



Ullapool – Shore Street Widening & Promenade & Small Boat Harbour Development

Supporting Document



Date: 20/09/2021

Document Number: 63/REP/03



Document Control

| | Name | Title | | Date |
|------------|------------------------------------|--|----------------------------|------------|
| Author | Kirsty Macdonald, Sophie Fallon | Senior Environmental Consultants | K. Macdonald, S. Fallon | 30/06/2021 |
| Reviewer | Fiona Henderson | Managing Director | F. Henderson | 30/06/2021 |
| Authoriser | Fiona Henderson | Managing Director | F. Henderson | 07/07/2021 |

| | |
|-----------------|------------|
| Effective Date: | 20/09/2021 |
|-----------------|------------|

| Revision No: | Comments | Date |
|--------------|--|------------|
| 1a | For client review | 29/06/2021 |
| 1 | For Issue | 30/06/2021 |
| 2 | Drawing 2127-952 updated and report Issued | 07/07/2021 |
| 3 | Superseded Drawings Removed Reference Update and new version of Drawing 2127-951 | 20/09/2021 |
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1 Introduction

This Supporting Document has been produced on behalf of Ullapool Harbour Trust to support the Planning and Marine Licence applications for the proposed Ullapool Shore Street and Widening & Small Boat Harbour development.

The purpose of this report is to ensure that an appropriate level of information is provided to allow the licences to be determined whilst demonstrating compliance with the legal framework and planning policies in Scotland.

This report provides a description of:

- The location of the proposed development;
- The proposed development;
- The Statutory context in terms of both Marine and Terrestrial legislation, and the Planning policies for both Marine and Terrestrial development;
- Construction methods and an outline programme of works;
- Environmental aspects; and
- Mitigation in place to minimise negative effects.

2 Project Overview

Shore Street, Ullapool, trunk road number A893, links the main trunk road running through Ullapool, the A835, to the Ullapool-Stornoway ferry terminal. The ferry terminal is the main gateway between the mainland and the Outer Hebrides. Shore Street is also popular with residents and visitors to Ullapool as it includes shops, cafes and tourist accommodation; there are footways on both sides of the carriageway and on-street parking. The street is protected from the sea by a small seawall and concrete block revetment on the seaward side of the promenade. The 40-year-old concrete block revetment sea defence is in a poor state due to age related damage and undercutting.

The existing trafficable width of Shore Street is currently around 7.5m overall, including an on-street parking strip on the landward side of the carriageway which is 2.5m wide, leaving a carriageway width of only 5m. Shore Street also includes a Scottish Water pumping station part-way along the street, located within the seaward footway, which requires on-street access for servicing and maintenance, blocking the carriageway when this occurs. As the existing road is evidently too narrow for normal two-way traffic, cars, camper vans and HGVs routinely mount the seaward footway in order to pass each other. This has caused damage to sewage manhole covers on the footway. These issues all present a significant element of danger to pedestrians walking along the seaward footway, particularly during the tourist high season. With visitor numbers to the region and the number of people using the Ullapool to Stornoway ferry route increasing year on year, this problem will likely exacerbate without action (Comhairle nan Eilean Siar, 2018; Visit Scotland, 2018).

An application is being made to widen Ullapool's Shore Street to make a wider road carriageway, and to construct a new shoreside promenade in place of the existing footway. Proposals will improve safety for vehicles and pedestrians and remove the hazardous bottleneck which currently exists over this length of the primary access route between Ullapool's Ferry Terminal and the rest of the trunk road network. The Ullapool Shore Street



Widening and Promenade proposals require land reclamation and installation of new sea defences.

Small boats currently haul out on the beach to the western end of Shore Street, and the land reclamation will reduce the available space for haul out. To address this issue, the application also includes a development of a Small Boat Harbour within the inner basin of Ullapool Harbour. The Harbour Development works will consist of a new quay at the eastern end of Shore Street and the installation of new berthing pontoons in the area to the north side of the existing main pontoon. To facilitate safe navigation and berthing of vessels utilising the facilities provided, the area will require dredging and a floating breakwater pontoon will be installed on the eastern end of the existing main pier to protect the berthing pontoons from wave action.

The development of the Small Boat Harbour not only replaces the haul out facility, it upgrades Ullapool Harbour's provision for small boats to meet a growing demand. The additional quay space and pontoons will provide extra berths and access for inshore fishing fleet, blue tourism companies and recreational boat users.

2.1 Location

Ullapool is a coastal village in the Highland region that lies on the eastern shoreline of the sea loch, Loch Broom. See Drawings 63.01.01 and 63.01.04 for location details. Ullapool Shore Street (A893) lies on the southern limit of Ullapool, the proposed Shore Street Widening and Promenade lie between the junction with the A835 to the east (NH1313 9407) and the pier to the west (NH1284 9396). The existing layout of Shore Street is shown in Drawing 2127-901. The Planning Consent and Marine Licence boundaries of the Shore Street Widening and Promenade project are shown on Drawings 2127-951 and 2127-952 respectively.

The Small Boat Harbour Development is situated at the west end of Shore Street. Drawing 2127-911 shows the layout of the development, which is discussed further in Section 4.

Ullapool falls within the boundaries of the Highland Council. Ullapool harbour is managed by the Ullapool Harbour Trust (UHT). The Ullapool Harbour Port limits extend throughout Loch Broom and beyond out to Cailleach Head, the landward limits extend to the harbour junction on Shore Street and include part of the seating area and small boat layout area at the west end of Shore Street. Shore Street itself, as a designated Trunk Road, falls under the control of Transport Scotland, and the road widening and promenade proposals in the Applications have been prepared in detailed consultation with that Authority.

3 Statutory Context

This section provides a summary of the statutory requirements for the proposed Ullapool Shore Street Improvements and Small Boat Harbour project.

3.1 Legislation

This development sits partly onshore and partly in the marine environment, and as such is subject to legislation relating to both marine and onshore (terrestrial) environments.



3.1.1 Marine Licensing

Under the Marine (Scotland) Act 2010 activities listed in Part 4, Section 21 of the Act require a Marine Licence issued by the Marine Scotland Licensing Operations Team (MS-LOT). This includes any activity where the project intends to do any of the following below Mean High Water Springs (MHWS):

- Deposit or remove substances or objects in the sea either on or under the seabed;
- Construct/alter/improve any works in or over the sea or on or under the seabed;
- Remove substances or objects from the seabed; or
- Dredging activity.

Accordingly, the aspects of this development below MHWS will require a Marine Construction Licence and a Dredge Licence.

3.1.2 Permitted Development Rights

As detailed in Statutory Instrument 1979 No.1116 (provided in Appendix 1), Shore Street is classified as a trunk road. Under the Roads (Scotland) Act 1984, Transport Scotland (on behalf of Scottish Ministers) has the permissive powers to maintain and improve the trunk road which falls under The Town and Country Planning (General Permitted Development) (Scotland) Order 1992, as amended. As such, the works between the buildings and the toe of the existing sea wall are not subject to planning consent. Once constructed, it is likely that the full extent of the promenade and the rock armour will become part of the trunk road.

The Ullapool Pier (Works) Order Confirmation Act 1983 also give UHT rights to rebuild, maintain, repair, renew, widen, alter, improve, restore, reconstruct, and extend their undertaking which means that the Town and Country Planning (General Permitted Development) (Scotland) Order 1992, as amended, also applies to parts of the small boat harbour area.

3.1.3 Planning Consent

Under the Town and Country Planning (Scotland) Act 1997, any type of new development, i.e., carrying out of building, engineering, mining, or other operations in, on, over or under land, or the making of any material change in the use of any buildings or other land will require Planning Permission, in this case from The Highland Council. This refers to development above MLWS. The proposed Shore Street widening, and associated project elements (see Section 3.1.1), are proposed above MLWS. Those areas not covered by permitted development rights, as discussed in Section 2.1.2, will require planning consent. The planning red line boundary is provided in Drawing 2127-951.

3.1.4 Pre- Application Consultation

The Marine Licensing (Pre-application Consultation (PAC)) (Scotland) Regulations 2013 as amended, prescribes the marine licensable activities that are subject to PAC and in combination with the Marine (Scotland) Act 2010, sets out the nature of the pre-application process. The Proposed Project falls within Regulation 4(d) as a construction activity within the marine area exceeds 1,000m² therefore requiring the project to go through a PAC process compliant with marine legislation.



Due to the scale of the proposed project (less than 2 hectares), it is not deemed a 'Major Development' as defined in Regulation 2(1) of the Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009. The project therefore is not required to go through the PAC process compliant with the terrestrial process laid out in the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2008.

It should, however, be noted that the whole project has been the subject of the public consultation not just the marine elements. A PAC report has been produced for submission with the Marine Licence application.

3.1.5 Environment Impact Assessment

A formal Screening Opinion was requested from Marine Scotland under regulation 10(1) of The Marine Works (Environmental Impact Assessment (EIA)) (Scotland) Regulations 2017 ('EIA Regulations') and The Highland Council under Regulation 8(1) of The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 respectively. A Screening Report was submitted to inform the Screening Decision (Appendix 2). It was determined that an EIA was not required. These two Screening Opinion decisions are appended to the document in Appendices 3 and 4.

It is noted that since the screening opinion was requested the project design has evolved, and hence there are some changes to the development. These are discussed further in Section 4.1.3., however, this does not introduce any significant environmental effects that would warrant the production of an EIA.

3.1.6 The Habitats Directive

The European Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, also referred to as the 'Habitats Directive' (European Commission, 1992). The primary aim of the Habitats Directive is to maintain biodiversity within the Member States and is transposed into Scottish law by a combination of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland), commonly known as the 'Habitat Regulations' together with the Habitats Regulations 2010 (in relation to reserved matters).

The Habitats Regulations identify several habitats or species whose conservation interest requires the designation of Special Areas of Conservation (SACs), which form the Natura 2000 network of protected sites, in conjunction with Special Protection Areas.

In addition, the Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4. However, these actions can be made lawful through the granting of licenses by the appropriate authorities. These species are commonly termed European Protected Species (EPS) and include all cetaceans in Scottish waters.

3.1.6.1 Habitats Regulations Appraisal

When a project may have a likely significant effect on a Natura Site (SAC or SPA), a Habitats Regulation Appraisal (HRA) and, when required, an Appropriate Assessment (AA) needs to be completed by the competent authority. The legislative context for carrying out an HRA is based on the Habitats Directive (92/43/EEC), in particular Article 6(3), and The Conservation (Natural Habitats, &c.) Regulations.



Information the competent authority requires in order to carry out an HRA and AA has been provided within this Environmental Report. Appendix 5 provides a Habitats Regulations Appraisal Report, produced to aid the competent authority's assessment of the designated sites which may have their qualifying interests potentially affected by the proposed development.

3.1.7 Equality Act 2010

The Equality Act 2010 legally protects people from discrimination in the workplace and in wider society. The Equality Act requires reasonable adjustments to be made in relation to accessibility, and accordingly, has been complied with during the design of the public access areas of this development.

3.2 Policy Context

As previously noted, this development is sited within both the marine and terrestrial environments. Accordingly, it will be subject to both marine planning policy and the tiered onshore planning principles framework in Scotland.

3.2.1 Scotland's National Marine Plan

As the project is partly below MHWS and within 12 nautical miles (nm) of the Scottish Coastline it falls within the remit of the Marine (Scotland) Act 2010. The 2015 Scottish National Marine Plan (NMP) covering inshore waters is a requirement of the Act. The NMP lays out the Scottish Minister's policies for the sustainable development of Scotland's seas and provides General Planning Principles (GENs), some of which apply to this development.

Many GENs are specific to environmental topics; these are identified in Table 3.2.1 below, along with the considerations made during design development to meet the requirements.

The NMP lays out sector specific objectives for Recreation and Tourism and Shipping, Ports, Harbours and Ferries. Table 3.2.2 details the relevant objectives and how the Ullapool Shore Street Widening & Promenade and Small Boat Harbour contribute towards these.



Table 3.2.1: Applicable Scottish National Marine Plan GENs (Marine Scotland, 2015)

| General Planning Principles | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|-----------------------------|--|--|
| GEN 2 Economic benefit | Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan. | <p>Increased berthing for the local fishing fleet and marine tourism boats will provide economic benefit associated with jobs in both sectors.</p> <p>Furthermore, increased berthing will also provide additional space to allow tourists to visit Ullapool via sea, bringing additional economic benefit to the local economy.</p> <p>The promenade development shall make the village more attractive to visitors which has the potential to encourage them to stay longer and utilise local facilities.</p> <p>The additional space at the west end of Shore Street can accommodate a range of activities which may contribute to the local economy.</p> |
| GEN 3: Social benefit | Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan. | <p>The trunk road improvements allow better access to the ferry terminal will provide sustainable access to goods and services for the Western Isles' communities, and the vital tourism link upon which the communities depend. The improved amenity area with the promenade development along Shore Street will enhance this part of the town, creating an attractive area for use by tourists and the local community and easing pedestrian and vehicular congestion in the peak season.</p> <p>Improving the ageing sea defences as an added benefit to this development is considered wholly sustainable as it can be achieved without additional subsequent disruption to the seafront area, which would otherwise impact residents, tourists, and vehicular access to the ferry terminal.</p> |
| GEN 4: Co-existence | Proposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision-making processes, when consistent with policies and objectives of the Plan. | The project has been designed to take all users of the harbour area into account, and final designs have been party to extensive public consultation to ensure cohesion within the existing users and service delivery. The trunk road improvements will create improved access to the ferry |



| General Planning Principles | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|-------------------------------------|--|---|
| | | terminal, and the small boat harbour development will make excellent use of a small space to increase capacity for a range of operators. |
| GEN 6: Historic environment | Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance. | This development balances the historic heritage of Ullapool Shore Street frontage with necessary improvements to the trunk road, and the small boat harbour development. The views of Shore Street and the harbour area (including nearby listed buildings) will be unrestricted across the carriageway and proposed promenade. |
| GEN 7: Landscape/seascape | Marine planners and decision makers should ensure that development and use of the marine environment take seascape, landscape and visual impacts into account. | <p>The carriageway and promenade elements of the development plus the new seawall and capping have all been sympathetically designed to complement the existing seascape frontage, coastal landscape, and historic marine environment.</p> <p>The site lies between two designated National Scenic Areas, Assynt Coigach (approx. 6.0km to the northwest) and Wester Ross (approx. 7.4km southwest). Both are designated for having some of finest mountainous scenery in Scotland. As the development is outside these areas and is low-profile, namely the road carriageway level and below the height of the sea wall, it will not affect these National Scenic Areas.</p> |
| GEN 8: Coastal process and flooding | Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding. | Replacement of concrete block revetment sea defences with rock armour will either continue the effectiveness of Shore Street coastal flood defence or improve it based on the modelling report, please see Ullapool Wave Study in Appendix 6. Replacement is particularly important because the current sea defences are damaged and undercut in parts. The existing coastline of the development area is all man made (rock revetment, or piled quay walls). The wave studies |

| General Planning Principles | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|------------------------------------|--|---|
| | | do not identify any changes to coastal processes outwith the development footprint, hence no likely significant negative effects are predicted. |
| GEN 9: Natural heritage | Development and use of the marine environment must: <ul style="list-style-type: none"> a. Comply with legal requirements for protected areas and protected species. b. Not result in significant impact on the national status of Priority Marine Features. c. Protect and, where appropriate, enhance the health of the marine area. | Ecological features of interest have been considered within the Marine Licence and Planning applications, and legal requirements have been taken into consideration throughout. There are no significant residual impacts on any Priority Marine Features from the proposed development; see Potential Effects discussed in Section 5: Environmental Considerations, and Mitigation identified in Section 6. |
| GEN 12: Water quality and resource | Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply. | A BPEO assessment has been completed for this development. The physical and chemical properties of the dredge spoil make the material ideal for reuse either within the development, for beach replenishment and granular infill, or as an aggregate for use at other developments. However, should it be necessary to dispose of a portion of the dredge spoil to the existing Ullapool Sea Disposal Site, the chemical and physical properties of the dredge spoil are unlikely to result in significant water quality deterioration (Affric, 2021a). |
| GEN 13: Noise | Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects. | Underwater Noise Assessment has been completed to understand the potential impacts associated with vibro-piling on ecological receptors and to inform the inclusion of appropriate mitigation to protect marine mammals. Note where practicable, piling will be completed outwith the water to avoid underwater noise issues. |
| GEN 15 planning alignment A: | Marine and terrestrial plans should align to support marine and land-based components required by development and seek to facilitate appropriate access to the shore and sea. | The design is fully compliant with the National Planning Framework (NPF3), the Highland-wide Local Development Plan, and the West Highlands and Islands Local Development Plan, alongside the requirements under the Scottish NMP. The design allows a smooth transition for pedestrians between the new pedestrian promenade to the shoreline and |



| General Planning Principles | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|-----------------------------|---|---|
| | | facilitates access to the shore by the provision of ramps and steps from the new promenade. The small boat harbour was specifically incorporated into the design to provides access to the sea for vessels which would have been compromised by a standalone promenade development. |
| GEN 17: Fairness | All marine interests will be treated with fairness and in a transparent manner when decisions are being made in the marine environment. | The project has undertaken extensive pre-application consultation, including more than the one event required by the regulations. By utilising the SP=EED framework, the project has improved and evolved the engagement process throughout. Stakeholder input from very early in the process has allowed the design to take on board suggestions and comments from all audiences, resulting in a high-quality design for the proposed Shore Street Widening and Promenade & Small Boat Harbour development. |
| GEN 18: Engagement | Early and effective engagement should be undertaken with the general public, and all interested stakeholders to facilitate planning and consenting processes. | Consultation was carried out to meet the requirements of the Marine Licensing (PAC) (Scotland) Regulations 2013, as modified by The Marine Works and Marine Licensing (Miscellaneous Temporary Modifications) (Coronavirus) (Scotland) Regulations 2020 to allow for online PAC events to be held during the coronavirus pandemic. The whole project has been the subject of the public consultation (not just the marine element), and the PAC process was started over 6 months before the Marine Licence application, ensuring early engagement. A PAC report has been produced for submission with the Marine Licence application and is submitted as part of the application, document reference 63/REP/02. Statutory consultees were consulted early during the process; this is discussed in sections 4.6.1 and 4.6.6 in the PAC report (Affric, 2021b). |



Table 3.2.2: Applicable Scottish National Marine Plan Sector Specific Objectives Comparison

| Sector | Objective | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|---------------------------------------|-------------|---|---|
| Recreation and Tourism | Objective 2 | Protection and enhancement of the unique, natural resources which attract visitors, and which are relied upon for recreational activities. | The construction of the Small Boat Harbour and promenade promotes and enhances facilities available for visitors arriving by sea to enjoy the unique character of the village. In addition, the Small Boat Harbour provides facilities for recreational activities such as sailing and skiffing. |
| | Objective 3 | Promote diversification of the recreation and tourism sector to increase the value of assets in rural towns and exploit opportunities from future climate change. | The construction of the Small Boat Harbour and promenade will provide facilities and infrastructure to promote tourism in the area and provide infrastructure to support recreational activities. |
| | Objective 4 | Continued and improved access to marine and coastal resources for tourism activities and recreational use. | The aim of the proposed Ullapool Shore Street Widening is to provide improved access to the Ullapool – Stornoway ferry terminal to meet growing demand for the ferry service. In addition, the proposed development allows for improved access to the marine and coastal areas through the Small Boat Harbour and proposed beach access from the promenade. |
| | Objective 5 | Sustainable improvement and/or development of existing or new facilities, encouraging the sharing of facilities and supporting infrastructure and the use of low carbon energy solutions. | The aim of the proposed project is to improve access to the existing ferry service; however, it also provides infrastructure that allows for small boats to be berthed within the Harbour. In addition, the construction of the promenade and widening of footways, provides a safe active travel space for pedestrians and cyclists. |
| Shipping, Ports, Harbours and Ferries | Objective 1 | Safeguarded access to ports and harbours and navigational safety. | The construction of the Small Boat Harbour ensures ongoing provision for small boat users. As the Small Boat Harbour will be constructed in an area to the east of the existing the main pier, the ferry will remain operational. |
| | Objective 2 | Sustainable growth and development of ports and harbours as a competitive sector, maximising their potential to facilitate cargo movement, passenger movement and support other sectors. | The improvements to Shore Street aim to meet the growing demand of the ferry service and will increase the ease with which passengers and commercial freight can access the ferry. The addition of the Small Boat Harbour also increases provision for small boat users. |



| Sector | Objective | Requirements | Ullapool Shore Street Widening & Promenade and Small Boat Harbour Considerations |
|--------|-------------|--|---|
| | Objective 3 | Safeguarded essential maritime transport links to island and remote mainland communities. | The improved access to the harbour aims to meet the growing demand of the ferry service and maintain this lifeline connection between the mainland and the Outer Hebrides. As the Small Boat Harbour will be constructed in an area to the east of the existing main pier, the ferry will remain operational. |
| | Objective 4 | Linking of ferry services with public transport routes and active travel routes to help encourage sustainable travel where possible. | The development will provide safer and improved access for all to the ferry terminal. The widened mixed-use promenade will increase the ease with which pedestrians and cyclists can access the ferry terminal, whilst the widened road carriageway will allow buses to travel along the street more easily. The provision of several crossing points of Shore Street will improve the safety for less mobile pedestrians and wheelers by minimising the crossing distance and increasing their visibility and sightlines. All of these factors will act to promote sustainable transport within the town and the wider area. |



3.2.2 Planning Policy Framework

The planning system in Scotland, which provides the framework for considering planning applications, is made up of four main documents:

- The National Planning Framework (NPF);
- Scottish Planning Policy (SPP);
- Strategic Development Plans (SDPs) produced for the Scotland's four largest cities; and
- Local Development Plans (LDPs) produced for each council area.

The Scottish Government provides advice and technical planning information in the form of Planning Advice Notes (PANs), to support the implementation of the framework.

Additionally, the development will be designed according to several specific planning policy documents which are detailed below.

3.2.2.1 National

The NPF is a requirement of the Planning (Scotland) Act 2006 and sets out the strategy for long-term development within Scotland. The third NPF (NPF3), was published in 2014 and sets out the strategy for development for the next 20 to 30 years (Scottish Government, 2014). Within Section 5: 'A Connected Place', it states that:

'We will reduce the disadvantage of distance for our coastal and island communities'.

It is specifically recognised in Section 5.36 that:

'Air and ferry services will continue to play an essential role – as a lifeline service but also supporting economic activity and the delivery of public services.'

The trunk road improvements will provide an improved transport link to the ferry terminal where the main ferry from the mainland to Stornoway operates from. However, there is a delicate balance between the requirement for an improved trunk road to retain and improve the access to the Western Isles' lifeline service whilst ensuring the coastal village environment of Ullapool is preserved. Section 4.29 of the NPF3 states that:

'The environment of our coastal areas, on land and at sea, is an outstanding, internationally important resource. These natural assets support quality of life and underpin important economic sectors like tourism, outdoor recreation and food and drink.'

The trunk road improvements to the road are therefore designed in such a way to take account of the needs of Ullapool, ensuring a high quality of life and retaining the character of the shoreside environment. The balance of improving essential services whilst preserving historic and coastal environments highlighted through the NPF is carried through the planning policy framework down to a local level, as discussed in the subsequent sections.

The development should ensure continued and improved provisions of services for residents and tourists, both in Ullapool and the island communities. This is recognised as being vital to the economy of both areas.



3.2.2.2 Regional

The Highland-wide Local Development Plan (HwLDP) is the Highland Council's vision for the whole area (excluding the area covered by the Cairngorms National Park which has its own plan) and sets out how land can be used by developers for the next 20 years (The Highland Council, 2012). The Vision within the HwLDP states that:

'by 2030, Highland will be one of Europe's leading regions by creating sustainable communities, balancing population growth, economic development, and the safeguarding of the environment across the area'.

In particular, the project contributes to two sections of the HwLDP vision within the design considerations. Section 5.2.2 sets out the Vision for safeguarding the Environment, stating that:

'ensuring that the special quality of the natural, built and cultural environment in Highland is protected and enhanced'

By considering the special qualities of the local built environment of Ullapool within the design specifications of the Shore Street widening, the promenade design concepts and the overall low-profile of the entire design, this project has delivered on this commitment.

The Vision for supporting a Competitive, Sustainable and Adaptable Highland Economy in section 5.2.3 states that by:

'providing opportunities which encourage economic development and create new employment across the area focusing on the key sectors of life sciences, energy, tourism, food and drink, higher education, inward investment, financial and business services, creative industries, aquaculture and renewable energy, whilst at the same time improving the strategic infrastructure necessary to allow the economy to grow over the long term'

And also:

'helping to deliver, in partnership with Transport Scotland and other transport bodies, transport infrastructure improvements across the area in line with the Council's Local Transport Strategy and the Scottish Government's Strategic Transport Projects Review.'

The project will deliver against these vision statements by delivering an improvement to local and strategic infrastructure of the trunk road leading to the ferry terminal, whilst preserving the local environment. As the ferry terminal provides a lifeline service to the Western Isles and the communities which depend on the tourism trade as a result, investment is vital to ensure continued service delivery.

3.2.2.3 Local

The West Highlands and Islands Local Development Plan (LDP) was adopted in 2019 and provides a vision and spatial strategy for future development in the West Highland and Islands area, identifying development sites and priorities for the main settlements over the next 20 years (The Highland Council, 2019).

The vision of the LDP has four main outcome themes:

- Growing Communities,
- Employment,



- Connectivity and Transport, and
- Environment and Heritage.

The Ullapool Shore Street Improvements, Promenade and Small Boat Harbour project will contribute to the LDP by providing direct employment opportunities through the construction period, and attractive amenity areas and better transport links as final outcomes which will support the town's tourism industry. At a local level, this further highlights the requirement to improve key transport links whilst conserving the environment and heritage of Ullapool.

Ullapool is classified as a 'Main Settlement' in the LDP and as such, specifically highlighted as:

'where the majority of future development should be directed'.

Ullapool's harbour plays a fundamental role in its economy, and the specific improvements to the harbour facilities and boat marina have been noted as *'of further potential'* in the LDP in section 4.24 (The Highland Council, 2019). Ullapool harbour welcomes seaborne leisure and commercial visitors, and the increased berths at the small boat harbour will support the expansion of visiting boat numbers. This will enable not only the local fishing industry but also the tourism industry to expand and therefore benefit economically from the proposed harbour improvements, particularly that of marine tourism.

3.2.2.4 Planning Advice Notes (PANs)

The Scottish Government provides advice and technical planning information in the form of Planning Advice Notes (PANs). As the development will be consented under the planning regulations the PANs have been considered as examples of best practice guidance throughout the design.

3.2.2.5 People, Place and Landscape

Within NatureScot's remit as a statutory consultee is the consideration of landscape, and the implications of a new development on the landscape of an area. The shared vision of NatureScot and Historic Environment Scotland is that:

'All Scotland's landscapes are vibrant and resilient. They realise their potential to inspire and benefit everyone. They are positively managed as a vital asset in tackling climate change. They continue to provide a strong sense of place and identity, connecting the past with the present and people with nature, and fostering wellbeing and prosperity.'
(Scottish Natural Heritage and Historic Environment Scotland, 2019).

The balance between supporting areas with economic development and trade and retaining the historic landscape and heritage is also highlighted by Transport Scotland in 'Fitting Landscapes' (Transport Scotland, 2014), the Scottish Government's policy statement addressing the landscape design and management of our transport corridors. Careful consideration of such policies within the development proposal of the Ullapool Shore Street improvements ensures that it has been designed to meet the functional objectives of a safer, road for pedestrians, cyclists, and vehicles but within the careful consideration of the landscape through which it passes.



3.2.2.6 The Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges (DMRB) contains information about current standards relating to the design, assessment and operation of motorway and all-purpose trunk roads in the United Kingdom. The development is therefore designed using these standards.

3.2.2.7 Local Transport Strategy

The Local Transport Strategy 2010/11 – 2013/14 (The Highland Council, 2010) sets the direction for transport in the Highlands, guiding policy and investment at a local level. It echoes the themes within the national and regional strategies of economic development with safety, sustainability and integration but distils the national framework into local investment needs.

Strong links between the Highland Council's LDP and the Local Transport Strategy aim to integrate both planning documents' visions for appropriate investment in transport links for the desired improvements in the locations of greatest benefit. Ullapool is one such location where transport and access improvements will enhance connectivity for remote communities, increase tourism, and aid economic development. This development will therefore adhere to the Local Transport Strategy by improving rural accessibility via improved access to the ferry terminal on Shore Street and onwards to West Shore Street.

3.2.2.8 Designing Streets: A Policy Statement for Scotland

The standards outlined in *Designing Streets: A Policy Statement for Scotland* have been incorporated into the design of the project (Scottish Government, 2010). This policy statement emphasises the importance of place-making in street design and of prioritising pedestrian provision over the movement of traffic, dependent on the context. Shore Street's classification as a trunk road means the uninterrupted flow of vehicular traffic along the street must be retained, although the architectural design of the project has adhered to the principles outlined in this policy statement where appropriate to simultaneously optimise pedestrian amenity.

4 Project Description

The Shore Street Widening & Promenade project has come to fruition from discussions between Transport Scotland and the Ullapool Promenade Group (led by Loch Broom Community Council) regarding concerns for road and pedestrian safety along Shore Street.

This project looks to improve the situation for pedestrians, cyclists and vehicles utilising Shore Street, to make it a safer and more pleasant experience, by widening the road and providing a shoreside promenade in place of the existing constrained footway.

In addition, recognising the need to replace small boat provision that will otherwise be lost at the west end of Shore Street through the Widening & Promenade works, the UHT wishes to expand its facilities for small boats and leisure vessels and to make improvements regarding shelter from the southern wave climate. This will include provision of new berthing pontoons, a deepened inner harbour with a new shore quay and a floating attenuator breakwater. The Small Boat Harbour Development will be constructed in conjunction with the Shore Street improvements.

Although final engineering designs are in place, minor alterations to the aesthetics and landscaping design are ongoing in response to public consultation.

4.1 Development Description

Figure 4.1.1 shows the existing Shore Street cross section and the proposed new layout. Full technical details are shown in the layout plan of the development (Drawing 2127-911 and 2127-954).

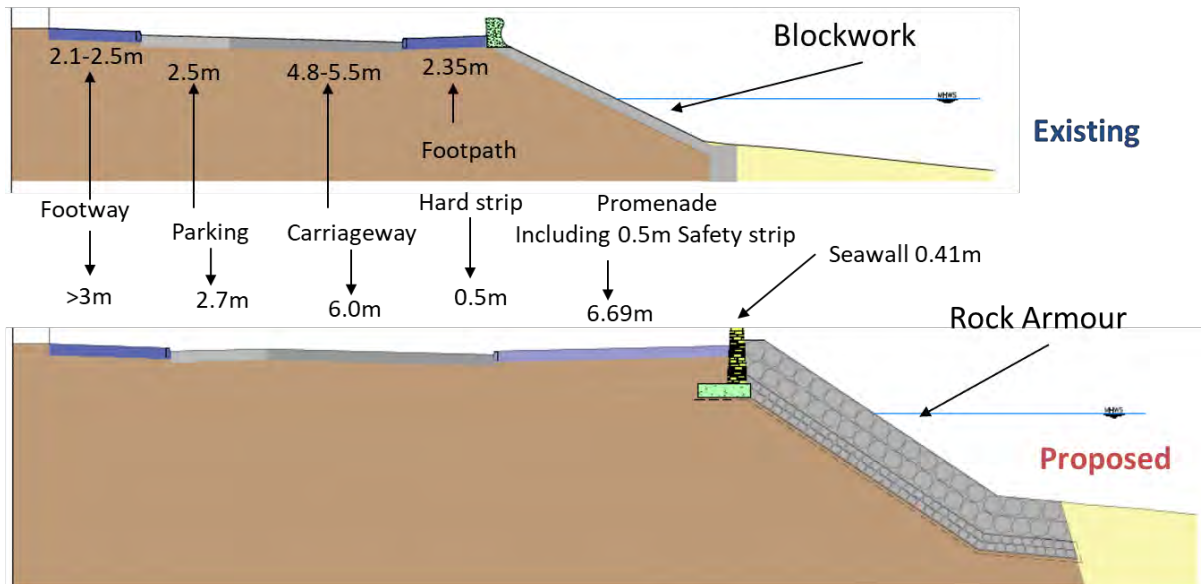


Figure 4.1.1: Cross section of proposed Shore Street Widening and Promenade

A 9.5m wide strip will be reclaimed from the sea, 6.6m of which will be brought up to a height to match the level of the widened road. The remaining width will slope seawards under the rock armour revetment, which will protect the new land. Overall, the useable surface of Shore Street will be widened to 18.89m.

The northern footway, adjacent to the shops, will be widened to allow safe flow of pedestrians and access to the buildings including commercial premises along the street. It is noted that some of the commercial premises, including shops, currently have a large step into them from the footway. Where possible the footway will incorporate sloped access towards these buildings to make them accessible to all. The increased width of the footway will help to make this achievable.

The current width of parking is too narrow to allow the safe opening of car doors without impinging upon the footway or the road. The increased width of the parking area aims to address this issue. Guidance states that parking lanes that allow disabled users direct access to a footway from a parked vehicle must have a minimum width of 2.7m (Department for Transport, 1995). As such the parking lane is wide enough to accommodate disabled parking.

To facilitate safe crossing of the carriageway there are outstands from the northern footway through the parking lane, such that pedestrians and wheelchair users don't have to pass between parked cars and they can be clearly seen by drivers and they can have a clear view of the road before deciding to cross.

The new road will be transformed from the current unmarked two-lane narrow road (See Drawing 2127-901 for existing layout) to a marked two-lane road with an overall width of 6.5m



(Drawing 2127-911). The carriageway itself will be 6.0m wide tarmacked surface with an additional delineated 0.5m wide hard strip provided along the road edge. The overall width is 6.5m to allow it to be safely resurfaced in the future one lane at a time without having to close the road. The narrow carriageway delineation aims to keep vehicle speeds lower, while the hard strip acts as a safety buffer between cars and the promenade.

The existing south footway will be replaced by a 6.69m wide promenade, running along the south edge of the widened roadway, paved to provide for cyclist and pedestrian use. At the western end of the street Shore Quay will be constructed along the seaward edge of the promenade. To meet current standards for proposed use, a delineated 0.5m wide safety strip will be provided along the roadside edge of the raised area of the promenade. Street furniture including planters and seating will be provided on the promenade.

The seaward side of the reclaimed land will be faced with rock armouring, as this helps to dissipate wave energy and in turn helps prevent overtopping. The beach will be replenished utilising dredge material to a depth of up to 500mm.

The promenade will have reinforced concrete ramps down to beach level through the rock armoured slope at each end, and a set of concrete steps at the centre. The promenade will also have a reinforced concrete wave wall along its seaward edge which will be capped and faced with stone. For details of the design see Drawing 2127-954.

New lighting is required along the length of Shore Street to ensure adequate illumination of the carriageway, north footway, and promenade. This will be achieved using LED fittings on the house fronts, in a similar style to the existing arrangement, subject to detailed design and approval by Transport Scotland as the Authority responsible for this trunk road. Supplementary lighting on the promenade will be provided as designed by the Landscape Architect for the project.

The existing Scottish Water sewage pumping station on the existing south footway will be reconfigured to suit its new position under the widened carriageway, with its pumping manhole strengthened to carry road traffic and its screening chamber reconstructed off-line in the promenade. The screening equipment will then be moved to the new chamber and the old chamber removed or infilled. An incoming gravity sewer at shallow depth in the south footway will be reconstructed in the promenade. The existing pumping main, which is at greater depth, will be retained below the widened carriageway. The pumping station control kiosk will be relocated onto the Promenade.

Delineated space for off-carriageway temporary parking of the Vactor lorry which is used for occasional maintenance of the pumping station will be provided on the promenade, removing the obstruction to traffic associated with its visits and improving safety for its operators. All details of the pumping station reconfiguration works will be subject to approval by Scottish Water.

In-kerb style surface water drainage will be utilised along carriageway edges, with pipework leading to catch pits and outfalls through the rock armour in a similar manner to drainage outlets through the existing revetment.

Sheet piled walls will form the edge of the new Shore Quay at the west end of Shore Street. The existing quay wall in the inner harbour will also be upgraded with sheet piling to a deeper

depth than is currently present to facilitate dredging. The reclaimed area behind the Shore Quay will provide an additional space for public use and can be utilised for community activities.

The Small Boat Harbour and floating pontoons will be constructed at the west end of the promenade, shown in Drawing 2127-911. The area in front of, and to the west of the new quay will be dredged to -2.5m (relative to chart datum (CD)) to create a permanent inner basin in the harbour; see details in Drawing 2127-955. A deeper dredge pocket will be dredged to -3.0m CD to allow access for deeper draft boats to the quay and pontoons along the harbour wall irrespective of tide state. Including the toe dredge for the rock revetment of the promenade the total volume of the dredge is 18,000m³, which is approximately 52,200tonnes of material.

New pontoons will be installed on steel pile guides in the dredged area along the new quay and main pier, incorporating the existing main pier pontoons (Drawing 2127-911). These will be of steel frame construction with Glass-Reinforced Plastic (GRP) mini-mesh decks and will have polystyrene floats encased in concrete or plastic. The pontoons will accommodate in the region of 40 vessels of various sizes.

A floating breakwater (ponton) will be added to the end of main pier (south-east corner) and will be a concrete structure containing polystyrene floats. This floating breakwater will be anchored by mooring chains; the exact location of which will be determined by detailed design. The floating breakwater will protect the Small Boat Harbour from waves in storm conditions.

Table 4.1.1 shows the total area calculations of the different elements of the development with regard to the different licences required.

Table 4.1.1: Development Areas

| Construction boundaries | Total area (m ²) | Drawing reference |
|--|------------------------------|--|
| The total footprint of the development | 34,280m ² | |
| Planning Consent Area | 13,335m ² | 2127-951 Red boundary line on drawing |
| Marine Construction Licence Area | 28,885m ² | 2127-952 Cyan boundary line on drawing |
| Dredge Licence Area | 14,120m ² | 2127-955 Green boundary line on drawing |
| Area to be dredged (excluding buffers) | 7,925m ² | 2127-955 Shaded area on drawing |

4.2 Design Evolution

Since the screening report was submitted, the project design has developed to take account of stakeholder feedback, engineering and pontoon supplier input, and a detailed wave assessment.

The width of the development along Shore Street has widened by 1.35m to allow more room for cyclists and pedestrians as the associated layout has evolved, however the footprint width of the land reclamation has not increased, instead the flat area at the top of the revetment armour has been sacrificed. The pontoon design has developed to ensure an appropriate number of berthing spaces are available, and the associated dredge has considered wave modelling and hence has increased slightly. Discussions with pontoon suppliers has identified



that for the water depths provided at the pontoons, the proximity of the rock armoured slope and sheet piled wall, and the size yachts to be accommodated, the use of chain moorings was not appropriate, and the pontoons will need to be located on pontoon guide piles.

The vibration installation of the tubular piles for the pontoon into the seabed will give rise to underwater noise which could impact upon marine mammals and fish. A full assessment of underwater noise has been completed within this document and appropriate mitigation has been identified; no significant effects have been identified (see Section 5.1.2).

The shoreline configuration around the Small Boat Harbour and dredge areas has changed slightly since the Screening Report was produced. The design changes have been modelled to ensure that they do not significantly impact upon coastal process. The output of which is discussed in Section 5.2.1

The increased number of pontoons and inclusion of cycling provision on the promenade provide operational benefits these are discussed in Sections 5.2.5 and 5.2.6 respectively.

4.3 Construction

The construction contractor has not yet been appointed; hence this indicative programme will be subject to change and is the best current estimate of proceedings. Construction steps have been defined in detail in the subsections below. Please see Figure 4.3.1 for the indicative construction programme, showing the overlapping tasks and timescales in more detail.

Construction Programme v3.1 at 18/06/2021

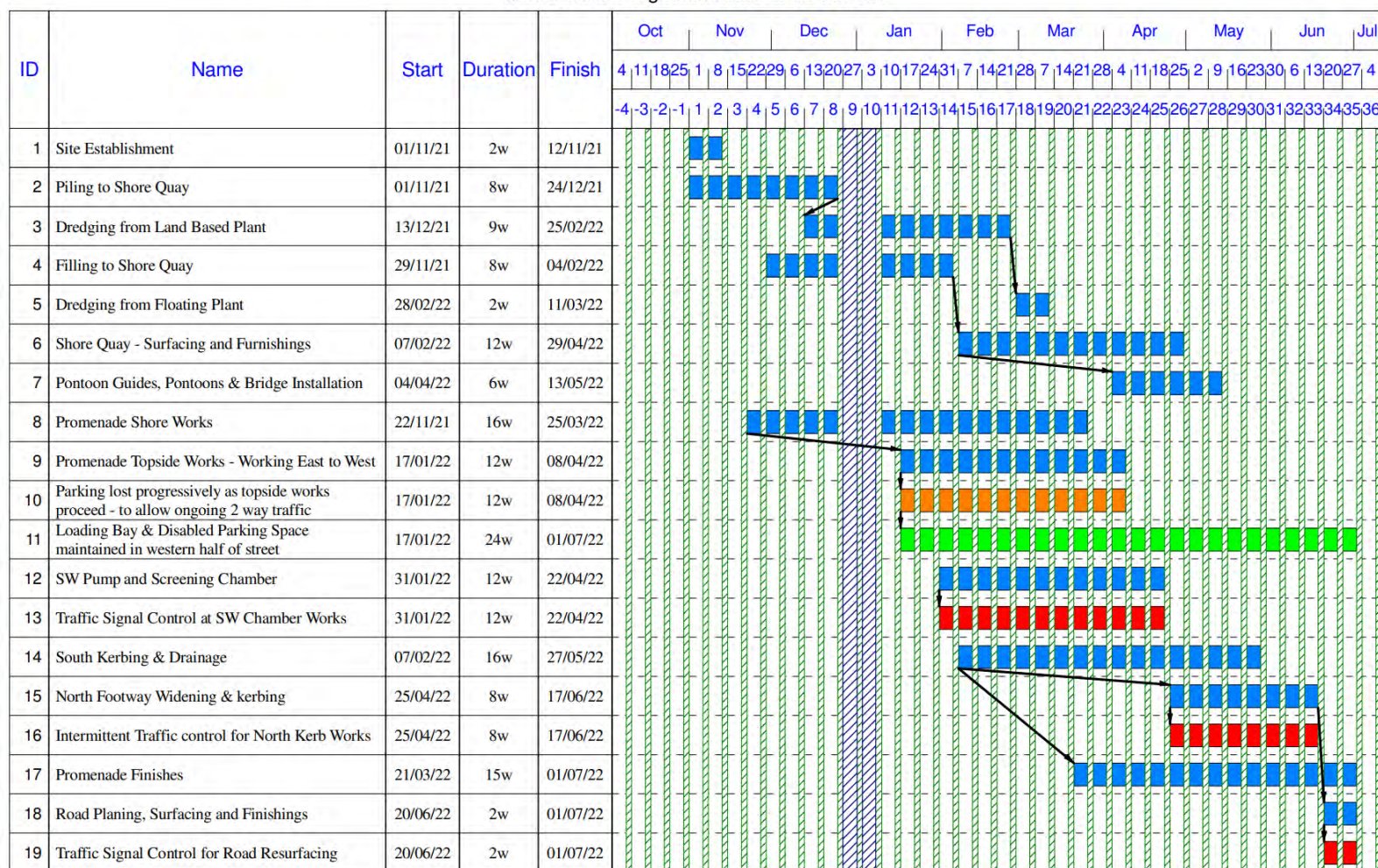


Figure 4.3.1: Indicative Construction Programme

4.3.1 Site Establishment

The seaward footway will be closed, and a safe working zone established including the existing seawall, revetment, and shore. Temporary access routes using imported aggregate will be established onto the beach at the east end and western end of Shore Street, as well as from the Yacht Club; these will provide access and egress for materials and heavy plant to the beach. Once no longer required the access ramp material will be utilised within the promenade.

4.3.2 Piling to Shore Quay

The new quay sheet piling works form the boundaries of the dredged pocket and basin for the proposed pontoons. These piling works must be undertaken before any dredging can commence. A temporary piling platform will be constructed behind the line of the new Shore Street quay for location of the leader piling rig plant which will be used to install the quay wall sheet piling. This platform will be constructed from imported aggregate and will be compacted and remain in place behind the piled wall of Shore Quay once piling has been completed.

Once the front Shore Street Quay wall sheet piles are installed, the anchor wall piles, and tie rods will then be installed. The tops of the front sheet piles along the quay will be finished off with a reinforced concrete capping beam.

The leader rig is expected to be able to reach from the existing pier to the piling line for the side wall which connects into the existing pier next to the existing pontoons and bridge.

Vibro-piling will be utilised to install the sheet pile walls. It should be noted that the piling works will be completed prior to dredging, and as such the majority of the piles will be in the intertidal area and hence will not always be in contact with the water column.

4.3.3 Dredging from land-based Plant

A shore-based long reach excavator will be used for dredging of the toe dredge area, for the new rock armoured revetment along the length of the promenade, and portions of the Inner basin along the eastern shore side slope which is to be protected by rock armour. The shore-based plant will dredge the areas it can reach within the -2.5m CD dredge area, with 12,000m³ of dredge material arising. 4000m³ of this material will be utilised in beach replenishment. Approximately 890m² of material will be reutilised in the land reclamation, the remaining material will be taken to a local quarry for processing to make it suitable for reuse in other developments for more details see the BPEO (Affric, 2021a).

Rock armouring will be placed on the dredge slope of the inner harbour as soon as possible after it has been dredged, to provide stability (see Section 5.2.1 for further details).

4.3.4 Infilling of Shore Quay

In-filling behind the Shore Quay piles will commence once piling and tie-rods have been installed. The piling platform will be left in-situ with additional material added to bring the reclamation up to level.

4.3.5 Dredging from floating Plant

Floating marine plant will be utilised as the method of dredging where the location is beyond reach of the long reach excavator, such as the deeper dredge pocket (-3m CD) and parts of the inner basin -2.5m dredge. The floating marine plant will comprise a backhoe excavator

on a self-propelled vessel with an integral hopper. Once the vessel's hopper is full, the material will be taken to the Ullapool Loch Broom licensed sea disposal location (HE050) where it will be deposited by bottom opening discharge. Based on the results of borehole investigation, the dredge material is expected to be a mixture of mainly gravel and sand, with less than 5% silt. The dredging of the deeper dredge pocket and portions of the inner pocket will produce 6,000m³ of dredge spoil, which will require disposal at sea in line with the BPEO (Affric, 2021a).

4.3.6 Shore Quay Surfacing & Furnishings

The Shore Quay surfacing will tie in with the surfacing on the promenade. The sheet piles on the eastern end of the quay and the face of the cantilever piled wall along Shore Street are to be stone faced above top of armour revetment level to improve the aesthetics. Wall finishes and furnishings will be installed to Shore Quay after the construction is brought up to road level and will be programmed for completion with the promenade wall finishing.

4.3.7 Pontoon Guides, pontoons & Bridge Installation

Pontoon guides will be welded to the sheet piled wall, and nine tubular 508mm pontoon guide piles will be installed within the dredged area using vibration installation equipment working from marine plant. The pontoons and access bridge will then be installed, and services (power, lighting, and water) will complete the inner harbour works.

4.3.8 Promenade Shore Works

The earthworks to form the promenade are expected to commence at the east end, working westwards in front of the existing seawall and revetment to avoid interfering with traffic on Shore Street. It is anticipated that the existing concrete block revetment facing will be removed first, and the material crushed for use as infilling.

As discussed in Section 4.3.3 a strip along the foreshore will be excavated to form the toe of the proposed rock armour revetment. This excavation material and dredge spoil will be used as reclamation fill for the formation of the promenade area and placed on the landward side of the toe.

The toe armour detail will then be constructed. A geotextile will be placed over outer edge of the infill material ready for secondary rock armour layer to be placed. Drainage pipework will be laid through the infill and secondary armour as required with their outfalls set within the revetment in a similar manner to existing drainage. The earthworks profile will include areas for the beach access stairs and ramps.

The primary outer layer of rock armouring will be placed on the revetment slope up to the level of the proposed concrete wall. The whole length of the promenade earthworks can be constructed seaward of the existing seawall, including the new sea wall and filling to underside of surfacing level, without interference with vehicular traffic on Shore Street.

4.3.9 Promenade Topside Works

The existing sea wall will be removed, and the new concrete sea wall will be placed once the infill and rock armour works are suitably progressed, working from the east to west. The wall will be precast concrete and installed in sections; once placed the final infill and rock armour material will be placed ready for surfacing. The ramps and stairways will be constructed, using a combination of pre-cast and in-situ pours of concrete.



Surfacing of the promenade will commence once the road widening works have been completed and will be aligned in the construction programme alongside the Shore Quay surfacing works.

4.3.10 Scottish Water Pump & Screening Chamber

Prior to the road resurfacing the Scottish Water pumping manhole top slab and covers will be upgraded to HGV load capacity to suit the widened road. A new screening chamber will be built within the promenade and the screening plant and equipment moved from the existing chamber in the road into the new chamber. The existing screening chamber would then be lowered and backfilled with foam concrete or similar. A new gravity sewer is to be laid along the eastern half of the promenade, to replace the existing shallow depth sewer which lies within the southern footway. Traffic signals will be required whilst the works to the chambers are undertaken in the road.

4.3.11 South (Seaward) Kerbing & Drainage Works

The initial stage of widening will comprise construction of road foundation layers, kerbing and drainage with bituminous surfacing laid up to the level of the edge of the existing carriageway, all to allow use of the partially constructed work as a temporary running surface for traffic.

4.3.12 North (Landward) Footway Widening & Kerbing

The north footway and kerbing works can commence once the south (seaward) widening and promenade footway works are sufficiently advanced, to allow for traffic management between the two phases. North footway widening works comprise removal of kerbs, planing the footway, laying new road kerbs to create wider footway, matching dropped kerb positions as existing to maintain fall away from house thresholds, regulate footway widening, then laying of the new footway surface. Safe pedestrian access to all domestic and commercial premises will be maintained throughout the works.

4.3.13 Promenade Finishes

It is envisaged that existing street furniture will be supplemented by additional furniture including new seating and planters. Wall finishes will also be completed at this stage, capping the concrete wave wall along the promenade and dressing the face with stone. New improved LED lighting will also be installed on the buildings at the north side of Shore Street, and to the wave wall on the promenade, at this stage.

4.3.14 Road Planing, Surfacing, & Furnishings

Finishes and surfacing will be applied to the promenade and Shore Quay once the road widening works are completed. Final surfacing of the carriageway and parking bays will take place on completion of the road widening and Scottish Water pumping station work, again keeping the road open with traffic signals, surfacing one lane at a time. Work will comprise planing of the north edge of the road and regulating and final surfacing of the existing road and road widening to achieve the desired final profile, with bituminous surfacing.

4.4 Operation

The new Shore Street Quay will be operated and maintained by UHT. The improved Shore Street and promenade area will be widely used and enjoyed safely by both residents and visitors to Ullapool alike. The temporary use of a designated area of the promenade for



Scottish Water's Vactor sewer maintenance lorries will prevent traffic issues that currently affect Shore Street.

As Shore Street is a Trunk Road, maintenance, and operation of the road (including the north footway, car parking strip, carriageway, and promenade) will be the responsibility of Transport Scotland, as the responsible Highway Authority. The project is being undertaken by UHT in partnership with Transport Scotland, and UHT propose to continue to undertake periodic litter removal from the shore after the works are complete, as they do at present.

The new and existing pontoons will benefit from tidal restriction-free access and calmer waters due to the floating breakwater; the increased number of pontoon berths will be used by local and visiting small boats.

As detailed in Section 4.5.2 of the Wave Study provided in Appendix 6, siltation rates in the Small Boat Harbour are expected to be low, and as such the need for regular maintenance dredges is highly unlikely.

4.5 Demolition/Reinstatement

The new works have the following minimum design lives:

- Piled Walls 50 years
- Concrete Works 50 years
- Paving & Roadworks 20 years
- Pedestrian Promenade 50 years
- Lighting 20 years

There are no plans to discontinue use of this site in the future, therefore it is not considered necessary to plan for demolition and reinstatement works for closure of this site.

All structures are of conventional construction, and no issues are foreseen if decommissioning or demolition is proposed at some future date. Any such decommissioning or demolition would require to be the subject of a separate detailed proposal.

5 Environmental Considerations

The EIA Screening Report for the project (included as Appendix 2) identified known sensitivities in the vicinity of the works. It then considered the potential environmental effects of the project during construction and operational phases of the project (see Tables 5.1 and 5.2 of Appendix 2). The aspects identified as having the potential for likely significant effects without mitigation in the Screening Report tables are further considered within this document.

Mitigation was proposed to minimise adverse environmental impacts. Mitigation included activities to be carried out prior to construction, a number of these have since been completed, the output of which are discussed in this section.

5.1 Construction

Table 5.1.1 provides a description of the environmental aspects resulting from the Shore Street Widening & Promenade works. It details the potential effects as identified from the screening process and details mitigation measures which have been updated where required. As discussed in Section 4.2 the only change to proposals giving rise to a new potential environmental effect is the piling of tubular piles for the pontoons, which have the potential to give rise underwater noise at levels that could affect marine mammals. This issue has been included within Table 5.1.1 and is discussed in Section 5.1.2.

Table 5.1.1: Construction Effects and Sensitivities

| Aspect | | Source | Sensitivities | Mitigation Measures |
|------------------------|-----------------------------------|---|---|--|
| Residues and Emissions | In-Air Noise and Vibration | Road, promenade, and rock armour construction works. Vibro piling. Plant and vessel movements for dredging and pontoon installation. | Cultural Heritage People | A Noise and Vibration assessment has been completed to inform specific mitigation requirements, for agreement through the planning process. Works will be conducted in line with current practice for noise and vibration control on construction and open sites. Good communications with the community will also be carried out to ensure they are aware of planned works. |
| | Underwater Noise and Vibration | Vibro/impact piling. | Biodiversity – Marine Mammals, Inner Hebrides and Minches SAC | An underwater noise assessment has been carried out to inform specific mitigation required. A Marine Mammal Observer (MMO) protocol will be implemented during piling works within the marine environment, detailed in Section 5.1.2. |
| | Water and Seabed Quality (Marine) | Increased sediment in the water column associated with primarily with dredging disposal activities. Drop out of sediments onto the seabed. Resuspension of contamination into water column. | Biodiversity – Marine (incl. PMF tall seapen (<i>Funiculina quadrangularis</i>) of the Wester Ross MPA; Salmon; Marine mammals Loch Broom | Dredge will be limited in depth, minimising volume and duration of dredge. Sampling has been carried out to ensure material to be dredged is not contaminated. An appropriate dredge reuse/disposal route has been identified through the BPEO assessments process. Dredge spoil will be reused within construction works as far as practicable. Land plant won dredge spoil will be taken off site for processing and onward reuse in other projects. Dredge disposal at sea will be avoided in areas where tall seapens are present. |
| Traffic, Transport, | Traffic and Transport | Vehicle movement restrictions associated with | Traffic, Transport | A Traffic, Transport and Access Management Plan has been produced and will be submitted to support the planning application. This will |

| Aspect | Source | Sensitivities | Mitigation Measures |
|------------------------|--------|--|---|
| Access, and Navigation | | | <p>identify the requirements of the various project phases and appropriate mitigation.</p> <p>This includes:</p> <ul style="list-style-type: none"> • The use of traffic lights to facilitate two-way traffic; • The use of parking bays as traffic or construction access corridor; • Alternative parking provision to offset temporary loss along Shore Street; • Active traffic management during ferry disembarkation; • Segregated pedestrian diversions on a rolling front during footway works; • Communication with local residents and stakeholders such as local businesses & CalMac; • Appropriate signage. |
| | Access | <p>Construction works on the footpath and the promenade.</p> <p>People (Locals and Visitors)</p> <p>Businesses on Shore Street</p> | <p>The Traffic, Transport and Access Management Plan to produced and submitted to support the planning application will specifically cover pedestrians and cyclists, it will identify the requirements of the various project phases and appropriate mitigation, this may include:</p> <ul style="list-style-type: none"> • Works on landward side footway being phased to minimise disturbance. • Accesses to businesses will always be maintained. • Alternative pedestrian routes being set up to provide safe routes along Shore Street. • Ongoing two-way communications with local businesses & residents. • Appropriate signage. |



| Aspect | | Source | Sensitivities | Mitigation Measures |
|--------|------------|---|---|--|
| | Navigation | Dredge and dredge disposal activities including access requirements and vessel movements associated with the Small Boat Harbour Development. Delivery and installation of pontoons. | Ferry Commercial Vessels including fishing boats Recreational Vessels from kayaks, row boats to yachts. | Early communication with local vessel owners will be carried out to allow alternative berths and arrangements to be put in place. Appropriate Notice to Mariners will be posted. Input from the Harbour Master pre and during construction works. Harbour Master will retain control of navigational safety during works, coordinating movements as required. |
| | | | | |

Without mitigation there are potentially five likely significant negative effects arising from the construction stage of the project as identified in Table 5.1.1.

5.1.1 In-Air Noise and Vibration

The location of the Shore Street Widening & Promenade works on a road lined by residential and business properties, coupled with the use of heavy machinery for construction will give rise to in-air noise and potentially vibration effects. Similarly, the Small Boat Harbour Development is close to residential and business properties at the west end of Shore Street and Quay Street and will utilise some heavy plant. However, noise and vibration effects of construction activities are well understood and predictable which allows appropriate mitigation to be identified to minimise effects. It is also recognised that the effects will be limited to the construction period only.

As mentioned in Table 6.1, an in-air noise and vibration assessment has been completed to inform specific mitigation requirements and will be submitted in support of the planning application(s). Standard construction noise mitigation techniques and communication strategies will also be put in place as detailed in Section 6.2.1.

5.1.2 Underwater Noise and Vibration

Construction of the pontoons will require the installation of tubular guide piles which will be vibro-piled within the dredged area. Some sheet piles installed for the construction of Shore Quay will also be installed within the intertidal area and may be installed while the tide is in and therefore within the marine environment. Piling within the marine environment will create underwater noise and vibration and will have the potential to impact marine mammals. Piling works have the potential to cause physical injury and disturbance to marine mammals.

As mentioned in Table 5.1.1, an underwater noise assessment has been carried out by Subacoustech Environmental (2021) to inform specific mitigation measures which will be required to minimise impacts on marine mammals, see Appendix 7. The assessment focused on the 508mm diameter cylindrical piles as these will give rise to higher noise levels than the sheet piles.

The outputs of the noise modelling were compared with the latest marine mammal auditory injury criteria provided by Southall *et al* (2019) in order to estimate the ranges from the works at which different magnitudes of acoustic impact may occur. The criteria groups marine mammals into functional hearing groups, as shown in Table 5.1.2, and applies filters to the unweighted noise to approximate the hearing response of the receptor. Table 5.1.2 also lists the species within each group most likely to be encountered within the vicinity of the development.

Table 5.1.2: Functional Hearing Groups, and Relevant Marine Mammal Receptors (NMFS, 2016)

| Hearing Group | Relevant Marine Mammal Receptors | Generalised Hearing Range |
|-------------------------------------|---|---------------------------|
| Low Frequency Cetaceans (LF) | Minke Whales | 7Hz to 35kHz |
| High Frequency (HF) Cetaceans | Common Dolphins | 150Hz to 160kHz |
| Very High Frequency Cetaceans (VHF) | Harbour Porpoises Inner Hebrides and the Minches SAC | 275Hz to 160kHz |

| | | |
|----------------------------------|----------------------------|---------------|
| Phocid carnivores in water (PCW) | Grey Seals Common Seals | 50Hz to 86kHz |
|----------------------------------|----------------------------|---------------|

Table 5.1.3 shows the cumulative sound exposure levels (SEL_{cum}) for both permanent threshold shift (PTS), where unrecoverable hearing damage may occur, and temporary threshold shift (TTS), where a temporary reduction in hearing sensitivity may occur in individual receptors during non-impulsive noise from vibro piling.

Table 5.1.3: Acoustic Injury Criteria for Marine Mammals in Relation to Non-Impulsive Noise (Southall *et al*, 2019)

| Hearing Group | TTS onset: SEL _{cum} (weighted) | PTS onset: SEL _{cum} (weighted) |
|---------------|--|--|
| LF | 179 | 199 |
| HF | 178 | 198 |
| VHF | 153 | 173 |
| PCW | 181 | 201 |

Table 5.1.4 shows the impact ranges for non-impulsive noise for the different hearing groups of marine mammals. Based on the modelling, which assumed a fleeing receptor, carried out in the assessment, for PTS impact ranges, any marine mammal would have to be less than 10m from the noise source at the start of piling to induce PTS. The onset of TTS may occur in VHF cetaceans should they be within 50m of the works at the start of piling.

Table 5.1.4: Summary of Impact Ranges for Non-Impulsive TTS and PTS Criteria (Table 5.3) for Marine Mammals assuming a Fleeing Receptor

| Functional Group | Impact Ranges | |
|------------------|---------------|------|
| | TTS | PTS |
| LF Cetaceans | <10m | <10m |
| HF Cetaceans | <10m | <10m |
| VHF Cetaceans | 50m | <10m |
| PCW Pinnipeds | <10m | <10m |

A Marine Mammal Observer (MMO) protocol will be implemented to reflect the results of the assessment and is detailed in Section 6.2.2. It is however, recognised that the standard Joint Nature Conservation Committee (JNCC) piling protocol is designed for offshore windfarm piling (JNCC 2010), where typical diameters are considerably larger than those proposed for this project and therefore resulting in greater underwater noise levels. For this reason, together with the very low marine mammal densities anticipated within the impact ranges of 10m and 50m and the location within the harbour waters, the standard JNCC protocol provides a disproportionate level of mitigation. As such, the standard JNCC protocol has been modified in order to ensure mitigation is proportionate to the perceived risk to marine mammals and not unduly restrictive. A summary of the changes made to the standard JNCC protocol, together with supporting rationale is provided in Table 5.1.5.

Table 5.1.5: Summary of Modifications to the JNCC Piling Marine Mammal Protocols

| Aspect | Change | Rationale |
|---|---|---|
| Mitigation Zone Radius | The mitigation zone radius is reduced from 500m to 100m. | The maximum predicted TTS range is 50m, which is conservatively calculated using a 24hr cumulative SEL for a fleeing animal. Therefore, mitigating to 500m is disproportionate. |
| Pre-Watch Duration | The duration of the pre watch (both visual and acoustic) is reduced from 30min to 15min. | The 30min pre watch is designed to maximise detection probability within the mitigation and allow for deeper diving marine mammals which may be present in the zone, but submerged and undetectable for extended periods. However, given that water depths within the 100m zone do not exceed 10m, prolonged deep dives cannot occur. In addition, the reduction of the mitigation zone to 100m increases detection probability within the mitigation zone. Therefore, a 15min watch is sufficient to ensure the mitigation zone is clear of marine mammals. A 30min watch would not increase detection probability but would result in unwarranted delays to construction. |
| Delays After Detection in Mitigation Zone | The delay following a detection within the mitigation zone during the pre-watch is reduced from 20min to 10min. | For the reasons stated above, a period of 10min following the last detection within the mitigation zone provides sufficient confidence that the mitigation zone is clear of marine mammals, allowing piling to commence. |
| Soft Start | No soft start will be provided. | The purpose of the soft start is to allow animals which may be present (but undetected) within the injury zones to move away before full power percussion piling is reached. In this instance only vibro piling is planned hence soft start is not appropriate. Given the shallow waters, significantly reduced acoustic injury zones (compared to windfarm piling operations), the 100m mitigation zone, and low anticipated marine mammal densities, the risk of an animal being present but undetected within the injury zone is extremely low. As such, additional delays resulting from implementing a soft start is not justified by a meaningful reduction in marine mammal risk for this development. |

It should be noted that a proportion of the sheet piles will be installed in the seabed above MLWS and therefore may be carried out in the dry however, where piling starts in the wet, mitigation will be implemented.

Fish were also considered within the noise assessment (Appendix 7) however, modelling showed it was found that it would be highly unlikely that vibration piling will have an effect and that the risk of injury or TTS to the most sensitive group of fish was low to negligible.

5.1.3 Water and Seabed Quality (Marine)

The Shore Street Widening & Promenade toe dredge is in the intertidal area, hence dredging will only give rise to sedimentation issues when the tide is in and is therefore not expected to be significant. The Small Boat Harbour Development dredge includes some intertidal areas but most of it will be carried out underwater. As the sediment content comprises largely of

gravel, it is anticipated that it will drop out of the water column fairly quickly, resulting in short-lived localised water quality increased solid loading effects.

Sediment sampling and analysis has been completed to inform BPEO assessments to identify the best management of spoil arising from the dredging works in support of the dredge licences. Sampling and analysis confirmed that the material is not contaminated and the physical characteristics, gravel and sand with low silt content, make the material suitable for both reuse within the development and as an aggregate for other developments. Reuse of the material will minimise the amount of material that will need to be deposited at sea.

A proportion of spoil will be required to be deposited at sea. Depositing of dredge spoil will give rise to localised sedimentation and will have the potential to have smothering effects to benthic organisms existing within the dredge disposal site. The closest dredge disposal site is the Ullapool (Loch Broom) Spoil Deposit Site, number HE050.

The dredge disposal site is situated within the Wester Ross Marine Protected Area (MPA) which is designated in part for the diversity of benthic organisms and the burrowed mud type habitats it supports, including burrowed mud, circalittoral muddy sand communities and three species of sea pen. The Wester Ross Marine Conservation Order 2016 outlaws dredging and trawling by larger vessels within the MPA however, it does not prohibit dredge disposal. It was recommended during the process of designating the MPA that pressures on tall sea pens associated with the licensed dredge disposal site in Loch Broom should be removed or avoided, and if this was not possible then the relocation of the site should be considered (SNH, 2013). However, at the time it was uncertain whether the range of the tall sea pens overlapped with the disposal site and thus whether the conservation objectives of the MPA would be compromised by the continued use of the site.

In order to understand the benthic status of HE050 and its potential suitability for spoil deposit, a benthic survey was undertaken by APEM in October 2020 (APEM, 2021), see full report provided in Appendix 8. Five habitat types were identified within the disposal site, three of which are designated features of the MPA and two of which are also listed as Priority Marine Features (PMFs), as identified by Marine Scotland for conservation importance. Table 5.1.6 and Figure 5.1.1 (reproduced for Appendix 8) provide a summary of habitat types identified during the benthic survey.

Table 5.1.6: Habitat types within the spoil ground

| Habitat Type | EUNIS Code | Protection |
|---|--------------|----------------------------------|
| Sublittoral mud | A5.3 | None. |
| Sea pens and burrowing megafauna in circalittoral fine mud (Note Burrowed mud - tall sea pen <i>Funiculina quadrangularis</i> were also recorded in Northeast section of Transect 6) | A5.361 | PMF & feature of Wester Ross MPA |
| Circalittoral mixed sediment | A5.44 | None. |
| Mosaic of Circalittoral mixed sediment/ Sea pens and burrowing megafauna in circalittoral fine mud | A5.44/A5.361 | PMF & feature of Wester Ross MPA |
| Circalittoral muddy sand | A5.26 | Feature of Wester Ross MPA |

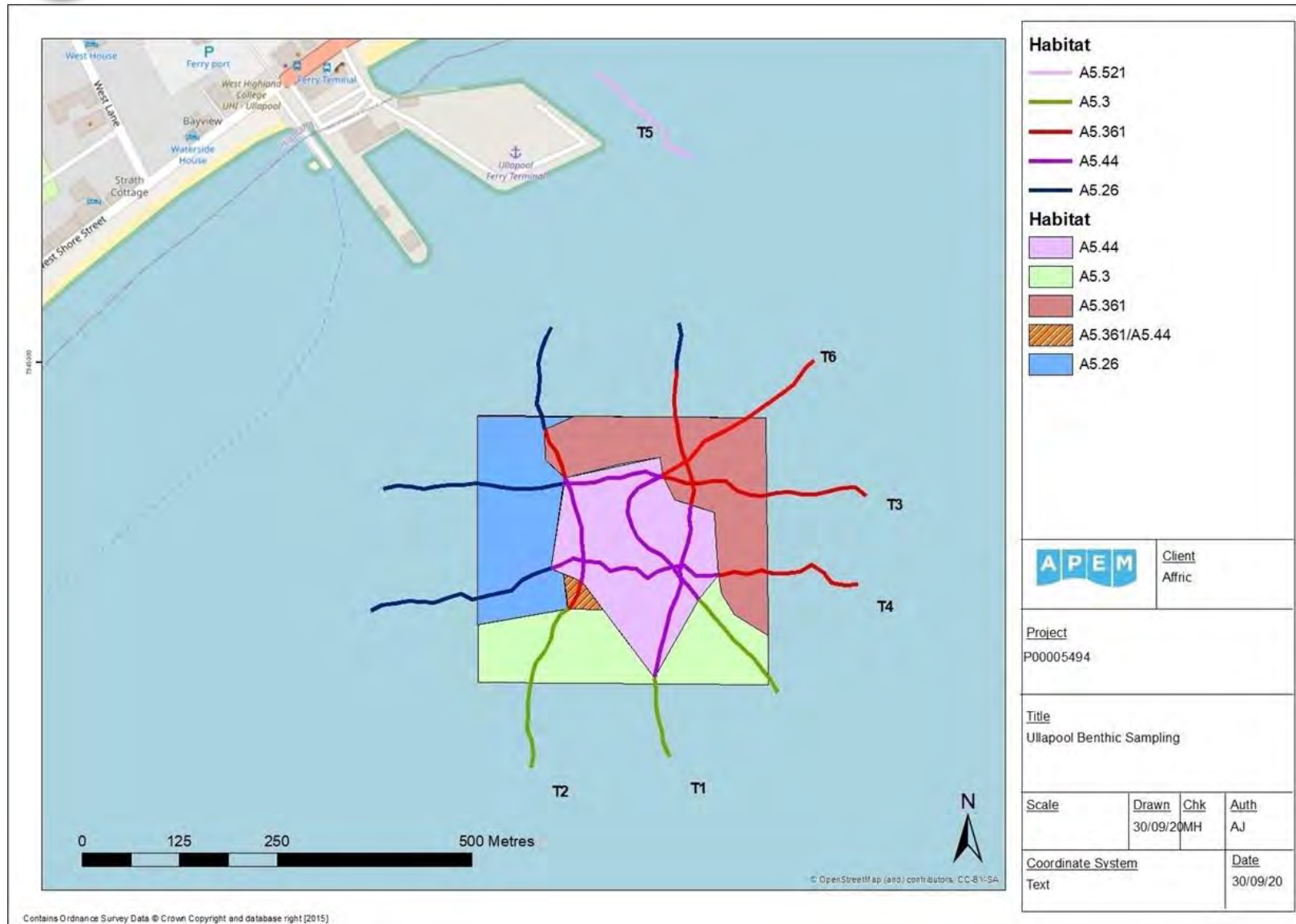


Figure 5.1.1: Estimated habitat extent map based on extrapolation of transect habitat data

The results of the benthic survey show the sea pens to be largely located within the northern and eastern edges of the disposal ground, (see the red patch in Figure 5.1.1.) with a small patch (orange) off centre to the southwest. Depositing of dredged material will avoid these areas and focus on the southern edge of the disposal ground, so as to avoid putting any pressure on the tall sea pen present in the disposal ground and hence, and not impact upon the conservation objectives of the MPA.

During the benthic survey, an additional transect, T5 (see Figure 5.1.1), was surveyed near where dredging will be carried out in the inner harbour and is indicative of what is likely to be present within the dredge area. The survey vessel could not access the inner harbour due to water depths. The habitat type 'Laminaria saccharina and red seaweeds on infralittoral sediments' was recorded. These species and sediments are indicators of the PMF 'Kelp and seaweed communities on sublittoral sediment.' The findings of this are similar to that which can be seen from the beach during low tides. However, the habitat was considered to be of poor quality with extensive anthropogenic construction debris, litter, and marina waste present and is therefore not considered to be representative of the PMF. Dredging within this area will remove the poor-quality habitat currently present and the waste materials identified. Anthropogenic waste will be appropriately disposed of to land or recycled where possible. The substrate made up largely of gravel and sand on which these organisms attach will remain similar to that which will be removed. Pre-disposal sampling results, see Pre-Disposal Sampling Results excel sheet, show the proportion of gravel does not change significantly with depth and will include over 55% gravel within the substrate following dredging. This substrate will allow for the settlement and attachment of zoospores likely to be present within the water column and from adjacent patches of habitat outwith the dredge area and will allow for the subsequent recolonisation of *Laminaria saccharina*.

5.1.4 Traffic, Transport and Access

The widening of Shore Street including the upgrade of the footways and the carriageway will impact upon both pedestrian and vehicle users. Two-way traffic will be retained along Shore Street for the duration of construction, although a traffic light system will need to be implemented during some phases to facilitate this. Stretches of the parking lane will also be sacrificed when appropriate to allow traffic to continue to flow in both directions and avoid the need for a disruptive diversion through the town. Alternative parking options will be provided at suitable locations to offset this temporary loss. At least one loading bay space and one disabled parking space will be maintained on the western half of Shore Street throughout the works, to maintain deliveries and access to shops in that area. Pedestrian access to businesses and residential properties will be maintained for the duration of the works, this will require temporary arrangements to be put in place during some phases of the works and appropriate safety segregation (fencing) to prevent the public interacting with the construction works. As discussed in Table 5.1 and Sections 6.1.3 and 6.2.3 a Traffic, Transport and Access Management Plan has been developed to consider the various phases of the works; this will be submitted as part of the planning application for the Shore Street Widening and Promenade project.

5.1.5 Navigation

To provide access to the Small Boat Harbour Development area, vessels currently utilising the inner walls of the main pier and the existing pontoons will need to be relocated elsewhere



within the harbour. This will give rise to a short-term inconvenience for the fishing and recreational vessel owners. The works will give rise to additional vessel movements within the harbour area and Loch Broom. The management of these movements will take account of the existing harbour users to prevent delays to the ferry service and avoid navigational risks. As discussed in Table 5.1 and Sections 6.1.4 and 6.2.4, mitigation including early communications and temporary arrangements can be put in place to minimise the effects arising.

5.2 Operations

As detailed in Table 5.2 of the Screening Report provided in as Appendix 2. There were four potentially significant positive effects associated with the development, these are discussed in this section. As mentioned in Section 4.2, coastal process modelling of the finalised design has been completed, the output of which is discussed in this section.

5.2.1 Coastal Processes

The wave modelling has been updated to take account of the larger dredge area to accommodate the additional berths. The updated modelling also took account the revised extreme water levels and predicted sea level rise to 2100 for Scottish Coastal Revisions issued by SEPA following the IPCC report on Climate Change due to Global Warming issued in late 2018. The wave modelling helped to inform the development design. A copy of the modelling report completed by RPS is provided as Appendix 6.

The modelling informed the need and size of the floating breakwater pontoon to reduce the significant wave heights experienced in the inner harbour area at the pontoons and on the coast to the east to levels slightly lower than currently experienced during storm conditions.

The stability of the dredge side slopes is also considered in Appendix 6 and highlights the need for armour stones to protect the parts of the slope and the importance of prompt installation once the slope is dredged to ensure stability.

The proposed development is not intended as a flood prevention scheme, although the improvements to the seawall and use of rock armour will confer an increased wave dampening effect and reduce overtopping along the length of the street. Current peak overtopping rates in a 1 in 200 year event are 20l per second per meter of wall, with the proposed design peak overtopping rates are reduced to 0.532l per second per meter of wall under the same scenario. The reduced rates associated with the proposals are within recommended values for safe pedestrian access, see Appendix 6 for full details.

