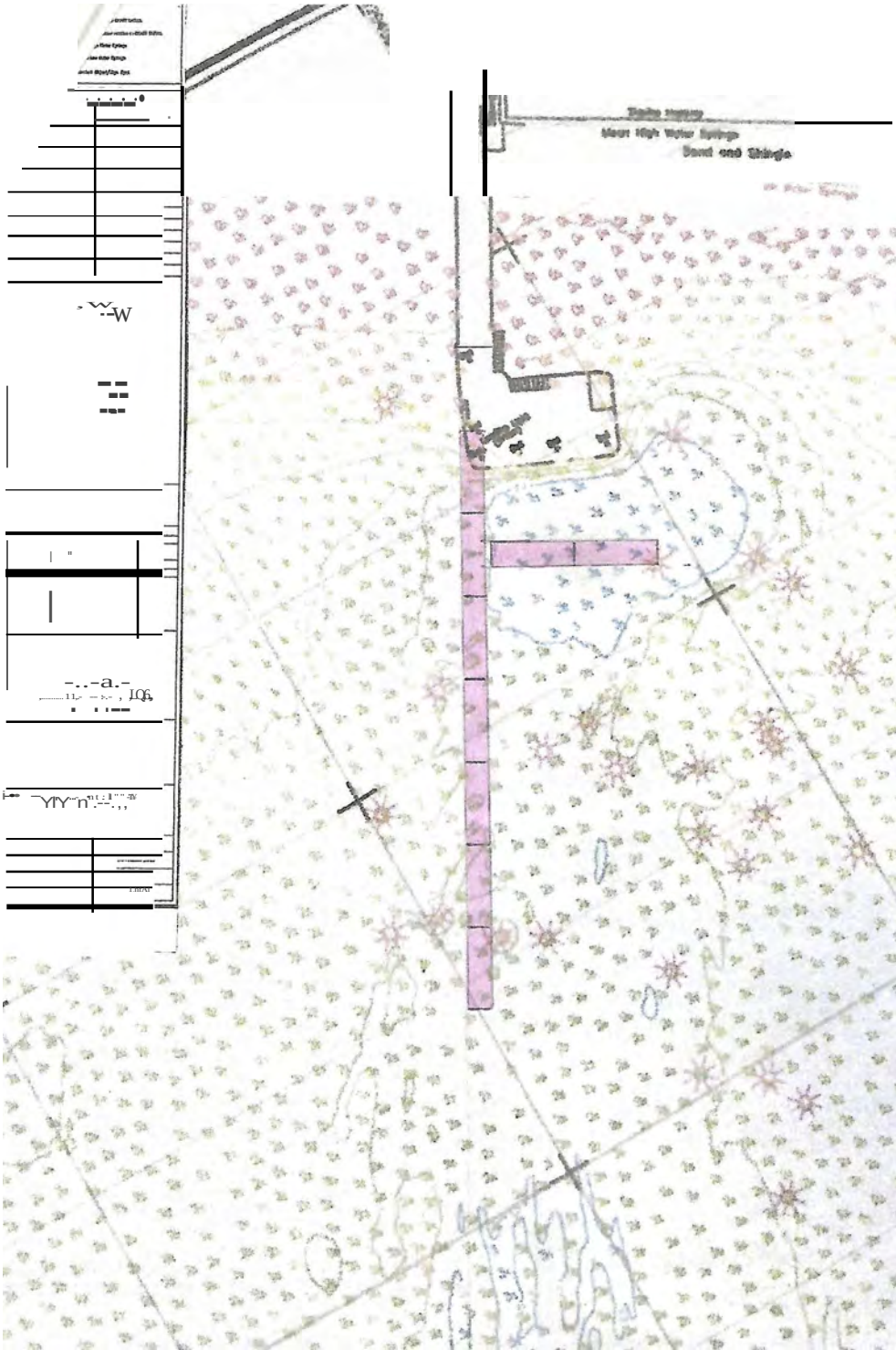
229400E
229450E
682100
HELENSBURGH PIER
SCALE 1:1000
ABC BATHYMETRIC SURVEY
05/02/2018
T.I.H. 15/10/22
STONE PIER
Rock
0.0
1.5
2.5
3.0
2.0
1.0
682050
RAISED DK.
TO CLOCH POINT
235°


Mean High Water Springs
Sand and Shingle