5.2.2 Social and Economic Benefits

The promenade development, and the west end land reclamation associated with the Shore Street Quay, give rise to additional space to allow residents and visitors to enjoy the coastal village environs. The provision of seating will allow people to take their time and potentially encourage visitors to stay longer, which in turn increases the probability of them utilising local services (shops, restaurants, cafés etc) and hence contributing to the local economy.

The development aims to provide access for all throughout, including the installation of access ramps to the beach, a facility not currently available.

Providing improved small boat facilities will potentially bring economic benefits to the village from visiting berth users and the ability of local providers to offer more water based tourism



activities. It will also reduce tidal restriction on access to vessels for commercial and leisure uses.

5.2.3 Pedestrian Access and Safety

The project will improve pedestrian safety and amenity along the street, as it will eliminate the need for vehicles to mount the kerb to allow passage in both directions and provide a significantly wider surface for people to walk and cycle on. The incorporation of the 0.5m safety strip on the northern edge of the new promenade will also act as a buffer to shield pedestrians from road users. The designated crossing points, which include outstands in the parking lane, will optimise visibility of pedestrians to drivers and maximise the sightlines available to pedestrians. These will also act to improve disabled access across the street. In addition, improvements to shop access along the northern footway will be incorporated into the resurfacing works, which will benefit the less mobile.

5.2.4 Traffic Flow and Road Safety

The widened carriageway will reduce congestion and allow vehicles to flow freely in both directions. This will eliminate standing traffic and result in improved air quality and reduced levels of the associated noise and vibration. This also constitutes an improvement in the accessibility of the lifeline ferry link between the mainland and the Outer Hebrides from Ullapool Harbour. There are proposals for a 20mph zone being discussed, which will further help to control speed along the street. Please see the Traffic Management Plan for further details (Affric, 2021c).

5.2.5 Navigation

The Small Boat Harbour aspect of the development will increase berthing provision for commercial and recreational boat users. The associated dredge will ensure access to small boats irrespective of the tide condition.

5.2.6 Cycling Provision

Cycling provision and safety will also improve as a result of the development, as the promenade is intended as a mixed-use space for both cyclists and pedestrians. Cyclists will therefore no longer have to navigate the trunk road.

6 Mitigation

6.1 Pre-Construction Requirements

The screening document identified a number of pre-construction requirements, most of which have been completed and are discussed in section 5, hence only those still to be completed have been included within this section.

6.1.1 In-Air Noise and Vibration

Noise and vibration survey protocol to be detailed prior to construction, taking account of the in-air noise and vibration assessment (TNEI, 2021) and construction contractors specific plans. In addition, a process detailing to action to be taken in event of a complaint will be produced.



6.1.2 Underwater Noise and Vibration

A European Protected Species (EPS) licence will be sought from Marine Scotland to allow for the piling works to be carried out in an area where there is the potential for EPS to be present and where the activity could potentially cause injury or disturbance. Mitigation measures, detailed in Section 6.2.2, will form part of the application. Navigation

Prior to construction, there will be communication with local vessel owners to allow alternative berthing arrangements to be put in place, to allow access for the Small Boat Harbour Development works to be undertaken.

Appropriate Notice to Mariners will be posted prior to works commencing, and input from the Harbour Master will be sought with regards to the planning of construction works, such that navigational risks are minimised. Plans will also take account of the ferry timetable.

6.1.3 General Mitigation

The detailed design process has taken account of the environmental sensitivities identified in Section 4 of the Screening Report (Appendix 2). Where potential effects arise from the construction works appropriate mitigation has been identified. Risk Assessment Method Statements will be in place for all construction tasks, these will include any environmental precautions and mitigation measures. Mitigation measures will be in alignment with construction guidance as discussed in Section 6.2.6.

6.2 Construction Mitigation

6.2.1 In-Air Noise and Vibration

Relevant guidance including Pollution Prevention Guidance 6 (PPG6) – for Working at Construction and Demolition Sites (Environmental Agency, NIEA, & SEPA, 2012) and Best practice control measures detailed in BS5228 parts 1 (noise) and 2 (vibration) will be followed where appropriate. The construction mitigation will include:

- Good communications with the community so they are aware of planned works and the programme and have a contact to raise any concerns to during the works.
- Timing restrictions for noisy activities.
- Use of appropriate well-maintained equipment for the given task.
- The contractor will be made aware of the issues and the workforce appropriately trained to ensure unnecessary noise is avoided.
- Noise monitoring to ensure mitigation employed is effective in line with the Survey Protocol.
- Vibration monitoring to be undertaken on Shore Street to ensure vibration levels stay within guideline values, as detailed in *BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration*.

It is also recognised that the mitigation identified in Section 6.2.4 to avoid the need to divert traffic and to actively manage ferry traffic will help to minimise impacts of in-air.

6.2.2 Underwater Noise and Vibration

A marine mammal protection plan will be implemented in order to minimise the risk of disturbance and injury to marine mammals where piling is being carried out in the marine

environment. This will include where piling being carried out in the intertidal area while the tide is in. Efforts will be made to carry out piling when the tide is out where practicable.

The piling marine mammal mitigation will provide the following measures and will apply to cetaceans (whales, dolphins, porpoise and seals):

- A 100m exclusion zone will be established around the piling rig for cetaceans (whales, dolphins and porpoise);
- A 10m exclusion zone will be established around the piling rig for seals;
- A trained operator will conduct a 15-minute pre-watch prior to the commencement of piling operations;
 - If the 100m zone remains clear of marine mammals during the watch, permission will be given to commence piling; but
 - If a marine mammal is sighted within the mitigation zone, piling will be delayed until the zone has been clear of marine mammals for at least 10 minutes.
- Watches will be carried out during daylight hours and in suitable weather conditions, i.e., where visual signs of marine mammals can be detected and not obscured by waves or low visibility.
- Once piling has commenced there will be no requirement to stop works if a marine mammal enters the mitigation zone, as long as piling has been continuous, with no breaks exceeding 10min;
- If a break in piling operations exceeds 10min the following conditions will apply:
 - If an operator has been on watch during the break, and the mitigation zone remains clear of marine mammals, piling can recommence immediately;
 - If an operator has been on watch during the break, and a marine mammal is observed within the mitigation, piling will not recommence until the zone has been clear of marine mammals for at least 10min; and
 - If no marine mammal observations have been conducted during a break exceeding 10min, a 15min pre-watch will be conducted before piling can recommence, as detailed above.
- All MMO operations will be recorded using the JCNCC marine mammal reporting forms template.

6.2.3 Water and Seabed Quality (Marine)

Sediments suitable for use within the construction works will be reused where practicable or taken off site for processing for use in other projects, with the rest deposited at sea within the disposal ground and in accordance with the BPEO.

Appropriate positioning systems will be employed to ensure that the area identified for dredging will not be exceeded.

Dredge deposits at sea will be carried out within the disposal ground, avoiding areas where sea pens are present. Deposits will focus on utilising the southern edge of the disposal ground. This will be ensured by utilising appropriate positioning systems being by the dredge disposal vessel.

Anthropogenic waste will be removed from the seabed within the dredge area and disposed of appropriately in line with the waste hierarchy, recycling where possible and disposing at land.



6.2.4 Traffic, Transport and Access

Mitigation shall be implemented as identified by the Traffic, Transport and Access Management Plan. Mitigation measures include:

- The use of traffic lights to facilitate two-way traffic use of Shore Street throughout construction;
- The use of the parking lane as a traffic and construction access corridor;
- Alternative parking provision to offset temporary loss along Shore Street;
- Active traffic management during ferry disembarkation;
- Works on northern footpath being phased to minimise disturbance;
- Segregated pedestrian diversions on a rolling front during northern footway works;
- Communication with local residents and stakeholders such as local businesses & CalMac;
- Ensuring access to businesses and residential properties is always maintained;
- Ongoing two-way communications with local businesses and residents; and
- Appropriate signage.

6.2.5 Navigation

There will be ongoing communications with the owners of boats affected by the works on the Small Boat Harbour Development, so that they are aware of alternative arrangements and progress as to when they will be able to utilise the upgraded facility.

The Harbour Master will retain control of navigational safety during works, coordinating movements as required. Appropriate Notice to Mariners will continue to be posted during the works.

6.2.6 General Mitigation

Due to the potential effects the projects could have on a range of stakeholders during the construction phase, stakeholder communications will be carried out throughout the works. This may include both verbal and written communications. The UHT's website will be kept up to date with regards to progress and the next stages of the works.

In addition to the specific mitigation identified to manage effects discussed within this document, construction guidance will be followed to minimise other potential negative effects of the projects, this is likely to include:

- Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014);
- Pollution Prevention Guidance 6 (PPG6) – for Working at Construction and Demolition Sites (Environmental Agency et al., 2012);
- Coastal and Marine Environmental Site Guide: C584 (Budd, John, Simm, & Wilkinson, 2003);
- Guidance for Pollution Prevention 8 (GPP8) – Safe storage and disposal of used oils (SEPA, Natural Resources Wales, & NIEA, 2017);
- Pollution Prevention Guidance 7 (PPG7) – The safe operation of refuelling facilities (Environment and Heritage Service, SEPA, & Environment Agency, 2011); and
- Guidance for Pollution Prevention 5 (GPP5) – Works and maintenance in or near water (NIEA, 2017).



In addition, any applicable General Binding Rules from the Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended will be applied.

7 Summary

There are proposals to widen Ullapool's Shore Street, develop a promenade and a small boat harbour. Once constructed the project will bring numerous benefits to those living, visiting, and passing through Ullapool. Due to the location of the works it is, however, recognised that they could give rise to disturbance and disruption and negatively impact upon the environment. Potential issues arising have been identified and appropriate mitigation proposed to minimise effects on stakeholders and the environment.



8 References

- Affric Limited. (2020). Ullapool Shore Street Widening & Promenade & Small Boat Harbour Development – EIA Screening – Support Document.
- Affric Limited. (2021a). Ullapool Shore Street Widening and Promenade & Small Boat Harbour Development Capital Dredge Best Practicable Environmental Opinion (BPEO) Report. Document Reference 63/REP/04.
- Affric Limited. (2021b). Ullapool Shore Street Widening and Promenade & Small Boat Harbour Development Pre-Application Consultation (PAC) Report. Document Reference 63/REP/02.
- Affric Limited. (2021c). Ullapool Shore Street Widening and Promenade & Small Boat Harbour Development Traffic Management Plan 63/REP/05
- APEM. (2021). Ullapool Harbour Benthic Survey. APEM Reference: P00005494.
- Budd, M., John, S., Simm, J., & Wilkinson, M. (2003). *Coastal and Marine Environmental Site Guide (C584)*. London, UK: CIRA.
- Comhairle nan Eilean Siar. (2018). Tourist Visitor Demand for the Ullapool-Stornoway Ferry Route and Potential Impacts from a Second Summer Ferry. APPENDIX 1. Retrieved from <https://www.cne-siar.gov.uk/media/10432/M%20Item%2013B%20-%20Appendix%20%201%20-%20Outer%20Hebrides%20Ferry%20Capacity%20Draft%20Study%20Report.pdf>
- Department for Transport. (1995). Traffic Advisory Leaflet 5/95 - Parking for Disabled People. London, UK: Department for Transport., UK: Department for Transport.
- Environment and Heritage Service, SEPA, & Environment Agency. (2011). *The safe operation of refuelling facilities: PPG 7*. Retrieved from Sheffield, UK:
- Environment Agency, NIEA, & SEPA. (2012). *PPG 6: Work at Construction and Demolition Sites*. Retrieved from <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>.
- IAQM. (2014). *Guidance on the Assessment of Dust from Demolition and Construction*. Retrieved from http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf
- JNCC. (2010). Statutory Nature CONservation Agency Protocol for Minimising the Risk of Injury to Marine Mammals from Piling Noise
- Marine Scotland. (2015). Scotland's National Marine Plan. Retrieved from <https://www.gov.scot/publications/scotlands-national-marine-plan/>.
- NIEA & Natural Resources Wales. (2017). *GPP 5: Works and maintenance in or near water*. Retrieved from http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017
- Scottish Government. (2010). Designing Streets: A Policy Statement for Scotland.
- Scottish Government. (2014). National Planning Framework 3.
- SEPA, Natural Resources Wales, & NIEA. (2017). GPP 8: Safe storage and disposal of used oils.
- SNH. (2013). *Scottish MPA Project Management options: North-West Sea Lochs and Summer Isles Possible MPA*, Version 11 July 2013. Retrieved from <https://www.nature.scot/professional-advice/protected-areas-and-species/protected->



[areas/marine-protected-areas/nature-conservation-mpas/wester-ross-ncmpa-designation.](#)

- SNH and Historic Environment Scotland. (2019) People, Place and Landscape. A position statement from Scottish Natural Heritage and Historic Environment Scotland. Retrieved from <https://www.nature.scot/sites/default/files/2019-10/Publication%202019%20-%20SNH%20and%20HES%20Landscape%20Position%20Statement%202019.pdf>.
- Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. & Tyack, P.L. (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals*, 45(2), 125-232.
- The Highland Council. (2010). Local Transport Strategy 2010/11 - 2013/14. Retrieved from https://www.highland.gov.uk/downloads/download/144/local_transport_strategy.
- The Highland Council. (2012). Highland-wide Local Development Plan. Retrieved from https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/199/highland-wide_local_development_plan.
- The Highland Council. (2019). The West Highland and Islands Local Development Plan. Retrieved from https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/582/west_highlands_and_islands_local_development_plan.
- TNEI. (2021), Ullapool – Shore Street Widening & Promenade & Small Boat Harbour Development Noise and Vibration Assessment, 14183-001
- Transport Scotland, (2014). "Fitting Landscapes" Policy. Retrieved from <https://www.transport.gov.scot/media/33663/j279083.pdf>.
- Visit Scotland. (2019). *Insight Department: Highland Factsheet 2019*. Retrieved from <https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-papers-2/regional-factsheets/highland-factsheet-2019.pdf>.

9 Glossary

| Acronym | Definition |
|---------|---|
| BPEO | Best Practicable Environmental Option |
| CD | Chart Datum |
| DMRB | Design Manual for Roads and Bridges |
| EIA | Environmental Impact Assessment |
| EPS | European Protected Species |
| GENs | General Planning Principles |
| HwLDP | The Highland-wide Local Development Plan |
| IAQM | Institute of Air Quality Management |
| JNCC | Joint Nature Conservation Committee |
| LDPs | Local Development Plans |
| MHWS | Mean High Water Spring |
| MLWS | Mean Low Water Spring |
| MMO | Marine Mammal Observer |
| MPA | Marine Protected Area |
| MS-LOT | Marine Scotland Licensing Operations Team |
| NIEA | Northern Ireland Environmental Agency |
| NM | Nautical miles |
| NMP | National Marine Plan |
| NPF | National Planning Framework |
| NPF3 | National Planning Framework 3 |
| NSA | National Scenic Areas |
| PAC | Pre - Application Consultation |
| PAM | Passive Acoustic Monitoring |
| PANs | Planning Advice Notes |
| PMFs | Priority Marine Features |
| PPG | Pollution Prevention Guidance |
| SAC | Special Areas of Conservation |
| SDPs | Strategic Development Plans |
| SELcum | cumulative sound exposure levels |
| SEPA | Scottish Environment Protection Agency |
| SNH | Scottish Natural Heritage |
| SPA | Special Protection Areas |
| SPP | Scottish Planning Policy |
| SSSI | Sites of Special Scientific Interest |
| UHT | Ullapool Harbour Trust |



Appendix 1 – Statutory Instrument 1979 No.1116

STATUTORY INSTRUMENTS

1979 No. 1116 (S.100)

ROADS AND BRIDGES, SCOTLAND

The Dingwall-Ullapool Trunk Road
(Shore Street, Ullapool Trunking) Order 1979

Made - - - - 3rd September 1979

Coming into Operation 28th September 1979

The Secretary of State in exercise of the powers conferred on him by section 1(2) of the Trunk Roads Act 1946(a) and of all other powers enabling him in that behalf, and having complied with the provisions of Schedule 2 to the said Act of 1946(b) hereby makes the following order:—

1. This order may be cited as the Dingwall-Ullapool Trunk Road (Shore Street, Ullapool Trunking) Order 1979 and shall come into operation on 28th September 1979.

2. On the date of the coming into operation of this order the lengths of road described in the Schedule to this order shall become trunk road.

Given under the seal of the Secretary of State for Scotland.



J. D. Penman,
Under Secretary.

Scottish Development Department,
New St Andrew's House,
Edinburgh.
3rd September 1979.

(a) 1946 c.30; as read with the Transfer of Functions (Roads, Bridges and Ferries) Order 1955 (S.I. 1955/1955).

(b) as amended by Section 51 of and Schedule I to the Roads (Scotland) Act 1970 (c.20).

SCHEDULE

LENGTHS OF ROAD TO BECOME TRUNK ROAD

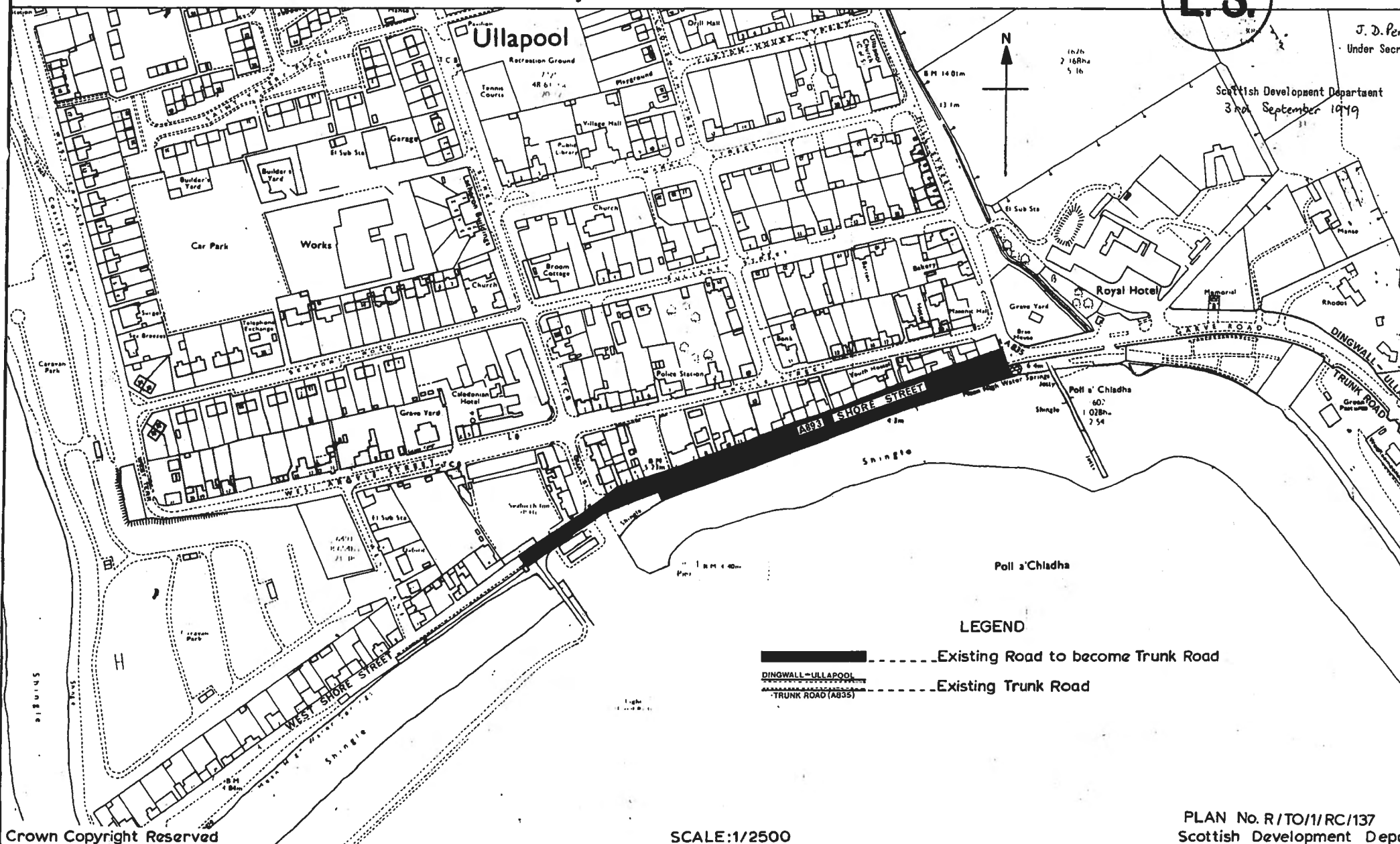
Those lengths of road named Shore Street (A893) and West Shore Street (unclassified) extending from the junction of Shore Street (A893) with the Dingwall-Ullapool Trunk Road (A835) at Mill Street/Garve Road in Ullapool in Highland Region in a westerly direction for a distance of 382 metres or thereby to the line of the west end of the Ferry terminal ramp as shown by a solid black band on the plan numbered R/TO/1/RC/137 and marked "The Dingwall-Ullapool Trunk Road (Shore Street, Ullapool Trunking) Order 1979" signed and sealed with reference to this order and deposited at the office of the Scottish Development Department, New St Andrew's House, Edinburgh. A certified copy of the said plan has been deposited at the office of the Regional Council of the Highland Region, Regional Buildings, Glenurquhart Road, Inverness IV3 5NX.

L.S.

J. D. Pen
Under Secy

Scottish Development Department
3rd September 1979

THE DINGWALL - ULLAPOOL TRUNK ROAD (SHORE STREET, ULLAPOOL TRUNKING) ORDER 1979





Appendix 2 – Screening Report



**Ullapool – Shore Street Widening & Promenade
&
Small Boat Harbour Development
EIA Screening - Support Document**



Date: 13/02/2020



Document Control

| | Name | Title | Date |
|------------|------|-------|------|
| Author | | | |
| Reviewer | | | |
| Authoriser | | | |

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| Effective Date: | 13/02/20 |
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| Revision No: | Signature | Comments | Date |
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1 Introduction

There are proposals to widen Ullapool's Shore Street in order to enable an increase in road carriageway width and the introduction of a pedestrian promenade. The proposals will improve safety for vehicles and pedestrians and remove the hazardous bottleneck which currently exists over this length of the primary access route between Ullapool's Ferry Terminal and the rest of the trunk road network. The Ullapool Shore Street Widening and Promenade proposals include the renewal of the sea defences.

In addition, there is the potential for a Small Boat Harbour Development in the inner basin of Ullapool harbour to be carried out at some time after the completion of the Promenade Works. It is likely that the Harbour Development works would consist of a new quay at the eastern end of Shore Street and the installation of additional pontoons in the area to the north side of the existing main pontoon. To facilitate safe navigation and berthing of vessels utilising the facilities provided, the area would require to be dredged and a breakwater pontoon installed on the eastern end of the main pier.

Shore Street is the main trunk road into Ullapool and serves as an access road to the Ullapool-Stornoway ferry terminal, which is the main gateway between the mainland and the Outer Hebrides. Shore Street is also popular with residents and visitors to Ullapool as it includes shops, cafes, tourist accommodation, a pavement adjacent to the seawall, and on-street parking. The street is protected from the sea by a small seawall and concrete block revetment on the seaward side of the promenade.

The trafficable width of Shore Street is currently around 7.5m overall, including an on-street parking strip on the landward side of the carriageway that is 2.5m wide, leaving a carriageway width of only 5m. Shore Street also includes a Scottish Water pumping station part way along the street, which requires access for maintenance. Despite frequent pedestrian use, there are currently no designated crossing points along Shore Street.

As the current road is evidently too narrow for normal two-way traffic, there are many traffic related issues along Shore Street. Cars and HGVs commonly mount the seaward pavement in order to pass each other. Sewage manhole covers on the pavement have been damaged due to car and HGV movements on the seaward pavement. Maintenance vehicles accessing the Scottish Water pumping station and Combined Storm Overflow (CSO) also block traffic on Shore Street during servicing. These issues present a significant element of danger to pedestrians walking along the promenade, particularly during the tourist high season. With visitor numbers to the region and the number of people using the Ullapool to Stornoway ferry route increasing year on year, this problem will likely exacerbate without action (Comhairle nan Eilean Siar, 2018; Visit Scotland, 2018). By widening the road and creating a seaward



promenade, the planned development will improve transport access issues, pedestrian safety and amenity.

The widening of Shore Street requires the installation of a new sea wall and new sea defence revetment. This has added benefit that the current 40 year old concrete block revetment sea defence is in need of maintenance due to age related damage and undercutting.

The potential Small Boat Harbour Development part of the proposed development is intended to upgrade Ullapool harbour in order to meet growing demand for the use of Ullapool harbour facilities. Additional quay space and pontoons will provide extra berths and access for inshore fishing fleet, blue tourism companies and recreational boat users.

Both aspects of the development will involve works both below Mean High Water Spring (MHWS) and above Mean Low Water Spring (MLWS). Therefore, Marine Licences and Town and Country planning permissions will need to be sought, where individual marine licences and planning permission will be sought for each aspect of the development. The exact licences and permission needed to be acquired are listed in Table 1.1.

Table 1.1 Planning Permission and Marine Licences required for the proposed development

| | Planning permission* ¹ | Marine Construction Licence* ² | Marine and Dredge Disposal Licence* ² | Marine Pontoon Licence* ² |
|-----------------------------------|-----------------------------------|---|--|--------------------------------------|
| Shore Street Widening & Promenade | ✓ | ✓ | ✓ | |
| Small Boat Harbour Development | ✓ | ✓ | ✓ | ✓ |

*¹ under Town and Country Planning (Scotland) Act 1997

*² under the Marine (Scotland) Act 2010

A formal Screening Opinion is requested from Marine Scotland under regulation 10(1) of The Marine Works (Environmental Impact Assessment (EIA)) (Scotland) Regulations 2017 ('EIA Regulations') and The Highland Council under Regulation 8(1) of The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 respectfully. This is to determine whether an EIA will be required to support the Marine Licence and Planning applications for the proposed Ullapool Shore Street Widening and Promenade and the Small Boat Harbour Development.

With regard to the potential need for an EIA, if the project falls under Schedule 2 of The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017, then the projects need to be screened under Schedule 3 of the same regulations to determine whether or not an EIA Report needs to be submitted in support of the applications.

Relevant sections under Schedule 2 of the EIA regulations are:



- 10. Infrastructure:
 - (f) Construction of roads – where the area of works exceeds 1 hectare
 - (g) Construction of harbours and port installations, including fishing harbours – where the area of works exceeds 1 hectare
 - (m) Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works – all works
- 13. Any change to or extension of works of a description mentioned in paragraphs 1 to 12 of Column 1 of this table where those works are already authorised, executed or in the process of being executed.

The Shore Street Widening and Promenade works are less than one hectare in area. However, they could be seen to trigger 10(m) if they were to alter the coastline. Although the Small Boat Harbour Development construction would be small in area, when considered and combined with the proposed Shore Street construction works, then the development encompasses a combined area of greater than 1-hectare, and thus, Section 13 of Schedule 2 could apply. Because of this, it is recognised that a screening opinion is required for all of the works, to determine whether or not an EIA will be required, for the Shore Street Widening and Promenade on its own, or for both projects together if the Small Boat Harbour Development were to be taken forward.

This report provides the information requested under Section 10 of the EIA Regulations, in order to assist in the consideration of these requests, and inform the corresponding screening opinion, namely a description of:

- The location of the proposed works;
- The proposed works;
- The environmental sensitivities of the geographical area;
- The aspects of the environment likely to be significantly affected by the proposed works;
- The likely significant effects; and
- The features of the proposed works or proposed measures envisaged to avoid or prevent significant adverse effects on the environment.

2 Location

Ullapool is a coastal village in the Highland region that lies on the eastern shoreline of the sea loch, Loch Broom (Drawing 63.01.01). Ullapool Shore Street (A893) lies on southern limit of Ullapool, the proposed Shore Street Widening and Promenade lie between the junction with the A835 to the east (NH1313 9407) and the pier to the west (NH1284 9396) (Drawing 2059-999). The existing layout of Shore Street is shown in Drawing 2127-901. The Planning Consent and Marine Licence boundaries of the Shore Street Widening and Promenade project are shown on Drawing 2059-951.



The Small Boat Harbour Development is situated at the west end of Shore Street. Drawing 2127-902 shows the layout of both developments, which are discussed further in Section 3. Drawing 2059-952 shows the combined Planning and Marine Licencing boundaries for the Shore Street Widening and Promenade Project and the Small Boat Harbour Development.

Ullapool falls within the boundaries of the Highland Council. Ullapool harbour is managed by the Ullapool Harbour Trust. The Ullapool Harbour Port limits extend throughout Loch Broom and beyond out to Cailleach Head, the landward limits extended to harbour junction on Shore Street and includes part of the seating area and small boat layout area at the west end of Shore.

3 Characteristics of Development

The Shore Street Widening & Promenade is currently expected to be funded by Transport Scotland and Ullapool Harbour Trust, with contributions being sought from Crown Estates and Highlands & Islands Enterprise and has come to fruition from discussions between Transport Scotland and Ullapool Promenade Community Group (led by Loch Broom Community Council) regarding concerns for road and pedestrian safety along Shore Street.

The Small Boat Harbour Development may be taken forward by the Ullapool Harbour Trust, if it were to proceed it would be after the Shore Street works have been completed.

3.1 Development description

3.1.1 Shore Street Widening & Promenade

Shore Street will be widened to 17.65m including the new seaward promenade which will be 4.5m wide (Drawing 2059-910D). A low stone wall will be built between the road and the promenade to provide protection to pedestrians. Four crossing points will be installed and marked with dropped kerbs, textured paving and gaps in the stone wall. The off-street parking bay on the landward side (2.7m wide) will be updated to accommodate for designated crossing points, a loading bay and disabled parking bays.

The new road will be transformed from the current unmarked two-lane narrow road (Drawing 2127-901) to a marked two-lane road with an overall width of 6.95m (Drawing 2059-910); the road itself will be 6.5m wide with an additional 0.45m on the promenade side at road level that will allow vehicle clearance from the low wall. The existing inland footpath will also be widened at the east and west end of the path so that it is no less than 3m wide along its whole length.

Gully drainage will be installed on the seaward side of the road. Existing gully drainage pipes will be extended through the new infill and concrete sea wall into the rock armour (Drawing 2059-910).

The section of the promenade adjacent to the Scottish Water pumping station and screening chamber will be made wider to accommodate space for vector service vehicles to access chambers without blocking road or promenade (Drawing 2059-910).

The sea defence will be reinstated along the sea wall in the form of rock armour. Two ramps and a set of concrete steps will be constructed within the rock armour to permit inclusive access to the shingle beach (Drawing 2059-910). An anchor wall will also be installed under



the promenade at the west end to provide structural support for a new quay, if the Small Boat Harbour Development is to proceed.

The boundary of the Shore Street Widening & Promenade works shown in Drawing 2059-951 is 9,721m², all of which is above MLWS and hence subject to planning consent. 3,891m² of the development area is below MHWS and subject to Marine Licensing.

3.1.2 Small Boat Harbour Development

If the Small Boat Harbour Works proceed a new quay and small laydown area will be constructed at the west end of the promenade (Drawing 2127-902) which will match the height of the existing quay. The area in front of, and to the west of the new quay will be dredged to -2.0m (relative to chart datum) to create a permanent inner basin in the harbour. This will allow access for small boats to the quay and pontoons along the harbour wall irrespective of tide state. The existing quay wall in the inner harbour will be upgraded with sheet piling frontage to facilitate dredging.

New pontoons will be installed in the dredged area along the new quay and main pier, incorporating the existing main pier pontoons (Drawing 2127-902). A floating breakwater (pontoon) will be added to the end of main pier (south east corner), this will be anchored by mooring chains the exact location of which will be determined by detailed design.

The total area of the Small Boat Harbour Development is 6,143m², 3,194m² of which is above MLWS and subject to planning consent. The area below MHWS and hence subject to Marine Licensing is 5,832m², 3,268m² of which is the dredge area.

3.1.3 Combined Works

The boundary of the combined works as shown on Drawing 2059-952 is 14,511m², including 11,561m² above MLWS and 8,682m² below MHWS. The floating breakwater pontoon will be anchored by mooring chains, but as these have not been designed yet Drawing 2059-952 does not show their location, however allowance has been made for them in the areas detailed here.

3.2 Construction

3.2.1 Shore Street Widening & Promenade

The current road, footpath and street furniture will be removed in a phased approach to reduce disturbance to businesses. The existing revetment will need to be removed to facilitate the proposed works. The volumes of demolished material will be minimised through design and where possible will be recovered and reused in the infill used to build out new promenade and rock armour sea defence. After removal of revetment a toe trench will be dug prior to installation of rock armour. Around 1,500m³ of material will be excavated.

An embankment will be created to support the new promenade using infill from the toe trench. As much of the toe trench material will be used as possible but there may be some material remaining that will need to be dealt with. It is acknowledged that a Best Practicable Environmental Option (BPEO) assessment will be required to determine the use/disposal route for this material to support the dredge licence application. The rock armour stone will be constructed in two distinct layers. The primary layer will be 1.1m thick and will be composed of larger 300-500kg rocks and the secondary base layer will be 0.5m thick composed of smaller



rock, 25-50kg (Drawing 2059-910). The ramps and set of steps will be constructed within the rock armour on concrete support foundations (Drawing 2059-910).

The infill material will be compacted using compaction plant prior to surfacing of the new promenade. The tubular steel poles for carrying festive lights and street furniture will be reinstated on the new promenade. It is envisaged that existing street furniture will be supplemented by additional furniture including new seating and planters.

Prior to the road resurfacing the Scottish Water pumping station and screening chamber covers will be lowered and upgraded to HGV load capacity to suit the widened road. The client's engineer is in discussion with Scottish Water regarding all works relevant to the pumping station and screening chamber.

An anchor wall for the future quay wall under the Small Boat Harbour Works scheme will be installed prior to promenade surfacing and will likely comprise 3m long sheet piles that will be vibro piled into the sand & gravel beach deposits for half their length, then backfilled the rest.

3.2.2 Small Boat Harbour Development

The new quay will be a sheet pile construction tied to the anchor wall installed as part of the Promenade works. The laydown area will be infilled and appropriately surfaced to blend in with the promenade. A sheet pile wall will also be installed along the adjacent harbour wall, to support that wall when dredging is carried out. Vibro-piling will be utilised to install the sheet pile walls.

A back-hoe dredger will be utilised as the method of dredging, to suit the small area and shallow water depths. The dredge material is expected to be a mixture of shingle, clay, silt and sand. Scour protection will be required on the dredge slope on the east side of the new quay. This is likely to be constructed of rock armour, with armour material being re-cycled so far as possible from that portion of the Promenade revetment being covered by the new works, to reduce further armour import.

Sediment sampling and testing will be required to inform a Best Practicable Environmental Option (BPEO) assessment to determine the use/disposal route for the dredge material to support the dredge licence application. However, it is assumed that dredged arisings will be deposited at an appropriate dredge disposal site, the closest being the Ullapool (Loch Broom) dredge spoil disposal site (58.89250°N, -5.15665°E).

Pontoons will be secured in place by steel guides attached to quay walls once the dredge works have been completed and furnishings will be installed thereafter.

3.3 Operation

The improved Shore Street and promenade area will be widely used and enjoyed safely by both residents and visitors to Ullapool alike. The wider road and presence of vector sewage maintenance area will prevent traffic issues that currently plague Shore Street. The installation of a low-lying wall next to the promenade will also ensure that no vehicles will drive on the promenade and four demarcated crossing points will be installed contributing to increased pedestrian safety.



The new and existing pontoons will benefit from tidal restricted-free access and calmer waters due to the breakwater; the increased number of pontoon berths will be used by local and visiting small boats. It is possible that maintenance dredging will be required during operation to maintain the required depth alongside the new pontoon berths, but any such requirement is expected to be infrequent.

3.4 Demolition/Reinstatement

There are no plans to discontinue use of this site in the future, therefore, it is not considered necessary to plan for demolition and reinstatement works for closure of this site.

4 Known Sensitivities

4.1 Biodiversity

4.1.1 Designated sites

Table 4.1 details the Statutory Nature Conservation Designations Sites (Marine Protected Areas (MPA), Special Scientific Interest (SSSI), Special Area of Conservation (SAC), and Special Protection Area (SPA) within 20km of the proposed development, their locations are shown on Drawing 63.01.02. Those unlikely to be affected by the development due to their location and/or associated designated features (e.g. terrestrial biological features that will not interface with site), are shown in grey. Due to the nature of the works being predominantly in the marine environment, marine specific designations have been described in more detail in subsequent sub-sections.



Table 4.1: Statutory Nature Conservation Designations within 20km of the Development Site (Marine Scotland, 2019; SNH, 2020)

| Site | Designation | Distance Direction | Designated Features (relevant designation) | Comments |
|--------------------------------|-------------|----------------------|--|--|
| Wester Ross | MPA | Immediately adjacent | Protected Biodiversity Features: Burrowed mud habitats; Circalittoral muddy sand communities; flame shell beds; kelp and seaweed communities on sublittoral sediment; maerl beds; maerl or coarse shell gravel with burrowing sea cucumbers; northern feather star aggregations on mixed substrata. Conservation objectives: recovery of maerl and flame shell beds; conserve other protected features. | Include in screening – Due to close proximity to works. |
| Rhidorroch Woods | SAC | 3.9km ENE | Annex I habitats: Caledonian forest; Northern Atlantic wet heaths with <i>Erica tetralix</i> . | No potential effects of projects on this designation site |
| Rhidorroch Woods | SSSI | 3.9km ENE | Biological feature: Native Pinewood; Upland birch woodland; Upland habitat, subalpine dry heath; Beetle (click beetle <i>Microrhagus pygmaeus</i>). | No potential effects of projects on this designation site and associated mobile species will not utilise the urban and coastal area. |
| Inner Hebrides and the Minches | SAC | 4.4km NNW | Annex II species: Harbour porpoise (<i>Phocoena phocoena</i>). | Include in screening – Harbour porpoise as they are a mobile feature. |
| An Teallach | SSSI | 7.0km SW | Biological features: Upland habitats (subalpine dry dwarf shrub heath, subalpine wet heath, alpine heath and alpine moss heath); Vascular plants (tufted saxifrage and Highland saxifrage). | No potential effect on the site due to distance. |
| Dundonnell Woods | SSSI | 7.3km S | Biological features: Upland mixed ash woodland. | No potential effect on the site due to distance. |



| | | | | |
|-------------|------|------------|--|--|
| River Oykel | SAC | 7.6km NE | Annex II Species: Freshwater pearl mussel; Atlantic salmon. | The River Oykel runs eastwards into the North Sea, hence there is no connectivity between Loch Broom and the site or associated Atlantic salmon. |
| Inverpolly | SAC | 11.8km NNE | Annex I Habitats: Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels; Natural dystrophic lakes and ponds; Northern Atlantic wet heaths with <i>Erica tetralix</i> ; Blanket bogs; Transition mires and quaking bogs; Depressions on peat substrates; Dry heaths; Alpine and subalpine heaths; Montane acid grasslands; Acidic scree; Plants in crevices on acid rocks; Western acidic oak woodland. Annex II Species: Otter (<i>Lutra lutra</i>); Freshwater pearl mussel. | Include in screening – Otter (<i>Lutra lutra</i>) due to their mobility. |
| Inverpolly | SSSI | 11.8km NNE | Biological features: Upland habitats (Alpine moss heath and associated vegetation, Alpine heath, Subalpine dry heath community, Spring-head, rill& flush, Subalpine wet heath); Blanket bog; Upland birch woodland; Vascular plants (Norwegian mugwort); Beetle (<i>Otiorhynchus auropunctatus</i>); Moths; Breeding bird assemblage (Red-throated diver, black-throated diver, heron, greylag goose, wigeon, teal, goldeneye, red-breasted merganser, snipe, curlew, greenshank, common sandpiper and grey wagtail). | Include in screening – Breeding Birds assemblage due to their mobility. |
| Beinn Dearg | SSSI | 12.5km SE | Biological features: Upland habitats (subalpine dry heath, subalpine wet heath, blanket bog, alpine heath, alpine moss-heath, snowbed, subalpine and alpine calcareous grassland, rocky slope, tall herb ledge, springhead rill and flush, alpine flushes); Native pinewood; Vascular plants (rare montane species); Breeding bird assemblage (golden eagle, dotterel, snow bunting, ptarmigan, ring ouzel, raven, golden plover and peregrine falcon). | No potential effects of projects on this designation site and associated mobile species will not utilise the urban and coastal area. |
| Beinn Dearg | SAC | 12.5km SE | Annex I habitats: Acidic scree; Alpine and subalpine calcareous grasslands; Alpine and subalpine heaths; Blanket bog; Caledonian forest; Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels; Dry | No potential effects of projects on this designation site. |



| | | | | |
|--|-------------|------------|---|--|
| | | | heaths; High-altitude plant communities associated with areas of water seepage; Montane acid grasslands; Mountain willow scrub; Plants in crevices on acid rocks; Plants in crevices on base-rich rocks; Species-rich grassland with mat-grass in upland areas; Tall herb communities; Wet heathland with cross-leaved heath. | |
| Beinn Dearg | SPA | 14.4km SE | Protected birds: Dotteral. | No potential effects of projects on this designation site and associated mobile species will not utilise the urban and coastal area. |
| Inverpolly, Loch Urigill, and nearby lochs | SPA | 12.6km N | Protected birds: Black-throated diver (<i>Gavia arctica</i>). | Include in screening – Black-throated diver is mobile. |
| Knockan cliff | SSSI | 15.4km NNE | Biological feature: Upland habitats (tall herb, calcareous grassland, calcareous screes, blanket bog, flush). | No potential effects of projects on this designation site. |
| Rubha Dunnan | SSSI | 16.4km NW | Biological feature: Hydromorphological mire range. | No potential effects of projects on this designation site. |
| Corrieshalloch Gorge | SSSI | 16.6km SSE | Biological features: upland birch woodland; crane fly, <i>Lipsothrix ecucullata</i> . | No potential effects of projects on this designation site and associated mobile species will not utilise the coastal habitat. |
| Wester Ross Lochs | SSSI SPA | 17.6km WSW | Biological feature (SSSI): Black-throated diver. Protected birds (SPA): Black-throated diver. | Include in screening – Black-throated diver is mobile. |
| Ardlair – Letterewe | SSSI | 18.3km SSW | Biological feature: upland oak woodland; upland birch woodland; upland habitats (subalpine wet heath, subalpine dry heath, alpine heath, alpine moss | No potential effects of projects on this designation site. |



| | | | | |
|----------------------|------|------------|--|---|
| | | | heath, calcareous grasslands, snowbeds, tall herb ledges, blanket bog and rocky slopes). | |
| Fannich Hills | SSSI | 18.4km SSE | Biological feature: upland habitats (heath and mire, montane grassland, snowbeds, summit moss heath and cliff ledges); beetles (leaf beetle <i>Phyllodecta polaris</i>); flies. | No potential effects of projects on this designation site as no connectivity between site and this designation. |
| Fannich Hills | SAC | | Habitat feature: Acidic scree; Alpine and subalpine heaths; Blanket bog; Clear-water lakes and lochs with aquatic vegetation and poor to moderate nutrient levels; Dry heaths; Montane acid grasslands; Plants in crevices on acid rocks; Wet heathland with cross-leaved heath. | No potential effects of projects on this designation site as no connectivity between site and this designation |
| Loch Urigill | SSSI | 18.6km NE | Biological feature: Oligo-mesotrophic loch; Black-throated diver; Breeding birds (waterfowl, ringed plover, common sandpiper and waders). | Include in screening – Black-throated diver (<i>Gavia arctica</i>) and Breeding bird assemblage are mobile. |
| Little Guinard River | SAC | 18.7km WSW | Annex II Species: Atlantic salmon | Include in screening – Atlantic Salmon (<i>Salmo salar</i>) are mobile. |

4.1.2 Biodiversity – Terrestrial

The project is surrounded on the landward side by the village of Ullapool and does not include or adjoin any 'green' areas. Hence there are no terrestrial ecosystems that will be directly affected by the development. There are areas of rough ground and scrub and trees to the east of the village. There are gardens with trees in Ullapool, but none of these directly adjoin the construction site. No sensitive flora species are expected to be affected by the development.

No trees or buildings will be disturbed by the development hence no bat or red squirrel surveys have been completed. Badgers are unlikely to be in the immediate vicinity to the works due to the lack of suitable habitat.

Inverpolly SAC which is 11.8km north of site is designated for European Otters (*Lutra lutra*) as it supports a high-quality population representative of north-west Scotland. Otters are a European Protected Species (EPS) and are protected under the Conservation (Natural Habits and Species) Regulations 1994 (as amended) in Scotland which transposes into Scottish law from the European Community's Habitats Directive (92/43/EEC).

Otters can travel over large distances (20km or more) along river habitat (The Mammal Society, 2016) and there is an aquatic route between Inverpolly SAC and Ullapool harbour less than 20km via River Canaird, Loch Kanaird and Loch Broom. Also of note, the mouth of Ullapool river is approximately 1.2km along the coastline from Ullapool harbour and there are a number of otter records in and around Loch Broom (National Biodiversity Network Atlas, 2019). However, it should be mentioned that records within the mid basin of Loch Broom are 20 years old or older. The current Shore Street revetment as shown in Figure 4.1 does not provide suitable habitat for couches, layups or holts.



Figure 4.1: Shore Street Revetment

4.1.3 Biodiversity – Ornithology

A total of 162 bird species have been recorded within a 5km radius of the proposed development (National Biodiversity Network Atlas, 2019). The area of the proposed development is not considered an important site for breeding bird species. There are two SPAs within 20km of the site that are designated for Black-throated Divers (*Gavia arctica*)-Inverpolly, Loch Urigill, and nearby lochs SPA and Wester Ross loch SPA. Black-throated divers



breed on small pools and freshwater lochs, predominantly in North-west Scotland during summer and during winter on the coasts of Scotland and further afield. There have been a number of records of black-throated divers in the outer basin of Loch Broom (National Biodiversity Network Atlas, 2019), the most recent of which was in 2011 about 2km from Ullapool Harbour.

There are records of species including red-breasted mergansers, red throated divers, red shank, common scoter, little grebe, goldeneye, curlew, eider, ringed plover, common sandpiper, and various sea birds in Loch Broom. However, the development area is already subject to a high level of disturbance and has minimal habitat suitable for nesting birds.

4.1.4 Biodiversity – Marine

Important benthic, fish and marine mammal receptors are all present within and close to Loch Broom. Designations are in place for all three groups of marine receptors within 20km of the development.

Most notably, the site is adjacent to the Wester Ross Nature Conservation MPA. At its closest point the site is approximately 10 m away from the MPA boundary. No Priority Marine Features (PMF) are present within the site. However, PMFs present within the mid basin of Loch Broom where Ullapool is situated, includes the Burrowed mud habitat and tall seapen (*Funiculina quadrangularis*) which is a characteristic species of this habitat. There are also kelp and seaweed communities on sublittoral sediments on the opposite side of the basin to Ullapool and flame shell beds (*Limaria hians*) have been recorded at the in Sruth Lagaidh Narrows which is approximately 2.8km south of the development site (SNH, 2013b).

There are records of tall seapens 250-900m south of site the most recent of which was recorded in 2010 during SNH's "Ullapool Approaches" video surveys (National Biodiversity Network Atlas, 2019). It is noted that there is a record of tall seapens within the Loch Broom dredge disposal site (Marine Scotland, 2019).

The Inner Hebrides and the Minches Special Area of Conservation (SAC), designated for Harbour porpoise (*Phocoena phocoena*), is located 4.4km to the northwest of the development. It is noted that the Harbour porpoise are afforded protection when they are outwith the SAC, and they are known to swim into Loch Broom. There are a number of records of porpoise from Loch Broom, however most records are concentrated in the outer basin towards the mouth of the loch (National Biodiversity Network Atlas, 2019). Other marine mammals have been recorded in Loch Broom and may swim close to Ullapool Harbour (National Biodiversity Network Atlas, 2019), these include grey seal (*Halichoerus grypus*), harbour seal (*Phoca vitulina*), and common dolphin (*Delphinus delphis*).

Little Gruinard river which runs into Gruinard Bay 18km to the west of Ullapool is designated for Atlantic Salmon (*Salmo salar*) because it supports a high-quality population. These salmon may use Loch Broom when they migrate to sea, rivers that run into Loch Broom also support salmon e.g. Cuileig and Ullapool River and migrating salmon from these rivers are likely to swim in the vicinity of the development particularly from rivers at the head of Loch Broom. River Oykel SAC (7.6km NE of Ullapool) is also designated for Salmon but this river runs to the east coast so this development will have no impact.



4.2 Cultural Heritage

The development area intersects the Ullapool Conservation Area which was designated in 1972 under the Civic Amenities Act 1967.

There are 75 Canmore and 29 Canmore maritime entries (Historic Environment Scotland, 2019) within a 2km radius of the proposed development site. There are no wrecks within the footprint of the development and dredge area. However, there is one unclassified wreck in the vicinity of the development which lies approximately 35m north of the end of the breakwater pontoon (57.89583°N, -5.15500°E) at a water depth of 3m (lowest astronomical tide) (Canmore, 2019). This wreck may lie within navigation routes into the inner harbour after the end pontoon is installed.

There are 11 listed buildings within 2km of the site, as detailed in Table 4.2.

Table 4.2: Details of listed buildings within a 2km radius of the Development Site.

| Site/Description | Index No. Primary Reference | Designation/Status | Location (OS NGR) |
|---|-----------------------------------|---------------------|-----------------------------------|
| Ullapool Quay Street, The Captain's Cabin Late 18th century former warehouse, 3 storeys, 3 bays; harled. Centre door in 1st floor reached by forestairs; ground floor doors symmetrically sited in outer bays, each with later shop window slapped to left. South (Shore Street) gable with single ground, 1st and apex windows; end stack to north. | LB7792 | Listed Building (B) | NH 12822 93969 |
| Ullapool, West Shore Street, Ornsay House Thomas Telford, 1829, with subsequent alterations and re-casting of main entrance. 2-storey, 3-bay house, with 2-storey wing to rear. All harled with contrasting painted margins and long and short detailing to frontage. Centre door (later insertion); 2-pane glazing; coped end stacks; slate roof. | LB7787 | Listed Building (C) | NH 12735 93911 |
| Ullapool West Shore Street Caledonian Macbrayne And Tourist Office Possibly Thomas Telford, circa 1800. Alterations, Robert Hurd & Partners, 1978. Tall 2-storey, wide 3-bay former warehouse; all harled. 1 wide and 1 narrow entrance in south elevation with 2 assymmetrical small windows. 3 small regularly spaced 1st floor windows. Long modern stair window rises to roof line from ground floor in east gable; slate roof. | LB7765 | Listed Building (C) | NH 12752 93915 |
| Ullapool Argyle Street Former Ullapool Parish Church And Burial Ground. Thomas Telford, 1829. Plans and specifications by James Smith. Standard Parliamentary T-plan church; coursed squared rubble, harled flanks and rear; contrasting | LB7764 | Listed Building (A) | NH 12685 93998, NH 12687 94020 |

| Site/Description | Index No. Primary Reference | Designation/Status | Location (OS NGR) |
|---|-----------------------------------|---------------------|----------------------|
| tooled ashlar dressings. Depressed arched outer doors in south elevation with similarly detailed paired windows in centre bays with standard cast-iron 2-light, latticed glazing. Similar windows in end gables and in east and west elevations of T-wing. Standard bellcote at west gable apex; slate roofs. Interior; plain galleried interior. Burial ground: pair squared dressed rubble gate piers with caps; coped drystone wall. | | | |
| Ullapool Quay Street, Memorial Clock Dated 1899. Handsome cast-iron clock on column. Square plinth supported fluted column, paired lamp brackets. Corinthian capital and square pedimented clock with face to each side; terminal urn and decorative weathervane. | LB7791 | Listed Building (B) | NH 12795 94019 |
| Ullapool Argyle Street Old Bank House Early 19th century, 2-storey and attic, 3-bay house; coursed red rubble, harled flanks and rear. Centre door with simple fanlight and plain wooden portico supported on slender Roman Doric columns. Smaller 1st floor windows; 12-pane glazing; 3 early piended dormers with 6-pane glazing; corniced end stacks; slate roof. Symmetrical fenestration to rear with centre stair window; single storey centre rear wing. Low rubble front retaining wall with ashlar cope. | LB7785 | Listed Building (B) | NH 12898 94046 |
| Ullapool Main Road, The Manse Circa 1844. Renovated, 1906. 2-storey and attic, 3 wide bays; coursed rubble, tooled dressings. Recessed narrow centre bay with entrance approach by 3 steps; fanlight; modern door; bipartite above; taller bipartites in ground floor outer bays; 12-pane glazing; 2 small gabled barge-boarded dormers (probably 1906) with 4-pane glazing; corniced end stacks; slate roof. Single storey, single bay wing to rear. | LB7788 | Listed Building (B) | NH 13338 94147 |
| Ullapool Old Mill Street, Parish Church (Church Of Scotland) Probably William Henderson, Architect, Aberdeen 1844. Reconstructed in 1906, with further alterations after 1929. Plain rectangular church with lower single storey, 3-bay wing at north. Coursed rubble, harled rear, tooled ashlar margins and dressings. | LB7789 | Listed Building (C) | NH 13021 94245 |

| Site/Description | Index No. Primary Reference | Designation/Status | Location (OS NGR) |
|---|-----------------------------------|---------------------|-----------------------------------|
| Round-headed entrance in centre of east gable with gallery window above. 5 long round-headed windows in symmetrical south elevation; lattice pane glazing; finialled bellcote at east gable apex; ridge ventilator; apex ball finials; slate roof. | | | |
| Ullapool, 1, 2 Custom House Street, Drill Hall And House Drill hall and adjoining 2-storey villa-like house built circa 1887 for the Seaforth Highlanders, on the site of the Custom House. South facing Custom House Street elevations, stone-built; snecked to front, rubble or rendered elsewhere, ashlar detailing; arched openings; plate glass timber sash and case windows to hall, modern uPVC replacements to house. 3-bay south front to hall, central double door with flanking windows and central timber louvred opening above door; segmental-arched corrugated iron roof. Door with 2 windows to long elevation on Ladysmith Street with north lean-to. Timber tongue and groove to some interior walls and to arched roof with thin metal tie beams. Attached 3-bay house of similar arrangement with central door (uPVC with timber effect finish) and flanking windows. Curvilinear gable to left bay; timber-corbelled oriel breaking eaves to right bay, both with finials. Pitched and piended slate roof, stone skews, prominent stacks. Rear single storey lean-to extension. | LB49788 | Listed Building (C) | NH 12886 94283, NH 12874 94294 |
| Ullapool 4 (L) And 5 (R) Custom House Street. Mid 19th century; pair 2-storey, 3-bay houses, of slightly differing build. Coursed rubble, tooled dressings; centre doors; 12-pane glazing; end and ridge stacks; slate roofs. | LB7786 | Listed Building (C) | NH 12926 94288, NH 12937 94294 |
| Ullapool Old Mill Street, Hill Cottage And Rear Byre Range. Earlier 19th century, 2-storey and attic, wide 3-bay house; west facing with late 19th century single storey and attic, 2 bay wing at south gable. All harled. Panelled centre door. 12-pane glazing; 2 later canted dormers with 2-pane glazing; flat skews with late 19th century skew-putts; corniced end stacks; slate | LB7790 | Listed Building (C) | NH 13225 94371, NH 13240 94375 |

| Site/Description | Index No. Primary Reference | Designation/Status | Location (OS NGR) |
|--|-----------------------------------|--------------------|----------------------|
| roof. 2-storey, single bay bathroom wing to rear. Contemporary single-story harled rubble byre range to rear. Corrugated iron roof. | | | |

4.3 Landscape and Visual

The site lies between two designated National Scenic Areas, Assynt Coigach (approx. 6.0km to the north west) and Wester Ross (approx. 7.4km south west). Both are designated for having some of finest mountainous scenery in Scotland. As the development is outside these areas and is not providing a significant change to wider landscape, we consider that the low-lying works will not compromise the integrity of the nearby National Scenic Areas.

4.4 Land

The underlying geology of the development is sandstone and pebble of Applecross Formation, with superficial deposits of marine beach gravel deposits (BGS, 2019c).

There is baseline borehole data close to the dredge area, taken during the previous main pier development (BGS, 2019b). Data for this borehole sample (taken adjacent to ferry pier, 57.894636°N, -5.159267°E) indicates that the dredge material will compose of silty sand and medium gravel in the surface layer and then the remainder will be coarse sand and fine gravel.

There is also baseline borehole data onshore from Argyle Street which is immediately parallel to Shore street (approximately 30m north, 57.896553°N, -5.156988°E) (BGS, 2019a). A description of the strata here indicates that under the initial bitumac and crushed limestone road base (0.35m) there is loose dark brown very silty sandy cobbly gravel, with rootlets (0.35m-1.0m) and underlying dense brown sandy rounded fine and coarse gravel and cobbles (1.0m-5.55m).

Designated sites with geological features within 20km of the site are outlined in Table 4.3. Creag Churcurach SSSI is the closet designation for a terrestrial geological feature, situated 5.4km south of the site and is designated for Moine. The development will not impact geological features at this distance away and therefore other terrestrial geological designations are not considered for the remainder of the screening document.

The Wester Ross MPA includes geodiversity features and detailed in Table 4.3, the closest of these features to Ullapool are moraines a few 100m offshore (SNH, 2013a).

Table 4.3: Statutory Nature Conservation Designations with Geological Designations within 20km of the Development Site (Marine Scotland, 2019; SNH, 2020)

| Site | Designation | Distance Direction | Designated Features (relevant designation) |
|------------------------------------|-------------|----------------------|--|
| Wester Ross | MPA | Immediately adjacent | Protected Geodiversity Features: Marine geomorphology of the Scottish shelf seabed - banks of unknown substrate; Quaternary of Scotland – glaciated channels/troughs, megascale glacial lineations, moraines; Seabed fluid and gas seep- pockmarks; Submarine mass movement -slide scars |
| Creag Chorcurach | SSSI | 5.4km S | Geological features (SSSI): Moine; |
| An Teallach | SSSI | 7.0km SW | Geological features (SSSI): Moine; Quaternary of Scotland (glacial and periglacial features) |
| Inverpolly | SSSI | 11.8km NNE | Geological feature (SSSI): Quaternary of Scotland |
| Beinn Dearg | SSSI | 12.5km SE | Geological features (SSSI): Quaternary of Scotland (moraines) |
| Cailleach Head | SSSI | 14.8km W | Geological feature (SSSI): Torridonian |
| Knockan cliff | SSSI | 15.4km NNE | Geological feature (SSSI): Moine |
| Rubha Dunnan | SSSI | 16.4km NW | Geological feature (SSSI): Torridonian |
| Corrieshalloch Gorge | SSSI | 16.6km SSE | Geological features (SSSI): Quaternary of Scotland; Fluvial geomorphology of Scotland |
| Meall an t-Sithe and Creag Rainich | SSSI | 16.9km S | Geological features (SSSI): Moine |
| Fannich Hills | SSSI | 18.4km SSE | Geological feature (SSSI): Quaternary of Scotland; Moine |

4.5 Air

The development site is not within an air quality management zone. There is only one Air Quality Management Area in the whole of the Highland Council Area (Air Quality in Scotland, 2019) This is within Inverness City Centre and covers a small area on a busy junction between 3 streets. No air quality data exists for the development area, but it is anticipated that air quality will be high based on its rural and coastal location.

4.6 Water and Coastal Processes

Loch Broom is classed as a coastal water body (ID: 200161) in the Scottish River Basin District, it has an overall status of good which it has retained since 2007, although the status of some biological elements considered by the scheme have dropped from high to good, while other have increased from good to high (SEPA, 2020).

There are no records of bathing water quality in Ullapool. There are no freshwater courses within the proposed development area, there are surface water drainage gullies passing under the road discharging onto the foreshore.



The frontage at Shore Street is exposed to wind driven waves generated over the local fetch in Loch Broom. The area to the north of the main pier where the existing pontoons are located can have rougher seas than are desired in certain weather conditions.

4.7 People

The total population of Ullapool as of the 2016 was 1,520 (National Records of Scotland, 2018). The main employment sectors in the Highland region are health and social care, tourism and hospitality; Ullapool is a popular tourism hotspot and contains numerous hotels, B&B's, guest houses, and holiday cottages as well as shops and restaurants. 5-10% of the population (% of total employment) in the Ullapool region are directly employed by the fishing, fish processing or aquaculture industry (Baxter, 2011). As of September 2019, the unemployment rate was 1.6% in the Wester Ross region (Highlands and Islands Enterprise, 2019).

Ullapool has a medical health centre which offers GP services and minor surgeries. For major medical requirements the closest hospital is Raigmore Hospital in Inverness which is 57miles away by road.

The onshore side of Shore Street is a row of residential and business properties which runs along the whole length of the development area (approximately 29 properties). These businesses operating on Shore Street include cafes, pubs, holiday accommodation (guesthouses, B&B's, and a youth hostel) and shops (including newsagent, pharmacy, clothes and gift shops).

There are a number of marine users which are likely to use the development area directly and if not will use its surroundings (e.g. slipway, mooring buoys, and Ullapool harbour). These include the Royal Yacht Association Loch Broom Sailing club, Ullapool Coastal Rowing club, Blue tourist businesses kayak, sailing and wildlife tour companies.

Ullapool harbour is an important fishing harbour representing a significant proportion of Scottish landings from demersal and shellfish fisheries (Table 4.4). The harbour is used by Scottish and Spanish fishing vessels that catch white fish and squid in summer and monkfish in winter (Ullapool Harbour Trust, 2020). These larger boats mostly berth and land their catch in the deeper parts of the harbour outside of the development area. There is also an inshore shellfish fleet operating out of Ullapool that lands crab, lobsters and prawn on daily/weekly basis (Ullapool Harbour Trust, 2020).

Table 4.4: Ullapool Fish and Shellfish Landings 2018 (Scottish Government, 2019)

| Species Category | Ullapool (live tonnes) | Whole of Scotland (live tonnes) | Proportion of national landings in Ullapool |
|------------------|------------------------|---------------------------------|---|
| Demersal | 9,403 | 117,216 | 8.0% |
| Shellfish | 1,924 | 140,948 | 1.4% |
| Pelagic | 13 | 43,966 | 0.03% |

4.8 Traffic, Transport, Access and Navigation

The proposed developed is situated on one of busiest streets in Ullapool. Shore Street (A893) is the main route to the ferry terminal and serves as key route to access amenities in the south side of Ullapool. Annual average daily traffic using this road was estimated at 2262 motor vehicles (of which 60 were HGVs) in 2018 (Department of Transport, 2020).



The footpaths along the street provide access to business and residential properties on one side and the seafront on the other side.

Ullapool's main pier has a navigation light (fixed red beacon) on the South East corner which marks the edge of the pier and assists safe passage up to the pier and into the part of harbour that will be upgraded in the development. This is maintained by Ullapool Harbour Trust. Currently Ullapool harbour has an average of 20-50 vessel transits per week from vessels that record AIS Shipping Traffic data (usually large vessels – fishing vessels below 15m are exempt from requiring AIS) (Marine Scotland, 2019). Most of these transits are carried out by the Caledonian MacBrayne ferry that links Ullapool to Stornoway but includes large fishing vessels, aquaculture service vessels and military vessels. There are also smaller fishing vessels and recreational vessels that operate from and use Ullapool harbour. Visiting recreational sailors use Ullapool as passing place for Northern routes to Cape Wrath, Orkney and Shetland (Sail Scotland, 2019).

4.9 Cumulative planning applications

There are 13 planning permission applications within 2km of the site (Highland Council e-planning website - <https://wam.highland.gov.uk/wam/> accessed 10/12/2019). None of applications are considered to interact with the Shore Street promenade and harbour upgrade proposal.

Further afield there is a holiday development on the Summer Isle, Tanera Mòr that indirectly interacts with this proposal. Tanera Mòr, described as an idyllic island retreat, is proposed to host 60 guests and house a resident staff population. When the development is complete, a ferry service could operate between Ullapool Harbour and the Island to transport guests, staff and visitors.



5 Potential Effects

5.1 Construction

Table 5.1 provides a description of the environmental aspects resulting from the Shore Street Widening & Promenade works (yellow) the Small Boat Harbour Development (blue) and both projects (green). It outlines the sensitivities as detailed in Section 4, identifies any likely significant effects and proposes mitigation measures for negative effects.

Table 5.1: Construction Effects and Sensitivities

| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--------------------------|----------------------------|---|-----------------------------------|---|---|
| Use of Natural Resources | Use of Material (eg steel) | Rock for rock armour. Infill material for land reclamation Tarmac, bricks etc for road, promenade and wall. Steel for sheet piles. | None | NO | Efficient use of resources. Appropriate design for long life in marine environment including corrosion protection of steel elements. |
| | Use of Land and/or Soil | Dredge spoil from rock armour toe trench and dredge pocket. | NO | NO | The volumes of removed material will be minimised through design and re-used where possible. |
| | Water | Construction water requirements. | NO | NO | No mitigation required. |
| | Biodiversity / Land-Take | Removal of intertidal habitat associated with widening of Shore Street and the Small Boat Harbour Development. | Biodiversity – Intertidal Benthic | NO | Construction footprint minimised by design. |
| Residues and Emissions | In-Air Noise and Vibration | Road, promenade and rock armour construction works. Vibro piling. | Cultural Heritage People | YES - Negative | Noise and Vibration assessment to be completed prior to works to inform specific mitigation requirements, for agreement through the planning process. |

| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--------|---|---|---|---|---|
| | | Plant and vessel movements for dredging and pontoon installation. | | | Works conducted in line with current practice for noise and vibration control on construction and open sites. Good communications with the community so they are aware of planned works. |
| | Underwater Noise and Vibration | Plant and vessel movements. Rock infill / Material placement. Vibro piling. | Biodiversity – Marine (incl. the qualifying features of the Inner Hebrides and the Minches SAC) | NO | Vibro piling carried out in shallow waters and mainly above MLWS protected from the wider Loch Broom by the existing harbour, hence noise levels experienced in water depths suitable for marine mammals will not cause physical harm, and disturbance effects will be minimal. Rock infill will not be dropped from height by the excavator, majority of works completed out of the water column. All plant vehicles / vessels used will be well maintained. |
| | Air Quality (Emissions – dust) | Removal of old pavements, roads and promenade. Rock infill / Material placement. Plant movements. | Air People | NO | Dust management including localised dampening and road sweeping. |
| | Air Quality (Greenhouse Gases and Climate Change) | Plant and vessel movements | No Local Sensitivities Possible Climate Change Contribution | NO | Plant, vehicles and vessels will be well maintained. Reuse and recycling of materials to limit the amount of bulk material needing to be imported onto site. |
| | Terrestrial Pollution | Risk of unplanned emissions / release of pollutants from, i.e. | Land Quality | NO | Quantities of hazardous materials, fuels and oils stored on site minimised. |

| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--------|-----------------------------------|--|--|---|---|
| | | <ul style="list-style-type: none"> Oil/fuel storage and handling Hazardous material storage and handling Plant/machinery fault | | | <p>Works conducted in line with standard best practice and Guidance on Pollution Prevention with regard to hazard material and fuel storage and handling.</p> <p>Spill procedures and kits in place.</p> <p>Plant and machinery will be appropriately maintained.</p> <p>Works associated with Scottish Water sewage pumping station will be conducted in conjunction with Scottish Water requirements.</p> |
| | Water Quality (Marine) | <p>Risk of unplanned emissions / release of pollutants from, i.e.</p> <ul style="list-style-type: none"> Oil/fuel storage and handling Chemical storage and handling Plant/machinery/vessel fault | Water Biodiversity – Marine (incl. Wester Ross NCMPA; Inner Hebrides and the Minches SAC) | NO | <p>Works conducted in line with standard best practice and existing guidelines:</p> <ul style="list-style-type: none"> Storage and handling; Waste management; and Surface water management <p>Plant and machinery will be appropriately maintained.</p> <p>Works associated with Scottish Water sewage pumping station will be conducted in conjunction with Scottish Water requirements.</p> |
| | Water and Seabed Quality (Marine) | <p>Increased sediment in the water column associated with primarily with dredging disposal activities. Drop out of sediments onto the seabed. Resuspension of contamination into water column.</p> | <p>Biodiversity – Marine (incl. PMF tall seapen (<i>Funiculina quadrangularis</i>) of the Wester Ross MPA; Salmon; Marine mammals Loch Broom</p> | YES - Negative | <p>Dredge limited in depth, minimising volume and duration of dredge. Ensure dredged material is not contaminated and appropriate dredge disposal route is identified through the dredge licensing BPEO assessments processes. Reuse dredge spoil in the construction works as far as practicable.</p> |

| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--|-----------------------|---|---|---|---|
| | Light Emissions | Light for construction | Biodiversity – Terrestrial Biodiversity – Marine People | NO | Works will follow the Scottish Executive Guidance Note, 'Controlling Light Pollution and Reducing Lighting Energy Consumption'; <ul style="list-style-type: none"> Over-lighting will be avoided and designed to industry recommended levels; and All lights will be carefully directed to where they are most needed and will be designed to minimise light pollution |
| Traffic, Transport, Access and Navigation | Traffic and Transport | Vehicle movement restrictions associated with construction works associated with the Shore Street Widening and Promenade Works. | Traffic, Transport | YES - Negative | A Traffic, Transport and Access Management Plan will be produced and submitted to support the planning application, this will identify the requirements of the various project phases and appropriate mitigation, this may include: <ul style="list-style-type: none"> The use of traffic lights if one carriageway needs to be closed; Temporary use of parking bay as traffic or construction access corridor; Diverting traffic along Quay Street and Argyle Street to allow both lanes to be closed; Timing road closures around the ferry timetable where practicable; Communication with local residents and stakeholders such as local businesses & CalMac; |

| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--------|------------|---|---|---|---|
| | | | | | <ul style="list-style-type: none"> Appropriate signage. |
| | Access | Construction works on the footpath and the promenade. | People (Locals and Visitors) Businesses on Shore Street | YES - Negative | <p>The Traffic, Transport and Access Management Plan to produced and submitted to support the planning application will specifically cover pedestrians and cyclists, it will identify the requirements of the various project phases and appropriate mitigation, this may include:</p> <ul style="list-style-type: none"> Works on landward side footpath being phased to minimise disturbance. Accesses to businesses will always be maintained. Alternative pedestrian routes being set up to provide safe routes along Shore Street. Ongoing two-way communications with local businesses & residents. Appropriate signage. |
| | Navigation | Dredge and dredge disposal activities including vessel movements associated with the Shore Street Widening and Promenade works. | Ferry Commercial Vessels including fishing boats Recreational Vessels from kayaks, row boats to yachts. | No | <p>Appropriate Notice to Mariners posted. Input from the Harbour Master pre and during construction works. Harbour Master retains control of safety during works, coordinating movements as required.</p> |



| Aspect | | Source | Sensitivities | Likely Significant Effects (excluding mitigation) | Any mitigation measures? |
|--------|------------|---|---|---|--|
| | Navigation | Dredge and dredge disposal activities including access requirements and vessel movements associated with the Small Boat Harbour Development. Delivery and installation of pontoons. | Ferry Commercial Vessels including fishing boats Recreational Vessels from kayaks, row boats to yachts. | YES - Negative | Early communication with local vessel owners to allow alternative berths and arrangements to be put in place. Appropriate Notice to Mariners posted. Input from the Harbour Master pre and during construction works. Harbour Master retains control of navigational safety during works, coordinating movements as required. |



Without mitigation there are potentially five likely significant negative effects arising from the construction stage of the project as identified in Table 5.1.

5.1.1 In-Air Noise and Vibration

The location of the Shore Street Widening & Promenade works on a road lined by residential and business properties, coupled with the use of heavy machinery for construction will give rise to in-air noise and potentially vibration effects. Similarly, the Small Boat Harbour Development is close to residential and business properties at the west end of Shore Street and Quay Street and will utilise some heavy plant. However, noise and vibration effects of construction activities are well understood and predictable which allows appropriate mitigation to be identified to minimise effects. It is also recognised that the effects will be limited to the construction period(s) only. The two projects will be carried out at different times hence the noise and vibration levels will not be a cumulative.

As mentioned in Table 5.1 and detailed in Section 6.1.1 a noise and vibration assessment will be completed once the design is further progressed to inform specific mitigation requirements and submitted in support of the planning application(s). Standard construction noise mitigation techniques and communication strategies will be put in place as detailed in Section 6.2.1.

5.1.2 Water and Seabed Quality (Marine)

Both projects will require an element of dredging, where practicable this will be reutilised as infill material, however there is a potential that it will need to be disposed of. Although there are no known contaminants present, until the material is sampled this cannot be confirmed.

Sediment sampling and analysis will be completed to inform BPEO assessments to identify the best management of dredge spoil in support of the dredge licences.

The Shore Street Widening & Promenade toe dredge is in the intertidal area, hence dredging will only give rise to sedimentation issues when the tide is in and these are not expected to be significant.

The Small Boat Harbour Development dredge includes some intertidal areas but more of it will be underwater than the toe dredge. However, sedimentation effects will be localised.

Dredge disposal would give rise to localised sedimentation and smothering effects at the dredge disposal site. The closest dredge disposal site is the Ullapool (Loch Broom) disposal site number HE050 however, it is recognised that there may be tall seapens in the vicinity of this disposal site which would need to be considered within the BPEO(s).

Recognising that the sampling, analysis and BPEO(s) will be completed to support the dredge licence and appropriate management put in place through this mechanism no significant effects are expected to occur.

5.1.3 Traffic, Transport and Access

The widening of Shore Street including the upgrade of the footpaths and the road will impact upon both pedestrian and vehicle users. This is likely to include reducing traffic flows to a single lane and potentially stopping vehicle access completely during some phases of the works. At this stage phasing has not been developed, but options to temporarily divert vehicles via Quay Street and Argyle Street are available. Pedestrian access to businesses and



residential properties will have to be retained for the duration of the works, this will require temporary arrangements to be put in place during some phases of the works and appropriate safety segregation (fencing) to prevent the public interacting with the construction works. As discussed in Table 5.1 and Sections 6.1.3 and 6.2.3 a Traffic, Transport and Access Management Plan will need to be developed considering the various phases of the works, this will be submitted as part of the planning application for the Shore Street Widening and Promenade project.

5.1.4 Navigation

To provide access to the Small Boat Harbour Development area, vessels currently utilising the inner walls of the main pier and the existing pontoons will need to be relocated elsewhere within the harbour. This will give rise to a short-term inconvenience for the fishing and recreational vessel owners. The works will give rise to additional vessel movements within the harbour area and Loch Broom, the management of these movements will have to take account of the existing harbour users to prevent delays to the ferry service and avoid navigational risks. As discussed in Table 5.1 and Sections 6.1.4 and 6.2.4 mitigation including early communications and temporary arrangements can be put in place to minimise the effects arising.

5.2 Operations

Table 5.2 provides a description of the environmental aspects arising during operations of Shore Street Widening & Promenade (yellow) the Small Boat Harbour Development (blue) and both projects (green). It outlines the sensitivities as per Section 4, identifies likely significant effects and proposes mitigation measures for negative effect on the environment.

Table 5.2: Operational Effects and Sensitivities

| Aspect | | Source | Sensitivities | Potential Significant Effect (no mitigation) | Any mitigation measures? |
|--|--------------------------------|---|--|--|--|
| Use of Natural Resources | Underwater Noise and Vibration | Potential slight increase in numbers of small vessels utilising the Harbour. | Biodiversity – Marine | NO | Only small vessels will be accommodated by the development, hence unlikely to give rise to significant additional noise effects. |
| | Coastal Processes | Rock Armour Revetment and Quay Fronts | Coast Line | NO | |
| | Coastal Processes | Breakwater Pontoon | Coast Line | NO | |
| | Coastal Processes | Flooding of Shore Street | Public -Locals and Visitors Buildings Local Businesses | NO | |
| | Social and Economic Benefits | Shore Street Widening and Promenade and Small Boat Harbour Development Infrastructure Provided | Public – Locals and Visitors Local Businesses | YES - Positive | |
| Traffic, Transport, Access and Navigation | Pedestrian Access and Safety | Widened path, road widening new promenade with wall segregation form the road and safe crossing points. | Public - Locals and Visitors | YES - Positive | |
| | Traffic Flow and Road Safety | Road widened, and provision for sewage maintenance. | Ferry Traffic Local and Visiting Vehicles. | YES- Positive | |
| | Navigation | New Pontoons, dredged area and breakwater pontoon. | Small Boats | YES – Positive | Harbour Master retains control of navigational and coordinating movements. |



5.2.1 Coastal Processes

As detailed in Table 5.2 there will be changes associated with the Shore Street Widening and Promenade on the coastline as the existing revetment will be replaced with a rock armour revetment located outward of the existing line. In addition, the Small Boat Harbour Development includes a breakwater and a dredged area. As discussed in Section 1 projects capable of altering the coast fall under Schedule 2 of the EIAR regulations, as such to inform this Screening Report and the Screening Opinion Requested it is important to consider this aspect further.

An independent wave study has been conducted to model the wave environment in normal and extreme weather events in connection to the proposed works, this is provided as Appendix 1 to this document. The findings of this study indicate that overtopping rate in an extreme 1 in 200 year weather event the maximum overtopping rate will reduce from a 20 litres per second per metre in the existing seawall set up to 0.5litres per second per metre for the proposed new promenade. This latter rate is well within the EurOtop manual's recommended values for safe pedestrian access (EurOtop, 2018). Modelling also indicated that wave heights in new inner basin of the harbour (to the specification described in Section 3.1.2) will be reduced to a level within the limits recommended for safe berthing of small boats. The latter reduction is due to the addition of the floating breakwater and pontoon at the south east corner of main pier.

Replacement of concrete block revetment sea defences with rock armour will either continue the effectiveness of Shore Street coastal flood defence or improve it based on the modelling report (Appendix 1). Replacement is particularly important because the current sea defences are damaged and undercut in parts.

The existing coastline of the development area is all man made (rock revetment, or piled quay walls) the wave studies do not identify any changes to coastal processes outwith the development footprint, hence no likely significant negative effects are predicted.

5.2.2 Social and Economic Benefits

The amenity value of Shore Street will be increased the provision of a safe promenade for locals and visitors to utilise with ramp and step access to the foreshore coupled with improvements for vehicle and pedestrian safety as discussed in Section 5.2.3. The separation between the road and the promenade will improve visitor experience to the shore front. If people are more inclined to spend time on Shore Street then they are more likely to frequent the shops and food outlets, contributing to the local economy. Due to its attractive shorefront location, exceptional views, shops and range of eateries, Shore Street is one of the principal destinations for visitors to Ullapool. The creation of a shoreside Promenade and widening of the pavement beside the shops and other businesses will alleviate the congestion currently experienced throughout the tourist season. The proposed works will significantly enhance the visitor experience, with consequential economic benefits expected to all tourist related businesses in the village, not only on Shore Street itself. The works will also significantly improve the experience of those permanently resident in Ullapool through easing of pedestrian and road congestion.

The Small Boat Harbour may encourage additional yachts to visit Ullapool. The facilitates will also assist the water related recreational businesses and the fishing sector, allowing them to



enter and leave the harbour in a wider range of tide states. All of which has knock on benefits to the economy of the village.

5.2.3 Traffic, Transport and Access

The purpose of the Shore Street Widening and Promenade development is to improve traffic flow and pedestrian safety. The widening of the road will minimise congestion especially that associated with the vehicles embarking and disembarking the ferry, as the restricted carriageway width will no longer impeded the flow of traffic. Pedestrian safety will be increased as vehicles will no longer need to, or be able to mount the shoreside pavement, as the new Promenade will be segregated by a wall from the road. The wider path in front of the buildings will allow pedestrians to pass each other without having to step out onto the road. In addition, the dedicated area for Scottish Water maintenance vehicles off the road and off the pavement will alleviate both traffic flow and pedestrian safety issues. Dedicated pedestrian crossing points will also increase safety on Shore Street.

5.2.4 Navigation

The new pontoons and associated breakwater and dredge will provide additional facilities for small boats in Ullapool. Boats which may have previously moored in the bay will be able to berth alongside where they are afforded additional protection and have easy access to shore side facilities. Any increase in vessel numbers is not expected to give rise to a significant navigational rise, and navigational safety will remain under the control of the Harbour.

6 Mitigation

Mitigation identified to avoid significant negative effects along with general mitigation measures to minimise other environmental effects are detailed within this section. These will form the basis of the mitigation which will be submitted in support of planning and marine licence applications.

6.1 Pre-Construction Requirements

6.1.1 In-Air Noise and Vibration

Noise and vibration assessments will be completed, considering the noise sources associated with the various stages of the work, in alignment with BS 5228-1:2009+A1:2014 – the 'Code of practice for noise and vibration control on construction and open sites' (British Standards Institute, 2014). Appropriate specific mitigation will be identified to minimise noise and vibration levels at receptor locations and the associated disturbance caused for each construction phase.

6.1.2 Water and Seabed Quality (Marine)

Sediment sampling and analysis in line with the Pre-Disposal Sampling Guidance (Marine Scotland, 2017) will be completed and a BPEO assessment carried out to identify the appropriate management and submitted with dredge licence applications to Marine Scotland. Dredge spoil will be reused in the construction works as far as practicable.



6.1.3 Traffic, Transport and Access

A Traffic, Transport and Access Management Plan will be produced and submitted to support the planning application, this will identify the requirements of the various project phases and appropriate mitigation.

6.1.4 Navigation

A sufficient period prior to construction there will be communication with local vessel owners to allow alternative berthing arrangements to be put in place, to allow access for the Small Boat Harbour Development works to be undertaken.

Appropriate Notice to Mariners will be posted prior to works commencing.

Input from the Harbour Master will be sought with regard to the planning of construction works, such that navigational risks are minimised. Plans will also take account of the ferry timetable.

6.1.5 General Mitigation

The detailed design process will take account of the environmental sensitivities identified in Section 4 of this document. Where potential effects arise from the construction works appropriate mitigation will be identified, details of which will be provided with the planning consent and marine licence applications. Risk Assessment Method Statements will be in place for all construction tasks, these will include any environmental precautions and mitigation measures. Mitigation measures will be in alignment with construction guidance as discussed in Section 6.2.5.

6.2 Construction Mitigation

6.2.1 In-Air Noise and Vibration

Relevant guidance including Pollution Prevention Guidance 6 (PPG6) – for Working at Construction and Demolition Sites (Environmental Agency, NIEA, & SEPA, 2012) will be followed where appropriate. The construction mitigation is likely to include:

- Good communications with the community so they are aware of planned works and the programme and have a contact to raise any concerns to during the works.
- Timing restrictions for noisy activities.
- Use of appropriate well-maintained equipment for the given task.
- Potential use of acoustic barriers.
- The contractor will be made aware of the issues and the workforce appropriately trained to ensure unnecessary noise is avoided.
- Monitoring to ensure mitigation employed is effective.

These will be confirmed through the noise and vibration assessment submitted in support of the planning application(s).

6.2.2 Water and Seabed Quality (Marine)

Sediments suitable for use within the construction works shall be reused, the rest will be managed in accordance with the findings of the BPEO.

6.2.3 Traffic, Transport and Access

Mitigation shall be implemented as identified by the Traffic, Transport and Access Management Plan, mitigation measures may include:

- The use of traffic lights if one carriageway needs to be closed;
- Diverting traffic along Quay Street and Argyle Street to allow both lanes to be closed;
- Timing road closures around the ferry timetable where practicable;
- Temporary use of parking bay as traffic or construction access corridor;
- Communication with local residents and stakeholders such as CalMac;
- Works on landward side footpath being phased to minimise disturbance;
- Ensuring access to businesses and residential properties is always maintained;
- Alternative pedestrian routes being set up to provide safe routes along Shore Street;
- Ongoing two-way communications with local businesses and residents.

6.2.4 Navigation

There will be ongoing communications with the owners of boats affected by the works on the Small Boat Harbour Development, so that they are aware of progress and when they will be able to utilise the upgraded facility.

The Harbour Master will retain control of navigational safety during works, coordinating movements as required. Appropriate Notice to Mariners will continue to be posted during the works.

6.2.5 General Mitigation

Due to the potential effects the projects could have on a range of stakeholders during the construction phase stakeholder communications will be carried out throughout the works, this may include both verbal and written communications. The Ullapool Harbour Trusts website will be kept up to date with regard to progress and the next stages of the works.

In addition to the specific mitigation identified to manage effects that could be significant in the absence of mitigation, construction guidance will be followed to minimise other potential negative effects of the projects, this is likely to include:

- Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)
- Pollution Prevention Guidance 6 (PPG6) – for Working at Construction and Demolition Sites (Environmental Agency et al., 2012)
- Coastal and Marine Environmental Site Guide: C584 (Budd, John, Simm, & Wilkinson, 2003)
- Guidance for Pollution Prevention 8 (GPP8) – Safe storage and disposal of used oils (SEPA, Natural Resources Wales, & NIEA, 2017)
- Pollution Prevention Guidance 7 (PPG7) – The safe operation of refuelling facilities (Environment and Heritage Service, SEPA, & Environment Agency, 2011) and
- Guidance for Pollution Prevention 5 (GPP5) – Works and maintenance in or near water (NIEA, 2017)

In addition, any applicable General Binding Rules from the Water Environment (Controlled Activities) (Scotland) Regulations 2011 as amended will be applied.



7 Summary

There are proposals to widen Ullapool's Shore Street and to develop a promenade, in addition there is a potential that following the completion of that project Ullapool Harbour Trust will undertake a Small Boat Harbour Development.

Both projects fall under both the Marine Act (Scotland) 2010 and the Town and Country Planning (Scotland) Act 1997. Screening opinions are sought from Marine Scotland and the Highland Council under the Marine Works (EIA)(Scotland) Regulations 2017 and the Town and Country Planning (EIA)(Scotland) Regulation 2017 respectively with regard to the Shore Street Widening and Promenade on it own and in combination with the Small Boat Harbour Development.

Likely significant negative effects were identified for both projects without mitigation. However, mitigation has been identified for all of these aspects which reduce the resultant effects such that they are unlikely to be significant.



8 References

- Air Quality in Scotland. (2019). Air Quality Management Areas. Retrieved from <http://www.scottishairquality.scot/laqm/aqma>
- Baxter, J. M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors),. (2011). Scotland's Marine Atlas: Information for the national marine plan.
- BGS. (2019a). BGS Borehole Records: BGS ID - 1103636; BGS Reference - NH19SW15. Retrieved from <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- BGS. (2019b). BGS Borehole Records: BGS ID – 616234; BGS Reference - NH19SW12928/3. Retrieved from <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- BGS. (2019c). BGS Onshore Digital Map DiGMapGB-50
Retrieved from <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- British Standards Institute. (2014). *BS EN 5228-1:2009 +A1 2014: Code of practice for noise and vibration control on construction and open sites*. London, UK: British Standards Institute.
- Budd, M., John, S., Simm, J., & Wilkinson, M. (2003). *Coastal and Marine Environmental Site Guide (C584)*. London, UK: CIRA.
- Canmore. (2019). Unknown Wreck: Ullapool, Loch Broom. Retrieved from <https://canmore.org.uk/site/102024/unknown-ullapool-loch-broom>
- Comhairle nan Eilean Siar. (2018). Tourist Visitor Demand for the Ullapool-Stornoway Ferry Route and Potential Impacts from a Second Summer Ferry. APPENDIX 1. Retrieved from <https://www.cne-siar.gov.uk/media/10432/M%20Item%2013B%20-%20Appendix%20%201%20-%20Outer%20Hebrides%20Ferry%20Capacity%20Draft%20Study%20Report.pdf>
- Department of Transport. (2020). Road traffic Statistics - Site Number: 41025.
- Environment and Heritage Service, SEPA, & Environment Agency. (2011). *The safe operation of refuelling facilities: PPG 7*. Retrieved from Sheffield, UK:
- Environmental Agency, NIEA, & SEPA. (2012). *PPG 6: Work at Construction and Demolition Sites*. Retrieved from <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>.
- EurOtop. (2018). Manual on Wave Overtopping of Sea Defences and Related Structures - Second Edition.
- Highlands and Islands Enterprise. (2019). Lochaber, Skye and Wester Ross Key Statistics.
- Historic Environment Scotland. (2019). PastMap. Retrieved from <http://pastmap.org.uk/>



- IAQM. (2014). *Guidance on the Assessment of Dust from Demolition and Construction*. Retrieved from http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf
- Marine Scotland. (2017). *Pre-Disposal Sampling Guidance*. Retrieved from <https://www2.gov.scot/Topics/marine/Licensing/marine/Applications/predredge>
- Marine Scotland. (2019). National Marine Plan Interactive. Retrieved from <https://marinescotland.atkinsgeospatial.com/nmpi/>
- National Biodiversity Network Atlas. (2019). NBN Atlas: Your Area. Retrieved from <https://nbnatlas.org/>
- National Records of Scotland. (2018). Population Estimates for Settlements and Localities in Scotland, Mid-2016.
- NIEA, S., Natural Resources Wales. (2017). *GPP 5: Works and maintenance in or near water*. Retrieved from http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf?utm_source=website&utm_medium=social&utm_campaign=GPP5%2027112017
- Sail Scotland. (2019). *Sail Scotland Official Guide 2019*.
- Scottish Government. (2019). *Scottish Sea Fisheries Statistics 2018*.
- SEPA. (2020). *Loch Broom Water Classification Data*.
- SEPA, Natural Resources Wales, & NIEA. (2017). *GPP 8: Safe storage and disposal of used oils*.
- SNH. (2013a). *North-West Sea Lochs and Summer Isles Possible Nature Conservation MPA - Data Confidence Assessment*.
- SNH. (2013b). *Scottish MPA Project Management options: North-West Sea Lochs and Summer Isles Possible MPA, Version 11 July 2013*. Retrieved from
- SNH. (2020). SNH Site Link. Retrieved from <https://gateway.snh.gov.uk/sitelink/>
- The Mammal Society. (2016). *The Mammal Society Species Factsheet: The Otter (Lutra lutra)*. Retrieved from https://www.mammal.org.uk/wp-content/uploads/2016/08/otter_complete.pdf
- Ullapool Harbour Trust. (2020). *Ullapool Harbour Trust Fishing*.
- Visit Scotland. (2018). *Insight Department: Visitors to Highlands & Islands - 2017 Tourism Performance*. Retrieved from

9 Glossary

| Acronym | Definition |
|---------|--|
| BPEO | Best Practicable Environmental Option |
| EIA | Environmental Impact Assessment |
| EPS | European Protected Species |
| MHWS | Mean High Water Spring |
| MLWS | Mean Low Water Spring |
| MPA | Marine Protected Areas |
| NSA | National Scenic Areas |
| PMFs | Priority Marine Features |
| SAC | Special Areas of Conservation |
| SEPA | Scottish Environment Protection Agency |
| SNH | Scottish Natural Heritage |
| SPA | Special Protection Areas |
| SSSI | Sites of Special Scientific Interest |



Appendix 1 – Ullapool Wave Study

ULLAPOOL HARBOUR TRUST

ULLAPOOL WAVE STUDY

ADDITIONAL COMPUTATIONAL MODEL STUDIES



IBE1403
Ullapool Wave Study
Additional Computational
Model Studies
1
07 Oct 2019

Document status

| Version | Purpose of document | Authored by | Reviewed by | Approved by | Review date |
|---------|---------------------|-------------|-------------|--------------|-------------|
| 1 | Draft Final | A K B | SS | Adrian .Bell | 07/10/19 |
| | | | | | |
| | | | | | |
| | | | | | |

Approval for issue

| | | |
|--|--|----------------|
| | | 7 October 2019 |
|--|--|----------------|

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Prepared by:

RPS

Adrian Bell

Technical Director – Coastal Engineering & Environment

Elmwood House

74 Boucher Road, Belfast

Co. Antrim BT12 6RZ

T +44 2890 667 914

E adrian.bell@rpsgroup.com

Prepared for:

Ullapool Harbour Trust

Kevin Peach

Chief Executive

Ullapool Harbour Trust

Harbour Buildings, The Pier

Ullapool, IV26 2UH

T 01854 6127724

E kevin@ullapool-harbour.co.uk

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1 INTRODUCTION

A promenade development scheme is being designed for the Shore Street frontage at Ullapool and the Harbour Trust are also proposing to increase the dredged depth and size of the small boat harbour which is located to the east of the Harbour Building in the lee of the main pier.

As RPS had already undertaken wave studies at Ullapool in connection with the Shore Street development, the firm was commissioned to undertake additional wave studies in connection with the proposed promenade and the enhanced small boat harbour facilities. The brief for these wave studies was as follows:

1. Update the original wave study to take account of the revised SEPA climate change sea level rise figures issued in 2019.
2. Undertake Joint Probability analysis for extreme waves and water levels. Run the wave transformation models for the combinations of waves and water levels to simulate the overtopping of both the existing Shore Street revetment and the proposed new seawall and rock revetment.
3. Set up harbour wave disturbance models for the proposed small boat harbour and run simulation for the existing and proposed Shore Street revetment.
4. Run harbour disturbance simulations to test the need for and effectiveness of floating breakwater wave attenuator located off the south eastern corner of the Pier.

The details for the various facilities to be tested in the model were provided by the Harbour Trusts engineering consultants Wallace Stone LLP, drawings 2059/909, 910 and 911 for the revetment and 2127/901 and 902 for the small boat harbour. Wallace Stone LLP Drawing 2127/902 shows a plan of the proposed small boat development and the proposed revetment and is reproduced in Figure 1.1 below.

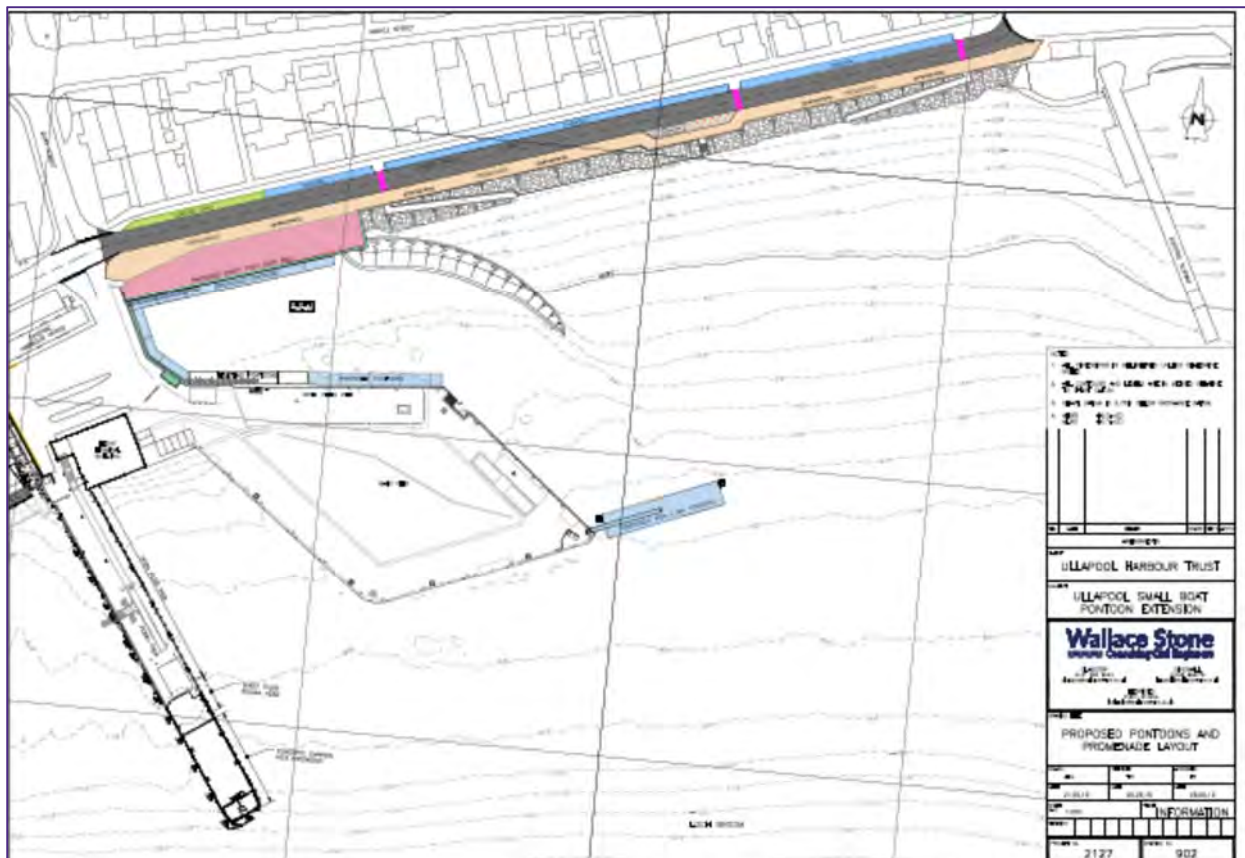


Figure 1.1 Layout of proposed promenade at Shore Street and enlarged small boat facilities at Ullapool Harbour

2 THE WAVE TRANSFORMATION MODEL STUDY

2.1 Conclusions from the Original Wave Study

The original wave studies for the Ullapool frontage at Shore Street were completed in November 2017, RPS report *IBE1403/AKB/Ullapool*. The conclusions from this November 2017 report were;

“The wave climate along the frontage at Shore Street Ullapool has been simulated for 1 in 1, 1 in 50, 1 in 100, and 1 in 200 year return period storm conditions using advanced computational modelling techniques. The simulations were undertaken at high tide, with an allowance for storm surge where appropriate, as the storm wave penetration into the site is expected to be greater at high water levels than at lower tidal levels.

The largest waves approach the site during storms from south south east to the south south west when the maximum significant wave heights at the designated wave points at the site vary from 0.393 metres to 0.648 metres for the 1 in 1 year return period storms with spectral peak wave periods varying between 2.76 seconds and 2.80 seconds. During 1 in 200 year return period storms the maximum significant wave heights at the designated wave points at the site vary from 0.770 metres to 1.331 metres with spectral peak wave periods varying between 3.63 seconds and 3.71 seconds.

The predicted sea level rise by 2080 is about 0.58 metres and this will only increase the significant wave high at the frontage by about 0.025 metre at times of high water.”

2.2 SEPA Extreme Water Levels and Predicted Sea Level Rise

Following the IPCC report on Climate Change due to Global Warming issued in late 2018, SEPA has revised its extreme water levels and predicted sea level rise to 2100 for Scottish Coastal Regions.

The current SEPA predicted extreme water levels and recommended allowance for sea level rise to 2100 for the coast at the entrance to Loch Broom is shown in Table 2.1.

Table 2.1 Ullapool SEPA recommended Extreme Water Levels and Sea Level rise to 2100

| Return Period years | Extreme Water Level [m OD] |
|------------------------|-------------------------------|
| 1 | 3.22 |
| 2 | 3.32 |
| 5 | 3.44 |
| 10 | 3.53 |
| 20 | 3.62 |
| 50 | 3.74 |
| 100 | 3.82 |
| 200 | 3.90 |
| 500 | 4.00 |
| 1000 | 4.08 |

Sea level rise to 2100 0.89m

2.3 Revised Wave Climate with Sea Level Rise

The storm wave climate simulations along the Shore Street frontage for the critical storm directions of 120° to 240° were simulated using the storm wind data as reported in the previous wave study but with the water levels increase to take account of the latest sea level rise projections. The wave heights are only increased by about 10mm due to the revision of the sea level rise provision from 0.58m to 0.89m.

The results for the simulations including the latest sea level rise projections are given in Tables 2.2 to 2.5. The locations of the wave points along the Shore Street frontage are shown in Figure 2.1.

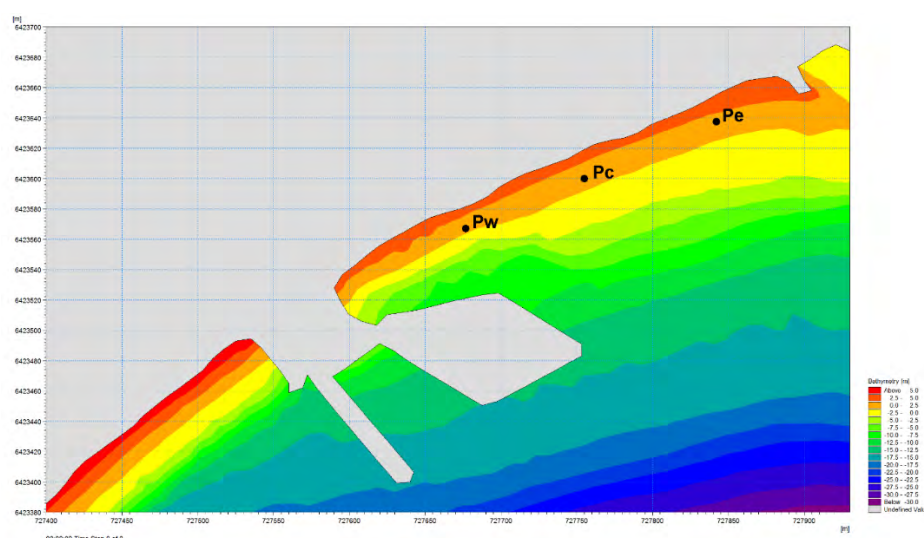


Figure 2.1 Location of wave climate points along Shore Street frontage

Table 2.2 1 in 1 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.351 | 0.735 | 2.44 | 1.94 | 121 |
| 135 | 0.376 | 0.785 | 2.56 | 2.04 | 125 |
| 150 | 0.400 | 0.835 | 2.73 | 2.14 | 128 |
| 165 | 0.400 | 0.834 | 2.73 | 2.14 | 128 |
| 180 | 0.372 | 0.776 | 2.77 | 2.18 | 132 |
| 195 | 0.334 | 0.703 | 3.00 | 2.01 | 155 |
| 210 | 0.304 | 0.462 | 1.75 | 1.59 | 195 |
| 225 | 0.276 | 0.409 | 1.36 | 1.30 | 223 |
| 240 | 0.267 | 0.416 | 1.37 | 1.22 | 236 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.483 | 1.004 | 2.49 | 2.17 | 141 |
| 135 | 0.551 | 1.141 | 2.64 | 2.30 | 146 |
| 150 | 0.605 | 1.250 | 2.76 | 2.39 | 148 |
| 165 | 0.606 | 1.251 | 2.77 | 2.39 | 148 |
| 180 | 0.600 | 1.240 | 2.78 | 2.41 | 150 |
| 195 | 0.603 | 1.247 | 2.82 | 2.42 | 159 |
| 210 | 0.552 | 1.144 | 2.84 | 2.33 | 172 |
| 225 | 0.454 | 0.949 | 2.75 | 2.04 | 190 |
| 240 | 0.375 | 0.540 | 1.56 | 1.66 | 215 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.458 | 0.953 | 2.47 | 2.12 | 147 |
| 135 | 0.540 | 1.120 | 2.58 | 2.25 | 151 |
| 150 | 0.603 | 1.248 | 2.71 | 2.34 | 154 |
| 165 | 0.604 | 1.249 | 2.71 | 2.34 | 154 |
| 180 | 0.612 | 1.265 | 2.74 | 2.36 | 158 |
| 195 | 0.657 | 1.358 | 2.76 | 2.39 | 169 |
| 210 | 0.658 | 1.359 | 2.78 | 2.39 | 180 |
| 225 | 0.587 | 1.218 | 2.70 | 2.27 | 192 |
| 240 | 0.494 | 1.033 | 2.51 | 2.02 | 206 |

Table 2.3 1 in 50 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.581 | 1.205 | 3.01 | 2.31 | 123 |
| 135 | 0.640 | 1.323 | 3.21 | 2.47 | 126 |
| 150 | 0.681 | 1.405 | 3.44 | 2.57 | 131 |
| 165 | 0.672 | 1.389 | 3.54 | 2.56 | 138 |
| 180 | 0.613 | 1.270 | 3.61 | 2.46 | 149 |
| 195 | 0.574 | 1.022 | 3.11 | 2.20 | 172 |
| 210 | 0.532 | 0.639 | 1.70 | 1.82 | 203 |
| 225 | 0.494 | 0.665 | 1.74 | 1.59 | 226 |
| 240 | 0.486 | 0.674 | 1.75 | 1.54 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.826 | 1.690 | 3.16 | 2.69 | 144 |
| 135 | 0.944 | 1.900 | 3.32 | 2.87 | 147 |
| 150 | 1.038 | 2.037 | 3.48 | 2.99 | 149 |
| 165 | 1.063 | 2.070 | 3.53 | 3.03 | 152 |
| 180 | 1.038 | 2.079 | 3.53 | 3.01 | 157 |
| 195 | 1.022 | 2.072 | 3.57 | 2.99 | 164 |
| 210 | 0.926 | 1.899 | 3.55 | 2.81 | 177 |
| 225 | 0.771 | 1.564 | 3.19 | 2.34 | 197 |
| 240 | 0.659 | 0.864 | 1.98 | 2.00 | 218 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.803 | 1.636 | 3.13 | 2.66 | 150 |
| 135 | 0.930 | 1.821 | 3.26 | 2.82 | 153 |
| 150 | 1.040 | 1.927 | 3.43 | 2.93 | 156 |
| 165 | 1.091 | 1.953 | 3.48 | 2.98 | 161 |
| 180 | 1.102 | 2.010 | 3.47 | 2.98 | 166 |
| 195 | 1.147 | 2.091 | 3.51 | 3.01 | 174 |
| 210 | 1.123 | 2.137 | 3.50 | 2.95 | 184 |
| 225 | 0.980 | 1.981 | 3.23 | 2.68 | 197 |
| 240 | 0.849 | 1.752 | 3.01 | 2.41 | 209 |

Table 2.4 1 in 100 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.627 | 1.299 | 3.11 | 2.37 | 123 |
| 135 | 0.689 | 1.422 | 3.33 | 2.54 | 126 |
| 150 | 0.733 | 1.510 | 3.53 | 2.65 | 131 |
| 165 | 0.722 | 1.490 | 3.63 | 2.63 | 138 |
| 180 | 0.658 | 1.363 | 3.72 | 2.52 | 149 |
| 195 | 0.620 | 1.102 | 3.22 | 2.26 | 172 |
| 210 | 0.578 | 0.682 | 1.76 | 1.87 | 204 |
| 225 | 0.538 | 0.699 | 1.78 | 1.64 | 226 |
| 240 | 0.529 | 0.707 | 1.79 | 1.59 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.891 | 1.808 | 3.24 | 2.79 | 144 |
| 135 | 1.020 | 2.016 | 3.46 | 2.96 | 147 |
| 150 | 1.123 | 2.117 | 3.58 | 3.08 | 149 |
| 165 | 1.146 | 2.136 | 3.61 | 3.15 | 152 |
| 180 | 1.121 | 2.178 | 3.61 | 3.11 | 157 |
| 195 | 1.107 | 2.225 | 3.65 | 3.09 | 165 |
| 210 | 1.005 | 2.055 | 3.64 | 2.90 | 177 |
| 225 | 0.838 | 1.649 | 3.19 | 2.42 | 197 |
| 240 | 0.718 | 0.903 | 2.02 | 2.07 | 219 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.868 | 1.743 | 3.21 | 2.74 | 150 |
| 135 | 1.005 | 1.912 | 3.41 | 2.91 | 153 |
| 150 | 1.125 | 1.980 | 3.54 | 3.03 | 157 |
| 165 | 1.181 | 1.994 | 3.57 | 3.08 | 161 |
| 180 | 1.193 | 2.057 | 3.56 | 3.07 | 166 |
| 195 | 1.244 | 2.169 | 3.60 | 3.12 | 174 |
| 210 | 1.220 | 2.224 | 3.60 | 3.04 | 185 |
| 225 | 1.064 | 2.115 | 3.33 | 2.77 | 197 |
| 240 | 0.923 | 1.899 | 3.13 | 2.50 | 209 |

Table 2.5 1 in 200 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.685 | 1.417 | 3.19 | 2.44 | 123 |
| 135 | 0.753 | 1.552 | 3.48 | 2.61 | 127 |
| 150 | 0.800 | 1.647 | 3.63 | 2.72 | 131 |
| 165 | 0.786 | 1.620 | 3.79 | 2.71 | 138 |
| 180 | 0.717 | 1.482 | 3.88 | 2.60 | 150 |
| 195 | 0.682 | 1.072 | 2.89 | 2.32 | 173 |
| 210 | 0.637 | 0.725 | 1.81 | 1.93 | 204 |
| 225 | 0.595 | 0.752 | 1.84 | 1.71 | 226 |
| 240 | 0.585 | 0.768 | 1.86 | 1.66 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.973 | 1.953 | 3.40 | 2.89 | 145 |
| 135 | 1.116 | 2.112 | 3.57 | 3.06 | 147 |
| 150 | 1.226 | 2.168 | 3.68 | 3.21 | 150 |
| 165 | 1.258 | 2.193 | 3.73 | 3.26 | 153 |
| 180 | 1.229 | 2.258 | 3.73 | 3.23 | 158 |
| 195 | 1.214 | 2.387 | 3.81 | 3.21 | 165 |
| 210 | 1.108 | 2.260 | 3.77 | 2.99 | 177 |
| 225 | 0.925 | 1.838 | 3.40 | 2.52 | 197 |
| 240 | 0.792 | 0.980 | 2.11 | 2.15 | 219 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.945 | 1.851 | 3.33 | 2.85 | 150 |
| 135 | 1.098 | 1.978 | 3.53 | 3.01 | 154 |
| 150 | 1.228 | 2.019 | 3.63 | 3.15 | 157 |
| 165 | 1.291 | 2.033 | 3.66 | 3.21 | 161 |
| 180 | 1.305 | 2.102 | 3.66 | 3.20 | 167 |
| 195 | 1.363 | 2.256 | 3.71 | 3.24 | 174 |
| 210 | 1.337 | 2.337 | 3.69 | 3.18 | 185 |
| 225 | 1.170 | 2.302 | 3.53 | 2.88 | 197 |
| 240 | 1.020 | 2.032 | 3.19 | 2.60 | 209 |

3 JOINT PROBABILITY AND OVERTOPPING

3.1 Joint Probability Analysis

As the waves which approach the revetment at Shore Street are the result of winds blowing over the local fetches, the joint probability analysis was undertaken between extreme water levels and wind speeds. The analysis was undertaken in accordance with the Defra/EA report “Joint Probability: Dependence Mapping and Best Practice” Technical report FD2308.

The analysis was undertaken for storm directions from 165° to 195° which give the largest wave heights approaching the lowest section of the revetment. The extreme water levels were taken from the SEPA data referenced in Section 2 above and the extreme winds speed were derived from BS EN 1991-1-4:2005+A1:2010 for extreme wind speeds throughout the British Isles. The wind speeds were adjusted for overwater wind conditions and the length of time required to fully generate the waves over the fetches.

A correlation factor of 0.4 was used for the correlation between the wind/waves and the water levels as indicated for Ullapool in FD2308/TR1. An example of the Joint Probability curves is shown in Figure 3.1 and the combinations of wind speeds and water levels is shown in Table 3.1 for the 195° storm direction.

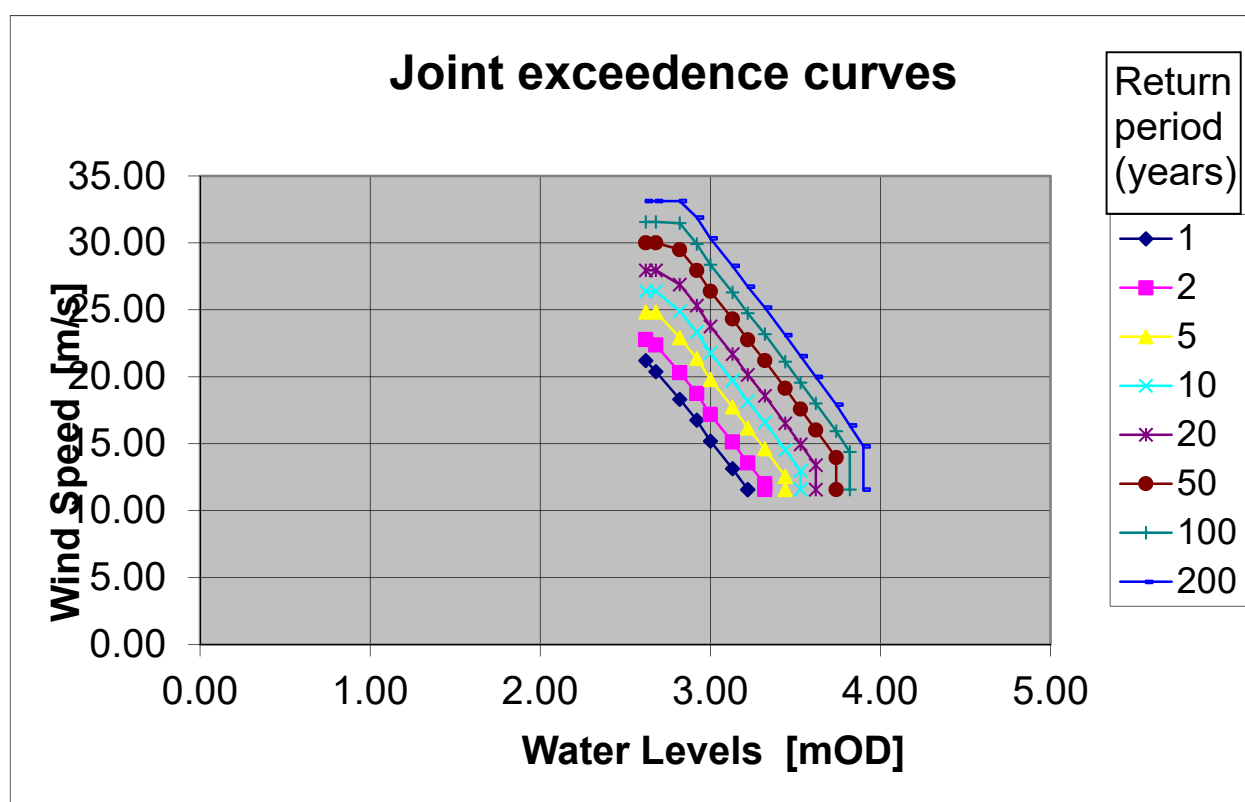


Figure 3.1 Joint Probability curves for extreme winds and water levels

Table 3.1 Joint Probability combinations of extreme water levels and storm wind speeds

| Value of first variable: Present-day sea level off Ullapool (mOD) | Joint exceedence return period (years) | | | | | | | |
|---|--|-------|-------|---------------------------|-------|-------|-------|---------|
| | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| | Value of second variable: | | | Wind speed 165-195 sector | | | | 195 deg |
| 2.62 | 21.21 | 22.77 | 24.83 | 26.39 | 27.95 | 30.00 | 31.56 | 33.12 |
| 2.68 | 20.38 | 22.36 | 24.83 | 26.39 | 27.95 | 30.00 | 31.56 | 33.12 |
| 2.82 | 18.32 | 20.30 | 22.92 | 24.90 | 26.88 | 29.49 | 31.47 | 33.12 |
| 2.92 | 16.76 | 18.74 | 21.36 | 23.34 | 25.32 | 27.94 | 29.91 | 31.89 |
| 3.00 | 15.20 | 17.18 | 19.80 | 21.78 | 23.76 | 26.38 | 28.36 | 30.33 |
| 3.13 | 13.14 | 15.12 | 17.74 | 19.72 | 21.70 | 24.32 | 26.30 | 28.28 |
| 3.22 | 11.58 | 13.56 | 16.18 | 18.16 | 20.14 | 22.76 | 24.74 | 26.72 |
| 3.32 | #N/A | 12.00 | 14.62 | 16.60 | 18.58 | 21.20 | 23.18 | 25.16 |
| 3.44 | #N/A | #N/A | 12.56 | 14.54 | 16.52 | 19.14 | 21.12 | 23.10 |
| 3.53 | #N/A | #N/A | #N/A | 12.98 | 14.96 | 17.58 | 19.56 | 21.54 |
| 3.62 | #N/A | #N/A | #N/A | #N/A | 13.40 | 16.02 | 18.00 | 19.98 |
| 3.74 | #N/A | #N/A | #N/A | #N/A | #N/A | 13.96 | 15.94 | 17.92 |
| 3.82 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 14.38 | 16.36 |
| 3.90 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 14.80 |

3.2 Wave and Water Level Simulations

As 1 in 200 year return events are used for coastal flood analysis, the combinations of extreme water levels and winds speeds for these JP events were used with the Mike21 SW wave generation and transformation model for Ullapool, Figure 3.2, to generate the combinations of wave and water levels approaching the revetment at Shore Street. The wave climate approaching the lowest point along the existing revetment and at points some 27 and 54 metres further east along the revetment, locations as shown in Figure 3.3, were extracted from the wave model simulations for use in the overtopping analysis.

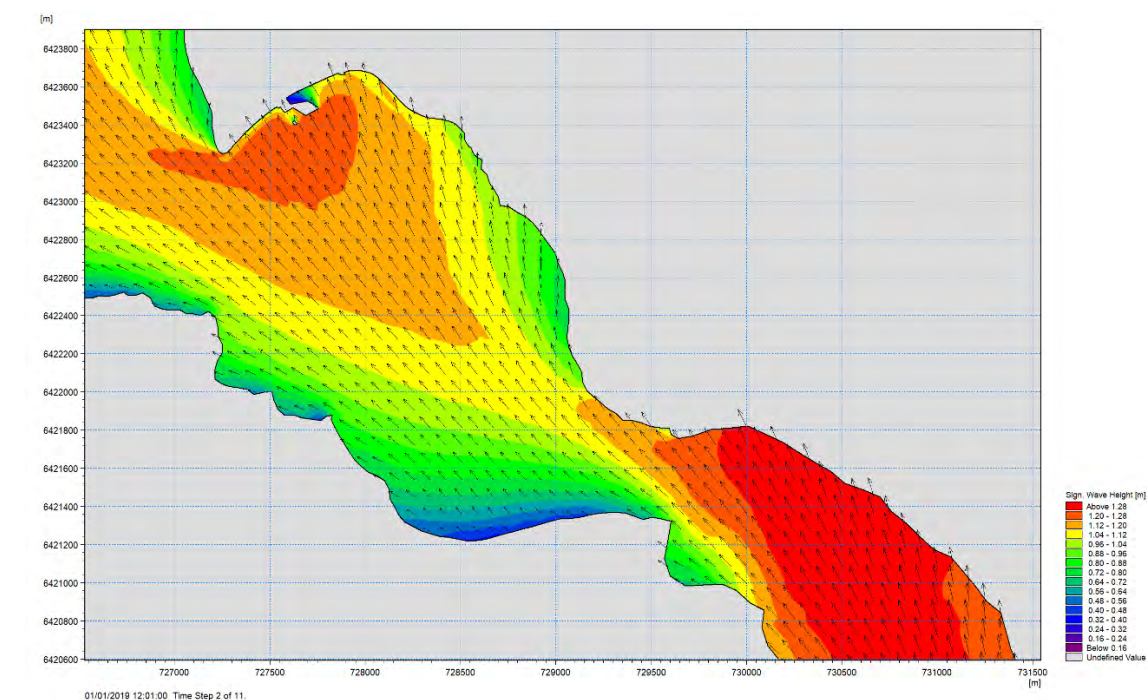


Figure 3.2 Significant wave height and mean wave direction – 1 in 200 year Joint Probability return period storm from 165° with a water level of 3.00m OD



Figure 3.3 Location of Joint Probability analysis points along the revetment

The combinations of water levels, wave heights and periods derived from the 1 in 200 return period JP modelling for the three points along the existing revetment for each of the storm directions 165°, 180° and 195° directions are shown in Tables 3.2, 3.3 and 3.4.

Table 3.2 1 in 200 JP return period water levels and waves at revetment – storm from 165°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.213 | 3.28 | 2.82 | 1.231 | 3.30 | 2.82 | 1.248 | 3.27 |
| 2.92 | 1.143 | 3.19 | 2.92 | 1.167 | 3.20 | 2.92 | 1.183 | 3.18 |
| 3.00 | 1.059 | 3.07 | 3.00 | 1.084 | 3.08 | 3.00 | 1.100 | 3.06 |
| 3.13 | 0.948 | 2.93 | 3.13 | 0.971 | 2.94 | 3.13 | 0.985 | 2.92 |
| 3.22 | 0.867 | 2.84 | 3.22 | 0.888 | 2.84 | 3.22 | 0.901 | 2.82 |
| 3.32 | 0.792 | 2.73 | 3.32 | 0.812 | 2.73 | 3.32 | 0.823 | 2.71 |
| 3.44 | 0.698 | 2.60 | 3.44 | 0.715 | 2.60 | 3.44 | 0.725 | 2.58 |
| 3.53 | 0.630 | 2.51 | 3.53 | 0.646 | 2.51 | 3.53 | 0.655 | 2.49 |
| 3.62 | 0.570 | 2.41 | 3.62 | 0.584 | 2.41 | 3.62 | 0.591 | 2.39 |
| 3.74 | 0.493 | 2.30 | 3.74 | 0.506 | 2.29 | 3.74 | 0.512 | 2.27 |
| 3.82 | 0.493 | 2.30 | 3.82 | 0.506 | 2.29 | 3.82 | 0.511 | 2.27 |
| 3.90 | 0.394 | 2.17 | 3.90 | 0.407 | 2.16 | 3.90 | 0.410 | 2.13 |

Table 3.3 1 in 200 JP return period water levels and waves at revetment – storm from 180°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.178 | 3.24 | 2.82 | 1.211 | 3.27 | 2.82 | 1.240 | 3.26 |
| 2.92 | 1.110 | 3.15 | 2.92 | 1.147 | 3.18 | 2.92 | 1.174 | 3.17 |
| 3.00 | 1.025 | 3.03 | 3.00 | 1.063 | 3.05 | 3.00 | 1.090 | 3.05 |
| 3.13 | 0.917 | 2.89 | 3.13 | 0.951 | 2.91 | 3.13 | 0.975 | 2.91 |
| 3.22 | 0.838 | 2.79 | 3.22 | 0.869 | 2.81 | 3.22 | 0.891 | 2.80 |
| 3.32 | 0.765 | 2.69 | 3.32 | 0.794 | 2.70 | 3.32 | 0.814 | 2.69 |
| 3.44 | 0.673 | 2.56 | 3.44 | 0.698 | 2.57 | 3.44 | 0.715 | 2.56 |
| 3.53 | 0.609 | 2.47 | 3.53 | 0.631 | 2.48 | 3.53 | 0.646 | 2.47 |
| 3.62 | 0.607 | 2.47 | 3.62 | 0.629 | 2.48 | 3.62 | 0.644 | 2.47 |
| 3.74 | 0.472 | 2.25 | 3.74 | 0.490 | 2.26 | 3.74 | 0.501 | 2.25 |
| 3.82 | 0.471 | 2.25 | 3.82 | 0.489 | 2.26 | 3.82 | 0.501 | 2.25 |
| 3.90 | 0.449 | 2.26 | 3.90 | 0.468 | 2.27 | 3.90 | 0.480 | 2.25 |

Table 3.4 1 in 200 JP return period water levels and waves at revetment – storm from 195°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.153 | 3.23 | 2.82 | 1.206 | 3.28 | 2.82 | 1.253 | 3.29 |
| 2.92 | 1.086 | 3.13 | 2.92 | 1.142 | 3.18 | 2.92 | 1.188 | 3.19 |
| 3.00 | 1.003 | 3.01 | 3.00 | 1.057 | 3.05 | 3.00 | 1.101 | 3.06 |
| 3.13 | 0.895 | 2.86 | 3.13 | 0.945 | 2.90 | 3.13 | 0.985 | 2.91 |
| 3.22 | 0.818 | 2.76 | 3.22 | 0.862 | 2.79 | 3.22 | 0.898 | 2.80 |
| 3.32 | 0.745 | 2.66 | 3.32 | 0.785 | 2.68 | 3.32 | 0.819 | 2.69 |
| 3.44 | 0.653 | 2.53 | 3.44 | 0.688 | 2.55 | 3.44 | 0.718 | 2.56 |
| 3.53 | 0.589 | 2.43 | 3.53 | 0.621 | 2.45 | 3.53 | 0.647 | 2.46 |
| 3.62 | 0.587 | 2.44 | 3.62 | 0.619 | 2.46 | 3.62 | 0.645 | 2.46 |
| 3.74 | 0.451 | 2.22 | 3.74 | 0.477 | 2.24 | 3.74 | 0.499 | 2.24 |
| 3.82 | 0.451 | 2.22 | 3.82 | 0.476 | 2.24 | 3.82 | 0.498 | 2.24 |
| 3.90 | 0.427 | 2.24 | 3.90 | 0.452 | 2.25 | 3.90 | 0.476 | 2.25 |

A similar analysis was undertaken for the proposed promenade which has slightly increased incoming wave heights (typically about 1.3% higher) as the revetment for the promenade is slightly seaward of the existing structure.

3.3 Overtopping Analysis - 2019 Water Levels

The second edition of the EurOtop “Manual on wave overtopping of sea defences and related structures” which was published in 2018 describes methods to predict wave overtopping of sea defences and related coastal or shoreline structures. The manual recommends a series of empirical methods to represent the physics of the overtopping process in a series of equations that relate the main overtopping response parameter to key wave climate and structure properties.

The EurOtop manual also provides guidance for use of an Artificial Neural Network (ANN) tool to predict mean overtopping discharges for all structure geometries, for a number of hydraulic and geometrical input parameters. The ANN tool is based on a large extended database that contains more than 13,000 physical model tests. For the purposes of this study, RPS utilised the online ANN tool to predict the mean, 5% and 95%’ile discharge rates for both the existing and proposed revetments along Shore Street.

The analysis was undertaken for the combination of waves and water levels derived from the joint probability analysis for points 1 and 3 along the revetments, Tables 3.2, 3.3, 3.4 and Figure 3.3 above.

3.3.1 Overtopping of existing revetment – 2019 water levels

The overtopping rates for location pts 1 and 3, Figure 3.3, for the existing revetment for 1 in 200 return period Joint Probability events are given in Tables 3.5 to 3.10

Table 3.5 Overtopping rates for location pt1 1 in 200 yr. JP event from 165°N - Existing

| For 1 in 200 JP return period events | | | Overtopping Litres/s/m | | |
|--------------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.213 | 3.28 | 18.50 | 2.00 | 172.00 |
| 2.92 | 1.143 | 3.19 | 20.00 | 2.17 | 179.00 |
| 3.00 | 1.059 | 3.07 | 18.60 | 2.13 | 162.00 |
| 3.13 | 0.948 | 2.93 | 18.20 | 2.44 | 145.00 |
| 3.22 | 0.867 | 2.84 | 17.20 | 2.28 | 134.00 |
| 3.32 | 0.792 | 2.73 | 16.60 | 1.96 | 121.00 |

Table 3.6 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.248 | 3.27 | 5.33 | 0.61 | 51.10 |
| 2.92 | 1.183 | 3.18 | 5.65 | 0.61 | 54.20 |
| 3.00 | 1.100 | 3.06 | 5.06 | 0.53 | 46.00 |
| 3.13 | 0.985 | 2.92 | 4.66 | 0.49 | 43.20 |
| 3.22 | 0.901 | 2.82 | 4.13 | 0.48 | 34.70 |
| 3.32 | 0.823 | 2.71 | 3.65 | 0.44 | 31.70 |

Table 3.7 Overtopping rates for location pt1 1 in 200 yr. JP event from 180°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.178 | 3.24 | 16.40 | 1.76 | 148.00 |
| 2.92 | 1.110 | 3.15 | 17.70 | 1.88 | 153.00 |
| 3.00 | 1.025 | 3.03 | 16.10 | 1.97 | 142.00 |
| 3.13 | 0.917 | 2.89 | 15.50 | 2.04 | 124.00 |
| 3.22 | 0.838 | 2.79 | 14.40 | 1.69 | 115.00 |
| 3.32 | 0.765 | 2.69 | 13.90 | 1.59 | 101.00 |

Table 3.8 Overtopping rates for location pt3 1 in 200 yr. JP event from 180°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WL mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.240 | 3.26 | 5.46 | 0.60 | 52.20 |
| 2.92 | 1.174 | 3.17 | 4.86 | 0.51 | 44.50 |
| 3.00 | 1.090 | 3.05 | 4.44 | 0.46 | 41.50 |
| 3.13 | 0.975 | 2.91 | 3.83 | 0.43 | 33.20 |
| 3.22 | 0.891 | 2.80 | 3.38 | 0.38 | 30.20 |
| 3.32 | 0.814 | 2.69 | 2.62 | 0.31 | 20.00 |

Table 3.9 Overtopping rates for location pt1 1 in 200 yr. JP event from 195°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WL mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.153 | 3.23 | 15.40 | 1.68 | 133.00 |
| 2.92 | 1.086 | 3.13 | 16.30 | 1.92 | 141.00 |
| 3.00 | 1.003 | 3.01 | 14.80 | 1.81 | 125.00 |
| 3.13 | 0.895 | 2.86 | 13.80 | 1.84 | 106.00 |
| 3.22 | 0.818 | 2.76 | 12.80 | 1.45 | 95.70 |
| 3.32 | 0.745 | 2.66 | 12.10 | 1.43 | 81.70 |

Table 3.10 Overtopping rates for location pt3 1 in 200 yr. JP event from 195°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WL mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.253 | 3.29 | 5.60 | 0.64 | 53.50 |
| 2.92 | 1.188 | 3.19 | 5.81 | 0.64 | 55.70 |
| 3.00 | 1.101 | 3.06 | 5.08 | 0.53 | 46.20 |
| 3.13 | 0.985 | 2.91 | 4.57 | 0.47 | 42.20 |
| 3.22 | 0.898 | 2.80 | 3.94 | 0.44 | 34.50 |
| 3.32 | 0.819 | 2.69 | 3.45 | 0.38 | 31.40 |

It will be seen from Tables 3.5 to 3.10 that the largest overtopping of the existing seawall along Shore Street occurs at the centre of the frontage during storms from the south south east with a predicted mean overtopping rate 20 litres/s/m. This rate of over topping is likely to result in significant flooding and the overtopping rate is such that the maximum volume for an individual wave (Vmax) will be about 2000 litres per metre. This is greatly in excess of the 600 litres limit recommended in the 2018 Overtopping Manual for pedestrians with a clear view of the sea. Even at location pt3, where the levels of the Shore Street seawall are higher, the Vmax value will be about 800 litres per metre.

3.3.2 Overtopping of proposed revetment – 2019 water levels

The overtopping rates for location pts 1 and 3, Figure 3.3, for the proposed revetment for 1 in 200 return period Joint Probability events are given in Tables 3.11 to 3.16

Table 3.11 Overtopping rates for location pt1 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.213 | 3.27 | 0.532 | 0.105 | 1.370 |
| 2.92 | 1.142 | 3.19 | 0.504 | 0.093 | 1.230 |
| 3.00 | 1.058 | 3.07 | 0.440 | 0.058 | 0.953 |
| 3.13 | 0.946 | 2.93 | 0.387 | 0.036 | 0.711 |
| 3.22 | 0.866 | 2.84 | 0.353 | 0.023 | 0.614 |
| 3.32 | 0.792 | 2.73 | 0.328 | 0.011 | 0.687 |

Table 3.12 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.264 | 3.25 | 0.349 | 0.030 | 0.508 |
| 2.92 | 1.192 | 3.17 | 0.346 | 0.029 | 0.499 |
| 3.00 | 1.105 | 3.05 | 0.321 | 0.018 | 0.445 |
| 3.13 | 0.991 | 2.92 | 0.294 | 0.011 | 0.285 |
| 3.22 | 0.907 | 2.82 | 0.263 | 0.007 | 0.238 |
| 3.32 | 0.829 | 2.71 | 0.191 | 0.004 | 0.263 |

Table 3.13 Overtopping rates for location pt1 1 in 200 yr. JP event from 180°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.177 | 3.23 | 0.473 | 0.087 | 1.070 |
| 2.92 | 1.108 | 3.14 | 0.451 | 0.070 | 0.995 |
| 3.00 | 1.022 | 3.03 | 0.399 | 0.046 | 0.710 |
| 3.13 | 0.915 | 2.89 | 0.358 | 0.028 | 0.582 |
| 3.22 | 0.837 | 2.79 | 0.329 | 0.014 | 0.529 |
| 3.32 | 0.764 | 2.69 | 0.307 | 0.008 | 0.601 |

Table 3.14 Overtopping rates for location pt3 1 in 200 yr. JP event from 180°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.253 | 3.24 | 0.351 | 0.031 | 0.520 |
| 2.92 | 1.182 | 3.15 | 0.340 | 0.026 | 0.471 |
| 3.00 | 1.095 | 3.04 | 0.316 | 0.017 | 0.421 |
| 3.13 | 0.980 | 2.90 | 0.289 | 0.010 | 0.270 |
| 3.22 | 0.896 | 2.80 | 0.240 | 0.006 | 0.237 |
| 3.32 | 0.819 | 2.69 | 0.175 | 0.003 | 0.263 |

Table 3.15 Overtopping rates for location pt1 1 in 200 yr. JP event from 195°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.149 | 3.22 | 0.438 | 0.071 | 0.889 |
| 2.92 | 1.082 | 3.12 | 0.420 | 0.057 | 0.842 |
| 3.00 | 0.998 | 3.01 | 0.375 | 0.038 | 0.603 |
| 3.13 | 0.891 | 2.87 | 0.339 | 0.020 | 0.504 |
| 3.22 | 0.814 | 2.76 | 0.313 | 0.010 | 0.498 |
| 3.32 | 0.741 | 2.66 | 0.292 | 0.006 | 0.552 |

Table 3.16 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.267 | 3.26 | 0.354 | 0.033 | 0.537 |
| 2.92 | 1.195 | 3.17 | 0.348 | 0.029 | 0.510 |
| 3.00 | 1.105 | 3.05 | 0.321 | 0.018 | 0.448 |
| 3.13 | 0.988 | 2.90 | 0.293 | 0.010 | 0.285 |
| 3.22 | 0.902 | 2.80 | 0.252 | 0.006 | 0.246 |
| 3.32 | 0.823 | 2.69 | 0.179 | 0.003 | 0.267 |

The overtopping analysis for the 1 in 200 year Joint Probability return period events show that the proposed revetment will result in the overtopping volumes being reduced by a factor of about 37 compared to those with the existing revetment and seawall. The resulting over topping rates are well within the recommended limits for pedestrians given in the 2018 EurOtop Overtopping Manual.

3.4 Overtopping with 2100 Water Levels

The 1 in 200 year return period water level is predicted to be some 0.89 metres higher than the current level of +3.90m OD as a result of rising sea levels due to climate change. This water level is some 0.9m above the lowest level of Shore Street so much of the area will flood directly from the sea. Even if the proposed seawall was to be raised, the area would still flood via the drainage system and/or through the slipway opening etc. Thus overtopping calculations have not been undertaken for the 2100 water levels as the flooding around the Shore Street area would be so extensive by 2100 that it makes such an analysis nonsensical in the absence of a defined policy on the future flood protection of the area.

4 HARBOUR DISTURBANCE MODELLING

4.1 General

The wave generation and transformation modelling undertaken for the Ullapool frontage does not include the impact of wave reflections or wave to wave interactions (See Appendix for wave model descriptions). The proposed extension to the small boat harbour facilities at Ullapool Harbour involve the dredging and construction of a basin with a vertical quay wall along this section of the shoreline. There is the potential for standing wave patterns and/or wave resonance issues with this type of basin thus the performance of the proposed small boat facility was evaluated using an advanced Boussinesq wave disturbance model.

Simulations were undertaken for the existing harbour infrastructure as well as for the new small boat facility with the existing and proposed seawalls along Shore Street. Simulations were also undertaken to examine the effectiveness of an additional floating breakwater installation off the south east corner of the Pier area.

The boundary conditions for the harbour disturbance modelling were taken from the results of the simulations for 1 in 50 and 1 in 1 year return period events using the overall wave generation and transformation spectral wave model. Simulations were undertaken at mean tidal levels so that the results of the modelling would be reasonably applicable for most of the tidal ranges at the site. The extent of the harbour disturbance model is shown in Figure 4.1.

In this Boussinesq wave model the boundary waves are generated along the southern side of the model with wave absorbing “sponge” layers along the eastern and western sides of the model and in areas which do not affect the wave climate in the small boat basin, i.e. the western side of the Pier area. The wave reflection properties of the various walls and revetments are controlled in the model by “porosity” layers placed along the various structures. In the simulations it was assumed that the existing open piled quays would have a 90% reflection from the back wall (under the pier deck), the existing seawall along Shore Street was given a 60% wave reflection factor while the new rock armour revetment was given a 40% wave reflection coefficient. These factors are well established values for the types of structures at Ullapool.

The largest waves which approach the pier occur during storm from about 165° direction with the waves approaching the pier from about 160°. However as the proposed small boat basin is situated in the lee of the main pier area it was found that the new basin was more exposed to storms from the 150° N. Thus after the initial model simulations with the 1 in 50 year from 165° direction all the remaining simulations were undertaken with waves approaching the harbour from 150°N.

The results of the simulations are shown in terms of the typical wave disturbance patterns and the distribution of significant wave heights around the basin and adjoining areas.

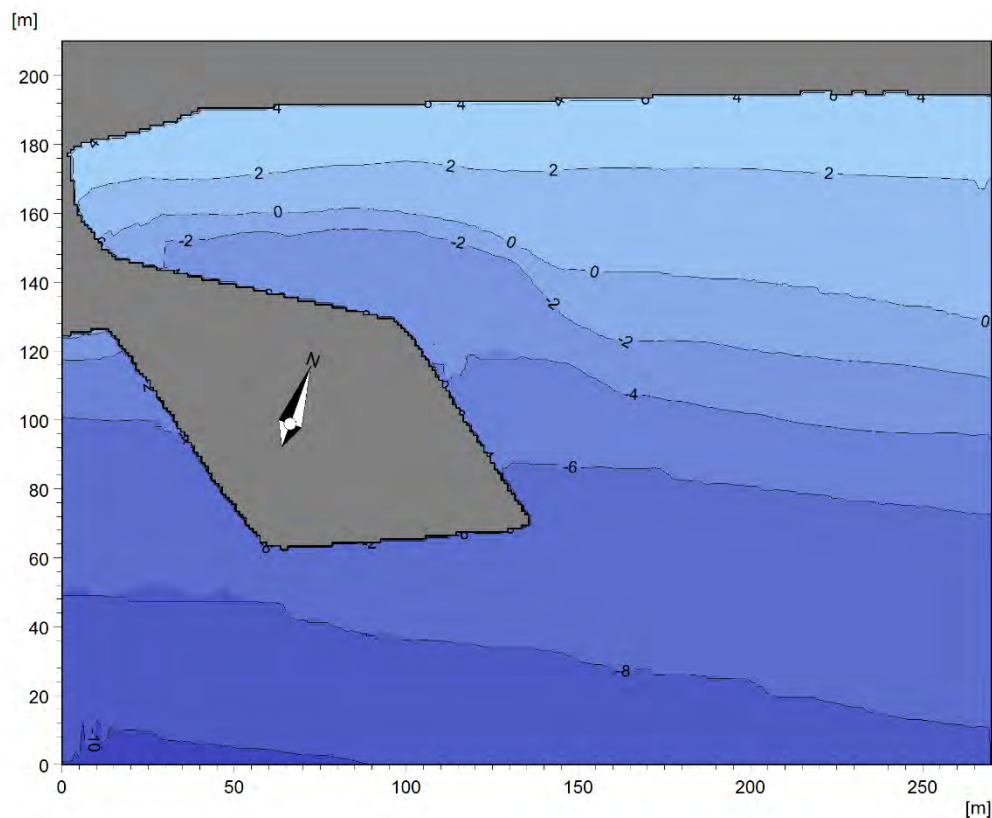


Figure 4.1 Extent of harbour disturbance model of existing bathymetry [m CD]

4.2 Wave Disturbance simulations 1 in 50 year return period storm from 165° N

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall are shown in Figures 4.2 and 4.3. Figures 4.4 and 4.5 show the wave disturbance patterns and significant wave heights with the new Shore Street revetment in place, while Figures 4.6 and 4.7 show the wave disturbance patterns and significant wave heights with the new Shore Street revetment and the enlarged small boat facility developed.

From Figure 4.2 to 4.7 it will be seen that the addition of the new quay wall along the Shore Street frontage at the small boat facility produces a standing wave pattern in the enlarged dredged basin. As noted in Section 4.1, storms from 150° result in greater wave penetration into the proposed enlarged small boat harbour facility and thus the wave disturbance model simulations were rerun using the 150° storm direction.

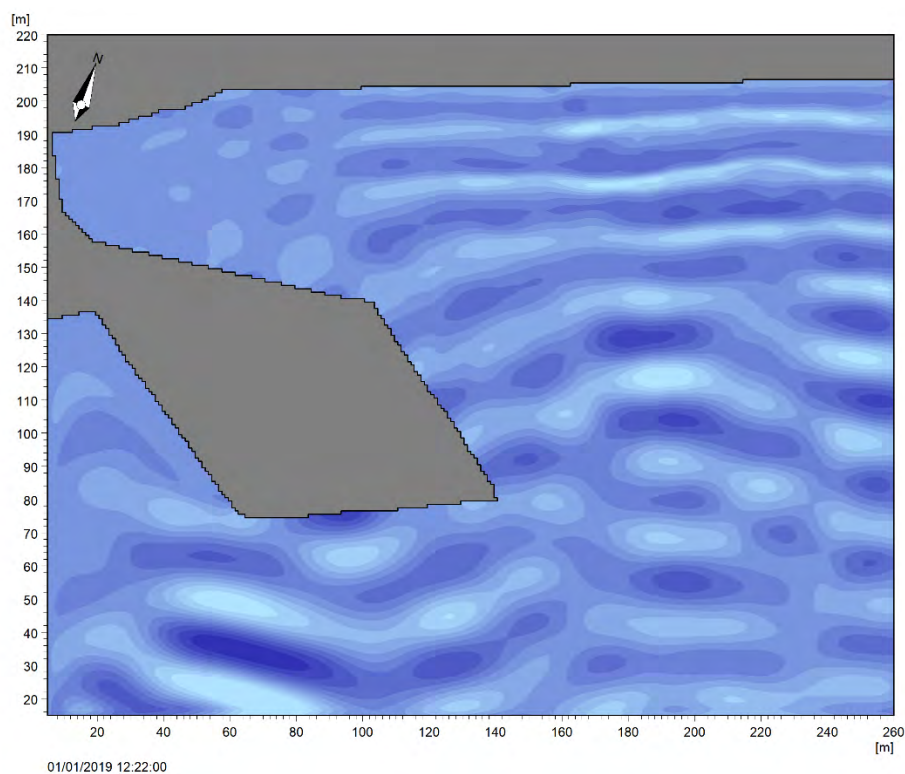


Figure 4.2 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 165° N

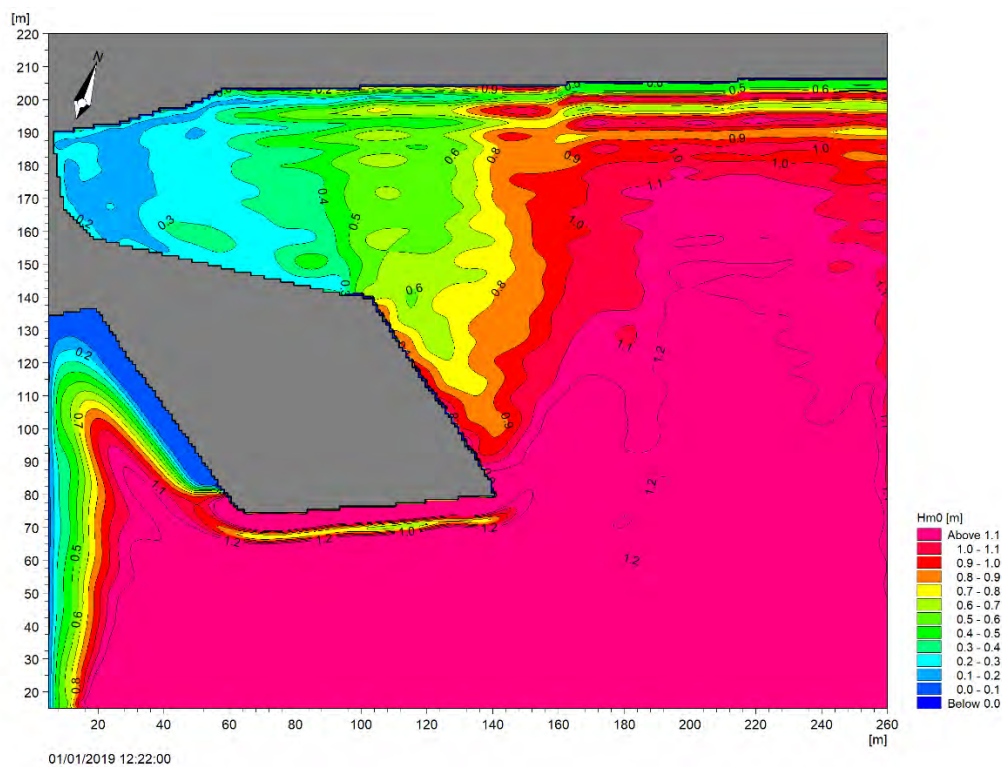


Figure 4.3 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 165° N

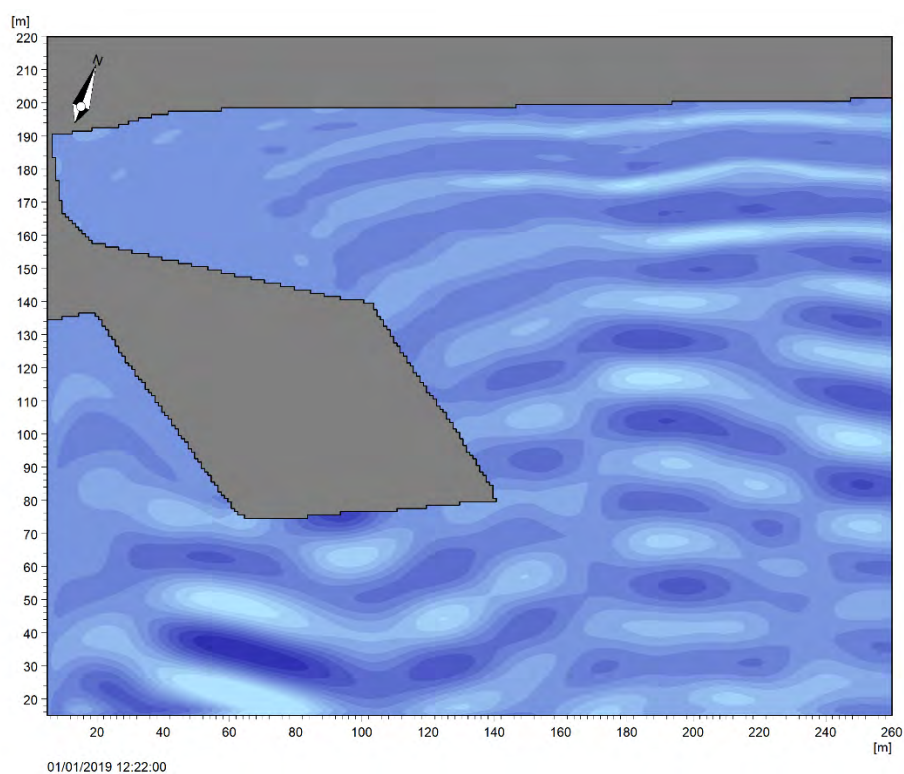


Figure 4.4 Typical wave disturbance patterns around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

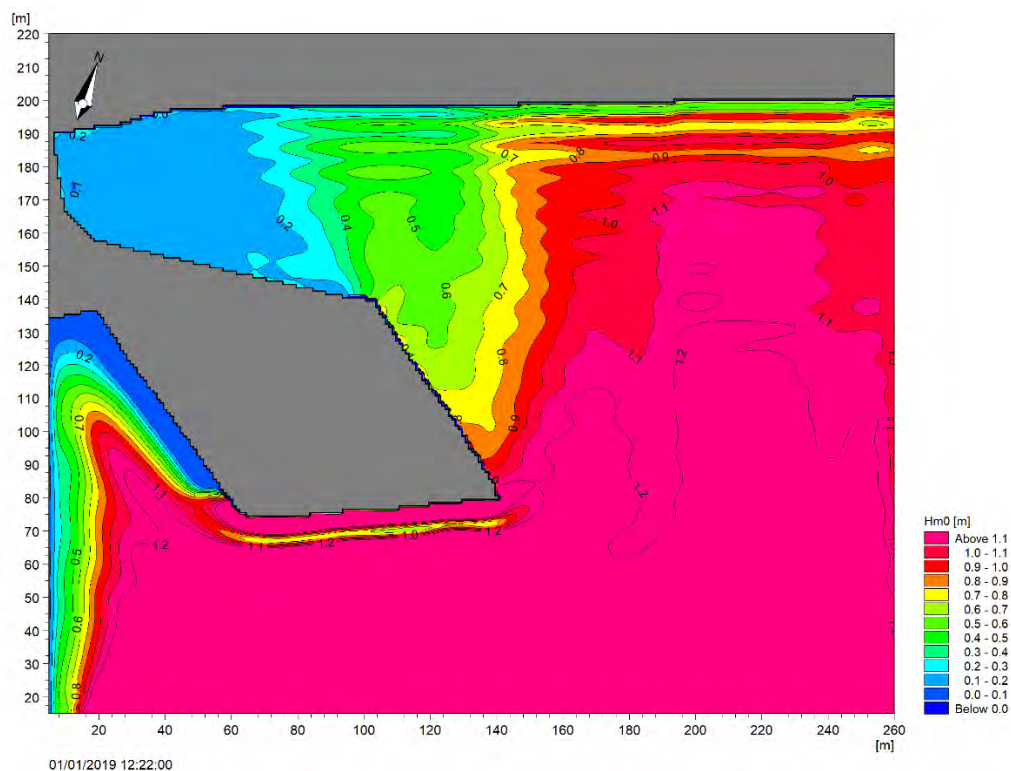


Figure 4.5 Significant wave heights around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

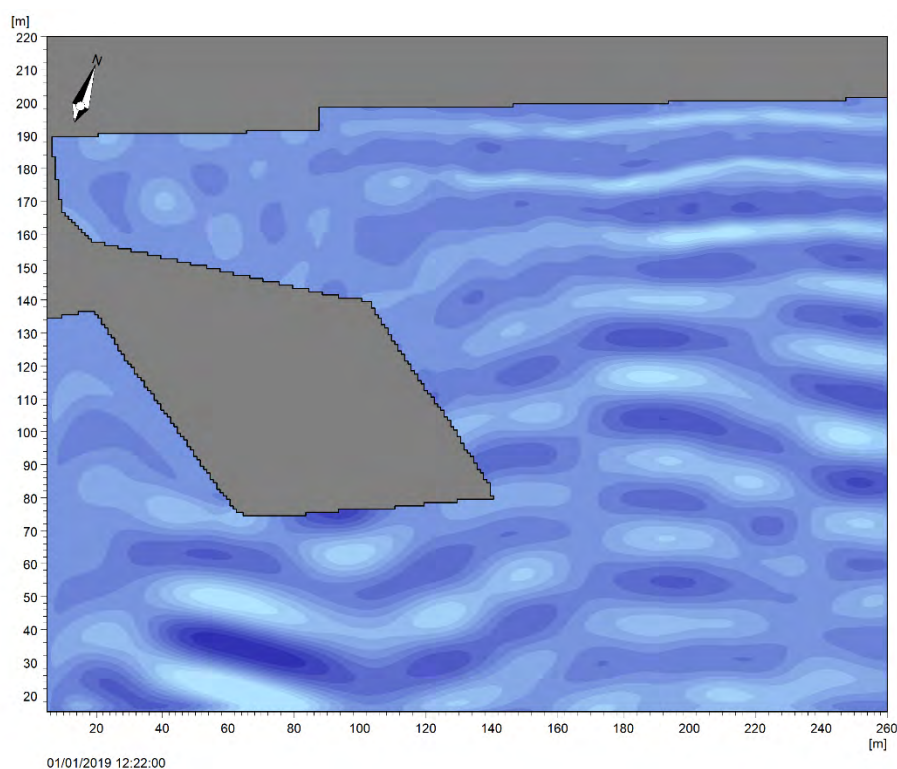


Figure 4.6 Typical wave disturbance patterns around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

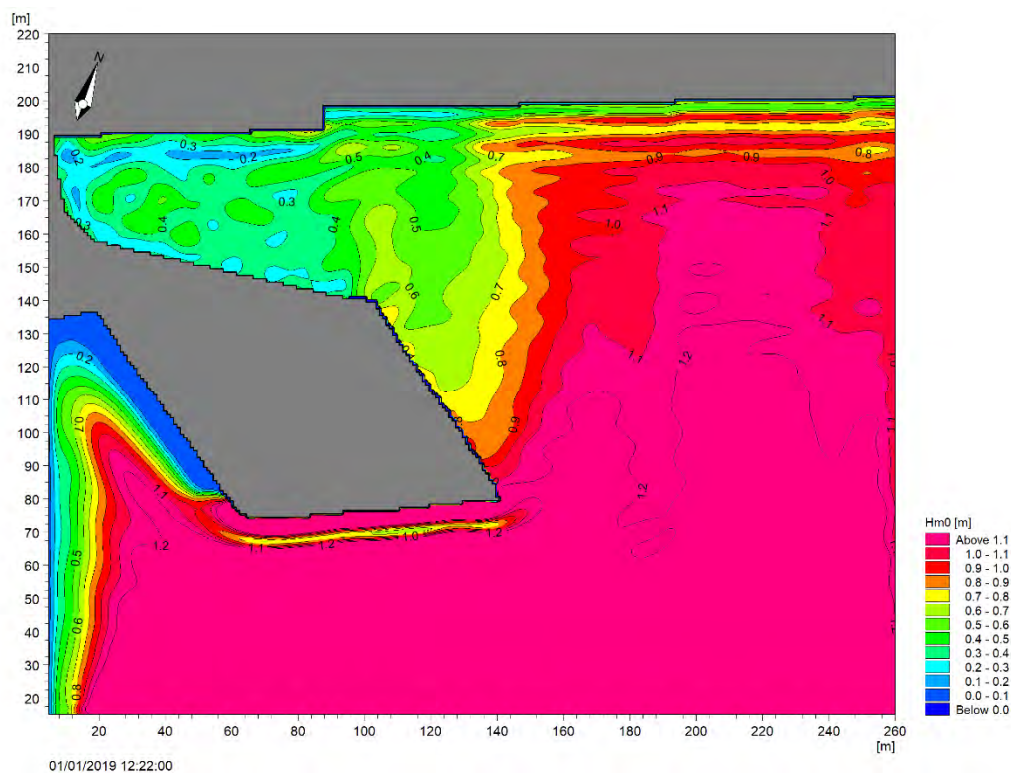


Figure 4.7 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

4.3 Wave Disturbance simulations

1 in 50 and 1 in 1 return period storm from 150° N

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall during a 1 in 50 year return period storm are shown in Figures 4.8 and 4.9. Figures 4.10 and 4.11 show the wave disturbance patterns and significant wave heights for the same storm with the existing Shore Street seawall and the enlarged small boat facility in place. The wave heights in the new small boat basin are larger than would normally be recommended thus the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 50 year return period storm as shown in Figures 4.12 and 4.13.

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility with the new Shore Street revetment during a 1 in 50 year return period storm are shown in Figures 4.14 and 4.15. Figures 4.16 and 4.17 show the wave disturbance patterns and significant wave heights for the same storm with the new Shore Street revetment and the enlarged small boat facility in place. As the wave heights in the new small boat basin are larger than would normally be recommended, the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 50 year return period storm as shown in Figures 4.18 and 4.19.

Wave disturbance simulations have also been undertaken for 1 in 1 year return period storms from 150° N. The boundary waves for this 1 in 1 year storm had significant wave heights of 0.67metres with wave period of 2.6 seconds. The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall during this 1 in 1 year return period storm are shown in Figures 4.20 and 4.21. Figures 4.22 and 4.23 show the wave disturbance patterns and significant wave heights for the same storm with the existing Shore Street seawall and the enlarged small boat facility in place. The wave heights in the new small boat basin are larger than would normally be recommended thus the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 1 year return period storm as shown in Figures 4.24 and 4.25.

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility with the new Shore Street revetment during a 1 in 1 year return period storm are shown in Figures 4.26 and 4.27. Figures 4.28 and 4.29 show the wave disturbance patterns and significant wave heights for the same storm with the new Shore Street revetment and the enlarged small boat facility in place. As the wave heights in the new small boat basin are larger than would normally be recommended, the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 1 year return period storm as shown in Figures 4.30 and 4.31.

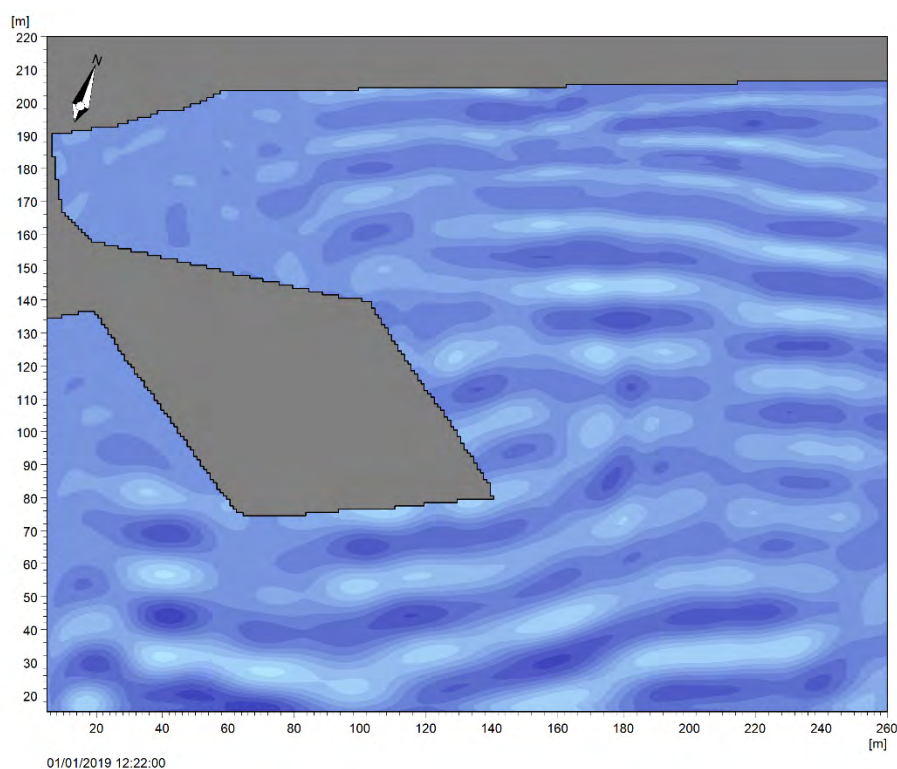


Figure 4.8 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

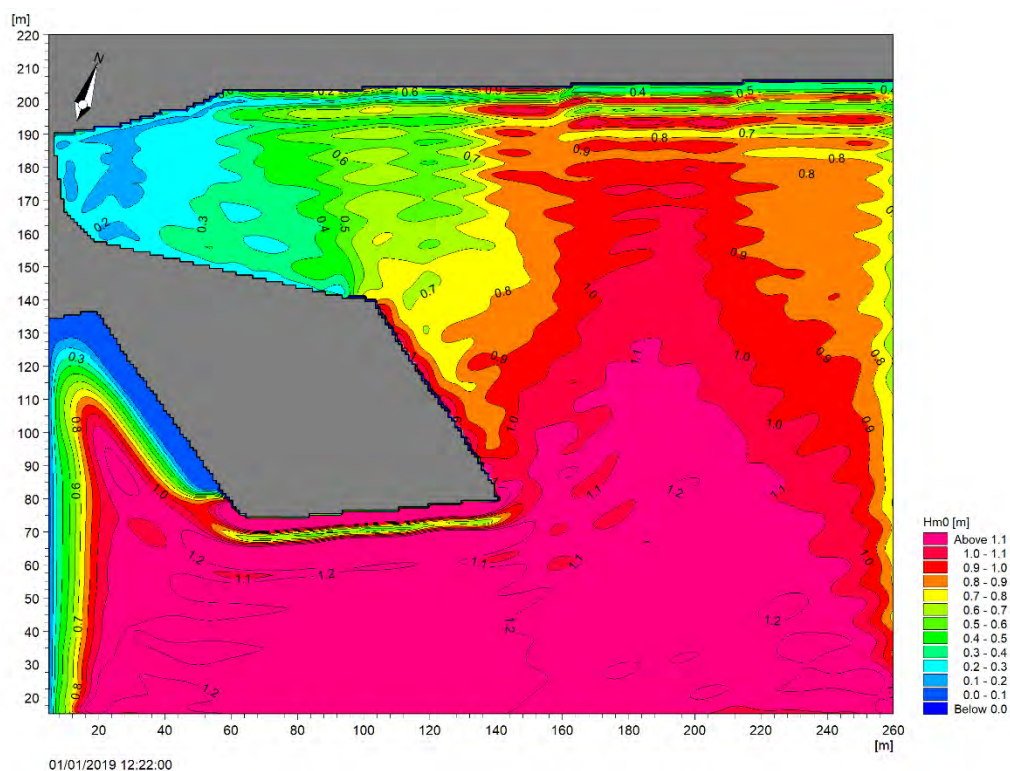


Figure 4.9 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

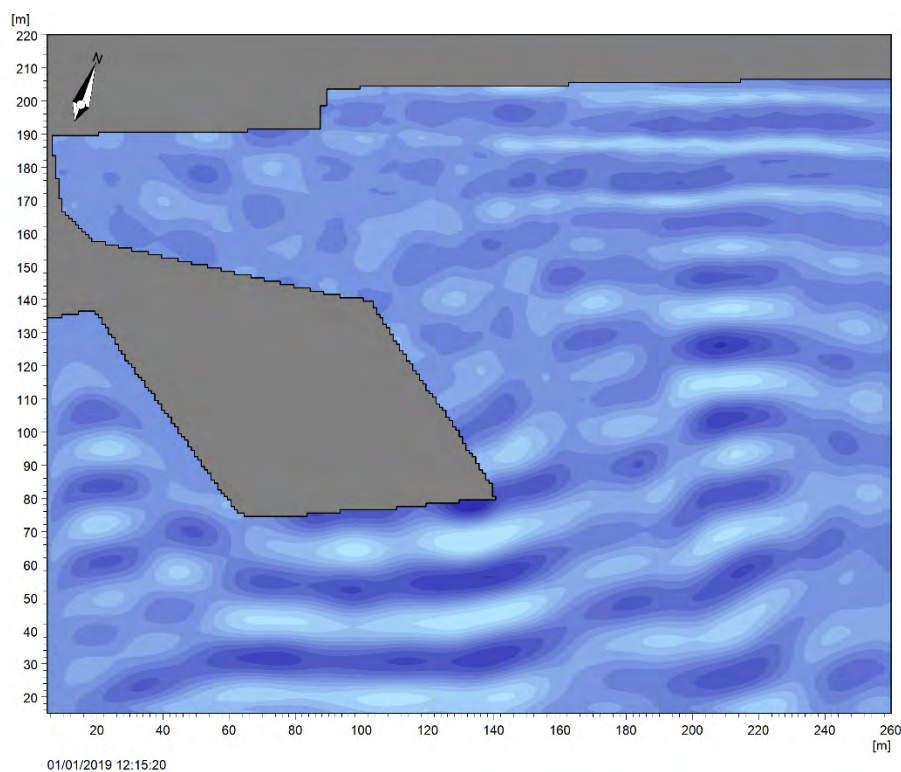


Figure 4.10 Typical wave disturbance patterns around the enlarged small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

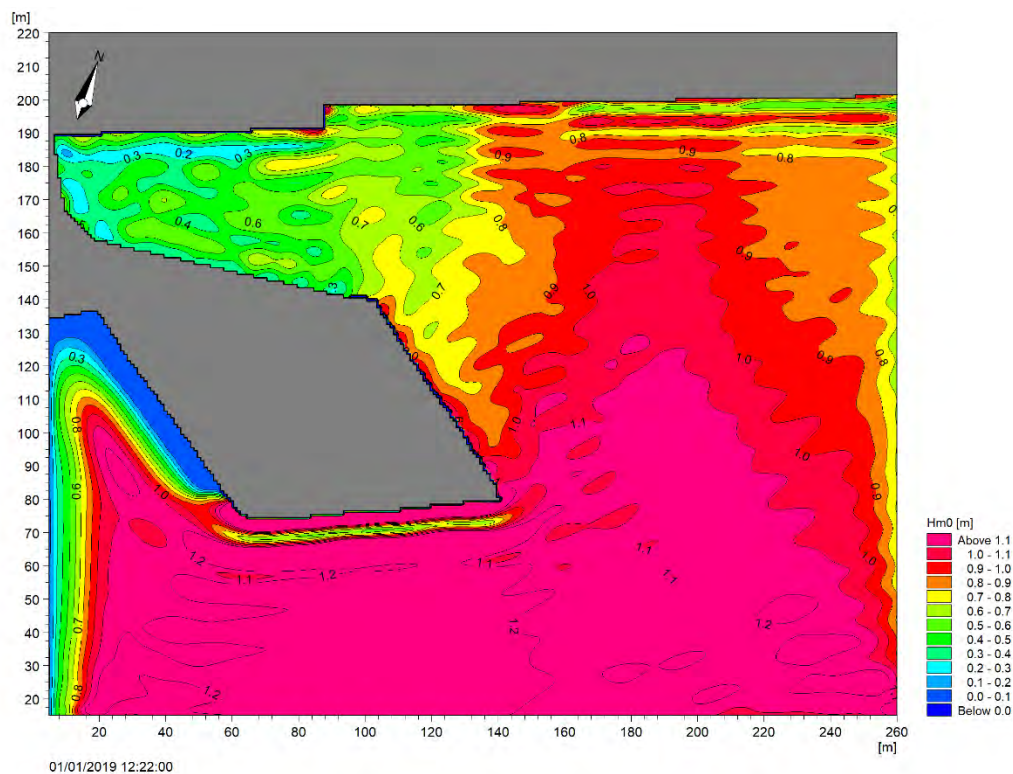


Figure 4.11 Significant wave heights around the enlarged small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

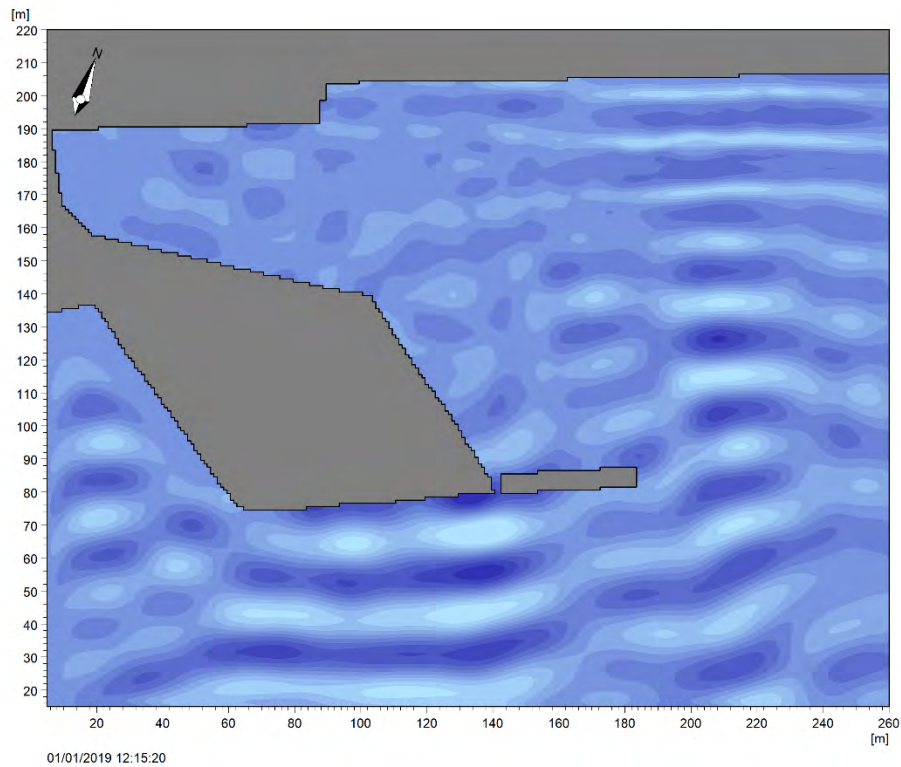


Figure 4.12 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 50 year return period storm from 150° N

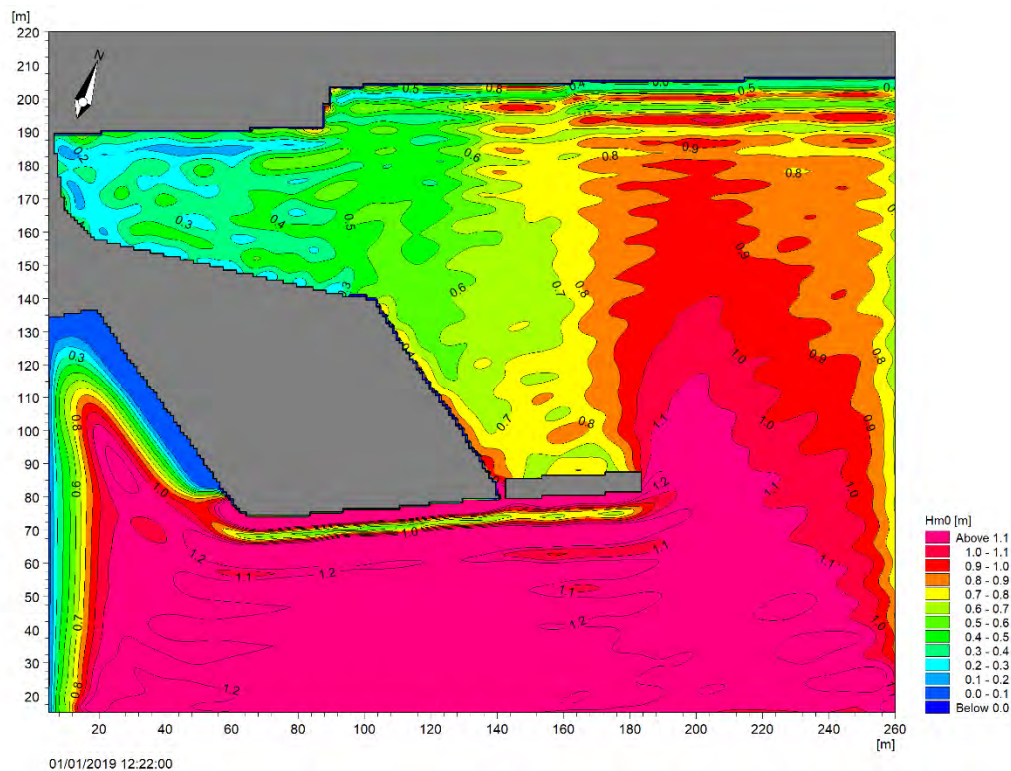


Figure 4.13 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 50 year return period storm from 150° N

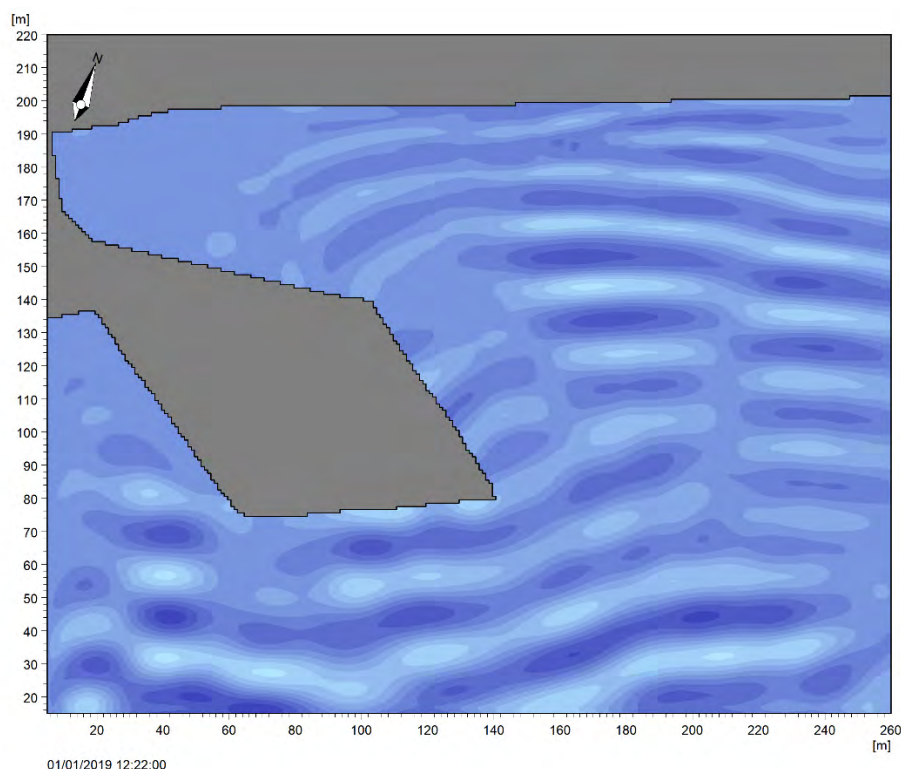


Figure 4.14 Typical wave disturbance patterns around the existing small boat facility and the new Shore Street revetment - 1 in 50 year return period storm from 150° N

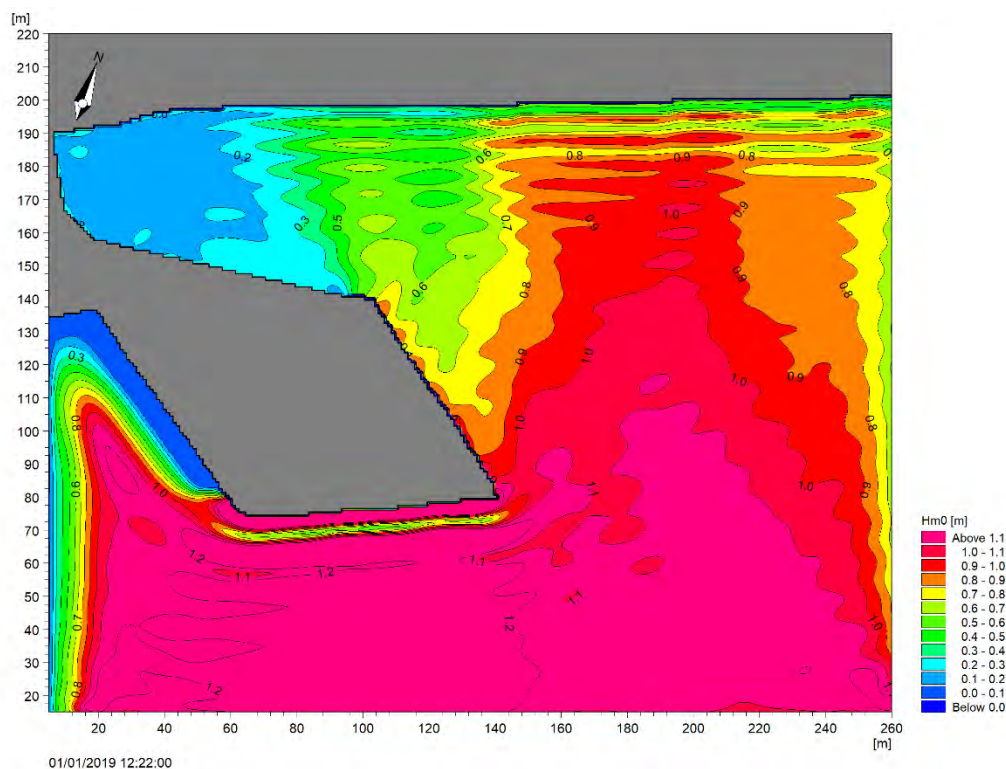


Figure 4.15 Significant wave heights around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 150° N

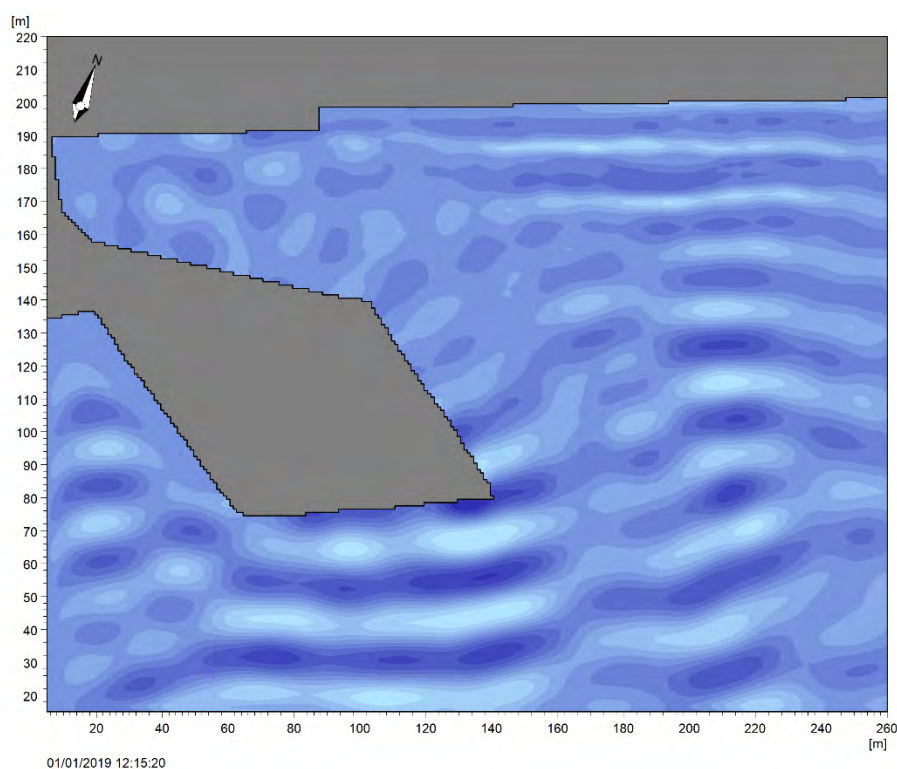


Figure 4.16 Typical wave disturbance patterns around the enlarged small boat facility and the new Shore Street revetment - 1 in 50 year return period storm from 150° N

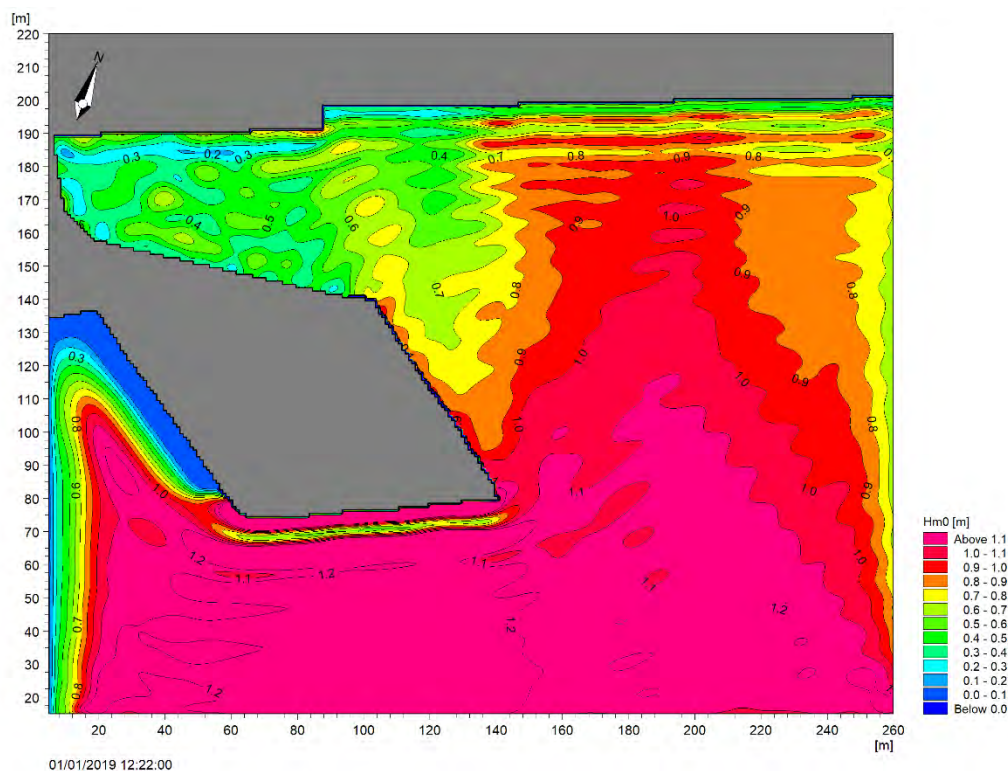


Figure 4.17 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 150° N

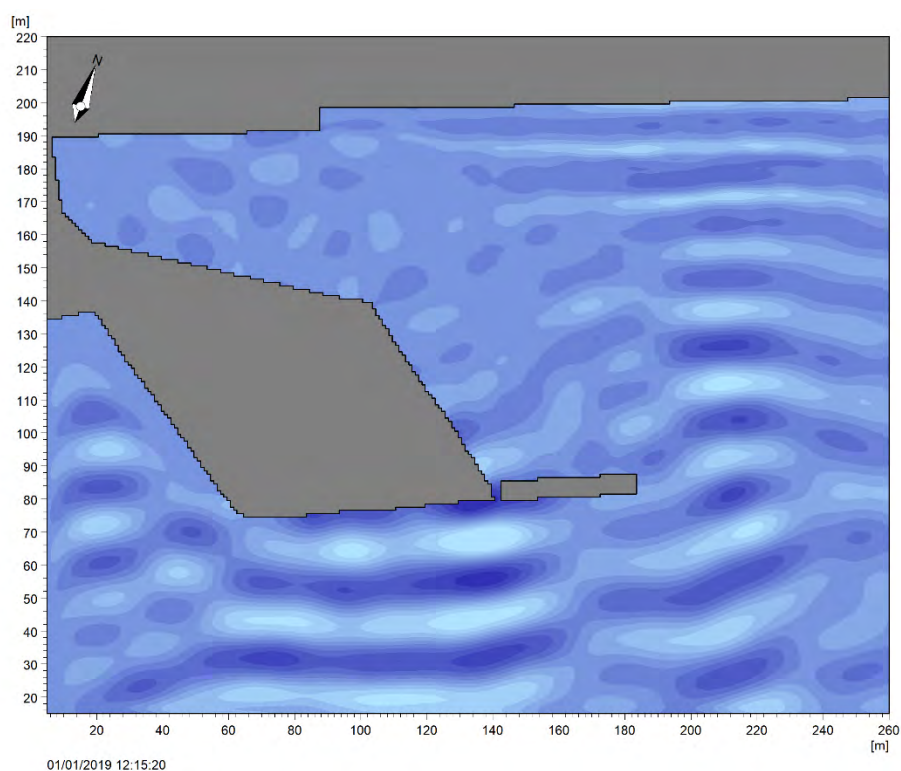


Figure 4.18 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 50 year return period storm from 150° N

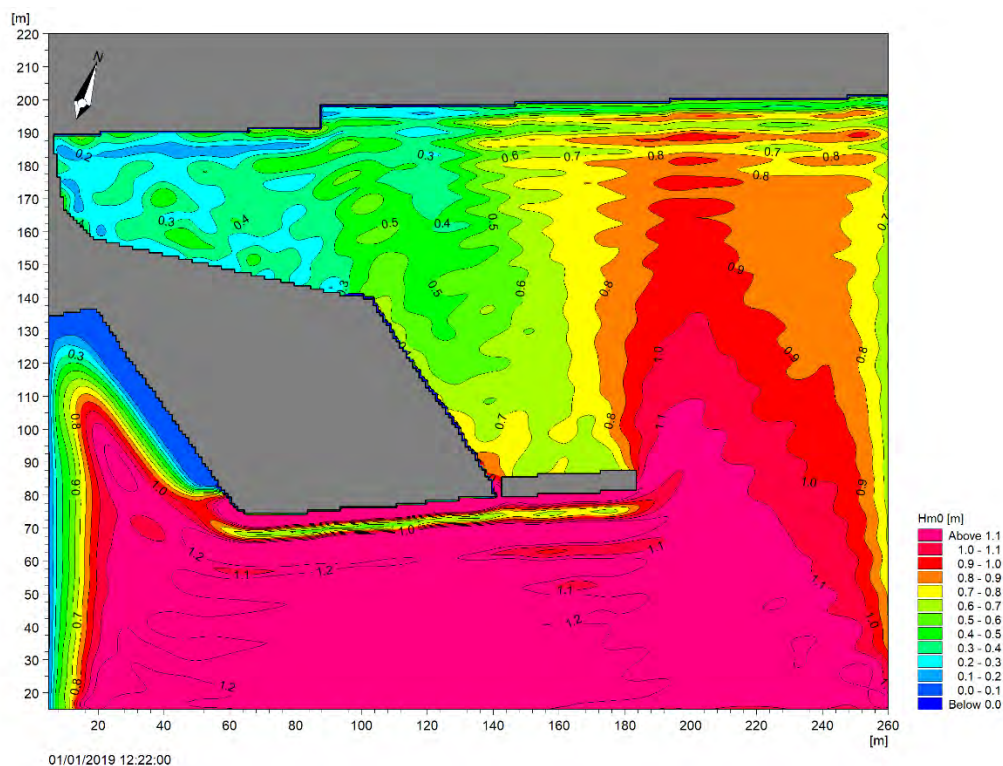


Figure 4.19 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 50 year return period storm from 150° N

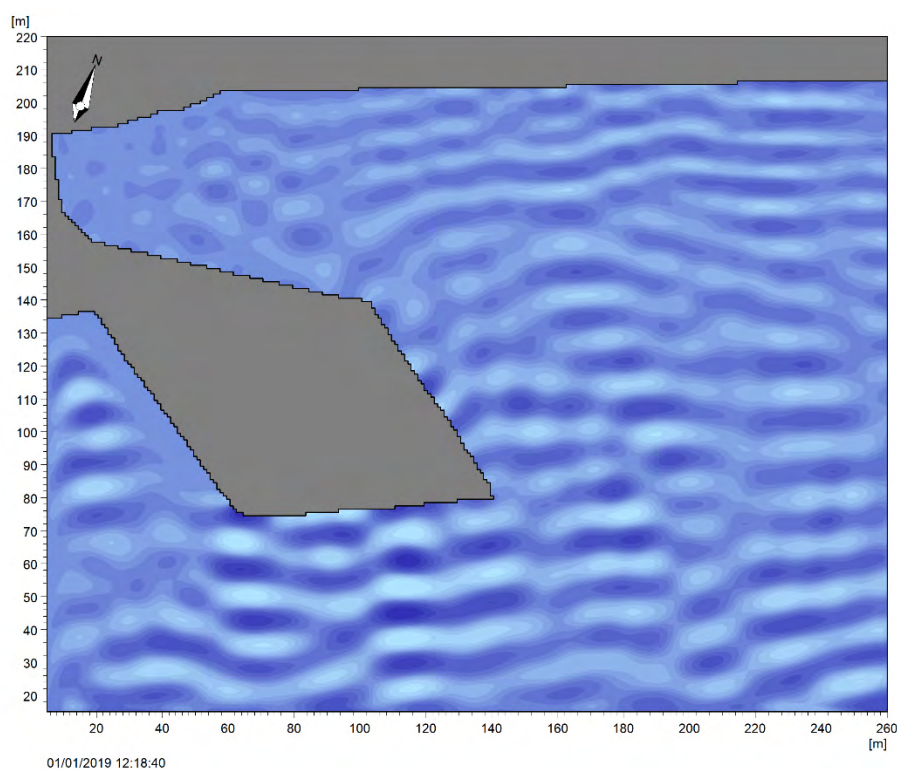


Figure 4.20 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

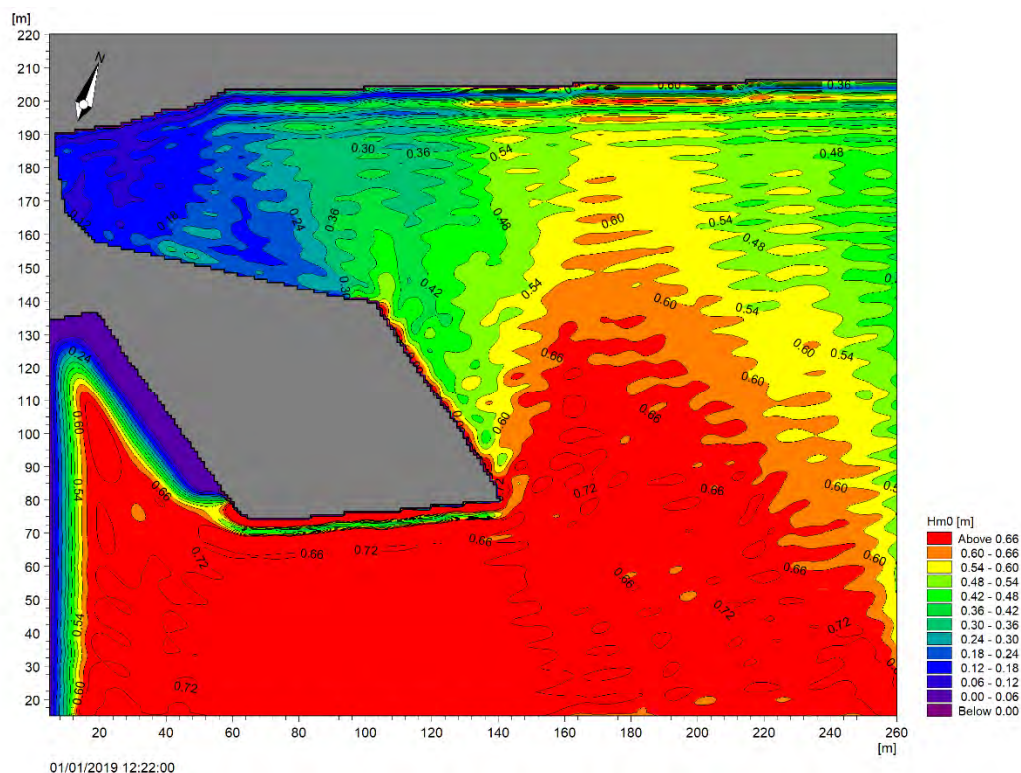


Figure 4.21 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

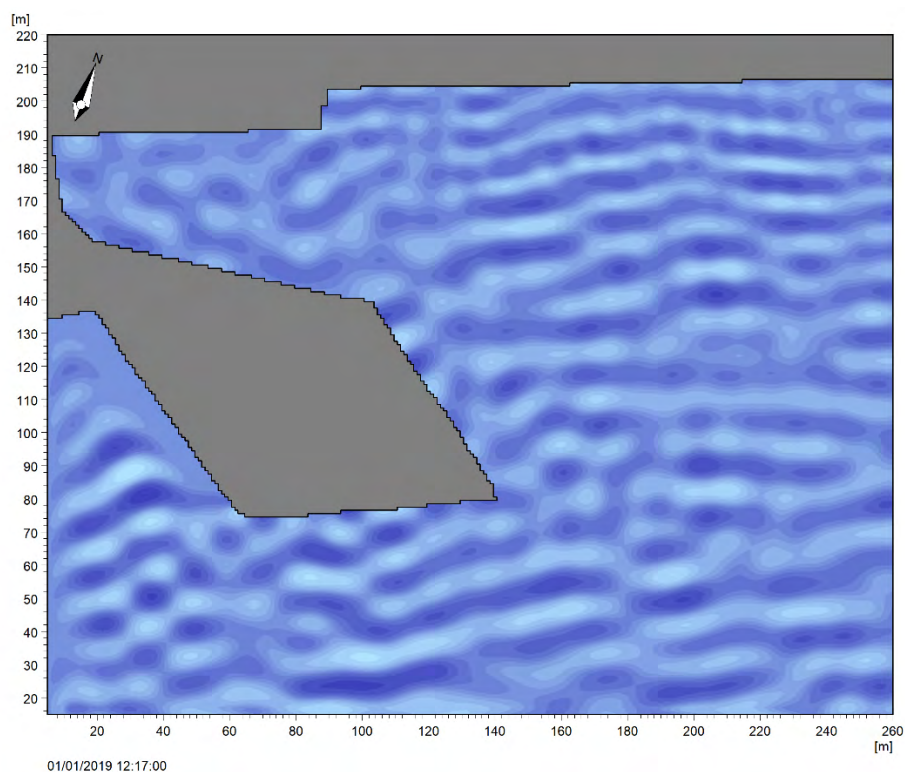


Figure 4.22 Typical wave disturbance patterns around the enlarged small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

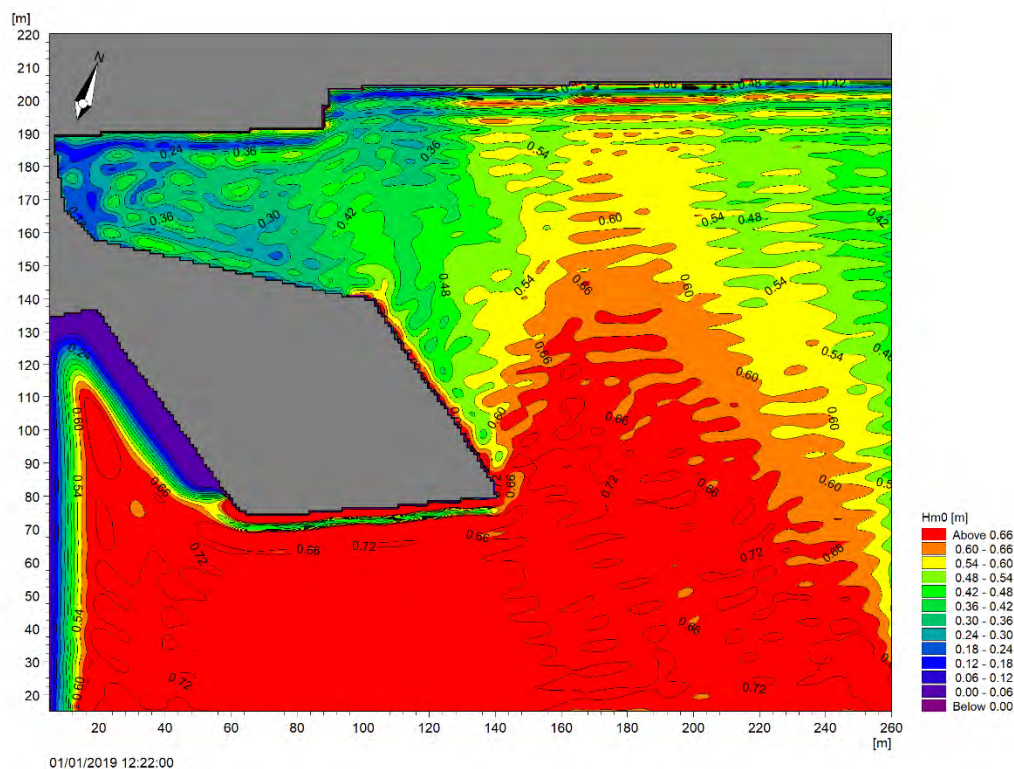


Figure 4.23 Significant wave heights around the enlarged small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

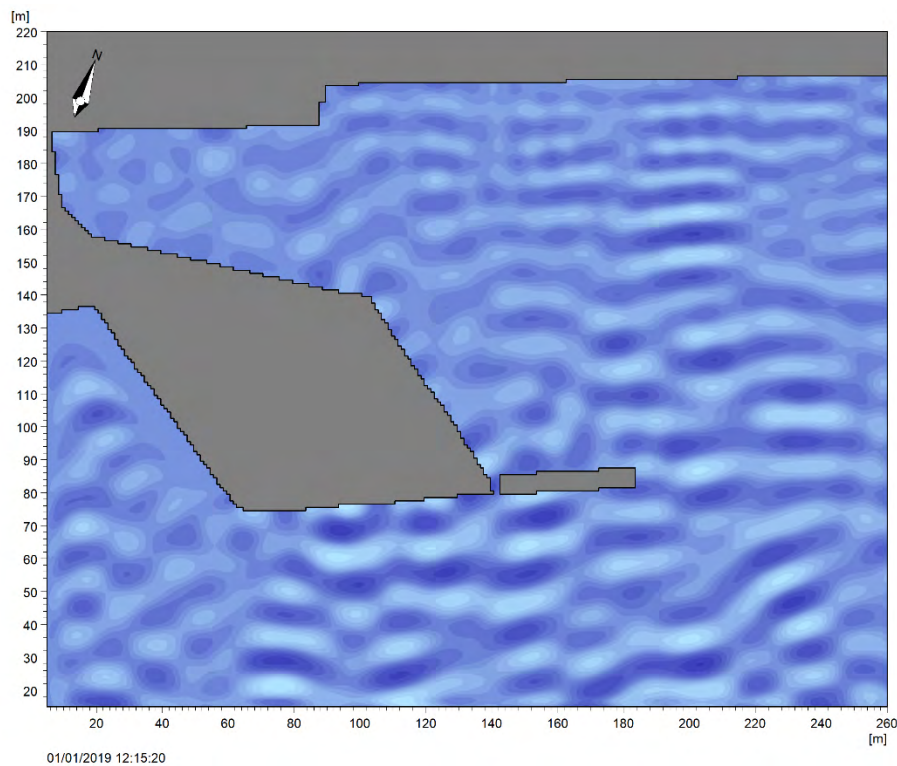


Figure 4.24 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 1 year return period storm from 150° N

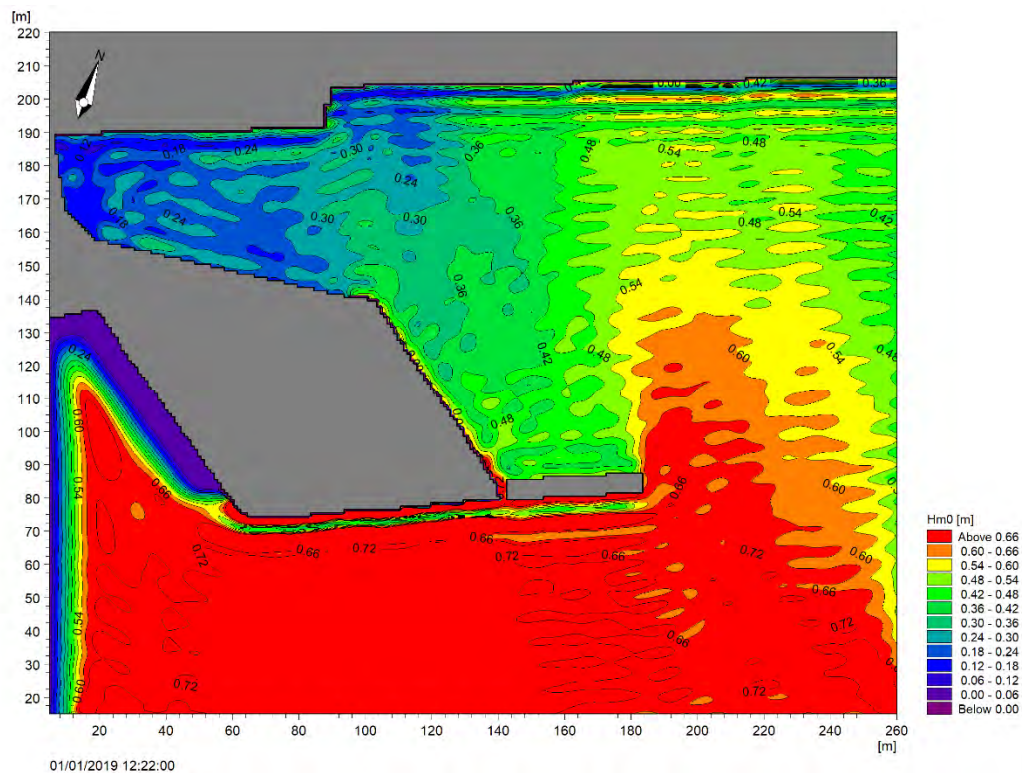


Figure 4.25 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 1 year return period storm from 150° N

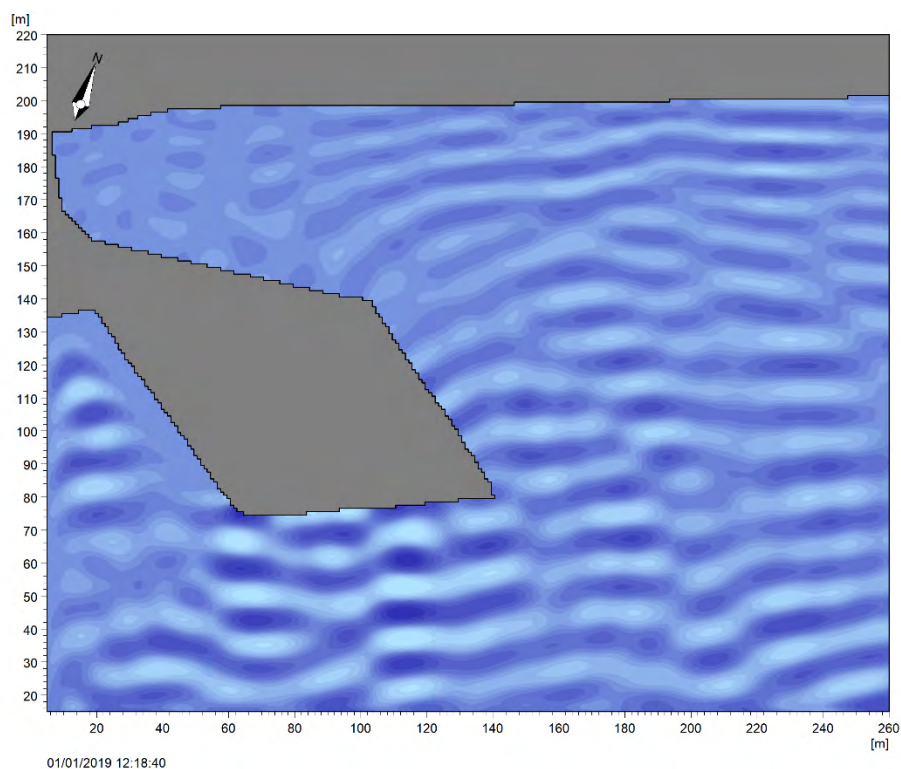


Figure 4.26 Typical wave disturbance patterns around the existing small boat facility and the new Shore Street revetment - 1 in 1 year return period storm from 150° N

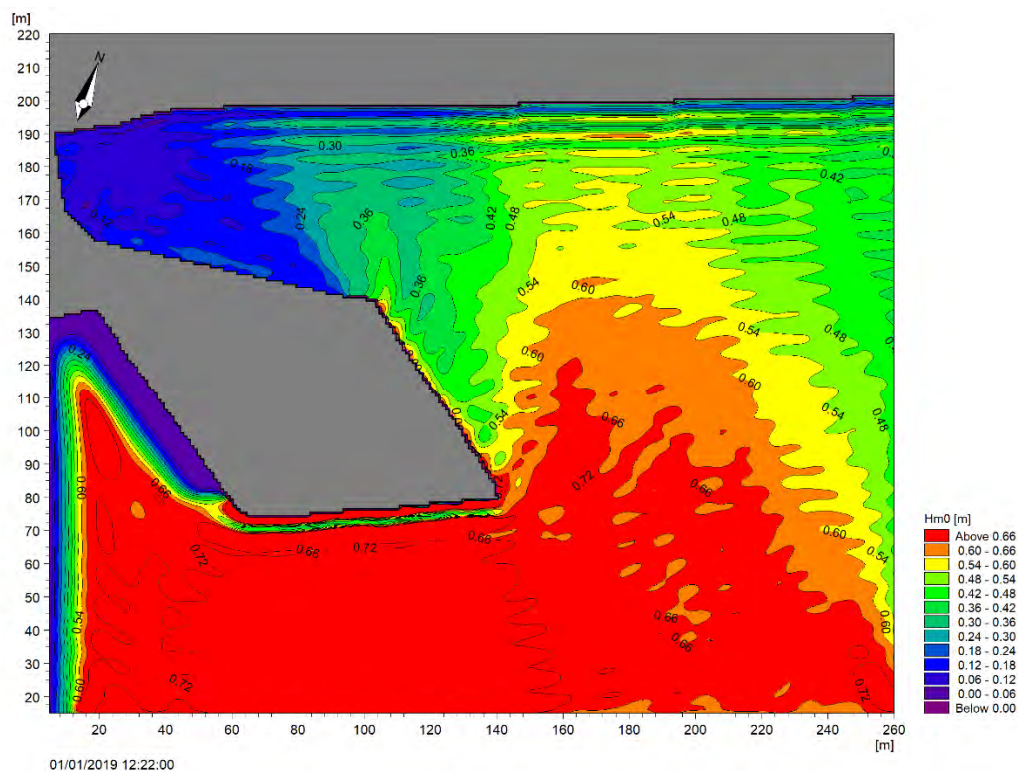


Figure 4.27 Significant wave heights around the existing small boat facility and new Shore Street revetment - 1 in 1 year return period storm from 150° N

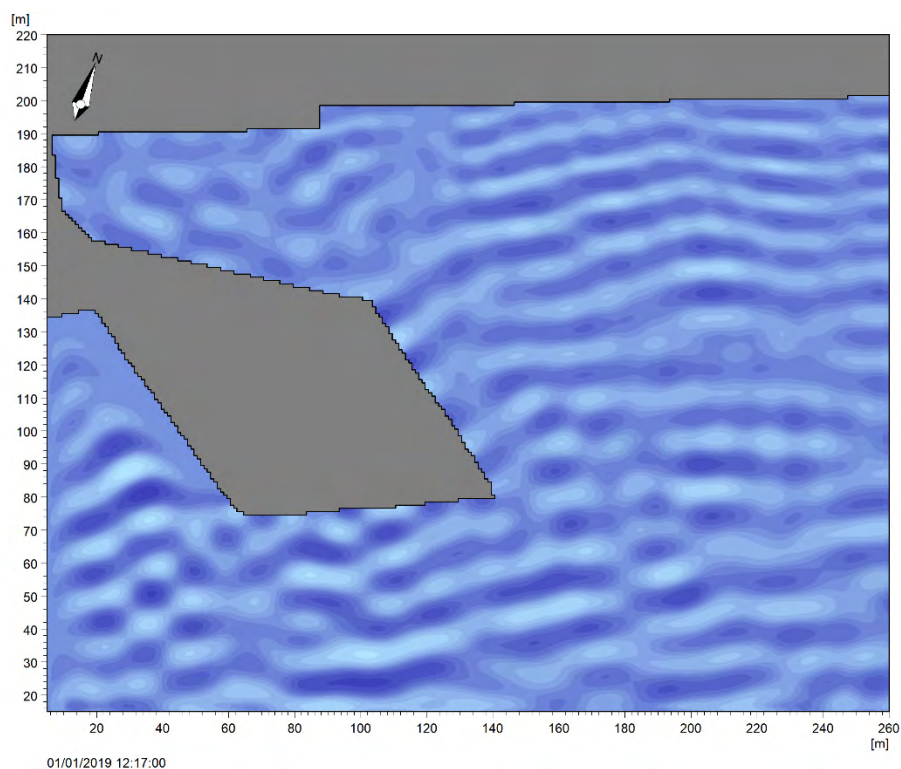


Figure 4.28 Typical wave disturbance patterns around the enlarged small boat facility and the new Shore Street revetment - 1 in 1 year return period storm from 150° N

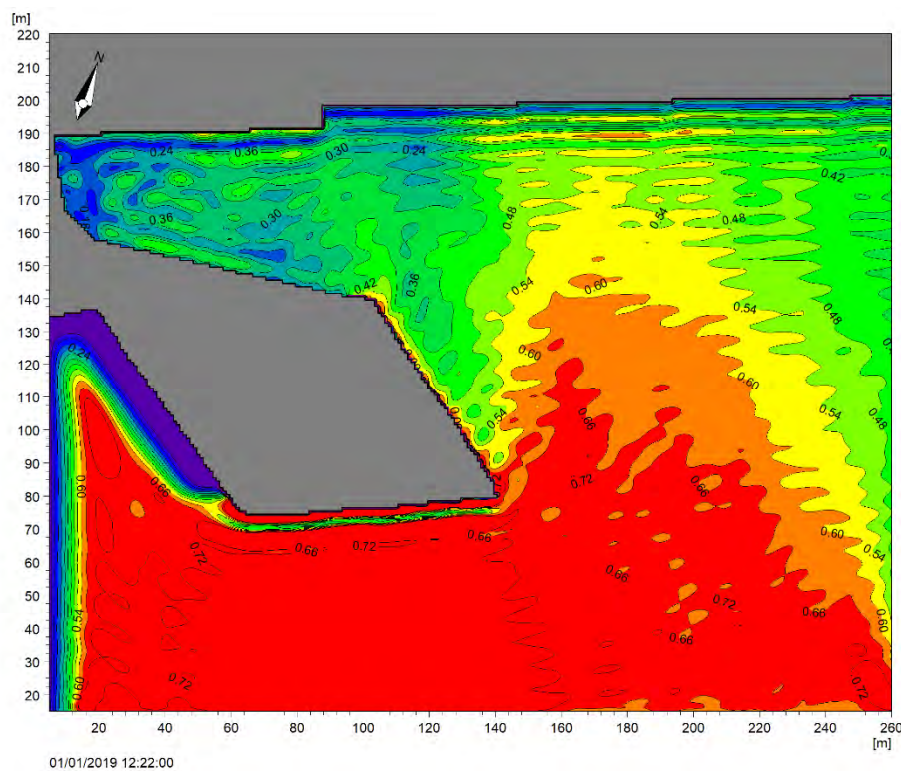


Figure 4.29 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 1 year return period storm from 150° N

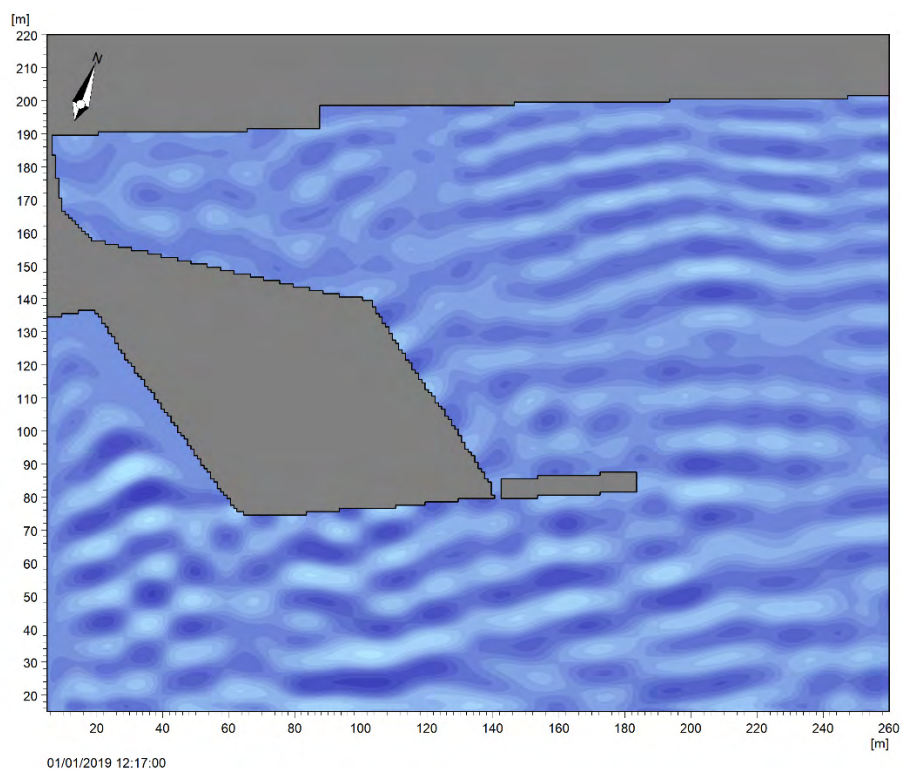


Figure 4.30 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 1 year return period storm from 150° N

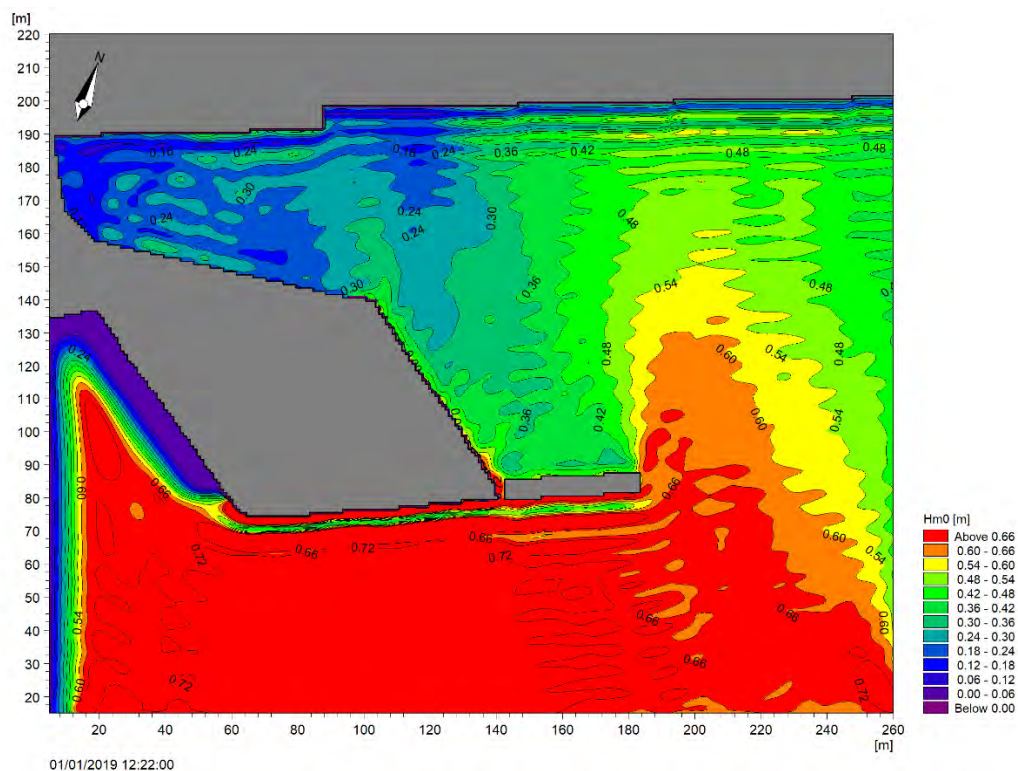


Figure 4.31 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 1 year return period storm from 150° N

4.4 Discussion of Results of Wave Disturbance Simulations

The results of the wave disturbance simulations have shown that while the conditions within the existing small boat harbour facility at Ullapool are satisfactory, the construction of the quay and dredging for the enlarged facility will result in the storm wave conditions exceeding the recommended wave heights in the basin. Due to the size and depth of the enlarged basin, the proposed small boat facility is proportionally more affected by the 1 in 1 year storm than the 1 in 50 year storm. It is predicted that the wave conditions in the proposed basin will be marginally worse with the existing seawall along Shore Street than with the proposed new promenade and revetment.

A 40 metre length of 5m wide floating concrete breakwater moored off the south east corner of the pier area will be effective in attenuating the wave climate in the proposed new small boat harbour and when installed, will bring the wave heights in the proposed enlarged basin to within 0.3m during the 1 in 1 year storm and 0.4m during the 1 in 50 year storm. These are considered to be acceptable values for the berthing of the small boats at the proposed facility.

The floating breakwater must at least be a 5m wide skirted concrete structure which typically will have a weight of about 52 Tonnes per 20 meter length and attenuation characteristics similar to a Marinetek K series 5300 floating breakwater. The modelling has predicted that the breakwater will be subjected to a wave climate with a JONSWAP spectra with the following characteristic during a 1 in 100 year storm.

H_{m0} – 1.345m, H_{max} – 2.727m, T_p – 3.56s, T₀₁ – 2.88s and T_{m10} – 3.18s.

5 CONCLUSIONS

The original wave study for the wave climate along the Shore Street frontage has been updated to take account of the increase in sea level rise by 2100 predicted as a result of the IPCC panel 2018 assessment. The increase in the allowance for sea level rise from 0.58 metres to the current SEPA recommended value of 0.89 metres results in an increase in the 1 in 200 year return period storm wave heights of about 10mm.

The frontage at Shore Street is exposed to wind driven waves generated over the local fetch in Loch Broom. Thus a joint probability analysis of extreme wind speed and water levels has been undertaken for the most exposed directions for wave attack along Shore Street. An overtopping analysis has been undertaken using the neural network methodology recommended in the 2018 EurOtop overtopping manual. The results of the analysis showed that for a 1 in 200 year joint probability return period event the current maximum overtopping rate at the existing seawall along Shore Street would be about 20 litres per second per metre length of wall. For the same event the overtopping rate for the proposed new promenade revetment and seawall would be 0.532 litres per second per metre length of wall. This latter rate is well within the 2018 EurOtop manual's recommended values for safe pedestrian access.

It was noted that by 2100 Shore Street would be under water during a 1 in 200 year return period tidal event. Thus no overtopping calculations have been made for the projected 2100 sea levels as these will depend upon what flood mitigation measures are to be undertaken around this part of Ullapool.

Harbour disturbance modelling has been undertaken to investigate the performance of the new quay and dredging for the proposed enlarged small facility at Ullapool. The modelling showed that while the storm wave conditions within the existing small boat harbour are satisfactory, the construction of the new quay and dredging would result in standing wave patterns within the basin during storm events from the south south east to south direction. The inclusion of a 40 metre long, 5 metre wide floating breakwater running east from the south east corner of the Pier area was found to reduce the significant wave heights within the proposed enlarged small boat facility to 0.4 metres and 0.3metres during 1 in 50 and 1 in 1 year return period storms respectively. These wave heights are within the limits recommended for the safe berthing of small boats alongside pontoon facilities.

It is recommended that the floating breakwater should be a concrete breakwater with a minimum width of 5 metres, a weight of at least 52 tonnes per 20 metre length and wave attenuating properties similar to that of a Marinetek K series 5300 breakwater.

APPENDIX

Wave Generation and Transformation Modelling Software

The wave transformation modelling was undertaken using the MIKE21 Spectral Wave model (SW). The MIKE 21 SW model is a new generation spectral wind-wave model based on unstructured meshes. The model simulates the growth, decay and transformation of wind-generated waves and swells in offshore and coastal areas.

MIKE 21 SW includes the following physical phenomena:

- Wave growth by action of wind
- Non-linear wave-wave interaction
- Dissipation due to white-capping
- Dissipation due to bottom friction
- Dissipation due to depth-induced wave breaking
- Refraction and shoaling due to depth variations
- Diffraction
- Wave-current interaction
- Effect of time-varying water depth and flooding and drying

The discretization of the governing equation in geographical and spectral space is performed using a cell-centred finite volume method. In the geographical domain, an unstructured mesh technique is used. The time integration is performed using a fractional step approach where a multi-sequence explicit method is applied for the propagation of wave action.

MIKE 21 SW includes two different formulations:

- Directional decoupled parametric formulation
- Fully spectral formulation

The fully spectral formulation was used in the simulations. The spectral formulation is based on the wave action conservation equation, as described in e.g. Komen et al. (1994) and Young (1999), where the directional-frequency wave action spectrum is the dependent variable.

Harbour Disturbance Modelling Software

The wave disturbance studies were undertaken using the MIKE21 Boussinesq wave model which is the most advanced wave model in the MIKE21 modelling system.

The Boussinesq Wave model, MIKE 21 BW, is the state-of-the-art numerical model for calculation and analysis of short- and long-period waves in ports, harbours and coastal areas. MIKE 21 BW is capable of reproducing the combined effects of all important wave phenomena of interest in port, harbour and coastal engineering. These include:

- Shoaling
- Refraction
- Diffraction
- Wave breaking
- Bottom friction
- Moving shoreline
- Partial reflection and transmission
- Non-linear wave-wave interaction
- Frequency spreading
- Directional spreading

Phenomena, such as wave grouping, surf beats, generation of bound sub-harmonics and super-harmonics and near-resonant triad interactions, can also be modelled using MIKE 21 BW. The 2DH module (two horizontal space co-ordinates) solves the enhanced Boussinesq equations by an implicit finite difference technique with variables defined on a space-staggered rectangular grid.

The Boussinesq wave model includes the provision of wave reflection and transmission properties for various structures within the harbour. This is achieved by placing porosity layers in the model either along the face in front of fixed structures or, in the case of floating breakwaters, along the line of the breakwater location.



Drawings

Registered Office:
Lochview Office, Loch Duntelchaig
Farr, Inverness, IV2 6AW

Telephone: 01808 521 498
Email: info@affriclimited.co.uk
www.affriclimited.co.uk

Title: Ullapool Location 63.01.01

Projection: OSGB 1936/British National
Grid EPSG: 27700

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Page 1

Rev No: 1

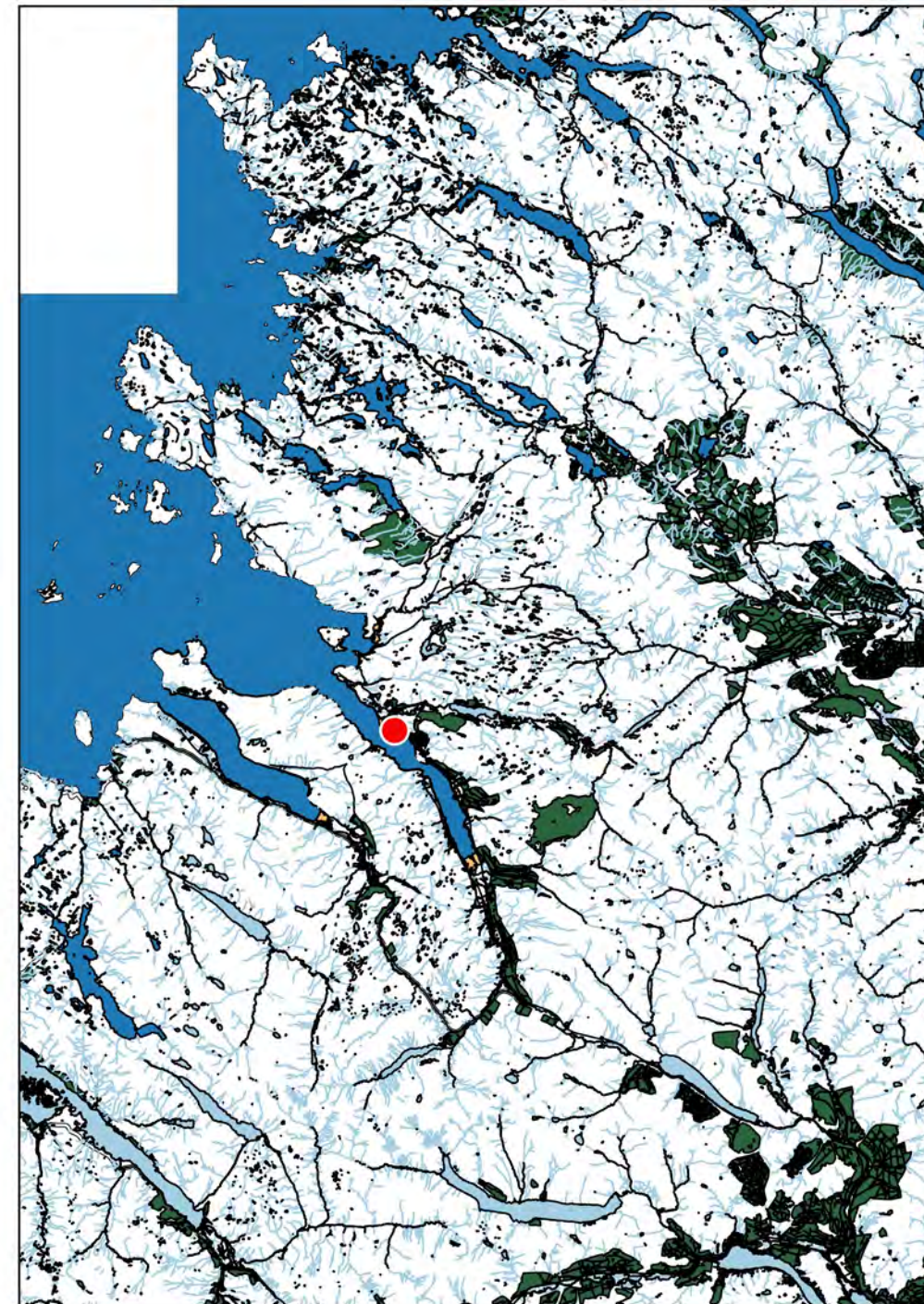
Drawing Date:
07/02/2020

Legend

- Ullapool
- Foreshore
- Fresh water
- Tidal Water
- Woodland



0 5 10 15 20 25 30 km





LEGEND

 AREA OF INTEREST

ULLAPOOL PROMINADE GROUP SHORE STREET WIDENING & PROMENADE LOCATION PLAN

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 600220
hebrides@wallacestone.co.uk

| | |
|-------------------|-----------------------|
| DRAWN: JHG | DATE DRAWN: 07.02.20 |
| CHKD: TR | DATE CHKD: 11.02.20 |
| APPRVD: TR | DATE APPRVD: 10.02.20 |
| DRG NO. 2059-999A | SCALE: 1:2500 |



- NOTES
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
 2. ALL CONTOURS AND LEVELS ARE IN METRES RELATIVE TO CHART DATUM.
 3. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
 4. MHWS +5.2mCD
MLWS +0.7mCD

| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |
|-----|------|---------|-------|-------|-------|
| | | | | | |

AMENDMENTS

CLIENT
ULLAPOOL HARBOUR TRUST

PROJECT
ULLAPOOL SMALL BOAT
PONTON EXTENSION

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE
EXISTING LAYOUT

| | | |
|------------------|------------------|------------------|
| DRAWN JHG | CHECKED TR | APPROVED TR |
| DATE 21.06.19 | DATE 06.06.19 | DATE 06.06.19 |

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| REVISION | |

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| PROJECT No. 2127 | DRAWING No. 901 |
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GENERAL NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

2. ALL CONTOURS ARE IN METRES RELATIVE TO CHART DATUM.

3. ALL TOPOGRAPHIC SURVEY LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.

4. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.

5. MHWS +5.2mCD
MLWS +0.7mCD

LEGEND

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PLANNING CONSENT

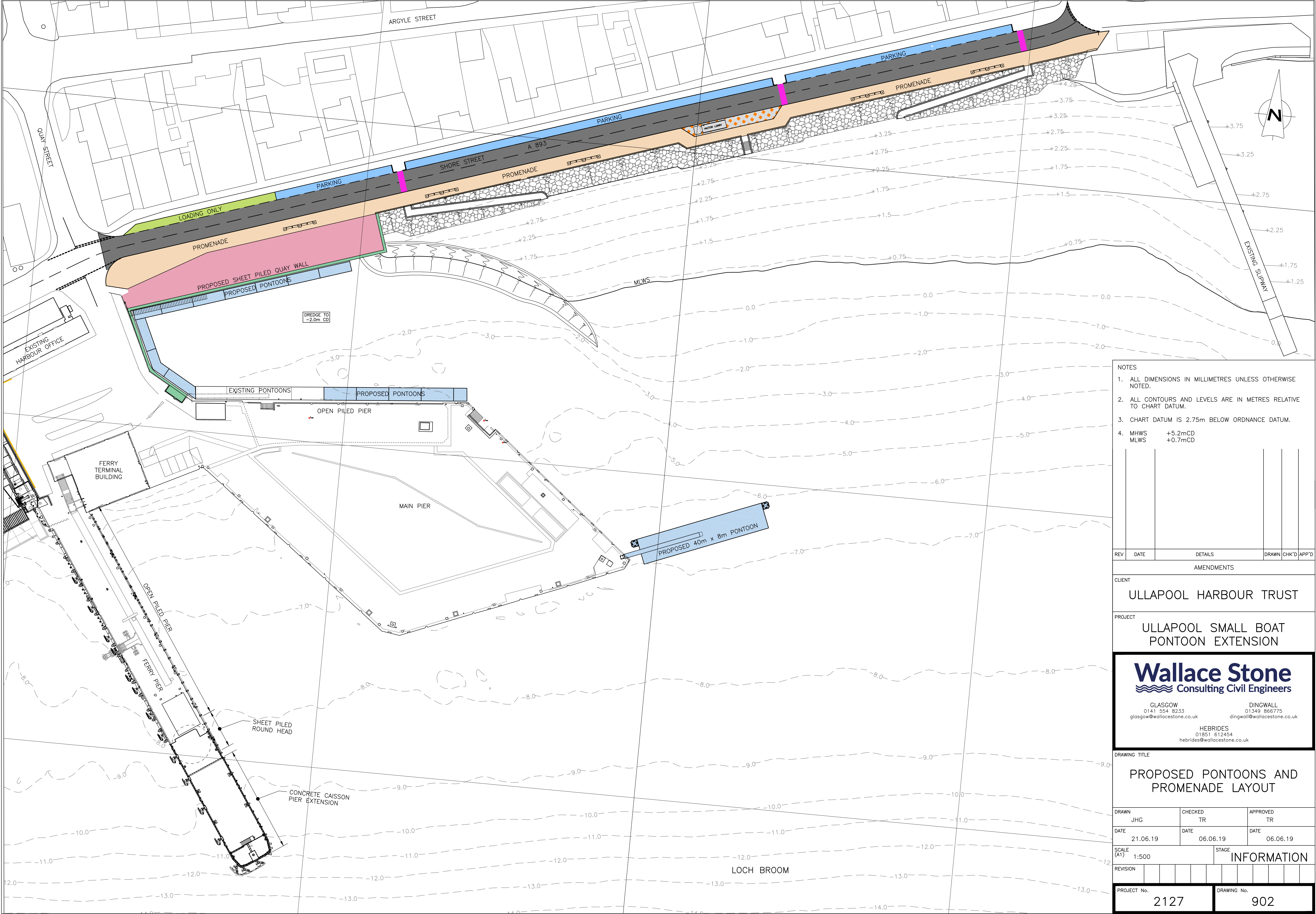
9,721m²

WORKS BOUNDARY
MARINE CONSENT

3,891m²

WORKS SHARED BOUNDARY
MARINE AND PLANNING CONSENT

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| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |
| AMENDMENTS | | | | | |
| CLIENT | | | | | |
| ULLAPOOL PROMENADE GROUP | | | | | |
| PROJECT | | | | | |
| SHORE STREET WIDENING & PROMENADE, ULLAPOOL | | | | | |
| <div><div><div>Wallace Stone</div><div>CONSULTING CIVIL ENGINEERS</div><div>GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk</div><div>DINGWALL 01349 866775 dingwall@wallacestone.co.uk</div><div>HEBRIDES 01851 612454 hebrides@wallacestone.co.uk</div></div></div> | | | | | |
| DRAWING TITLE | | | | | |
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| DATE FEB 2020 | | DATE FEB 2020 | | DATE FEB 2020 | |
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| REVISION | A | | | | |
| PROJECT No. 2059 | | | DRAWING No. 951 | | |



- NOTES
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
 2. ALL CONTOURS AND LEVELS ARE IN METRES RELATIVE TO CHART DATUM.
 3. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
 4. MHWS +5.2mCD
MLWS +0.7mCD

| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |
|-----|------|---------|-------|-------|-------|
| | | | | | |

AMENDMENTS

CLIENT
ULLAPOOL HARBOUR TRUST

PROJECT
ULLAPOOL SMALL BOAT
PONTOON EXTENSION

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

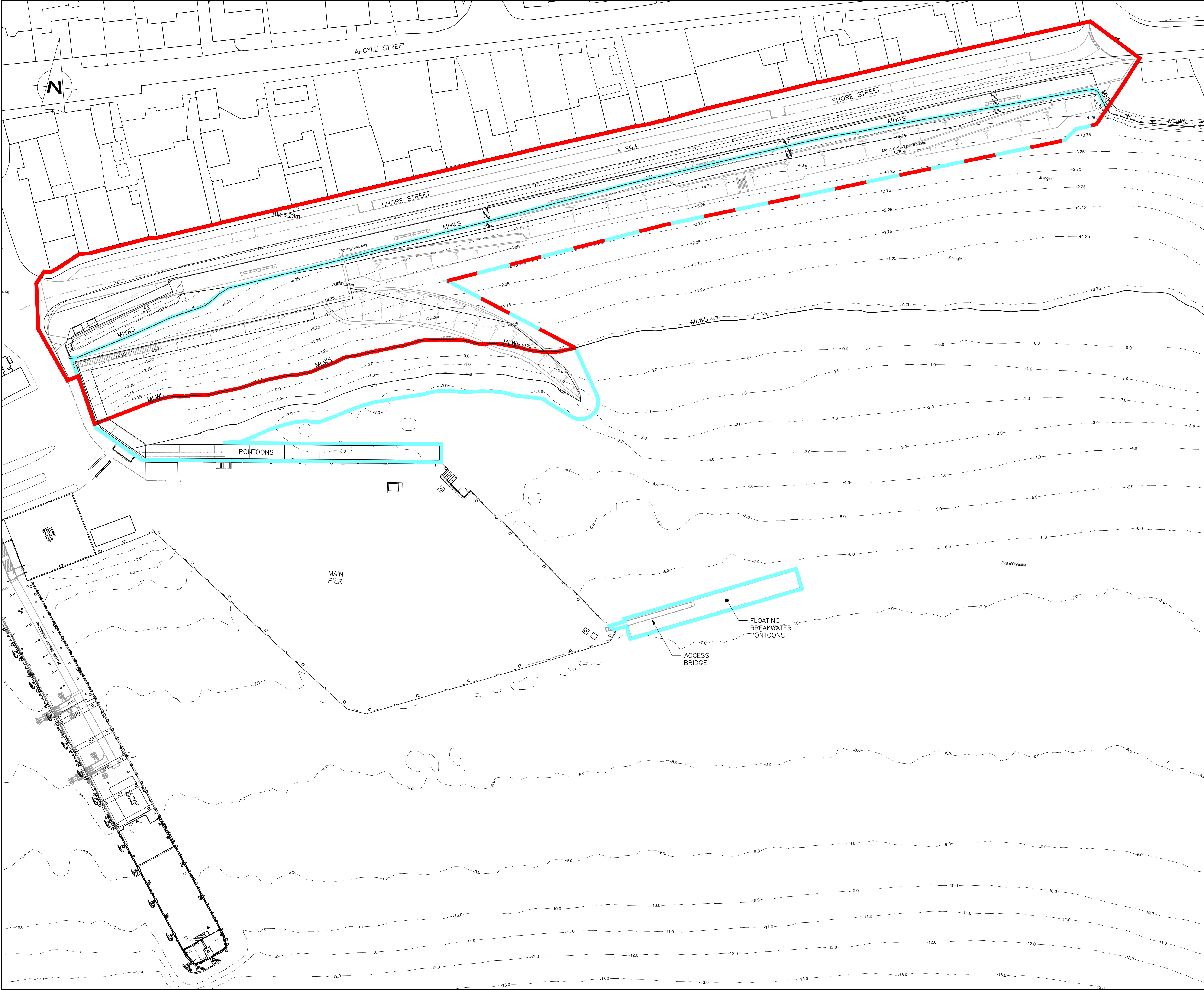
HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE
PROPOSED PONTOONS AND
PROMENADE LAYOUT

| | | |
|------------------|------------------|------------------|
| DRAWN JHG | CHECKED TR | APPROVED TR |
| DATE 21.06.19 | DATE 06.06.19 | DATE 06.06.19 |

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| REVISION | |

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|---------------------|--------------------|
| PROJECT No. 2127 | DRAWING No. 902 |
|---------------------|--------------------|



GENERAL NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

2. ALL CONTOURS ARE IN METRES RELATIVE TO CHART DATUM.

3. ALL TOPOGRAPHIC SURVEY LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM.

4. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.

5. MHWS +5.2mCD
MLWS +0.7mCD

LEGEND

WORKS BOUNDARY
PLANNING CONSENT

11,561m²

WORKS BOUNDARY
MARINE CONSENT

8,126m² FORESHORE,
DREDGE AND PONTOONS
556m² BREAKWATER
AND MOORINGS

WORKS SHARED BOUNDARY
MARINE AND PLANNING CONSENT

| | | | | | |
|-----|----------|--------------------------|-------|-------|-------|
| | | | | | |
| B | 12.02.20 | MINOR REVISIONS | JHG | EC | TR |
| A | 11.02.20 | WORKS BOUNDARIES REVISED | JHG | TR | TR |
| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |

AMENDMENTS

CLIENT

ULLAPOOL PROMENADE GROUP

PROJECT

SHORE STREET WIDENING &
PROMENADE, ULLAPOOL

Wallace
Stone

CONSULTING CIVIL ENGINEERS

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE

PROPOSED PONTOONS AND
PROMENADE DEVELOPMENT
AREA BOUNDARIES

| | | | | | |
|-------|----------|---------|----------|----------|----------|
| DRAWN | JHG | CHECKED | EC | APPROVED | TR |
| DATE | FEB 2020 | DATE | FEB 2020 | DATE | FEB 2020 |

SCALE (A1) 1:500 (1:1000 AT A3)

STAGE

CONSENTS

REVISION

A

B

PROJECT No.

2059

DRAWING No.

952

Registered Office:
Lochview Office, Loch Duntelchaig
Farr, Inverness, IV2 6AW

Telephone: 01808 521 498
Email: info@affriclimited.co.uk
www.affriclimited.co.uk

Title: Designated Sites 20Km Buffer
63.01.02

Projection: OSGB 1936/British National
Grid EPSG: 27700










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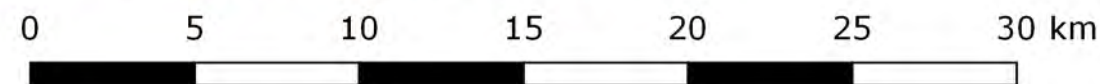
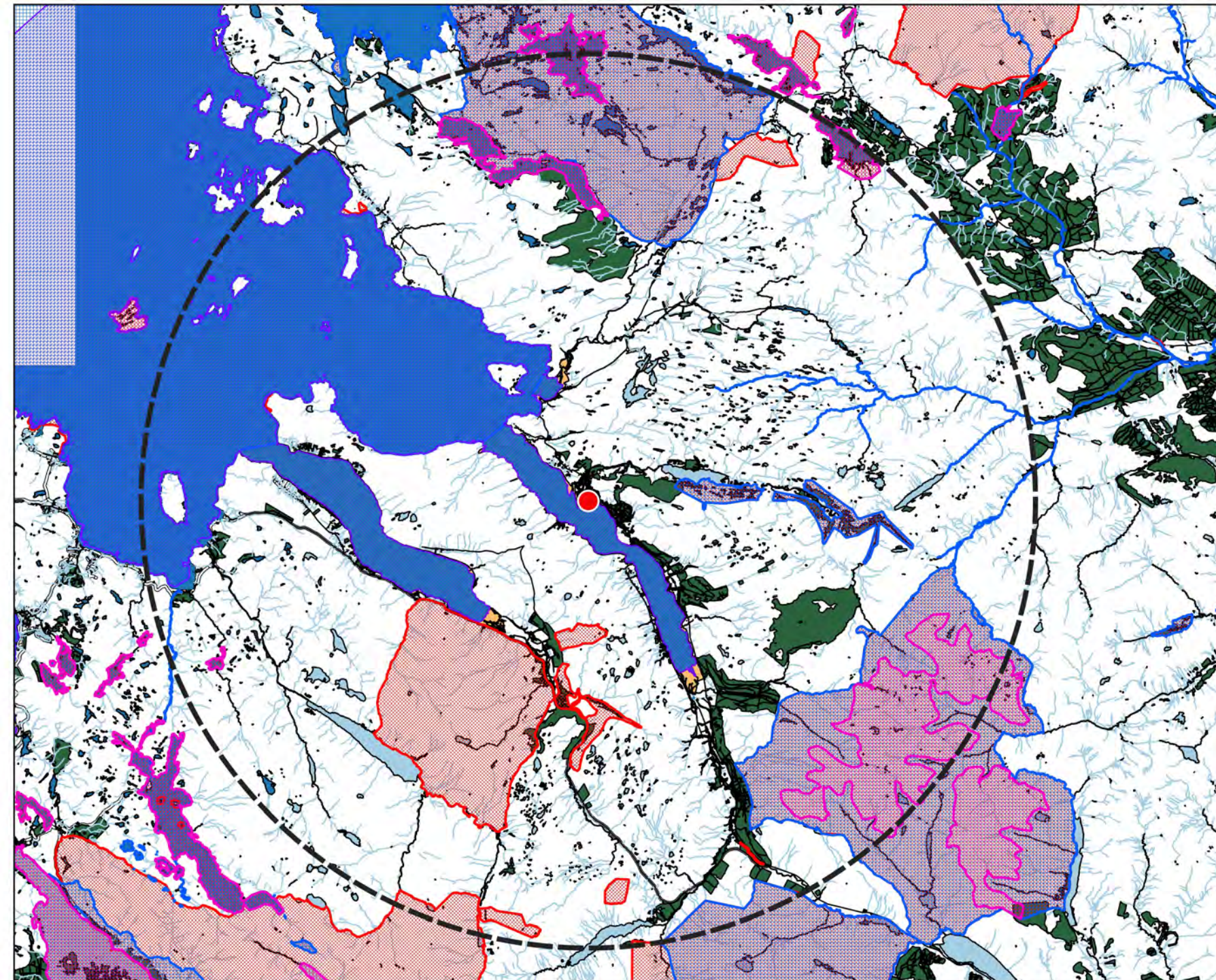
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| Page 1 | Rev No: 1 | Drawing Date: 12/02/2020 |
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Legend

-  Ullapool
-  Foreshore
-  Tidal Water
-  Woodland
-  20km buffer
-  MPA
-  SAC
-  SSSI
-  SPA





Appendix 3 - Screening Opinion: Marine Scotland

Fiona Henderson
Affric Limited
Lochview Office
Loch Duntelchaig
Farr
Inverness
IV2 6AW

Date: 07 May 2020

Dear Ms Henderson,

SCREENING OPINION UNDER PART 2, REGULATION 11 OF THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017 (AS AMENDED)

Thank you for your screening opinion request dated 13 February 2020, further information submitted on 13 March 2020 and supporting correspondence dated 30 April 2020, in regards to the proposed construction of a promenade and small boat harbour development, including new sea wall, sea defence revetment and sheet piled quay construction, dredging and the installation of additional pontoons, at Shore Street, Ullapool, Highland ("the Proposed Works").

The Scottish Ministers consider the Proposed Works to fall under paragraphs 10(m) and 12(a) of schedule 2 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) ("the 2017 MW Regulations"). Consequently, the Scottish Ministers are obliged to adopt a screening opinion as to whether the Proposed Works are, or are not, an Environmental Impact Assessment ("EIA") project under the 2017 MW Regulations.

Under regulation 10(5) of the 2017 MW Regulations, the Scottish Ministers have consulted with the relevant local planning authority The Highland Council, Scottish Natural Heritage ("SNH"), the Scottish Environment Protection Agency ("SEPA") and Historic Environment Scotland ("HES") as to their view on whether the Proposed Works are an EIA project. Copies of the consultation responses received are enclosed for your review (at Appendix I).

A consultation response was not received from The Highland Council. However, it is the Scottish Ministers' understanding that The Highland Council screened the terrestrial concerns of this project under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 and concluded an EIA was not required.

When making a determination as to whether schedule 2 works are an EIA project, the Scottish Ministers must take into account the selection criteria set out in schedule 3 of the 2017 MW Regulations as are relevant to the works. In this regard, the Scottish Ministers have considered the following:

Characteristics of works

The Proposed Works involve the removal of the existing revetment and construction of a new seaward promenade, of which 315 square metres will be constructed below Mean High Water Springs. The promenade will be supported by an embankment using infill from the demolished revetment. Approximately 7061 cubic metres of rock armour will be used to reinstate the sea defence along the sea wall, within which two ramps and a set of concrete steps will be constructed on concrete support foundations. A new 82 metre (“m”) long quay and small laydown area will be constructed at the west end of the promenade which will match the height of the existing quay. An anchor wall will be installed under the promenade at the west end to provide structural support for the new quay and will likely comprise 3m long sheet piles which will be installed by vibropiling for half their length, and the rest backfilled.

The area in front of, and to the west of the new quay will be dredged using a back-hoe dredger to -2.0m relative to chart datum to create a permanent inner basin in the harbour. Scour protection, likely using rock armour, will be installed on the dredge slope on the east side of the new quay. New pontoons will be installed in the dredged area along the new quay and main pier which will be secured in place by steel guides attached to the quay walls. A floating breakwater pontoon will also be anchored by mooring chains to the end of the main pier. A drawing of the Proposed Works is provided in Appendix II.

During the Proposed Works, increased sedimentation may occur within the water column, primarily associated with dredging and dredged material deposit activities. The Proposed Works also have the potential to pollute the marine environment should any release of contaminants from the dredged material occur. It is intended for these issues to be considered in the Best Practicable Environmental Option (“BPEO”) document, which is required to be submitted in support of the marine licence application for dredging and deposit. Provided the contaminant levels within the dredged material do not give rise to any concerns, it is considered unlikely the dredging activities will result in significant adverse impacts to the water quality.

SEPA provided general guidance in regards to waste management, sediment runoff, and pollution prevention. Due to the scale of the Proposed Works and providing that good working practices and environmental mitigation measures are followed, SEPA advised that, with respect to its interests, the Proposed Works are unlikely to have a significant effect on the environment and therefore it does not consider an EIA to be required.

Location of the works

The Proposed Works are located immediately adjacent to the Wester Ross Marine Protected Area (“MPA”), selected for various benthic protected features. In particular, the breakwater pontoon borders the MPA boundary. Burrowed mud habitat, a protected feature of the Wester Ross MPA and a Priority Marine Feature (“PMF”), is present within the mid basin of Loch Broom but not within the area of the Proposed Works. Tall sea pens (*Funiculina quadrangularis*) are also present within the Loch Broom designated dredged material deposit site. The BPEO to be submitted in support of the dredging and deposit marine licence application will include sediment sampling and analysis to identify any potential contaminants that could have an impact on the water and seabed quality. It is intended for the presence of tall sea pens also to be considered within the BPEO.

The Inner Hebrides and the Minches Special Area of Conservation (“SAC”) is located 4.4 kilometres from the Proposed Works. There are records of porpoise sightings in Loch Broom although most of these sightings are in the outer basin, rather than the mid basin where the Proposed Works are located. The installation of sheet piles is proposed to be carried out in shallow waters and mainly above Mean Low Water Springs. Yet there remains the potential for marine mammals to be impacted by the underwater noise caused by piling.

An unclassified wreck was identified on Canmore, the online catalogue of the National Record of the Historic Environment, located approximately 35m north of the end of the breakwater pontoon at a water depth of 3m at lowest astronomical tide. However, the wreck is classed on Canmore as DEAD (not detected in repeated surveys and therefore not considered to exist) and the position quality is noted to be “unreliable”. A Protocol for Archaeological Discovery will be implemented for the Proposed Works which will be used in the event of a discovery of archaeological artefacts and appropriate steps taken to protect the archaeological value of these artefacts, in conjunction with The Highland Council and HES. HES confirmed it is content that the information provided shows no evidence of a wreck within the footprint of the Proposed Works and therefore it does not consider an EIA to be required.

Characteristics of the potential impact

SNH advised that, although there may be direct impacts on the protected features of the Wester Ross MPA from the pontoon mooring arrangements or from the indirect effects of any hydrodynamic changes, there do not appear to be any habitats sensitive to these effects in the immediate vicinity. As regards the deposit of dredged material at the Ullapool dredge deposit site, SNH noted that tall sea pens are particularly vulnerable to this activity advising that any deposit of material within this site would need to avoid the areas where this feature occurs.

Additionally, in relation to the Inner Hebrides and the Minches SAC, SNH noted that the installation of driven piles in the marine environment without mitigation is likely to produce noise levels capable of causing injury and disturbance to marine mammals and advised that further consideration be given to this risk. SNH confirmed that, while they do not consider the Proposed Works to require EIA, an Environmental Management Plan may be

necessary to minimise the risk of injury to marine mammals from piling noise, as per the 2010 Joint Nature Conservation Committee guidance on the subject.

The Scottish Ministers are content that the further research and mitigation proposed by SNH above, in particular the production and implementation of an Environmental Management Plan and the identification of suitable dredged material deposit areas (in order to avoid adverse impacts to tall sea pens), is sufficient to ensure no significant effects on the environment. It is the Scottish Ministers' expectation that this mitigation will be detailed in any subsequent application(s) submitted for the Proposed Works and formalised in conditions, as appropriate, attached to any marine or European Protected Species licence subsequently granted for the Proposed Works.

Conclusion

In view of the findings above, the Scottish Ministers are of the opinion that the Proposed Works are not an EIA project under 2017 MW Regulations and, therefore, an EIA is not required to be carried out in respect of the Proposed Works.

If you increase, alter or extend the Proposed Works, you are advised to contact Marine Scotland - Licensing Operations Team again to confirm if the screening opinion is still valid.

A copy of the screening opinion has been forwarded to The Highland Council planning department. The screening opinion has also been made publicly available through the Marine Scotland Information website.

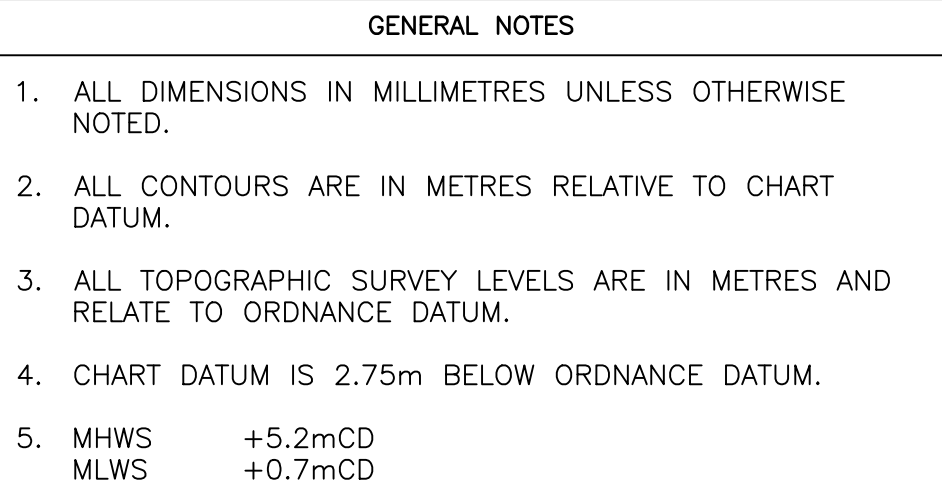
If you require any further assistance or advice on this matter, please do not hesitate to contact me.

Yours sincerely,

Rebecca Bamlett
Licensing Operations Team
Marine Scotland

Appendix I – Consultation Responses

Appendix II – Drawing of the Proposed Works



AMENDMENTS

PROJECT
SHORE STREET WIDENING &
PROMENADE, ULLAPOOL

DRAWING TITLE _____

PROPOSED PONTOONS AND PROMENADE DEVELOPMENT SUPPLEMENTARY INFORMATION

| | |
|------------------------------------|-------------------|
| SCALE (A1) 1:500 (1:1000 AT A3) | STAGE CONSENTS |
|------------------------------------|-------------------|

| | |
|-------------|-------------|
| PROJECT No. | DRAWING No. |
| 2059 | 953 |

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Appendix 4 – Screening Opinion: The Highland Council

Ullapool Harbour Trust
c/o Fiona Henderson
Lochview Office
Loch Duntelchaig
Farr
Inverness
IV2 6AW

Please ask for/Foighnich airson: Meadhbh Maguire
Direct Dial/Àireamh fòn: (01349) 868619
E-mail/Post-d: Meadhbh.Maguire@highland.gov.uk
OurRef/Ur n-àireamh-iùil: 20/00743/SCRE
Your Ref/Ar n-àireamh-iùil:
Date/Ceann-là: 19 February 2020

Dear Sir/Madam

**TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND)
REGULATIONS 2011
RIAGHAILTEAN DEALBHaidh BAILE IS DÙTHCHA (MEASADH BUAIDH ÀRAINNEACHD) (ALBA)
2011**

**PROPOSAL: REQUEST FOR EIA SCREENING OPINION - WIDENING OF ROAD, FORMATION OF
PROMENADE AND SMALL BOAT HARBOUR
LOCATION: LAND AT SHORE STREET, ULLAPOOL**

Thank you for your screening opinion request.

Your request was registered on 17 February 2020 and the case officer is Meadhbh Maguire. Any additional or follow up information relating to your application should be submitted via the ePlanning.scot portal at <https://www.eplanning.scot> using the Post Submission Additional Documents online form. Alternatively please email this information to our eProcessing Centre at ePlanning@highland.gov.uk quoting the relevant application reference number.

We aim to issue a screening opinion to you in writing within three weeks of your request being registered. Under certain circumstances, however, we may not be able to provide an opinion by the target deadline. In such cases, we will write to you to explain the reasons why and request a revised response date.

Should you require any further information or clarification on any of the above, please do not hesitate to contact me.

Our privacy notices for planning applications, consents and notice of review sets out our legal basis for collecting personal information and how we use it. To view the privacy notice please visit the Council's website:

https://www.highland.gov.uk/directory_record/1052173/planning_applications_consents_and_notice_of_review

Yours faithfully

ePlanning Centre: The Highland Council, Glenurquhart Road, Inverness, IV3 5NX

Email/Post-d: eplanning@highland.gov.uk Web/Lìon: www.highland.gov.uk

Ionad dDealbhaidh: Comhairle na Gàidhealtachd, Rathad Ghleann Urchadain, Inbhir Nis, IV3 5NX

Dafydd Jones

Area Planning Manager (North)
(Caithness, Sutherland, Ross And Skye)

ePlanning Centre: The Highland Council, Glenurquhart Road, Inverness, IV3 5NX

Email/Post-d: eplanning@highland.gov.uk Web/Lìon: www.highland.gov.uk

Ionad dDealbhaidh: Comhairle na Gàidhealtachd, Rathad Ghleann Urchadain, Inbhir Nis, IV3 5NX

ACKSCR



Appendix 5 – Habitat Regulations Assessment



**Ullapool – Shore Street Widening
&
Promenade
&
Small Boat Harbour Development
Habitat Regulations Appraisal Pre-
Screening Report**



Date: 30/06/2021

Document Number: 63/REP/06



Document Control

| | Name | Title | Signature | Date |
|-------------------|-----------------|-------------------|---------------------|----------|
| Author | Fiona Henderson | Managing Director | <i>F. Henderson</i> | 30/06/21 |
| Reviewer | Jack Clarkson | Consultant | <i>J. Clarkson</i> | 30/06/21 |
| Authoriser | Fiona Henderson | Managing Director | <i>F. Henderson</i> | 30/06/21 |

| | |
|------------------------|-----------------|
| Effective Date: | 30/06/21 |
|------------------------|-----------------|

| Revision No: | Signature | Comments | Date |
|--------------|---------------------|-----------|----------|
| 1 | <i>F. Henderson</i> | For Issue | 30/06/21 |
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1 Introduction

In support of the Marine Licence and planning permission application(s) for the proposed Ullapool Shore Street Widening & Promenade and Small Boat Harbour Development, this Habitats Regulations Appraisal (HRA) Pre-Screening Report provides information required for the competent authority to carry out an HRA, and, where required, an Appropriate Assessment (AA).

This report is designed to be read in conjunction with the Supporting Document and directs the reader to the section of the supporting document which are relevant to the designated site or qualifying species being discussed.

1.1 Legislative Basis

A HRA is required for this development due to its proximity to multiple Natura 2000 sites. These include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The legislative context for this requirement is based on Article 6(3) of the Habitats Directive (92/43/EEC), Article 4(4) of the Birds Directive (2009/147/EC), and is implemented in Scotland through The Conservation (Natural Habitats, &c Regulations 1994 (the Habitats Regulations).

In Scotland, the Scottish Planning Policy document ensures that Ramsar sites, which are normally included in an HRA assessment, overlap with Natura sites, and are therefore protected under the same legislation (Scottish Government, 2014). Therefore, Ramsar sites are not considered separately as part of this HRA Screening report.

If a likely significant effect (Van Alsenoy, Bernard, & Van Grieken, 1993) is predicted on a Natura Site at the first stage of the HRA, then an Appropriate Assessment (AA) must then be carried out. The AA must demonstrate that the proposal will not adversely affect the integrity of the site (NatureScot, 2021a).

It is the responsibility of the competent authority to carry out the HRA based on robust, scientific information provided by the project developer about the Proposed Project. It is not the role of the developer to make an assessment on whether the proposal will have an adverse effect on any associated Natura sites.

1.2 Terminology

The terminology employed as part of the HRA process relates to likely significant effects (LSEs). In this HRA Pre-Screening report, the use of the word 'significant' relates to potential ecological connectivity.

Assessment of LSEs take a precautionary approach and ask whether a project may have an effect, or have the possibility of having an effect, on a Natura site (NatureScot, 2021b). A project component is said to have an LSE on a designated site if there is ecological connectivity with the site's qualifying interests, or there is the potential for the conservation objectives of the designated site to be undermined. Where an LSE "*cannot be excluded, on the basis of objective information*" (European Court of Justice C-127/02, 2004) an AA is required. The conservation objectives of the site provide the framework for considering the potential for LSEs.



1.3 Objectives

The objectives of this HRA Pre-Screening report are to summarise:

- The proposed development details;
- The Natura 2000 sites considered, with reference to the Ullapool development, along with these sites' qualifying interests and conservation objectives;
- Details on the qualifying interests for each of the scoped-in Natura sites.

This information will aid the competent authority in carrying out an HRA. This HRA Pre-Screening Report provides a reference as to where the relevant information required to complete the HRA is located within the supporting document, and as such should be read in conjunction with it and not as a stand-alone document. An indication of whether LSEs are expected is given for each designated site, but it is ultimately up to the competent authority carrying out the HRA to ascertain whether LSEs are present, and therefore whether an AA is needed for each designated site.

2 Project Summary

The proposed Shore Street Widening & Promenade and Small Boat Harbour Development is located in the coastal village of Ullapool in the Highland region on the eastern shoreline of the sea loch, Loch Broom (Drawings 63.01.01 and 63.01.04). Ullapool Shore Street (A893) lies on the southern limit of Ullapool, the proposal lies between the junction with the A835 to the east (NH1313 9407) and the pier to the west (NH1284 9396).

The intent is to reclaim land in a seaward direction to widen Shore Street and create a promenade to increase pedestrian, vehicle and cycling provision. A Small Boat Harbour within the inner basin of Ullapool Harbour will also be created. This will consist of a new quay at the eastern end of Shore Street and the installation of new berthing pontoons in the area to the north side of the existing main pontoon. To facilitate safe navigation and berthing of vessels utilising the facilities provided, the area will require dredging and a floating breakwater pontoon will be installed on the eastern end of the main pier.

Further details on the project description as well as each individual element of the proposed project can be found in the Section 3: Project Description of the Supporting Document.

Due to the development's proximity to numerous Natura 2000 sites and the potential for aspects of the construction process to have some degree of connectivity with the qualifying features of Natura 2000 sites, a HRA is required. Information on the designated sites and qualifying features relevant to the development and therefore taken into consideration, can be found in Section 3: Designated Sites of this report.

3 Designated Sites

The designated sites and their qualifying interests relevant to the development are shown in Table 3.1. The sites specifically considered and included within Table 3.1 are those within 20km of the development (irrespective of qualifying interest). Sites with mobile marine species as part of the qualifying interest and whom are within typical ranges of the species were also sought. However, although there are multiple designations for grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) on the west coast of Scotland none were within the greatest

possible, daily, long-distance travel and/or foraging range of these species of 100km and 60km, respectively.

The sites, or species within the sites, are scoped in or out depending on the level of ecological connectivity to the proposed works. A reduced list of designated sites and features is then taken forward for further assessment. Explanations for why certain sites or qualifying features are excluded is laid out in Section 3.1.

Only Special Areas of Conservation (SACs) and Special Protections Areas (SPAs) are considered, as together, they make up the Natura 2000 Network.

Table 3.1: Designated Sites Relevant to the Proposal

| Site | Distance and Direction | Qualifying Feature(s) | Included in Further Assessment? (in/out) |
|-------------------------------------|------------------------|--|---|
| Special Area of Conservation | | | |
| Rhidorroch Woods SAC | 3.9km ENE | Annex I habitats: Caledonian forest; Northern Atlantic wet heaths with <i>Erica tetralix</i> . | Out - No connectivity to the immobile features. |
| Inner Hebrides & The Minches SAC | 4.4km NNW | Harbour porpoise (<i>Phocoena phocoena</i>) - favourable maintained | IN – there is the potential for construction activities to impact on the qualifying features of the SAC due to the mobile nature of the designated feature. |
| River Oykel SAC | 7.6km NE | Annex II Species: Freshwater pearl mussel; Atlantic salmon. | Out – No connectivity |
| Inverpolly SAC | 11.8km NNE | Annex I Habitats: Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels; Natural dystrophic lakes and ponds; Northern Atlantic wet heaths with <i>Erica tetralix</i> ; Blanket bogs; Transition mires and quaking bogs; Depressions on peat substrates; Dry heaths; Alpine and subalpine heaths; Montane acid grasslands; Acidic scree; Plants in crevices on acid rocks; Western acidic oak woodland. Annex II Species: Otter (<i>Lutra lutra</i>); Freshwater pearl mussel. | Out – No connectivity |
| Beinn Dearg SAC | 12.5km SE | Annex I habitats: Acidic scree; Alpine and subalpine calcareous | Out - No connectivity |

| Site | Distance and Direction | Qualifying Feature(s) | Included in Further Assessment? (in/out) |
|--|------------------------|---|--|
| | | grasslands; Alpine and subalpine heaths; Blanket bog; Caledonian forest; Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels; Dry heaths; High-altitude plant communities associated with areas of water seepage; Montane acid grasslands; Mountain willow scrub; Plants in crevices on acid rocks; Plants in crevices on base-rich rocks; Species-rich grassland with mat-grass in upland areas; Tall herb communities; Wet heathland with cross-leaved heath. | |
| Fannich Hills | 17km SSE | Habitat feature: Acidic scree; Alpine and subalpine heaths; Blanket bog; Clear-water lakes and lochs with aquatic vegetation and poor to moderate nutrient levels; Dry heaths; Montane acid grasslands; Plants in crevices on acid rocks; Wet heathland with cross-leaved heath. | Out – No Connectivity |
| Little Guinard River SAC | 18.7km WSW | Annex II Species: Atlantic salmon | In – due to link to mobile feature by sea. |
| Special Protection Area | | | |
| Inverpolly, Loch Urigill, and nearby lochs | 12.6km N | Protected birds: Black-throated diver (<i>Gavia arctica</i>). | In – mobile feature which can winter on the coast. |
| Beinn Dearg SPA | 14.4km SE | Protected birds: Dotterel (<i>Charadrius morinellus</i>) breeding | Out – No connectivity |
| Wester Ross Lochs | 17.6km WSW | Protected birds: Black-throated diver. | In – mobile feature which can winter on the coast. |

3.1 Reasons for Designated Sites or Species Exclusions

3.1.1 Rhidorroch Woods SAC

The designated features are immobile and sufficiently far from the development site not to be affected by issues such as airborne pollutants (i.e., dust) associated with the works. As such there are no LSE and hence this SAC has not been taken forward for further assessment.



3.1.2 River Oykel SAC

The River Oykel runs eastwards into the North Sea, hence there is no connectivity between Loch Broom and the site or associated Atlantic salmon and freshwater pearl mussel. This SAC has therefore not been taken forward for further assessment.

3.1.3 Inverpolly SAC

The qualifying habitat features of the SAC are a sufficient distance from the development site that there is no interconnectivity with the project.

The development is in Loch Broom which is a sea loch with no connectivity to the freshwater bodies associated with the Inverpolly SAC hence, there is no possibility of impacting upon the Freshwater pearl mussel qualifying feature of the site.

The designation includes Otter which is a mobile feature and can have territories of up to 20km, however they tend to travel along water features. The route around the coast from Enard Bay at the western end of the SAC to Ullapool is over 40km. The overland routes from Inverpolly SAC to the development site that could be utilised by otters are not obvious due to the topography and lack of direct links. As such there is a lack of connectivity between the otter population associated with the Inverpolly SAC and the development site, hence this SAC is not taken forward for assessment.

3.1.4 Beinn Dearg SAC

The designated habitats and floral features are immobile and sufficiently far from the development site not to be affected by issues such as airborne pollutants (i.e., dust) associated with the works. There are no above ground links between the freshwater bodies and Loch Broom. As such there is no connection between the development site and this SAC hence it has not been taken forward for further assessment.

3.1.5 Fannich Hills SAC

As with the Beinn Dearg SAC, the designated habitats and floral feature are immobile and sufficiently far from the development site not to be affected by issues such as airborne pollutants (i.e., dust) associated with the works. There are no above ground links between the freshwater bodies and Loch Broom. As such there is no connection between the development site and this SAC hence it has not been taken forward for further assessment.

3.1.6 Beinn Dearg SPA

The designated species, dotterel are upland breeding wader birds and as such are not likely to be found on coastal habitats or populated areas, as such there is no connectivity with the Beinn Dearg SPA and the development hence it is not considered further.

3.2 Designated Site Information

The Conservation Objectives of each of the designated sites taken forward is provided under each designated site section. Information on where the assessment for the qualifying features or species for each site is then provided. Reference to the relevant section of the Ullapool – Shore Street Widening & Promenade & Small Boat Harbour Development Supporting Document (Affric, 2021) are provided.

3.2.1 Inner Hebrides & The Minches SAC

The conservation objectives for the Inner Hebrides & The Minches SAC are shown in Table 3.2 and the qualifying features are shown in Table 3.3.

A degree of connectivity has been identified between the Inner Hebrides & The Minches SAC and the proposed development due to the highly mobile nature of the site's qualifying feature of harbour porpoise. This, combined with the techniques likely to be utilised during the construction of the development, means that there is the potential for the works to have an LSE on the site. Therefore, it is likely an AA will be required.

Table 3.2: Inner Hebrides & The Minches SAC Conservation Objectives

| Conservation Objective of the Designated Site | Section of the supporting document to inform the assessment |
|--|--|
| Overarching Conservation Objective: To ensure that the habitat of the qualifying species, or disturbance to the qualifying species, does not significantly deteriorate the condition of the site. The site must maintain an appropriate condition to achieve favourable conservation status. | Section 5.1.2 Underwater Noise |
| Further Conservation Objective: To ensure for the qualifying species that the following are maintained in the long term: <ul style="list-style-type: none"> No significant disturbance that can contribute to a decline in the ability of the qualifying feature's ability to survive; High density of species across the site; Population of the species as a viable component of the site; Distribution of the species within site; Distribution and extent of habitats supporting the species; and Structure, function and supporting processes of habitats supporting the species. | Section 5.1.2 Underwater Noise, Appendix 7 Section 6.1.2 and 6.2.2 for mitigation. |

Table 3.3: Inner Hebrides & The Minches SAC Qualifying Feature

| Qualifying Feature | Summary of Assessment |
|--|---|
| Harbour porpoise (<i>Phocoena phocoena</i>) | <p>In the absence of mitigation procedures, there is potential to cause very localised disturbance and possible injury to harbour porpoises designated under the SAC.</p> <p>Vibration piling of piles in the water column have potential to cause Temporary Threshold Shift (TTS) to harbour porpoise within 50m of the pile at the start of the works.</p> <p>Pollutants released into the water as a result of the release of hydraulic oils or fluids from vessels and the spillage of onshore fluids and/or chemicals can have negative, direct or indirect, implications on harbour porpoise. In the unlikely event of a pollution incident, the scale of the event is likely to be too small to have any LSE that can contribute to a decline in the ability of the harbour porpoise ability to survive.</p> |

LSE cannot be ruled out for underwater noise emissions during vibro piling.

3.2.2 Little Guinard River SAC

The conservation objectives for the Little Guinard River SAC are shown in Table 3.4 and the qualifying features are shown in Table 3.5.

There is very limited connectivity between the Little Guinard River SAC and the proposed development works due to it being unlikely that the qualifying feature although mobile, is unlikely to enter Loch Broom. This, combined with the techniques likely to be utilised during the construction mean that any effects would be localised.

Table 3.4: Little Guinard River SAC Conservation Objectives

| Conservation Objective of the Designated Site | Section of the supporting document to inform the assessment |
|--|---|
| Overarching Conservation Objective: To ensure that the qualifying feature of Little Guinard River SAC is in favourable condition and makes an appropriate contribution to achieving favourable conservation status. | Section 5.1.2 Underwater Noise |
| Further Conservation Objective: To ensure that the integrity of Little Guinard River SAC is maintained by: <ul style="list-style-type: none"> • Maintain the population of Atlantic salmon, including range of genetic types, as a viable component of the site; • Maintain the distribution of Atlantic salmon throughout the site; and • Maintain the habitats supporting Atlantic salmon within the site and availability of food. | Section 5.1.2 Underwater Noise, Appendix 7 |

Table 3.5: Little Guinard River SAC Qualifying Feature

| Qualifying Feature | Summary of Assessment |
|--|---|
| Atlantic salmon (<i>Salmo salar</i>) | <p>In the absence of mitigation procedures, there is no potential to cause injury to Atlantic salmon designated under the SAC.</p> <p>Noise calculations for the vibration piling works planned show that levels are too low to cause harm to fish.</p> <p>Atlantic salmon associated with the SAC are unlikely to be in Loch Broom, hence any pollutants released into the water as a result of the release of hydraulic oils or fluids from vessels and the spillage of onshore fluids and/or chemicals will be localised and hence not have any LSE on the qualifying feature.</p> |

3.2.3 Inverpoll Loch Urigill and nearby Lochs SPA

The conservation objectives for the Inverpoll Loch Urigill and nearby Lochs SPA are shown in Table 3.6 and the qualifying features are shown in Table 3.7.

A small degree of connectivity has been identified between the Inverpoll Loch Urigill and nearby Lochs SPA and the proposed development works due to the mobile nature of the site's qualifying feature of black throated diver who are designated for breeding within the SPA but are likely to leave it to winter on the coastline. They are particularly susceptible to disturbance; hence it is unlikely that they would be found in the immediate vicinity of Ullapool. As the extent of effects associated with the project will be within a very limited area there is unlikely to be any LSE.

Table 3.6: Inverpoll Loch Urigill and nearby Lochs SPA Objectives

| Conservation Objective of the Designated Site | Section of the supporting document to inform the assessment |
|---|---|
| Overarching Conservation Objective: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained. | Appendix 2: Section 4.1.3 |
| Further Conservation Objective: To ensure for the qualifying species that the following are maintained in the long term: <ul style="list-style-type: none"> • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species | Appendix 2: Section 4.1.3 Section 5.1.1 Section 5.1.2 |

Table 3.7: Inverpoll Loch Urigill and nearby Lochs SPA Qualifying Feature

| Qualifying Feature | Summary of Assessment |
|---|---|
| <i>Black-throated diver (Gavia arctica)</i> | <p>In the absence of mitigation procedures, there is no potential to cause an impact on black-throated diver.</p> <p>The designation is specifically for breeding Black-throated divers, during breeding season, they will be inland and hence not in the vicinity of the harbour development.</p> <p>Divers do however winter on the coast. As construction works will be carried out primarily through the winter there is the potential for connectivity during this season.</p> <p>Effects on the qualifying feature that could occur would be disturbance due to in-air noise and the presence of people and plant on the construction site. However, as the works are on the edge of the village and existing harbour, these areas are already sources of disturbance which mean it is unlikely for Black-throated divers to be in the area, as they are susceptible to human disturbance (M. Ruddock & D.P. Whitfield, 2007).</p> <p>During wintering months, black-throated divers forage in coastal areas on a wide variety of fish species. During this time, any pollutants released into the water through the release of hydraulic oils or fluids from vessels and the spillage of onshore fluids and/or chemicals have the potential to cause</p> |

| | |
|--|--|
| | <p>possible harm to divers. However, as spills are likely to be localised and divers are likely to be located away from the vicinity of the development due to disturbance, it is unlikely that there will be LSE on the qualifying feature.</p> <p>Effects on the qualifying feature main prey species fish, have been considered with particular regard to under water noise associated with piling, they will not be harmed by the noise levels likely to arise, as such there will be no LSE associated with the availability of food.</p> |
|--|--|

3.2.4 Wester Ross Lochs SPA

The conservation objectives for the Wester Ross Lochs SPA are shown in Table 3.8 and the qualifying features are shown in Table 3.9.

A small degree of connectivity has been identified between the Wester Ross Lochs SPA and the proposed development works due to the mobile nature of the site's qualifying feature of black throated diver who are designated for breeding within the SPA, but are likely to leave it, to winter on the coastline. They are particularly susceptible to disturbance; hence it is unlikely that they would be found in the immediate vicinity of Ullapool. As the extent of effects associated with the project will be within a very limited area there is unlikely to be any LSE.

Table 3.8: Wester Ross Lochs SPA Objectives

| Conservation Objective of the Designated Site | Section of the supporting document to inform the assessment |
|---|--|
| <p>Overarching Conservation Objective: To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained.</p> | Appendix 2: Section 4.1.3 |
| <p>Further Conservation Objective: To ensure for the qualifying species that the following are maintained in the long term:</p> <ul style="list-style-type: none"> Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species | <p>Appendix 2: Section 4.1.3 Section 5.1.1 Section 5.1.2</p> |

Table 3.7: Wester Ross Lochs SPA Qualifying Feature

| Qualifying Feature | Summary of Assessment |
|---|--|
| <i>Black-throated diver (Gavia arctica)</i> | <p>In the absence of mitigation procedures, there is no potential to cause an impact on black-throated diver.</p> <p>The designation is specifically for breeding Black-throated divers, during breeding season, they will be inland and hence not in the vicinity of the harbour development.</p> |

Divers do however winter on the coast. As construction works will be carried out primarily through the winter there is the potential for connectivity during this season.

Effects on the qualifying feature that could occur would be disturbance due to in-air noise and the presence of people and plant on the construction site. However, as the works are on the edge of the village and existing harbour, these areas are already sources of disturbance which mean it is unlikely for Black-throated divers to be in the area, as they are susceptible to human disturbance (M. Ruddock & D.P. Whitfield, 2007).

During wintering months, black-throated divers forage in coastal areas on a wide variety of fish species. During this time, any pollutants released into the water through the release of hydraulic oils or fluids from vessels and the spillage of onshore fluids and/or chemicals have the potential to cause possible harm to divers. However, as spills are likely to be localised and divers are likely to be located away from the vicinity of the development due to disturbance, it is unlikely that there will be LSE on the qualifying feature.

Effects on the qualifying feature main prey species fish, have been considered with particular regard to under water noise associated with piling, they will not be harmed by the noise levels likely to arise, as such there will be no LSE associated with the availability of food.

4 Cumulative & In- Combination Effects

Cumulative and in-combination effects of the development were considered as part of the HRA process. As there are no other projects planned in the Loch Broom area it is unlikely that there will be any cumulative or in-combination effects that could impact upon the qualifying species at a population level.

5 Conclusion

The supporting document did not predict residual, adverse impacts for any of the qualifying features of the designated sites assessed as part of this HRA. Further, no cumulative or in-combination effects are anticipated. Information from this report can be used by the competent authority, in conjunction with the relevant sections of the supporting document and as identified in this report, to carry out the HRA and any necessary AAs. It will be up to the competent authority to ascertain whether the proposal will adversely affect the integrity of the designated sites to be considered.

6 References

- Affric. (2021). Ullapool – Shore Street Widening & Promenade & Small Boat Harbour Development Supporting Document, 63/REP/03_v1
- Government, U. K. (1994). *Conservation (Natural Habitats, &c.) Regulations 1994*. Retrieved 04 14, 2021, from <https://www.legislation.gov.uk/ukxi/1994/2716/regulation/1/made>
- NatureScot. (2021a, 3 4). *Habitats Regulations Appraisal (HRA)*. Retrieved 4 14, 2021, from <https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra>
- NatureScot. (2021b, 3 24). *Habitats Regulations Appraisal (HRA): likely significant effects*. Retrieved 4 14, 2021, from <https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra/habitats-regulations-appraisal-hra-likely>
- Ruddock, M., & D.P. Whitfield. (2007). A review of Disturbance Distances in Selected Bird Species
- Scottish Government. (2014). *Scottish Planning Policy*.
- Van Alsenoy, V., Bernard, P., & Van Grieken, R. (1993). *Elemental concentrations and heavy metal pollution in sediments and suspended matter from the Belgian North Sea and the Scheldt estuary* (Vol. 133). Science of The Total Environment. Retrieved 4 14, 2021, from <https://www.sciencedirect.com/science/article/abs/pii/004896979390119Q>.
- European Court of Justice C-127/02. (2004). Directive 92/43/EEC -Conservation of natural habitats and of wild flora and fauna - Concept of "plan" or "project" - Assessment of the implications of certain plans or projects for the protected site. Case C-127/02. *Waddenvereniging and Vogelsbeschermingvereniging*

7 Glossary

| Acronym | Definition |
|---------|--------------------------------|
| AA | Appropriate Assessment |
| ENE | East North East |
| HRA | Habitats Regulations Appraisal |
| km | Kilometres |
| LSE | Likely Significant Effects |
| N | North |
| NE | Northeast |
| NNE | North-Northeast |
| NNW | North-Northwest |
| SAC | Special Area of Conservation |
| SE | Southeast |
| SPA | Special Protection Area |
| SSE | South-Southeast |
| TTS | Temporary Threshold Shift |
| WSW | West-Southwest |



Appendix 6 - Ullapool Wave Study

ULLAPOOL HARBOUR TRUST

ULLAPOOL WAVE STUDY

ADDITIONAL COMPUTATIONAL MODEL STUDIES



IBE1403
Ullapool Wave Study
Additional Computational
Model Studies
1
07 Oct 2019

Document status

| Version | Purpose of document | Authored by | Reviewed by | Approved by | Review date |
|---------|---------------------|-------------|-------------|--------------|-------------|
| 1 | Draft Final | A K B | SS | Adrian .Bell | 07/10/19 |
| | | | | | |
| | | | | | |
| | | | | | |

Approval for issue

| | | |
|-------------|----------------------|----------------|
| Adrian Bell | <i>Adrian K Bell</i> | 7 October 2019 |
|-------------|----------------------|----------------|

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Prepared by:

RPS

Adrian Bell

Technical Director – Coastal Engineering & Environment

Elmwood House

74 Boucher Road, Belfast

Co. Antrim BT12 6RZ

T +44 2890 667 914

E adrian.bell@rpsgroup.com

Prepared for:

Ullapool Harbour Trust

Kevin Peach

Chief Executive

Ullapool Harbour Trust

Harbour Buildings, The Pier

Ullapool, IV26 2UH

T 01854 6127724

E kevin@ullapool-harbour.co.uk

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1 INTRODUCTION

A promenade development scheme is being designed for the Shore Street frontage at Ullapool and the Harbour Trust are also proposing to increase the dredged depth and size of the small boat harbour which is located to the east of the Harbour Building in the lee of the main pier.

As RPS had already undertaken wave studies at Ullapool in connection with the Shore Street development, the firm was commissioned to undertake additional wave studies in connection with the proposed promenade and the enhanced small boat harbour facilities. The brief for these wave studies was as follows:

1. Update the original wave study to take account of the revised SEPA climate change sea level rise figures issued in 2019.
2. Undertake Joint Probability analysis for extreme waves and water levels. Run the wave transformation models for the combinations of waves and water levels to simulate the overtopping of both the existing Shore Street revetment and the proposed new seawall and rock revetment.
3. Set up harbour wave disturbance models for the proposed small boat harbour and run simulation for the existing and proposed Shore Street revetment.
4. Run harbour disturbance simulations to test the need for and effectiveness of floating breakwater wave attenuator located off the south eastern corner of the Pier.

The details for the various facilities to be tested in the model were provided by the Harbour Trusts engineering consultants Wallace Stone LLP, drawings 2059/909, 910 and 911 for the revetment and 2127/901 and 902 for the small boat harbour. Wallace Stone LLP Drawing 2127/902 shows a plan of the proposed small boat development and the proposed revetment and is reproduced in Figure 1.1 below.

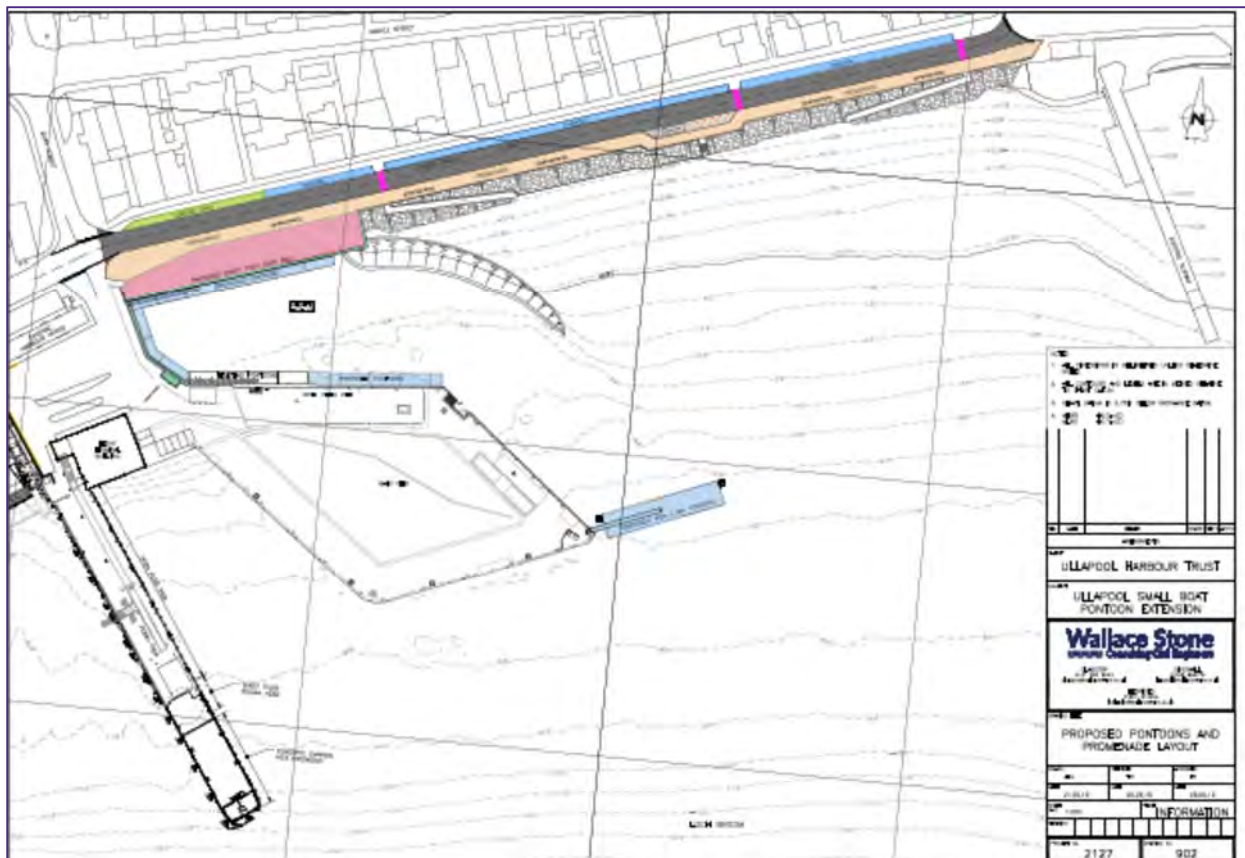


Figure 1.1 Layout of proposed promenade at Shore Street and enlarged small boat facilities at Ullapool Harbour

2 THE WAVE TRANSFORMATION MODEL STUDY

2.1 Conclusions from the Original Wave Study

The original wave studies for the Ullapool frontage at Shore Street were completed in November 2017, RPS report *IBE1403/AKB/Ullapool*. The conclusions from this November 2017 report were;

“The wave climate along the frontage at Shore Street Ullapool has been simulated for 1 in 1, 1 in 50, 1 in 100, and 1 in 200 year return period storm conditions using advanced computational modelling techniques. The simulations were undertaken at high tide, with an allowance for storm surge where appropriate, as the storm wave penetration into the site is expected to be greater at high water levels than at lower tidal levels.

The largest waves approach the site during storms from south south east to the south south west when the maximum significant wave heights at the designated wave points at the site vary from 0.393 metres to 0.648 metres for the 1 in 1 year return period storms with spectral peak wave periods varying between 2.76 seconds and 2.80 seconds. During 1 in 200 year return period storms the maximum significant wave heights at the designated wave points at the site vary from 0.770 metres to 1.331 metres with spectral peak wave periods varying between 3.63 seconds and 3.71 seconds.

The predicted sea level rise by 2080 is about 0.58 metres and this will only increase the significant wave high at the frontage by about 0.025 metre at times of high water.”

2.2 SEPA Extreme Water Levels and Predicted Sea Level Rise

Following the IPCC report on Climate Change due to Global Warming issued in late 2018, SEPA has revised its extreme water levels and predicted sea level rise to 2100 for Scottish Coastal Regions.

The current SEPA predicted extreme water levels and recommended allowance for sea level rise to 2100 for the coast at the entrance to Loch Broom is shown in Table 2.1.

Table 2.1 Ullapool SEPA recommended Extreme Water Levels and Sea Level rise to 2100

| Return Period years | Extreme Water Level [m OD] |
|------------------------|-------------------------------|
| 1 | 3.22 |
| 2 | 3.32 |
| 5 | 3.44 |
| 10 | 3.53 |
| 20 | 3.62 |
| 50 | 3.74 |
| 100 | 3.82 |
| 200 | 3.90 |
| 500 | 4.00 |
| 1000 | 4.08 |

Sea level rise to 2100 0.89m

2.3 Revised Wave Climate with Sea Level Rise

The storm wave climate simulations along the Shore Street frontage for the critical storm directions of 120° to 240° were simulated using the storm wind data as reported in the previous wave study but with the water levels increase to take account of the latest sea level rise projections. The wave heights are only increased by about 10mm due to the revision of the sea level rise provision from 0.58m to 0.89m.

The results for the simulations including the latest sea level rise projections are given in Tables 2.2 to 2.5. The locations of the wave points along the Shore Street frontage are shown in Figure 2.1.

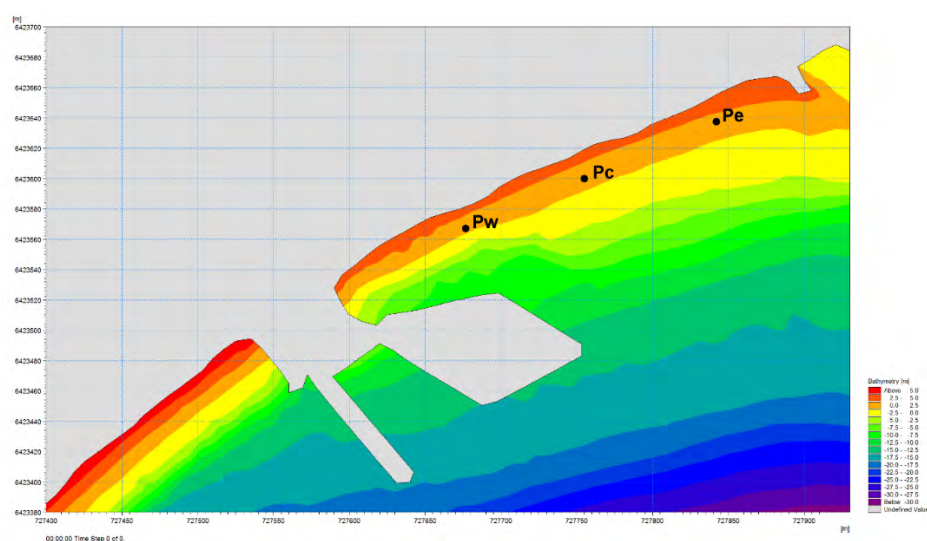


Figure 2.1 Location of wave climate points along Shore Street frontage

Table 2.2 1 in 1 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.351 | 0.735 | 2.44 | 1.94 | 121 |
| 135 | 0.376 | 0.785 | 2.56 | 2.04 | 125 |
| 150 | 0.400 | 0.835 | 2.73 | 2.14 | 128 |
| 165 | 0.400 | 0.834 | 2.73 | 2.14 | 128 |
| 180 | 0.372 | 0.776 | 2.77 | 2.18 | 132 |
| 195 | 0.334 | 0.703 | 3.00 | 2.01 | 155 |
| 210 | 0.304 | 0.462 | 1.75 | 1.59 | 195 |
| 225 | 0.276 | 0.409 | 1.36 | 1.30 | 223 |
| 240 | 0.267 | 0.416 | 1.37 | 1.22 | 236 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.483 | 1.004 | 2.49 | 2.17 | 141 |
| 135 | 0.551 | 1.141 | 2.64 | 2.30 | 146 |
| 150 | 0.605 | 1.250 | 2.76 | 2.39 | 148 |
| 165 | 0.606 | 1.251 | 2.77 | 2.39 | 148 |
| 180 | 0.600 | 1.240 | 2.78 | 2.41 | 150 |
| 195 | 0.603 | 1.247 | 2.82 | 2.42 | 159 |
| 210 | 0.552 | 1.144 | 2.84 | 2.33 | 172 |
| 225 | 0.454 | 0.949 | 2.75 | 2.04 | 190 |
| 240 | 0.375 | 0.540 | 1.56 | 1.66 | 215 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.458 | 0.953 | 2.47 | 2.12 | 147 |
| 135 | 0.540 | 1.120 | 2.58 | 2.25 | 151 |
| 150 | 0.603 | 1.248 | 2.71 | 2.34 | 154 |
| 165 | 0.604 | 1.249 | 2.71 | 2.34 | 154 |
| 180 | 0.612 | 1.265 | 2.74 | 2.36 | 158 |
| 195 | 0.657 | 1.358 | 2.76 | 2.39 | 169 |
| 210 | 0.658 | 1.359 | 2.78 | 2.39 | 180 |
| 225 | 0.587 | 1.218 | 2.70 | 2.27 | 192 |
| 240 | 0.494 | 1.033 | 2.51 | 2.02 | 206 |

Table 2.3 1 in 50 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.581 | 1.205 | 3.01 | 2.31 | 123 |
| 135 | 0.640 | 1.323 | 3.21 | 2.47 | 126 |
| 150 | 0.681 | 1.405 | 3.44 | 2.57 | 131 |
| 165 | 0.672 | 1.389 | 3.54 | 2.56 | 138 |
| 180 | 0.613 | 1.270 | 3.61 | 2.46 | 149 |
| 195 | 0.574 | 1.022 | 3.11 | 2.20 | 172 |
| 210 | 0.532 | 0.639 | 1.70 | 1.82 | 203 |
| 225 | 0.494 | 0.665 | 1.74 | 1.59 | 226 |
| 240 | 0.486 | 0.674 | 1.75 | 1.54 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.826 | 1.690 | 3.16 | 2.69 | 144 |
| 135 | 0.944 | 1.900 | 3.32 | 2.87 | 147 |
| 150 | 1.038 | 2.037 | 3.48 | 2.99 | 149 |
| 165 | 1.063 | 2.070 | 3.53 | 3.03 | 152 |
| 180 | 1.038 | 2.079 | 3.53 | 3.01 | 157 |
| 195 | 1.022 | 2.072 | 3.57 | 2.99 | 164 |
| 210 | 0.926 | 1.899 | 3.55 | 2.81 | 177 |
| 225 | 0.771 | 1.564 | 3.19 | 2.34 | 197 |
| 240 | 0.659 | 0.864 | 1.98 | 2.00 | 218 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.803 | 1.636 | 3.13 | 2.66 | 150 |
| 135 | 0.930 | 1.821 | 3.26 | 2.82 | 153 |
| 150 | 1.040 | 1.927 | 3.43 | 2.93 | 156 |
| 165 | 1.091 | 1.953 | 3.48 | 2.98 | 161 |
| 180 | 1.102 | 2.010 | 3.47 | 2.98 | 166 |
| 195 | 1.147 | 2.091 | 3.51 | 3.01 | 174 |
| 210 | 1.123 | 2.137 | 3.50 | 2.95 | 184 |
| 225 | 0.980 | 1.981 | 3.23 | 2.68 | 197 |
| 240 | 0.849 | 1.752 | 3.01 | 2.41 | 209 |

Table 2.4 1 in 100 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.627 | 1.299 | 3.11 | 2.37 | 123 |
| 135 | 0.689 | 1.422 | 3.33 | 2.54 | 126 |
| 150 | 0.733 | 1.510 | 3.53 | 2.65 | 131 |
| 165 | 0.722 | 1.490 | 3.63 | 2.63 | 138 |
| 180 | 0.658 | 1.363 | 3.72 | 2.52 | 149 |
| 195 | 0.620 | 1.102 | 3.22 | 2.26 | 172 |
| 210 | 0.578 | 0.682 | 1.76 | 1.87 | 204 |
| 225 | 0.538 | 0.699 | 1.78 | 1.64 | 226 |
| 240 | 0.529 | 0.707 | 1.79 | 1.59 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.891 | 1.808 | 3.24 | 2.79 | 144 |
| 135 | 1.020 | 2.016 | 3.46 | 2.96 | 147 |
| 150 | 1.123 | 2.117 | 3.58 | 3.08 | 149 |
| 165 | 1.146 | 2.136 | 3.61 | 3.15 | 152 |
| 180 | 1.121 | 2.178 | 3.61 | 3.11 | 157 |
| 195 | 1.107 | 2.225 | 3.65 | 3.09 | 165 |
| 210 | 1.005 | 2.055 | 3.64 | 2.90 | 177 |
| 225 | 0.838 | 1.649 | 3.19 | 2.42 | 197 |
| 240 | 0.718 | 0.903 | 2.02 | 2.07 | 219 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.868 | 1.743 | 3.21 | 2.74 | 150 |
| 135 | 1.005 | 1.912 | 3.41 | 2.91 | 153 |
| 150 | 1.125 | 1.980 | 3.54 | 3.03 | 157 |
| 165 | 1.181 | 1.994 | 3.57 | 3.08 | 161 |
| 180 | 1.193 | 2.057 | 3.56 | 3.07 | 166 |
| 195 | 1.244 | 2.169 | 3.60 | 3.12 | 174 |
| 210 | 1.220 | 2.224 | 3.60 | 3.04 | 185 |
| 225 | 1.064 | 2.115 | 3.33 | 2.77 | 197 |
| 240 | 0.923 | 1.899 | 3.13 | 2.50 | 209 |

Table 2.5 1 in 200 year return period wave climate with SLR of 0.89m to 2100

Wave point Pw

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.685 | 1.417 | 3.19 | 2.44 | 123 |
| 135 | 0.753 | 1.552 | 3.48 | 2.61 | 127 |
| 150 | 0.800 | 1.647 | 3.63 | 2.72 | 131 |
| 165 | 0.786 | 1.620 | 3.79 | 2.71 | 138 |
| 180 | 0.717 | 1.482 | 3.88 | 2.60 | 150 |
| 195 | 0.682 | 1.072 | 2.89 | 2.32 | 173 |
| 210 | 0.637 | 0.725 | 1.81 | 1.93 | 204 |
| 225 | 0.595 | 0.752 | 1.84 | 1.71 | 226 |
| 240 | 0.585 | 0.768 | 1.86 | 1.66 | 237 |

Wave point Pc

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.973 | 1.953 | 3.40 | 2.89 | 145 |
| 135 | 1.116 | 2.112 | 3.57 | 3.06 | 147 |
| 150 | 1.226 | 2.168 | 3.68 | 3.21 | 150 |
| 165 | 1.258 | 2.193 | 3.73 | 3.26 | 153 |
| 180 | 1.229 | 2.258 | 3.73 | 3.23 | 158 |
| 195 | 1.214 | 2.387 | 3.81 | 3.21 | 165 |
| 210 | 1.108 | 2.260 | 3.77 | 2.99 | 177 |
| 225 | 0.925 | 1.838 | 3.40 | 2.52 | 197 |
| 240 | 0.792 | 0.980 | 2.11 | 2.15 | 219 |

Wave point Pe

| Storm | Significant Wave | Maximum Wave | Spectral Peak Wave | Mean Energy Wave | Mean Wave Direction |
|-----------|------------------|-----------------|--------------------|------------------|---------------------|
| Direction | Height Hm0 [m] | Height Hmax [m] | Period Tp [s] | Period Tm10 [s] | MWD degree N |
| 120 | 0.945 | 1.851 | 3.33 | 2.85 | 150 |
| 135 | 1.098 | 1.978 | 3.53 | 3.01 | 154 |
| 150 | 1.228 | 2.019 | 3.63 | 3.15 | 157 |
| 165 | 1.291 | 2.033 | 3.66 | 3.21 | 161 |
| 180 | 1.305 | 2.102 | 3.66 | 3.20 | 167 |
| 195 | 1.363 | 2.256 | 3.71 | 3.24 | 174 |
| 210 | 1.337 | 2.337 | 3.69 | 3.18 | 185 |
| 225 | 1.170 | 2.302 | 3.53 | 2.88 | 197 |
| 240 | 1.020 | 2.032 | 3.19 | 2.60 | 209 |

3 JOINT PROBABILITY AND OVERTOPPING

3.1 Joint Probability Analysis

As the waves which approach the revetment at Shore Street are the result of winds blowing over the local fetches, the joint probability analysis was undertaken between extreme water levels and wind speeds. The analysis was undertaken in accordance with the Defra/EA report “Joint Probability: Dependence Mapping and Best Practice” Technical report FD2308.

The analysis was undertaken for storm directions from 165° to 195° which give the largest wave heights approaching the lowest section of the revetment. The extreme water levels were taken from the SEPA data referenced in Section 2 above and the extreme winds speed were derived from BS EN 1991-1-4:2005+A1:2010 for extreme wind speeds throughout the British Isles. The wind speeds were adjusted for overwater wind conditions and the length of time required to fully generate the waves over the fetches.

A correlation factor of 0.4 was used for the correlation between the wind/waves and the water levels as indicated for Ullapool in FD2308/TR1. An example of the Joint Probability curves is shown in Figure 3.1 and the combinations of wind speeds and water levels is shown in Table 3.1 for the 195° storm direction.

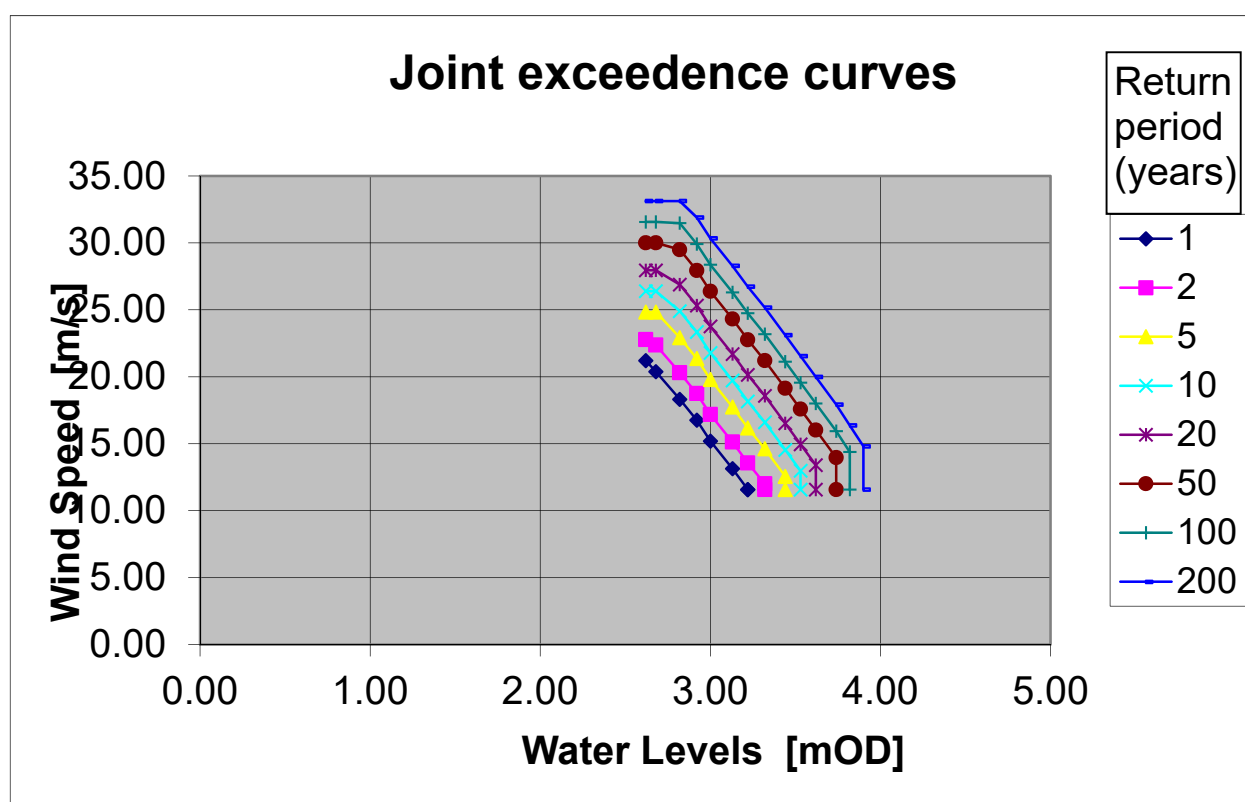


Figure 3.1 Joint Probability curves for extreme winds and water levels

Table 3.1 Joint Probability combinations of extreme water levels and storm wind speeds

| Value of first variable: Present-day sea level off Ullapool (mOD) | Joint exceedence return period (years) | | | | | | | |
|---|--|-------|-------|---------------------------|-------|-------|-------|---------|
| | 1 | 2 | 5 | 10 | 20 | 50 | 100 | 200 |
| | Value of second variable: | | | Wind speed 165-195 sector | | | | 195 deg |
| 2.62 | 21.21 | 22.77 | 24.83 | 26.39 | 27.95 | 30.00 | 31.56 | 33.12 |
| 2.68 | 20.38 | 22.36 | 24.83 | 26.39 | 27.95 | 30.00 | 31.56 | 33.12 |
| 2.82 | 18.32 | 20.30 | 22.92 | 24.90 | 26.88 | 29.49 | 31.47 | 33.12 |
| 2.92 | 16.76 | 18.74 | 21.36 | 23.34 | 25.32 | 27.94 | 29.91 | 31.89 |
| 3.00 | 15.20 | 17.18 | 19.80 | 21.78 | 23.76 | 26.38 | 28.36 | 30.33 |
| 3.13 | 13.14 | 15.12 | 17.74 | 19.72 | 21.70 | 24.32 | 26.30 | 28.28 |
| 3.22 | 11.58 | 13.56 | 16.18 | 18.16 | 20.14 | 22.76 | 24.74 | 26.72 |
| 3.32 | #N/A | 12.00 | 14.62 | 16.60 | 18.58 | 21.20 | 23.18 | 25.16 |
| 3.44 | #N/A | #N/A | 12.56 | 14.54 | 16.52 | 19.14 | 21.12 | 23.10 |
| 3.53 | #N/A | #N/A | #N/A | 12.98 | 14.96 | 17.58 | 19.56 | 21.54 |
| 3.62 | #N/A | #N/A | #N/A | #N/A | 13.40 | 16.02 | 18.00 | 19.98 |
| 3.74 | #N/A | #N/A | #N/A | #N/A | #N/A | 13.96 | 15.94 | 17.92 |
| 3.82 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 14.38 | 16.36 |
| 3.90 | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | #N/A | 14.80 |

3.2 Wave and Water Level Simulations

As 1 in 200 year return events are used for coastal flood analysis, the combinations of extreme water levels and winds speeds for these JP events were used with the Mike21 SW wave generation and transformation model for Ullapool, Figure 3.2, to generate the combinations of wave and water levels approaching the revetment at Shore Street. The wave climate approaching the lowest point along the existing revetment and at points some 27 and 54 metres further east along the revetment, locations as shown in Figure 3.3, were extracted from the wave model simulations for use in the overtopping analysis.

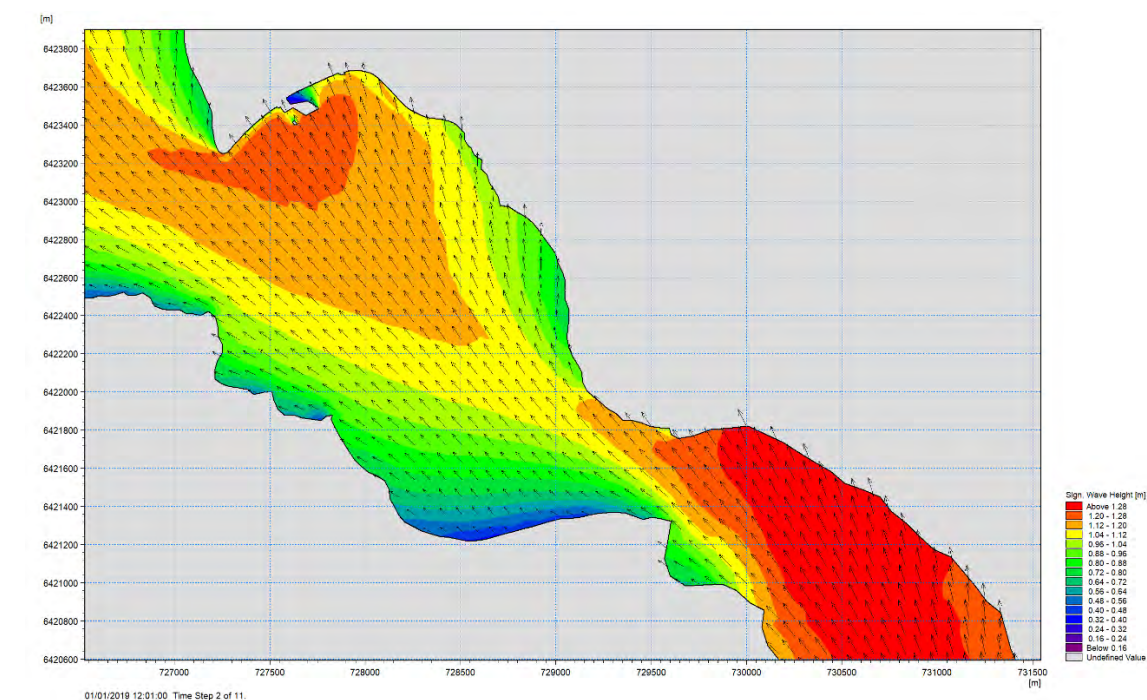


Figure 3.2 Significant wave height and mean wave direction – 1 in 200 year Joint Probability return period storm from 165° with a water level of 3.00m OD



Figure 3.3 Location of Joint Probability analysis points along the revetment

The combinations of water levels, wave heights and periods derived from the 1 in 200 return period JP modelling for the three points along the existing revetment for each of the storm directions 165°, 180° and 195° directions are shown in Tables 3.2, 3.3 and 3.4.

Table 3.2 1 in 200 JP return period water levels and waves at revetment – storm from 165°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.213 | 3.28 | 2.82 | 1.231 | 3.30 | 2.82 | 1.248 | 3.27 |
| 2.92 | 1.143 | 3.19 | 2.92 | 1.167 | 3.20 | 2.92 | 1.183 | 3.18 |
| 3.00 | 1.059 | 3.07 | 3.00 | 1.084 | 3.08 | 3.00 | 1.100 | 3.06 |
| 3.13 | 0.948 | 2.93 | 3.13 | 0.971 | 2.94 | 3.13 | 0.985 | 2.92 |
| 3.22 | 0.867 | 2.84 | 3.22 | 0.888 | 2.84 | 3.22 | 0.901 | 2.82 |
| 3.32 | 0.792 | 2.73 | 3.32 | 0.812 | 2.73 | 3.32 | 0.823 | 2.71 |
| 3.44 | 0.698 | 2.60 | 3.44 | 0.715 | 2.60 | 3.44 | 0.725 | 2.58 |
| 3.53 | 0.630 | 2.51 | 3.53 | 0.646 | 2.51 | 3.53 | 0.655 | 2.49 |
| 3.62 | 0.570 | 2.41 | 3.62 | 0.584 | 2.41 | 3.62 | 0.591 | 2.39 |
| 3.74 | 0.493 | 2.30 | 3.74 | 0.506 | 2.29 | 3.74 | 0.512 | 2.27 |
| 3.82 | 0.493 | 2.30 | 3.82 | 0.506 | 2.29 | 3.82 | 0.511 | 2.27 |
| 3.90 | 0.394 | 2.17 | 3.90 | 0.407 | 2.16 | 3.90 | 0.410 | 2.13 |

Table 3.3 1 in 200 JP return period water levels and waves at revetment – storm from 180°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.178 | 3.24 | 2.82 | 1.211 | 3.27 | 2.82 | 1.240 | 3.26 |
| 2.92 | 1.110 | 3.15 | 2.92 | 1.147 | 3.18 | 2.92 | 1.174 | 3.17 |
| 3.00 | 1.025 | 3.03 | 3.00 | 1.063 | 3.05 | 3.00 | 1.090 | 3.05 |
| 3.13 | 0.917 | 2.89 | 3.13 | 0.951 | 2.91 | 3.13 | 0.975 | 2.91 |
| 3.22 | 0.838 | 2.79 | 3.22 | 0.869 | 2.81 | 3.22 | 0.891 | 2.80 |
| 3.32 | 0.765 | 2.69 | 3.32 | 0.794 | 2.70 | 3.32 | 0.814 | 2.69 |
| 3.44 | 0.673 | 2.56 | 3.44 | 0.698 | 2.57 | 3.44 | 0.715 | 2.56 |
| 3.53 | 0.609 | 2.47 | 3.53 | 0.631 | 2.48 | 3.53 | 0.646 | 2.47 |
| 3.62 | 0.607 | 2.47 | 3.62 | 0.629 | 2.48 | 3.62 | 0.644 | 2.47 |
| 3.74 | 0.472 | 2.25 | 3.74 | 0.490 | 2.26 | 3.74 | 0.501 | 2.25 |
| 3.82 | 0.471 | 2.25 | 3.82 | 0.489 | 2.26 | 3.82 | 0.501 | 2.25 |
| 3.90 | 0.449 | 2.26 | 3.90 | 0.468 | 2.27 | 3.90 | 0.480 | 2.25 |

Table 3.4 1 in 200 JP return period water levels and waves at revetment – storm from 195°

| pt1 | | | pt2 | | | pt3 | | |
|--------|-------|--------|--------|-------|--------|--------|-------|--------|
| WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s | WL mOD | Hm0 m | Tm10 s |
| 2.82 | 1.153 | 3.23 | 2.82 | 1.206 | 3.28 | 2.82 | 1.253 | 3.29 |
| 2.92 | 1.086 | 3.13 | 2.92 | 1.142 | 3.18 | 2.92 | 1.188 | 3.19 |
| 3.00 | 1.003 | 3.01 | 3.00 | 1.057 | 3.05 | 3.00 | 1.101 | 3.06 |
| 3.13 | 0.895 | 2.86 | 3.13 | 0.945 | 2.90 | 3.13 | 0.985 | 2.91 |
| 3.22 | 0.818 | 2.76 | 3.22 | 0.862 | 2.79 | 3.22 | 0.898 | 2.80 |
| 3.32 | 0.745 | 2.66 | 3.32 | 0.785 | 2.68 | 3.32 | 0.819 | 2.69 |
| 3.44 | 0.653 | 2.53 | 3.44 | 0.688 | 2.55 | 3.44 | 0.718 | 2.56 |
| 3.53 | 0.589 | 2.43 | 3.53 | 0.621 | 2.45 | 3.53 | 0.647 | 2.46 |
| 3.62 | 0.587 | 2.44 | 3.62 | 0.619 | 2.46 | 3.62 | 0.645 | 2.46 |
| 3.74 | 0.451 | 2.22 | 3.74 | 0.477 | 2.24 | 3.74 | 0.499 | 2.24 |
| 3.82 | 0.451 | 2.22 | 3.82 | 0.476 | 2.24 | 3.82 | 0.498 | 2.24 |
| 3.90 | 0.427 | 2.24 | 3.90 | 0.452 | 2.25 | 3.90 | 0.476 | 2.25 |

A similar analysis was undertaken for the proposed promenade which has slightly increased incoming wave heights (typically about 1.3% higher) as the revetment for the promenade is slightly seaward of the existing structure.

3.3 Overtopping Analysis - 2019 Water Levels

The second edition of the EurOtop “Manual on wave overtopping of sea defences and related structures” which was published in 2018 describes methods to predict wave overtopping of sea defences and related coastal or shoreline structures. The manual recommends a series of empirical methods to represent the physics of the overtopping process in a series of equations that relate the main overtopping response parameter to key wave climate and structure properties.

The EurOtop manual also provides guidance for use of an Artificial Neural Network (ANN) tool to predict mean overtopping discharges for all structure geometries, for a number of hydraulic and geometrical input parameters. The ANN tool is based on a large extended database that contains more than 13,000 physical model tests. For the purposes of this study, RPS utilised the online ANN tool to predict the mean, 5% and 95%’ile discharge rates for both the existing and proposed revetments along Shore Street.

The analysis was undertaken for the combination of waves and water levels derived from the joint probability analysis for points 1 and 3 along the revetments, Tables 3.2, 3.3, 3.4 and Figure 3.3 above.

3.3.1 Overtopping of existing revetment – 2019 water levels

The overtopping rates for location pts 1 and 3, Figure 3.3, for the existing revetment for 1 in 200 return period Joint Probability events are given in Tables 3.5 to 3.10

Table 3.5 Overtopping rates for location pt1 1 in 200 yr. JP event from 165°N - Existing

| For 1 in 200 JP return period events | | | Overtopping Litres/s/m | | |
|--------------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.213 | 3.28 | 18.50 | 2.00 | 172.00 |
| 2.92 | 1.143 | 3.19 | 20.00 | 2.17 | 179.00 |
| 3.00 | 1.059 | 3.07 | 18.60 | 2.13 | 162.00 |
| 3.13 | 0.948 | 2.93 | 18.20 | 2.44 | 145.00 |
| 3.22 | 0.867 | 2.84 | 17.20 | 2.28 | 134.00 |
| 3.32 | 0.792 | 2.73 | 16.60 | 1.96 | 121.00 |

Table 3.6 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.248 | 3.27 | 5.33 | 0.61 | 51.10 |
| 2.92 | 1.183 | 3.18 | 5.65 | 0.61 | 54.20 |
| 3.00 | 1.100 | 3.06 | 5.06 | 0.53 | 46.00 |
| 3.13 | 0.985 | 2.92 | 4.66 | 0.49 | 43.20 |
| 3.22 | 0.901 | 2.82 | 4.13 | 0.48 | 34.70 |
| 3.32 | 0.823 | 2.71 | 3.65 | 0.44 | 31.70 |

Table 3.7 Overtopping rates for location pt1 1 in 200 yr. JP event from 180°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.178 | 3.24 | 16.40 | 1.76 | 148.00 |
| 2.92 | 1.110 | 3.15 | 17.70 | 1.88 | 153.00 |
| 3.00 | 1.025 | 3.03 | 16.10 | 1.97 | 142.00 |
| 3.13 | 0.917 | 2.89 | 15.50 | 2.04 | 124.00 |
| 3.22 | 0.838 | 2.79 | 14.40 | 1.69 | 115.00 |
| 3.32 | 0.765 | 2.69 | 13.90 | 1.59 | 101.00 |

Table 3.8 Overtopping rates for location pt3 1 in 200 yr. JP event from 180°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.240 | 3.26 | 5.46 | 0.60 | 52.20 |
| 2.92 | 1.174 | 3.17 | 4.86 | 0.51 | 44.50 |
| 3.00 | 1.090 | 3.05 | 4.44 | 0.46 | 41.50 |
| 3.13 | 0.975 | 2.91 | 3.83 | 0.43 | 33.20 |
| 3.22 | 0.891 | 2.80 | 3.38 | 0.38 | 30.20 |
| 3.32 | 0.814 | 2.69 | 2.62 | 0.31 | 20.00 |

Table 3.9 Overtopping rates for location pt1 1 in 200 yr. JP event from 195°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.153 | 3.23 | 15.40 | 1.68 | 133.00 |
| 2.92 | 1.086 | 3.13 | 16.30 | 1.92 | 141.00 |
| 3.00 | 1.003 | 3.01 | 14.80 | 1.81 | 125.00 |
| 3.13 | 0.895 | 2.86 | 13.80 | 1.84 | 106.00 |
| 3.22 | 0.818 | 2.76 | 12.80 | 1.45 | 95.70 |
| 3.32 | 0.745 | 2.66 | 12.10 | 1.43 | 81.70 |

Table 3.10 Overtopping rates for location pt3 1 in 200 yr. JP event from 195°N - Existing

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.253 | 3.29 | 5.60 | 0.64 | 53.50 |
| 2.92 | 1.188 | 3.19 | 5.81 | 0.64 | 55.70 |
| 3.00 | 1.101 | 3.06 | 5.08 | 0.53 | 46.20 |
| 3.13 | 0.985 | 2.91 | 4.57 | 0.47 | 42.20 |
| 3.22 | 0.898 | 2.80 | 3.94 | 0.44 | 34.50 |
| 3.32 | 0.819 | 2.69 | 3.45 | 0.38 | 31.40 |

It will be seen from Tables 3.5 to 3.10 that the largest overtopping of the existing seawall along Shore Street occurs at the centre of the frontage during storms from the south south east with a predicted mean overtopping rate 20 litres/s/m. This rate of over topping is likely to result in significant flooding and the overtopping rate is such that the maximum volume for an individual wave (Vmax) will be about 2000 litres per metre. This is greatly in excess of the 600 litres limit recommended in the 2018 Overtopping Manual for pedestrians with a clear view of the sea. Even at location pt3, where the levels of the Shore Street seawall are higher, the Vmax value will be about 800 litres per metre.

3.3.2 Overtopping of proposed revetment – 2019 water levels

The overtopping rates for location pts 1 and 3, Figure 3.3, for the proposed revetment for 1 in 200 return period Joint Probability events are given in Tables 3.11 to 3.16

Table 3.11 Overtopping rates for location pt1 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.213 | 3.27 | 0.532 | 0.105 | 1.370 |
| 2.92 | 1.142 | 3.19 | 0.504 | 0.093 | 1.230 |
| 3.00 | 1.058 | 3.07 | 0.440 | 0.058 | 0.953 |
| 3.13 | 0.946 | 2.93 | 0.387 | 0.036 | 0.711 |
| 3.22 | 0.866 | 2.84 | 0.353 | 0.023 | 0.614 |
| 3.32 | 0.792 | 2.73 | 0.328 | 0.011 | 0.687 |

Table 3.12 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.264 | 3.25 | 0.349 | 0.030 | 0.508 |
| 2.92 | 1.192 | 3.17 | 0.346 | 0.029 | 0.499 |
| 3.00 | 1.105 | 3.05 | 0.321 | 0.018 | 0.445 |
| 3.13 | 0.991 | 2.92 | 0.294 | 0.011 | 0.285 |
| 3.22 | 0.907 | 2.82 | 0.263 | 0.007 | 0.238 |
| 3.32 | 0.829 | 2.71 | 0.191 | 0.004 | 0.263 |

Table 3.13 Overtopping rates for location pt1 1 in 200 yr. JP event from 180°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| Wl mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.177 | 3.23 | 0.473 | 0.087 | 1.070 |
| 2.92 | 1.108 | 3.14 | 0.451 | 0.070 | 0.995 |
| 3.00 | 1.022 | 3.03 | 0.399 | 0.046 | 0.710 |
| 3.13 | 0.915 | 2.89 | 0.358 | 0.028 | 0.582 |
| 3.22 | 0.837 | 2.79 | 0.329 | 0.014 | 0.529 |
| 3.32 | 0.764 | 2.69 | 0.307 | 0.008 | 0.601 |

Table 3.14 Overtopping rates for location pt3 1 in 200 yr. JP event from 180°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.253 | 3.24 | 0.351 | 0.031 | 0.520 |
| 2.92 | 1.182 | 3.15 | 0.340 | 0.026 | 0.471 |
| 3.00 | 1.095 | 3.04 | 0.316 | 0.017 | 0.421 |
| 3.13 | 0.980 | 2.90 | 0.289 | 0.010 | 0.270 |
| 3.22 | 0.896 | 2.80 | 0.240 | 0.006 | 0.237 |
| 3.32 | 0.819 | 2.69 | 0.175 | 0.003 | 0.263 |

Table 3.15 Overtopping rates for location pt1 1 in 200 yr. JP event from 195°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.149 | 3.22 | 0.438 | 0.071 | 0.889 |
| 2.92 | 1.082 | 3.12 | 0.420 | 0.057 | 0.842 |
| 3.00 | 0.998 | 3.01 | 0.375 | 0.038 | 0.603 |
| 3.13 | 0.891 | 2.87 | 0.339 | 0.020 | 0.504 |
| 3.22 | 0.814 | 2.76 | 0.313 | 0.010 | 0.498 |
| 3.32 | 0.741 | 2.66 | 0.292 | 0.006 | 0.552 |

Table 3.16 Overtopping rates for location pt3 1 in 200 yr. JP event from 165°N - Proposed

| Water level and Wave Climate | | | Overtopping Litres/s/m | | |
|------------------------------|-------|--------|------------------------|--------|---------|
| WI mOD | Hm0 m | Tm10 s | Mean | 5%tile | 95%tile |
| 2.82 | 1.267 | 3.26 | 0.354 | 0.033 | 0.537 |
| 2.92 | 1.195 | 3.17 | 0.348 | 0.029 | 0.510 |
| 3.00 | 1.105 | 3.05 | 0.321 | 0.018 | 0.448 |
| 3.13 | 0.988 | 2.90 | 0.293 | 0.010 | 0.285 |
| 3.22 | 0.902 | 2.80 | 0.252 | 0.006 | 0.246 |
| 3.32 | 0.823 | 2.69 | 0.179 | 0.003 | 0.267 |

The overtopping analysis for the 1 in 200 year Joint Probability return period events show that the proposed revetment will result in the overtopping volumes being reduced by a factor of about 37 compared to those with the existing revetment and seawall. The resulting over topping rates are well within the recommended limits for pedestrians given in the 2018 EurOtop Overtopping Manual.

3.4 Overtopping with 2100 Water Levels

The 1 in 200 year return period water level is predicted to be some 0.89 metres higher than the current level of +3.90m OD as a result of rising sea levels due to climate change. This water level is some 0.9m above the lowest level of Shore Street so much of the area will flood directly from the sea. Even if the proposed seawall was to be raised, the area would still flood via the drainage system and/or through the slipway opening etc. Thus overtopping calculations have not been undertaken for the 2100 water levels as the flooding around the Shore Street area would be so extensive by 2100 that it makes such an analysis nonsensical in the absence of a defined policy on the future flood protection of the area.

4 HARBOUR DISTURBANCE MODELLING

4.1 General

The wave generation and transformation modelling undertaken for the Ullapool frontage does not include the impact of wave reflections or wave to wave interactions (See Appendix for wave model descriptions). The proposed extension to the small boat harbour facilities at Ullapool Harbour involve the dredging and construction of a basin with a vertical quay wall along this section of the shoreline. There is the potential for standing wave patterns and/or wave resonance issues with this type of basin thus the performance of the proposed small boat facility was evaluated using an advanced Boussinesq wave disturbance model.

Simulations were undertaken for the existing harbour infrastructure as well as for the new small boat facility with the existing and proposed seawalls along Shore Street. Simulations were also undertaken to examine the effectiveness of an additional floating breakwater installation off the south east corner of the Pier area.

The boundary conditions for the harbour disturbance modelling were taken from the results of the simulations for 1 in 50 and 1 in 1 year return period events using the overall wave generation and transformation spectral wave model. Simulations were undertaken at mean tidal levels so that the results of the modelling would be reasonably applicable for most of the tidal ranges at the site. The extent of the harbour disturbance model is shown in Figure 4.1.

In this Boussinesq wave model the boundary waves are generated along the southern side of the model with wave absorbing “sponge” layers along the eastern and western sides of the model and in areas which do not affect the wave climate in the small boat basin, i.e. the western side of the Pier area. The wave reflection properties of the various walls and revetments are controlled in the model by “porosity” layers placed along the various structures. In the simulations it was assumed that the existing open piled quays would have a 90% reflection from the back wall (under the pier deck), the existing seawall along Shore Street was given a 60% wave reflection factor while the new rock armour revetment was given a 40% wave reflection coefficient. These factors are well established values for the types of structures at Ullapool.

The largest waves which approach the pier occur during storm from about 165° direction with the waves approaching the pier from about 160°. However as the proposed small boat basin is situated in the lee of the main pier area it was found that the new basin was more exposed to storms from the 150° N. Thus after the initial model simulations with the 1 in 50 year from 165° direction all the remaining simulations were undertaken with waves approaching the harbour from 150°N.

The results of the simulations are shown in terms of the typical wave disturbance patterns and the distribution of significant wave heights around the basin and adjoining areas.

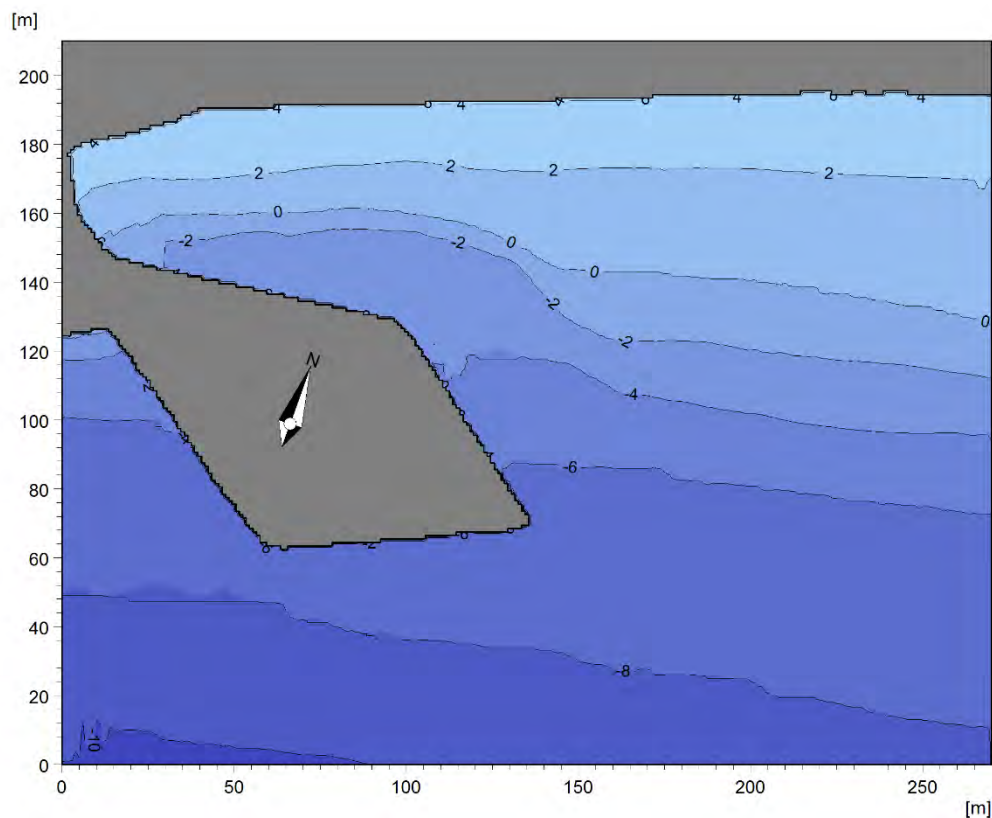


Figure 4.1 Extent of harbour disturbance model of existing bathymetry [m CD]

4.2 Wave Disturbance simulations 1 in 50 year return period storm from 165° N

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall are shown in Figures 4.2 and 4.3. Figures 4.4 and 4.5 show the wave disturbance patterns and significant wave heights with the new Shore Street revetment in place, while Figures 4.6 and 4.7 show the wave disturbance patterns and significant wave heights with the new Shore Street revetment and the enlarged small boat facility developed.

From Figure 4.2 to 4.7 it will be seen that the addition of the new quay wall along the Shore Street frontage at the small boat facility produces a standing wave pattern in the enlarged dredged basin. As noted in Section 4.1, storms from 150° result in greater wave penetration into the proposed enlarged small boat harbour facility and thus the wave disturbance model simulations were rerun using the 150° storm direction.

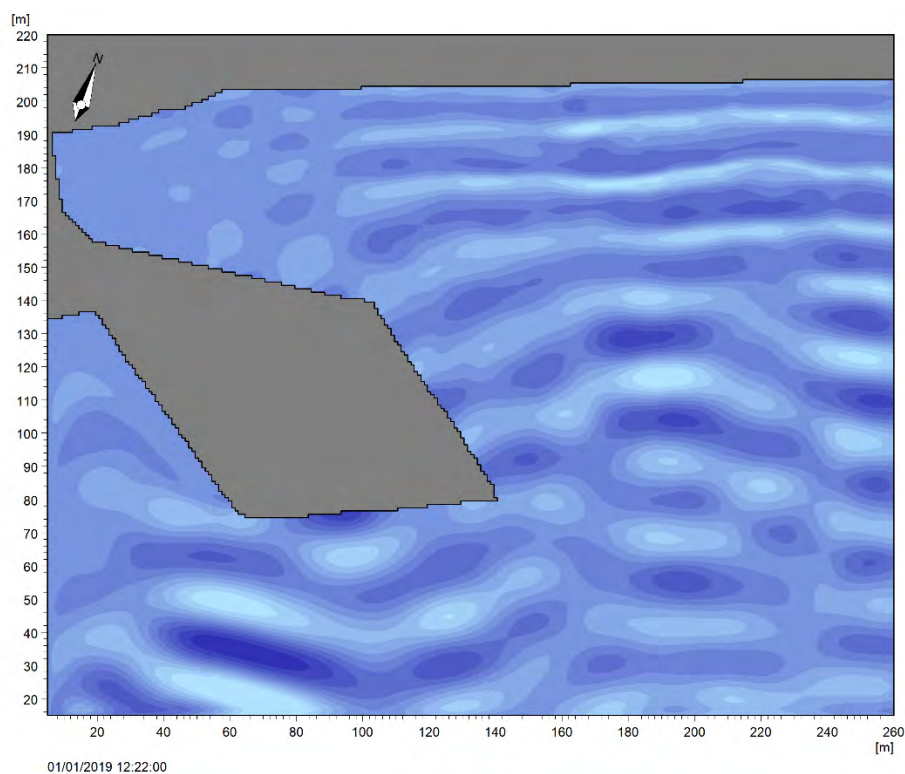


Figure 4.2 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 165° N

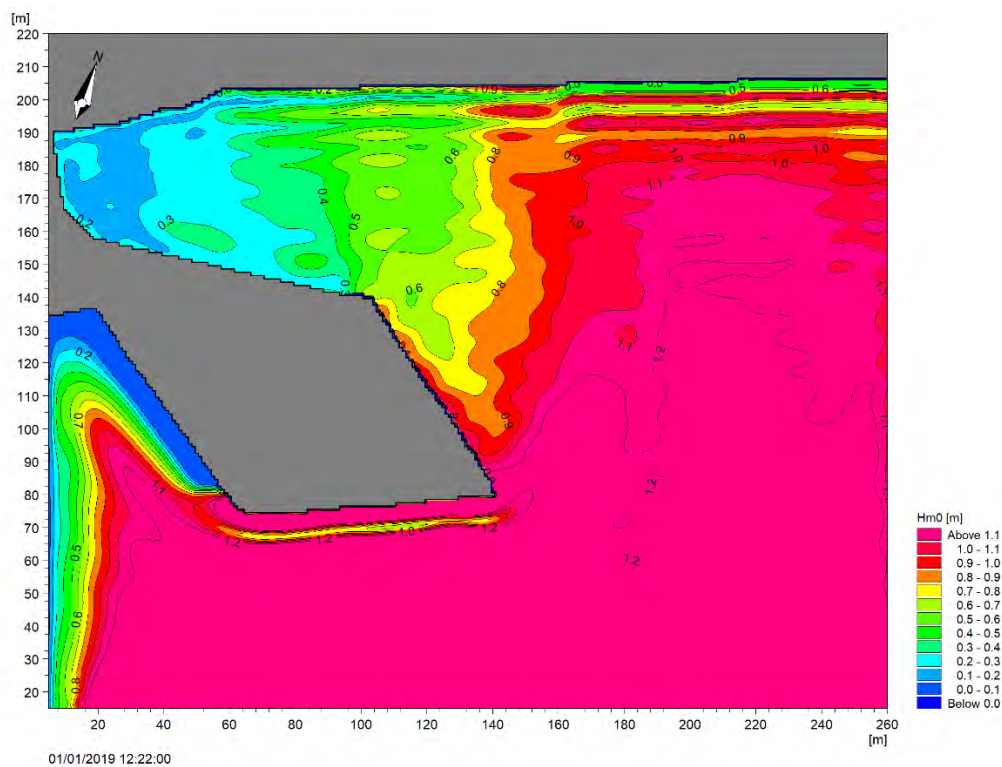


Figure 4.3 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 165° N

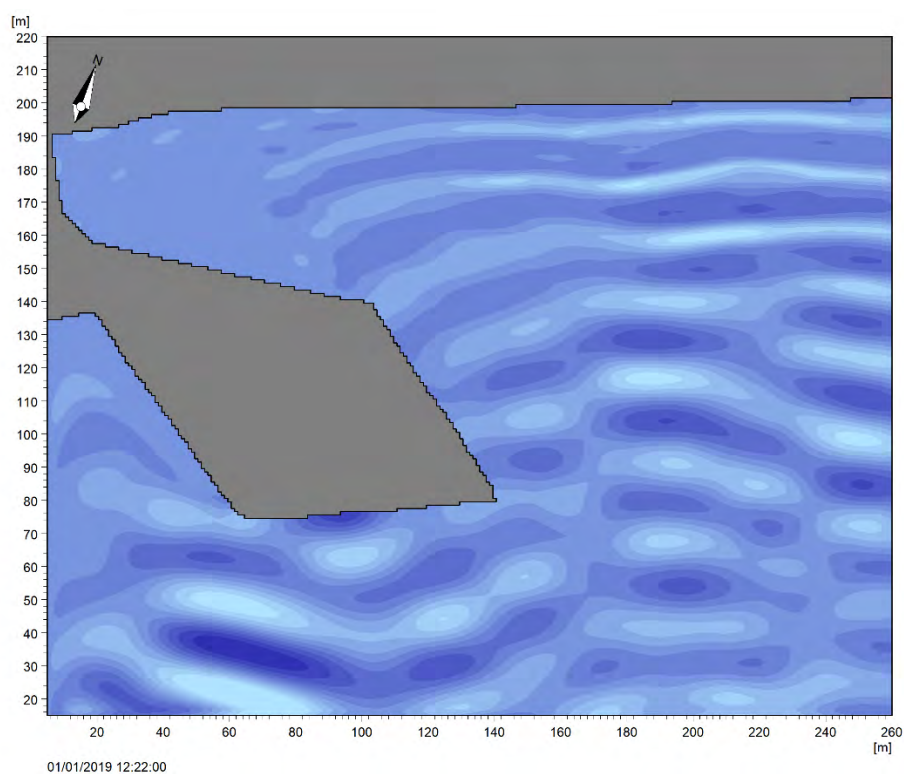


Figure 4.4 Typical wave disturbance patterns around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

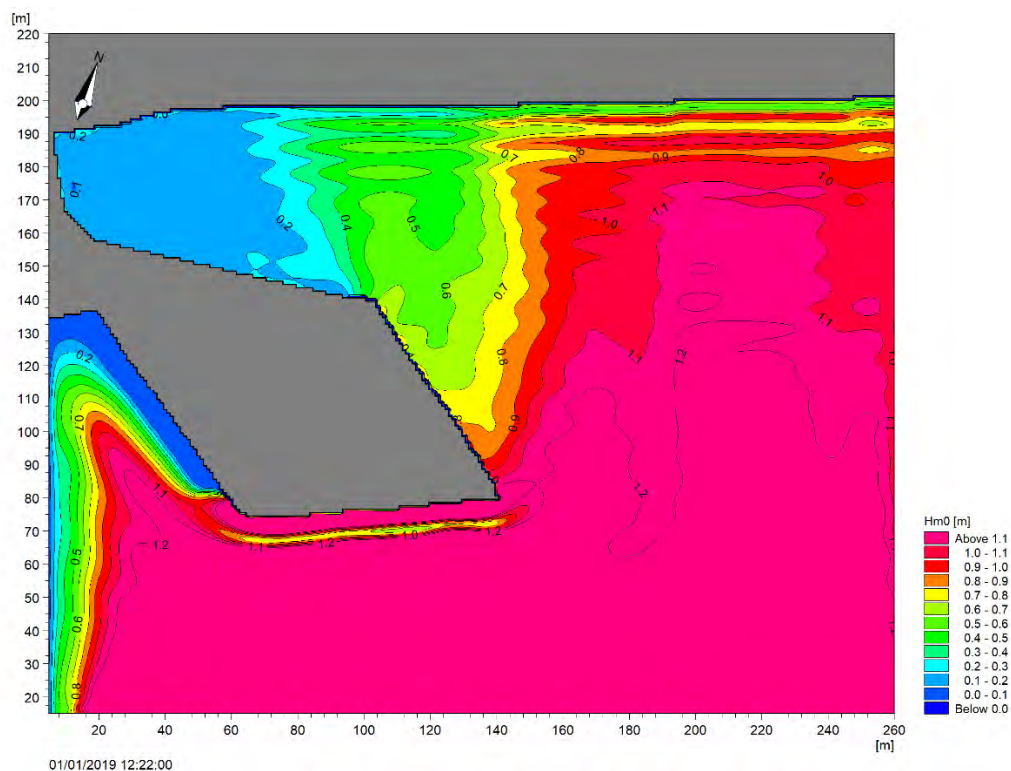


Figure 4.5 Significant wave heights around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

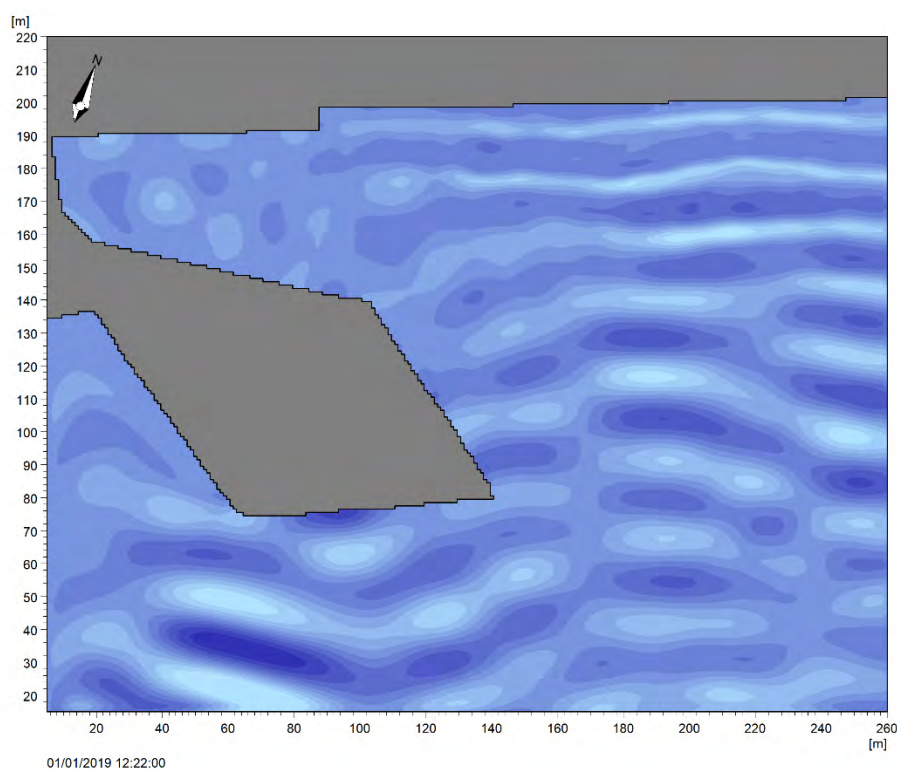


Figure 4.6 Typical wave disturbance patterns around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

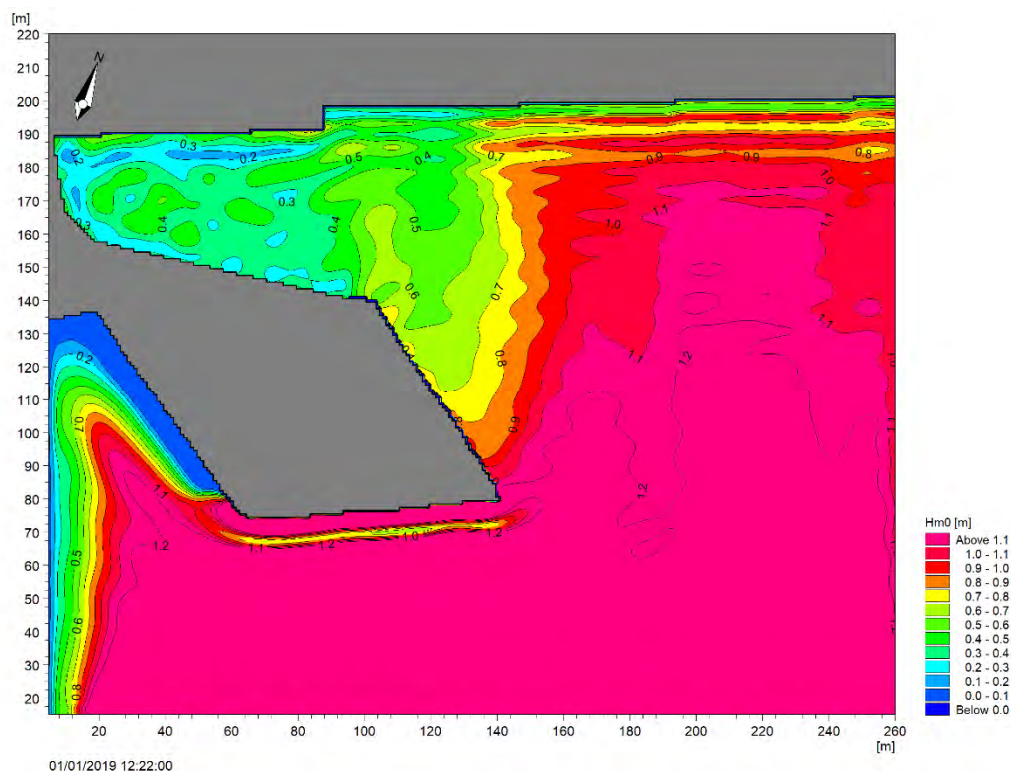


Figure 4.7 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 165° N

4.3 Wave Disturbance simulations

1 in 50 and 1 in 1 return period storm from 150° N

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall during a 1 in 50 year return period storm are shown in Figures 4.8 and 4.9. Figures 4.10 and 4.11 show the wave disturbance patterns and significant wave heights for the same storm with the existing Shore Street seawall and the enlarged small boat facility in place. The wave heights in the new small boat basin are larger than would normally be recommended thus the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 50 year return period storm as shown in Figures 4.12 and 4.13.

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility with the new Shore Street revetment during a 1 in 50 year return period storm are shown in Figures 4.14 and 4.15. Figures 4.16 and 4.17 show the wave disturbance patterns and significant wave heights for the same storm with the new Shore Street revetment and the enlarged small boat facility in place. As the wave heights in the new small boat basin are larger than would normally be recommended, the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 50 year return period storm as shown in Figures 4.18 and 4.19.

Wave disturbance simulations have also been undertaken for 1 in 1 year return period storms from 150° N. The boundary waves for this 1 in 1 year storm had significant wave heights of 0.67metres with wave period of 2.6 seconds. The wave disturbance patterns and significant wave heights around the existing small boat harbour facility and Shore Street seawall during this 1 in 1 year return period storm are shown in Figures 4.20 and 4.21. Figures 4.22 and 4.23 show the wave disturbance patterns and significant wave heights for the same storm with the existing Shore Street seawall and the enlarged small boat facility in place. The wave heights in the new small boat basin are larger than would normally be recommended thus the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 1 year return period storm as shown in Figures 4.24 and 4.25.

The wave disturbance patterns and significant wave heights around the existing small boat harbour facility with the new Shore Street revetment during a 1 in 1 year return period storm are shown in Figures 4.26 and 4.27. Figures 4.28 and 4.29 show the wave disturbance patterns and significant wave heights for the same storm with the new Shore Street revetment and the enlarged small boat facility in place. As the wave heights in the new small boat basin are larger than would normally be recommended, the use of a 5m wide floating breakwater off the south east corner of the pier area has been simulated for the 1 in 1 year return period storm as shown in Figures 4.30 and 4.31.

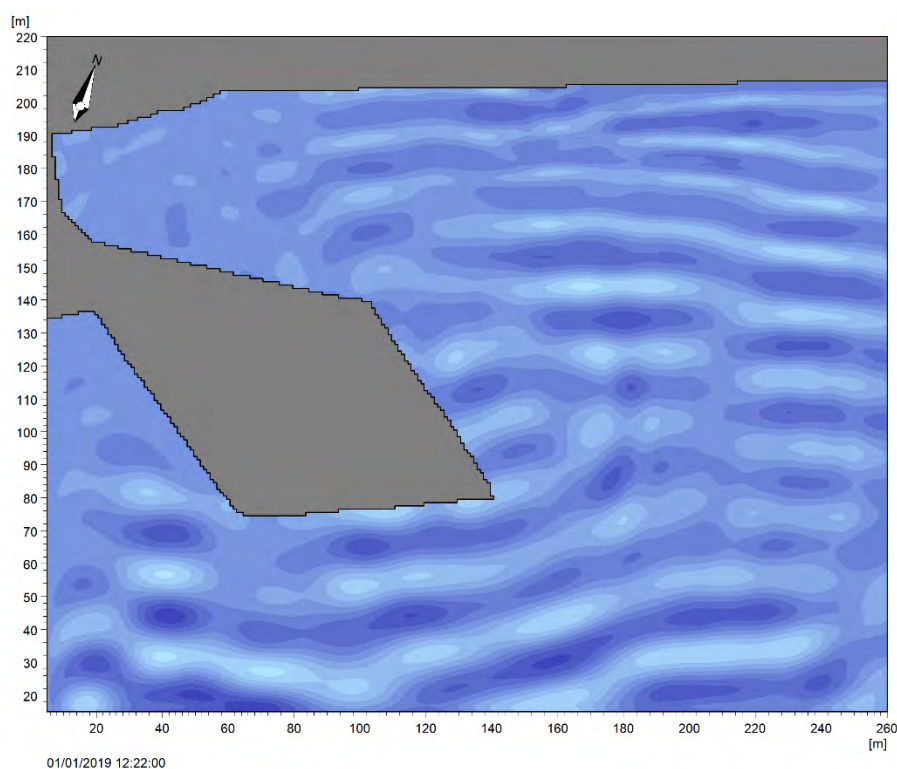


Figure 4.8 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

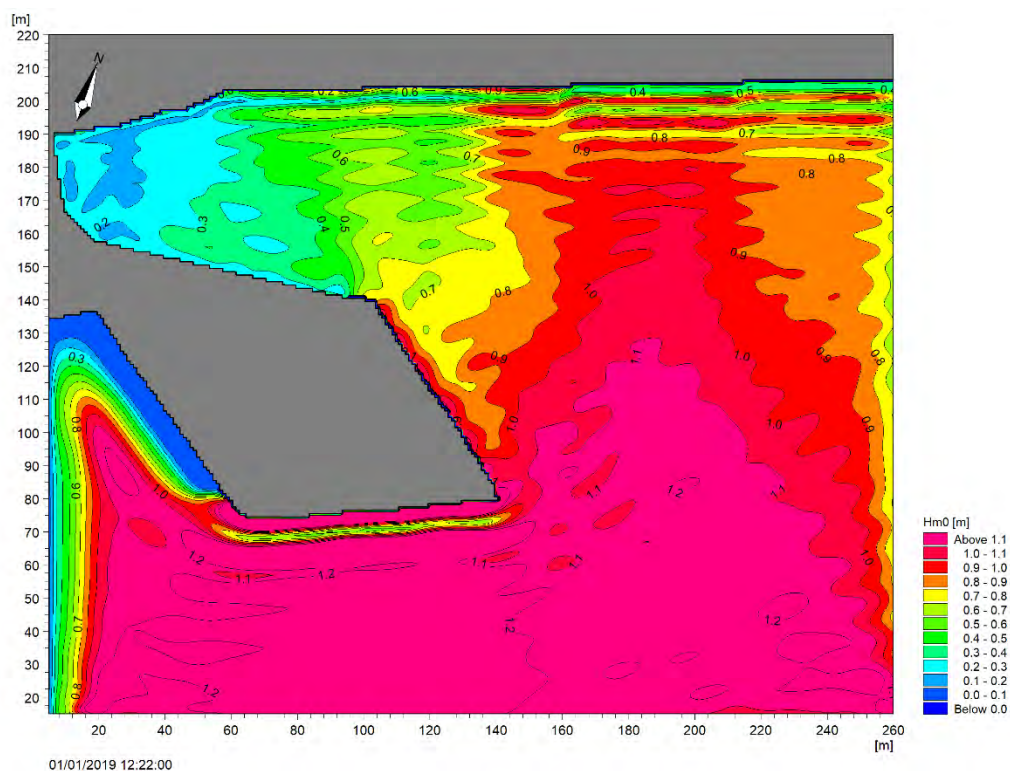


Figure 4.9 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

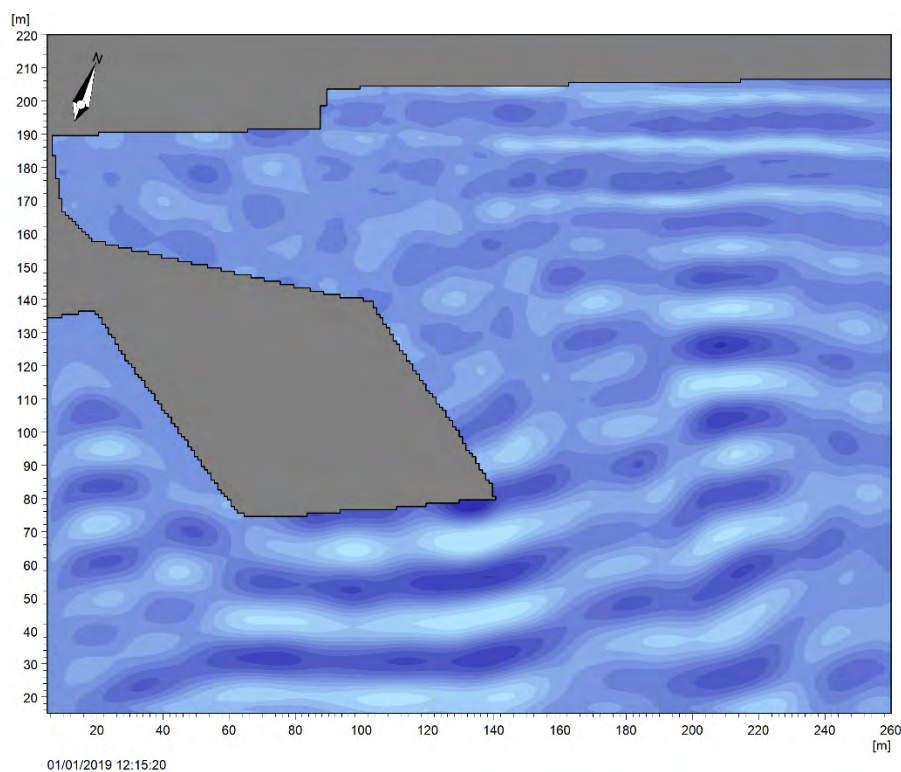


Figure 4.10 Typical wave disturbance patterns around the enlarged small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

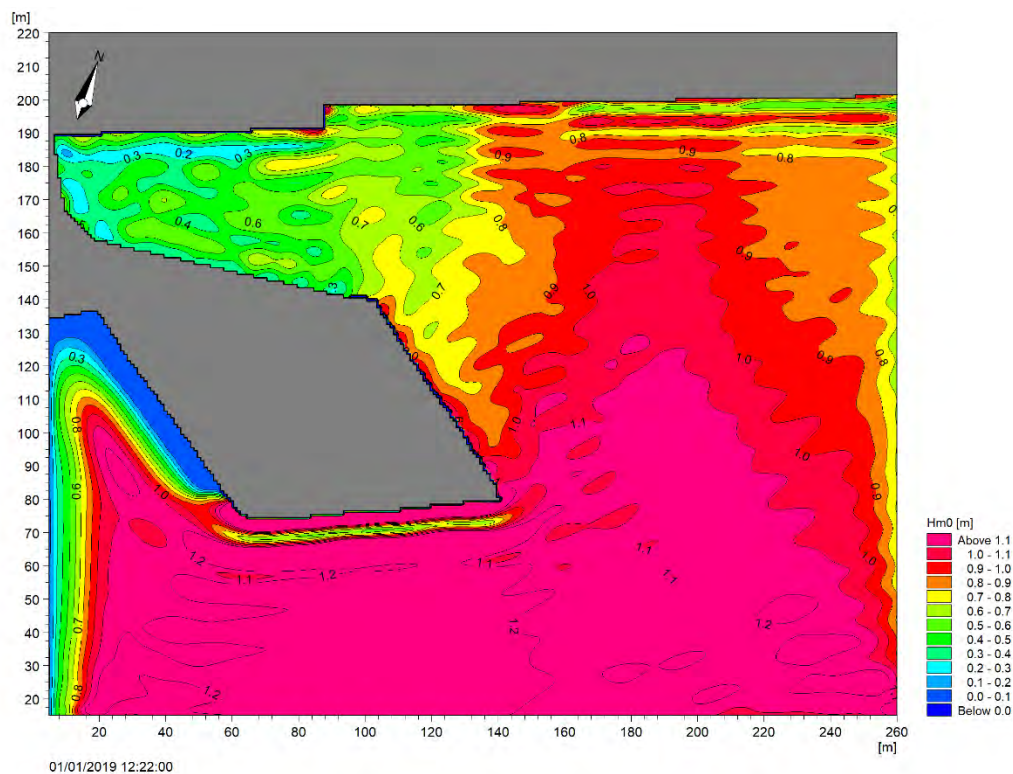


Figure 4.11 Significant wave heights around the enlarged small boat facility and Shore Street seawall - 1 in 50 year return period storm from 150° N

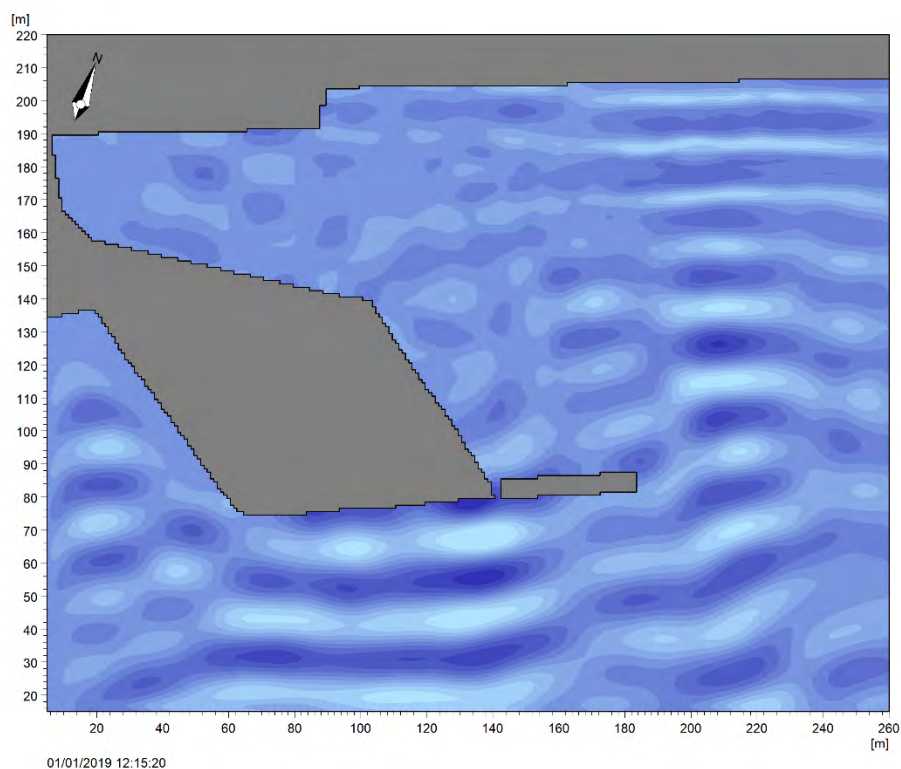


Figure 4.12 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 50 year return period storm from 150° N

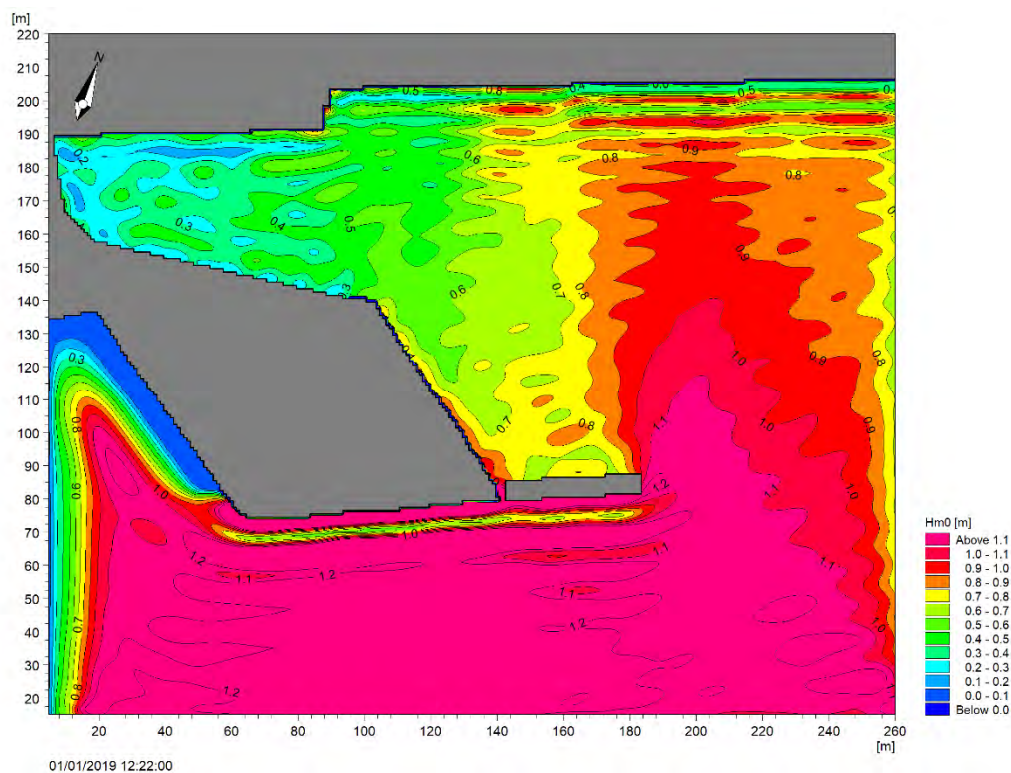


Figure 4.13 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 50 year return period storm from 150° N

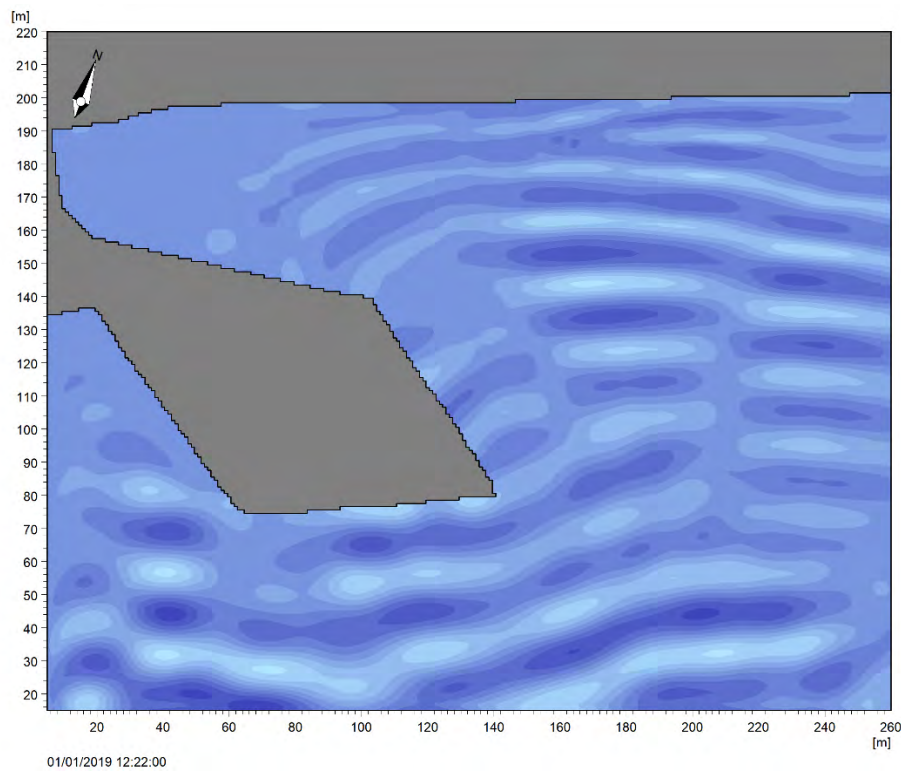


Figure 4.14 Typical wave disturbance patterns around the existing small boat facility and the new Shore Street revetment - 1 in 50 year return period storm from 150° N

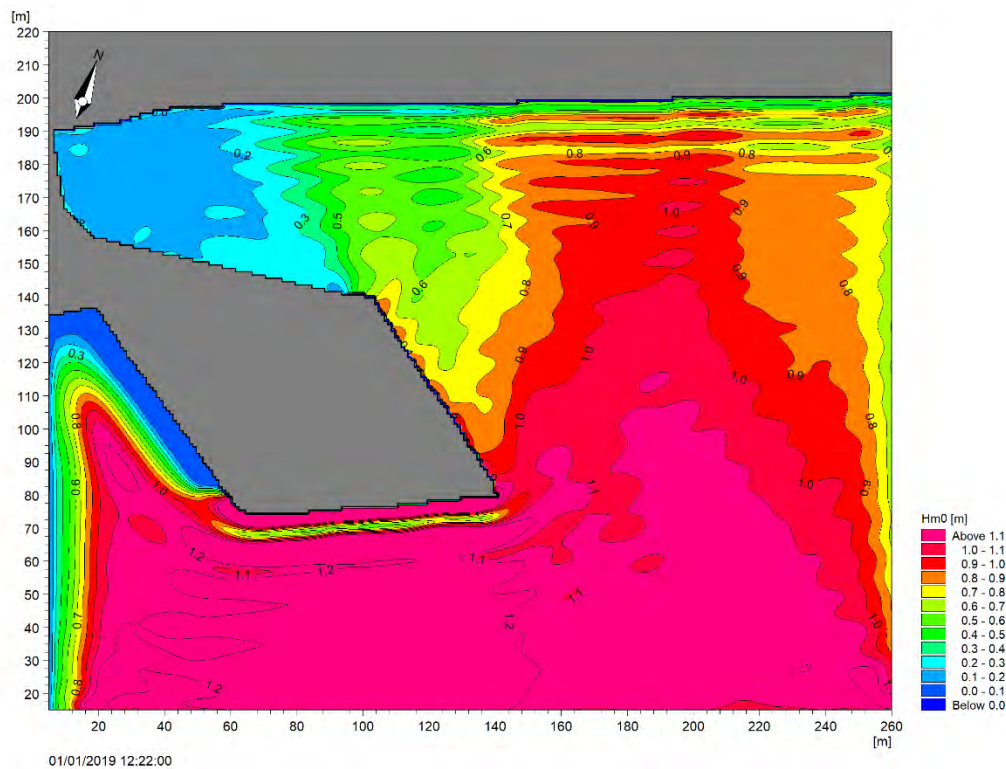


Figure 4.15 Significant wave heights around the existing small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 150° N

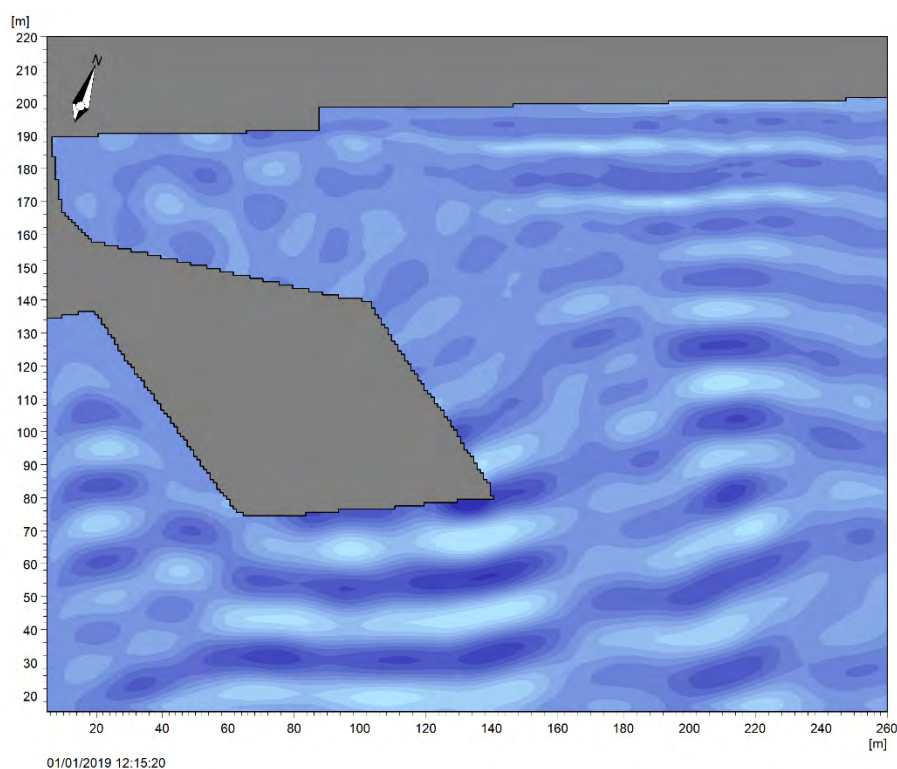


Figure 4.16 Typical wave disturbance patterns around the enlarged small boat facility and the new Shore Street revetment - 1 in 50 year return period storm from 150° N

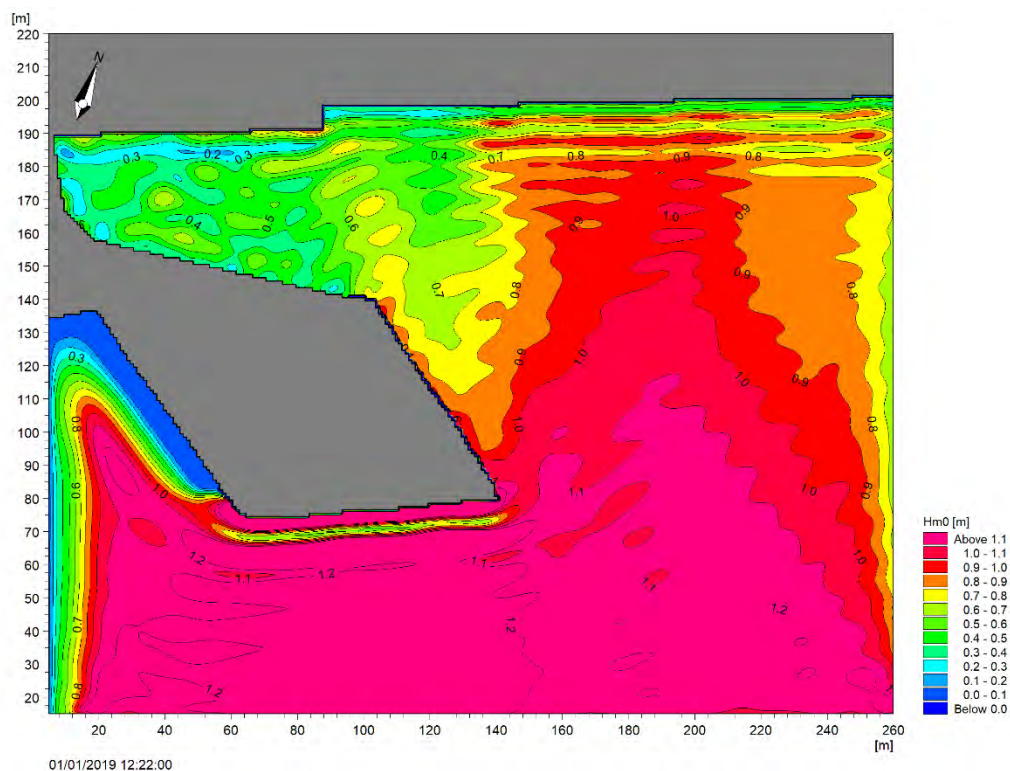


Figure 4.17 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 50 year return period storm from 150° N

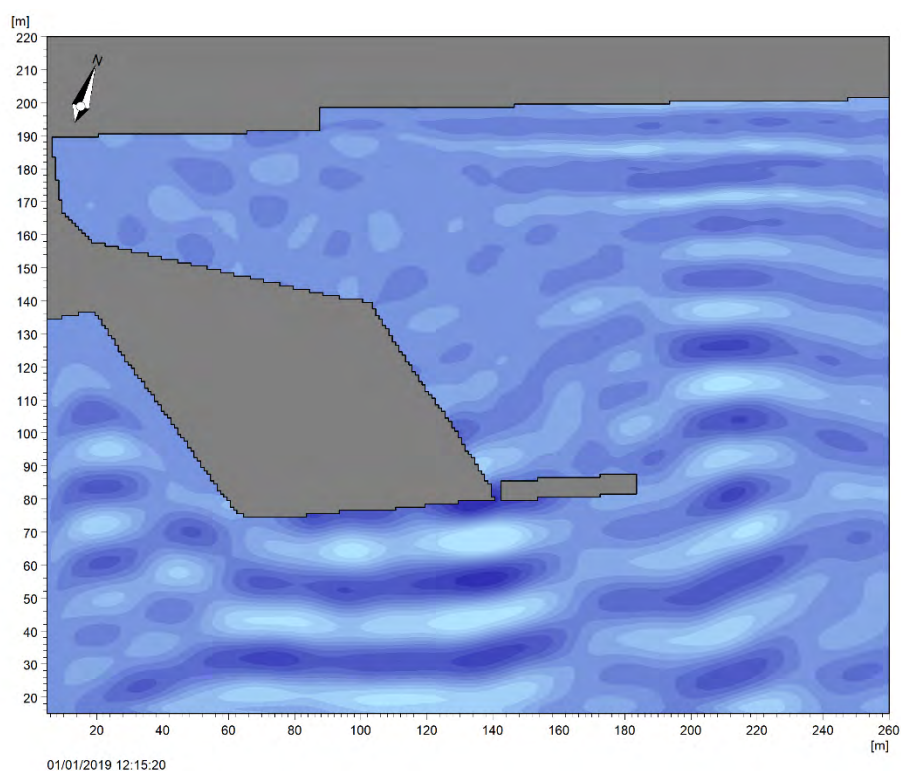


Figure 4.18 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 50 year return period storm from 150° N

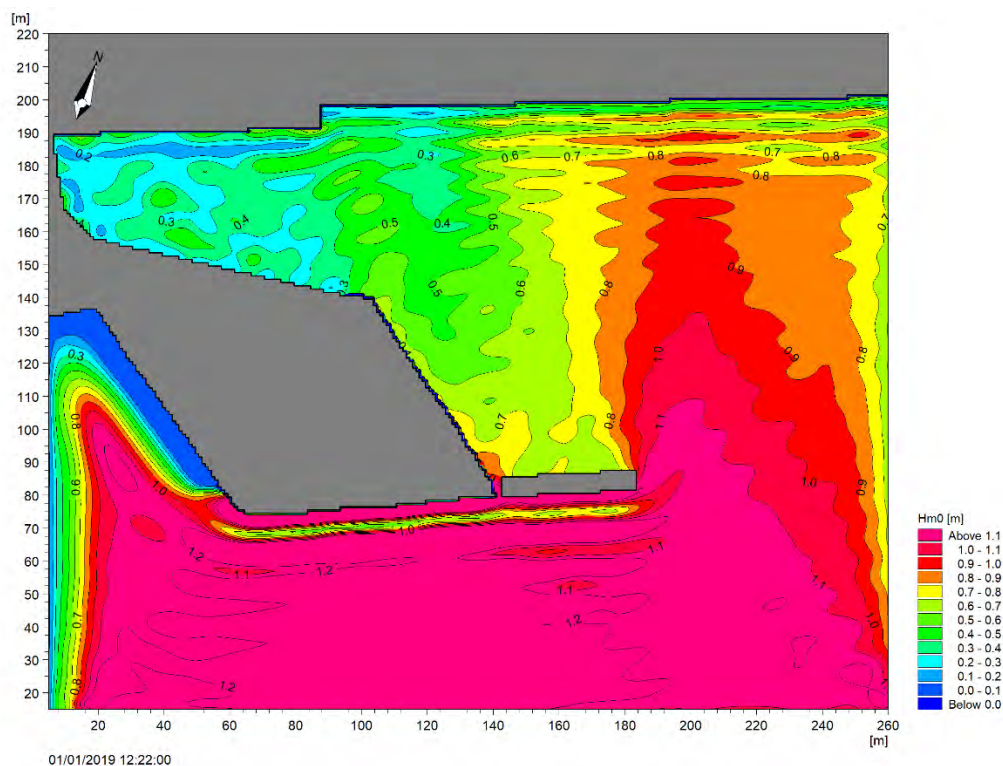


Figure 4.19 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 50 year return period storm from 150° N

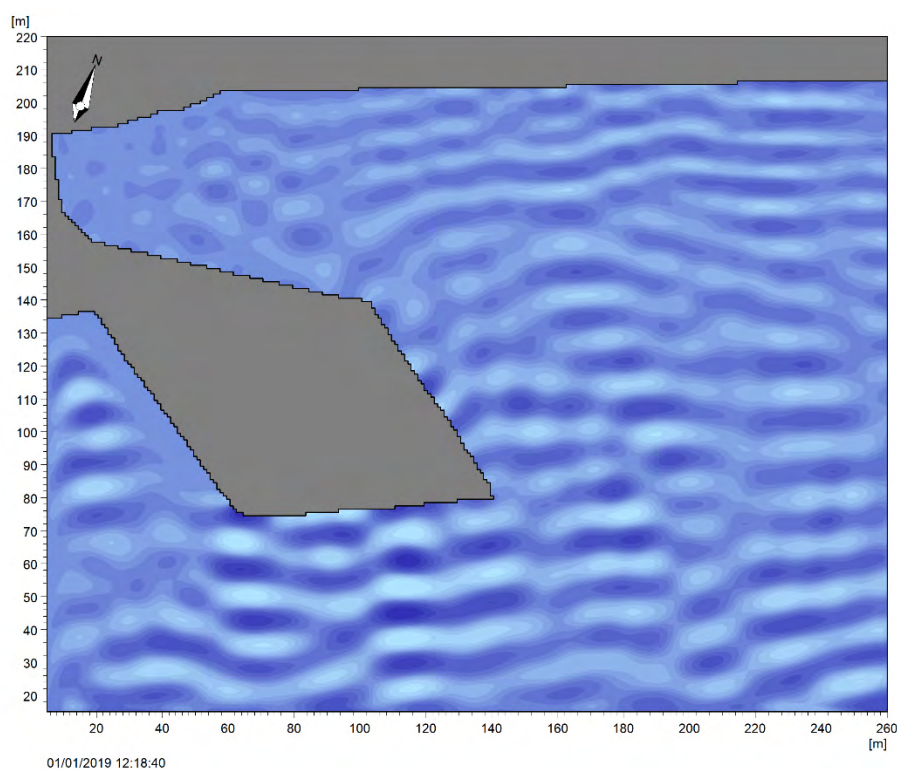


Figure 4.20 Typical wave disturbance patterns around the existing small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

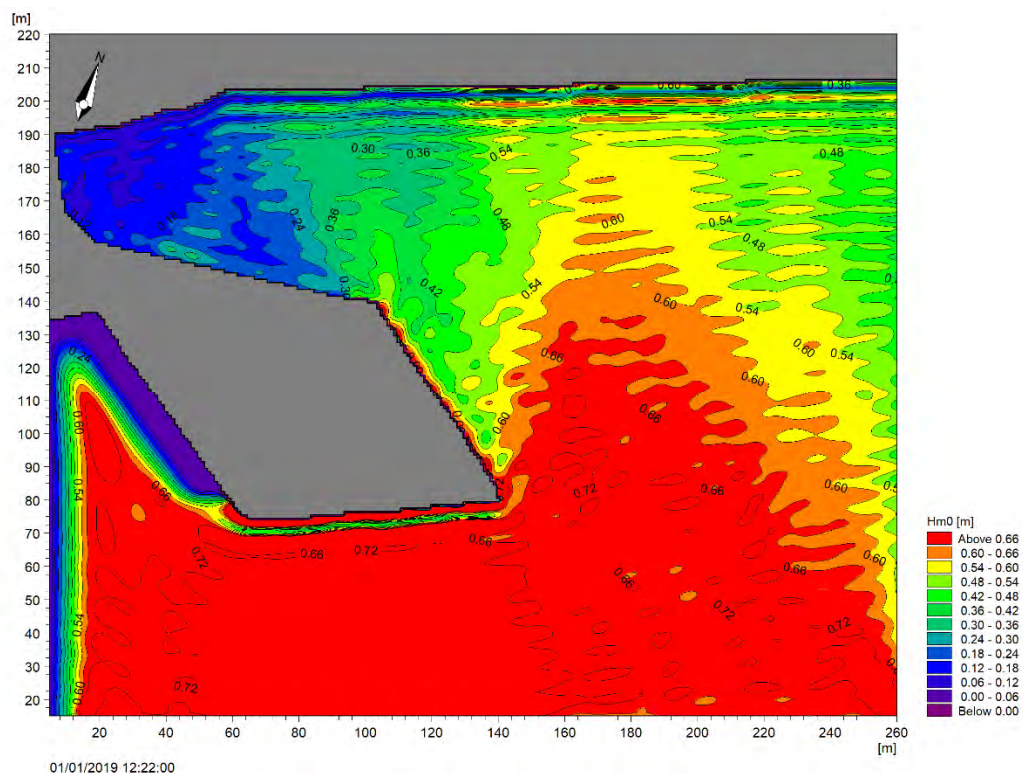


Figure 4.21 Significant wave heights around the existing small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

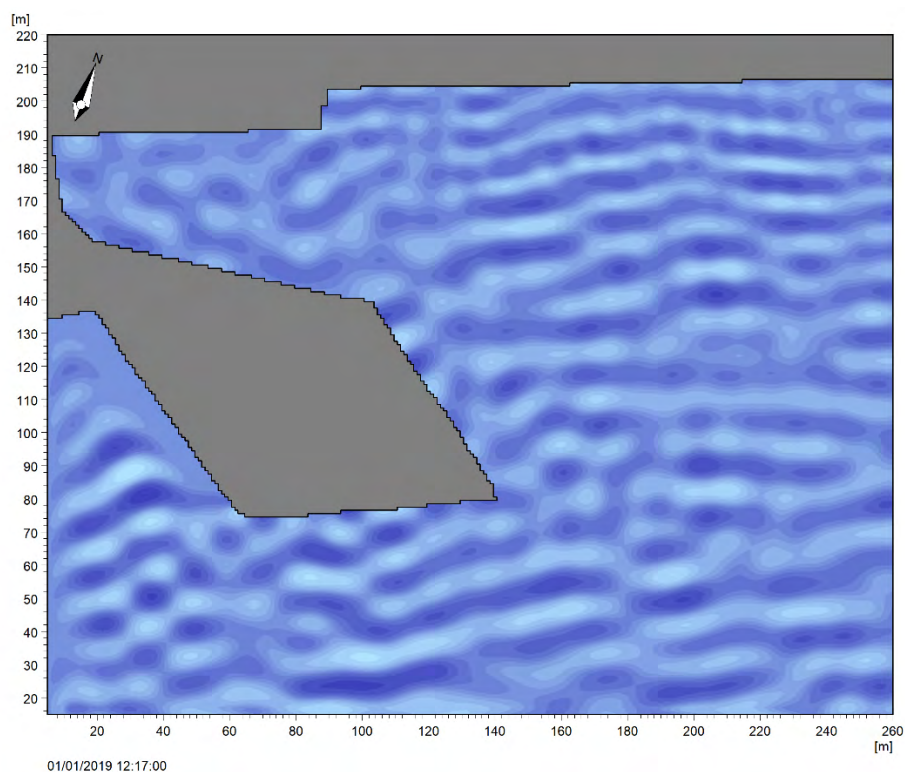


Figure 4.22 Typical wave disturbance patterns around the enlarged small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

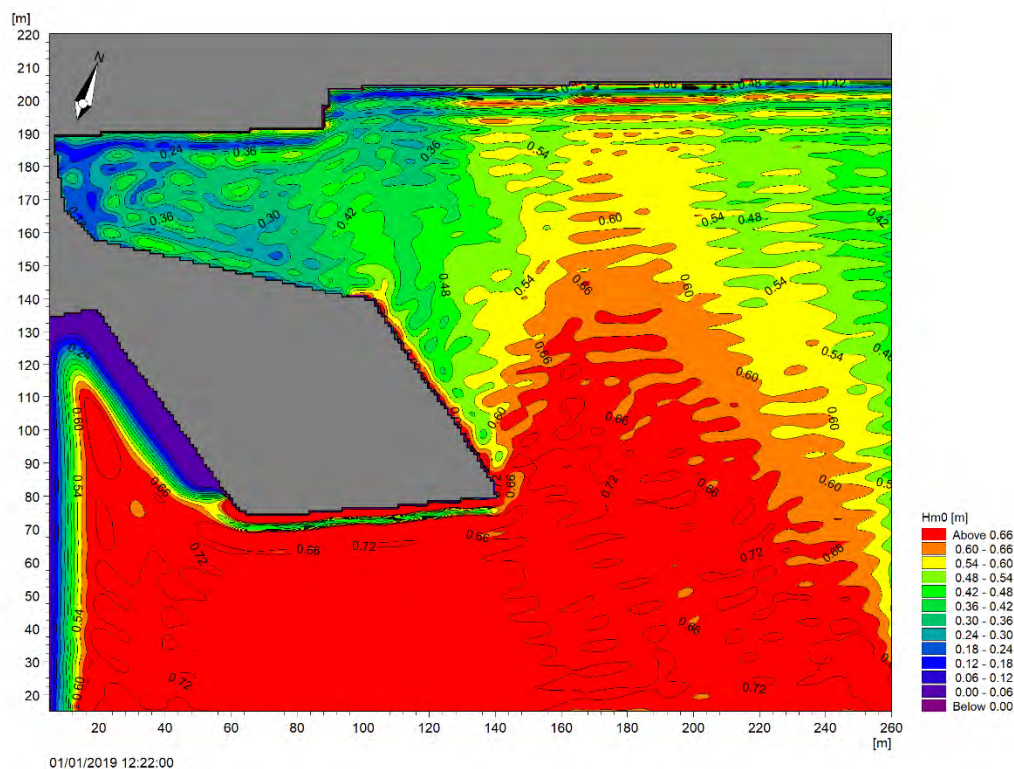


Figure 4.23 Significant wave heights around the enlarged small boat facility and Shore Street seawall - 1 in 1 year return period storm from 150° N

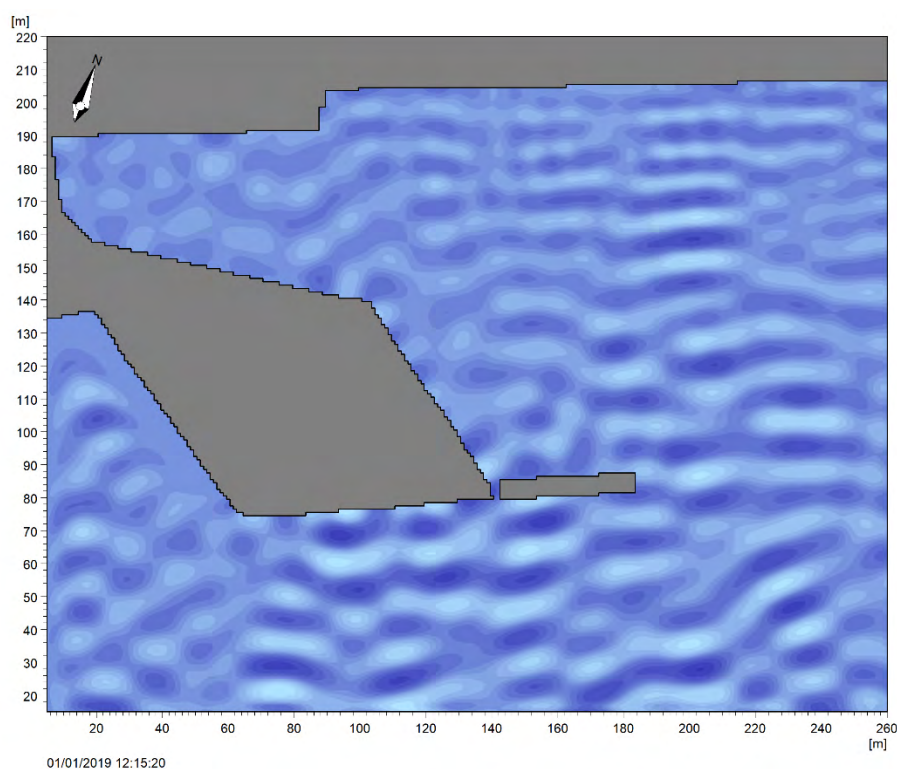


Figure 4.24 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 1 year return period storm from 150° N

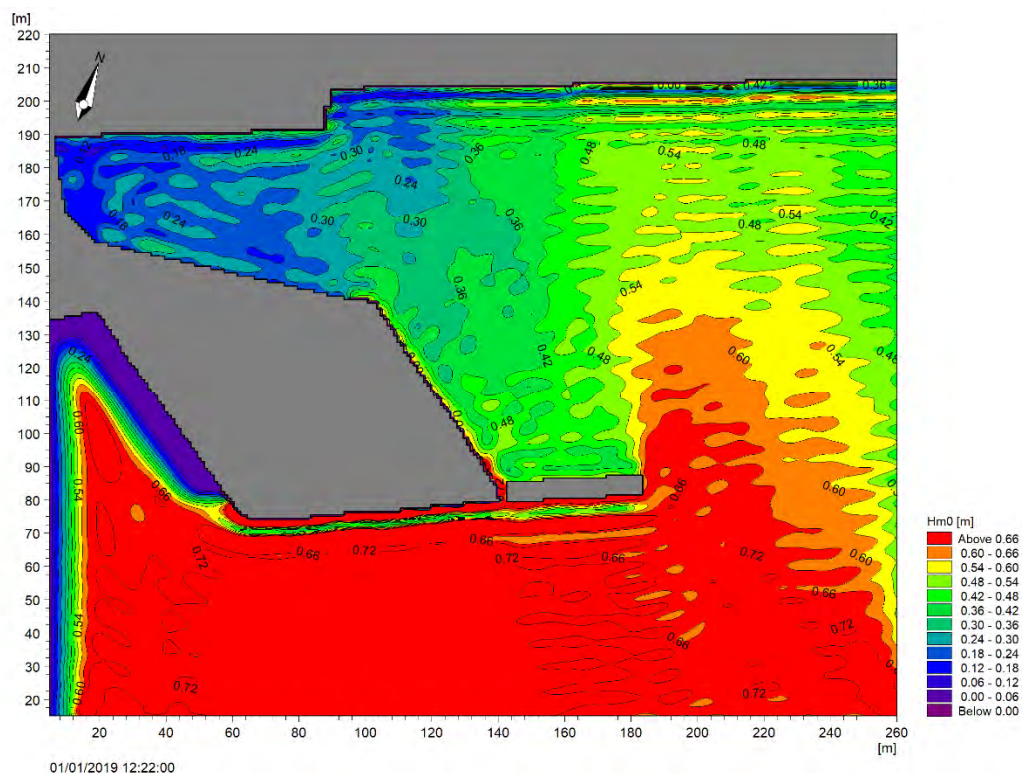


Figure 4.25 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street seawall - 1 in 1 year return period storm from 150° N

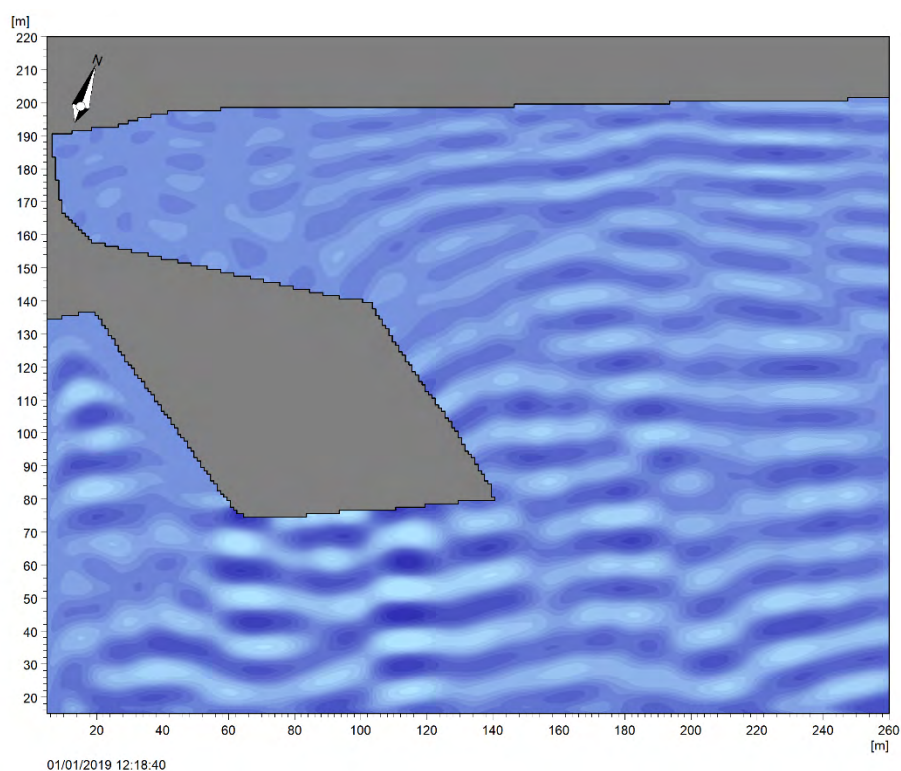
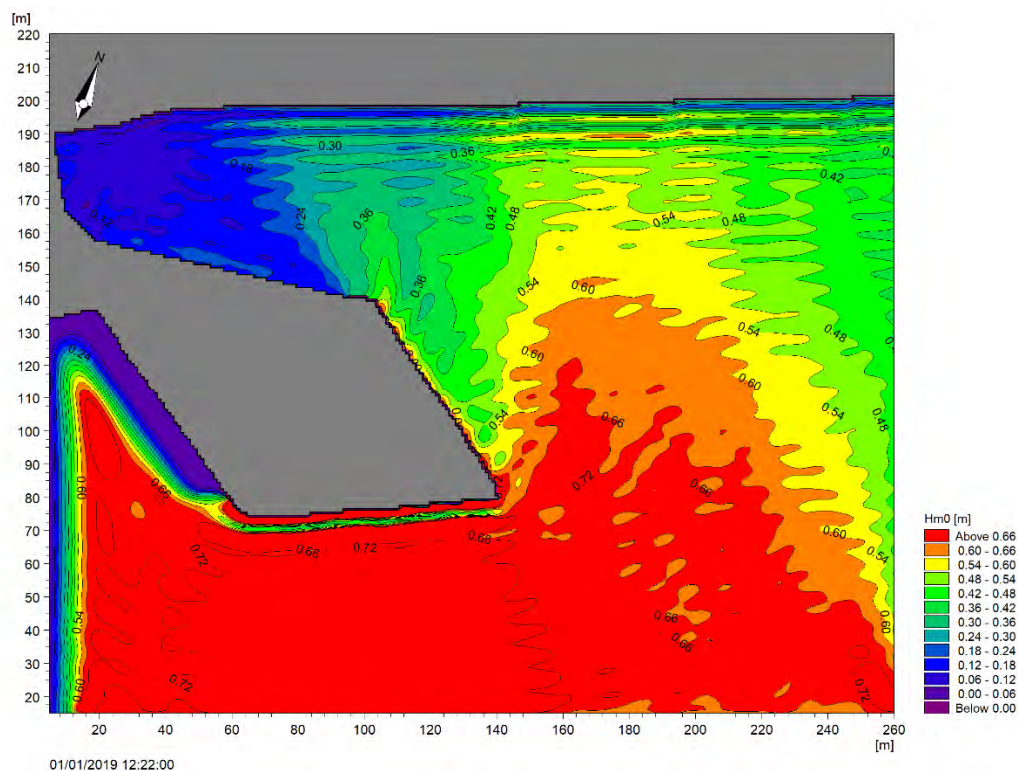


Figure 4.26 Typical wave disturbance patterns around the existing small boat facility and the new Shore Street revetment - 1 in 1 year return period storm from 150° N



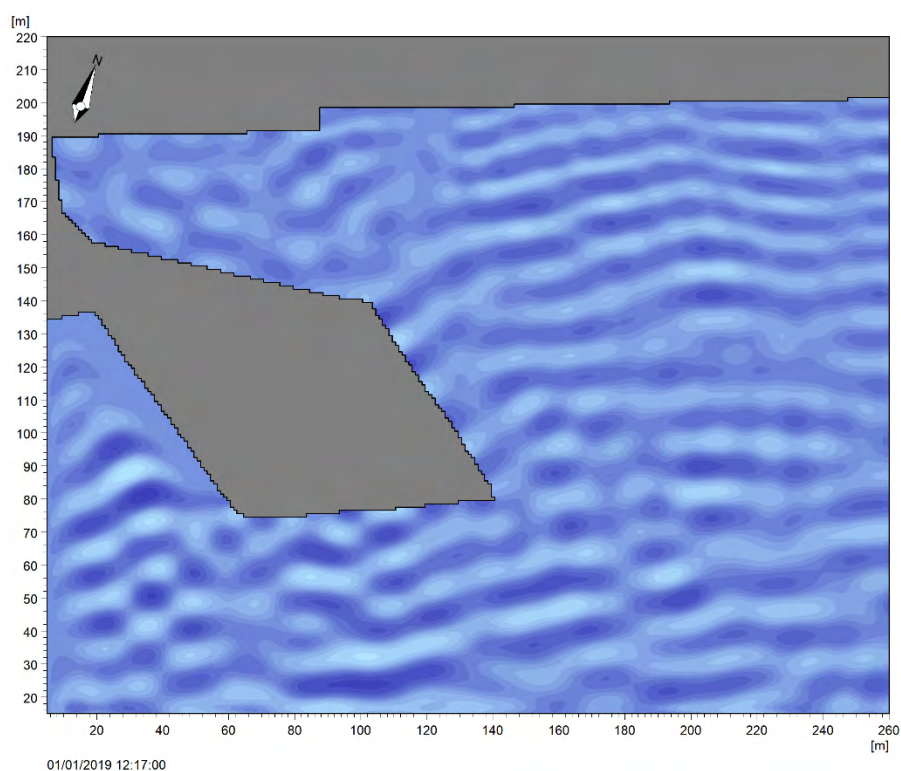


Figure 4.28 Typical wave disturbance patterns around the enlarged small boat facility and the new Shore Street revetment - 1 in 1 year return period storm from 150° N

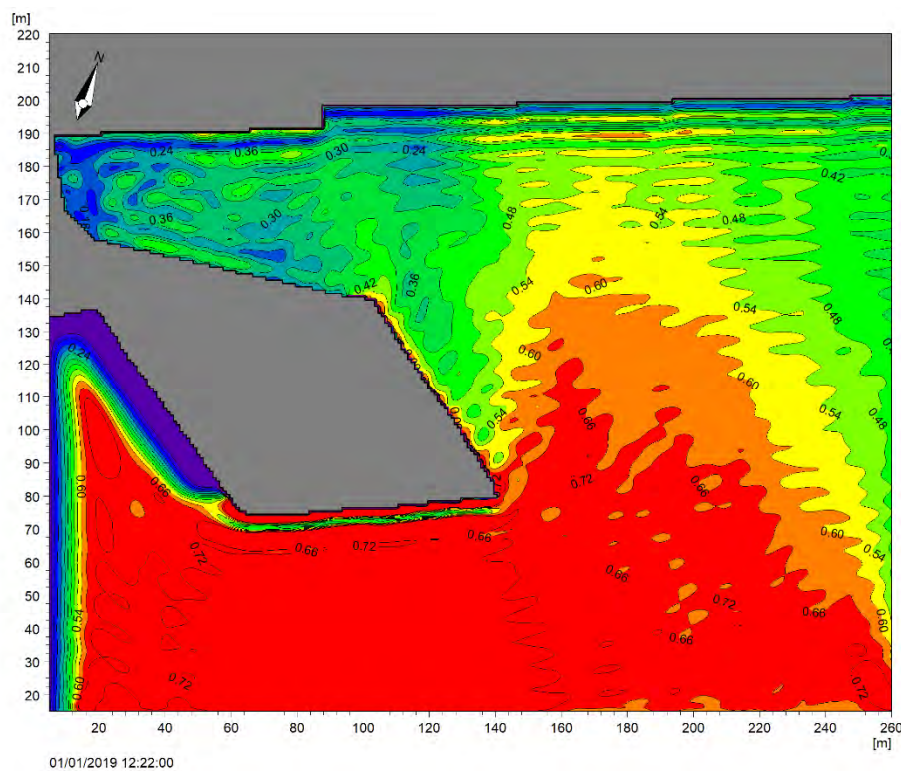


Figure 4.29 Significant wave heights around the enlarged small boat facility and new Shore Street revetment - 1 in 1 year return period storm from 150° N

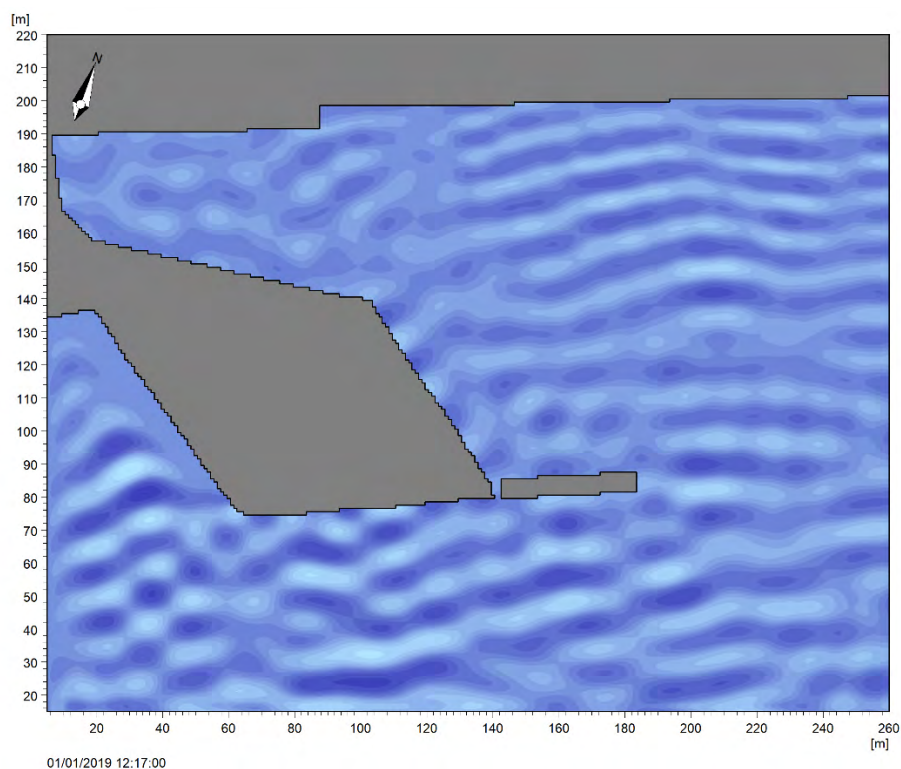


Figure 4.30 Typical wave disturbance patterns around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 1 year return period storm from 150° N

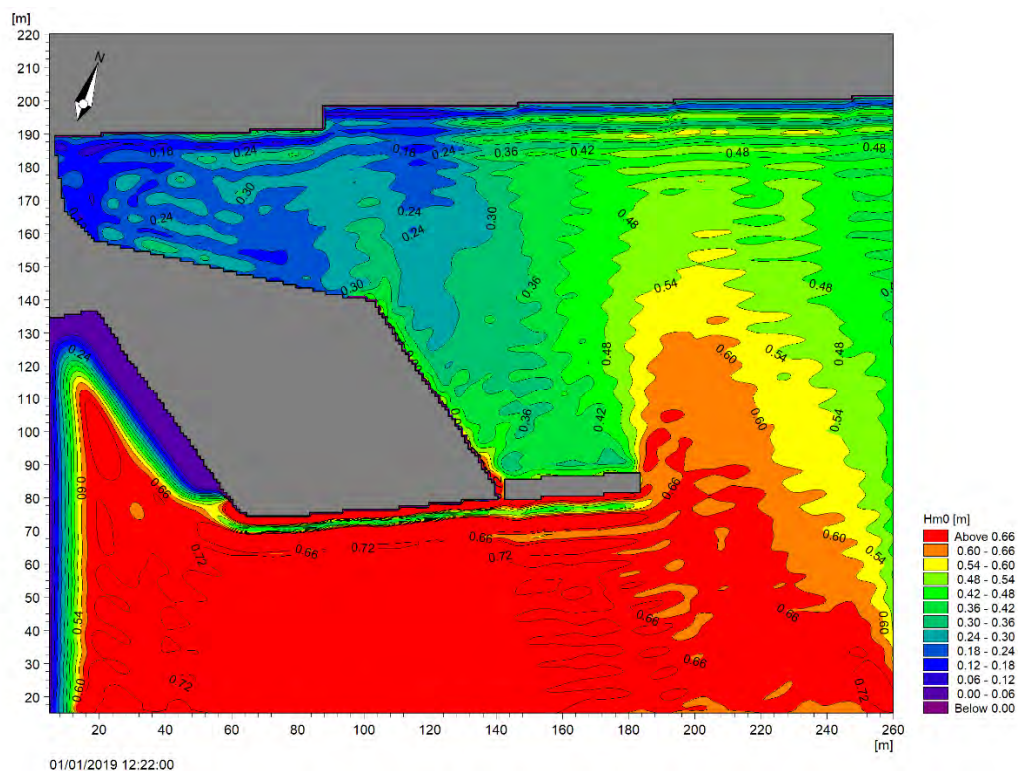


Figure 4.31 Significant wave heights around the enlarged small boat facility with floating breakwater and Shore Street revetment - 1 in 1 year return period storm from 150° N

4.4 Discussion of Results of Wave Disturbance Simulations

The results of the wave disturbance simulations have shown that while the conditions within the existing small boat harbour facility at Ullapool are satisfactory, the construction of the quay and dredging for the enlarged facility will result in the storm wave conditions exceeding the recommended wave heights in the basin. Due to the size and depth of the enlarged basin, the proposed small boat facility is proportionally more affected by the 1 in 1 year storm than the 1 in 50 year storm. It is predicted that the wave conditions in the proposed basin will be marginally worse with the existing seawall along Shore Street than with the proposed new promenade and revetment.

A 40 metre length of 5m wide floating concrete breakwater moored off the south east corner of the pier area will be effective in attenuating the wave climate in the proposed new small boat harbour and when installed, will bring the wave heights in the proposed enlarged basin to within 0.3m during the 1 in 1 year storm and 0.4m during the 1 in 50 year storm. These are considered to be acceptable values for the berthing of the small boats at the proposed facility.

The floating breakwater must at least be a 5m wide skirted concrete structure which typically will have a weight of about 52 Tonnes per 20 meter length and attenuation characteristics similar to a Marinetek K series 5300 floating breakwater. The modelling has predicted that the breakwater will be subjected to a wave climate with a JONSWAP spectra with the following characteristic during a 1 in 100 year storm.

H_{m0} – 1.345m, H_{max} – 2.727m, T_p – 3.56s, T₀₁ – 2.88s and T_{m10} – 3.18s.

5 CONCLUSIONS

The original wave study for the wave climate along the Shore Street frontage has been updated to take account of the increase in sea level rise by 2100 predicted as a result of the IPCC panel 2018 assessment. The increase in the allowance for sea level rise from 0.58 metres to the current SEPA recommended value of 0.89 metres results in an increase in the 1 in 200 year return period storm wave heights of about 10mm.

The frontage at Shore Street is exposed to wind driven waves generated over the local fetch in Loch Broom. Thus a joint probability analysis of extreme wind speed and water levels has been undertaken for the most exposed directions for wave attack along Shore Street. An overtopping analysis has been undertaken using the neural network methodology recommended in the 2018 EurOtop overtopping manual. The results of the analysis showed that for a 1 in 200 year joint probability return period event the current maximum overtopping rate at the existing seawall along Shore Street would be about 20 litres per second per metre length of wall. For the same event the overtopping rate for the proposed new promenade revetment and seawall would be 0.532 litres per second per metre length of wall. This latter rate is well within the 2018 EurOtop manual's recommended values for safe pedestrian access.

It was noted that by 2100 Shore Street would be under water during a 1 in 200 year return period tidal event. Thus no overtopping calculations have been made for the projected 2100 sea levels as these will depend upon what flood mitigation measures are to be undertaken around this part of Ullapool.

Harbour disturbance modelling has been undertaken to investigate the performance of the new quay and dredging for the proposed enlarged small facility at Ullapool. The modelling showed that while the storm wave conditions within the existing small boat harbour are satisfactory, the construction of the new quay and dredging would result in standing wave patterns within the basin during storm events from the south south east to south direction. The inclusion of a 40 metre long, 5 metre wide floating breakwater running east from the south east corner of the Pier area was found to reduce the significant wave heights within the proposed enlarged small boat facility to 0.4 metres and 0.3metres during 1 in 50 and 1 in 1 year return period storms respectively. These wave heights are within the limits recommended for the safe berthing of small boats alongside pontoon facilities.

It is recommended that the floating breakwater should be a concrete breakwater with a minimum width of 5 metres, a weight of at least 52 tonnes per 20 metre length and wave attenuating properties similar to that of a Marinetek K series 5300 breakwater.

APPENDIX

Wave Generation and Transformation Modelling Software

The wave transformation modelling was undertaken using the MIKE21 Spectral Wave model (SW). The MIKE 21 SW model is a new generation spectral wind-wave model based on unstructured meshes. The model simulates the growth, decay and transformation of wind-generated waves and swells in offshore and coastal areas.

MIKE 21 SW includes the following physical phenomena:

- Wave growth by action of wind
- Non-linear wave-wave interaction
- Dissipation due to white-capping
- Dissipation due to bottom friction
- Dissipation due to depth-induced wave breaking
- Refraction and shoaling due to depth variations
- Diffraction
- Wave-current interaction
- Effect of time-varying water depth and flooding and drying

The discretization of the governing equation in geographical and spectral space is performed using a cell-centred finite volume method. In the geographical domain, an unstructured mesh technique is used. The time integration is performed using a fractional step approach where a multi-sequence explicit method is applied for the propagation of wave action.

MIKE 21 SW includes two different formulations:

- Directional decoupled parametric formulation
- Fully spectral formulation

The fully spectral formulation was used in the simulations. The spectral formulation is based on the wave action conservation equation, as described in e.g. Komen et al. (1994) and Young (1999), where the directional-frequency wave action spectrum is the dependent variable.

Harbour Disturbance Modelling Software

The wave disturbance studies were undertaken using the MIKE21 Boussinesq wave model which is the most advanced wave model in the MIKE21 modelling system.

The Boussinesq Wave model, MIKE 21 BW, is the state-of-the-art numerical model for calculation and analysis of short- and long-period waves in ports, harbours and coastal areas. MIKE 21 BW is capable of reproducing the combined effects of all important wave phenomena of interest in port, harbour and coastal engineering. These include:

- Shoaling
- Refraction
- Diffraction
- Wave breaking
- Bottom friction
- Moving shoreline
- Partial reflection and transmission
- Non-linear wave-wave interaction
- Frequency spreading
- Directional spreading

Phenomena, such as wave grouping, surf beats, generation of bound sub-harmonics and super-harmonics and near-resonant triad interactions, can also be modelled using MIKE 21 BW. The 2DH module (two horizontal space co-ordinates) solves the enhanced Boussinesq equations by an implicit finite difference technique with variables defined on a space-staggered rectangular grid.

The Boussinesq wave model includes the provision of wave reflection and transmission properties for various structures within the harbour. This is achieved by placing porosity layers in the model either along the face in front of fixed structures or, in the case of floating breakwaters, along the line of the breakwater location.



Appendix 7 – Underwater Noise Assessment

Submitted to:

Affric Limited

Website: www.affriclimited.co.uk

Submitted by:

Subacoustech Environmental Ltd

Website: www.subacoustech.com

Underwater noise assessment for vibration piling at Ullapool

Fergus Midforth

22/06/2021

Subacoustech Environmental Report No. P290R0102



| <i>Document No.</i> | <i>Date</i> | <i>Written</i> | <i>Approved</i> | <i>Distribution</i> |
|---------------------|-------------------|-------------------|-----------------|---------------------------------|
| <i>P290R0101</i> | <i>21/06/2021</i> | <i>F Midforth</i> | <i>S East</i> | <i>Fiona Henderson (Affric)</i> |
| <i>P290R0102</i> | <i>22/06/2021</i> | <i>F Midforth</i> | <i>S East</i> | <i>Fiona Henderson (Affric)</i> |

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| <p><i>This report is a controlled document. The report documentation page lists the version number, record of changes, referencing information, abstract and other documentation details.</i></p> |
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1 Introduction

Subacoustech Environmental Ltd. has undertaken underwater noise modelling and analysis for proposed works at Ullapool Harbour. The works considered are the vibration piling of 508mm steel piles as a part of the construction of a pontoon in the harbour. The site and location of the proposed piling is shown in Figure 1-1 where the location of the piles has been highlighted with red circles. This report presents an assessment of the potential underwater noise effects of the piling on marine fauna at the site.

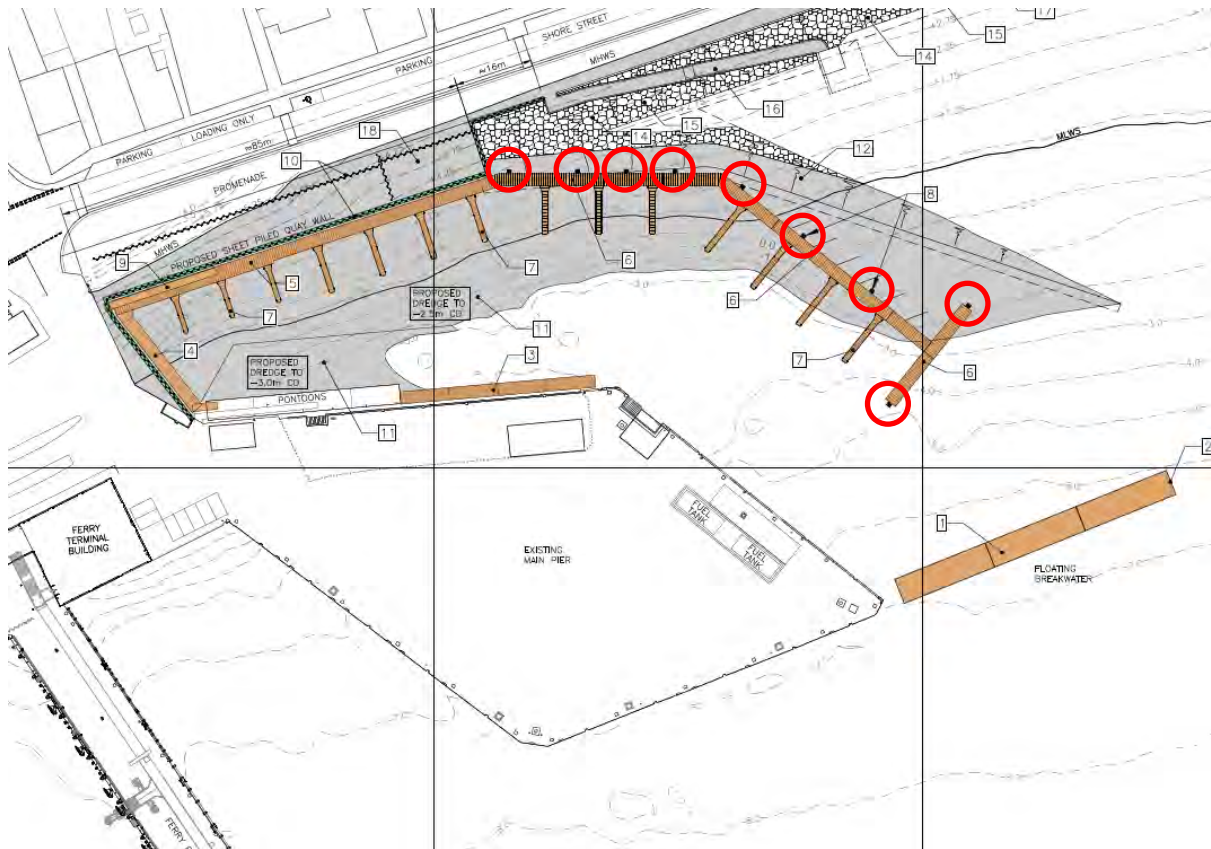


Figure 1-1 Excerpt of technical drawing of the proposed works by Wallace Stone Consulting Civil Engineers, provided to Subacoustech by Affric Limited. Red circle annotations have been added by Subacoustech to highlight the pontoon piles.

2 Assessment Criteria

2.1 Marine Mammals

Marine mammals are considered using guidance in Southall *et al.* (2019), which groups similar species into categories according to their hearing sensitivities. Filters can be applied to the unweighted noise levels to approximate the hearing sensitivities of the receptor for the calculation of cumulative sound exposure levels (SEL_{cum}).

For this study the individual criteria for non-impulsive noise outlined in Southall *et al.* (2019) have been applied as vibration piling, the noise source considered in this study, is considered a non-impulsive noise source. To calculate the SEL_{cum} , a fleeing animal model has been assumed for marine mammals. This assumes that a receptor, when exposed to high noise levels, will swim away from the noise source.

The weighted sound exposure criteria (SEL_{cum}) from Southall *et al.* (2019) for both permanent threshold shift (PTS), where unrecoverable hearing damage may occur, and temporary threshold shift (TTS), where a temporary reduction in hearing sensitivity may occur in individual receptors, is outlined in Table 2-1 along with the fleeing speeds assumed in the calculations.

| Southall <i>et al.</i> (2019) | Weighted SEL _{cum} (dB re 1 μPa ² s) | | | Fleeing Speed (m/s) | References |
|-------------------------------------|---|-----|--|------------------------|----------------------------|
| | Non-impulsive | | | | |
| | PTS | TTS | | | |
| Low-frequency cetaceans (LF) | 199 | 179 | | 3.25 | Blix and Folkow, 1995 |
| High-frequency cetaceans (HF) | 198 | 178 | | 1.5 | Otani <i>et al.</i> , 2000 |
| Very high-frequency cetaceans (VHF) | 173 | 153 | | | |
| Phocid carnivores in water (PCW) | 201 | 181 | | | |

Table 2-1 Non-impulsive SEL_{cum} criteria for PTS and TTS in marine mammals (Southall *et al.*, 2019).

The fleeing speeds are considered worst case assumptions as marine mammals are expected to be able to swim much faster under stress conditions. The fleeing animal calculations have been undertaken following the approach provided by Lepper *et al.* (2012).

2.2 Fishes

For fishes, the guidelines presented by Popper *et al.* (2014) are the widely accepted criteria for assessing of the likely impact of noise.

The Popper *et al.* (2014) guidance groups species of fish by whether they possess a swim bladder, and whether it is involved in its hearing. The criteria for continuous noise sources are summarised in Table 2-2.

Where insufficient data are available, Popper *et al.* (2014) also gives qualitative criteria that summarise the effect of the noise as having either a high, moderate or low effect on an individual in either the near-field (tens of metres), intermediate-field (hundreds of metres), or far-field (thousands of metres).

The assumption of a stationary receptor has been used in this assessment.

| Type of animal | Mortality and potential mortal injury | Impairment | | | Behaviour |
|--|---------------------------------------|-------------------------------|------------------------------------|--------------------------------------|---|
| | | Recoverable injury | TTS | Masking | |
| <i>Fish: no swim bladder</i> | (N) Low (I) Low (F) Low | (N) Low (I) Low (F) Low | (N) Moderate (I) Low (F) Low | (N) High (I) High (F) Moderate | (N) Moderate (I) Moderate (F) Low |
| <i>Fish: swim bladder is not involved in hearing</i> | (N) Low (I) Low (F) Low | (N) Low (I) Low (F) Low | (N) Moderate (I) Low (F) Low | (N) High (I) High (F) Moderate | (N) Moderate (I) Moderate (F) Low |
| <i>Fish: swim bladder involving in hearing</i> | (N) Low (I) Low (F) Low | 170 dB RMS for 48 hrs | 158 dB RMS For 12 hrs | (N) High (I) High (F) High | (N) High (I) Moderate (F) Low |
| <i>Eggs and larvae</i> | (N) Low (I) Low (F) Low | (N) Low (I) Low (F) Low | (N) Low (I) Low (F) Low | (N) High (I) Moderate (F) Low | (N) Moderate (I) Moderate (F) Low |

Table 2-2 Summary of the qualitative and quantitative effects on fish from continuous noise from Popper et al. (2014) (N = Near-field; I = Intermediate-field; F = Far-field).

3 Modelling methodology

3.1 Introduction

Modelling for this study has been undertaken using measured data from Subacoustech Environmental's underwater noise measurement database. Only data from vibration piling on a similar scale to the proposed specification of the works were selected to form the basis of the model.

The NPL Good Practice Guide 133 for underwater noise measurements (Robinson *et al.*, 2014) indicates that under certain circumstances, a simple modelling approach may be considered acceptable. The method of modelling that has been presented here is considered sufficient and there would be little benefit in undertaking a more detailed modelling approach. The limitations of this approach are noted, including the lack of frequency or bathymetric dependence, but are acceptable due to the relatively low noise levels produced by vibration piling of small diameter piles.

3.2 Noise source

Approximate subsea noise levels have been predicted for the proposed vibration piling using a modelling approach based on measured data of vibration piling events from Subacoustech Environmental's own underwater noise measurement database. The calculation of underwater noise transmission loss for the non-impulsive sources is based on an empirical analysis of the noise measurements taken on transects around these sources by Subacoustech Environmental. The predictions use the following principle fitted to the measured data, where R is the range from the source, N is the transmission loss and α is the absorption loss:

$$\text{Received level} = \text{Source level (SL)} - N \log R - \alpha R$$

The predicted source level and propagation calculations for vibration piling are presented in Table 3-1. It should be noted that this modelling approach does not take bathymetry or other specific environmental conditions of the proposed site into account, this includes the features of the harbour in Ullapool such as the existing pier which may reduce the propagation of noise in that direction. Data utilised for the modelling are from three datasets of vibration piling in a UK harbour.

| | Vibration piling modelling source |
|--------------------------------|--|
| Unweighted Source Level | 185.3 dB re 1 μ Pa @ 1 m |
| Transmission Loss | $15\log R - 0.002R$ |

Table 3-1 Source level and transmission loss used for modelling

For SELcum calculations, the duration the noise is present is also considered, with all sources assumed to be operating continuously for 12 hours in any given 24-hour period. This is considered a conservative assumption as it is unlikely that piling will be continuous and without break for 12 hours each day.

To account for the weightings required for modelling using Southall *et al.* (2019) criteria, reductions in source level have been applied to the various noise sources, based on the source frequency spectrum. The weighted source levels are presented in Table 3-2. 1/3rd octave band levels for both weighted and unweighted sources are shown in Figure 3-1.

| Species group weighting | Source level after weighting is applied |
|--------------------------------|--|
| LF | 183.5 dB re 1 μ Pa @ 1 m |
| HF | 168.3 dB re 1 μ Pa @ 1 m |
| VHF | 166.2 dB re 1 μ Pa @ 1 m |
| PCW | 177.8 dB re 1 μ Pa @ 1 m |

Table 3-2 Southall *et al.* (2019) weighted source levels

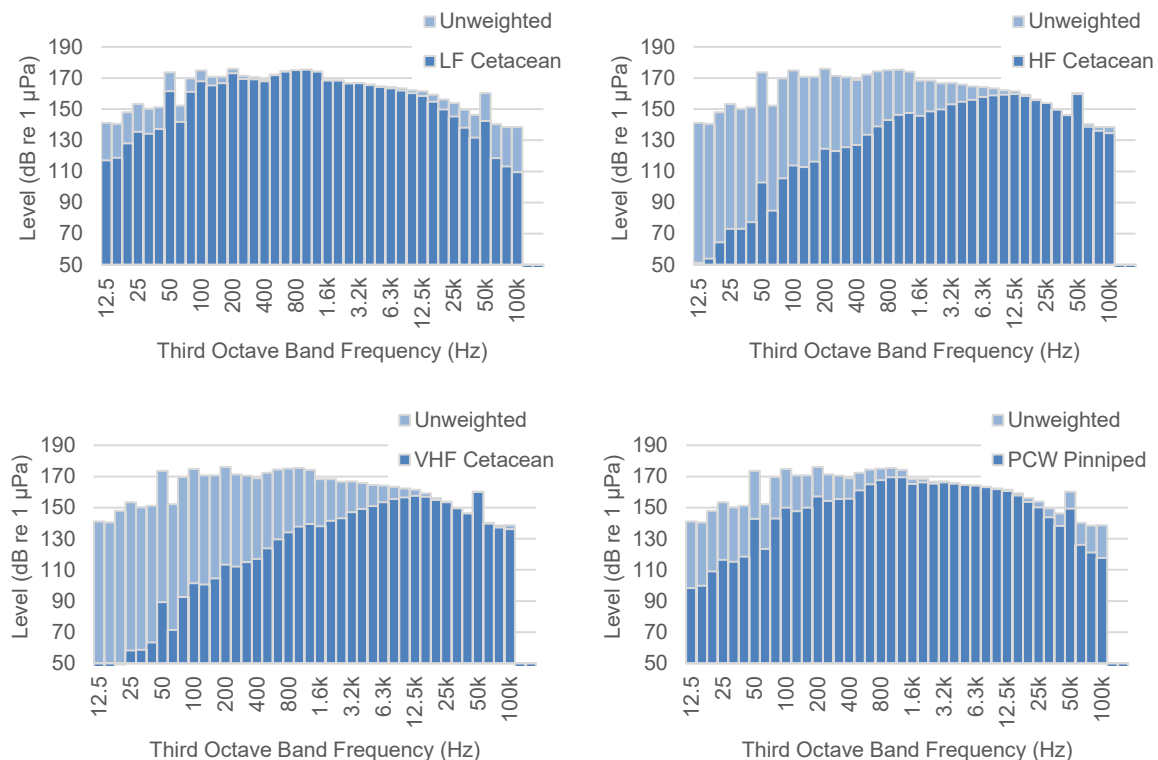


Figure 3-1 Unweighted and Southall *et al.* (2019) weighted source 1/3rd octave levels for modelling

4 Modelling results

Table 4-1 and Table 4-2 summarise the predicted impact ranges of the vibration piling for marine mammals per Southall *et al.* (2019) criteria. Given the modelled impact ranges, any marine mammal would have to be less than 10 m from the noise source at the start of piling to acquire the necessary exposure to induce PTS. Onset of TTS may occur for VHF cetaceans should they be within 50 m of the works at the start of piling.

Table 4-3 summarises the quantitative impact for fish with a swim bladder involved in hearing, the most sensitive species group. As it highly unlikely that vibration piling will be continuous and without break for 12 or 48 hours, there is a low to negligible risk of any injury or TTS to fish with swim bladder involved in hearing. Qualitative effects are shown in Table 2-2Table 2-2.

| Southall <i>et al.</i> (2019) Weighted SEL _{cum} | PTS Impact range |
|--|------------------|
| 199 dB (LF) | < 10 m |
| 198 dB (HF) | < 10 m |
| 173 dB (VHF) | < 10 m |
| 201 dB (PCW) | < 10 m |

Table 4-1 Summary of impact ranges for non-impulsive PTS criteria from Southall *et al.* (2019) for marine mammals assuming a fleeing receptor

| Southall et al. (2019) Weighted SEL_{cum} | TTS Impact range |
|--|-------------------------|
| 179 dB (LF) | < 10 m |
| 178 dB (HF) | < 10 m |
| 153 dB (VHF) | 50 m |
| 181 dB (PCW) | < 10 m |

Table 4-2 Summary of impact ranges for non-impulsive TTS criteria from Southall et al. (2019) for marine mammals assuming a fleeing receptor

| Popper et al. (2014) Unweighted SPL_{RMS} | Impact range |
|--|---------------------|
| Recoverable injury 170 dB (48 hours) | < 10 m |
| TTS 158 dB (12 hours) | 60 m |

Table 4-3 Summary of impact ranges from Popper et al. (2014) for continuous noise sources for the most sensitive fish species group (swim bladder involved in hearing)

5 Summary and conclusions

Subacoustech Environmental have undertaken underwater noise modelling and analysis to assess the impact of underwater noise from proposed works in Ullapool harbour, Scotland. The assessment considered the use of vibration piling as a part of the installation of a pontoon in the harbour.

The noise from the proposed piling was considered using a simple modelling approach of geometrical spreading with absorption. The results of the modelling showed that the risk of any potentially injurious effects to fish or marine mammals is expected to be very low, as the underwater noise from the works are close to, or below, the appropriate injury criteria even when very close to the source of the noise. The greatest impact range for TTS onset for any marine mammal species is 50 m for VHF cetaceans, which is the distance a VHF-sensitive receptor would have to be at the start of vibration piling for the TTS threshold to be exceeded.

A fish in the most sensitive category as per Popper *et al.* (2014) would need to be within 10 m of the piling for a continuous 48 hours to reach the PTS threshold. As this situation will not occur in practice, any risk of PTS is considered negligible. The TTS threshold would be exceeded after 12 hours exposure within 60 m of the piling. This situation is also considered unlikely.

The modelling does not take account of local features such as the existing main pier which may reduce the propagation of noise in that direction depending on the construction.

References

1. Blix A S, Folkow L P (1995). *Daily energy expenditure in free living minke whales*. Acta Physio. Scand., 153: 61-66.
2. Hastings M C and Popper A N (2005). *Effects of sound on fish*. Report to the California Department of Transport, under Contract No. 43A01392005, January 2005.
3. Lepper P A, Robinson S P, Ainslie M A, Theobald P D, de Jong C A F (2012). *Assessment of Cumulative Sound Exposure Levels for Marine Piling Events IN: Popper, A.N and Hopkins, A. (eds). The Effects of Noise on Aquatic Life: Advances in Experimental Medicine and Biology, 730 (VII), 453 - 457*
4. Nedwell J R, Langworthy J, Howell D (2003). *Assessment of subsea noise and vibration from offshore wind turbines and its impact on marine wildlife. Initial measurements of underwater noise during construction of offshore wind farms, and comparisons with background noise*. Subacoustech Report No. 544R0423, published by COWRIE, May 2003.
5. Nedwell J R, Parvin S J, Edwards B, Workman R, Brooker A G, Kynoch J E (2007). *Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters*. Subacoustech Report No. 544R0738 to COWRIE. ISBN: 978-09554276-5-4.
6. Otani S, Naito T, Kato A, Kawamura A (2000). *Diving behaviour and swimming speed of a free-ranging harbour porpoise (Phocoena phocoena)*. Marine Mammal Science, Volume 16, Issue 4, pp 881-814, October 2000.
7. Popper A N, Hawkins A D, Fay R R, Mann D A, Bartol S, Carlson T J, Coombs S, Ellison W T, Gentry R L, Halvorsen M B, Løkkeborg S, Rogers P H, Southall B L, Zeddis D G, Tavolga W N (2014). *Sound exposure guidelines for Fishes and Sea Turtles*. Springer Briefs in Oceanography, DOI 10.1007/978-3-319-06659-2.
8. Robinson S P, Lepper P A, Hazelwood R A (2014). *Good practice guide for underwater noise measurement*. National Measurement Office, Marine Scotland, The Crown Estate. NPL Good Practice Guide No. 133, ISSN 1368-6550.
9. Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019). *Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects*. Aquatic Mammals 2019, 45 (20, 125-232) DOI 10.1578/AM.45.2.2019.125.

Report documentation page

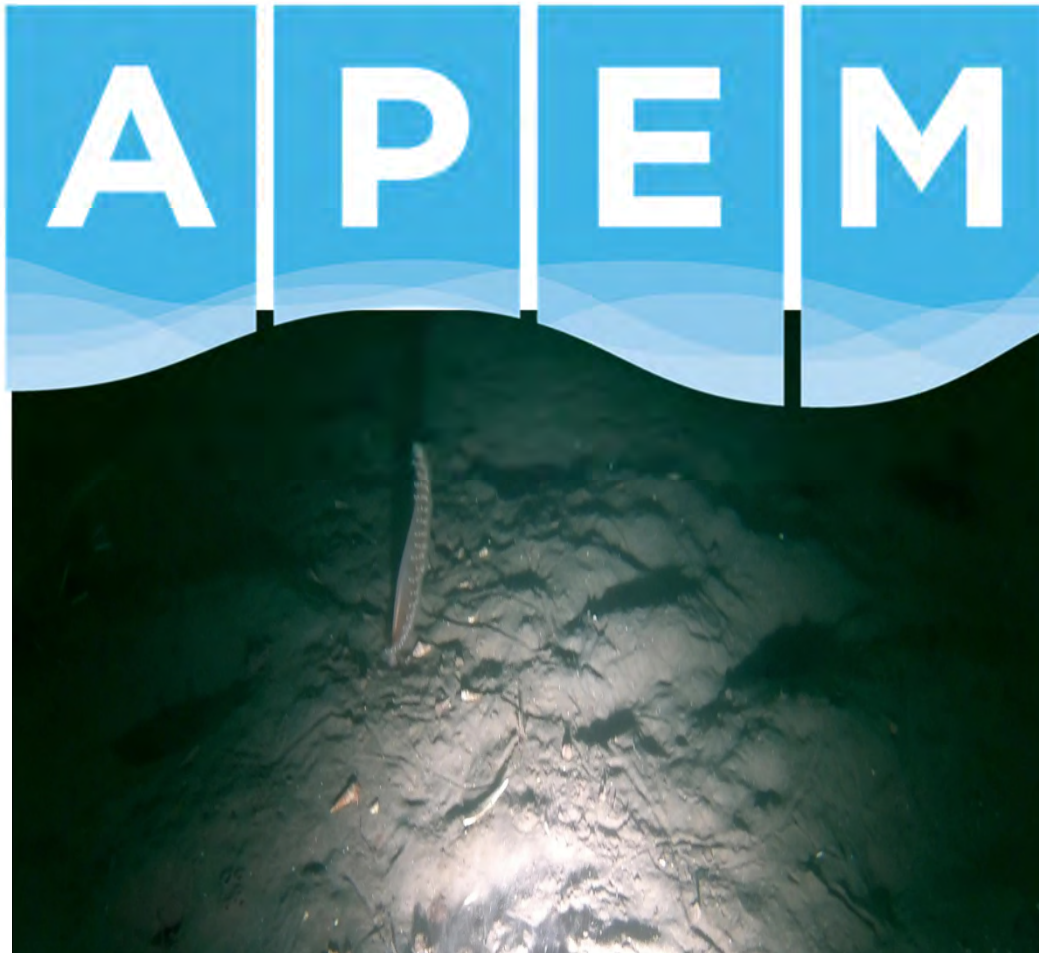
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|--------------|-------|------------|-------------------------------------|
| P290R0100 | 01 | 18/06/2021 | Initial writing and internal review |
| P290R0101 | - | 21/06/2021 | Issue to client |
| | | | |
| | | | |

| | |
|--|--|
| Originator's current report number | P290R0102 |
| Originator's name and location | F Midforth; Subacoustech Environmental Ltd. |
| Contract number and period covered | P290; June 2021 – June 2021 |
| Sponsor's name and location | Fiona Henderson; Affric Limited |
| Report classification and caveats in use | Unclassified |
| Date written | June 2021 |
| Pagination | Cover + i + 9 |
| References | |
| Report title | Underwater noise assessment for vibration piling at Ullapool |
| Translation/Conference details (if translation, give foreign title/if part of a conference, give conference particulars) | |
| Title classification | Unclassified |
| Author(s) | Fergus Midforth |
| Descriptors/keywords | |
| Abstract | |
| Abstract classification | Unclassified; Unlimited distribution |



Appendix 8 - Benthic Study



Ullapool Harbour Benthic Survey

Affric Ltd

APEM Ref: P00005494

March 2021

Client: Affric Ltd
Reference no: P00005494
Date of issue: March 2021

APEM contact: Dr Marc Hubble

APEM Ltd
Riverview
A17 Embankment Business Park
Heaton Mersey
Stockport
SK4 3GN

Tel: 0161 442 8938
Fax: 0161 432 6083

Registered in England No. 2530851

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Executive Summary

APEM was commissioned by Affric Limited to conduct a subtidal benthic survey to determine the presence of Priority Marine Features (PMFs) in the area intended for dredge disposal as part of Ullapool Harbour Trust's widening of Ullapool Shore Street. This subtidal survey was carried out to inform a Best Practice Environmental Option (BPEO) assessment to determine the most appropriate dredge disposal location.

A subtidal survey was carried out on 1st October 2020 using a Drop Down Video (DDV) system to obtain video and still images of the benthic environment to classify the habitats present. The DDV survey outputs were used to identify areas of the PMF 'Burrowed mud - sea pens and burrowing megafauna' (EUNIS A5.361) and other PMFs along transects in the spoil site. An additional transect was conducted along the north eastern side of the quay in Ullapool harbour to determine the habitats present which could potentially be subjected to dredging or other disturbance during the proposed works.

Within the spoil ground the following EUNIS habitats were recorded: 'Sublittoral mud' (EUNIS Code A5.3), 'Sea pens and burrowing megafauna' (A5.361), 'Circalittoral mixed sediments' (A5.44) and 'Circalittoral muddy sand' (A5.26).

The PMF feature 'Burrowed mud - Seapens and burrowing megafauna in circalittoral fine mud' (EUNIS A5.361) was limited to the north and east side of the spoil ground. In addition, a small patch of sea pens was found in the south west corner of the site, however, this patch was not representative of 'Sea pens and burrowing megafauna' as extensive cobbles and boulders were found through the patch on soft sediment and there was a lack of burrows and supporting megafauna characteristic of this habitat type.

Along the transect in the vicinity the harbour quay the habitat '*Laminaria saccharina*¹ and red seaweeds on infralittoral sediments' (EUNIS A5.521) was recorded. Although these species and sediments are indicators of the PMF 'Kelp and seaweed communities on sublittoral sediment' it should be noted that throughout the transect the habitat was considered to be of poor quality with extensive anthropogenic construction debris, litter and marina waste present. Consequently, it is not considered a good quality example of this potential PMF.

¹ *Laminaria saccharina* is now known as *Saccharina latissima*

1. Introduction

Ullapool Harbour Trust is intending to widen Ullapool's Shore Street and to develop a small boat harbour in the inner basin of Ullapool Harbour, which includes the installation of a new quay and pontoons, along with associated dredging activities. Dredging of the area is required to ensure the safe navigation and berthing of vessels operating within the facility. A Best Practice Environmental Option (BPEO) assessment is required to determine the most appropriate dredge disposal location. The nearest disposal ground to the dredge site is the Ullapool (Loch Broom) dredge spoil disposal site (HE050: 57.89250°N, -5.15665°E) and this will therefore be included in the BPEO assessment.

A previous data review indicated the presence of tall sea pens *Funiculina quadrangularis* within the spoil disposal ground which is located within the Wester Ross Nature Conservation Marine Protected Area (Moore *et al.* 2011). Previous surveys also determined the presence of several other species/habitat Priority Marine Features (PMFs) in the area (Moore *et al.* 2011).

A benthic survey was conducted to identify the habitats within the disposal ground and in the vicinity of the harbour quay to determine the presence and location of tall sea pens or other PMFs to inform the marine licence application. This report provides the results of the benthic survey conducted to inform the BPEO assessment and marine licencing.

2. Methodology

To determine the presence of PMFs within the dredge disposal site a Drop-Down Video (DDV) survey was conducted. The survey was designed to provide underwater video footage and still imagery to characterise the seabed features and habitats present on site.

Considering the PMFs historically present (which can be readily determined based on surface features and macrobenthos above the sediment surface) a broad scale visual assessment was deemed adequate to classify both habitat type and extent of potential PMFs within the spoil site. A previous survey of Loch Broom indicated that the PMFs tall sea pens *Funiculina quadrangularis*, 'Blue mussel *Mytilus edulis* beds on littoral mud' (EUNIS code: A2.721) and 'Kelp and seaweed communities on sublittoral sediment' (A5.5211) have been recorded in the vicinity of the Harbour and several others PMFs (Table 2) have been found within the Wester Ross MPA.

2.1.1 Survey location

To achieve full coverage and determine the extent of any PMFs, four intersecting transect line were proposed to locate and map the potential habitats within the spoil ground (Transects 1 to 4; Figure 1). In addition, while on site a further transect was completed to provide additional information for the eastern extent of the spoil ground (Transect 6).

A transect was also surveyed in the vicinity of the harbour quay as this area could be subjected to dredging or other disturbance during the proposed project works (Transect 5; Figure 1),

The coordinates of these transects are indicated in Table 1.

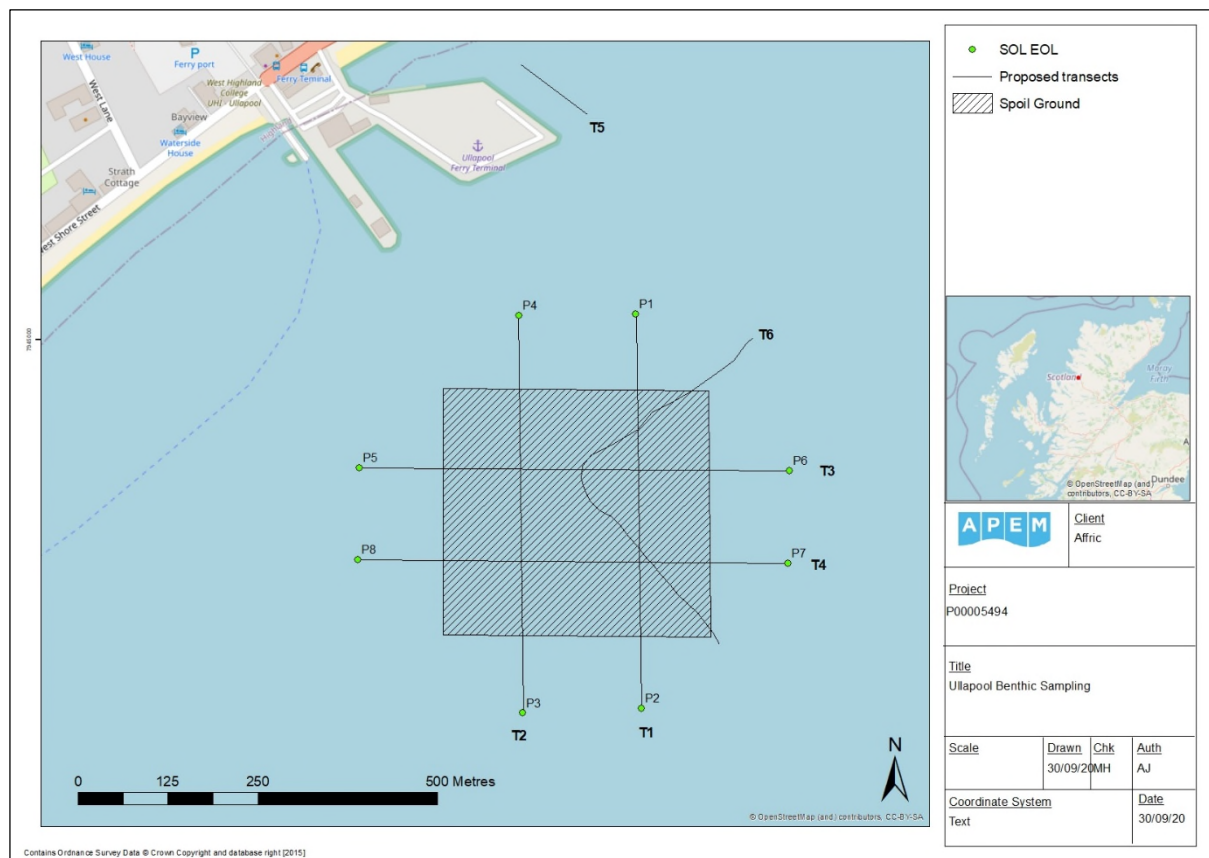


Figure 1. Map of transects locations

Table 1. Coordinates of the planned survey start and finish points for each transect.

| Transect | Coordinates | | | |
|-----------|-------------|-----------|-----------|-----------|
| | Start | | End | |
| | Latitude | Longitude | Latitude | Longitude |
| 1 (P2-P1) | 57.892101 | -5.159340 | 57.892101 | -5.153960 |
| 2 (P3-P4) | 57.892700 | -5.153940 | 57.892700 | -5.159320 |
| 3 (P6-P5) | 57.891102 | -5.157270 | 57.893799 | -5.157320 |
| 4 (P7-P8) | 57.891102 | -5.155790 | 57.893799 | -5.155870 |
| 5 | 57.536915 | -5.947600 | 57.537223 | -5.941470 |
| 6 | 57.536172 | -5.926343 | 57.534949 | -5.928900 |

2.1.2 Timing of surveys

Sampling was conducted on Thursday 1st October 2020, which provided a suitable weather window for vessel operation.

2.1.3 Survey vessel

For the DDV survey, APEM used the MV Skua based in Achiltibuie near Ullapool. The 10.5 m vessel is MCA Cat 2 coded and has conducted numerous DDV surveys in the area. The vessel frequently operates out of Ullapool harbour and operates within the Ullapool Harbour Trust Marine Operations Procedures².



Figure 2. The MV Skua operated in accordance with the Ullapool Harbour Trust Marine Operations Procedures

2.1.4 Survey methodology

The DDV system used was a Deep Trekker mk2 with full HD video which was combined with a Go Pro 7 to capture 2.7k video. Images were taken as *.jpg from the video stream in post-processing. Onboard the vessel the DDV footage was gathered using guidance produced as part of the Mapping European Seabed Habitats mapping project (MESH), (Coggan *et al.* 2007).

2.1.5 Onboard analysis of DDV footage

Initial interpretation of the footage was undertaken *in situ* to determine and record the extent of different habitats and abundance of species, with focus on the presence of habitats or species of conservation importance (e.g. PMFs as indicated in Table 2). Survey logs were

² <http://www.ullapool-harbour.co.uk/about-us/marine-operations-procedures/>

completed for each transect, detailing each drop of the camera equipment, with the following information recorded per deployment:

- Transect number;
- Date;
- Start time (24-hour format);
- Water depth;
- Tidal state;
- Sea surface conditions;
- Weather conditions;
- Seabed substrate;
- Any conspicuous fauna and presence/absence of PMFs.

In addition to the ship's position, separate GPS logs were also recorded for video overlay.

Table 2. List of PMFs identified in the Wester Ross MPA area during previous surveys (Moore *et al.* 2011). N/A = not applicable.

| Priority Marine Feature | PMF code | EUNIS code | JNCC code ³ |
|---|----------|------------------------------|---|
| Blue mussel beds - <i>Mytilus edulis</i> beds on littoral mud | ME | A2.721 | LS.LBR.LMus.Myt |
| Burrowed mud - Sea pens and burrowing megafauna in circalittoral fine mud | BM | A5.361 | SS.SMu.CFiMu.SpnMeg |
| Burrowed mud - Tall sea pen <i>Funiculina quadrangularis</i> | FQ | Found in A5.361 (as A5.3611) | Found in SS.SMu.CFiMu.SpnMeg as SS.SMu.CFiMu.SpnMeg.Fun |
| Flame shell beds - <i>Limaria hians</i> beds in tide-swept sublittoral muddy mixed sediment | FS | A5.434 | SS.SMx.IMx.Lim |
| Kelp and seaweed communities on sublittoral sediment | KS | A5.52 | SS.SMp.KSwSS |
| Northern feather star <i>Leptometra celtica</i> | LC | N/A | N/A |
| Ocean quahog <i>Arctica islandica</i> | AI | N/A | N/A |
| Horse mussel beds - <i>Modiolus modiolus</i> beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata | HM | A5.623 | SS.SBR.SMus.ModHAs |
| <i>Brissopsis lyrifera</i> and <i>Amphiura chiajei</i> in circalittoral mud | DM | Found in A5.363 | SS.SMu.CFiMu.BlyrAchi |

³ Code taken from Connor *et al.* 2004

2.1.6 Laboratory analysis

Detailed laboratory-based interpretation and analysis of habitats/species of conservation importance (including PMFs) were undertaken and observed taxa were identified to the lowest possible taxonomic level using relevant taxonomic keys and photographic guides (Hayward & Ryland 2017, MarLIN 2016). The laboratory review of digital stills and video footage was conducted to supplement notes recorded in the field.

High Definition (HD) video was reviewed by playing back footage in real time and paused every minute using a random start time (<1 minute into footage), in addition, the footage was also paused to record the position of any changes in species or substrate composition. Conspicuous species were counted for each substrate type and abundance was indicated in relation to the SACFOR (Superabundant, Abundant, Common, Frequent, Occasional, Rare) scale⁴.

The GPS track data for the transects were overlayed onto the video for ease of interpretation and the coordinates of the paused frames including the coordinates of any significant changes in species substrate were recorded from the video overlay to allow accurate spatial mapping of any habitats. These data were then imported into ArcGIS to delimit the habitats present along the GPS track. The GPS track and habitat data were then used to map habitat types along the transects in a GIS.

Once the transects had been mapped, areas of similar or the same habitat type were linked to form larger polygons. In areas with only one transect line to inform the mapping an appropriate estimation of the associated polygon was made based on available data. It was ensured that data from overlapping transects and the geographic distribution of the habitats all matched in the extent map, however, it should be noted the extent map for habitats within the spoil ground is an estimate based on data extrapolation and is purely illustrative.

3. Results

Within the spoil ground the following EUNIS habitats were recorded: 'Sublittoral mud' (EUNIS Code A5.3), 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361), 'Circalittoral mixed sediments' (A5.44) and 'Circalittoral muddy sand' (A5.26), (Figure 3).

The PMFs recorded within the spoil ground were 'Burrowed mud - Sea pens and burrowing megafauna in circalittoral fine mud' and 'Burrowed mud - tall sea pen *Funiculina quadrangularis*'. The PMF feature 'Burrowed mud - Sea pens and burrowing megafauna in circalittoral fine mud' (EUNIS A5.361) was limited to the north and east side of the spoil ground. In addition, a small patch of sea pens was found in the south west corner of the site, however, this patch was not representative of 'Burrowed mud - Sea pens and burrowing megafauna in circalittoral fine mud' as extensive cobbles and boulders were found through the patch on soft sediment and this area of habitat also lacked burrows or supporting megafauna.

⁴ <https://mhc.jncc.gov.uk/media/1009/sacfor.pdf>

The PMF 'Burrowed mud - tall sea pen *Funiculina quadrangularis*' was only recorded within some areas of the 'Burrowed mud - Sea pens and burrowing megafauna in circalittoral fine mud' PMF habitat, mainly restricted to the north eastern corner of the spoil ground in the first section of Transect 6.

An additional transect outside the spoil ground was also surveyed along the harbour quay wall. During this transect, the habitat '*Laminaria saccharina*⁵ and red seaweeds on infralittoral sediments' (EUNIS A5.521) was recorded. Although these species and sediments are indicators of the PMF 'Kelp and seaweed communities on sublittoral sediment' it should be noted that throughout the transect the habitat was considered to be of poor quality with extensive anthropogenic construction debris, litter and marina waste present. Consequently, it is not considered a good quality example of this potential PMF.

Detailed standard descriptions of each habitat recorded have been provided in Appendix 1 for reference (EEA 2020). The location of each habitat type and how representative each habitat was of the standard description is indicated below.

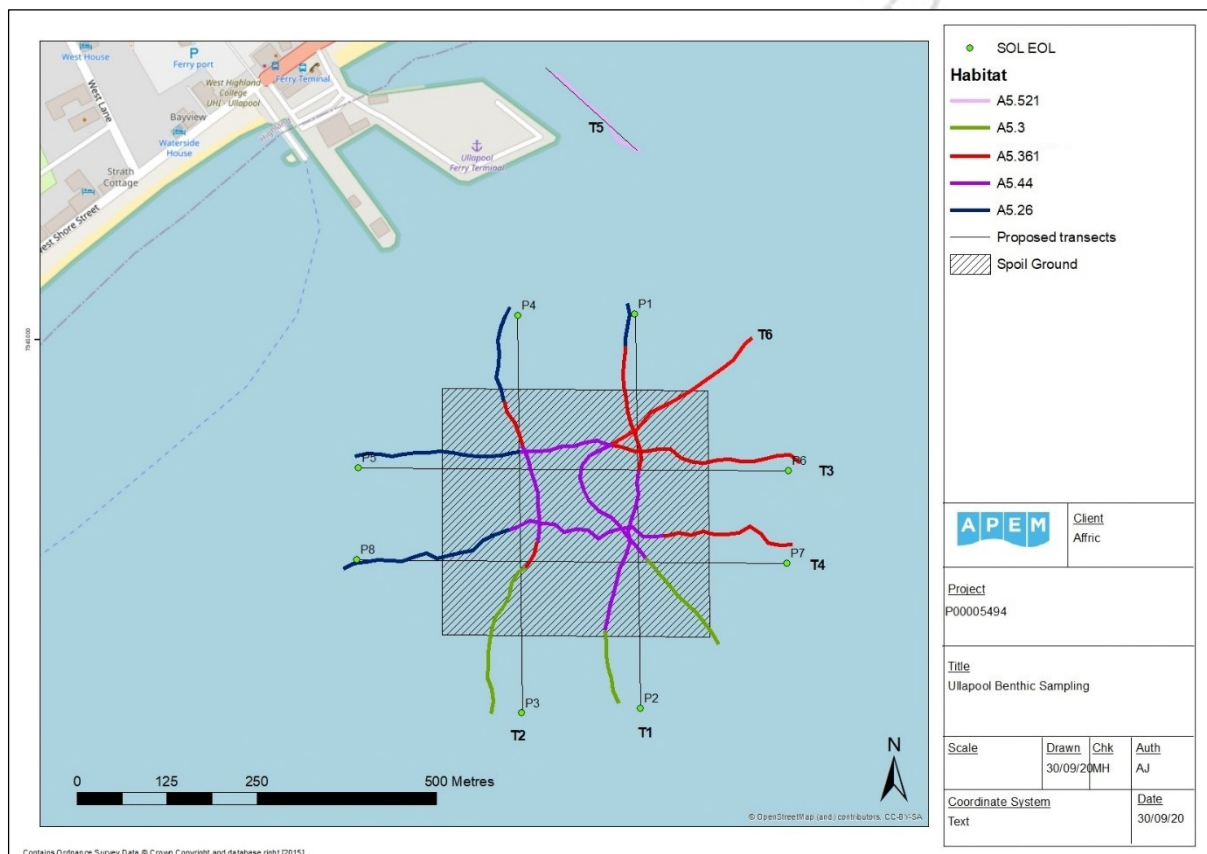


Figure 3. Map of GPS tracks and allocated habitats

⁵ *Laminaria saccharina* is now known as *Saccharina latissima*

3.1.1 Transect 1

Transect one was 571 m long and ran south to north with a depth ranging between 26 and 28m (**Error! Reference source not found.**3 & 4). The transect started with 103 m of 'Sublittoral mud' (EUNIS code A5.3) transitioning into 230 m of 'Circalittoral mixed sediment' (A5.44) which typified the habitat found in the central area of the spoil ground. This area had lots of anthropogenic debris and was littered with a mixture of substrate from dredge activities (cobbles, pebbles and boulders). The transect then passed through a large section (a distance of 177 m) of 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361) which is a PMF. This habitat was typical of the standard description with a high abundance of the phosphorescent sea pen *Pennatula phosphorea*, auger shell *Turritella communis*, Norway lobster *Nephrops norvegicus* and associated burrows. The final section of the transect consisted of 61 m of 'Circalittoral muddy sand' (A5.26) a muddy habitat with no sea pens.

3.1.2 Transect 2

Transect two was 602 m long and ran from south to north starting in approximately 28 m of water depth with the transect shallowing to 26 m toward the north of the transect (**Error! Reference source not found.**3 & 5). The first section of the transect was characterised by 'Sublittoral mud' (A5.3) which continued for 220 m, the habitat was littered with anthropogenic artefacts and debris. Shortly into the spoil ground, the transect passed through a mixed area of 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361) with elements of 'Circalittoral mixed sediment' (A5.44) (for a distance of approximately 40 m). This area was not representative of pristine A5.361 due to the poor quality of the habitat caused by what looked like dredge spoil on top of the 'Sea pens and burrowing megafauna in circalittoral fine mud' habitat (A5.361). As such, the habitat contained isolated sea pen and mud communities amongst the spoil and anthropogenic debris. This area lacked the auger shell *T. communis* and burrows that typify this habitat type.

The transect then passed through 137 m of 'Circalittoral mixed sediment' (A5.44) and what appeared to be the main spoil dumping ground which was characterised by the large cobbles and mixed sediment. The transect then passed over a section (a distance of 68 m) of the larger northern area of 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361). This area was typical of this habitat type with a high abundance of the phosphorescent sea pen, auger shell, Norway lobster and associated burrows. The transect transitioned into 137 m of 'Circalittoral muddy sands' (A5.26), a muddy habitat with no sea pens.

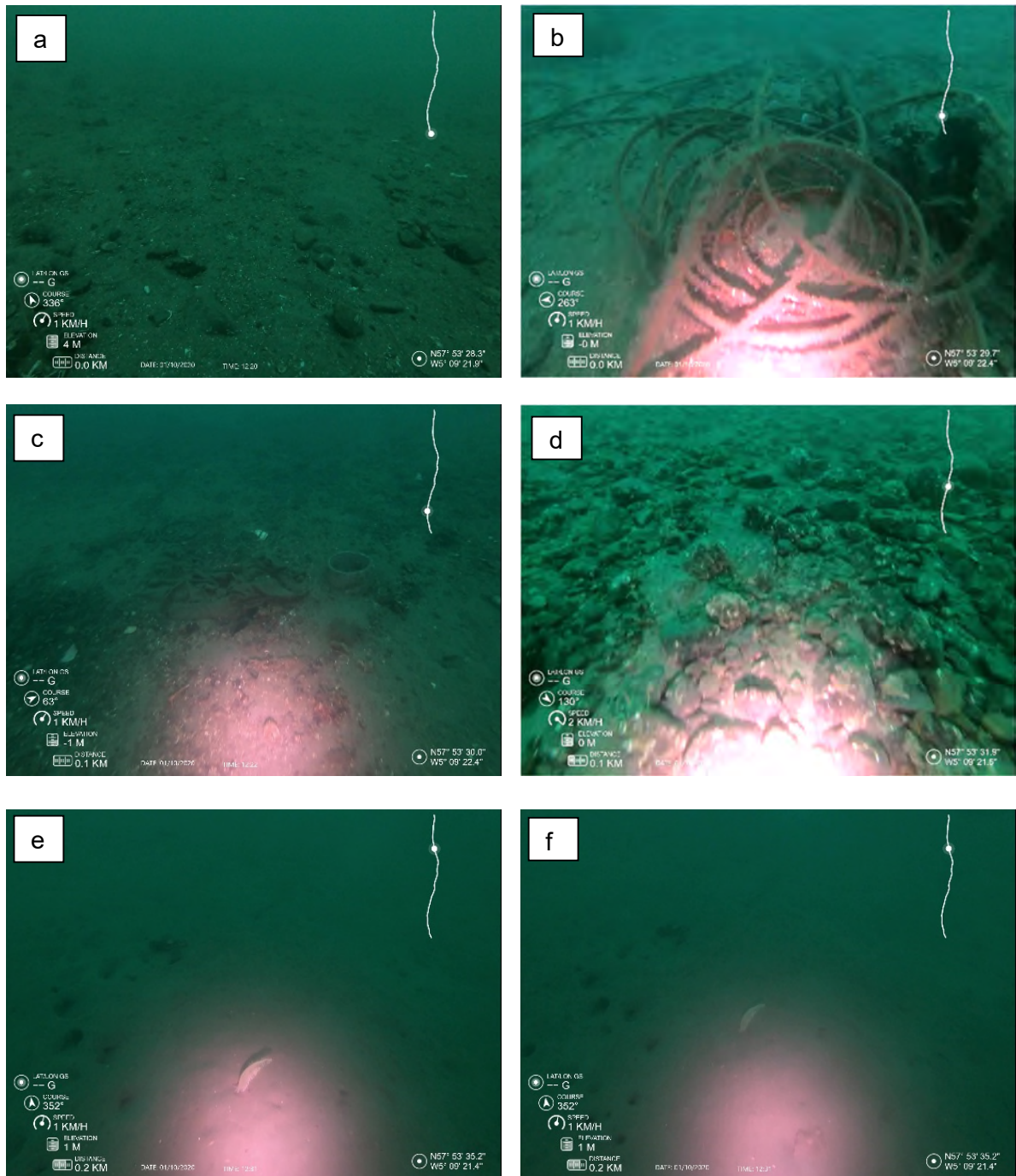


Figure 4. Transect 1 - Selection of representative seabed images. a) 'Sublittoral mud' EUNIS code (A5.3); b) anthropogenic debris; c) 'Circalittoral mixed sediment' (A5.44); d) dredge or spoil material; e) phosphorescent sea pen *Pennatula phosphorea*; f) 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361).

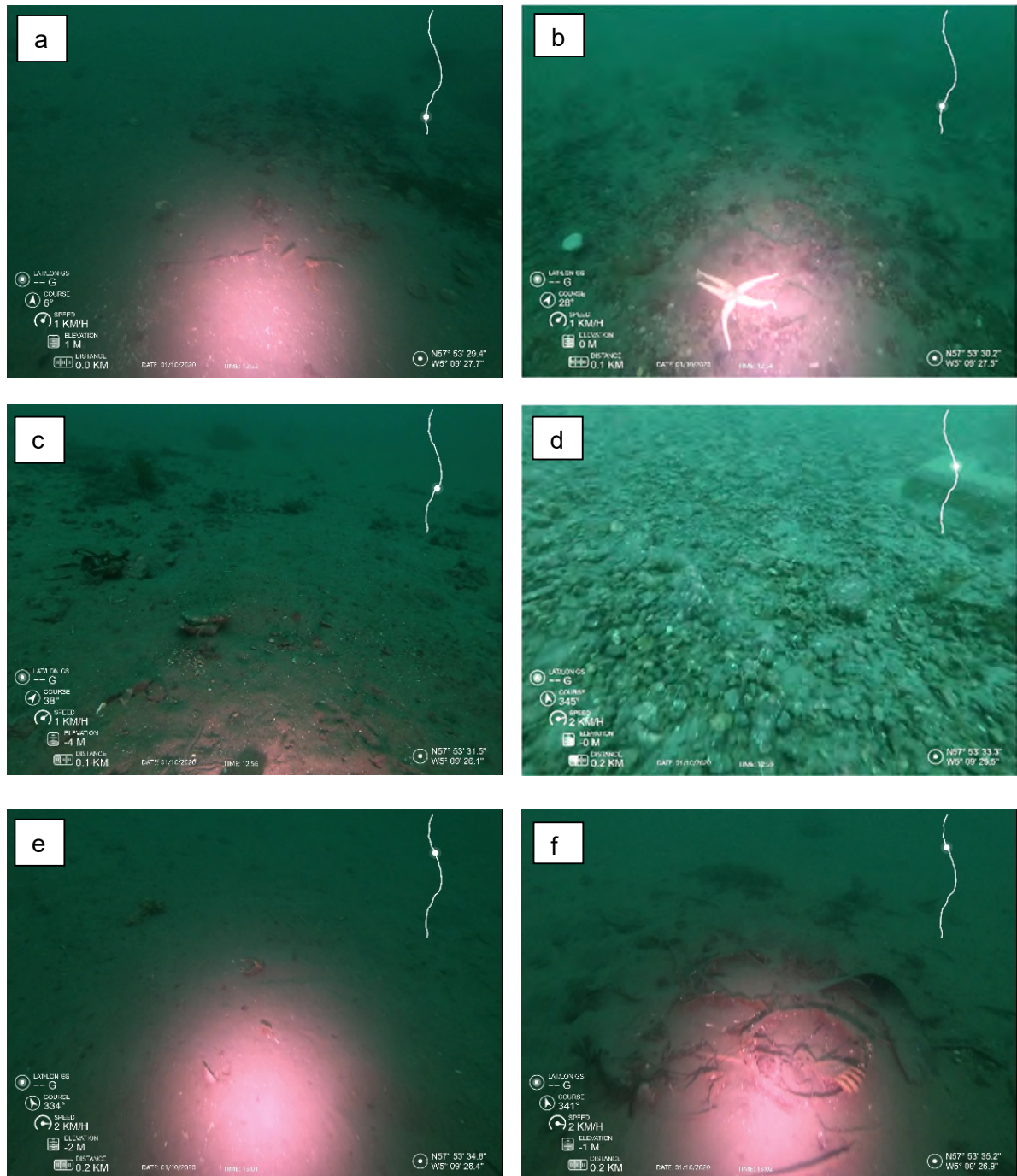


Figure 5. Transect 2 - Selection of representative seabed images. a) Sublittoral mud (A5.3); b) *Asterias rubens* on 'Circalittoral mixed sediment' (A5.44); c) Sea pens and burrowing megafauna in circalittoral fine mud (A5.361); d) Mixed substrate dredge or spoil material; e) phosphorescent sea pen *Pennatula phosphorea*; f) anthropogenic debris

3.1.3 Transect 3

Transect three was 638 m in length and ran from east to west (**Error! Reference source not found.**3 & 6). The transect started within the habitat 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361) which was characterised by phosphorescent sea pen, auger shell, Norway lobster and associated burrows. Despite being representative of the habitat the biotope was littered with rubbish and marine waste so was not in pristine condition. The A5.361 habitat extended for 272 m until entering the centre of the spoil ground at which point the habitat transitioned into 'Circalittoral mixed sediment' (A5.44) for 133 m. In common with the other transects, this habitat was heavily affected by anthropogenic waste and had high numbers of scavenger species such as common starfish and sea urchins. Once beyond the centre of the spoil ground the habitat transitioned into 'Circalittoral muddy sand' (A5.26) and continued for approximately 233 m until the end of the transect.

3.1.4 Transect 4

Transect four was 678 m in length and ran from east to west **Error! Reference source not found.** The habitat on this transect was very similar to that on Transect 3 starting within 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361) habitat which is a PMF. The habitat had a high abundance of phosphorescent sea pen, auger shell, Norway lobster and associated burrows. Despite being representative of the habitat the biotope was littered with rubbish and marine waste. This habitat extended for 194 m until entering the centre of the spoil ground at which point the habitat transitioned into 'Circalittoral mixed sediment' (A5.44) for 237 m. As with the other transects this habitat was heavily affected by anthropogenic waste and there were high numbers of individuals of scavenger species. Once out of the centre block of the spoil ground the habitat transitioned to 'Circalittoral muddy sand' A5.26 and extended for approximately 247 m until the end of the transect.

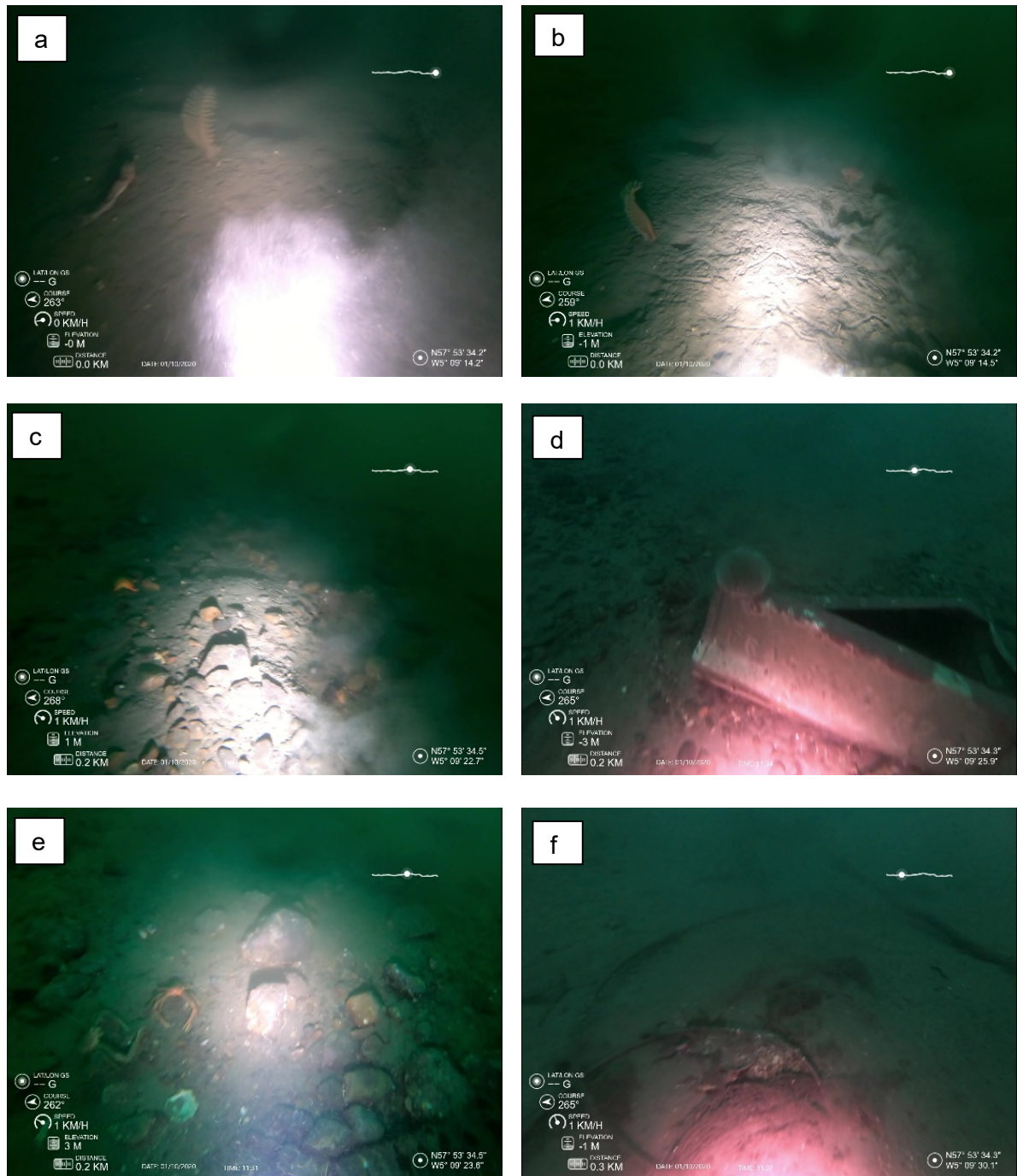


Figure 6. Transect 3 - Selection of representative seabed images. a-b) Sea pens and burrowing megafauna in cirralittoral fine mud (A5.361); c-f) Mixed substrate dredge or spoil material

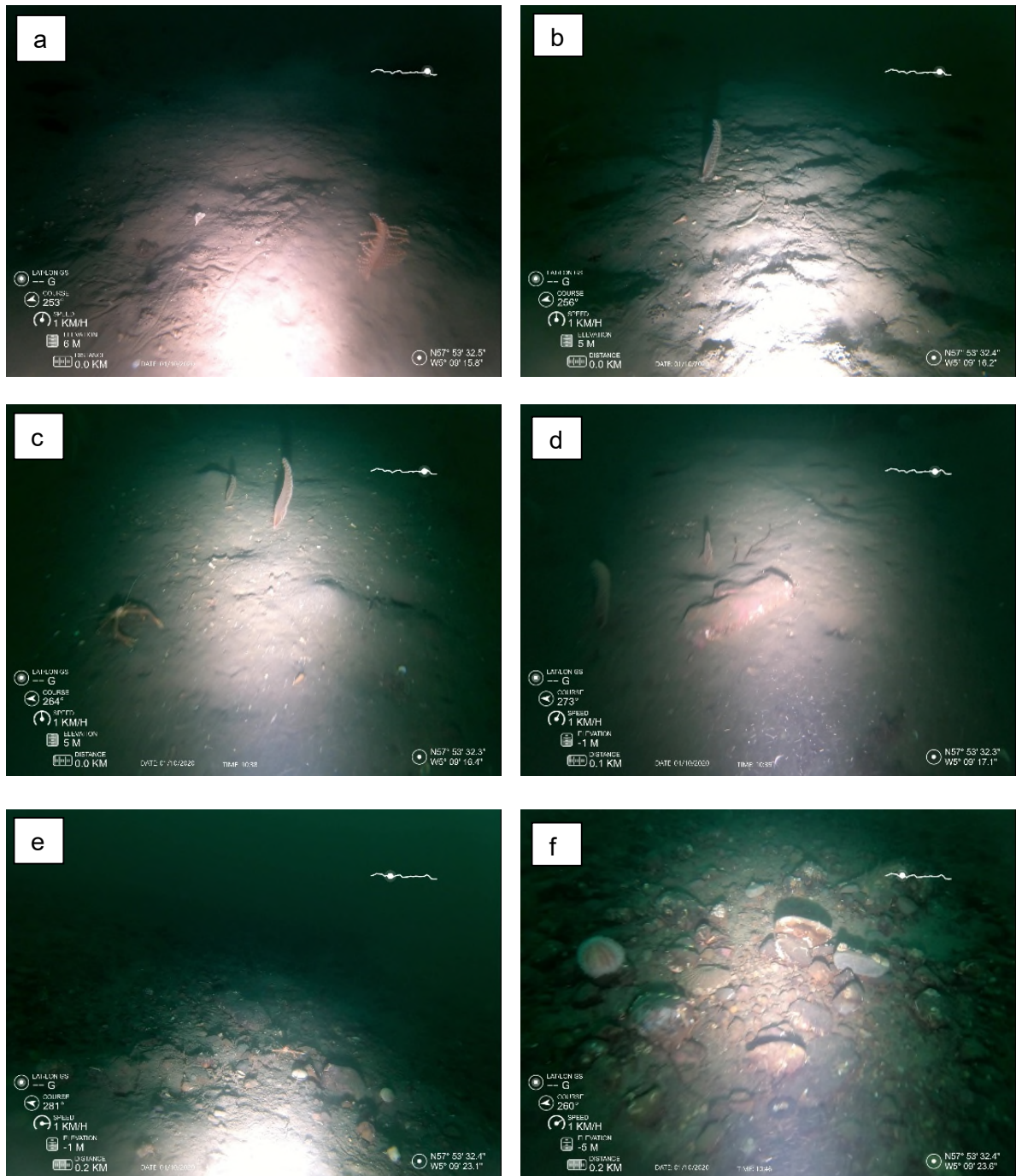


Figure 7. Transect 4 - Selection of representative seabed images. a-d) Sea pens and burrowing megafauna in circalittoral fine mud (A5.361); e-f) Mixed substrate dredge or spoil material

3.1.5 Transect 6

Transect 5 is described below as it was conducted in the vicinity of the harbour quay and Transect 6 is first described here as it was in the spoil ground, supplementing data collected on Transects 1-4.

Transect 6 was run ad hoc while on site to provide further data to determine the extent of the northern spoil ground sea pen habitat and as such, it was run in a semicircle, from the north east corner to centre and back out to the south east corner (Figure 3). The transect was 625 m long and conducted at 28m water depth. The transect started within the habitat 'Sea pens and burrowing megafauna in circalittoral fine mud' (A5.361) which extended for 249 m and consistent with Transects 3 and 4 it was typical of this habitat with a high abundance of phosphorescent sea pen, auger shell, Norway lobster and associated burrows. In addition, the slender sea pen *Funiculina quadrangularis* which is a PMF feature in itself was recorded in this transect (where present this represents the habitat type 'Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud' (A5.3611)).

Towards the centre of the transect 'Circalittoral mixed sediment' (A5.44) was present for a distance of 218 m and in common with all the other transects there was extensive anthropogenic waste. As the transect exited the spoil ground it transitioned into 'Sublittoral mud' (A5.3) for 158 m until the end of the transect.

3.1.6 Transect 5

Transect five was run south east to north west along the Ullapool harbour jetty at a water depth of 5 m and extended for 170 m (**Error! Reference source not found.**3 & 9). The entirety of the 170 m transect was characterised by the alga *Saccharina latissima* (previously call *Laminaria saccharina*) and was allocated the habitat type '*Laminaria saccharina* and red seaweeds on infralittoral sediments' (EUNIS A5.521)

Although '*Laminaria saccharina* and red seaweeds on infralittoral sediments' is a representative habitat type of the PMF 'Kelp and seaweed communities on sublittoral sediment', due to its proximity to the harbour it was heavily fouled with anthropogenic refuse and was considered to be of poor quality.

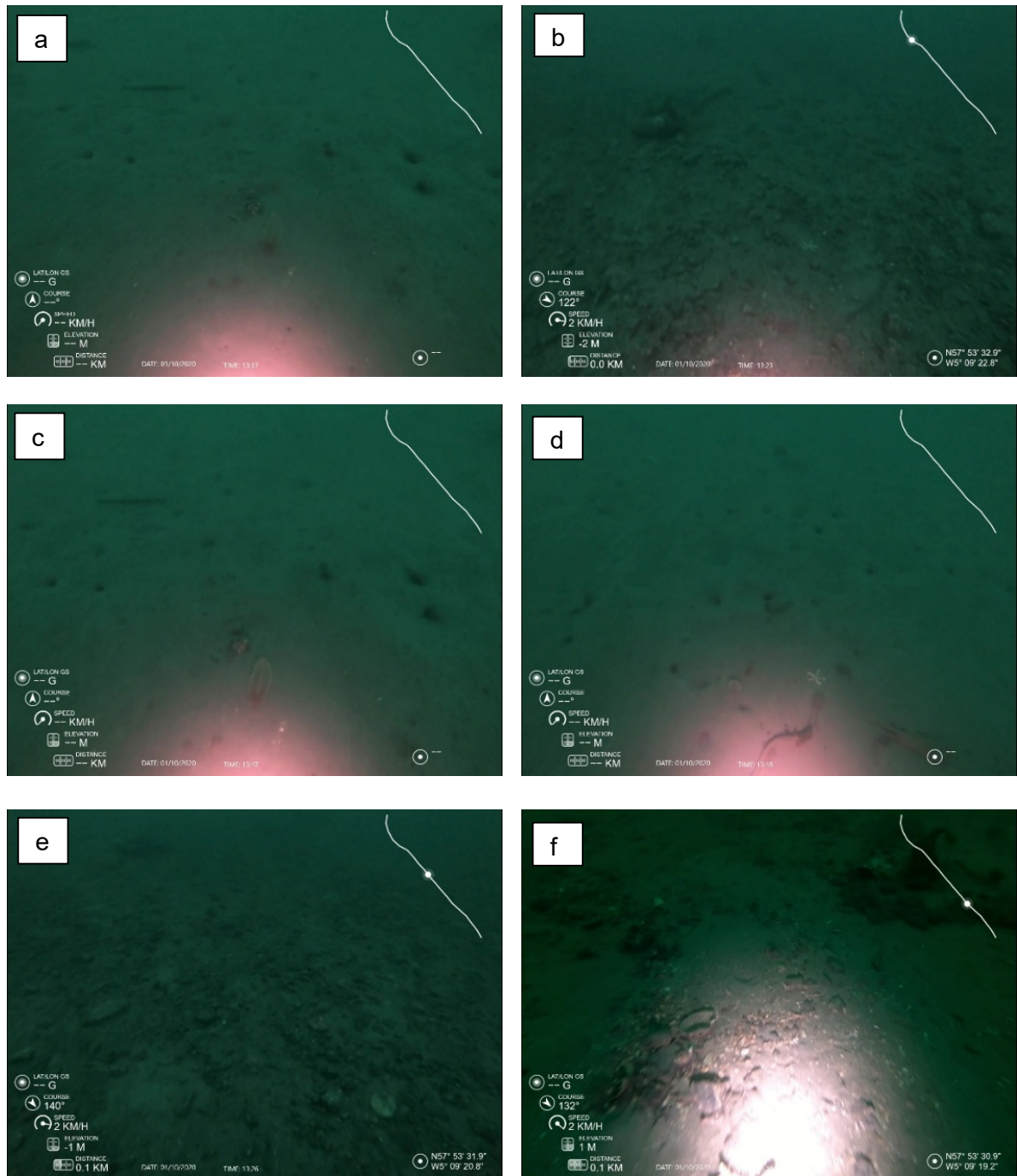


Figure 8. Transect 6 - Selection of representative seabed images. a-d) Sea pens and burrowing megafauna in circalittoral fine mud (A5.361) e-f) Mixed substrate dredge or spoil material

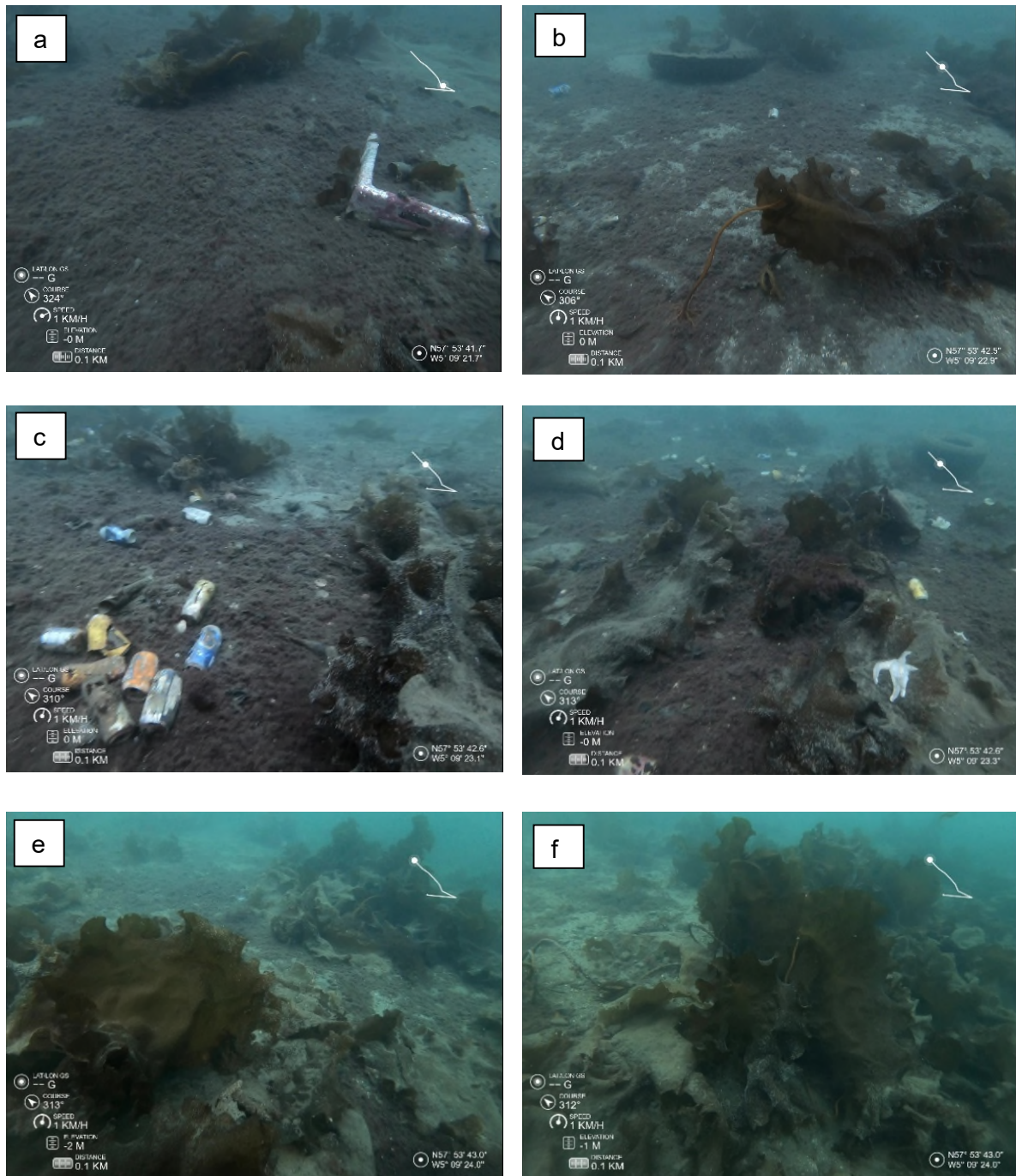


Figure 9. Transect 5 - Selection of representative seabed images. a-d) *Saccharina latissima* and red algal turf with anthropogenic waste; e-f) Dense area of *Saccharina latissima* and red algal turf closer to shore in shallow water.

3.1.7 Transect summary

A summary of the total length of broadscale habitat encountered on each transect is detailed in the table below (Table 3. Total length of each habitat type per transect and the corresponding habitat descriptions are provided in Appendix 1.

Table 3. Total length of each habitat type per transect

| Transect | Habitat type | Length (m) |
|--------------|--------------|------------|
| T1 | A5.3 | 104 |
| | A5.361 | 177 |
| | A5.44 | 230 |
| | A5.26 | 61 |
| Total length | | 573 |
| T2 | A5.3 | 221 |
| | A5.361 | 108 |
| | A5.44 | 137 |
| | A5.26 | 137 |
| Total length | | 603 |
| T3 | A5.361 | 272 |
| | A5.44 | 133 |
| | A5.26 | 233 |
| Total length | | 638 |
| T4 | A5.361 | 194 |
| | A5.44 | 237 |
| | A5.26 | 247 |
| Total length | | 678 |
| T5 | A5.521 | 170 |
| Total length | | 170 |
| T6 | A5.3 | 158 |
| | A5.361 | 249 |
| | A5.44 | 218 |
| Total length | | 625 |
| Total | | 3286 |

3.1.8 Broadscale habitat map

Based on the extent of habitat types along transects the estimated geographic distribution of the habitats are provided in **Figure 10** and the estimated area of each habitat type is provided in Table 4. It should be noted that these areas are based on extrapolation of data and are indicative only.

Table 4. Estimated area of different habitat types within the spoil ground.

| Habitat | EUNIS code | Estimated area (m ²) |
|--|--------------|----------------------------------|
| Sublittoral mud | A5.3 | 29,395 |
| Sea pens and burrowing megafauna in circalittoral fine mud | A5.361 | 33,448 |
| Circalittoral mixed sediment | A5.44 | 36,510 |
| Mosaic of Circalittoral mixed sediment/ Sea pens and burrowing megafauna in circalittoral fine mud | A5.44/A5.361 | 1,284 |
| Circalittoral muddy sand | A5.26 | 26,429 |

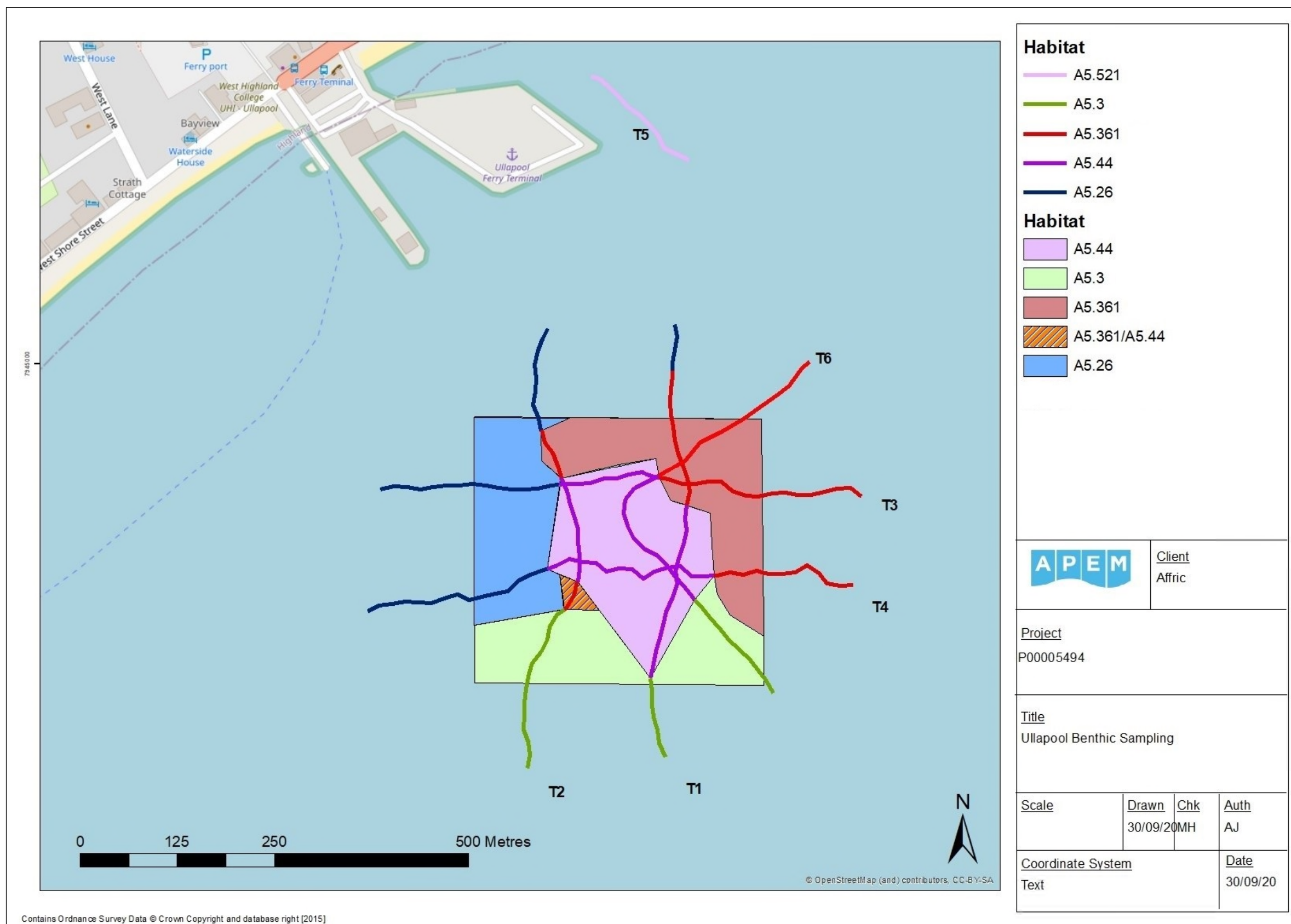


Figure 10. Estimated habitat extent map based on extrapolation of transect habitat data

4. Summary

APEM conducted a subtidal benthic survey to determine the presence of PMFs in Ullapool Harbour spoil ground and in the vicinity of the harbour quay. The survey was carried out on 1st October 2020 using a Drop Down Video (DDV) system to classify the habitats present. A total of six transects were surveyed with five crossing the spoil ground and one adjacent to the harbour quay.

Within the spoil ground the following EUNIS habitats were recorded: 'Sublittoral mud' (EUNIS Code A5.3), 'Sea pens and burrowing megafauna' (A5.361), 'Circalittoral mixed sediments' (A5.44) and 'Circalittoral muddy sand' (A5.26). In total, the survey covered 483 m of A5.3, 1000 m of A5.361, 955 m of A5.44 and 678 m of A5.26. Transect data were extrapolated to provide indicative estimates of habitat extent in the spoil ground as follows: 29,395 m² of 'Sublittoral mud' (A5.3), 33,448 m² of 'Sea pens and burrowing megafauna' (A5.361), 36,510 m² of 'Circalittoral mixed sediment' (A5.44) and 26,429 m² of 'Circalittoral muddy sand' (A5.26).

All habitats within the transects had extensive signs of anthropogenic impacts that included commercial and dredge waste, anthropogenic debris and litter.

Within the spoil ground, the PMF feature 'Burrowed mud - Sea pens and burrowing megafauna' (EUNIS A5.361) was recorded in the north and east sections. In addition, a small patch of sea pens was found in the south west corner of the site, however, this patch was not representative of 'Burrowed mud - Sea pens and burrowing megafauna' as extensive cobbles and boulders were found through the patch on soft sediment and there was a lack of burrows and supporting megafauna characteristic of this habitat type.

The PMF 'Burrowed mud - tall sea pen *Funiculina quadrangularis*' was also recorded within some areas of the 'Burrowed mud - Sea pens and burrowing megafauna' PMF habitat. This species was found in the north eastern corner of the spoil ground within the first section of Transect 6.

Adjacent to the harbour quay the habitat '*Laminaria saccharina* and red seaweeds on infralittoral sediments' A5.5211 was recorded which extended for 170 m. This habitat is representative of the PMF 'Kelp and seaweed communities on sublittoral sediment'. It was noted, however, that this habitat was of poor quality with extensive anthropogenic construction debris, litter and marina waste present. Consequently, it is not considered to be a good quality example of this potential PMF.

References

Coggan R., Mitchell A., White J. & Golding N. 2007. Recommended operating guidelines (ROG) for underwater video and photographic imaging techniques. MESH Project Available from: http://www.emodnet-seabedhabitats.eu/pdf/GMHM3_Video_ROG.pdf

Connor D. W., Allen J. H., Golding N., Howell K. L., Lieberknecht L. M., Northen K.O. & Reker, J.B. 2004. The National Marine Habitat Classification for Britain and Ireland. Version 04.05. Peterborough: Joint Nature Conservation Committee. ISBN: 1 861 07561 8 (internet version).

EEA (European Environment Agency). 2020. EUNIS habitat descriptions <https://eunis.eea.europa.eu/habitats-code-browser.jsp>

EUNIS, 2019 Laminaria saccharina and red seaweeds on infralittoral sediments. Accessed on 21/10/2020. Available from:

Hayward, P.J. & Ryland, J.S. eds. 2017. Handbook of the marine fauna of North-West Europe. Oxford University Press

Hill J. M., Tyler-Walters H. & Garrard S. L. 2020. Seapens and burrowing megafauna in circalittoral fine mud. In Tayler-Walters H. and Hiscoll K. (eds) Marine life Information Network: Biology and Sensitivity Key Information Reviews, [On-line]. Plymouth: Marine Biology Association of the United Kingdom. Accessed on: 21/10/2020. Available from <https://www.marlin.ac.uk/habitat/detail/131>

MarLIN (Marine Life Information Network), 2016. Marine Life Information Network. Plymouth: Marine Biological Association of the United Kingdom. [On-line]. Accessed on 21/10/20. Available from: www.marlin.ac.uk

Moore C. Harries D. B., Trigg C., Porter J. S. & Lyndon A. R. 2011. The distribution of Priority Marine Features and MPA search features within the Ullapool Approaches: a broadscale validation survey. Scottish Natural Heritage Commissioned Report No. 422.

Appendix 1

4.1.1 Standard EUNIS Habitat descriptions

Within the survey area a range of broad scale EUNIS habitats, were recorded and details of each habitat type are provided below from the EUNIS website (EEA 2020).

4.1.2 Sea pens and burrowing megafauna in circalittoral fine mud (A5.361)

This habitat is defined by plains of fine mud at depths greater than about 15m and maybe heavily bioturbated by burrowing megafauna. Burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of sea pens, typically Slender sea pens *Virgularia mirabilis* and phosphorescent sea pens *Pennatula phosphorea*. The habitat is known for species including: common starfish *Asterias rubens*, silky mudlark *Brissopsis lyrifera*, basket shell *Crobia gibba*, harbour crab *Liocarcinus depurator*, Norway lobster *Nephrops norvegicus*, *Nucula sulcata*, serpent's table brittlestar *Ophiura albida*, and *Ophiura ophiura* (Hill *et al.* 2020). Sea pens and burrowing megafauna in circalittoral fine mud is included in a Resolution 4 habitat type at a higher level (A5) under the Bern Convention.

4.1.3 Circalittoral sandy mud (A5.3)

Sublittoral mud and cohesive sandy mud extending from the extreme lower shore to offshore, circalittoral habitats. This biotope is predominantly found in sheltered harbours, sea lochs, bays, marine inlets and estuaries and stable deeper/offshore areas where the reduced influence of wave action and/or tidal streams allow fine sediments to settle. Such habitats are often by dominated by polychaetes and echinoderms, in particular brittle stars such as *Amphiura* spp. Sea pens such as *Virgularia mirabilis* and burrowing megafauna including *Nephrops norvegicus* are common in deeper muds. Estuarine muds tend to be characterised by infaunal polychaetes and oligochaetes.

4.1.4 Circalittoral mixed sediment (A5.44)

Circalittoral mixed sediment is a mixed, heterogeneous, sediment habitat in the circalittoral zone including well mixed muddy gravelly sands or very poorly sorted mosaics of shells, cobbles and pebbles embedded in or laying upon mud, sand or gravel. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones such as *Cerianthus lloydii* are often present in such habitat and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia* spp and *Hydrallmania falcata*. Circalittoral mixed sediment is included in a Resolution 4 habitat type at a higher level (A5) under the Bern Convention.

4.1.5 Circalittoral muddy sand (A5.26)

Circalittoral muddy sands with the silt content of the substratum typically ranging from 5% to 20%. This habitat is generally found in water depths of over 15-20m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves such as *Abra alba* and *Nucula nitidosa*, and echinoderms such as *Amphiura* spp and *Ophiura* spp., and

Astropecten irregularis. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community.

4.1.6 *Laminaria saccharina* and red seaweeds on infralittoral sediments (A5.521)

This habitat is characterised by communities of the kelp *Laminaria saccharina* on infralittoral mixed muddy substrata and mixed filamentous and foliose red algae can also be found. This biotope contains a number of sub-biotopes distinguished by the degree of either wave or tidal exposure.

COMMERCIAL IN CONFIDENCE

Appendix 2

| DDV Log | Date | weather | wind | depth | Sediment description | Start | | End | | Species | | | | | | | | |
|---------|----------|------------------|----------|-------|----------------------------|-------------|------------|-------------|------------|-----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| | | | | | | N | W | N | W | <i>Echinus esculentus</i> | <i>Nephrops norvegicus</i> | <i>Hydroids</i> | <i>Henricia oculata</i> | <i>Pectinida</i> | <i>Marthasterias gacialis</i> | <i>Burrows</i> | <i>Pennatula phosphorea</i> | <i>Asterias rubens</i> |
| T1 | 01/10/20 | sunny | calm 1-2 | 28 | Sublittoral mixed sediment | 57 53 28.3 | 5 09 21.9 | 57 53 30.0 | 09 22.4 | A | A | O | F | F | F | C | | F |
| | | | | 28 | Sublittoral mixed sediment | 57 53 30.0 | 09 22.4 | 57 53 33.9 | 05 09 20.9 | | | | | | | | | |
| | | | | 28 | Mud | 57 53 33.9 | 05 09 20.9 | 57 53 35 | 05 09 21.3 | A | A | F | F | | | | | |
| | | | | 28 | Mud | 57 53 35 | 05 09 21.3 | 57 53 36.8 | 5 09 21.5 | C | C | | | | F | A | | |
| | | | | 28 | Sublittoral mixed sediment | 57 53 36.8 | 5 09 21.5 | 57 53 37.7 | 5 09 21.4 | F | C | F | | | | C | O | R |
| T2 | 01/10/20 | sunny | calm 1-2 | 26 | | | | | | <i>Pennatula phosphorea</i> | <i>Nephrops norvegicus</i> | <i>Burrows</i> | <i>Turritella communis</i> | <i>Asteria rubens</i> | <i>Echinus esculentus</i> | <i>Pectinida</i> | <i>Marthasterias gacialis</i> | |
| | | | | 26 | Mud/ shell and gravel | 57 53 28.1 | 05 09 27.5 | 57 53 30.2 | 5 09 27.5 | | C | | A | | F | | F | |
| | | | | 26 | Sublittoral mixed sediment | 57 53 30.2 | 5 09 27.5 | 57 53 31.5 | 5 09 26 | | C | | | | C | | C | |
| | | | | 26 | Mud | 57 53 31.5 | 5 09 26 | 57 53 32.1 | 05 09 25.5 | F | C | | A | | | | | |
| | | | | 26 | Sublittoral mixed sediment | 57 53 32.1 | 05 09 25.5 | 57 53 34.1 | 5 09 .25.9 | | C | | | C | | F | F | |
| | | | | 26 | Mud and shell | 57 53 34.1 | 5 09 .25.9 | 57 53 35.5 | 5 0927.0 | O | C | F | | | | | | |
| | | | | 26 | Mixed | 57 53 35.5 | 5 0927.0 | 57 53 37.6 | 5 09 26.8 | | | | | | | R | | |
| T3 | 01/10/20 | overcast raining | calm 1-2 | 29 | | | | | | <i>Pennatula phosphorea</i> | <i>Gurnard</i> | <i>Nephrops norvegicus</i> | <i>Burrows</i> | <i>Turritella communis</i> | <i>Asteria rubens</i> | <i>Echinus esculentus</i> | <i>Henrica oculata</i> | <i>Marthasterias gacialis</i> |
| | | | | 29 | Mud | 57 53 34.2 | 5 09 14.2 | 57 53 34.1 | 5 09 17.3 | C | R | O | C | S | R | | | |
| | | | | 29 | Mud | 57 53 34.1 | 5 09 17.3 | 57 53 34.4 | 05 09 22.1 | C | R | R | C | A | R | | | |
| | | | | 29 | Sublittoral mixed sediment | 57 53 34.4 | 05 09 22.1 | 57 53 34 .5 | 05 09 22.7 | | | | | | | | | |
| | | | | 29 | Sublittoral mixed sediment | 57 53 34 .5 | 05 09 22.7 | 57 53 34 .3 | 05 09 26.3 | | | F | | | | C | | |
| | | | | 29 | Mud/shell | 57 53 34 .3 | 05 09 26.3 | 57 53 34.2 | 5 09 34.4 | | | C | F | | O | C | R | F |
| T4 | 01/10/20 | overcast raining | calm 1-2 | 28 | | | | | | <i>Pennatula phosphorea</i> | <i>Nephrops norvegicus</i> | <i>Burrows</i> | <i>Turritella communis</i> | <i>Echinus esculentus</i> | <i>Stalked anemone</i> | <i>Inarchus sp</i> | | |
| | | | | 28 | Mud and shell pebble | 57 53 32.3 | 5 09 17.7 | 57 53 32.3 | 05 09 19.8 | C | C | C | A | | O | | | |
| | | | | 28 | Sublittoral mixed sediment | 57 53 32.3 | 05 09 19.8 | 57 53 32.4 | | C | C | | A | F | | O | | |
| T5 | 01/10/20 | overcast raining | calm 1-2 | 5 | | | | | | <i>Laminaria saccharina</i> | <i>Hermit crab</i> | <i>Urchin</i> | <i>Scallop</i> | <i>Gold sinny</i> | <i>Algal turf</i> | <i>Marthasterias gacialis</i> | <i>Sea cucumber</i> | <i>Ciona intestinalis</i> |
| | | | | 5 | Mud sand | 57 53 41.6 | 5 06 21.5 | 57 53 42.9 | 05 09 23.8 | C | R | R | R | R | S | R | | |
| | | | | 5 | Kelp | 57 53 42.9 | 05 09 23.8 | 57 53 43.1 | 05 09 24.1 | | | | | | | | O | O |
| T6 | 01/10/20 | sunny | calm 1-2 | | | | | | | <i>Nephrops norvegicus</i> | <i>Burrows</i> | <i>Turritella communis</i> | <i>Slender sea pen</i> | <i>Echinus esculentus</i> | <i>Virgularia mirabilis</i> | <i>Echinus esculentus</i> | | |
| | | | | | Mud | 57 53 37.0 | 5°9'15.8 | 57°53'34.57 | 05 09 22.0 | C | C | A | | | O | | | |
| | | | | 28 | Sublittoral mixed sediment | 57 53 34.5 | 5 9 22.0 | 57 53 33.5 | 05 09 20.3 | C | | | | A | | | | |
| | | | | | Mud sand | 57 53 33.5 | 05 09 20.3 | 57 53 29.7 | 50 9 17.2 | C | | | | | | o | | |





Drawings

Registered Office:
Lochview Office, Loch Duntelchaig
Farr, Inverness, IV2 6AW

Telephone: 01808 521 498
Email: info@affriclimited.co.uk
www.affriclimited.co.uk

Title: Ullapool Location 63.01.01

Projection: OSGB 1936/British National
Grid EPSG: 27700

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Rev No: 1

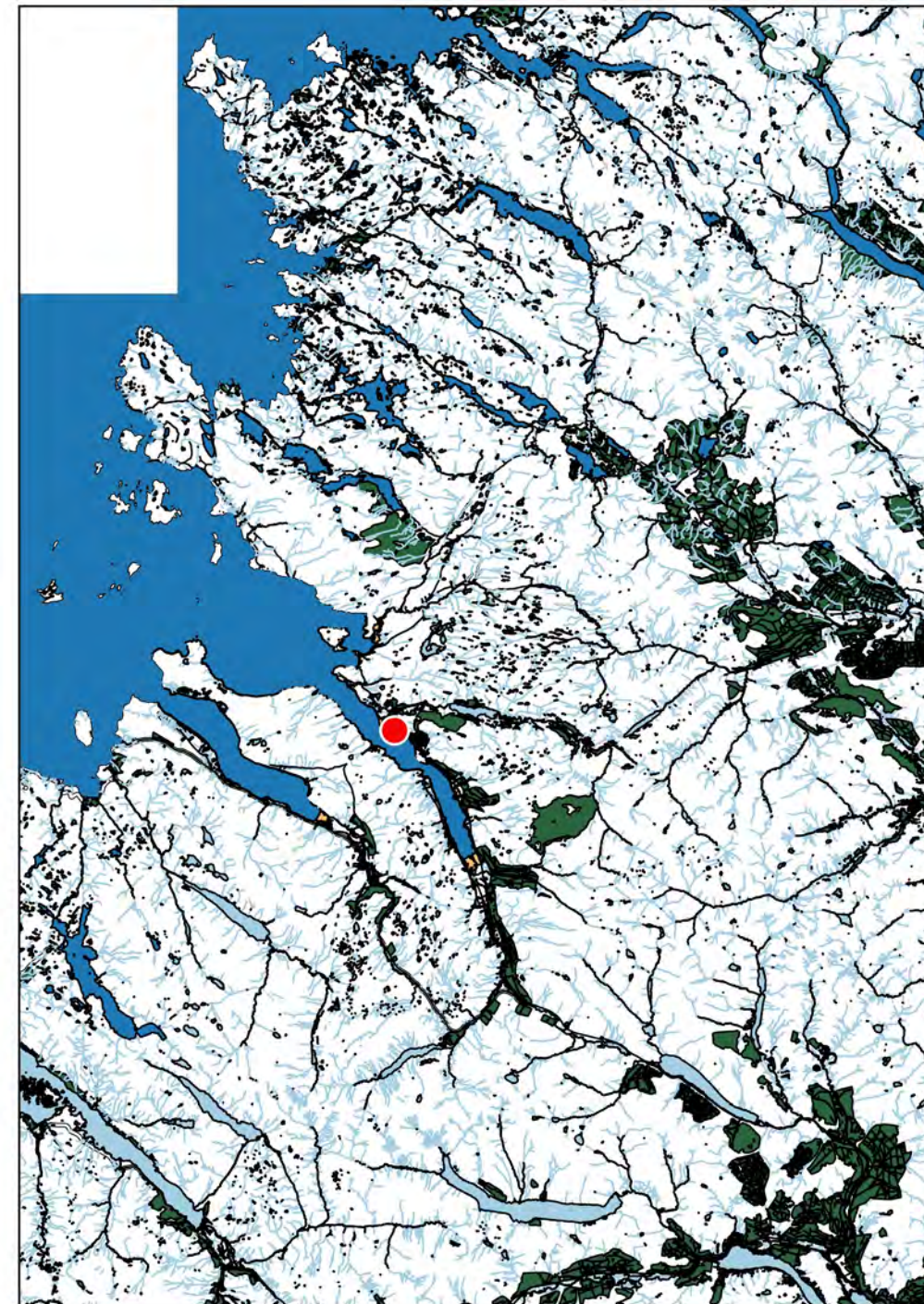
Drawing Date:
07/02/2020

Legend

- Ullapool
- Foreshore
- Fresh water
- Tidal Water
- Woodland



0 5 10 15 20 25 30 km



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Lochview Office, Loch Duntelchaig
Farr, Inverness, IV2 6AW

Telephone: 01808 521 498
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Title: 63.01.04 Ullapool, Shore Street
Location

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|--------|-----------|-----------------------------|
| Page 1 | Rev No: 1 | Drawing Date: 21/06/2021 |
|--------|-----------|-----------------------------|

Legend

- A835 & A893
- Foreshore
- Tidal Water



0 200 400 600 800 1,000 m





- NOTES
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
 2. ALL CONTOURS AND LEVELS ARE IN METRES RELATIVE TO CHART DATUM.
 3. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
 4. MHWS +5.2mCD
MLWS +0.7mCD

| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |
|-----|------|---------|-------|-------|-------|
| | | | | | |

AMENDMENTS

CLIENT
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PROJECT
ULLAPOOL SMALL BOAT
PONTON EXTENSION

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

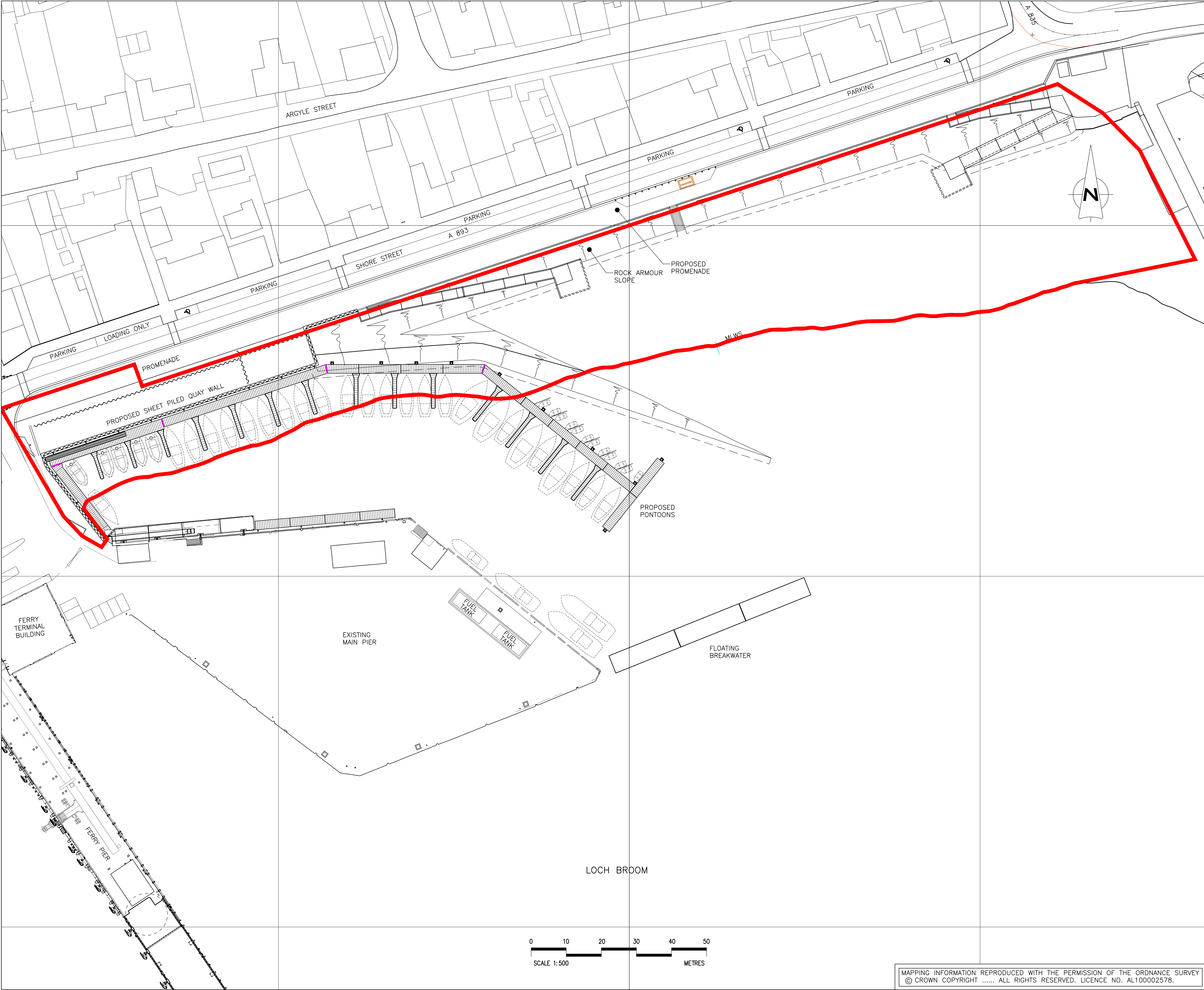
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01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE
EXISTING LAYOUT

| | | |
|------------------|------------------|------------------|
| DRAWN JHG | CHECKED TR | APPROVED TR |
| DATE 21.06.19 | DATE 06.06.19 | DATE 06.06.19 |

| | |
|---------------------|----------------------|
| SCALE (A1) 1:500 | STAGE INFORMATION |
| REVISION | |

| | |
|---------------------|--------------------|
| PROJECT No. 2127 | DRAWING No. 901 |
|---------------------|--------------------|



GENERAL NOTES

- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
- ALL CONTOURS AND LEVELS ARE IN METRES RELATIVE TO CHART DATUM.
- CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
- MHWS +5.2mCD
MLWS +0.7mCD
- BERTHS PROVIDED 42 TOTAL.
- NORTHERN EDGE OF PLANNING BOUNDARY IS TAKEN FROM THE LIMIT OF PERMITTED DEVELOPMENT AREA INDICATED ON THE PLAN CONTAINED WITHIN THE SHORE STREET, ULLAPOOL, TRUNKING ORDER, 1979. SOUTHERN EDGE OF PLANNING BOUNDARY INDICATED IS THE CURRENT LINE OF MLWS.

LEGEND:

WORKS BOUNDARY 12,765m²
PLANNING CONSENT

| | | | | | |
|-----|----------|--|-------|-------|-------|
| D | 14.09.21 | PLANNING BOUNDARY REVISED | PM | TR | TR |
| C | 25.06.21 | PLANNING BOUNDARY REVISED | PM | TR | TR |
| B | 09.06.21 | PLATFORMS REVISED | PM | TR | TR |
| A | 30.04.21 | PROMENADE REVISED, PLATFORM ADDED AT EAST RAMP | PM | TR | TR |
| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |

AMENDMENTS

CLIENT

ULLAPOOL HARBOUR TRUST

PROJECT

ULLAPOOL SHORE STREET & INNER HARBOUR IMPROVEMENTS

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE

PROPOSED PONTOONS AND PROMENADE DEVELOPMENT PLANNING BOUNDARY

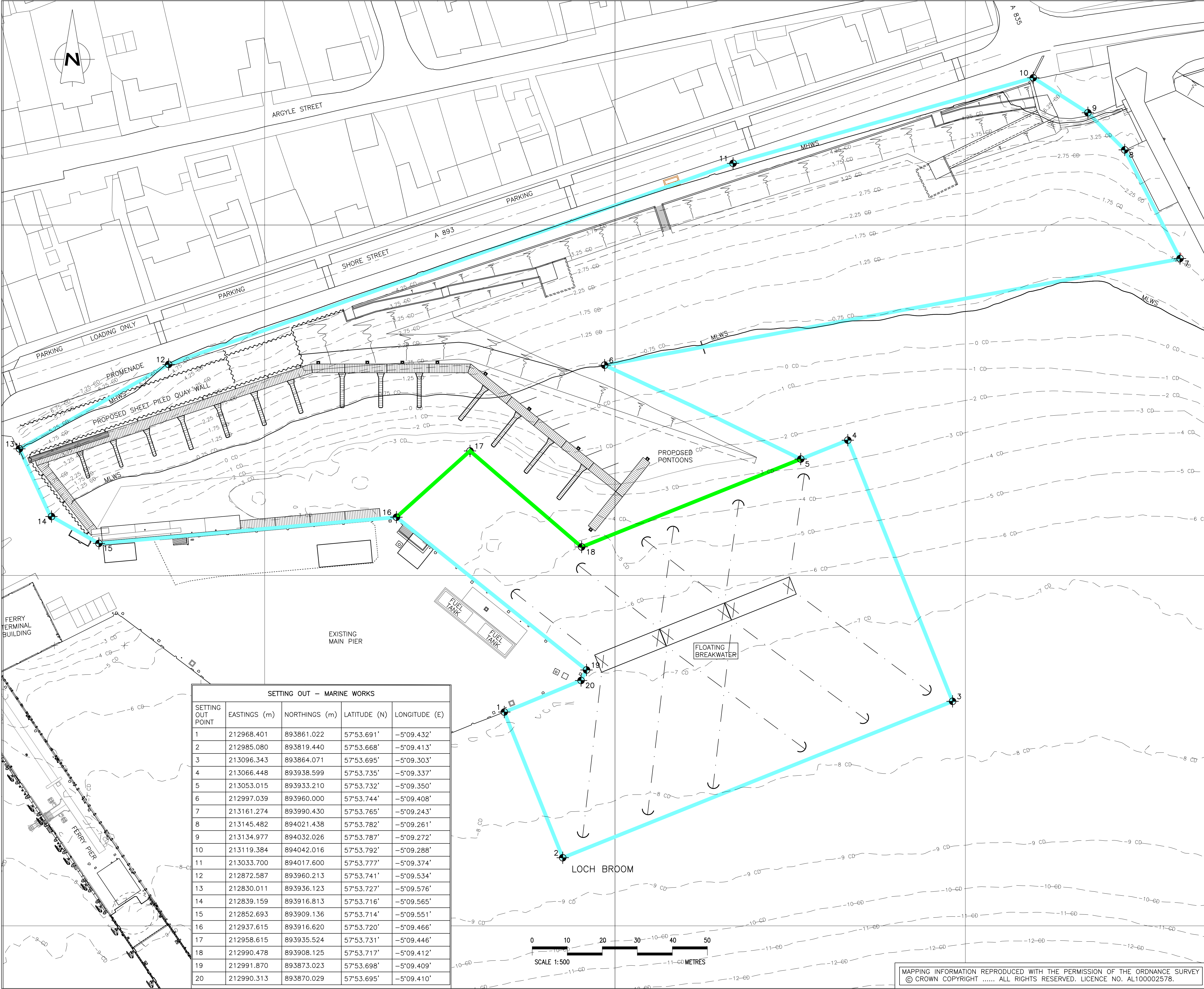
| | | |
|----------|----------|----------|
| DRAWN | CHECKED | APPROVED |
| PM | TR | TR |
| DATE | DATE | DATE |
| 27.04.21 | 28.04.21 | 28.04.21 |

| | |
|----------------------|----------|
| SCALE (A1) | STAGE |
| 1:500 (1:1000 AT A3) | CONSENTS |

| | | | | | | | | | | | |
|----------|---|---|---|---|--|--|--|--|--|--|--|
| REVISION | A | B | C | D | | | | | | | |
|----------|---|---|---|---|--|--|--|--|--|--|--|

| | |
|-------------|-------------|
| PROJECT No. | DRAWING No. |
| 2127 | 951 |

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GENERAL NOTES

- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
- ALL LEVELS ARE IN METRES AND RELATIVE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
- CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
- MHWS +5.2
MLWS +0.7

LEGEND

WORKS BOUNDARY

MARINE CONSENT

OUTER EDGE OF DREDGE

| | | | | | |
|-----|----------|--|-------|-------|-------|
| F | 07.07.21 | SOP 06 COORDINATES REVISED | JM | TR | TR |
| E | 23.06.21 | SOP'S 6, 7 & 8 REVISED | LS | TR | TR |
| D | 18.06.21 | LATITUDE AND LONGITUDE DECIMAL PLACES AMENDED | PM | TR | TR |
| C | 17.06.21 | BOUNDARY AMENDED | LS | TR | TR |
| B | 09.06.21 | PLATFORMS REVISED | PM | TR | TR |
| A | 30.04.21 | PROMENADE REVISED, PLATFORM ADDED AT EAST RAMP | PM | TR | TR |
| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |

AMENDMENTS

CLIENT

ULLAPOOL HARBOUR TRUST

PROJECT

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Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE

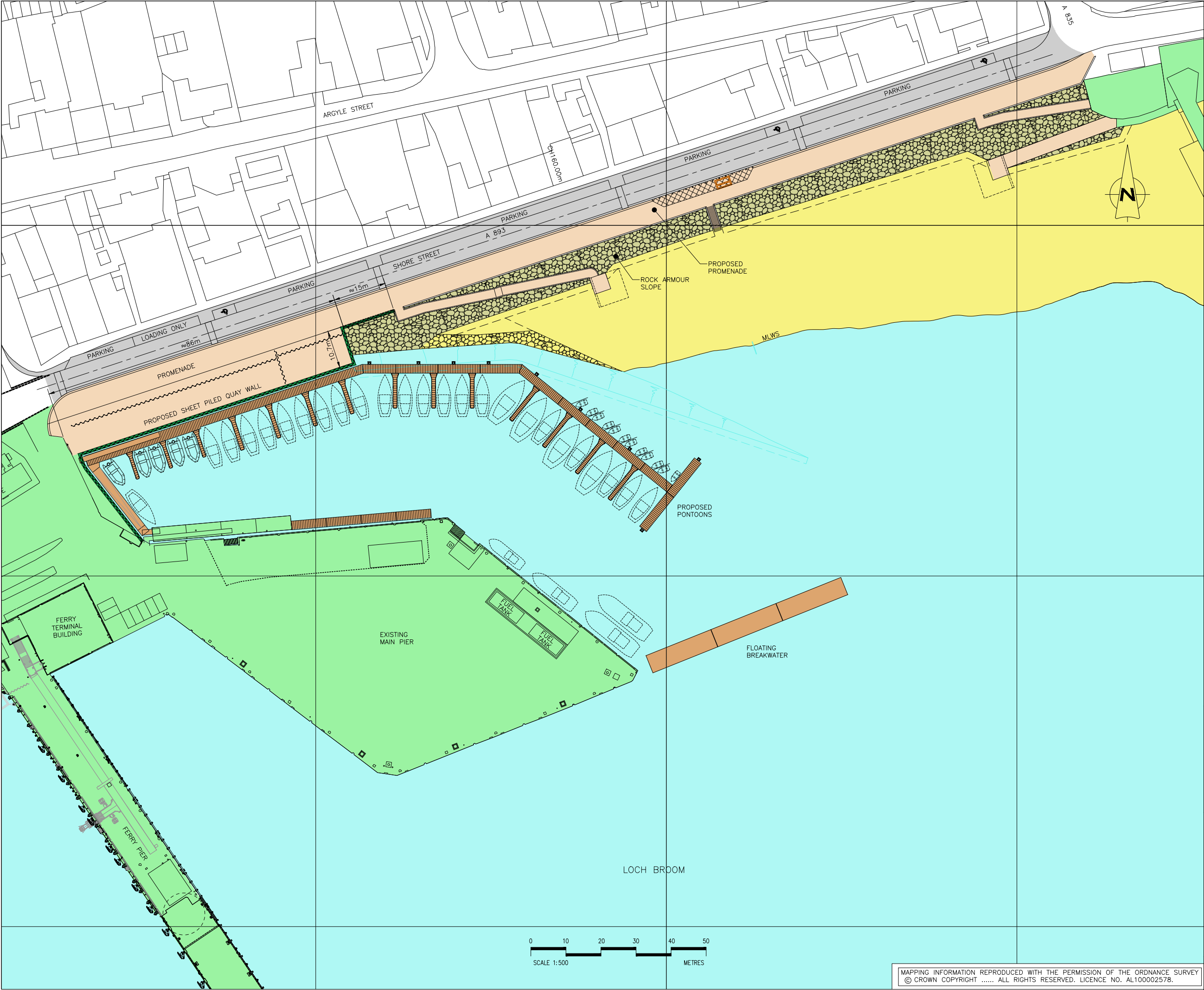
PROPOSED PONTOONS AND PROMENADE DEVELOPMENT AREA BOUNDARIES

| | | | | | |
|-------|----------|---------|----------|----------|----------|
| DRAWN | PM | CHECKED | TR | APPROVED | TR |
| DATE | 27.04.21 | DATE | 28.04.21 | DATE | 28.04.21 |

| | | | | | | |
|------------|----------------------|-------|----------|---|---|---|
| SCALE (A1) | 1:500 (1:1000 AT A3) | STAGE | CONSENTS | | | |
| REVISION | A | B | C | D | E | F |

| | | | |
|-------------|------|-------------|-----|
| PROJECT No. | 2127 | DRAWING No. | 952 |
|-------------|------|-------------|-----|

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GENERAL NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALL CONTOURS AND LEVELS ARE IN METRES RELATIVE TO CHART DATUM.
3. CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
4. MHWS +5.2mCD
MLWS +0.7mCD
5. BERTHS PROVIDED 42 TOTAL.

| No BERTHS | FINGER LENGTH (m) | BERTH LENGTH (m) |
|-----------|-------------------|------------------|
| 1 | 20 | 25 |
| 9 | 12 | 15 |
| 15 | 10 | 12 |
| 5 | 8 | 10 |
| 12 | 5 | 5 |

LEGEND:

- BELOW MLWS
- FORESHORE
- ROCK ARMOUR SLOPE
- PROPOSED PROMENADE
- PROPOSED PONTOONS
- SHORE STREET
- EXISTING HARBOUR AREA

| | | | | | |
|-----|----------|--|-------|-------|-------|
| J | 25.05.21 | SHEET PILED QUAY, PONTOON LAYOUT AND WEST RAMP REVISED | PM | TR | TR |
| H | 19.05.21 | CROSSING POINTS REVISED | PM | EC | EC |
| G | 30.04.21 | PROMENADE WIDTH INCREASED, ROCK ARMOUR BENCH REMOVED | PM | TR | TR |
| F | 26.04.21 | EAST RAMP REVISED, PROMENADE LINE REVISED | PM | TR | TR |
| E | 03.03.21 | TEXT REVISED | PM | EC | EC |
| D | 02.03.21 | PARKING SPACES REVISED | PM | EC | TR |
| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |

AMENDMENTS

CLIENT

ULLAPOOL HARBOUR TRUST

PROJECT

ULLAPOOL SHORE STREET & INNER HARBOUR IMPROVEMENTS

Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
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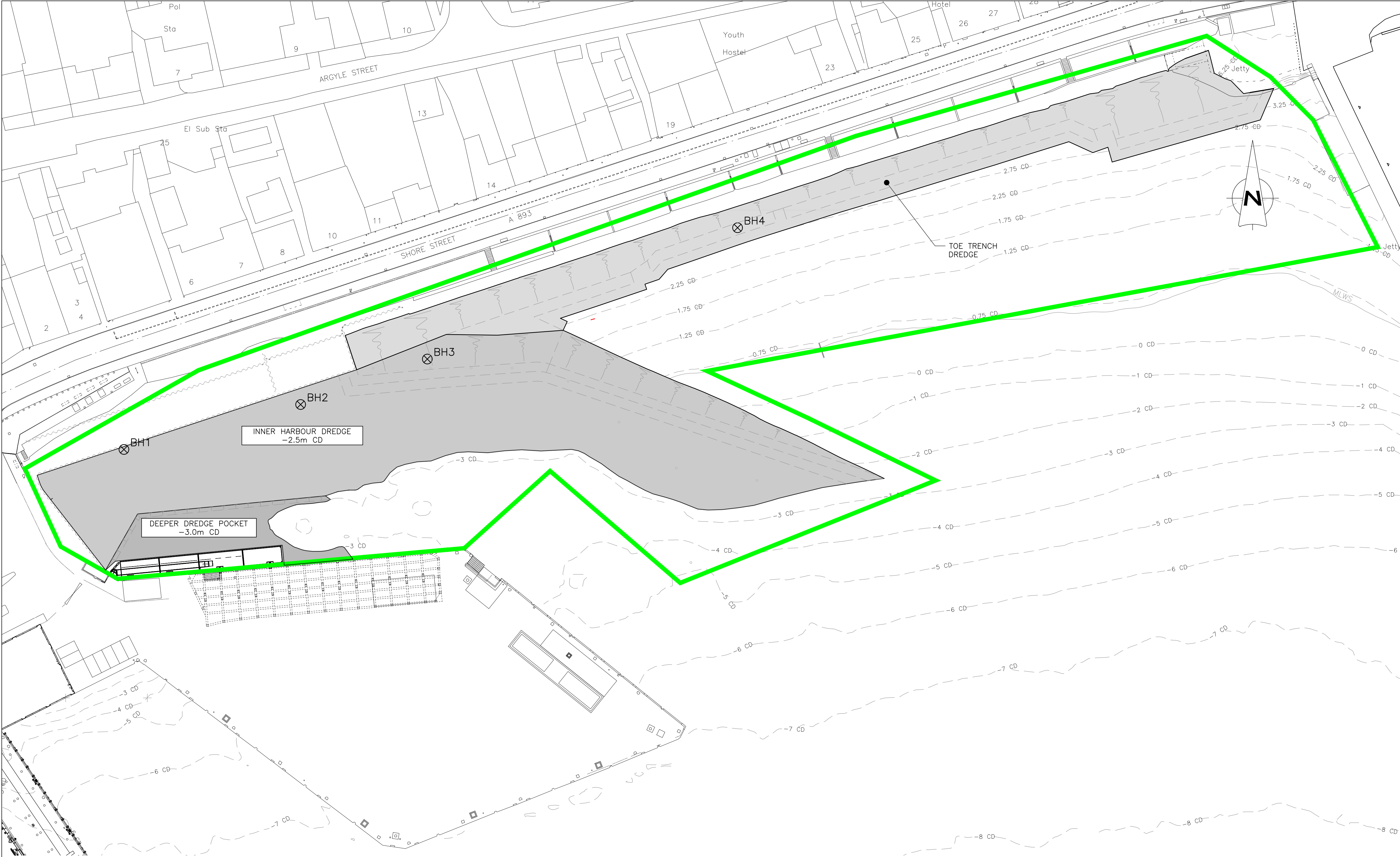
DRAWING TITLE

PROPOSED LAYOUT

| | | | | | | | | | |
|------------|----------|-------------------|----------|----------|----------|---|---|---|---|
| DRAWN | PM | CHECKED | TR | APPROVED | TR | | | | |
| DATE | 02.02.21 | DATE | 02.02.21 | DATE | 02.02.21 | | | | |
| SCALE (A1) | 1:500 | STAGE PRELIMINARY | | | | | | | |
| REVISION | A | B | C | D | E | F | G | H | J |

| | | | |
|-------------|------|-------------|-----|
| PROJECT No. | 2127 | DRAWING No. | 911 |
|-------------|------|-------------|-----|

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GENERAL NOTES

- ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
- CHART DATUM IS 2.75m BELOW ORDNANCE DATUM.
- TIDE LEVELS ARE AS BELOW:
MHWS +5.2m CD
MLWS +0.7m CD
- REFER TO DRAWING NUMBER 2127-952 FOR FULL DETAILS OF MARINE CONSENTS BOUNDARIES.

LEGEND:

- BH1 - BOREHOLES
- DREDGE LICENCE BOUNDARY
- TOE TRENCH DREDGE
- INNER HARBOUR DREDGE
- DEEPER DREDGE POCKET

| | | | | | |
|-----|----------|--|-------|-------|-------|
| | | | | | |
| C | 25.06.21 | BOUNDARY REVISED | PM | TR | TR |
| B | 23.06.21 | CONTOURS REVISED TO CD | LS | TR | TR |
| A | 18.06.21 | DREDGE LICENCE BOUNDARY ADDED, SHADING ADDED | PM | TR | TR |
| REV | DATE | DETAILS | DRAWN | CHK'D | APP'D |

AMENDMENTS

CLIENT

ULLAPOOL HARBOUR TRUST

PROJECT

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Wallace Stone
Consulting Civil Engineers

GLASGOW
0141 554 8233
glasgow@wallacestone.co.uk

DINGWALL
01349 866775
dingwall@wallacestone.co.uk

HEBRIDES
01851 612454
hebrides@wallacestone.co.uk

DRAWING TITLE

PROPOSED DREDGE LAYOUT

| | | |
|--------|----------|----------|
| DRAWN | CHECKED | APPROVED |
| PM | TR | TR |
| DATE | DATE | DATE |
| JUN 21 | 18.06.21 | 18.06.21 |

| | |
|------------|----------|
| SCALE (A1) | STAGE |
| 1:500 | CONSENTS |

| | | | | | | | | | | |
|----------|---|---|---|--|--|--|--|--|--|--|
| REVISION | A | B | C | | | | | | | |
|----------|---|---|---|--|--|--|--|--|--|--|

| | |
|-------------|-------------|
| PROJECT No. | DRAWING No. |
| 2127 | 955 |